Support to the renovation wave - energy efficiency pathways and energy saving obligation in Estonia

Deliverable 3: Comprehensive study of energy efficiency pathways for Estonia

Final

(REFORM/SC2022/067)

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Authors

Frank Gérard (Trinomics)

Jessica Glicker (Trinomics)

Louise Aeby (Trinomics)

Nora Cheikh (Trinomics)

Ling Ying Lee (Trinomics)

Professor Anna Volkova (TalTech)

Professor Jarek Kurnitski (TalTech)

Markus Tamm (Energex)

Rander Süld (Energex)

Contact person

Mr. Frank Gérard

T: +32 (0) 496 38 92 78

E: Frank.Gerard@trinomics.eu

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In association with:

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Executive Summary

This report proposes different strategies to reach the new energy efficiency targets. The results of the study should feed in the updated NECP to be submitted to the EC by June 2024 (a draft was submitted in June 2023) to show how it will reach the targets. The results should also be used for the preparation of the national development plan for the energy sector (at 2035). This report includes the main impacts and co-benefits of the pathways, with a detailed description of the underlying policy options.

Energy efficiency measures to meet the Energy Efficiency Directive Target

The 'Fit for 55' package and the revised Energy Efficiency Directive (EED) aim to increase the EU energy efficiency target to 39% for primary energy consumption and 36% for final energy consumption.[1] Additionally, the recently adopted Energy Efficiency Directive[2] foresees an increase of the annual energy savings **obligation for Member States from the current level of 0.8% to average 1.49% energy savings between 2024 to 2030, and achieve 1.9% for 2028, 2029 and 2030**.[3] This increased target has a huge impact and will require significant reinforcement of energy savings policies and measures, probably in all sectors.

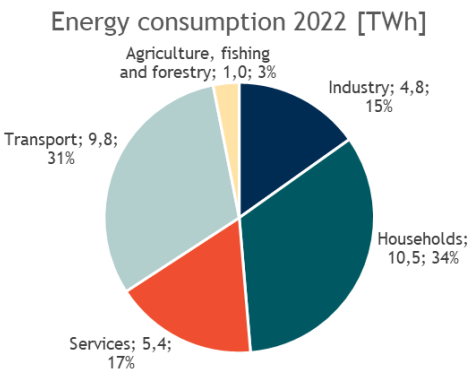
With existing measures, Estonia will not reach the previous EED target of 0.8% annual energy savings, and consequently is far from reaching the new target of 1.5%. The National Energy and Climate Plan (NECP) proposed measures' impact is unclear, and the energy efficiency targets are considered too low. Energy efficiency investments involve high up-front costs, making them unattractive and often untenable for individuals as the generated savings are not paying back the investment (due to among others low energy prices). Insufficient incentives exist to improve energy efficiency. Overall, addressing these challenges is crucial for Estonia to achieve its energy efficiency targets, to comply with EED.

Energy use in Estonia

While final energy demand in Estonia has experienced a slight decline of 4% over the past decade (2012-2022), **Estonia is still the most energy intensive of the Baltic states.** The bulk of the decline can be attributed to a shift from manufacturing to services in the country.

The energy demand is divided among different sectors, as depicted by Figure 0-1.

Figure 0-1 Energy consumption by sector, 2022



Source: Trinomics, Energex & TalTech

[1] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-targets_en
[2] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en
[3] European Commission. 10.03.2023. European Green Deal: EU agrees stronger rules to boost energy efficiency. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1581

Following the ongoing recast of the EED, **Estonia will need to seriously adjust its energy efficiency strategy to be aligned with the new energy saving targets.** There remains potential for savings in each sector to reach the target, but these will need to be adjusted to sector specific constraints, and cost effectiveness.

Table 0-1 illustrates all targets that have been fixed by the revised EED (DIR (EU) 2023/1791), and compare some of them with targets set in the previous EED (2018).

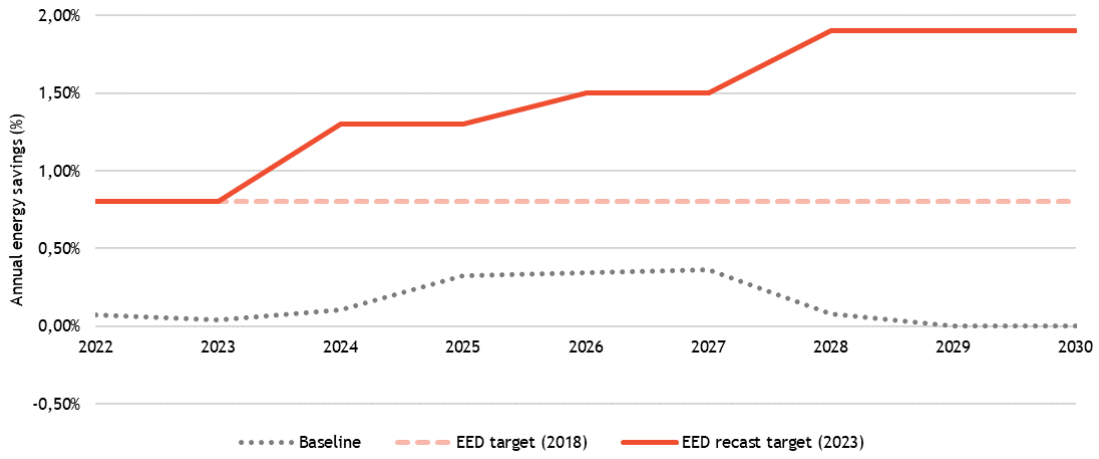
Table 0-1: 2030 energy efficiency targets and savings

NECP 2030 objective	EED 2018	EED 2023[4]	Reference
Final energy consumption in 2030 (TWh)	33	30	Art 4, binding at EU, Estonia contribution
Primary energy consumption in 2030 (TWh)		45.7	Art 4, indicative at EU, Estonia contribution
Annual final savings rate, 2024-2030 average (%)	0.8%	1.5%	Art 8(1), binding per MS
Annual final energy savings rate in 2030 (%)		1.90%	Art 8(1), binding per MS
Cumulative savings over the 2021-2030 period (TWh)	14.767	21.279	Art 8(1), binding per MS

Existing policies will not deliver enough savings

Despite current plans, strategies, and associated ongoing policies, Estonia will not reach the previous EED additional yearly saving target set by EED (2018), as illustrated in Figure 0-2**.** The new target set by EED (2023) is way more ambitious than the previous and is therefore increasing the gap significantly, showing the negligible effect of the baseline pathway (i.e. existing EE measures).

Figure 0-2 Forecast of annual energy savings with the existing energy efficiency measures shows that Estonia is far behind the EED target



Source: Trinomics, Energex & TalTech

To conclude, a comprehensive pathway covering all sectors and strengthening the existing measures and implementing new ones is needed to reach the 2030 energy saving target.

[4] DIR (EU) 2023/1791

Pathways to accelerate the uptake of energy savings

Reaching the energy efficiency targets is challenging and will require a large set of Energy Efficiency policies and measures in all concerned sectors. In order to define the most optimal and comprehensive pathway to reach the energy saving 2030 target, policies and measures are bundled into 7 energy efficiency pathways which will be compared to support the selection of the optimal path to the targets.

Table 0-2 briefly describes the pathways that consist of a carefully selected and designed set of measures or policies. The pathways and their measures have different emphasis on different sectors, to illustrate the benefits, drawbacks, impacts and risks of various measures' bundling. Given the high ambition set with the targets, it is unrealistic to focus on one sector only, therefore, although some pathways focus on a specific sector, they contain measures addressing all sectors with varying intensities.

Table 0-2: Brief description of the pathways

	Pathway	Short description of included measures	Renovation of detached houses (indicative indicator)
1	Baseline	Only existing measures (e.g., support schemes, energy pricing, Renovation Wave, energy efficient transport)	/
2	Obligation Scheme (EEOS) *Focus building & industry*	Obligation Scheme in all sectors (high ambition in building), limited grants in buildings, MEPS, grants in industry, and partial transport measures	0.4% of total surface (*) undergoes deep renovation, while 7.7% undergoes shallow renovation, leading to 6.2% additional annual savings.
3	Voluntary Agreement (VA) *Focus industry*	Highly ambitious Voluntary Agreements in industry & partial grants to support, CO_2 pricing, partial grants in buildings, and partial transport measures	1.1% of total surface undergoes deep renovation, while 1.8% undergoes shallow renovation, leading to 2.8% additional annual savings.
4	Renovation Wave (Renowave) *Focus buildings*	Focus on buildings (ambitious grants with a slightly higher ambition for public buildings & MEPS), partial CO_2 & property taxation, partial grants in industry, partial in transport	3.5% of total surface undergoes deep renovation, while 0% undergoes shallow renovation, leading to 7.4% additional annual savings.
5	Energy efficient transport (EET) *Focus transport*	Focus on EE in transport vehicle efficiency, public transport and micromobility (high ambition for subsidising the use of public transport, the development of convenient public transport and the railroad infrastructure), CO_2 and property taxation, partial grants in industry & buildings, partial MEPS, grants in industry	1.1% of total surface undergoes deep renovation, while 1.8% undergoes shallow renovation, leading to 2.8% additional annual savings.
6	Comprehensive Energy Efficiency Reform 1 (CEER1) *Balanced*	MEPS and grants in buildings, property taxation, voluntary agreements in industry with support, and EE in transport vehicle efficiency, public transport and micromobility	2% of total surface undergoes deep renovation, while 1.8% undergoes shallow renovation, leading to 3.3% additional annual savings.
7	Comprehensive Energy Efficiency Reform 2 (CEER2) *Balanced, with increased ambitions for some measures*	A slightly less ambitious MEPS (compared to CEER1) and ambitious grants in buildings, property taxation, CO_2 pricing, an obligation scheme in non-residential, ambitious voluntary agreements in industry with support, and EE in transport vehicle efficiency, public transport and micromobility (with high ambition for subsidising the use of public transport, the development of convenient public transport and the railroad infrastructure)	2.3% of total surface undergoes deep renovation, while 1.8% undergoes shallow renovation, leading to 4.3% additional annual savings.

(*) total surface area of detached houses in 2020 was 22.400.000 m2

The 7 pathways will be compared to each other against the following set of criteria

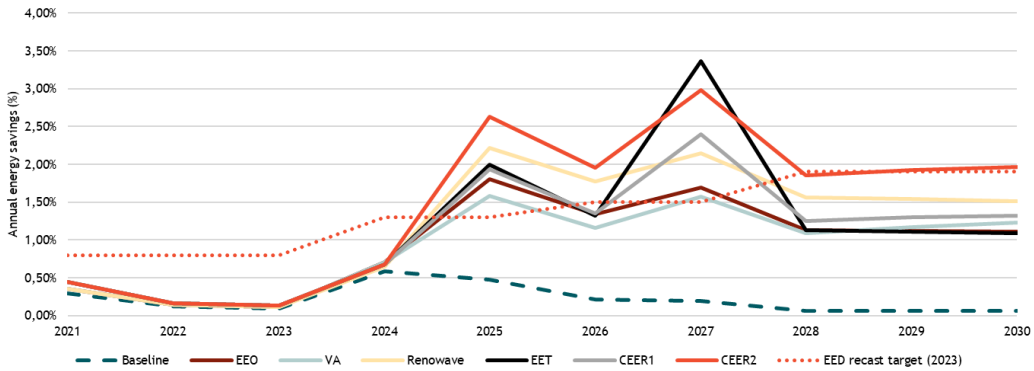
- The ability to reach the target. Given the high level of ambition, all pathways will not be able to reach all targets set by EED (2023);
- The assessment of various impacts like job creation, increase of GDP, tax revenues, etc;
- Their feasibility (from a political, socio-economic and technical point of views), and expectation from each sector;
- Advantages and disadvantages linked to the pathways.

- Risks linked to the pathways.

Ability of the pathways to reach the targets (criterion 1)

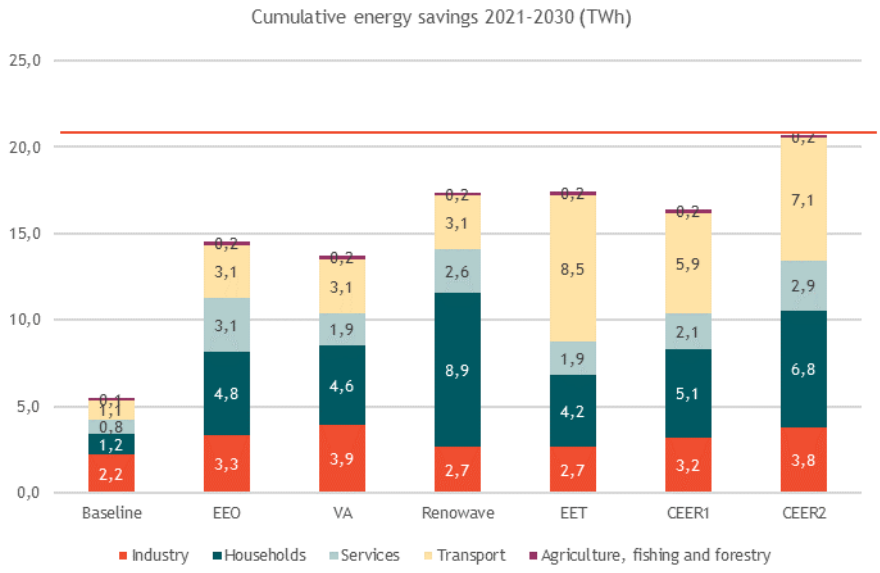
Figure 0-3 shows how the pathways are performing with regard to additional yearly savings, and particularly the 1.9% yearly savings in (2028, 2029 & 2030). It is expected that the new measures are entering into force in 2025, and directly show results (strong grants and supports), allowing all pathways to be above expectations. **Only CEER2 achieves the target of 1.9% additional yearly savings** in 2028, 2029 and 2030, all other pathways aren't able to remain at such high level of 1.9%/y, which is very ambitious. The average annual energy savings over the 2024-2030 (1.5%) can be reached by the RenoWave and the CEER2 pathways, those having the strongest component to renovate the building stock.

Figure 0-3 Annual energy savings (%)



Cumulative energy savings per sector vary depending on the chosen pathway and associated measures, as each pathway has an emphasis on different sector(s). Figure 0-4 illustrates how much savings each sector is responsible for by pathway. **None of the pathways achieve the cumulative target of 21.3 TWh** over the 2021-2030 period at the end of 2030.

Figure 0-4 Cumulative energy savings (TWh) 2021-2030



Source: Trinomics, Energex & TalTech

CEER2 achieves the cumulative savings early 2031, Renowave by mid of 2031. **Given the weak performance during the first half of the obligation period (2020-2025), cumulative savings become hard to achieve.** CEER1, EEO, EET & VA only achieve the targets in 2032.

The savings of the pathways are not cumulative, and cannot be added, but a mix of the measures under each pathway could achieve the target by balancing the efforts across the sectors.

Table 0-3 depicts the results for all targets set in the EED, but also additional targets set by Estonia in its NECP/NDPES, among which the transport fuel consumption in 2030 remains hard to reach (only EET allows to reach this target). Almost all pathways, except the EEO and VA pathways, achieves the final energy consumption target set by EED. However, the cumulative savings cannot be reached in 2030 by any of the 7 pathways.

Table 0-3: Summary of pathways achieving the targets

	Year	Unit	EED target	NECP 2030[5]	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Final energy consumption	2030	TWh	30,0	33,3	32,8	30,4	30,5	29,6	29,7	29,9	28,7
Cumulative energy savings	2021-2030	TWh		21,3	5,5	14,5	13,7	17,4	17,4	16,4	20,7
Final energy savings rate	2030	%	1,90%	1,90%	0,1%	1,1%	1,2%	1,5%	1,1%	1,3%	1,96%
Final energy savings rate, average	2024-2030	%	1,50%	1,50%	0,1%	1,1%	1,1%	1,5%	1,4%	1,3%	1,9%
Primary energy consumption	2030	TWh	45,7	63,9	51,5	47,5	47,7	46,3	47,3	47,1	45,1
Final energy savings of public sector/buildings	2021-2030	%	1,9%		0,0%	1,6%	0,9%	1,2%	0,9%	1,1%	1,6%
Renovation rate of public owned buildings	2021-2030	%	3,0%		0,9%	6,5%	3,5%	4,3%	3,5%	4,2%	6,4%
Total renovated area of central government buildings	2021-2030	mln. m2		0,30	0,12	86,7%	48,3%	58,7%	48,3%	58,7%	91,6%
Industry annual energy savings	2030	GWh		232	313	564	865.1	418	418	647	836
Transport fuel consumption	2030	TWh		8,3	10,1	9,6	9,6	9,6	8,3	9,0	8,6

Source: Trinomics, Energex & TalTech

[5] DIR (EU) 2023/1791

The global average scoring of this criterion 1 on the ability of the pathways to reach the targets can be made by retaining the mandatory targets set by the revised EED, as depicted by Table 0-4.

Table 0-4: Scoring of pathways achieving the targets

	EED target	NECP 2030[6]	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Final energy consumption	30,0	33,3	32,8	30,4	30,5	29,6	29,7	29,9	28,7
Cumulative energy savings		21,3	5,5	14,5	13,7	17,4	17,4	16,4	20,7
Final energy savings rate	1,90%	1,90%	0,1%	1,1%	1,2%	1,5%	1,1%	1,3%	1,96%
Final energy savings rate, average	1,50%	1,50%	0,1%	1,1%	1,1%	1,5%	1,4%	1,3%	1,9%
Primary energy consumption	45,7	63,9	51,5	47,5	47,7	46,3	47,3	47,1	45,1
Renovation rate of public owned buildings	3,0%		0,9%	6,5%	3,5%	4,3%	3,5%	4,2%	6,4%
Global average scoring									

Source: Trinomics, Energex & TalTech

CEER2 is scoring green due to the fact it achieves the highest number of targets, although not all (as already mentioned none is able to achieve the cumulative savings over the period), while RenoWave is the second in terms of number of targets achieved, but still misses the final energy savings rate due in 2030 (mainly due to the RRP funds ending in 2027, and the lack of mesaures to replace those support).

Impact assessment (criterion 2)

Taking the policy pathways and direct impacts into effect, in particular direct costs and costs savings borne by the public sector and private sector, Table 0-5 below illustrates these impacts by pathway:

- As the **CEER2 pathway** has the greatest potential for energy savings, this leads directly to the greatest impact on GHG emissions reduction and cost savings on energy costs. At the same time, this pathway also leads to relatively higher investment costs, which in turn leads to greater impact on GDP, employment and tax revenue from investments.
- The **RenoWave pathway** has the highest investment requirements, although it does not lead to relatively higher energy savings, thus relatively less impactful on GHG emissions and cost savings. Notably, the RenoWave pathway has the greatest increase in employment, considering the labour intensity of renovation.
- The **EET and CEER1 pathways** lead to moderate impacts, in terms of their relative impact on GHG emissions, investment costs (and GDP), cost savings and impact on average energy costs for households. Notably, the EET pathway requires the greatest investment from public sources, given the focus on improving public (transport) infrastructure.
- Compared to the other pathways, the **VA and EEO pathways** are the worst performing pathways in terms of impacts, taking into account a relatively low impact on GHG emissions, low-cost savings, low impact on employment and minimal impact on reducing energy costs for households.

[6] DIR (EU) 2023/1791

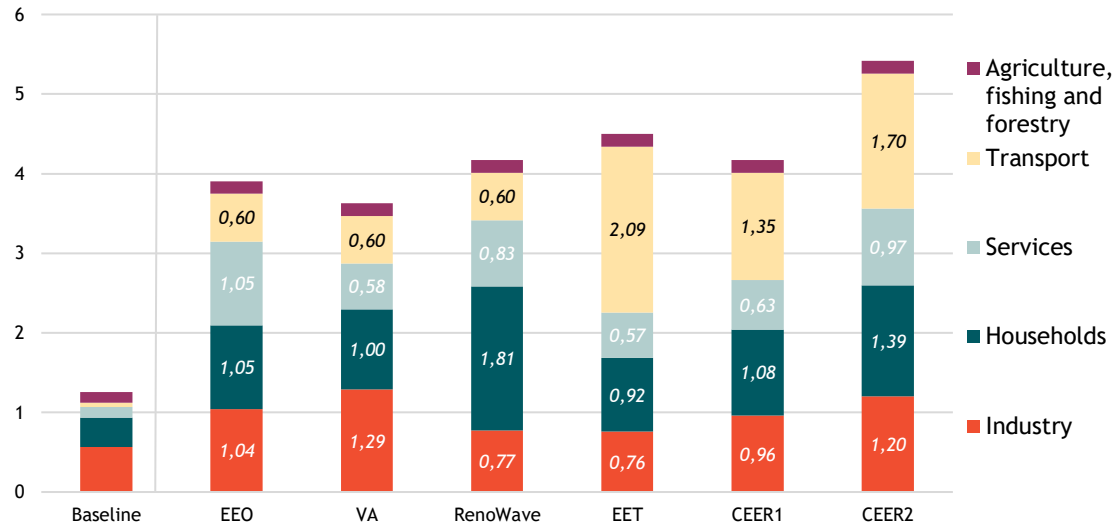
Table 0-5: Summary of impact assessment

			Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
GHG emission reduction, cumulative	2021-2030	MtCO2	1,26	3,91	3,63	4,17	4,50	4,17	5,42
Investment costs (total), cumulative	2021-2030	MEUR	1.588	10.042	10.565	17.851	12.594	12.458	17.281
of which public support, cumulative	*2021-2030*	*MEUR*	*331*	*2.888*	*3.210*	*4.287*	*5.951*	*4.395*	*5.749*
Cost savings, cumulative	2021-2030	MEUR	489	1.408	1.314	1.712	1.752	1.627	2.063
Impact on GDP	2021-2030	%	0,6%	3,3%	3,4%	5,6%	4,1%	4,1%	5,6%
Impact on disposable income	2021-2030	%	0,8%	1,9%	2,5%	1,3%	4,1%	3,3%	4,8%
Impact on employment (Average annual job creation)	2021-2030	Thousand employees	0,83	14,18	13,81	26,28	16,68	16,40	22,76
Impact on tax revenue	2021-2030	%	0,6%	1,8%	1,9%	3,1%	1,7%	2,0%	2,7%
Average energy cost as a share of household disposable income	2021-2030	%	7,98%	7,61%	7,58%	7,33%	7,49%	7,48%	7,25%
Average yearly GDP	2021-2030	MEUR	42.823	43.975	44.027	44.971	44.330	44.298	44.944
Average yearly Investment costs (total)	2021-2030	MEUR	159	1.004	1.056	1.785	1.259	1.246	1.728
Average yearly tax revenue	2021-2030	MEUR	16.042	16.229	16.239	16.430	162.152	16.268	16.378
Average yearly public support	2021-2030	MEUR	33	289	321	429	595	439	575

Source: Trinomics, Energex & TalTech

Figure 0-5 illustrates the distribution of GHG emission reduction per sector, showing the efforts on each sector in each pathway (e.g. EEO focusing on non-residential, VA on the industry, RenoWave on residential, EET on transport, CEER1 more balanced but too low, CEER2 more balanced but reaching several targets, as explained above).

Figure 0-5 GHG Emission reduction per sector ($MtCO_2e$) 2021-2030



Source: Trinomics, Energex & TalTech

The global average scoring of this criterion 1 on the impact assessment of the pathways to reach the targets can be made by retaining the mandatory targets set by the revised EED, as depicted by Table 0-6.

Table 0-6: Scoring of the impact assessment

			Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
GHG emission reduction, cumulative	2021-2030	MtCO2	1,26	3,91	3,63	4,17	4,50	4,17	5,42
Investment costs (total), cumulative	2021-2030	MEUR	1.588	10.042	10.565	17.851	12.594	12.458	17.281
of which public support, cumulative	*2021-2030*	*MEUR*	*331*	*2.888*	*3.210*	*4.287*	*5.951*	*4.395*	*5.749*
Impact on GDP	2021-2030	%	0,6%	3,3%	3,4%	5,6%	4,1%	4,1%	5,6%
Impact on disposable income	2021-2030	%	0,8%	1,9%	2,5%	1,3%	4,1%	3,3%	4,8%
Impact on employment (Average annual job creation)	2021-2030	Thousand employees	0,83	14,18	13,81	26,28	16,68	16,40	22,76
Impact on tax revenue	2021-2030	%	0,6%	1,8%	1,9%	3,1%	1,7%	2,0%	2,7%
Average energy cost as a share of household disposable income	2021-2030	%	7,98%	7,61%	7,58%	7,33%	7,49%	7,48%	7,25%
Global average scoring									

Source: Trinomics, Energex & TalTech

The scoring is mainly justified by the following considerations

- GHG emissions savings is significantly higher for CEER2 than for the other pathways

- Although this is balanced by the fact that public budget (support and own investments) is significantly higher for CEER2 than for RenoWave, mainly due to public investments (in transport), as RenoWave is already intense in support
- The positive impact on GDP is significantly higher for both CEER2 & RenoWave than for the other pathways, mainly thanks to the focus on the building sector and consequently the important investments for these 2 pathways
- The impact on disposable income is much higher for CEER2 than for the other pathways, including RenoWave due to the important investment of households
- RenoWave creates significantly more jobs than all other pathways, although the importance of the building sector gives to CEER2 a good second position in job creation
- Building renovation generates more tax revenues than measures in other sectors, and consequently RenoWave has the best score, closely followed by CEER2
- The average energy cost as a share of household disposable income is the lowest for CEER2 (thanks to the balance of measures between sectors).

Feasibility and expectation from each sector (criterion 3)

To varying degrees the pathways require the building, industry and transport sectors to take action to reduce energy consumption, where reaching these expectations for each sector can be complicated and may not be feasible. To investigate the feasibility of the pathways for each sector, table 0-7 illustrates the expectations for renovation for residential and non-residential buildings as well as the savings rates for industry and transport over the next decade. Notably, certain pathways require a significant increase in energy savings:

- The **EEO pathway** increases the renovation rate of residential and non-residential buildings, namely renovating 52% and 97% of the building stocks respectively by 2035, which is very challenging although Obligation Scheme is expected to remain shallow renovation (and not deep renovation). Renovating the entire non-residential building stock (both public and commercial) in 10 year appears to be unfeasible (it represents a 8.6% annual renovation rate, well beyond the current capacity of the construction sector), even with additional support;
- The **VA pathway** notably requires a significant increase in energy savings in industry, which is extremely ambitious, and probably not realistic due to the expected duration of the measure implementation (at least 2 years to see the first limited results, and 5 years to see significant results);
- The **Renovation Wave pathway** pushes the annual renovation rate of residential buildings from 0.5% to 8%, leading to 91% of the residential building stock being renovated by 2035, which is highly challenging. Renovating almost the entire non-residential building stock (both public and commercial) in 10 year appears to be unfeasible (it represents a 5.8% annual renovation rate, well beyond the current capacity of the construction sector). Even with massive grants, this would remain unrealistic;
- The **EET pathway** increases the energy savings rate of transport by 17x compared to the baseline, which would require a huge behavioural change, inciting citizens to significantly decrease the use of their car, while at the same time replacing the old vehicle stock by more efficient ones (with a strong switch to EV, but not only);

- The **CEER1 and CEER2 pathways** overall require a significant increase in renovation (residential and non-residential and reduction of energy consumption of the transport sector. But globally, these pathways are more balanced regarding the efforts expected in each sector.

Table 0-7 Renovation rate for buildings (%) and energy savings rate for industry and transport (%), 2024-2035

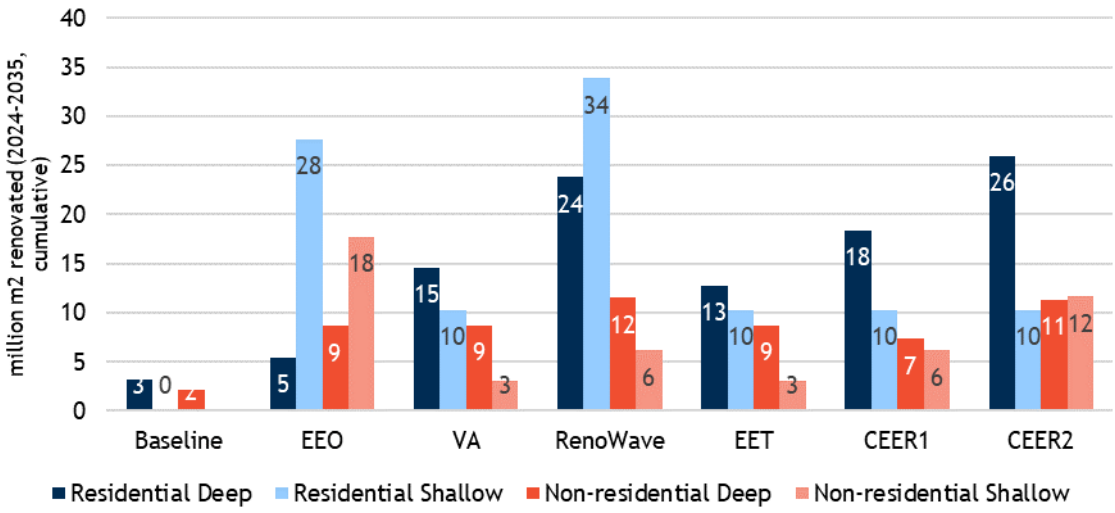
	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Residential annual renovation rate (%)	0.5%	4.6%	3.5%	8.0%	3.2%	4.0%	5.1%
% of residential buildings renovated (in 2035 vs 2024)	5.1%	52.2%	39.2%	90.8%	36.3%	45.1%	57.1%
Non-residential renovation rate	0.7%	8.6%	3.9%	5.8%	3.9%	4.4%	7.5%
% of non-residential buildings renovated (in 2035 vs 2024)	7.9%	96.9%	43.5%	65.0%	43.5%	49.6%	84.5%
Industry energy savings rate	0.4%	1.0%	2.3%	0.6%	0.6%	1.6%	2.3%
Transport energy savings rate	0.1%	0.5%	0.5%	0.5%	1.7%	1.1%	1.4%

Source: Trinomics, Energex & TalTech

The focus of the pathways with regards to the sectors should take into account the constraints in each sector:

- **Buildings** (residential and service) can cost-effectively improve their energy performance and reduce energy consumption, through deep renovation having also co-benefits of improved indoor climate and well-being, service-life and life quality, which means that the room for significant impact is important. Figure 0-6 illustrates the various degrees of renovation depth required per pathway. The Renovation Wave pathway requires the most deep and shallow renovation of residential buildings, corresponding to the highest investment requirements as noted in the impact assessment. The CEER1 and CEER2 pathways also require significant deep renovation of residential buildings, though less shallow renovations. The use of obligation schemes in the EEO pathway leads to a significant increase in shallow renovations of both residential and service buildings.

Figure 0-6 Deep and shallow renovated residential and non-residential building stock per pathway, 2024-2035 cumulative



Source: Trinomics, Energex & TalTech

- **Industry** can still increase energy efficiency, but industrial processes have limits to savings and cannot significantly reduce energy consumption without decreasing competitiveness. Notably, the VA pathway puts the most pressure on industry, requiring a total of 11.3 TWh of savings from 2024 to 2035 and 931 MEUR of investment. This is also the case for the EEO, CEER1 and CEER2 pathways, but to a lesser extent.

Table 0-8 Industry energy savings and investment needs, 2024-2035 cumulative

	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Cumulative energy savings (GWh)	3.460	6.233	10.159	4.613	4.613	7.541	9.817
Investment needs[7] (MEUR)	405	632	1.002	503	503	770	969

Source: Trinomics, Energex & TalTech

- Energy efficiency in **transport** mainly relies on reducing the use of personal cars (less persons*km, and less ton*km) calling to develop public transport, active & micro-mobility, and replacing the old vehicle stock by more efficient ones. The table below shows that the EET, CEER1 and CEER2 have the greatest efforts to reduce energy consumption in transport, compared to the other pathways.

Table 0-9 Transport energy savings and investment needs, 2024-2035 cumulative

	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Cumulative energy savings (GWh)	1.905	6.377	6.377	6.377	18.750	12.538	15.695
Investment needs[8] (MEUR)	844	1.914	1.914	1.914	4.594	2.880	3.567

Source: Trinomics, Energex & TalTech

[7] This includes the additional costs related to tax measures
[8] This includes the additional costs related to tax measures

- **Agroforestry** has limited room to improve efficiency, where all pathways have the same increase in energy savings and investment needs for the next decade borne from the addition of auditing in large agriculture holdings.

Table 0-10 Agroforestry energy savings and investment needs, 2024-2035 cumulative

	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Cumulative energy savings (GWh)	182	386	386	386	386	386	386
Investment needs[9] (MEUR)	82	93	93	93	93	93	93

Source: Trinomics, Energex & TalTech

Consequently, there is more room to significantly reduce energy consumption in buildings, than in the industry and agro-forestry. Energy efficiency in transport relies heavily on spatial planning, public transport infrastructure long-term investments, fuel and vehicle taxation, and consequent behavioural changes that somewhat depend on users' willingness.

Residential buildings and transport are each representing ~1/3 of final energy use and should be addressed as first. However, renovation of dwellings requires important investments and a strong incentive to carry them out (as shown in the *RenoWave* pathway, there is need to boost grants to accelerate the pace of renovation). Also, energy efficiency in transport has some limits and requires important behavioural changes which takes time (almost all pathways are not able to reach the transport target fixed by the transport and mobility development plan until 2035 to consume less than 8.3 TWh, while the sector faces clear growth). Non-residential buildings and industry (inc. agro forestry) are each representing ~1/6 of final energy use. These 2 sectors could be left aside regarding financial support measures (to concentrate efforts on residential and transport), but non-residential offers substantial perspective for energy savings with regulatory minimum energy performance standards (MEPS) (where there is currently a very bad level of performance, leaving potential for substantial energy savings), while industry should be accompanied along its decarbonisation path, to remain competitive and attractive at EU scale. For that reason, there are no mandatory schemes or obligations proposed for industry. Consequently, the important efforts towards energy saving targets set by the EED has to be spread properly between sectors. The targets are too ambitious to leave any sector aside.

Table 0-11 summarises the feasibility of each pathway.

Table 0-11 Summary of feasibility for each pathway

Pathway	Description
EEO	• The focus on building via an Obligation Scheme is highly ambitious, and probably unrealistic
VA	• The Voluntary is key for the industry, but to allow this pathway dedicated to accelerate EE in the industry, the VA should be too fast and effective, with an impressive additional annual savings (3.9%/y)
RenoWave	• A strong focus on building, similar to the EEO, does reach unrealistic levels of renovation rates
EET	• Accelerating EE in transport is essential and highly challenging, but with a strong political willingness to deploy alternatives to individual cars, this might be feasible
CEER1	• This more balanced pathway is spreading the efforts across sectors, and should be the most realistic
CEER2	• Starting from the CEER1 which is the most realistic but does not reach the goals, there is a need to reinforce some of the measures leading to more challenging pathway than CEER1

[9] This includes the additional costs related to tax measures

Pros, cons and risks related to pathways (criterion 4)

Table 0-12 below lists an overview of the pros and cons of each pathway, in addition to their feasibility.

Table 0-12 Summary of Pros and cons for each pathway

Pathway	Pros	Cons
EEO	• Cost-effective energy savings • Leverages from EU best practices, streamlining implementation. • Creates demand for energy-efficiency technology • Shifts focus from energy as a product to a service • Accelerates knowledge building relating to renovation.	• High administrative costs, especially for small-scale energy savings units. • Complexity in navigating small-scale energy savings units. • Risk of higher energy prices for vulnerable households if there is no dedicated support • For building renovation, it may lead to a missed opportunity to deep renovation (remaining shallow)
VA	• Tailored solutions for cost-effective energy savings • Promoting stakeholder collaboration and ownership • Scalable across sectors and levels, accommodating diverse efficiency goals. • Encourages innovation, public-private partnerships, and collaboration, enhancing market appeal.	• Voluntary agreements may have lower participation without sufficient incentives. • Initial energy efficiency investments seen as barriers for some stakeholders. • Limited enforcement and varying commitments may lead to uneven outcomes.
RenoWave	• Greater access to EU funds, grants and loans for renovation • Generates jobs, boosting construction and manufacturing sectors • Drives economic growth • Enhances energy security, optimising energy usage with smart technologies	• High upfront costs deter building owners from energy-efficient solutions. • Challenges in implementing universal MEPS for dwellings. • Limited awareness hampers adoption. • Shortage of skilled professionals and lack of sufficient energy-efficient renovation expertise.
EET	• Strong commitment to sustainability and energy efficiency, backed by clear government support for promoting energy-efficient transport initiatives. • EVs create an opportunity to both reduce emissions and enhance energy efficiency. • Promotion of active transportation (cycling and walking) • Integrated transport systems and multimodal transportation can optimize energy utilization and enhance overall efficiency.	• Limited EV/public infrastructure hampers adoption of EVs/public mobility • Public resistance and lack of awareness
CEER1 & CEER2	• Strong commitment to sustainability and energy efficiency, backed by clear government support for promoting energy-efficient initiatives. • Balanced between sectors, allowing for diverse funding mechanisms • Rapid advancement of EE technologies offers innovative and cost-effective renovation solutions, and job opportunities. • EVs create an opportunity to both reduce emissions and enhance energy efficiency. • Promotion of active transportation (cycling and walking) • Integrated transport systems and multimodal transportation can optimize energy utilization and enhance overall efficiency. • Enhances energy security, optimising energy usage with smart technologies	• Limited EV/public infrastructure hampers adoption of EVs/public mobility • Public resistance and lack of awareness • High renovation costs and limited awareness of benefits of renovation • Shortage of skilled professionals and lack of sufficient energy-efficient renovation expertise.

Source: Trinomics, Energex & TalTech

Risks related to pathways (criterion 5)

Table 0-13 below shows the main risks and mitigation measures related to each pathway.

Table 0-13 Summary of risk related to each pathway

Pathway	Technical skills	Social	Economic	Environmental	Administrative
EEO	• Specialized knowledge needed for complex technologies. • Training for energy operators and stakeholders essential. • Flexible framework required for adjustments based on tech advancements. • Regularly update eligible technologies list to include new innovations. • Energy operators need market knowledge for identifying cost-effective projects.	• Opposition due to administrative burden and perceived financial strain for obligated parties. • Resistance from high-energy consumption industries citing competitiveness/cost concerns. • Energy operators need effective communication to convince consumers for EE projects. • Mitigation through public awareness, dialogue with obligated parties, and incentives. • Support energy operators with awareness campaigns to enhance acceptance.	• Passed-on costs might cause financial strain, especially for vulnerable households • Challenges with initial investment for energy operators, especially for smaller companies • Consumer protection policies, price caps, and financial support can mitigate cost impact. • Transparent communication enhances understanding and acceptance of program objectives and costs. • Regular market monitoring and program flexibility address competitiveness concerns.	• Promotion of EE might inadvertently promote increase in demand for non-renewable/high-emission sources. • EEO programs should take a holistic approach, targeting multiple sectors and technologies, addressing a wide range of energy-saving opportunities, ensuring adaptability to changing market dynamics and technological advancements.	• Requires agreement on accepted projects, savings calculation, verification, compliance, etc. • Complexity in savings calculation for industrial consumers challenges standardization.
VA	• High upfront costs for new technology • Required updated skilled workforce, potential shortage of skilled labour • Mitigation through financial incentives, grants, subsidies and low-interest loans • Investment in training programmes	• VAs are voluntary programs, requiring participants to be: ○ Aware of the program ○ Well-informed about the benefits ○ Willing to participate • Mitigation strategies include: ○ Awareness campaigns ○ Informing about energy renovation benefits and financial options () ○ Involving stakeholders (technology providers, experts, end-users) in decision-making ○ Fostering collaborative efforts to address technological risks	• Risk of market distortions due to varying compliance costs • Longer payback periods deter participation • Changes in market demand or energy prices affect cost-effectiveness • May impact vulnerable consumers through increased prices • Potential mitigations measures include: ○ Allow flexibility in timing and sequence of measures ○ Collaborative efforts ○ Dedicating funding ○ Clear and stable policies to reduce uncertainty	• Increasing construction activities can generate more waste and pollution. To mitigate this risk, Incorporate life-cycle assessments into the design phase of renovations. Strengthen waste management of construction-related waste to promote recycling and re-use of materials.	• Administrative burden for obligated parties and implementing authorities relating to complying to specific targets and regularly reporting progress • Need for accurate data for realistic targets and progress monitoring • Complexities with parallel initiatives, requiring coordination and integration to reduce inefficiencies • To mitigation risks: ○ Simplify reporting ○ Implement digital solutions ○ Encourage transparency and cooperation ○ Engage stakeholders ○ Regularly assess effectiveness of VAs
Reno Wave	• Major risk of lack of sufficient labour for construction activities. Mitigate through training programmes • Constraints on material availability. Mitigate by promoting local production and encourage resource efficiency and recycling/reuse of materials.	• Lack of public acceptance of MEPS and disproportionate impact on low-income housholds. Mitigate through direct grants for low-income households affected by MEPS • Lack of awareness of new developments/benefits of public transport. Mitigate through awareness campaigns.	• Fluctuations of energy prices create uncertainty for the cost-effectiveness of energy-savings measures. Consider loan schemes based on actual cost savings to reduce the impact of fluctuating energy prices.	• Increasing construction activities can generate more waste and pollution. To mitigate this risk, Incorporate life-cycle assessments into the design phase of renovations. Strengthen waste management of construction-related waste to promote recycling and re-use of materials.	• Ensuring compliance with MEPS regulation could be a challenge in terms of enforcing inspections and penalties for non-compliance. • Given the amount of grants, there is a lot of issues to access and information sharing, as well as monitoring compliance of measures.
EET	• Complexities in integrating EE technologies in existing transport systems • Establishing reliable EV charging infrastructure • Lack of skilled labour for installing/maintaining EE transport technologies. Mitigate with training and capacity building	• Resistance to change behaviour and lifestyle. Mitigate through awareness campaigns and financial incentives • Limited access/affordability for EE transport among low-income/ marginalised communities. Mitigate with inclusive design/engagement and assessment of social equity.	• Requires high upfront costs relating to upgrading/ developing infrastructure	• Indirect emissions from vehicles, relating to the lifecycle emissions of new technologies. • Environmental impact of resource extraction, including habitat destruction and water pollution, from new technologies (i.e., new lanes, EVs). • Mitigate by conducting comprehensive LCA for EE technologies and prioritising measures with the overall lowest impact. H having careful land use planning	• Lengthy and bureaucratic public procurement processes. Mitigate through streamlining and creating flexibilities in the procurement process.

CEER1	• Major risk of lack of sufficient labour for construction activities. Mitigate through training programmes • Constraints on material availability. Mitigate by promoting local production and encourage resource efficiency and recycling/reuse of materials.	• Lack of public acceptance of MEPS and disproportionate impact on low-income households. Mitigate through direct grants for low-income households affected by MEPS • Lack of awareness of new developments/benefits of public transport. Mitigate through awareness campaigns.	• Fluctuations of energy prices create uncertainty for the cost-effectiveness of energy-savings measures. Consider loan schemes based on actual cost savings to reduce the impact of fluctuating energy prices.	• Increasing construction activities can generate more waste and pollution. To mitigate this risk, Incorporate life-cycle assessments into the design phase of renovations. Strengthen waste management of construction-related waste to promote recycling and re-use of materials.	• Ensuring compliance with MEPS, particularly concerning the enforcement of inspections and penalties for non-compliance. • Mitigation measures should focus on the need for effective coordination, monitoring, and implementation, given that this pathway comprises numerous ad hoc, small-scale measures that require diligent oversight.
CEER2	• Major risk of lack of sufficient labour for construction activities. Mitigate through training programmes • Constraints on material availability. Mitigate by promoting local production and encourage resource efficiency and recycling/reuse of materials.	• Lack of public acceptance of MEPS and disproportionate impact on low-income households. Mitigate through direct grants for low-income households affected by MEPS	• Fluctuations of energy prices create uncertainty for the cost-effectiveness of energy-savings measures. Consider loan schemes based on actual cost savings to reduce the impact of fluctuating energy prices.	• Increasing construction activities can generate more waste and pollution. To mitigate this risk, Incorporate life-cycle assessments into the design phase of renovations. Strengthen waste management of construction-related waste to promote recycling and re-use of materials.	• Given the increased ambition of the measures, keeping up with all administrative tracking, implementation, compliance and monitoring will be a real challenge. • If the administrative processes are too burdensome, or unable to keep up with new measures, construction, permitting, etc, this may cause a significant roadblock to implementation.

Source: Trinomics, Energex & TalTech

Final comparison of the 7 pathways (all 5 criteria)

Table 0-14 compares the pathways against the 5 criteria.

Table 0-14 Summary of all criteria for each pathway

Criteria	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
1: Ability of the pathways to reach the targets							
2: Impact assessment							
3: Feasibility and expectation from each sector							
4: Pros and cons related to pathways							
5: Risks related to pathways							

Source: Trinomics, Energex & TalTech

It is assumed that these 5 criteria encompass all considerations which are relevant for the implementation of the measures contained in each pathway, including social and/or political acceptance which are key factors for the selection of the optimal pathway.

Considering that CEER2 is the pathway which allows to reach the highest number of targets fixed by EED, has consequently the best performance with regards to impacts (similarly to RenoWave), and is scoring high related to the balance between advantages and disadvantages, we conclude that CEER2 is the optimal pathway. It will require around EUR 15.2 billion over the obligation period (2021-2030), with bulk of the investments to be made during the 2025-2030 period.

However, it should be pointed out that its feasibility is not obvious, and it remains highly challenging, due the very high EED ambition. This pathway also contains several risks that will require attention in the next phases of planning EE actions.

CEER2 pathway articulates actions in all sectors, with the goal to drive notable enhancements in energy efficiency across the entire economy, and hence all sectors:

- In residential buildings, *CEER2* combines renovation grants, MEPS (for rented/selling buildings), property taxation and a minimal level of CO_2 tax. Among these long-term measures, renovation grants may be seen as intermediate especially in single family dwellings, to support the transition to mandatory renovation via MEPS and disadvantageous property taxation. Renovation grants in multifamily dwellings represent single largest saving potential in the case of deep renovation and are likely needed for longer period to avoid renovation locks and other negative implications otherwise caused by MEPS. Tax reduction for renovation is also an intermediate measure but could possibly stay for a longer period. All these measures are forming a coherent and efficient set to improve residential building stock energy performance, in the most balanced and optimal way;
- In non-residential buildings, *CEER2* combines an obligation scheme for all buildings, MEPS to strengthen and accelerate the effect of the obligation, property taxation and a minimal level of CO_2 tax. These long-term measures require, however, to be accompanied by renovation support for public buildings (central and municipal). However, no support for commercial buildings is deemed necessary, as the savings are expected to come via obligation schemes and MEPS. All these measures are forming a coherent and efficient set to improve non-residential buildings energy performance, in the most rapid and cost-effective way;
- In the industry, a strong voluntary scheme is considered as the most appropriate option, engaging a long-term dialogue between the government and the industry, to ensure sustainable savings, and possibly full decarbonisation. To incentivise the industrial actors, supports are necessary, to help investing (via promoting resource-efficient green technologies, support energy efficiency investments in energy intensive industry & other companies, support for the food industry, energy consulting and networking for SMEs), or to motivate commitment towards energy efficiency targets (and reduced GHG emissions). The measures were chosen considering two main outcomes - increase energy efficiency of industry without hurting competitiveness;
- In transport, alternatives to personal cars are proposed, such as public transport & micro modes, and encourage users to choose these alternatives, CEER 2 combines:
    - Investments in the required infrastructure (priority lanes for micro mobility, EV charging, development of convenient public transport, railroad and its electrification, tram line in Tallinn,
    - Direct investments or incentives to invest in the required vehicles (additional passenger trains, EV taxis in Tallinn & Tartu,
    - Incentives to use alternatives (subsidy for public transport usage, subsidy for micro mobility usage),
    - Price adjustment to de-incentivise the use of personal cars (congestion charge),
    - Price adjustment to incentivise the purchase of more efficient cars (vehicle tax for registration and annual vehicle tax).
- In agroforestry, *CEER2* proposes to accompany enterprises to manage better energy use and to support energy efficiency measures in fisheries.

The fuel tax measure should also be considered as a long-term supporting policy option, as it would direct consumers towards energy efficiency and incentivises best performing consumers.

In each sector, these combinations are necessary to ensure the right balance:

- Accelerating the transition (via expensive support) and ensure long term affordability (moving to norms and price signal);
- Avoiding too expensive options requiring massive investments and support from the public, and possibly influence behavioural changes thanks to price signal;
- Incentivising investments and changes by providing support, and then by progressively de-incentivising (via normative measures);
- Setting up realistic and the least complex options (it is hard to say simple, as none of the measures can be considered to be simple), from a technical and administrative point of view;
- Engaging the concerned actors, namely consumers and professionals;
- Designing all measures in a coherent package to ensure the measures are complementing each other;
- Allowing easy and fair distribution of costs, to deal with energy poverty concerns.

Looking at the Energy Efficiency measures more closely

The pathways bundle existing and new EE measures/policies to try to achieve collectively the different targets, assessing their feasibility, pros, cons and risks through the analysis of their dominant underlying EE measures. However, the optimal pathway selection remains highly indicative, as each EE measures should be considered in an isolated way when it comes to its design (incl. level of ambition) & implementation (incl. political decision). The most appropriate approach is always to balance normative with incentive measures, by providing grants or by using price signals as levers to invest or change behaviours. We assume that funding and grant capacity of the government remains limited, and cannot provide support to all sectors on the long run. Hence, such supporting measures should be considered as transitional measures for a longer term price signal and normative combination.

Until now, the pathway analysis did not look at each specific measure with regards to the others. The pathways look at the coherence and complementarity of the EE measures, but not specifically at their interactions, while this could become a critical aspect of their feasibility, or efficiency. In that regard, an obligation scheme (applying on commercial buildings) and a MEPS could possibly be conflicting instruments, as they both aim at obliging 2 different actors to achieve results: an energy supplier has to reduce its supply (on entire portfolio) by stimulating investments, while at the same time a building owner has to increase the performance of its building. Energy supplier and building owner have both the same objective: improve building performance, but with possibly different agenda/timeline, scope (one building vs a portfolio), or even ambition. To conclude, it will be crucial to ensure the coherence and complementarity in the design of the two measures, if it is decided to use both (which we recommend only for commercial buildings, not for public ones).

Ultimately, decision makers implement EE policies and measures, not pathways. Hence, these underlying EE measures which are the backbone of the pathways need to be looked at more closely, and particularly the optimal pathway. This is the aim of Deliverable 4, which will be more descriptive on the content of all measures, suggestions on a clear action plan to proceed with the implementation with the CEER2 EE measures, and additional enabling measures. The optimal CEER2 pathway is a

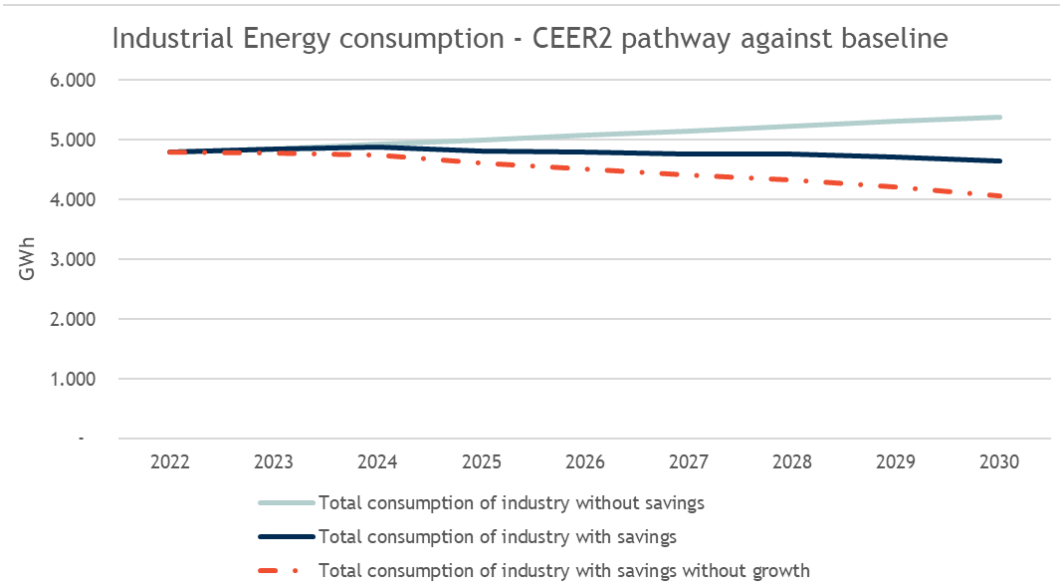
balanced mix of almost all EE measures, with some being well known since more than two decades (like grants and support, public transport infrastructure, carbon price, subsidies, …), and others that are more recent for Estonia (like vehicle/property taxation, voluntary agreement, MEPS, obligation scheme). Under Deliverable 5, we recommend to look at flagship measures which are highly relevant (important expectations, but also coming with a new concept) for CEER2 pathway. We recommend as flagship measures: voluntary agreement, MEPS and taxation measures (property and carbon pricing).

Energy efficiency and growth

Increasing energy efficiency should not become an obstacle to growth in the country. As explored in the work done to build the baseline, growth expectations have been included since the beginning.
Figure 0-7 illustrates the case of the industry

- The light blue line shows the expected energy consumption of the industry in a growth scenario, with an average yearly increase of 1.5% of industrial activity (all sectors included), without considering any savings;
- The dark blue line shows the results when applying energy efficiency measures to the industry. The difference between these lines shows the savings, highlighting that the difference between 2030 and 2022 is rather small (savings being compensated by growth)
- The red dotted line shows a fictive scenario where there is no growth in the industrial production. This is what would happen if there is no change in the industrial production, but energy savings are made across the industry. The difference between the dark blue and the red lines shows the potential for growth, including the arrival of new industrial players within Estonia

Figure 0-7 Comparison of industrial consumption under CEER2 pathway in a growth scenario and in a status uo scenario



Source: Trinomics, Energex & TalTech

The way forward

Political commitment in Estonia is crucial to achieve energy efficiency gains in buildings, industry and transport to meet the ambitious targets set by the European Union. **Given the current trajectory and measures, Estonia is not on track to meet the Energy Efficiency Directive Target.** It is imperative to take additional actions to fully unlock the potential of cost-effective energy savings, including ramping up measures and investment in energy efficiency. With all measures, additional resources need to be taken into account to address energy poverty. This would entail a prioritization of measures, identifying vulnerable groups, and developing tailored support.

Developing and implementing the optimal pathway towards the 2030 target requires the mobilization of all administrations concerned by the building sector; the public authorities, health, education (as administrative building owners); the economic affairs (to address private service buildings and SMEs); transport and spatial planning; the industry (to engage all important sub sectors); and the finance and budget (to manage incomes and outcomes). The optimal pathway will require around EUR 15.2 billion over the obligation period (2021-2030), with bulk of the investments to be made during the 2025-2030 period, out of which EUR 5.3 billion will be public money (grants and support but also public infrastructure). Given the large public and private investments, where both the public and financial sector need to be involved, a wide array of financial instruments needs to be mobilised - from grants to loans and guarantees.

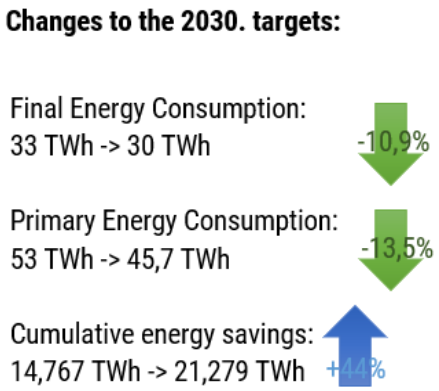
1 Introduction

Deliverable 3 is a comprehensive study of the key policies and measures used to create 6 policy pathways identified to achieve Estonia's energy efficiency potential in the context of climate neutrality by 2050.

Final goal of the deliverable

Each pathway is assessed to which extend it can lead to comply with the new Energy Efficiency Directive (EED) targets. Obligations arising from the revised EED lead to cumulative savings of 21.279 TWh over the 2021-2030 period (the previous 2018 EED led to 14.767 TWh), while final consumption should be at maximum 30TWh in 2030 (the previous 2018 EED led to 33TWh). Overall changes to the 2030 energy target, in line with the EED recast are shown in Figure 1-1.

Figure 1-1 EED Changes to 2030 targets



The 2023 EED recast introduces a progressive increase in ambition for the annual rate of energy savings. It starts with a rate of 1.3% from 1 January 2024 to 31 December 2025, followed by 1.5% from 1 January 2026 to 31 December 2027, and finally, 1.9% from 1 January 2028 to 31 December 2030 (EED Art. 8.1). This results in a constant average annual rate of 1.49% over the entire period from 2024 to 2030 Figure 1-2.

Figure 1-2 Updated yearly savings in % under the revised EED

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Per year	0.8%	0.8%	0.8%	0.8%	1.3%	1.3%	1.5%	1.5%	1.9%	1.9%	1.9%
Average					1.49%						

Design of a comprehensive set of EE policies and measures

The study analyses six energy efficiency pathways up to 2030 in addition to the baseline scenario developed in deliverable 2, and draws some considerations up to 2050. Each pathway encompasses various levels of ambition and includes a detailed description of its policies and measures. At least 10 new or changed policy measures are analysed and included per pathway, with two pathways focusing on energy efficiency obligation (the *EEOS* pathway) and voluntary agreements schemes (the *VA* pathway) as flagship policies.

The 6 policy pathways include:

- the Energy Efficiency Obligation Scheme (EEOS) pathway, with as main policy instrument the Obligation Scheme, as per Article 9 of the 2023 EED, for all sectors;

- the Voluntary Agreement (VA) pathway, with as main policy instrument a *VA*, mainly for the industry, possibly for large buildings and the agricultural/forestry sector;
- the Renovation Wave Pathway, with policy instruments mainly targeting the renovation of buildings (via support schemes, Minimum Energy Performance Standards, property taxation, carbon taxation);
- the Energy Efficient Transport (EET) pathway, with a strengthening of all policies aiming at accelerating the modal shift to public transport, low emitting alternatives (e.g., soft transport modes);
- the Comprehensive Energy Efficiency Reform 1 (CEER1) pathway, which combines a set of EE policies and measures in a comprehensive and coherent way; and
- the Comprehensive Energy Efficiency Reform 2 (CEER2) pathway, which strengthen *CEER1* to allow reach all EED targets.

We need to ensure that at least one out of the six pathways allow to reach all EED targets, while the others can only reach a few ones.

Objectives of the report

The key objectives of the report are to:

- Thoroughly assess the benefits, costs, and risks of various energy efficiency policy options, configurations, and combinations across relevant indicators
- Determine the optimal level of ambition for energy efficiency targets, considering the NECP update and the National Development Plan of the Energy Sector until 2035, while adhering to EU legislation and the energy efficiency first principle.
- Make informed decisions on specific policies and measures required to achieve the identified ambition level.

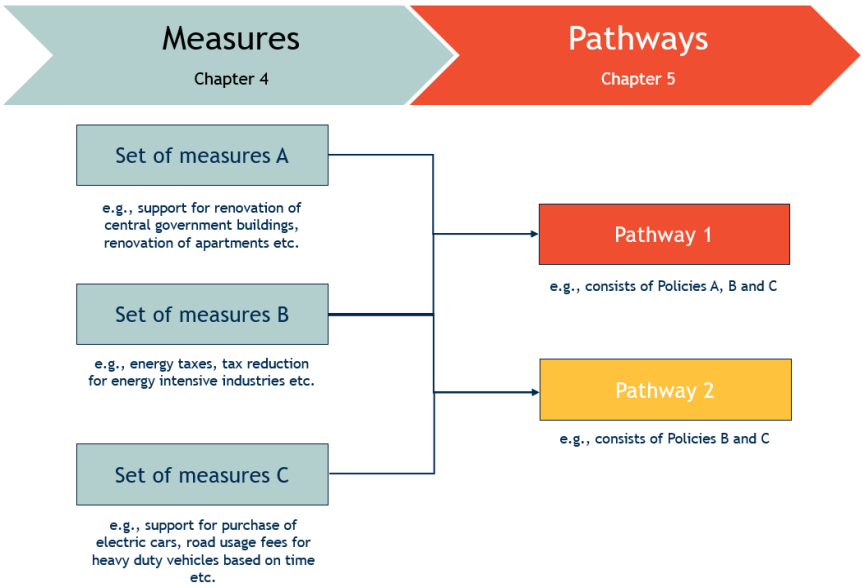
The study is based on input provided via literature review, best practice analysis, and also workshops and interviews conducted with Estonia stakeholders.

Structure of the report

Under **chapter 2**, the report starts by summarising the current situation regarding Energy Efficiency in Estonia, highlighting how Estonia currently performs with regards to Energy Efficiency, and what is the gap with the current policies to reach the 2030 EED targets. Thereafter it recalls the EED targets into details, to guide the assessment of compliance with the directive, and support the adaptation of the revised NECP by June 2024. It also.

Under **chapter 3**, the report provides the global overview of six Energy Efficiency pathways towards the EED targets. The pathways are a combination of various Energy Efficiency policy measures (cf. Figure 1-3). This chapter describes shortly the pathways and the measures they contain, with some global indicators allowing a better overarching understanding of their content and logic.

Figure 1-3: The process of measures and policies to create energy efficiency pathways



Under **chapter 4**, the report introduces all policy Energy Efficiency measures individually.
To reach the EED targets, the government will have to take Energy Efficiency measures requiring political decisions and commitment and involving several stakeholders. The pathways only illustrate how several measures can increase the country's energy savings by focusing on specific sectors, or by balancing in a comprehensive set several measures across all sectors. To assess a specific pathway, there is need to preliminary deeply understand the underlying measures of the pathway. The aim of chapter 4 is to provide the needed data to understand the Energy Efficiency measures, developing their detailed descriptions, also trying to capture their political sensitivity.
The detailed analysis of policies and measures includes the expected costs, impacts, risks, barriers, and key implementation steps.

Under **chapter 5**, the pathways towards Energy Efficiency targets are established. Thereafter, a comprehensive impact assessment is conducted for each pathway (Pathway analysis), covering the

- main results: achieved level of (primary and final) energy consumption in 2030, energy savings achieved, annual savings, renovated building area, investment needs and cost of measures (by private and public funding), annual cost savings, main considerations beyond 2030;
- impact assessment of the following indicators: impact on GDP breakdown; GHG emissions and environmental factors; energy prices; disposable income and energy poverty, employment and labour productivity, taxes and additional incomes, regional impact;
- implementation assessment of the following topics: advantages and disadvantages; potential barriers to more Energy Efficiency, actors and concerned stakeholders, key risk of the pathway, policy impacts, alignment with EEF.

Under **chapter 6**, the report compares the pathways, evaluating their suitability, against the main energy results, the impact assessment of various indicators and the implementation assessment.

Chapter 7 concludes the optimal contribution of the selected pathway compared to other decarbonization options, and provides some recommendations for the next steps.

The D3 Modelling accompanying XLS sheet includes the input data and results of the modelling and assessment in Excel format.

Energy Efficiency First principle

Disclaimer on the alignment with the Energy Efficiency First (EEF) principle

This study and deliverable simulate Energy Efficiency measures in all end use sectors that might contribute to increase energy savings, for Estonia to reach the EU Energy Efficiency target. It does not comprise the decarbonization of the electricity system, nor does it integrate fuel switch to low carbon alternatives. The model does use the primary energy factor, or the increase in electricity use (e.g. via the deployment of heat pumps) as external parameters, which values are fixed outside the model.

The EEF principle is applied through the following logic.

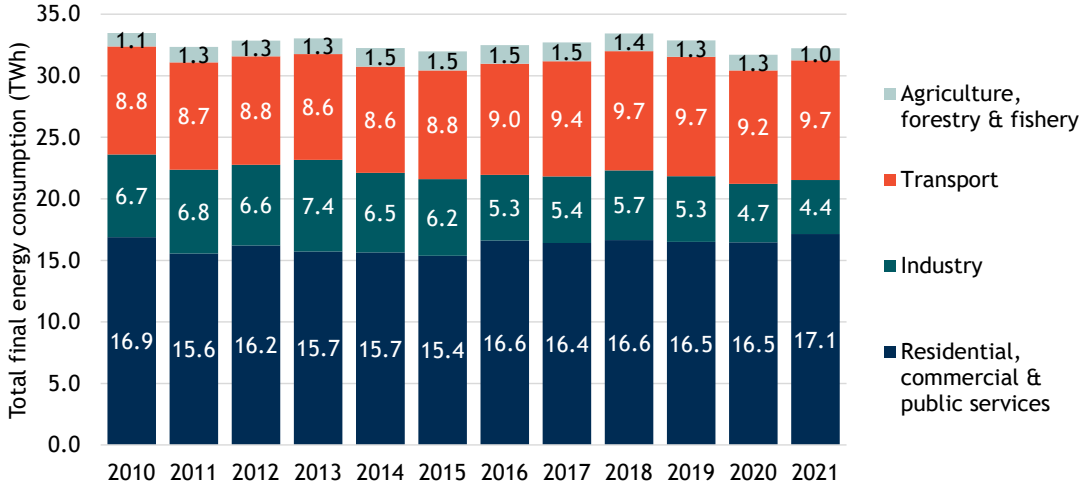
- Firstly, the selected pathway (CEER2) will propose the most balanced path towards the EU Energy Efficiency target, which is the outcome, at EU level, of the application of the EEF. Hence reaching the EU EE target already implements the EEF principle;
- Secondly, the model compares EE pathways each addressing a specific sector (buildings, transport, and industry), with a highly ambitious EE objective. The final result (CEER1 and CEER2) looks at the most balanced option, spreading the efforts across sectors, primarily buildings and transport. This could be seen as contradictory to the EEF, as more could be done in each sector, but it also captures the most realistic path to ensure effective savings;
- Thirdly, there are major interaction between EE and fuel switch, like behavioural changes required (e.g. more public transport replacing individual vehicles vs using e-fuels); infrastructure deployment and the pace at which low carbon alternative fuels can deploy; global market trends (e.g. massive mobilisation of feedstock to feed in one specific sector, while not being anymore available for the other sectors); growth trend in Estonia, and particularly regarding the industrial activity and/or evolution of the building stock, and transport needs;
- Fourthly, an ambitious EE target should take into account the time horizon for the changes to occur. This crucial aspect has been captured within the *CEER1* and *CEER2* pathways, accelerating EE in a realistic way.

2 Energy Efficiency Targets & current state of play of energy efficiency in Estonia

2.1 Current situation of energy consumption in Estonia

Over the past decade, final energy demand in Estonia has slightly declined by 4%. This is mainly driven by the economic shift to services (information and communication, trade, professional and technical activities) and away from manufacturing. Additionally, the decline in energy use in industry is also driven by the introduction of a carbon price under the EU ETS, where the carbon price started to significantly increase after 2017. The impact of COVID-19 pandemic reduced the energy demand of industry in 2020 and 2021, while transport did face a drop in 2020 and saw its increasing trend back in 2021 (Figure 2-1).

Figure 2-1 Total final energy consumption in Estonia, 2000-2020, TWh

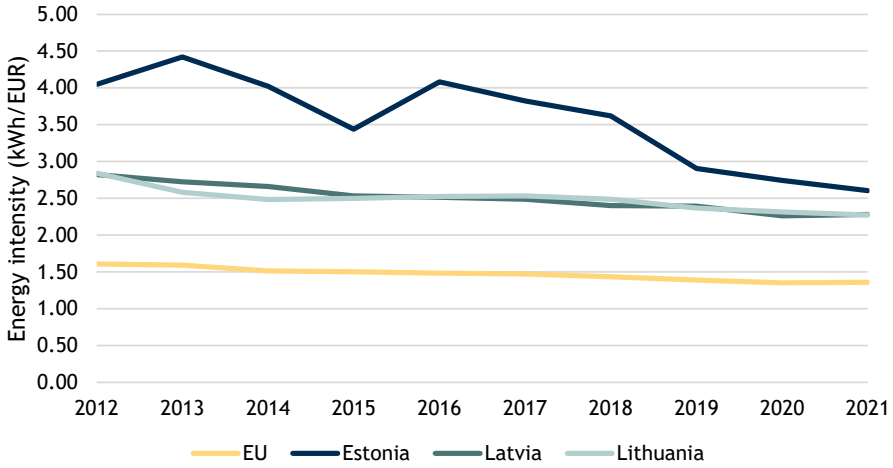


Source: Statistics Estonia

Compared to the EU average and the other Baltic States, Estonia is considered energy intensive (Figure 2-2), based on the energy intensity of the economy, which is calculated as a ratio of the GDP and energy consumption. The main difference in energy intensity between the Baltic States and the EU average is that more heating is required in these northern countries (including the Nordics). Estonia's energy intensity has declined over the past decade, which is partially due to the economic shift to services as mentioned above, but also because of the decline of energy intensive industry, and decreasing usage of oil shale. However, it remains higher than the other Baltic States, Latvia and Lithuania, due to the countries high energy intensity[10]. Potential causes of this difference are Estonia's use of oil shale and use of older energy infrastructure (e.g., district heating).

[10] Energy intensity is based on gross available energy = Primary production + Recovered & Recycled products + Imports – Export + Stock changes

Figure 2-2 Energy intensity of Estonia, the Baltic States and EU, 2012-2021, kWh/EUR



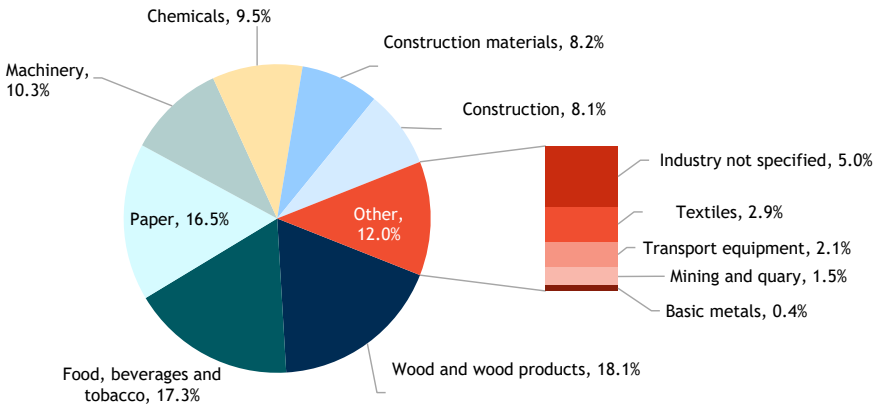
Source: Eurostat (2023). Energy intensity[11]

2.1.1 Energy efficiency in industry

Estonia's energy consumption from industry has declined as Estonia shifts towards a more service-oriented economy. Overall, industry accounts for 15-20% of energy final consumption in Estonia. Over the past two decades, energy demand from industry has decreased by 30%. As of 2021, most of Estonia's industrial energy consumption comes from the production of wood/wood products, food/beverages, paper, construction and construction materials (Figure 2-3). Over the past decade, the greatest decline in energy use has occurred in the construction materials sector, where the drop in energy use is greatly driven by the impact of COVID-19 on the industry.

The energy demand has also decreased due to the closure of many energy-intensive industries, such as the ammonia industry NITROFERT AS, the cement plant Kunda Nordic Tsement AS (which has stopped producing energy-intensive clinker and today only produces cement from imported clinker), etc.

Figure 2-3 Share of Estonia's industry energy consumption, 2021, %



Source: Eurostat (2023). Simplified energy balances

[11] Energy intensity is based on gross available energy = Primary production + Recovered & Recycled products + Imports – Export + Stock changes

2.1.2 Energy efficiency of buildings

Over 50% of Estonia's energy demand comes from the residential and service sector, accounting for 16.5 TWh of final energy consumption in 2020.[12] Roughly 73% of Estonia's building stock is residential (in terms of floor area, m^2), while the remaining building stock consists of offices, health facilities, education buildings, hotels and restaurants and wholesale and retail trade.[13] Likewise, most of the energy consumption from buildings comes from households (10.9 TWh). In particular, residential consumption per square meter is higher in Estonia compared to the EU average[14] as well as the highest in comparison to all IEA countries.[15] The main drivers of this excess of energy use are due to the required heating in the colder months as well as Estonia's aging building stock and the energy inefficiency of most residential buildings.[16]

As building energy demand forms a significant part of Estonia's energy balance, there is a high potential for energy savings. According to Estonia's Long-term Renovation Strategy (LTRS), only 22% of single-family dwellings, 9% of apartment buildings and 27% of non-residential buildings meet an energy performance certificate (EPC) class C or higher.[16] This data is mostly based on age of the building, as only 10% of buildings have energy performance certificates. The living space per capita in Estonia is 30.1 m^2. This is lower than the European average of 38 m^2.

The key to increasing energy efficiency in Estonia's building sector is through (deep) renovation. Deep renovation of a building is categorised as a renovation that results in reducing energy demand by more than 60% and therefore achieving, among other things, a reduction in the volume of imported fossil fuels and CO_2 emissions. At the same time, it is possible to improve the quality of the living environment (i.e., improving indoor air quality) and reduce the maintenance costs of the housing stock, which have a direct positive impact on people's livelihoods.

In the past decade, the number of granted building permits for renovating residential buildings has more than doubled.[17] However, the volume of renovations may be underestimated due to unregistered renovations,[16] although as the construction sector becomes more digital, unregistered construction works is expected to decrease. Furthermore, not all recorded renovations are expected to dramatically improve the energy performance of buildings, as improving energy efficiency is not usually the main goal of these renovations.[16]

Overall, the current renovation rate of Estonia's building stock has been insufficient to achieve Estonia's building energy efficiency targets for 2050. According to Estonia's LTRS, about 54 million square meters of the existing building stock need to be renovated from 2020 to 2050 (22 mil. m^2 of non-residential buildings, 14 mil. m^2 of single-family dwellings and 18 mil. m^2 of apartment buildings).[18] At the current

[12] IEA (n.d.). Share of total final consumption (TFC) by sector, Estonia 1990-2020; 1 https://ec.europa.eu/eurostat/databrowser/view/nrg_bal_s/default/table?lang=en
[13] European Commission, Directorate-General for Energy. (2019). Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU: final report, Publications Office.
[14] Government of the Estonian Republic (2017). Energiamajanduse arengukava aastani 2030 (EN: National Development Plan of the Energy Sector until 2030).
[15] OECD (2022). Shrinking Smartly in Estonia: preparing regions for demographic change. Figure 2.9
[16] Tal Tech & Estonian Ministry of Economic Affairs and Communication (2020). Long-term strategy for building renovation.
[17] https://andmed.stat.ee/en/stat/majandus__ehitus__ehitus-ja-kasutusload/EH045/table/tableViewLayout2
[18] Tal Tech & Estonian Ministry of Economic Affairs and Communication (2020). Long-term strategy for building renovation.

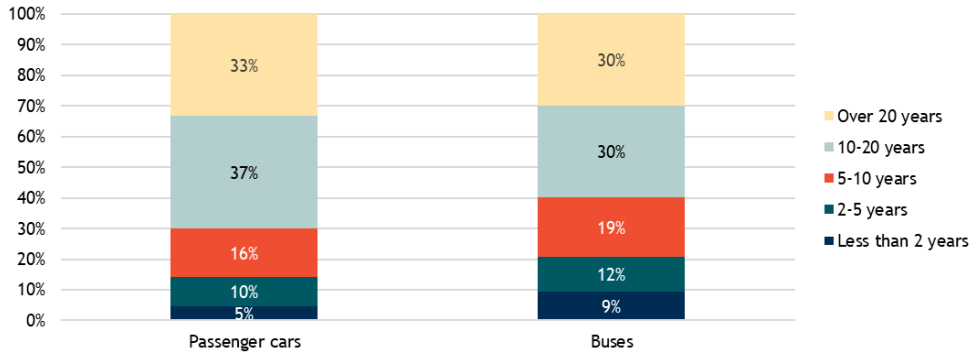
rate of energy renovation in Estonia (about 1% annually[19]), the majority of Estonia's building stock will remain unrenovated, and energy inefficient by 2050. Specifically, only government-owned buildings are expected to reach Estonia's target, according to the LTRS; however, these buildings account for only 1.5% of the building stock requiring renovation.[18]

2.1.3 *Energy efficiency in transport*

Estonia's transport sector's energy consumption has remained fairly stable over the past two decades, representing almost one-third of Estonia's total final energy demand as of 2020. The majority of Estonia's transport energy consumption comes from road transport. While Estonia has relatively good access to public transport mainly in large cities (especially Tallinn and Tartu), in 2019, passenger cars represented 80% of inland passenger transport, followed by 18% by bus and 2% by train. This tendency of private car use is driven by the amount of time required to reach the destinations and the complexity of connections between different means of transportation needed to reach these destinations.

Further, one of the main problems is the average age of Estonia's rolling stock. Almost 60% of buses[20] and 70% of passenger cars in Estonia are over 10 years old (Figure 2-4).[21] As older vehicles are less energy efficient than newer vehicles, the age of the current public transport stock signals inefficiency.

Figure 2-4 Share of Estonia's rolling stock by age category, 2021, %

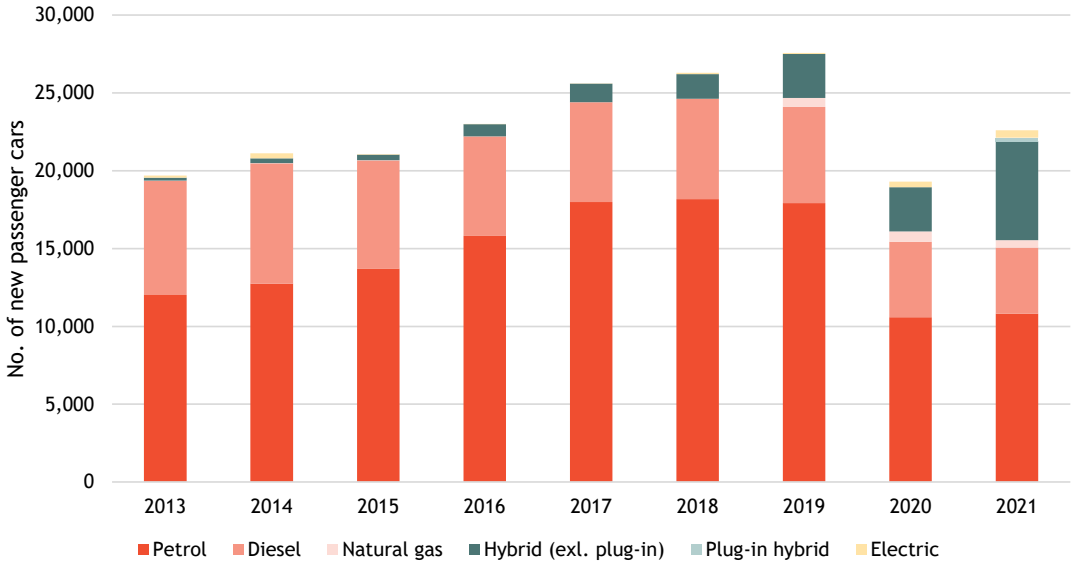


Source: Eurostat (2023). Modal split of inland passenger transport.

In the past decade, there has been an increase in uptake of electric and hybrid vehicles, which are less energy and emissions intensive, however fossil-based cars remain the most dominant in the market (Figure 2-5). From 2013 to 2021, the uptake of new hybrid and electric passenger vehicles has increased significantly, while fossil-based vehicle sales have declined. However, almost 70% of all new passenger vehicles in 2021 were 100% fossil-based. For new buses, all are fossil-based.[22]

[19] TalTech (2023). How can we smoothly organise the Renovation Wave in Estonia.
[20] Including motor coaches, buses and trolley buses
[21] https://ec.europa.eu/eurostat/databrowser/view/road_eqs_busage/default/table?lang=en
[22] Eurostat (2023). New motor coaches, buses and trolley buses by type of motor energy. Retrieved from: https://ec.europa.eu/eurostat/databrowser/view/ROAD_EQR_BUSMOT__custom_5548100/default/table?lang=en

Figure 2-5 New passenger cars by type of motor energy in Estonia, 2013-2021



Source: Eurostat (2023). New passenger cars by type of motor energy.

2.2 Energy efficiency targets

2.2.1 EU energy efficiency targets and strategies

The European Union has set several targets to boost the energy efficiency of the Member States' economies. The main component of the EU's energy efficiency strategy is the Energy Efficiency Directive (EED) (2018), recast by the European Commission (EC) in 2021 and recently published (2023) with more ambitious targets and measures in order to reach the EU's climate goal to reach 55% reduction in GHG emissions by 2030 (compared to 1990 levels). **Erreur ! Source du renvoi introuvable.** 2-1 illustrates the change in the EU's energy efficiency targets. Additionally, the recast promotes the *Energy Efficiency First principle*, emphasising the objective to prioritise energy efficiency. Particularly for industry, the EED also establishes minimum criteria for energy audits of large companies as well as promoting the setting up of energy management systems.

Additionally, in light of the ongoing energy crisis, the EC proposed an increase of energy efficiency targets in the REPowerEU plan in order to accelerate the energy transition.

In March 2023, a provisional political agreement between the Council of the EU and the EU Parliament was proposed to reduce the final energy consumption at the EU level by 11.7% in 2030 (compared to 2020 forecast for 2030).[23] The new agreement proposes that Member States will have to:

- Achieve new annual savings of 1.49% of average final energy consumption between 2024 and 2030, and achieve 1.9% by 31 December 2030. Energy savings realised through policy measures under the current and revised Energy Performance of Buildings Directive (EPBD), and measures stemming from the extension of EU ETS for buildings and transport; and from emergency energy measures may be used to count towards this target.

[23] European Commission. 10.03.2023. European Green Deal: EU agrees stronger rules to boost energy efficiency. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1581

- Ensure that the public sector will achieve an annual energy consumption reduction of 1.9% - excluding public transport and armed forces.
- Achieve an annual renovation rate of at least 3% of the total floor area of buildings owned by public bodies.

Table 2-1 EU 2030 energy efficiency targets

	EED (2018)	EED recast (2021)	REPowerEU (2022)	EED recast (2023)
Energy efficiency target (compared to 2007 RS[24]) (final/primary) (%)	32.5%	44.4%/ 45.8%	47.0%/ 48.1%	46.1%/47.4%
Energy efficiency target (compared to the 2020 RS[25])	-	9%	13%	11.7%
Annual energy savings (%)	0.8%	1.5%	2.2%	1.9%
Final energy consumption (Mtoe)	956	787	750	763
Primary energy consumption (Mtoe)	1 273	1 023	980	993
Annual renovation of public buildings (% total floor area)	-	3%	*no change*	3%

In addition to the EED, the EC further promotes energy efficiency in industry through the EU emissions trading system (ETS), which sets a carbon price for emissions intensive industries. In 2021, the EC proposed a recast of the EU ETS Directive, which expands ETS to maritime, waste, road transport and buildings.

Another main element of the EU's energy efficiency policy is the Energy Performance in Buildings Directive (EPBD), which sets goals to decarbonise the EU building stock to meet the EU's climate goals. The EC also proposed a recast of the EPBD in 2021, and as of 2023 is also under revision, which sets out measures to fully decarbonise the building stock by 2050. The main new measures of the proposal include:

- Introduction of minimum energy performance standards;
- National Building Renovation Plans (revised Long-Term Renovation Strategies (LTRS));
- Increase the reliability, quality, and digitalisation of Energy Performance Certificates (EPCs); and
- Introduce Building Renovation Passports.

Additionally, in 2020, the EU published the Renovation Wave strategy, which establishes the EU's goal to at least double the annual energy renovation rate of buildings by 2030 as well as promote deep renovation.

2.2.2 *Energy Efficiency targets for Estonia*

There are several Energy Efficiency targets:

- Targets directly coming from the EED compliance;
- Targets fixed in national policy commitments, like the 2019 NECP or NDPES, that have been decided to reach decarbonisation targets.

[24] The 2007 reference scenario (RS) projected EU final energy consumption to be 1416 Mtoe and EU primary energy consumption to be 1887 Mtoe
[25] The 2020 reference scenario (RS) projected EU final energy consumption to be 864 Mtoe and EU primary energy consumption to be 1124 Mtoe

Different pathways will be assessed in chapter 5 to determine to which extend they reach all Energy to Efficiency targets, including their alignment with the new Energy Efficiency Directive (EED) targets reveal their potential to comply with these goals.

Reduction of energy consumption in 2030

EED, article 4

Member States shall collectively ensure a reduction of energy consumption of at least 11,7 % in 2030 compared to the projections of the 2020 EU Reference Scenario so that the Union's final energy consumption amounts to no more than 763 Mtoe. Member States shall make efforts to collectively contribute to the indicative Union primary energy consumption target amounting to no more than 992,5 Mtoe in 2030.

For Estonia, the contribution to the binding EU final energy consumption amounts to **no more the 30 TWh in 2030**, down from the previous 33 TWh established in the 2018 EED, thereby aligning with overall changes to the 2030 energy target in accordance with the EED recast.

The contribution to the indicative target EU's primary energy consumption target amount to **no more than 45.7 TWh** in Estonia.

Annual rate of energy savings

The 2023 EED recast introduces a progressively more ambitious approach to the annual energy savings rate. This progression entails a 1.3% rate from January 1, 2024, to December 31, 2025, followed by 1.5% from January 1, 2026, to December 31, 2027, and ultimately reaching 1.9% from January 1, 2028, to December 31, 2030 (as outlined in EED Article 8.1 below, and depicted in *Table 2-2 Updated yearly savings in % under the revised EED*). This sequence yields a consistent average annual rate of 1.49% over the entire 2024-2030 period.

Table 2-2 Updated yearly savings in % under the revised EED

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Per year	0.8%	0.8%	0.8%	0.8%	1.3%	1.3%	1.5%	1.5%	1.9%	1.9%	1.9%
Average					1.49% (*)						

(*) The "MAIN ELEMENTS OF THE FINAL COMPROMISE TEXTS" of EED says "There will be a gradual increase of the annual energy savings target for final energy consumption from 2024 to 2030. Member states will ensure new annual savings of 1.49% of final energy consumption on average during this period, gradually reaching 1.9% on 31 December 2030." And also the web site of the EC.

EED, article 8 (1)

Member States shall achieve cumulative end-use energy savings at least equivalent to:

(a) new savings each year from 1 January 2014 to 31 December 2020 of 1,5 % of annual energy sales to final customers by volume, averaged over the most recent three-year period prior to 1 January 2013. Sales of energy, by volume, used in transport may be excluded, in whole or in part, from that calculation;

*(b) new savings each year **from 1 January 2021 to 31 December 2030** of:*

(b)(i) 0,8 % of annual final energy consumption from 1 January 2021 to 31 December 2023, averaged over the most recent three-year period prior to 1 January 2019;

(b)(ii) 1,3 % of annual final energy consumption from 1 January 2024 to 31 December 2025, averaged over the most recent three-year period prior to 1 January 2019;

(b)(iii)	*1,5 % of annual final energy consumption from 1 January 2026 to 31 December 2027, averaged over the most recent three-year period prior to 1 January 2019;*
(b)(iv)	*1,9 % of annual final energy consumption from 1 January 2028 to 31 December 2030, averaged over the most recent three-year period prior to 1 January 2019.*

With an average annual rate of 1.49% over the entire period from 2024 to 2030.

Cumulative savings

The article 8(1) EED requirement results in cumulative savings of 21.279 TWh between 2021 and 2030 (representing a 44% increase from the previous 2018 EED target of 14.767 TWh).

EED, article 8 (1)

...

Member States shall decide how to phase the calculated quantity of new savings over each period referred to in points (a) and (b) of the first subparagraph, provided that the required total cumulative end-use energy savings have been achieved by the end of each obligation period.

Member States shall continue to achieve new annual savings in accordance with the savings rate provided in point (b) (iv) of the first subparagraph for ten-year periods after 2030.

EED, article 8 (2)

Member States shall achieve the amount of energy savings required under paragraph 1 of this Article either by establishing an energy efficiency obligation scheme referred to in Article 9 or by adopting alternative policy measures referred to in Article 10. Member States may combine an energy efficiency obligation scheme with alternative policy measures…

EED, article 8 (3)

Member States shall implement energy efficiency obligation schemes, alternative policy measures, or a combination of both, or programmes or measures financed under an Energy Efficiency National Fund, as a priority among, but not limited to, people affected by energy poverty, vulnerable customers, low-income households and, where applicable, people living in social housing. Member States shall ensure that policy measures implemented pursuant to this Article have no adverse effect on those persons. Where applicable, Member States shall make the best possible use of funding, including public funding, funding facilities established at Union level, and revenues from allowances pursuant to Article 22(3)(b) with the aim of removing adverse effects and ensuring a just and inclusive energy transition…

Exemplary role of public sector

EED, article 5

Member States shall ensure that the total final energy consumption of all public bodies combined is reduced by at least 1.9% each year, when compared to 2021.

Exemplary role of public bodies' buildings

EED, article 6

... each Member State shall ensure that at least 3% of the total floor area of heated and/or cooled buildings owned by public bodies is renovated each year to at least be transformed into nearly zero-energy buildings or zero-emission buildings...

Summary of all EED targets for Estonia

Table 2-3 provides an overview of all the EED targets for Estonia.

Table 2-3 EED targets for the 2024 NECP

NECP 2030 objective	Target	Reference
Final energy consumption in 2030 (TWh)	30	EED Art. 4
Primary energy consumption in 2030 (TWh)	45.7	EED Art. 4
Annual final energy savings rate in 2030 (%)	1.90%	EED Art. 8(1)
Annual final savings rate, 2024-2030 average (%)	1.49%	EED and EC web site annual savings obligation
Cumulative savings 2021-2030 (TWh)	21.279	The required total cumulative end-use energy savings have been achieved by the end of the obligation period 2021-2030, article 8(1)
Total renovated area of central government buildings (2021-2030) (m2)	296,185	2023 NECP update; based on Art 6 EED 3% target
Industry primary energy savings in 2023 (GWh)	460[26]	2023 NECP update
Transport fuel consumption (TWh)	8.3	2023 NECP update

2.3 Estonia energy efficiency strategies

There are several guiding policy plans in Estonia which develop strategies to increase energy savings, contributing to reach the EED targets, particularly:

- 2017 National Development Plan of the Energy Sector until 2030;
- National Energy and Climate Plan (an update to the 2019 NECP is under preparation to be submitted by June 2023);[27]
- Long-term Renovation Strategy (until 2050), and
- Recovery and Resilience Plans.

Estonia's current energy efficiency targets are based on the current EU EED (2018), with an annual final energy savings target of 0.8% from 2021 to 2030. Following the ongoing recast of the EED, **Estonia will need to adjust its energy efficiency strategy to be aligned with the new more ambitious EED targets**, like reaching 1.9% annual energy savings target by 2030, and the 1.49% annual energy savings in average over the 2024-2030 period.

2.3.1 2017 National Development Plan of the Energy Sector until 2030 (NDPES 2030)

The National Development Plan of the Energy Sector until 2030 NDPES 2030 is the guiding policy document of the Estonian energy sector (MEAC, 2017), integrating six policies among which the following address Heating & Cooling (H&C): energy efficiency, renewable energy, housing and building, and energy technology programme. Its aim is to ensure that comprehensive planning of the energy sector is guided by a single development plan. The plan establishes that GHG emissions from the energy sector must be reduced by at least 70% by 2030 (compared to 1990 levels), with more than 80% by 2050. Additionally, there is a target of final energy consumption stabilising to 32 TWh by 2030 (same as the 2010 level).

[26] The NECP 2030 target is industrial energy savings of 460 GWh of primary energy per year, which is 232 GWh of final energy savings per year

[27] Draft of Estonia's National Energy and Climate Plan 2023. Available at: https://www.mkm.ee/energeetika-ja-maavarad/energiamajandus/energia-ja-kliimakava

Considering the new EED target, the final energy consumption should be reduced to 30 TWh, which is below the NDPES target, requiring additional efforts.

In order to meet Estonia's 2030 targets, the plan states that the following energy efficiency-related outcomes are required:

- Energy renovations of buildings – 40% of small residential buildings have an EPC class of at least C or D, 50% of apartment buildings have at least class C and 20% of non-residential buildings have at least class C;
- All new buildings are nearly zero-energy buildings;
- 37% of the total floor areas of central government buildings have at least the minimum energy efficiency requirements enforced in 2013[28];
- Vehicles in 2030 do not consume more than the levels of 2012 (8.3 TWh).

Based on the energy efficiency actions laid out in Estonia's NDPES 2030, the following contributions to climate targets are expected:

- Domestic primary energy consumption in 2030 to be 10% lower compared to 2012 levels;
- Energy intensity of the Estonian economy to drop from 5.6 MWh/EUR 1,000 in 2017 to 2 MWh/EUR 1,000 in 2030.

2.3.2 *National Energy and Climate Action Plan 2030 (2023 update)[29]*

Under the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, every Member State was required to submit a National Energy and Climate Action Plan 2030 (NECP) by the end of 2019, which provides an overview of the national energy and climate targets per sector and the action plan to achieve them. In August 2023, the Estonian government submitted an update to their NECP. The level of ambition of the Action Plans must meet a certain level in order to reach the EU-wide targets. Estonia's NECP has been developed by several national ministries based on existing development documents and various related studies and analyses. Estonia's NECP comprises of 112 measures (71 measures in the previous NECP) to meet its energy and climate policy targets, of which 27 are related to energy efficiency.

Objectives of the 2030 NECP (2023 update)

The 2023 NECP 2030 sets the following national objectives related to energy efficiency:

- ***Overall energy efficiency***
  - Annual energy savings rate of 1.3% from 2024 to 2025, 1.5% from 2026 to 2027 and 1.9% from 2028 to 2030 (in line with 2023 EED);
  - Less than 33.3 TWh of final energy consumption in 2030;
  - 21.3 TWh of cumulative end-use energy savings from 2021 to 2030;
  - Less than 63.9 TWh of primary energy consumption in 2030;
- ***Reconstruction of buildings (same as NDPES)***
  - ≥40% of single houses have an EPC rating of at least category C or D;
  - ≥50% of apartment buildings have an EPC rating of at least category C;
  - ≥20% of non-residential buildings have an EPC rating of at least category C;

[28] According to the Building Code, the minimum requirements for energy performance are reviewed at least once every five years.
[29] https://mkm.ee/energeetika-ja-maavarad/energiamajandus/energia-ja-kliimakava

- 296,200 m2 of central government buildings undergoing renovation in 2021 to 2030;

- ***Industry***
  - Manufacturing companies must have an annual primary energy savings of 460 GWh;
- ***District heating and cooling***
  - At least 0.1 TWh reduction in heat loss of district heating by 2030 (compared to 2012);
  - 25 MW of electricity power from cogeneration facilities in the additional district heating network built over the period 2020-2030;
- ***Transport***
  - Less than 5% increase in demand for use of passenger cars in 2030 compared to 2010; and
  - ≤ 8.3 TWh of fuel consumption of the vehicle fleet in 2030 (to not exceed 2012 levels).

Existing Energy Efficiency Measures in current 2019 NECP and in its draft update

The relevant existing energy efficiency measures mentioned in the Estonian NECP are listed in table 2-4, including existing and potential measures.

Table 2-4 Relevant energy efficiency measures in Estonia's NECP

Type of measure	NECP 2019	NECP 2023	Measure
Energy	EN1	EN1	Renewable energy support and support for efficiency CHP
	EN3	EN3a-c	Development of heating sector
	EN4	EN4a-c	Additional development of the heating sector
	EN7	EN7	R&D activities program of the energy development
	EN8	EN8	Improving the quality of network services
	EN9	EN9	Increasing the share of the weatherproof grid
	EN10	EN10	Transition to the remote reading system
		EN16	Support for making the processing of fishery and aquaculture products more energy and resource efficient
		EN17	Support for energy and resource audits of fishery and aquaculture products establishments
		EN18	Oil boiler replacement programme
		EN19	Support for energy- and resource audits in industries
		EN20	Energy and resource efficiency in industries
		EN25	Energy tax measures
Buildings	HF1	HF1a-i	The renovation of public sector and commercial buildings
	HF2	HF2a-b	The renovation of private residential and apartment buildings
	HF3		The establishment of minimum requirements for nearly zero-energy buildings
	HF4	HF4	Investments in the street lighting renovation programme
	HF5	HF5a-b	Additional renovation of public sector and commercial buildings
	HF6	HF6a-b	Additional renovation of private residential and apartment buildings
		HF7	Residential Investment Fund
Transport	TR2	TR2a-b	Increasing fuel efficiency of the transport sector
	TR3	TR3	Promotion of sustainable driving
	TR4	TR4a-b	Spatial and land use measures in cities to increase the fuel-efficiency of transport and enhancement of the transportation system
	TR5	TR5	The development of convenient and modern public transport
	TR6	TR6	Time-based road usage fees for heavy-duty vehicles
	TR8	TR8	Additional enhancement of fuel-efficient driving
	TR9	TR9	Additional spatial and land use measures in cities to increase the fuel efficiency of urban transport and the effectiveness of the transportation system

Type of measure	NECP 2019	NECP 2023	Measure
	TR10		Additional activities for the development of convenient and modern public transport
	TR11	TR11	Establishment of mileage-based road usage fees for heavy-duty vehicles
	TR12	TR12	Tyres and aerodynamics of vehicles
		TR17	Promotion of clean and energy efficient road transport vehicles in public procurement
		TR18	Acquisition of additional passenger trains
		TR20	New tram lines in Tallinn
Agriculture	PM8	PM8	Investment to increase effectiveness of farms
	PM18		Investments in energy savings in greenhouses and vegetable warehouses and in the introduction of renewable energy therein
	PM22	PM22	Research and pilot projects
Industry	IP1	IP1	Green technology investment programme

Measures not yet implemented

New measures

Source: National Energy and Climate Action Plan 2030

2.3.3 Estonia's Long-term Renovation Strategy

Estonia's **Long-term Renovation Strategy** (LTRS) (2020) delivers a long-term vision for the renovation of the existing building stock and provides measures to support the renovation wave in Estonia, including:

- **Adoption of new technological solutions**, such as *prefabricated building materials* and *(simplified) digital tools*, to accelerate the rate of renovation, while not exacerbating the problem of labour shortage.
- **Research and development** to improve quality and efficiency of data collection and ease the issue of the labour shortage.
    - *Development of state registries*, to improve monitoring of renovation activities and tackle the lack of data for preparing renovation strategies;
    - *Mapping of decision-making process*, to understand why owners decide to start renovation works;
    - *Development of strategic spatial planning*, where general architectural and local government guidance materials for renovating buildings of different types and in different regions are needed.
    - *Analysis of the impact of buildings renovation*, to better understand the economic and environmental impact of renovating the building stock;
    - *Development of technical expertise*, to ensure that building renovations are economical and affordable as well as lead to higher indoor environmental quality (IEQ).
- **Awareness raising** where needed for private houses, apartment associations and commercial property owners, including cooperation with apartment associations and supporting energy audits for commercial buildings.
- **Demolition of underused buildings**, due to internal migration within Estonia, while resolving ownership issues and ensuring that urban spaces remain fully functional for the displaced residents.
- **Establishing financing measures** for private houses, commercial property owners and the public sector.

The Building Performance Institute Europe (BPIE) provided an assessment of Estonia's LTRS, amongst several others, and considered the strategy not compliant with the EPBD, as it did not provide a clear roadmap nor action plan of what is explicitly required to decarbonise the building stock.

2.3.4 The Estonian Recovery and Resilience Plan

The **Estonian Recovery and Resilience Plan** (RRP), which is an annex to the national strategy "Estonia 2035", establishes the objectives as well as reforms and investments funded by the European Union's Recovery and Resilience Facility (RRF). The RRF was established to support the long-term recovery of the European economy after the COVID-19 pandemic, with the aim to further support the green and digital transition of EU Member States.

Since the approval of the Recovery Plan in 2021, the budget of the plan has been adjusted, namely in accordance with the support needed for the REPowerEU initiative.[30] Specifically, this includes EUR 20 million of additional support for energy efficiency in single-family homes.

The investments of the RRP in Estonia totals up to EUR 863.3 million in grants, where the most critical opportunities are related to the green and digital transitions and a large portion of the funding will go to businesses.[31] Estonia's RRP includes investments directly relevant for energy efficiency, including:

- Development of e-construction (EUR 9 million);
- Support for renovation of apartment buildings (EUR 45 million); and
- Support for the renovation of small residential buildings (EUR 31 million).

The plan also includes funding for constructing public transport infrastructure, including:

- Construction of five Rail Baltica viaducts (EUR 31 million);
- Construction of the Tallinn Old Port tram line (EUR 10.5 million); and
- Municipalities' investments in bike-and walkways (EUR 5 million).

The NRRP also includes investments which are indirectly relevant, as they can be used for improving the energy efficiency of Estonia's economy, but are not directly related to energy efficiency, including:

- Green skills to support the green transition of enterprises (EUR 15 million);
- Green technologies development programme (EUR 8.38 million); and
- Deployment of resource-efficient green technologies (EUR 37.8 million).

2.4 Assessment of existing energy efficiency policies

Based on the barriers and policy gaps identified, an assessment is made of the existing measures and whether they should be continued, stopped/minimised or strengthened in order to achieve Estonia's energy efficiency targets.

Table 2-5 Assessment of existing energy efficiency policies

[30] https://www.rtk.ee/toetusfondid-ja-programmid/taaste-ja-vastupidavusrahastu-rrf/eesti-taastekava
[31] Ibid.

Type	Policy type	Policy	Cost-effectiveness (EUR /MWh)	Assessment
General	Strategies/ regulations	Strategies and targets	*Enabling*	Current strategies (NECP, LTRS) need to be modified to provide a comprehensive action plan to achieve the ambitious EE goals
		District Heating Act	*Enabling*	District Heating Act needs to be modified to encourage recovery of waste heat. Obligation to provide heat for 12 years and a low profit margin is not attractive to industrial stakeholders.
		Energy Sector Organisation Act (May 2022)	*Enabling*	This act provides the measures for achieving the national target of energy efficiency; the principles for promoting renewable energy; and the requirements for improving energy efficiency
	Financial incentives/ support	Fuel and energy tax (and exemptions)	n/a	Estonia's cumulative energy saving obligation for the period 2021-2030 is approximately 14,767 GWh. In order to fulfil this obligation, it is desired to continue with the tax measures reported in the previous reporting period. The purpose of the methodology presented by the European Commission is to calculate what the consumption would be if the minimum rates of the European Union were used and to compare it with the consumption based on the rates used in Estonia.[32]
		Carbon pricing (carbon tax, ETS)	n/a	In the EU, the ETS is in use, which is currently being implemented in Estonia for about 50 years for a large company. Some EU countries also use a more extensive carbon tax, which was mostly introduced before the EU system. The price of a ton of CO_2 in this trading system has increased from 7 euros in 2015 to 103 euros by the summer of 2023. With the "Fit for 55" bill, the EC plans to create a separate emissions trading system for road transport fuels, building fuels and polluting industries.[33] In the short term, CO_2 prices depend primarily on the weather. On the other hand, the developments taking place in the EU are important within the framework of *RePowerEU*, *Fit For 55* as well as the planned gas and electricity market crisis measures, which may significantly affect the prices of CO_2 quotas by increasing or decreasing the supply depending on the results.
		EU-funding financial support schemes	n/a	The projected energy savings for projects financed by grants from EU structural and investment funds in the period 2021-2030 is approximately 1133.26 GWh.[34]
Industry	Strategies/ regulation	Energy audits	n/a	Minimum requirements should be strengthened so that energy audits lead to more significant uptake of EE measures
	Financial incentives/ support	Carbon-pricing (ETS)	n/a	Continue
		ISO50001 standards for electric-intensive industry	n/a	Continue
		Financial support for EE measures in industry (EU-funding)	€223	
	Technical support schemes	Trainings and events to promote more sustainable use of energy and resources	n/a	Continue
Buildings	Strategies/ regulation	Long-term Renovation Strategy	*Enabling*	LTRS needs to be replaced with a new strategy which provides a clearer roadmap with a more detailed action plan
		Minimum energy performance requirements (MEPR)	n/a	
		Energy performance Certificates (EPCs)	n/a	That mandate for EPCs should be expanded to older buildings. Currently only 10% of buildings have EPC.

[32] *Development of calculation methodologies for financial measures suitable for fulfilling the national energy saving obligation and assessment of energy saving potential (KPMG study, 2020, in Estonian)*
[33] https://majandus.postimees.ee/7718200/hea-aeg-riigikassale-heitmekvootide-hind-pusib-rekordkorgel
[34] A *study on "EU Structural Funds the impact of the funded measures of the state to the fulfilment of energy economy goals", SEI Tallinn 2021*

Type	Policy type	Policy	Cost-effectiveness (EUR /MWh)	Assessment
		3% Renovation obligation for public buildings	n/a	Continue
	Financial incentives/ support	Financing measures for renovation (grants, loans, loan guarantees) (using EU-funding)	Apartments: €165-294 Small houses: €626 Public buildings: €1,079	
		Funding for resource efficiency in (construction) manufacturing	EUR 61	Continue
	Technical support schemes	One-stop shop	n/a	The one-stop shop could be more focused towards specific target groups (i.e., worst performing buildings, apartment residents, Russian speaking population)
		Certifications and training programmes	n/a	Continue, but increase information campaigns on the benefits of working in the construction industry
		Building registry	n/a	Continue
	Social support	Information campaigns	€2	Information campaigns should be focused on specific target groups (i.e., worst performing buildings, apartment residents, Russian speaking population)
Transport	Strategies/ regulations	Transport and mobility development plan 2021-2035	*Enabling*	
		Compulsory training on sustainable driving	n/a	Continue
	Financial incentives/ support	Transport fuel taxes	n/a	
		Grants for EVs	n/a	
		Time-based road use fee	n/a	
		Financial support for infrastructure development (EU-funding)	Electrification of railways: €570 New tram lines: €153	

Continue
Stop/minimise
Strengthen/modify

2.5 Towards all new Energy Efficiency targets with existing measures

The current existing measures together constitute the *Baseline* pathway. Most of them are planned until 2027 (in the frame of the NRRP), and their intensity most of the time only support the previous annual savings target (0.8%) rather than the new target (from 1.3% to 1.9% as annual new savings). In the current context, Estonia will not be able to reach the EED targets for the obligation period 2021-2030, as illustrated in table 2-6.

Table 2-6 Baseline scenario towards the EED targets

EED Targets	Target value	Baseline
Final energy consumption in 2030 (TWh)	30.0	32.9
Primary energy consumption in 2030	45.7	51.6
Annual final energy savings rate in 2030 (%)	1.90%	0.00%
Average annual final savings, 2024-2030 average (%)	1.49%	0.15%
Cumulative savings 2021-2030 (TWh)	21.28	5.22
NECP Targets	**Target value**	**Baseline**
Industry annual energy savings (2021-2030 average) (GWh)	232	118
Road transport fuel consumption (TWh)	8.3	10.1
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0.30	0.14

Final energy consumption remains more than 10% above the target (33.2TWh rather than 30TWh), and also the primary energy consumption remains well beyond. The annual savings rate in 2030 is inexistant as no measures continue beyond 2027. The average for the 2024-2030 period is way lower (0.15%) than what is expected from the directive (1.49%). Consequently, the savings cumulated over the 2021-2030 remains far from the cumulative savings expected under EED 2023.

To conclude, there is a need to strengthen the Energy Efficiency measures taken so far, and to implement new measures that will contribute to reach the targets. These new EE measures will be bundled in different pathways to explore how their combination allows to comply with all targets. Energy savings have to be accelerated, more than likely across all sectors.

3 Estonian Energy Efficiency Pathway options

Additional Energy Efficiency (EE) measures have to be implemented in order to drastically increase energy savings until 2030. These measures have to address all sectors to ensure the global targets can be reached. They need to be bundled to achieve the collective goal. Therefore, to simulate how the packaging of the measures can be done for their implementation, we organize the different Energy Efficiency measures into different pathways. The pathways are only indicative as the level of ambition and the speed of implementation of each measure can be adapted according to the needs and political willingness. A same measure can be at an average intensity (i.e., level of ambition) in one pathway, and then sees its intensity reduced in another pathway, or increased in a third pathway. These variations are foreseen to provide a sensitivity analysis.

Before diving into the impact assessment of the different pathways, an in-depth analysis of each EE measure is required, to properly understand the difficulties, risks, and advantages of the measure. This in-depth analysis of EE measures is done within chapter 4.

This chapter 3 previously introduces the pathways to guide the reader through the bundling of the measures, to understand the high-level logic of the bundling.

3.1 Type of EE measures within the pathways

First, we need to remind the type of EE measures that will constitute the pathways. There are two types of measures: the main EE measures and the enabling measures.

As analysed within Deliverable 2, there are various barriers to Energy Efficiency projects (i.e., investments or behaviours), among which the lack of attractiveness is certainly the most critical and requires dedicated policies and measures. The lack of attractiveness should clearly drive the main Energy Efficiency policy options. This lack of attractiveness can be financial (e.g., building insulation can have a long payback time, due to expensive material and low cost of energy), but also caused by the fact that alternatives are not affordable and practical (e.g., using public transport is not always the simplest way to commute, especially in rural areas). This lack of attractiveness should therefore be considered as primary barrier and require the main policy options to be set up to overcome unattractiveness, leading to more attractive or mandatory EE projects to be realised. All the measures tackling the lack of attractiveness are considered as ***Main* EE Measures** and will form the basis of the pathways.

Additional policy options, called ***Enabling* EE Measures**, will be required to ensure the global framework is favourable, and contains all the needed elements to successfully implement the main measures. These enabling policies are not addressed in this deliverable, but rather in the Deliverable 4, on the action plan.

3.2 Designing the pathways

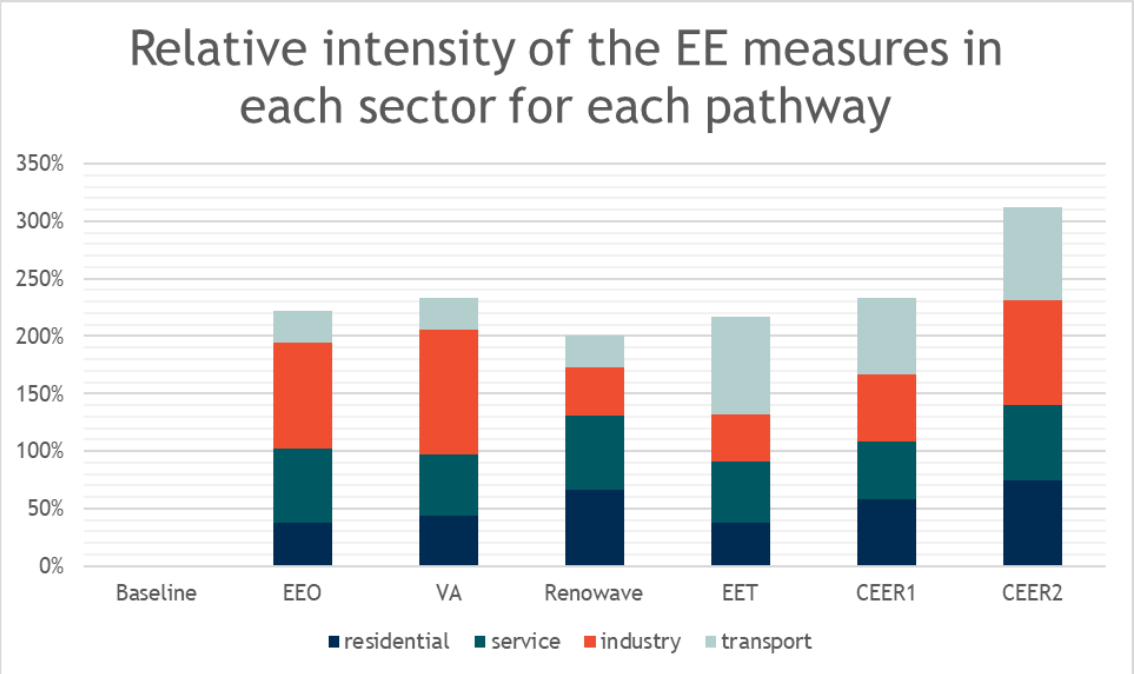
This assessment examines six different pathways plus a baseline pathway to see how different approaches to tackling energy efficiency can reach Estonia's targets. The table below gives a brief description of the pathways, where the measures mentioned in the table are described in Chapter 4. Each pathway takes a different approach, by focussing on different sectors and measures to increase efficiency. Note that some pathways take up measures *partially*, where for instance a 50% uptake of a support measure would translate to 50% of the grant support, investment costs, energy savings, etc.

Table 3-1 Overview of pathways

Pathway	Sector focus	Description
Baseline	n/a	The baseline pathway assumes that all existing energy efficiency measures are continued from 2021 to 2027.This also includes energy taxation which continues up to 2030 (the last modelled year).
Energy efficiency obligation scheme (EEOS)	Buildings and Industry	This pathway focuses on the implementation of an **Obligation Scheme (as per Article 9 2023 EED)**, where certain energy operators are obliged to trade energy savings certificates to stimulate cost-effective investments in energy efficiency in buildings. It also obliges building owners to renovate at trigger points (rental/selling) via MEPS, and contains support schemes for single houses, public buildings and industry. Property taxes for non-residential and efficient transport measures are included but to a lesser extent.
Voluntary Agreements (VA)	Industry and Buildings	This pathway focuses on the use of **voluntary agreements** (VAs) between government and industry to commit to energy targets, with incentives via reduced grants. However, VAs alone do not bring sufficient energy savings to reach EE targets, therefore a basic package of building measures is taken in addition, including building MEPS (at rental/selling point), grants for residential and public buildings, CO2 tax for residential and non-residential. It also includes partial implementation of transport measures.
Renovation Wave (RenoWave)	Buildings	This pathway focuses on increasing the renovation rate of residential and non-residential buildings by introducing MEPS for all dwellings and non-residential buildings, tax deduction for renovation works and renovation grants as well as partial uptake of property and CO2 tax for residential and non-residential buildings. The pathway also has a partial uptake of industry and transport support measures.
Energy Efficient Transport (EET)	Transport and Buildings	This pathway focuses on implementing energy-efficient transport policy, where the government would take a leading role in investing in required infrastructure to promote greater use of low-carbon and soft mobility options. The measures making up this pathway are focused on developing and subsidising public transport and micro-mobility as well as increasing vehicle taxes to replace old vehicles by more efficient ones. The same a basic package of building measures as under the *VA* is taken in addition, and the partial uptake of industry measures, such as in the RenoWave.
Comprehensive energy efficiency reform 1 (CEER1)	Buildings, Industry and Transport	This pathway takes a holistic approach, which brings in various measures from the other pathways to create a comprehensive and integrated path. In residential, it includes building MEPS (at rental/selling point), as much grants as under *RenoWave,* it introduces a strong property taxation, but does not include the CO2 tax. For non-residential, it includes grants for public buildings, it introduces a strong property taxation (in function of EPC level), and MEPS for all buildings. For the industry, like in the *VA* it comprises the voluntary agreement complemented by grants. For transport, it comprises all measures of the EET.
Comprehensive energy efficiency reform 1 (CEER1)	Buildings, Industry and Transport	Considering that *CEER1* does not reach all EE targets, it's necessary to reinforce some of the measures. On top of the *CEER1* measures, this pathway reintroduces a "partial" CO2 tax for residential & non-residential, an obligation scheme for non-residential. It strengthens the voluntary scheme of the industry while strengthening support measures. In transport it doubles the subsidies provided to stimulate the use of public transport, and the development of convenient and modern public transport.

Figure 3-1 illustrates the efforts of all measures taken per sector for each of the pathways. By effort we understand an indicator combining the number of measures and their intensities.

Figure 3-1 relative intensity(*) of the EE measures within each sector for each pathway



Source: Trinomics, Energex & TalTech

(*) relative intensity means the number of measures and their intensity. Sectors should not be compared against each other, but the differences for each sector should assessed. E.g. take residential, most of the measures come with CEER 2, which is followed by RenoWave and CEER 1. VA comes as fourth, followed by EET and then EEO. It means that CEER 2 strengthens the measures for residential buildings compared to RenoWave, or CEER 1.

For residential buildings, the effort is the highest under *RenoWave* and *CEER2,* and slightly reduced for *CEER1,* while being significantly lower for *EEO, VA* and *EET*.

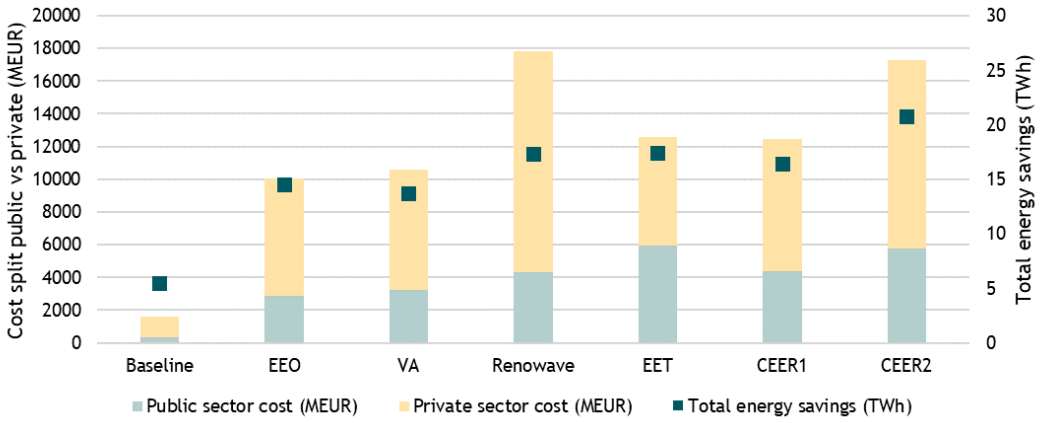
For non-residential, similarly than for residential the *RenoWave* and *CEER2* requires the highest efforts, followed by the *EEO, VA* and *EET,* while *CEER1* requires the lowest effort.
For the industry, the *VA* requires the highest efforts (combining incentive and VA), and is closely followed by *EEO* and *CEER2* (boosting the voluntary agreements), then *CEER1,* while *RenoWave* and *EET* require lower efforts.

For transport, the *EET* and *CEER1* require similar and high effort, but *CEER2* is boosting some key transport measures and therefore require the highest effort, while *EEO, VA* and *RenoWave* require similar low effort for transport.

The figure 3-2 below provides a broad comparison of the pathways in terms of the public/private investment requirements and the energy savings. Overall, the pathways require a significant amount of investment compared to Baseline pathway, while also leading to much greater energy savings. The *Renovation Wave* pathway provides the most energy savings, although the greatest (private) investment requirement. All pathways, except the *EET* pathway, require significant private investment, as these pathways depend on renovation of buildings and investments in industrial efficiency whereas the *EET*

pathway focuses on public investment in transport infrastructure. The CEER pathways provide the most balanced results, between investment cost and cumulative energy savings from 2021 to 2030.

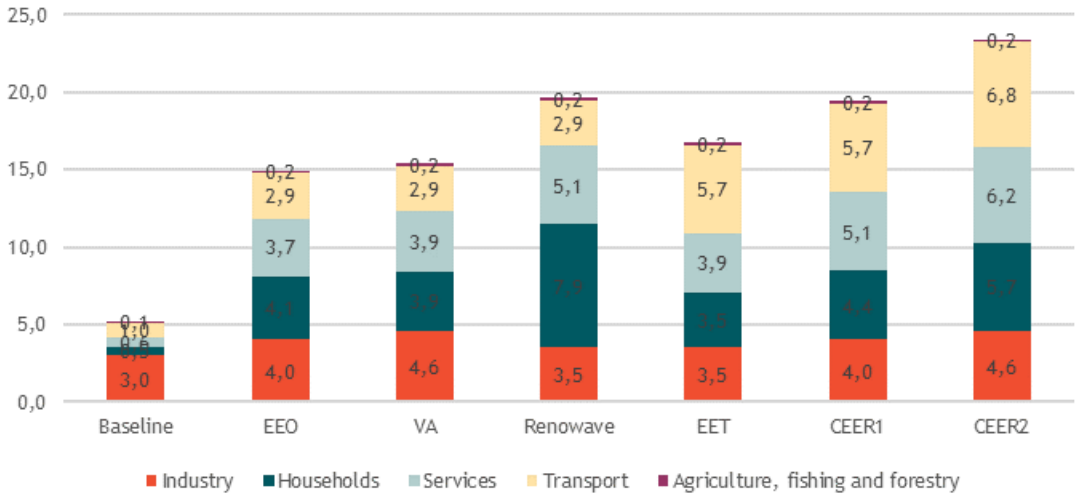
Figure 3-2 Overview of pathway investment requirements and energy savings from 2021-2030



Source: Trinomics, Energex & TalTech

The figure 3-3 below provides a breakdown of the share of energy savings per sector. All pathways, except the Baseline, have a majority of the energy savings coming from building renovation (households and services), ranging from 55% in the *EET* pathway to nearly 80% in the *RenoWave* pathway. As defined, the *EET* pathway depends heavily on transport energy savings compared to the other pathways and the *EEOS* and *VA* pathways rely more heavily on savings measures from industry.

Figure 3-3 Overview of cumulative energy savings (TWh) per sector per pathway, 2021-2030



Source: Trinomics, Energex & TalTech

3.3 Preliminary takeaways regarding the pathways

A few preliminary takeaways

- To be able to reach the target, measures should be taken in all sectors.

- Reinforcing or strengthening a measure is always possible, in any of the pathways. Consequently, all pathways could possibly reach all targets if we increase the ambition of its measures.
- The *EEOS* pathway is built mainly on normative measures (obliging building owners or energy operators to reach a target); the *VA* pathway combines positive and negative incentives (via grants & energy taxation); the *RenoWave* pathway combines all three types (normative via MEPS, positive incentives via grants and negative incentives via taxation); the *EET* is built on incentives and public expenses; both *CEER1* and *CEER2* like the *RenoWave* pathway combine all three types (normative via MEPS and obligation for non-residential, positive incentives via grants and negative incentives via some taxation). We recommend combining all three types, to ensure a long term and smooth increase of energy savings.
- Pathway can inform on the sensitivity between major variants, across sectors. But pathways do not inform about the feasibility of the measures, nor their intensity which can be adapted according to a final goal.

4 Energy Efficiency Measures

4.1 Introduction

This Chapter describes the various measures to be considered across the pathways which would be implemented in the residential sector, services, industry, transport, agroforestry and cross-sectors. These measures are to append the already existing measures which will be active until 2027, with most commencing in 2025 and remaining active at least until 2030. More details concerning the modelling of the measures can be found in the Annexed Excel workbook.

Section 4.2 describes the overarching new measures that represent the main policy options. The next sections 4.3 to 4.7 present by sector a list of new energy efficiency measures considered in the pathways. For each measure, descriptions are provided which cover: pros/cons, concerned stakeholders, regional impacts[35], energy savings parameter, energy price impact, modelling assumptions, key risks and outstanding considerations for Estonia.

The section on the scope and targeted parties and/or assets clarifies the coverage of each measure and identifies the obligated parties and/or beneficiaries, i.e., the stakeholders who gain from its implementation. The pros and cons for each measure will be tailored to reflect different stakeholders' perspectives. This approach ensures a comprehensive analysis that considers various viewpoints.

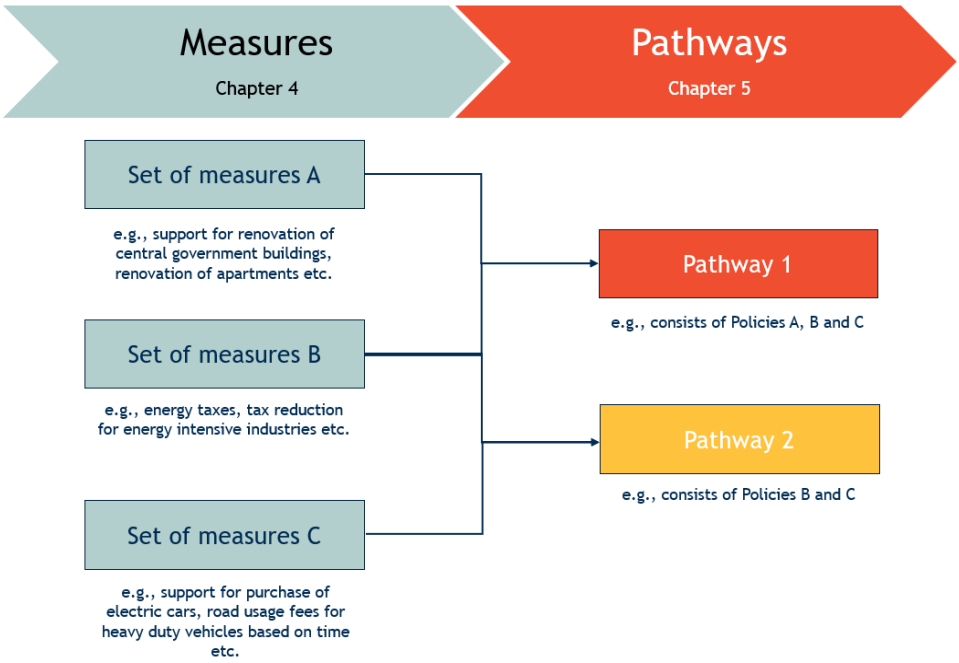
For nearly every measure mentioned in the "concerned stakeholders" section, an implementing body is suggested. However, it is important to note that these are only recommendations, and given that most of these measures are new, they require confirmation and approval from the Estonian government.

4.1.1 Relationship between energy efficiency measures and pathways

The energy efficiency pathways refer to a strategic plan or roadmap that outlines a specific set of measures aimed at achieving a particular energy efficiency goal, in a specific sector, or in several sectors, as depicted in Figure 4-1.

[35] There are 5 NUTS regions for Estonia: Põhja (EE001); Lääne (EE04); Kesk (EE006); Kirde (EE007); Lõuna (EE008)[35].

Figure 4-1 Relationship between energy efficiency measures and pathways



The pathways serve as a coherent and comprehensive approach to guide Estonia towards improving energy efficiency in a targeted and efficient manner. Some of the Energy Efficiency measures, such as an Energy Efficiency Obligation Scheme, encompass a complete policy option, while others are basic instruments that belong to a broader policy (e.g., a grant/subsidy for the renovation of a specific building type is a measure belonging to a renovation policy).

Each energy efficiency pathway is made up of a combination of existing and new measures. These policies work in synergy to collectively contribute towards the overall energy efficiency goal. The selection and design of these policies are crucial to ensure their effectiveness and maximize their impact on energy savings and emission reductions. It is important to note, that while some measures are new in the Estonian context, they are or have been employed elsewhere, using existing technology.

By breaking down the energy efficiency pathway into measures, the report aims to identify the most appropriate and effective combination of actions to achieve the desired energy efficiency outcomes, across the various sectors. This systematic approach allows for better coordination, resource allocation, and evaluation of progress, ultimately leading to a more successful and sustainable energy efficiency transformation.

The study analyses 6 main policy pathways and a baseline pathway[36] defined to achieve Estonia's energy efficiency potential in the context of climate neutrality by 2050. The 6 policy pathways include:

- the Energy Efficiency Obligation Scheme (EEOS) pathway,
- the Voluntary Agreement (VA) pathway,
- the Renovation Wave (RenoWave) Pathway,
- the Energy Efficient Transport (EET) pathway,
- the Comprehensive Energy Efficiency Reform 1 (CEER1) pathway, and
- the Comprehensive Energy Efficiency Reform 2 (CEER2) pathway.

[36] The baseline pathway only considers existing measures which will discontinue after 2027.

4.1.2 Existing EE measures starting from 2021 to 2027

All pathways take into account existing measures which will be effective from 2021 to 2027. Table 4-1 provides an overview of these measures. More details of the measures can be found in the Annexed Excel workbook in the 'EE measures' tab. Note that the excise duty and value added tax measures (cross-sectoral) remain effective after 2027.

Table 4-1 Description of existing measures in the different sectors

Sector	Existing measures
Residential	• Renovation of apartment buildings (2014-2020) • Renovation of private buildings (2019-present) • Renovation of rental apartments (2016-present) • Atmospheric air protection programme, including replacing fossil fuel-based heating equipment for apartment associations (2014-present)
Service	• Renovation of healthcare centres (2016-on-going) • Modernisation of street lighting (2016-on-going) • Renovation of social care homes (2017-on-going) • Renovation of school buildings (2018-on-going) • Renovation of university and R&D institutions (2016-on-going) • Renovation of kindergarten (2017-on-going) • New childcare and pre-primary education infrastructure (2016-on-going)
Industry	• Energy and resource efficiency in industries (2016-on-going) • Electro intensive enterprises tax reduction (2018-on-going)
Transport	• Eco-driving (2011-ongoing) • Walking and cycling roads (2015-2018) • Mobile speed cameras (2019-on-going) • Time-based road toll for heavy duty vehicles (2018-on-going) • Electric car purchase and rental programme (2019-on-going)
Agroforestry	• Aid for energy and resource-efficient processing of fishery and aquaculture products (2017-on-going) • Support for improving the energy efficiency of coastal fishing vessels (2019-on-going)
Cross-sectoral	• Excise and value added tax of natural gas, electricity, heating sector, gasoline, diesel fuel, light fuel oil, firewood and woodchips/waste • Renewable energy fee • Excise duty on specially marked diesel • Electricity smart meters (2015-on-going) • Energy efficiency investments by electricity distribution companies (2020-on-going) • Profit distribution based corporate income tax (1991-on-going) • Oil boiler replacement (2015-on-going)

4.1.3 Type of Stakeholders

For each measure, a list of the stakeholders concerned is presented. Table 4-2 defines the different types of stakeholders concerned/involved in policy measures and their overall role. This will also be further developed and discussed in Deliverable 4 on institutional arrangements in implementation of an action plan.

Table 4-2 Description and role of the concerned stakeholders

Concerned stakeholders	Description and role
Obligated party	The obligated party is the stakeholder which is responsible for complying with the policy measure which is an obligation (e.g., obligation scheme, MEPS, etc.). If it does not comply, the obligated party will be subject to a penalty. It can be an energy supplier, energy operator, building occupier, building owner, etc.

Concerned stakeholders	Description and role
Administrator	The administrator is responsible for determining, designing and enforcing the policy measure. Therefore, the administrator is always the government.
Implementing body	The implementing body is a public, semi-public or private body that is assigned by the administrator as the body responsible for implementing and monitoring the policy measure, based on required competences. For example: • Fiscal measures will be implemented and monitored by the public body responsible for taxes (e.g., Estonian Tax and Customs Board); • Grants for supporting renovation of buildings will be implemented and monitored by the public body responsible for energy or housing; • Transport measures will be implemented and monitored by the public body in charge of transport (Ministry of Climate); • Etc.
Final payer	The final payer is the stakeholder which pays the final costs of the measure, in a direct way (e.g., costs cannot be passed on to another stakeholder) or indirect way (e.g., costs are passed on to the final payer by other stakeholders who bore costs first).
Beneficiary	The beneficiary is the stakeholder which benefits of the concerned EE investment, by generating energy savings, and therefore saving on its energy bill. It can be a household, a company or public organization.

Table 4-3 further elaborates on the specific type of stakeholders that will play a role according to the above categories. Having a keen understanding of which stakeholders are responsible either financially or for implementation, and which are most impacted is important for choosing policy measures.

Table 4-3 Key stakeholders involved in Estonian energy efficiency policy

Stakeholder	Type	Role
Ministry of Climate	Government	Main stakeholder of the project Main project stakeholder (relating to construction, buildings and transport
Ministry of Economic Affairs and Communications	Government	Key project stakeholder (relating to industry)
Ministry of Finance	Government	Policy making, grants, targets
Ministry of the Interior	Government	Policy making
Ministry of Social affairs	Government	Policy making and consultation
Ministry of Education and research	Government	Policy making and consultation
Joint organisation of KredEx and Enterprise Estonia	Financial institution	Financial measures for renovation, competence centre for residential buildings
representatives of Local Governments and Association of Estonian Cities and Rural Municipalities (Eesti Linnade Liit)	Government Agency/Landowner	Buildings owned by Local Governments, Local Governments role and contribution in renovation
Estonian Union of Cooperative Housing (Eesti Korteriühistute Liit)	Housing association	Consumer side of renovation – problems, cost and possibilities of renovation, legal issues, raising awareness, best practices
State Shared Service Center	Government Agency/Financial institution	Grants for renovation (public buildings)
Riigi Kinnisvara AS	Government agency	Manager of state-owned buildings, renovation plan of state-owned buildings, competence centre for non-residential buildings
Environmental Investment Centre (KIK)	Financial institution	Grants for district heating projects, heat management plans, resource efficiency, environmental awareness
Agricultural Registers and Information Board	Financial institution	Rural development and grants (including resource efficiency, solar panels)
Estonian Road Administration	Government agency	Measures for transportation

Stakeholder	Type	Role
Estonian Power and Heat Association	Association	District heating networks (which most inhabitants use in Estonia), heat management plans
Utilitas OÜ	Utility	Main district heating producer and provider in Tallinn, possibilities in largest district heating network in Estonia, main developer of district cooling networks
DeltaE Insenerid OÜ	Company	ESCO and other Energy, resource and environmental efficiency solutions for industry and commercial buildings
Estonian Chamber of Commerce and Industry	Association	Largest representative of industries in Estonia - renovation plan for industries
Estonian Association of Electrical Enterprises	Association	Representing companies providing electrical and automation works
Estonian Association of Construction Entrepreneurs	Association	Feedback for building renovation plan, capacity of construction, assessment of assigned targets
AS Estonian Cell	Enterprise	Industry (wood and paper)
AS Enefit Power	Enterprise	Industry (Chemistry and energy)
Nordic Milk (Tere/Farmi)	Enterprise	Industry (Food)
Estonian Central Association of Owners	Association	Representing owners of private households
IVIA	Agency	Industrial Park representative (Ida-Viru County)
Tartu Regional Energy Agency	Agency	Energy efficiency of local authorities, industries

4.2 Description of new overarching policies for Estonia

The pathways are defined by the uptake of several new measures (support for home renovations, increased infrastructure for electric mobility, etc.), which also consider several general broader policies (obligation schemes, voluntary agreements, etc.). These measures and policies can be applicable to multiple sectors, for example, voluntary agreements can be administered to both buildings and industry. These measures and policies are elaborated on at the sectoral level throughout the chapter, but a brief overview of the main measures and policies includes:

- Energy Efficiency Obligation Schemes (EEOS);
- Voluntary Agreements (VA);
- Minimum Energy Performance Standards (MEPS); and
- Energy Pricing.

Table 4-4 provides an overview of how the pathways take into account these overarching policies. Note that the pathways also include additional financial measures which support energy efficiency (i.e., renovation grants, support for renovation of public/commercial buildings, support for investments in industry, development of (public) transport infrastructure, etc.).

Table 4-4 Overview of the pathways' incorporation of overarching policies

	New overarching policies			
Pathway	EE Obligation Schemes	Voluntary Agreements	MEPS	Energy Pricing
EE Obligation Scheme (EEOS)	Yes	No	Yes, targeted	Yes, property tax according to

				EPC levels (services only)
Voluntary Agreements (VA)	No	Yes, for industry	Yes, targeted	Yes, CO2 tax for buildings & property tax (services only)
Renovation Wave	No	No	Yes, all buildings	Yes, CO2 tax for buildings & property tax (all buildings)
Energy Efficient Transport (EET)	No	No	Yes, targeted	Yes, CO2 tax for buildings & property tax (services only)
Comprehensive Energy Efficiency Reform 1 (CEER1)	No	Yes, for industry	Yes, targeted	Yes, property tax (all buildings)
Comprehensive Energy Efficiency Reform 2 (CEER2)	Yes, non-residential only	Yes, for industry	Yes, targeted	Yes, CO2 tax & property tax for all buildings

4.2.1 *Energy Efficiency Obligation Schemes*

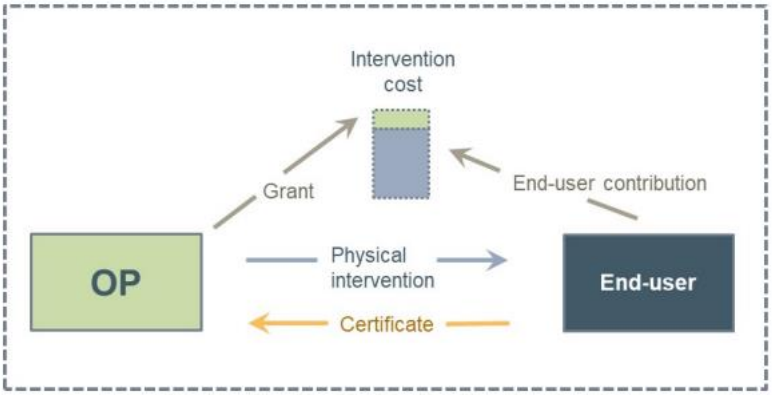
The obligation for Member States to set up Energy Efficiency Obligation Schemes (EEOS) was introduced in EU legislation by Article 7 of Directive 2012/27/EU on Energy Efficiency (EED). These *EEOS* are based on the concept of 'White Certificate Obligation Schemes' which had already been implemented in several European countries since the beginning of the 21st century, i.e. Great Britain in 2002, Italy in 2005 and France in 2006.[37] A White Certificate Obligation Scheme is a market-based instrument that consists of imposing energy saving obligations on certain categories of energy operators (e.g. energy distributors or suppliers, retail energy sales companies, consumers) called 'obligated parties'.[38] It can be coupled with a trading system, in which obligated parties that do not achieve the required energy savings may buy energy savings certificates (or white certificates) from other parties which exceeded their obligations.[39] Obligated parties can trade white certificates on a dedicated market (e.g. a parties that does not reach the saving target can buy white certificates from a party that has produced more savings than obliged to). This allows those not able to reach their target to meet savings targets flexibly and at the lowest cost.

The scope and business model of different obligation scheme options is determined by the legislative framework of the scheme. Generally, there will be several viable strategies available, and indeed, various approaches have been experimented with in *EEO* schemes so far. The three main structures are (1) the obligated party (OP) is in direct contact with the end-user (Figure 4-2), (2) the obligated party engages a third party installer (Figure 4-3), or (3) engaging a third party certifier/over the counter trading (OTC) (Figure 4-4).

[37] White certificates schemes: the static and dynamic efficiency of a multifunctional policy instrument (hal.science)
[38] Energy Efficiency Obligation Schemes | E3P (europa.eu)
[39] *Ibid.*

Figure 4-2 Direct OP - end-user interaction

Directly by the OP who installs the EE measure itself (possibly via a subsidiary unit);



Obligated party directly engages the end-user:

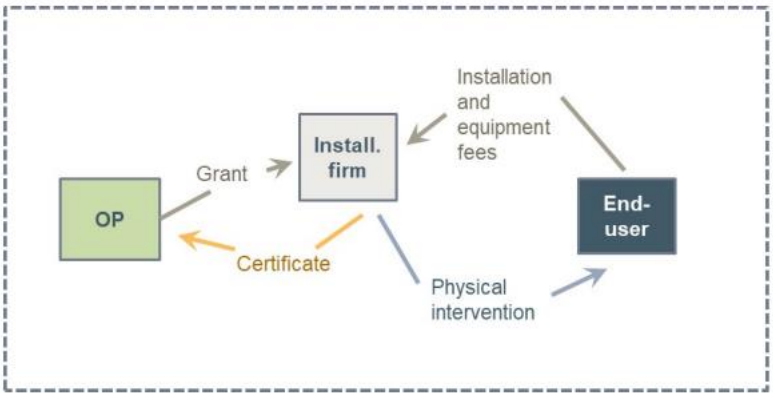
- OPs subsidize installation costs
- End-user contributes the remaining cost

Leverage rate varies by scheme, sector and end-user but averages around 2:1

Source: European Bank for Reconstruction and Development & Energy Community (2019). Energy Efficiency Obligation Schemes: Policy guidelines.

Figure 4-3 Third party installer

Provide to a third party contracted by the OP to install an EE measure;



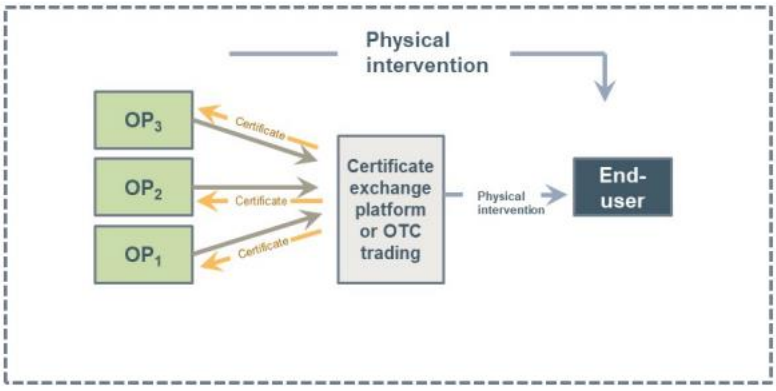
Obligated party sub-contracts energy service / installation firms to implement interventions:

- End-users pay the service firm directly for installation
- OPs subsidize installation costs
- Energy service firms offer specialised interventions

Source: European Bank for Reconstruction and Development & Energy Community (2019). Energy Efficiency Obligation Schemes: Policy guidelines.

Figure 4-4 Certificate exchange platform/OTC trading

Paid by the OP to a third party in exchange for an energy saving certificate either over-the-counter (OTC) in a bilateral deal or on a platform/exchange.



OPs trade certificates on an open exchange or through OTC transactions:

- Interventions include subsidised financing products

Source: European Bank for Reconstruction and Development & Energy Community (2019). Energy Efficiency Obligation Schemes: Policy guidelines.

The purpose of the white certificate is twofold. First, it can be considered as an accounting tool, which can justify that a certain amount of energy has been saved in a specific place and time. Second, it is a tradable commodity, which belongs initially to the operators that has achieved the energy savings for example by implementing an energy efficiency project or owns the rights to these energy savings, and then can be traded according to market rules, always keeping one owner at the time.[40] There are five elements that are key to the creation of a White Certificate Scheme, as defined by the European Commission (2011): [41]

- The creation and framing of the demand, the government shall set the overall target and its allocation to the obligated parties;
- The institutional infrastructure and processes (such as measurement and verification) to support the scheme;
- The cost recovery mechanism in some cases;
- A system of sanctions in the case of non-compliance with the obligations imposed by the scheme;
- The tradable instrument (certificate) and the rules for issuing and trading.

Under Former EED Article 7, now Article 8, the EU *EEOS* imposes to obligated parties to achieve annually new savings by implementing additional energy efficiency projects. The 2023 recast of the Energy Efficiency Directive (EED) brings in a gradual escalation of ambition, with an annual rate of 1.3% from January 1, 2024, to December 31, 2025, followed by 1.5% from January 1, 2026, to December 31, 2027, and further rising to 1.9% from January 1, 2028, to December 31, 2030 (EED Art. 8.1). The obligation provides the possibility for Member States to introduce alternative policy measures to EEOS, provided that the annual amount of new energy savings achieved through these measures is equivalent to the amount of new energy savings by the default obligation.[42] Examples of alternative policy measures include energy or CO_2 taxes, financing schemes and instruments, regulations or voluntary agreements, energy labelling schemes, training and education, etc.

In Estonia, the absence of energy efficiency obligation schemes can be attributed to several factors, including the perceived complexity of the scheme and a lack of willingness from energy operators such as suppliers and system operators. Implementing such schemes could bring about various positive outcomes, such as incentivising market players to adopt energy efficiency measures in a cost-effective manner, complementing existing support schemes, and enhancing the confidence of energy suppliers in achieving the required savings. To address these challenges, providing additional training for energy suppliers and seeking guidance from the experiences of other regions could prove beneficial.

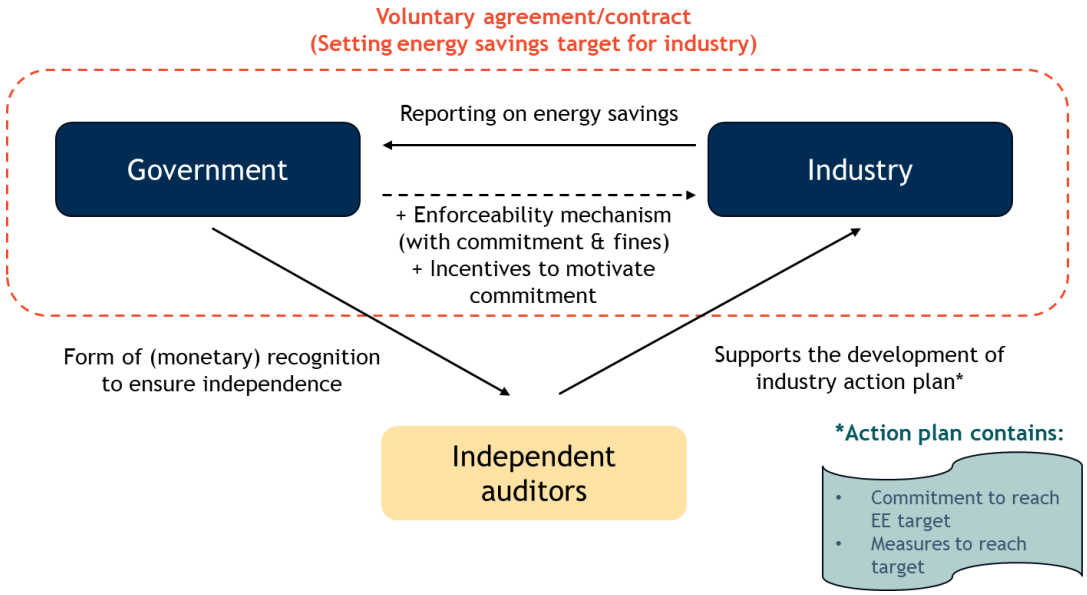
4.2.2 Voluntary Agreements

Voluntary agreements are defined by the International Energy Agency (IEA) as 'contracts between governments and industry that include negotiated targets with time schedules and commitments on the part of all participating parties'.[43] Unlike traditional command-and-control policy measures, voluntary agreements are characterised by their tailor-made nature.[44] Public authorities and individual firms or

[40] Assessment and Experience of White Certificate Schemes in the European Union (windows.net)
[41] *Ibid.*
[42] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/ECText with EEA relevance (europa.eu)
[43] IEA, 1997.Voluntary Actions for Energy-Related CO_2 Abatement. OECD/IEA,Paris.
[44] History and prospect of voluntary agreements on industrial energy efficiency in Europe (eceee.org)

groups of firms negotiate and agree on targets and timetables for action aimed at improving energy efficiency or reducing GHG emissions. For the purpose of this study, the focus is set on *VA* aimed at improving energy efficiency. Generally, voluntary agreements also include an enforceability mechanism through the definition of rewards or incentives and penalties. Voluntary agreements take various forms, legal status, structures and provisions and differ in terms of participants involved and level of enforceability.[45] Figure 4-5 illustrates the functioning of voluntary agreements and the roles and responsibilities of involved parties. As shown below, voluntary agreements also often involve independent auditors which support the industry in developing an action plan aimed at specifying the industry's commitment to reach energy savings targets as well as the measures it will take to reach this target. To ensure independence of auditors, the government may reward them with a form of (financial) recognition.

Figure 4-5 Schematic representation of voluntary agreements



Source: Trinomics, own illustration

In Europe, *VA* on energy efficiency started to be implemented in several countries in the beginning of the 1990s. At the time, it was one of the most rapidly growing policy instruments across European countries.[46] The first country to implement a *VA* was France followed closely by Germany, Austria, Belgium (both Wallonia & Flanders[47]) and the Netherlands.

When designing voluntary agreements, key elements include determining covered sectors and levels of coverage, setting targets and time schedules through unilateral, public, or negotiated commitments, and choosing between target-based or implementation-based approaches. Methodologies to distribute targets among participants should be established, and additional actions like energy management schemes and networking activities can support the agreements. Enforcing commitments may involve rewards or penalties. Details are outlined in the respective sectoral sections below.

[45] JRC Publications Repository - Voluntary Agreements in the Field of Energy Efficiency and Emission Reduction: Review and Analysis of Experiences in the European Union (europa.eu)
[46] *Ibid.*
[47] https://www.benchmarking.be/en/convenant_toelichtingen.asp

4.2.3 Minimum Energy Performance Standards

Minimum Energy Performance Standards (MEPS) are primarily applied in the building sector, as required by ongoing revision of Energy Performance of Buildings Directive (EPBD), though they can extend to other sectors like transport and electrical appliances. Within the building sector, MEPS focus on building owners, while in other sectors, such as transportation, they might apply to producers like car manufacturers, mandating them to meet minimum fuel efficiency levels. On the other hand, industry binding targets are tailored specifically for industrial actors to ensure their adherence to set energy efficiency goals.

Minimum Energy Performance Standards (MEPS) are defined by the United Nations as a 'specification containing a number of performance requirements for an energy-using device, and that effectively limits the maximum amount of energy that may be consumed by a product in performing a specified task.'[48] Globally, MEPS have already been introduced in various countries, for different sectors or applications that consume energy, usually to achieve certain safety, environmental or energy efficiency objectives.

The building sector

As part of its Renovation Wave strategy, the European Commission proposes to introduce MEPS in the building sector to improve energy efficiency and increase renovation rates.[49] In 2021, the European Commission published its proposal for the revision of Directive 2010/31/EU on Energy Performance of Buildings (EPBD proposal) in which it introduces MEPS for the building sector and defines them as '**rules that require existing buildings to meet an energy performance requirement** as part of a wide renovation plan for a building stock or at a trigger point on the market (sale or rent), in a period of time or by a specific date, thereby triggering renovation of existing buildings.'[50]

Article 9 of the EPBD recast proposal lays down the provisions for meeting MEPS in the building sector. It requires Member States to ensure that certain categories of buildings reach a specified energy performance class within a defined time period, and to support the compliance with MEPS, in accordance with Article 15 by implementing measures such as the provision of financial support and technical assistance, the design of financing schemes, the removal of non-economic barriers (e.g. split incentives) and the monitoring of social impacts.[51]

MEPS offers various advantages including drawing clear lines for decision-making in multi-owner buildings, fostering investment in energy efficiency, reflecting energy performance in the value of a building, increasing the awareness of the benefits of renovation, etc.[52,53] However, the EPBD proposal also lists a number of negative impacts associated with the introduction of MEPS in the building sector, which should be carefully considered when designing them. For example, landlords might be tempted to pass renovation costs to tenants, or the further reduction in prices of worst-performing buildings.[54]

[48] minimum energy performance standards (unescwa.org)
[49] Renovation Wave Communication (europa.eu)
[50] resource.html (europa.eu); https://www.europarl.europa.eu/doceo/document/TA-9-2023-0068_EN.pdf
[51] *Ibid.*
[52] Renovation Wave Communication (europa.eu)
[53] qe-05-22-310-en-n.pdf (europa.eu)
[54] resource.html (europa.eu)

Industry target

In 2021, the EC proposed to amend the RED to implement the ambition of the new 2030 climate target. As part of the proposed amendments, the EC suggests implementing industrial binding targets. These targets aim to mainstream renewable energy in industry:[55]

- By increasing the share of renewable in the amount of energy sources used for final energy and non-energy purposes in the industry sector, by an indicative average minimum annual increase of 1.1 percentage points by 2030;
- With a binding target of 50% for renewable fuels of non-biological origin used as feedstock or as an energy carrier.

No such targets are foreseen for energy efficiency. However, they could be implemented by national governments to enhance energy efficiency in the local industry.

4.2.4 Energy pricing

Energy pricing can take different forms. Two main types of pricing policies are addressed in the rest of this section: carbon pricing and energy and fuel taxation. Energy pricing can be implemented in various sectors. It can either target specific sectors (e.g., in the EU ETS) or be implemented unilaterally to all consumers (e.g., a carbon/fuel tax on heating and transport fuels on all energy products).

Carbon pricing

Carbon pricing is an approach to decrease carbon emissions that is based on the 'polluter pays' principle. A price is set on GHG emissions in order to hold emitters accountable for the damages they cause in adding emissions to the atmosphere. Carbon pricing can take different forms, but all aim at creating a price signal on GHG emissions. The two main forms of carbon pricing are Emission Trading Systems (ETS) and carbon taxes.

An **Emission Trading System** (ETS) (also known as 'cap-and-trade') is a tradable permit system for GHG emissions.[56] A cap is set on the number of emissions that can be emitted. Participants need to hold one allowance/permit per ton of GHG emitted. Participants can trade their allowances on a dedicated market (e.g., a participant that emits more than allowed can buy allowances from a participant that emits less than allowed). This allows emitters to meet emissions reductions targets flexibly and at the lowest cost. It provides certainty about emissions reductions, but not the price for emitting, which fluctuates with the market. The EU ETS was introduced in 2005 and it covers the following sectors: power and heat generation, energy-intensive industrial installations and aviation.[57] As part of the Fit-For-55 package, the EU ETS has been revised to encompass the transport and building sectors from 2027. In December 2022, a provisional trialogue agreement was reached.[58] The agreed text increases overall GHG emissions reductions. In addition, it extends the ETS to the maritime sector as of 2024. A new separate EU ETS for buildings and road transports fuels will start in 2027 (EU ETS II).

A **carbon tax** sets a price on carbon by defining a tax rate on GHG emissions, or on the carbon content of fossil fuels.[59] This allows to create a financial incentive to lower emissions by switching to more efficient processes and cleaner fuels.[60] It differs from the ETS as the outcome in terms of emission reduction is unknown, but the carbon price is defined.

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[55] resource.html (europa.eu)
[56] About Carbon Pricing | UNFCCC
[57] Emissions Trading - Putting a Price on carbon (europa.eu)
[58] Review of the EU ETS (europa.eu)
[59] Pricing Carbon (worldbank.org)
[60] Understanding carbon pricing — Carbon Pricing Leadership Coalition

The determination of the adequate carbon pricing instrument depends on national and economic circumstances. Worldwide, almost 50 countries and more than 30 subnational jurisdictions (i.e., cities, states and provinces) have implemented a carbon pricing mechanism, with more scheduled to be implemented in the future.[61] In 2022, carbon pricing mechanisms covered 23.2% of global GHG emissions.

Energy and fuel taxation

The taxation of energy and fuels is also a tool based on the 'polluter pays' principle that can contribute to fostering energy transition and decarbonisation of the economy.[62] It can discourage harmful energy consumption behaviours by developing adequate price signals. In addition, it can also have an effect on consumption and investment patterns as well as on the type of energy consumed and their use.[63] However, it does not take into account the effect of climate change, as there is no distinction based on carbon emissions.

Taxes and levies represent an important share of the final price paid by consumers in the EU.[64] The fourth study on energy prices and costs (2020)[65] indicates that EU average taxes and levies account for around 40% and 32% of household's electricity and gas prices, respectively. In the industry, taxes and levies represent 30 to 34% of electricity prices and 13 to 16% of gas prices. These taxes and levies differ among Member States and can take various forms, e.g., excises, VAT, renewable energy levies, capacity levies, environmental taxes.[66]

Energy Taxation Directive

Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (also called the Energy Taxation Directive or ETD) lays down the current EU rules for taxing energy products including electricity and most heating fuels.[67] The ETD sets structural rules to avoid potential competition distortion in the EU and excise duty minimum rates to encourage decarbonisation and energy efficiency.[68] As part of the Fit-For-55 package the EC has proposed a revision of the ETD that will be aimed at ensuring that energy taxes account for the carbon content of fuels.[69] This revision is expected to contribute to the alignment of energy taxation with climate and energy efficiency objectives. It aims to remove disadvantages for clean technologies and introduce higher levels of taxation for inefficient and polluting fuels, complementing carbon pricing through the ETS. Ensuring that environmental impacts (external costs) are properly reflected in the taxation structure is also crucial to avoid misleading messages for businesses and residential consumers, thereby reducing the risk to push them towards investment choices that may face increased risks of becoming stranded or increasingly expensive due to climate policy. Taxes on electricity and fuels would be aligned based on their energy content (rather than on volume or weight as currently applied) and environmental performance.

4.3 Residential sector

4.3.1 nR1 – Obligation scheme for residential sector

[61] Carbon Pricing Dashboard | Up-to-date overview of carbon pricing initiatives (worldbank.org)
[62] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0951&from=EN
[63] Energy taxation (europa.eu)
[64] *Ibid.*
[65] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0951&from=EN
[66] *Ibid.*
[67] Excise Duty on Energy (europa.eu)
[68] Energy Taxation Directive - KPMG Global
[69] resource.html (europa.eu)

This measure is based on the EEOS, which is described under section 4.2.1. It aims to achieve energy savings in the residential sector covering buildings and any other types of assets and equipment in this sector. Energy savings will be achieved by obligated parties, which will be in most cases energy suppliers. To meet their obligation, energy suppliers or distributors must invest in or promote energy efficiency measures and programs for residential buildings. In Estonian context energy suppliers might establish privately operated 'KredEx' to organise these investments. Each obligated party's energy savings obligation is calculated based on its market share or the total energy supplied to residential customers during a specified baseline period.

Concerned stakeholders

The concerned stakeholders for energy efficiency obligation schemes in the residential sector are the following:

- ✓ **Obligated party**: energy suppliers, who need to comply with energy savings obligations by implementing energy efficiency projects or buying energy savings certificates (e.g., white certificate)
- ✓ **Administrator:** government
- ✓ **Implementing body**: Ministry in charge of Housing or Energy & obliged parties
- ✓ **Final payer**: all energy consumers, who will face price increases reflecting the investments made by obligated parties to achieve energy savings
- ✓ **Beneficiary:** a single energy consumer benefitting from an investment (i.e., higher quality of goods and services, e.g., higher performance of buildings with reducing energy bills)

Key considerations of the measure

Table 4-5 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-5 Key considerations for the Obligation Scheme in residential sector

Parameter	Description
Pros	• Enables energy savings in the most cost-effective way (those for which it is easier to achieve energy savings will do so and others will buy certificates), compared to grants that have to adapt regularly the level of support to remain attractive • Likely addresses worst performing buildings first (as they would bring more savings, and therefore reduce the number of interventions for a same amount) • Various best practices and longstanding experience exist in the EU which are developed under D5 and D6, which may facilitate the implementation of the scheme • The energy market evolves from a product supply (energy in MWh) to a service supply (building with the right temperature level) • Stimulate mass markets (manufacturing and installation) driven by energy suppliers obliged to invest in savings in the building stock
Cons	• High administrative costs (designing the system, establishing a complete list of eligible investments with their calculated savings, monitoring of the market for energy saving certificates & compliance with scheme) • Comparatively high complexity for small size saving units (if a tradable unit represents 1 MWh, a households could possibly generate between 5 and 10 units/year, which would require pooling to efficiently trade) • Impact on vulnerable households facing higher prices (assuming the cost of the investments was passed on all consumers), unless there is a dedicated programme to tackle them first, and ensure proper redistribution

NUTS3 impact	• There are 5 NUTS regions for Estonia: Põhja (EE001); Lääne (EE04); Kesk (EE006); Kirde (EE007); Lõuna (EE008)[70] • Different regions within Estonia have varying levels of income, real estate prices, economic development, and infrastructure. High level of income and high real estate prices are mainly in Tallinn/Harjumaa which corresponds to NUTS region Põhja (EE001). Another high price area Tartumaa is a small piece inside Lõuna (EE008), which as a total is still low-income region. Thus Harjumaa, including Tallinn, and Tartu are with higher income and more developed/advanced infrastructure and workforce with access to additional training, and their borders generally do not follow NUTS regions. Financial supports have been and can be differentiated according to geographical location so that they are higher out of Tallinn and Tartu and highest in Ida-Virumaa (NUTS Kirde EE007). • Energy suppliers might be tempted to invest efforts where there is higher chance to get investment done (higher economic development, like in large cities Tallinn, Tartu, Pärnu), while neglecting areas with lower income and means to invest.
Energy price impact	• when suppliers provide support to households to invest in their dwelling, the cost of the support should be passed on to all consumers via energy price increase. Each time the energy supplier provide support, it has to increase its energy price. • Consequently, higher energy prices will make energy efficiency measures more financially attractive, potentially leading to greater investment in energy-saving projects, or reducing the amount needed to support new energy efficiency investments (assuming that the level of support is based on the gap to make an investment attractive). But this might be compensated by the fact that the cheapest savings are made in priority, while the same savings cost more and more with the new stock to be renovated; • Households having invested in energy efficiency have an advantage as they will consume less than previously.
Key risks	• Non-compliance penalties remain insufficient to incentivise suppliers to implement energy efficiency measures, often resulting in them opting to pay the fine. • Suppliers face challenges in effectively engaging building owners, even when offering attractive support packages. • Limited expertise may lead to suboptimal investment decisions by certain suppliers. • The calculated energy savings based on theoretical models often diverge from actual results due to generic assumptions, resulting in longer real payback periods than initially projected. • Energy suppliers encounter difficulties in motivating building owners who aren't the occupants, highlighting the split incentive dilemma.
Modelling Assumptions	• **Energy savings target:** 1%/y or ~109GWh (90GWh heat and 19 GWh electricity) in 2025; • **Calculated savings:** 64kWh saved/m2 renovated every year, meaning we need to renovate ~1.7 million m2 every year. If the average size of dwellings is 150m2, it means 11.400 dwellings have to be renovated every year. To reach the 64kWh savings, all EPC level E, F or G dwellings have to be renovated up to level D; This is calculated as 80% of nR6 savings. • **Investment cost:** 270 EUR/m2 (incl. VAT, with 2% inflation), or EUR 463 million per year. This is 60% of nR6 cost, because focus on energy savings over indoor climate. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 10y, then investment cost should be reduced by 20% ((10-8)/10). These 20% should be provided as a support, by the energy supplier • **Burden of the investment**: 80% by building owners, and 20% by energy suppliers (and then billed to end consumers).

[70] https://en.wikipedia.org/wiki/NUTS_statistical_regions_of_Estonia

	• **Energy price impact:** The support is then passed on the energy price. if we count 20% of the 463 M, support represents a yearly cost of EUR 93 million, to be passed to all residential consumers (93 MEUR / 10.5TWh = an increase of 17.14 eur/MWh, or 0.17 ct/kWh) • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• An *EEOS* requires a strong dialogue with energy suppliers, to design the scheme appropriately. If the sector is reluctant, it might remain difficult to engage them under constraints • It requires a good technical capacity and market knowledge the various energy suppliers don't have at the moment, more than likely, as it requires to adapt their business model (also seen as an opportunity to evolve from a product to a service supply) • Measures should be taken to avoid increasing energy poverty (the government should intervene in the way the increase in energy price is passed to consumers, and should also influence to focus on dwellings occupied by low-income households first)
Implementation steps	• Opening the dialogue with the energy suppliers (see best practices from other MS) • Setting up the scheme: define obligations/responsibilities; establish catalogue of eligible investments and related savings; define non-compliance fee; develop IT system with Energy Efficiency Certificates (EEC); … • Implement the EEOS: determine baseline and savings to be achieved per player; deliver WC; monitor results; …

Outstanding considerations for Estonia

- For residential, à priori only energy suppliers should be considered as obligated parties. However, system operator or installers could also be considered.
- Define the investments that are eligible and calculate their related savings.
- Establish a monitoring scheme to verify and control savings.

4.3.2 nR2 – MEPS targeting rented dwellings

Minimum Energy Performance Standards (MEPS) for buildings have been proposed as part of the proposal for the revision of Directive 2010/31/EU on Energy Performance of Buildings. MEPS are defined as 'rules that require existing buildings to meet an energy performance requirement as part of a wide renovation plan for a building stock or at a trigger point on the market (sale or rent), in a period of time or by a specific date, thereby triggering renovation of existing buildings.[71]

The objective of this measure is to introduce MEPS for rented dwellings in Estonia. The measure would prevent owners from:

- ✓ Renting residential buildings which are below a certain EPC level;
- ✓ Increasing the rent of residential buildings which are below a certain EPC level.

In case of non-compliance with MEPS, building owners will get a penalty.

This measure would target all rented dwellings in the residential sector. Having a separate targeted measure for rented dwellings allows us to address split incentives directly. We understand that the rental market is rather small in Estonia. However, tenants have usually a lower income than owners and may belong to vulnerable categories of the population (e.g., energy poor), which require specific attention, and be considered as a priority.

[71] resource.html (europa.eu)

Energy savings will be achieved by building owners when renovating their building to the minimum required energy performance level.

Concerned stakeholders

The beneficiaries of the measure (who are also expected to be the final payers) are the tenants, as they will face lower energy bills and increased comfort, without having to bear any additional cost.

The concerned stakeholders are the following:

- ✓ **Obliged party**: building owners, who need to renovate the buildings they rent to achieve the minimum required energy performance
- ✓ **Administrator**: government, setting the rules (levels of performance ante and post renovation; trigger points; fines in case of non-compliance; renting regulation; verification and control)
- ✓ **Implementing body**: ideally the Ministry in charge of Housing, supported by the Ministry of Energy
- ✓ **Final payer**: building owner to bear the investment costs, and possibly (and partially) the tenants indirectly, who could experience an increase in their rent which reflects the investments made by owners to achieve the minimum required energy performance. It is highly recommended to set up rules, in order to avoid all the cost is passed over to the tenants (it could even be avoided, therefore leaving the entire cost to the owner)
- ✓ **Beneficiary:** a single energy consumer, most likely the unit tenant, benefitting from an energy efficiency investment (i.e. higher quality of energy devices, higher performance of building envelopes), with consequently reduced energy bills

Key considerations of the measure

Table 4-6 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-6 Key considerations for the MESP in residential sector

Parameter	Description
Pros	• Stimulates the renovation of buildings by obliging the worst performing buildings to be renovated according to a pre-defined agenda • Addresses the issue of split incentives, and may protect vulnerable households who are mostly tenants • MEPS drive market transformation by promoting the adoption of energy-efficient building practices and technologies in the residential sector, in the most cost-effective way
Cons	• Possible impact on vulnerable households facing higher prices, if no renting regulation is taken to avoid (or control) a rent increase • May encourage a black market in the rental market (if e.g., rentals cannot take place below a certain level).
NUTS3 impact	• Different regions may have varying levels of housing affordability. Implementing MEPS could impact rental costs, and regions with higher living costs may face challenges in ensuring that MEPS do not disproportionately burden renters. • Urban areas might have more extensive rental markets with higher demand for energy-efficient housing. Rural areas might have limited rental markets, making it harder to find energy-efficient options and potentially impacting compliance. • Regional rental markets can vary significantly in terms of vacancy rates, demand for housing, and turnover rates. MEPS should consider these dynamics to ensure that property owners can comply without facing financial strain.

	• In regions with a significant number of professional property management companies, compliance with MEPS might be easier to monitor and enforce. In contrast, regions with a higher proportion of individual landlords might need tailored support.
Energy price impact	• Considering this is a normative measure applying only to building owners, it will have no direct impact on the energy prices (only the building owner, and possibly occupier, will bear the cost of renovation)
Key risks	• MEPS could impact the rental market dynamics and the competitiveness of properties. Landlords who need to make energy-efficient upgrades to comply with MEPS might pass some of the costs on to tenants through higher rent. This could lead to lack of affordability for tenants, especially in regions with already high housing costs. • Implementing MEPS might require technical assessments, audits, and upgrades to buildings. These processes can be complex, especially in older buildings with structural limitations and historic projection. Coordinating these efforts across multiple stakeholders, including landlords, tenants, and contractors, can be challenging and might result in delays or non-compliance.
Modelling Assumptions	• **Energy savings target:** 1%/y or ~55GWh (60GWh heat and -5 GWh electricity, due to the deployment of heat pumps); • **Calculated savings:** 59 kWh saved/m2 renovated every year (64 kWh/m2/y saving in heat and 5 kWh/m2/y increase in electricity), meaning we need to renovate ~864 000 m2 every year. If the average size of dwellings is 150m2, it means 5 762 dwellings have to be renovated every year. To reach the 59 kWh savings, all EPC level E, or F dwellings have to be renovated up to level D. This is calculated as 80% of nR6 savings. • **Investment cost:** 360EUR/m2 (incl. VAT, with 2% inflation), or EUR 311 million; This is calculated as 80% of nR6 cost. • Support (if relevant) to the investment: there is no support for MEPS • **Burden of the investment**: 100% by building owners, as this is an obligation • Energy price impact: no direct impact • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Enforcing MEPS in rented buildings requires effective monitoring and enforcement mechanisms. Without proper oversight, landlords might not comply, leading to a lack of energy efficiency improvements. • The rental market can be fragmented, making it challenging to implement uniform MEPS across diverse building types, ownership structures, and geographical locations.
Implementation steps	• Require energy audits or assessments of rented buildings to identify areas for improvement. Provide guidance to landlords on cost-effective energy-saving measures. • Implement MEPS in phases, focusing initially on larger buildings or those with lower energy performance. This approach can help landlords adapt to the changes gradually. • Establish financing options for landlords to cover the upfront costs of energy efficiency improvements. These could include low-interest loans, green bonds, or energy performance contracts. • Develop a robust monitoring and compliance system to ensure landlords comply with MEPS. Implement penalties for non-compliance to incentivise adherence.

Outstanding considerations for Estonia

- Determine the EPC level below which rented buildings qualify.
- Determine the EPC level above which the building should be renovated.
- Determine at which moment the building should be renovated, with the 2 main options
  - At trigger points (when the building is being rented)
  - By a deadline (e.g. by 31/12/2029) for all buildings with a very low EPC level (e.g. above EPC label F)

- Establish renting regulations to avoid unaffordable increase of rents, to balance the cost sharing between owners and tenants.
- Establish the type and severity of penalty (i.e., property tax, fine, etc) of building non-compliance.

4.3.3 nR3 - MEPS for all dwellings

Compared to the nR2 measure, which was focusing on rented dwellings, the objective of this nR3 measure is to introduce **MEPS for all dwellings** in Estonia. The measure would require all building owners to have an EPC for their building. Therefore, dwellings which present an EPC level of a predefined class or above (e.g., class F or above) should be obliged to improve the performance of the buildings until a predefined EPC threshold (e.g., class C or above) depending on certain circumstances. The renovations should be done in a predefined timeframe and could be progressive regarding the class level (e.g., targeting EPC class F for the first 10 years, and then class D for the next 10 years). In case of non-compliance with MEPS, building owners will get a penalty.

Concerned stakeholders

This measure would target all dwellings in the residential sector, apartments and houses. Energy savings will be achieved by building owners when renovating their building to the minimum required energy performance level.

The beneficiaries of the measure (who are also expected to be the final payers) will be building occupiers (owner or tenant), as they will face lower energy bills and increased comfort.

The concerned stakeholders are the following:

- ✓ **Obliged party**: building owners, who need to renovate the buildings they own to achieve the minimum required energy performance
- ✓ **Administrator**: government, similarly to nR2
- ✓ **Implementing body**: Ministry in charge of Housing, with support from the Ministry of Energy
- ✓ **Final payer**: building occupiers (owners or tenants):
  - If owners occupy their own building, they will need to invest in renovation works.
  - If the building is occupied by tenants, building owner will bear the investment costs, and possibly (and partially) the tenants, who could experience an increase in their rent which reflects the investments made by owners to achieve the minimum required energy performance. It is highly recommended to set up rules, in order to avoid all the cost is passed over to the tenants (it could even be avoided, therefore leaving the entire cost to the owner)
- ✓ **Beneficiary:** a single energy consumer, most likely the unit tenant, benefitting from an energy efficiency investment (i.e. higher quality of energy devices, higher performance of building envelopes), with consequently reduced energy bills

Key considerations of the measure

Table 4-7 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-7 Key considerations for MESP in residential sector (all buildings)

Parameter	Description
Pros	• Stimulates the renovation of buildings by obliging the worst performing buildings to be renovated according to a pre-defined agenda, while progressively ensuring the entire dwelling stock is being renovated • Addresses the issue of split incentives • MEPS drive market transformation by promoting the adoption of energy-efficient building practices and technologies in the residential sector, in the most cost-effective way. • Energy-efficient dwellings offer better indoor comfort by reducing heat loss, drafts, and temperature fluctuations.
Cons	• Impact on vulnerable households obliged to invest in the dwelling they occupy • Inability of vulnerable households and apartment associations to renovate without significant additional support mechanisms (complexity when the obligation applies on a large amount of apartment owners in one building) • May encourage a black market in the rental market (if e.g. rentals cannot take place below a certain level).
NUTS3 impact	• Different regions may have varying economic conditions and levels of development. Implementing MEPS could have differing financial impacts on businesses and residents in regions with different economic capacities. • Urban areas might have better access to energy-efficient products and technologies, while rural areas might face challenges in terms of availability and affordability of such products. Ensuring equitable access to energy-efficient solutions is crucial. • Regions may have diverse types of buildings with varying energy efficiency levels. Some regions might have older housing stock that requires more extensive upgrades to meet MEPS, while others might have newer buildings with better energy performance. • Some regions might already have existing energy efficiency regulations or incentives in place. Harmonizing MEPS with these local regulations and ensuring consistency is important to avoid confusion. • Some regions might already have existing support mechanisms for energy efficiency, such as grants or incentives. Coordinating MEPS with these mechanisms can maximize the impact of energy efficiency policies.
Energy price impact	• Considering this is a normative measure applying only to building owners, it will have no direct impact on the energy prices (only the building owner, and possibly occupier, will bear the cost of renovation)
Key risks	• There's a risk that implementing MEPS could disrupt the real estate market and impact affordability for both buyers and renters. Stricter standards might lead to higher upfront costs for new construction or renovations, which could be passed on to tenants or buyers through higher prices. This could potentially reduce the overall supply of affordable housing, leading to concerns about housing affordability in certain regions. • Enforcing compliance with MEPS can be challenging, especially if there are inadequate resources or mechanisms in place to monitor and ensure adherence to the standards. Inconsistent enforcement can undermine the effectiveness of the standards and lead to non-compliance.
Modelling Assumptions	• **Energy savings target:** 1%/y or ~182 GWh (197 GWh heat and -15.4 GWh electricity, due to the deployment of heat pumps); • **Calculated savings:** 59 kWh saved/m2 renovated every year (64 kWh/m2/y saving in heat and 5 kWh/m2/y increase in electricity), meaning we need to renovate ~2.84 million m2 every year. If the average size of dwellings is 150m2, it means 18 918 dwellings have to be renovated every year. To reach the 64kWh savings, all EPC level E, F, and G dwellings have to be renovated up to level D. This is calculated as 80% of nR6 savings. • **Investment cost:** 360EUR/m2 (incl. VAT, with 2% inflation), or EUR 1 022 million; This is calculated as 80% of nR6 cost per m2. • Support (if relevant) to the investment: there is no support for MEPS • **Burden of the investment**: 100% by building owners, as this is an obligation

	• Energy price impact: no impact • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Implementing MEPS might lead to higher rents or property prices, which could pose affordability challenges for tenants or potential buyers, especially in a competitive real estate market. • Retrofitting existing buildings to meet MEPS could pose technical challenges, particularly in historical or architecturally significant structures. Balancing energy efficiency improvements with preserving the building's aesthetic and historical value can be complex.
Implementation steps	• Require energy audits or assessments of buildings to identify areas for improvement. Provide guidance to property owners on cost-effective energy-saving measures. • Launch public awareness campaigns to educate property owners, tenants, and the public about the benefits of energy efficiency improvements and the requirements of MEPS.

Outstanding considerations for Estonia

- determine by when all buildings/dwellings should have their EPC, in order to track compliance with the MEPS.
- Determine the base minimum energy performance level class.
- Define the type and severity of penalty (taxation, fine, etc) for non-compliance.
- Determine in which timeframe buildings should be renovated, depending on their performance category, target the worst performing (EPC label F or above), and progressively expanding the scope to better performing buildings.
- Determine rules of verification and control.

4.3.4 nR4 – Renovation grants for single family houses

The objective of this measure is to increase the energy performance of buildings in the residential sector by supporting the **renovation of single-family houses**. Support will be provided via a renovation grant which aims to cover partially the costs of renovation works, to directly increase the financial attractiveness of EE investments. Households who are willing to engage in renovation will need to apply for the grant. To benefit from the renovation grant, applicants will need to comply with a set of predefined eligibility criteria, such as the types of works, the energy performance of the building, the building construction year.

The renovation grant would cover the share of the costs incurred for renovation in order to make these investments attractive, while avoiding over subsidization. Determining the appropriate share requires a continuous evaluation in order to find the right balance, which would not disturb the market, but would encourage a real ramp up of renovation. Avoiding over subsidization is essential as this would lead to a loss of public money (to the advantage of the households benefitting from the grant) but also to disturb the market (e.g., high grants can encourage higher pricing, which would have been lower without grant). On the contrary, setting a level of grant which is high enough is needed to attract households. Currently the share of grants is at 20-30% of the investment cost. A differentiation of the amount granted could also be made depending on income (up to 6-fold is the practice in other countries). This would encourage vulnerable households to engage in renovation and improve the energy performance of their dwellings, in order to benefit from lower energy bills and higher comfort.

A similar grant is already provided successfully in Estonia by KredEx.[72]

Concerned stakeholders

The beneficiaries of the measure are building owners and/or tenants living in single family houses and willing to engage in renovation works.

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator**: government, to set up the grant scheme (define eligibility criteria; evaluate and fine-tune the level of support; monitor the impact on market prices; …)
- ✓ **Implementing body**: Joint organisation of KredEx and Enterprise Estonia
- ✓ **Final payer**: taxpayers, as the grant will be funded via public budget
- ✓ **Beneficiary:** a single energy consumer, individual building owner, benefitting from an investment)

Key considerations of the measure

Table 4-8 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-8 Key considerations for renovation grants in multi-family houses

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • The measure drives market transformation by promoting the construction and renovation of energy-efficient buildings, thus increasing the availability of sustainable properties in the market. • Energy-efficient buildings are often more valuable and attractive to potential buyers or tenants, enhancing property values in the long term. • The government can orient the grants towards specific building categories (e.g., targeting low-income households, by adapting the level of support)
Cons	• Instrument is not sustainable in the long run as they rely on limited public financial resources to ensure attractiveness of the EE investments • Level of support might not be sufficient to cover the costs, especially for vulnerable households, and therefore decrease attractiveness • Extra support/measures needed in order to renovation historic homes since they require more tailored measures • The implementing body should permanently evaluate effectiveness of support with the main parameters
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a grant supported by the government, it will have no direct impact on the energy prices and will be paid by taxpayers
Key risks	• A shortage of skilled contractors and professionals experienced in energy-efficient renovations can hinder the successful implementation of the programme. Homeowners, therefore, might struggle to find qualified experts to carry out the renovations, causing delays and affecting the quality of the work. • There's a risk that renovation grants might primarily benefit higher-income households that can afford to invest in renovations, while lower-income households might not have the resources to take advantage of the programme.
Modelling Assumptions	• **Energy savings target:** 8.0 GWh (7.6 GWh heat and 0.4 GWh electricity) in 2025;

[72] https://kredex.ee/en

	• **Calculated savings:** 36kWh saved/m2 renovated every year (34 kWh/m2 in heat and 2 kWh/m2 in electricity) meaning we need to renovate ~235 000 m2 every year. If the average size of dwellings is 150m2, it means 1 569 dwellings have to be renovated every year. This is 1% of total detached house stock. To reach the 36kWh savings, 25% of EPC level F or G dwellings have to be renovated up to C, and 25% to level E. This is calculated as 33% of nR6 savings. • **Investment cost:** 150EUR/m2 (incl. VAT, with 2% inflation), or EUR 35 million. This is calculated as 33% of nR6 cost per m2. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 12y, then investment cost should be reduced by 33% ((12-8)/12). These 33.3% should be provided as a support, by the government via grants; • **Burden of the investment**: 70% by building owners, and 30% by the government (and then paid by the taxpayer); • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• There's a risk that renovation grants might not lead to substantial energy efficiency improvements if the provided incentives are not sufficient to cover the full costs of renovations, leading homeowners to opt for minimal upgrades. • Homeowners might delay or avoid energy efficiency renovations due to perceived hassle, disruption, or lack of urgency in making changes to their homes.
Implementation steps	• Create a user-friendly online application process that minimises administrative burdens for homeowners. Provide guidance and assistance throughout the application process. • Offer free or subsidized energy audits to homeowners to help them identify energy efficiency improvement opportunities and make informed renovation decisions. • Establish a network of accredited contractors with expertise in energy efficiency renovations. Homeowners can choose from these contractors, ensuring quality and reliability. • Collect feedback from homeowners who have participated in the grant programme to identify areas for improvement and make necessary adjustments.

Outstanding considerations for Estonia

- Determine who qualifies for the grant, the owner or the tenant, or both, depending on which party is willing to engage in the renovation and responsible for the upfront cost of the implemented measures.
- Define a list of eligible renovation works. Will any renovation measure be considered? Or only deep renovation measures that a achieve a certain energy savings target?
- Adapt the grant amount on the level of income (i.e., low-income households qualify for a higher amount).
- Establish continuous revision of support levels, based at least on the following parameters: investment costs (considering Estonian cost, also having in mind the possible influence of the grants on market practices); energy savings generated (calculated based on real experience); energy price and evolution.
- Possibly combine or complement with property taxation and energy pricing measures.

4.3.5 nR5 – Tax deduction for renovation works

Instead of a renovation grant, households who are engaging in renovation works can benefit from a tax deduction. This tax deduction would take the form of reduced VAT (from the standard Estonian VAT rate

of 20%, starting from 2024 VAT rate of 22%). There are two possible options for applying the reduced VAT on renovation works :

- ✓ Option 1 - Direct application, i.e. eligible renovation or construction work carried out by professionals is directly invoiced at reduced VAT rate once it has been approved by public authorities; or
- ✓ Option 2 - Refund of the difference between normal and reduced VAT.

For works applying to the eligibility criteria, a reduced VAT rate would apply to the work (salaries), to the materials, or to both. We would suggest that all types of residential buildings may benefit from a tax deduction in order to encourage energy renovation. Ideally a direct application is the most effective and easy to stimulate renovation works.

Energy savings will be achieved by the party which benefits from the tax deduction.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator:** government
- ✓ **Implementing body**: Estonian Tax and Customs Board
- ✓ **Final Payer**: taxpayers, as the reduced VAT will decrease the public budget income. However this would only represent a small fraction of the investment cost, and consequently the building owner would bear the majority of the cost
- ✓ **Beneficiary:** building owner (occupier) receiving the works and benefiting from lower energy costs, also the construction sector which will experience increased demand for workers able to implement energy efficiency measures

Key considerations of the measure

Table 4-9 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-9 Key considerations for tax reduction for renovation works

Parameter	Description
Pros	• Reduces the cost of energy efficiency projects for households, to make works more attractive • Implementing a tax deduction system is generally less bureaucratic and more straightforward than traditional grant programmes. Homeowners can easily benefit from the reduced VAT rate by presenting their renovation receipts during the tax filing process. • Encourages “green job creation” for installers and contractors implementing energy efficient measures • Many European best practices to serve as an example/provide guidance • Reduces black market share in construction as renovation works have to be correctly documented.
Cons	• The reduced VAT rate on renovation expenses leads to a decrease in tax revenue for the government, which is then partially compensated by an increase in construction activity. Depending on the scale of renovation activities, this could potentially impact public finances and other public services if not adequately compensated.
NUTS3 impact	• Cf. previous measure

Energy price impact	• Considering this is a fiscal advantage with consequently less oncome for the government, it will have no direct impact on the energy prices and will be "paid" (or supported) by taxpayers
Key risks	• There's a risk that tax deductions might primarily benefit higher-income homeowners who have the financial capacity to undertake substantial renovation projects, while lower-income households might not be able to take advantage of the tax incentives. • Tax deductions might not provide sufficient motivation for homeowners to undertake comprehensive energy efficiency retrofits, leading them to opt for minor upgrades that have minimal impact on energy savings.
Modelling Assumptions	• **Energy savings target:** 7.2 GWh (6.8 GWh heat and 0.4 GWh electricity) in 2025; • **Calculated savings:** 36kWh saved/m2 renovated every year (34 kWh/m2 in heat and 2 kWh/m2 in electricity), meaning we need to renovate ~212 000 m2 every year. If the average size of dwellings is 150m2, it means 1 412 dwellings have to be renovated every year. To reach the 36kWh savings, 25% of EPC level F or G dwellings have to be renovated up to C, and 75% to level E. This is calculated as 33% of nR6 savings. • **Investment cost:** 150 EUR/m2 (incl. VAT, with 2% inflation), or EUR 32 million; This is calculated as 33% of nR6 cost per m2. • **Support (if relevant) to the investment:** tax deduction for all works means that the investment is indirectly supported with 20% exemption of renovation work. Work cost is assumed to be 50% of total renovation cost, and hence the total cost becomes EUR 3.2 million (10% out of 32 MEUR); • **Burden of the investment**: 90% by building owners, and 10% by the government (via tax exemption); • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Complicated tax regulations and eligibility criteria might confuse homeowners, making it difficult for them to accurately assess their eligibility and potential benefits. • Tax deductions might incentivise homeowners to focus on immediate financial gains rather than long-term energy efficiency benefits, leading to inadequate investment in comprehensive energy-saving measures.
Implementation steps	• Develop a user-friendly application process that clearly outlines eligibility criteria and required documentation. Offer online tools or calculators to help homeowners estimate potential tax benefits. • Provide detailed guidelines that outline eligible renovation works, energy efficiency requirements, and necessary documentation. Ensure that homeowners have a clear understanding of the scope of qualifying projects. • Implement a tiered structure where larger tax deductions are provided for more comprehensive energy efficiency renovations. This encourages homeowners to invest in significant energy-saving measures. • Develop requirements that encourage homeowners to prioritise long-term energy savings. For example, offer higher deductions for projects that achieve higher energy efficiency standards.

Outstanding considerations for Estonia

- Establish who is eligible and what measures are eligible. Determine if a certain level of renovation needs to be met.
- Determine the means of verification, e.g., via aggregated installers (which invoice would then be considered knowledgeable)
- Determine the overall VAT reduction rate for approved measures.
- Clarify when building owner need to apply – before renovation, after, upon compliance…
- Determine how to administer to the reduction, as this impacts the administrative burden for the implementing authority.

4.3.6 nR6 – Renovation grants for multifamily buildings/housing associations

The objective of this measure is to increase the energy performance of buildings in the residential sector by supporting the renovation of multifamily houses or housing associations. Support will be provided via a renovation grant which aims to cover the costs of renovation works. Households/buildings willing to engage in renovation will need to apply for the grant. To benefit from the renovation grant, applicants will need to comply with a set of predefined eligibility criteria, such as the types of works, the energy performance of the building, the building construction year. The renovation grant will cover around 30% of the costs incurred for renovation. A similar grant is already provided in Estonia by KredEx and continuation of this measure should be assessed.

We would suggest that all types of multifamily houses benefit from a renovation grant (regardless of construction year or energy performance) in order to encourage households to improve the energy performance of their housing.

Concerned stakeholders

The beneficiaries of the measure are building owners and/or tenants living in multifamily houses and willing to engage in renovation works.

The concerned stakeholders include the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator:** Government
- ✓ **Implementing body**: Joint organisation of KredEx and Enterprise Estonia
- ✓ **Final payer**: taxpayers, as the grant will be funded via public budget
- ✓ **Beneficiary:** building owners, apartment owners, and tenants

Key considerations of the measure

Table 4-10 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-10 Key considerations for renovation grants for multifamily buildings/housing associations

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Addresses issue of collective ownership and payment • Aggregates potential small-scale savings/projects into larger, deeper savings projects
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Unequal distribution of resources between rural and urban areas, as well as conflicting priority • Level of support might not be sufficient to cover the costs, especially for vulnerable households • Split incentive in buildings with mixed ownership and rental units
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a grant supported by the government, it will have no direct impact on the energy prices and will be paid by taxpayers
Key risks	• Decision-making within housing associations can be complex, involving multiple stakeholders with varying priorities and interests. Disagreements over renovation plans and funding allocation could hinder progress. •

	• **Energy savings target:** 120 GWh (113.3 GWh heat and 6.7 GWh electricity) in 2025; • **Calculated savings:** 108 kWh saved/m2 renovated every year (102 kWh heat and 6 kWh electricity saved/m2), meaning we need to renovate ~1.18 million m2 every year. If the average size of flat is 50m2 and there are 60 flats per building, it means 392 apartment buildings have to be renovated every year. To reach the 102kWh savings, all EPC level F or G apartments have to be renovated up to level C and PV panels have to be installed to achieve electricity saving 6 kWh/m2 (KredEx renovation + PV panels) • **Energy savings** • **Investment cost:** 450EUR/m2 (incl. VAT, with 2% inflation), or EUR 529 million. This consist of additional insulation and heat recovery ventilation and PV panels. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 12y, then investment cost should be reduced by 33% ((12-8)/12). These 33.3% should be provided as a support, by the government via grants; • **Burden of the investment**: 66.6% by building owners, and 33.3% by the government (and then paid by the taxpayer); • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Complex application processes, documentation requirements, and lengthy approval procedures could discourage housing associations from applying for renovation grants. • Disparities in financial capacity among housing associations might raise concerns about the fairness of grant distribution, leading to a perception of inequitable access to energy efficiency funding.
Implementation steps	• Streamline the application process by providing clear guidelines and templates for required documentation. Offer online submission options to reduce administrative burden. • Encourage community engagement and participation in renovation planning. Organize meetings where housing association members can discuss energy efficiency goals, renovation options, and funding allocation.

Outstanding considerations for Estonia

- Clearly outline the types of renovations eligible for the grant. Establish if the grant will focus on specific aspects like energy efficiency, safety upgrades, accessibility improvements, or a comprehensive renovation plan.
- Determine if the amount vary on a case-by-case basis, i.e., applicants' income, level of savings achieved, current energy performance of the building, etc.

4.3.7 nR7 – Property tax (according to EPC levels)

The objective of this measure is to grant some form of a property tax exemption (i.e., a reduction and/or rebate) for buildings that have a predefined level of energy performance or higher (see outstanding considerations section). Building owners would need to apply to the property tax reduction by proving their compliance with the minimum required energy performance level via an EPC. The level of the reduction may vary based on various criteria: building construction year, energy performance level, etc.

A property tax reduction according to EPC levels may cause the sale of less energy performant properties. However, this negative impact can be reduced by increasing the energy performance of the building.

Residential buildings which comply with the minimum required energy performance level may benefit from the property tax exemption, reduction and/or rebate. Energy savings will be achieved by owners who have upgraded their building to the minimum required energy performance level.

Concerned stakeholders

The beneficiaries of the measure are building owners/taxpayers who benefit from a property tax exemption, reduction and/or rebate if their building corresponds to the minimum required energy performance level.

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator:** government
- ✓ **Implementing body**: local public authorities that are responsible for defining changes in property tax
- ✓ **Final payer**: taxpayers, as the reduced property tax will decrease the public budget
- ✓ **Beneficiary:** Government for receiving tax revenue

Key considerations of the measure

Table 4-11 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-11 Key considerations for property taxation for residential

Parameter	Description
Pros	• Provides an incentive to shift towards low- to zero-carbon energy sources in residential buildings • Provides an incentive in addition to a penalty • Generates potential revenue to put back into the programme (i.e., to provide renovation grants) • The construction and renovation of energy-efficient buildings can generate job opportunities in various sectors, including architecture, construction, and renewable energy.
Cons	• Property tax exemptions may benefit primarily wealthier property owners who can afford energy-efficient upgrades, potentially exacerbating income inequality. • Implementing property tax exemptions may lead to a reduction in revenue for local governments, potentially affecting public services and infrastructure funding. • Property tax exemptions may take time to translate into energy savings and environmental benefits, depending on the building's usage and occupants' behaviour.
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a fiscal measure supported by the government, it will have no direct impact on the energy prices
Key risks	• Property owners with older buildings or lower incomes might face difficulties in meeting higher property tax payments due to lower energy performance. This could lead to perceived inequities in the tax system. • Implementing a property tax based on EPC levels requires accurate data on energy performance for all properties. This might pose challenges in terms of data collection, verification, and maintenance.
Modelling Assumptions	• **Energy savings target:** 40 GWh (37.8 GWh heat and 2.2 GWh electricity) in 2025; • **Calculated savings:** 108 kWh saved/m2 renovated every year (102 kWh heat and 6 kWh electricity saved/m2), meaning we need to renovate ~392 000 m2 every year. If the average size of dwellings is 150m2, it

	means 2 614 dwellings have to be renovated every year. To reach the 102kWh savings, all EPC level F or G dwellings have to be renovated up to level C. Calculated similarly to nR6. • **Investment cost:** 450EUR/m2 (incl. VAT, with 2% inflation), or EUR 176 million; Calculated similarly to nR6. • **Support (if relevant) to the investment:** Tax for all residential property owners is 1€/m2/y. This funds KredEx style renovation. • **Burden of the investment**:100% by building owners; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• The availability of reliable and up-to-date energy performance data for all properties can be a significant barrier, especially for older buildings. Inaccurate data might lead to unfair taxation.
Implementation steps	• Establish a comprehensive and accurate database of energy performance data. • Introduce the property tax based on EPC levels gradually, allowing property owners time to adapt and make necessary improvements. • Provide educational resources, workshops, and information sessions to address property owners' concerns and questions.

Outstanding considerations for Estonia

- Determine the type of tax benefit – exemption, reduction, rebate, etc. Typically based on administrative burden or prevue of the implementing party.
- Define the established performance level for qualifying buildings.

4.3.8 nR8 – CO_2 tax for end energy use of residential buildings

This fiscal measure imposes a tax on the CO_2 emitted for end energy use of residential buildings. The primary goal of this tax is to incentivise homeowners and tenants to adopt more energy-efficient practices and technologies, ultimately leading to a reduction in greenhouse gas emissions and contributing to climate change mitigation efforts.

To apply the tax accurately, the emissions associated with the end energy use of residential buildings need to be quantified. This is typically done by considering the type and quantity of energy consumed, such as electricity, natural gas, heating oil, or other fossil fuels, and calculating the resulting CO2 emissions. The CO2 tax is usually collected through energy bills or through a separate tax mechanism applied at regular intervals (e.g., monthly, quarterly, or annually). Energy providers, such as utilities, are responsible for billing and collecting the tax on behalf of the government.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: building occupiers (tenants or owners) who will need to pay the CO_2 tax for the energy used in their building
- ✓ **Administrator**: Government and energy providers
- ✓ **Implementing body**: Ministry in charge of Energy or Estonian Tax and Customs Board
- ✓ **Final Payer:** building occupiers (tenants or owners) who will face increased energy bills due to the CO_2 tax
- ✓ **Beneficiary:** building owners and tenants of efficient homes with low energy usage and government for increase tax revenue

Key considerations of the measure

Table 4-12 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-12 Key considerations for CO_2 tax for end energy use of residential buildings

Parameter	Description
Pros	• Provides an incentive to shift towards low- to zero-carbon energy sources in residential buildings • Generates revenue to be ideally put back into renovation measures
Cons	• Carbon and energy pricing can raise issues of social inequality as vulnerable households will be particularly affected by increased prices. Distributional and compensation measures should be taken to minimise these effects. • Social barriers to the implementation of carbon pricing are high, as it may lead to high increases in final energy prices.
NUTS3 impact	• Cf. previous measure
Energy price impact	• CO2 tax on end energy use impacts directly the energy price
Key risks	• Risks are related to increased energy prices, leading to possibly more households not anymore able to afford their energy bill
Modelling Assumptions	• **Energy savings target:** 40 GWh (37.8 GWh heat and 2.2 GWh electricity) in 2025; • **Calculated savings:** 108 kWh saved/m2 renovated every year (102 kWh heat and 6 kWh electricity saved/m2), meaning we need to renovate ~392 000 m2 every year. If the average size of dwellings is 150m2, it means 2 614 dwellings have to be renovated every year. This is To reach the 102kWh savings, all EPC level F or G dwellings have to be renovated up to level C. Calculated similarly to nR6. • **Investment cost:** 450EUR/m2 (incl. VAT, with 2% inflation), or EUR 176 million; Calculated similarly to nR6. • **Support (if relevant) to the investment:** Average tax for all residential property owners is 1€/m2/y. Tax is higher. This funds KredEx style renovation. • **Burden of the investment**: 100% building owners; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• A CO2 tax can influence the housing market. Energy-efficient homes may see increased demand and value, while older, less efficient homes may become less attractive. Policymakers may need to consider measures to ensure housing affordability and accessibility. • The regressive nature of energy taxes may necessitate policies to address income inequality. A portion of the tax revenue can be used to fund social welfare programs, energy assistance for low-income households, or progressive tax structures.

Outstanding considerations for Estonia

- How will the CO2 emissions be measured? Establish a reliable and standardized method for measuring CO2 emissions associated with the end energy use of residential buildings.
- Determine how will the tax be imposed and who will pay it – homeowners or tenants.
- Will there be exemptions or discounts? Consider whether certain low-income households or energy-intensive industries should be exempt from the CO2 tax or qualify for reduced rates.
- Consider if there should be a transition period or incentives to ease the burden on residents during the initial implementation of the CO2 tax.
- Establish how the CO2 tax be regularly evaluated and adjusted. Establish a mechanism for periodic review and adjustment of the tax rate and structure based on performance and changing circumstances.

4.4 Services

4.4.1 nS1 – Obligation scheme for service sector

Similar to nR1, this measure is based on Energy Efficiency Obligation Schemes introduced by Article 7 of Directive 2012/27/EU on Energy Efficiency (EED), however the objective of this measure is to establish an obligation scheme for the service sector. The *EEOS* aims to achieve energy savings in the services sector covering buildings and any other types of assets and equipment in this sector. Energy savings will be achieved by obliged parties, which are different categories of energy operators. To meet their obligation, energy suppliers or distributors must invest in or promote energy efficiency measures and programmes for residential buildings. Each obligated party's energy savings obligation is calculated based on its market share or the total energy supplied to residential customers during a specified baseline period.

Concerned stakeholders

The beneficiaries of the measure (who are also expected to be the final payers) are both energy consumers (i.e., higher quality of goods and services, e.g., higher performance of buildings) and obliged parties (i.e., increased energy efficiency may have a positive impact on costs).

The concerned stakeholders are the following:

- ✓ **Obliged party**: categories of energy operators, who need to comply with energy savings obligations by implementing energy efficiency measures or buying energy savings certificates.
- ✓ **Administrator:** Government
- ✓ **Implementing body**: Ministry of Climate & obliged parties
- ✓ **Final payer**: energy consumer, who will face price increases reflecting the investments made by obliged parties to achieve energy savings
- ✓ **Beneficiary:** obligated parties for upgraded services and eventually lower energy bills

Key considerations of the measure

Table 4-13 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-13 Key considerations for Obligation scheme for service sector

Parameter	Description
Pros	• Allows to achieve energy savings in the most cost-effective way (those for which it is easier to achieve energy savings will do so and others will buy certificates) • Various best practices and longstanding experience exist in the EU, which may facilitate the implementation of the scheme • The obligation scheme ensures that businesses and organizations in the services sector are accountable for their energy efficiency performance, fostering a sense of responsibility towards sustainable practices. • The scheme incentivizes the adoption of energy-efficient technologies and practices, driving market transformation towards more sustainable products and services.
Cons	• High administrative costs (monitoring of the market for energy saving certificates & compliance with scheme) • Ensuring compliance among all businesses and organizations in the services sector may be challenging, especially for businesses operating in remote areas.

	• Compliance with the scheme may impose additional administrative burdens on businesses, especially if reporting and verification requirements are extensive.
NUTS3 impact	• There are 5 NUTS regions for Estonia: Põhja (EE001); Lääne (EE04); Kesk (EE006); Kirde (EE007); Lõuna (EE008)[73] • Different regions within Estonia may have varying levels of energy consumption, economic development, and infrastructure, especially given certain rural areas with higher industrial activity, or urban areas, such as Tallinn, with more developed/advanced infrastructure and workforce with access to additional training. • Energy suppliers might be tempted to invest efforts where there is higher chance to get investment done (higher economic development, like in large cities Tallinn, Tartu, Pärnu, Viljandi), while neglecting areas with lower income and means to invest.
Energy price impact	• when suppliers provide support to companies to invest in their buildings, the cost of the support should be passed on to all consumers via energy price increase. Each time the energy supplier provide support, it has to increase its energy price. • Consequently, higher energy prices will make energy efficiency measures more financially attractive, potentially leading to greater investment in energy-saving projects, or reducing the amount needed to support new energy efficiency investments (assuming that the level of support is based on the gap to make an investment attractive). But this might be compensated by the fact that the cheapest savings are made in priority, while the same savings cost more and more with the new stock to be renovated; • Companies having invested in energy efficiency have an advantage as they will consume less than previously.
Key risks	• Service sector businesses may perceive energy efficiency as a lower priority compared to industries with higher energy consumption. This could lead to a lack of motivation to actively participate in the scheme. • Verifying reported energy savings poses challenges, as businesses may not have proper systems in place to track and validate their achieved efficiency gains. This can raise concerns about the reliability and credibility of reported results. • Insufficient financial incentives or benefits for achieving energy savings may discourage businesses from investing in energy efficiency measures. The scheme needs to offer attractive incentives to drive active participation and implementation.
Modelling Assumptions	• **Energy savings target:** 56 GWh (27 GWh heat and 29 GWh electricity) in 2025; • **Calculated savings:** 42 kWh energy saved/m2 renovated every year (23 kWh/m2/y in heat and 19 kWh/m2/y electricity, meaning we need to renovate ~1.33 million m2 every year. To reach the 42 kWh/m2 savings in energy, all EPC level F or G service buildings have to be renovated up to level D; • **Investment cost:** 75 EUR/m2 (incl. VAT, with 2% inflation), or EUR 100 million. This comprises of ESCO renovation which includes lighting, HVAC and automation upgrades and in some cases PV panel installation. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 10y, then investment cost should be reduced by 20% ((10-8)/10). These 20% should be provided as a support, by the energy supplier • **Burden of the investment**: in the model 100% is paid by energy providers, and then billed to end consumers (this could evolve, and 80% could be paid by building owners, and 20% by energy suppliers) • **Energy price impact:** The support is then passed on the energy price. if we count 20% of the 100 MEUR, support represents a yearly cost of EUR 20

[73] https://en.wikipedia.org/wiki/NUTS_statistical_regions_of_Estonia

	million, to be passed to all service consumers (20 MEUR / 5.4 TWh = an increase of 3.70 EUR/MWh, or 0.37 ct/kWh) • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Engaging energy suppliers in a productive dialogue is essential for shaping the *EEOS* effectively. Resistance from the sector might impede successful engagement within established limitations. • Implementing an *EEOS* demands robust technical proficiency and a comprehensive understanding of the market landscape, which many energy suppliers currently lack. This transformation necessitates adjustments in their business models, presenting an opportunity to transition from product-centric approaches to service-oriented ones. • Safeguarding against the escalation of energy poverty is crucial. The government's intervention in managing energy price hikes and directing the focus towards housing occupied by lower-income households is vital to prevent adverse impacts on vulnerable sections of the population.
Implementation steps	• Initiating conversations with energy suppliers (referring to successful approaches in other Member States). • Establishing the framework for the scheme: outlining obligations and responsibilities, creating a list of eligible investments and their associated savings, setting the non-compliance fee, developing an IT system incorporating white certificates (WC), among others. • Executing the EEOS: determining baseline and targeted savings for each participant, issuing WC, closely monitoring outcomes.

Outstanding considerations for Estonia

- Set clear and achievable targets for energy efficiency improvements or emissions reductions in the service sector. Establish timelines for meeting these targets and consider the feasibility of implementation.
- Develop a reporting mechanism for obligated parties to submit data on their energy consumption or emissions reductions. Establish penalties for non-compliance and a process for addressing non-compliant parties.
- Establish the administrative structure for overseeing and managing the Obligation scheme. Clarify the roles and responsibilities of relevant government agencies and regulatory bodies.

4.4.2 nS2 – Central government buildings renovation support

The objective of this measure is to increase the energy performance of central government buildings by supporting their renovation. Support will be provided via a renovation grant which aims to cover the costs of renovation works. The renovation grant would cover 100% of the costs incurred for renovation. The measure covers the buildings of all central government bodies.

Concerned stakeholders

The beneficiaries of the measure are central government bodies willing to engage in renovation works. A list of central government bodies in Annex I of the Estonian 2017 NEEAP.[74] They will also be the ones achieving energy savings.

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator:** Government

[74] https://energy.ec.europa.eu/system/files/2017-09/ee_neeap_2017_en_0.pdf

- ✓ **Implementing body**: Estonian body in charge of public building
- ✓ **Final payer**: taxpayers, as the grant will be funded via public budget
- ✓ **Beneficiary:** Public authorities and government for overall lower energy bills

Key considerations of the measure

Table 4-14 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-14 Key considerations for Central government buildings renovation support

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Stimulates the renovation of public buildings which is essential for compliance with EED article 6 • Investing in energy-efficient renovations showcases the government's commitment to sustainability and sets an example for other organizations and the public to follow. • Renovation projects offer the opportunity to modernize building systems, incorporating smart technologies and improving overall functionality.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • The initial investment required for energy-efficient renovations may strain government budgets, especially if there are competing priorities. • Central government buildings vary in age, size, and structural characteristics, which can complicate the standardization of energy-efficient measures. • Renovation work may cause temporary disruptions to government operations and services, impacting employees and citizens.
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a grant supported by the government, it will have no direct impact on the energy prices and will be paid by taxpayers
Key risks	• Government budgets are often subject to competing priorities, and funds earmarked for energy efficiency renovations might be diverted to address more immediate concerns. Fluctuations in available funds can affect the implementation of renovation projects, leading to uncertainties in project timelines and potential downsizing of planned initiatives.
Modelling Assumptions	• **Energy savings target:** 1.8 GWh (1.7 GWh heat and 0.1 GWh electricity) in 2025. This represent 3% of the central government building stock, that needs to be renovated each year as required by EU. • **Calculated savings:** 85 kWh saved/m2 renovated every year (and 5 kWh electricity saved/m2), meaning we need to renovate ~20 000 m2 every year. To reach the 85 kWh savings, all EPC level F or G government buildings have to be renovated up to level C. This is based on long term renovation strategy of Estonia. • **Investment cost:** 750 EUR/m2 (incl. VAT, with 2% inflation), or EUR 15 million per year; This consists of deep energy renovation and remodelling cost. • **Support (if relevant) to the investment:** not applicable given that the government is paying the entirety of the works • **Burden of the investment**: 100% by building owner / government; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• The grant programme may lead to unintended consequences, such as suppliers inflating costs to match the grant amount, or projects not delivering the expected energy savings. • Government agencies may become dependent on grants for energy efficiency renovations, potentially delaying the development of a self-sustaining approach to energy efficiency. • The grant programme may lead to delays in project implementation due to administrative processes, eligibility criteria, or capacity constraints.

	• Resistance from stakeholders, including government officials, building occupants, or other relevant parties, could hinder the smooth implementation of the grant programme.
Implementation steps	• Conduct a comprehensive assessment of central government buildings to identify energy efficiency improvement opportunities and prioritise renovation projects. • Define the terms of the renovation loans, including interest rates, repayment periods, loan amounts, and eligibility criteria. • Offer workshops and training sessions to building managers and administrators to enhance their understanding of the loan programme and how to identify suitable energy efficiency projects.

Outstanding considerations for Estonia

- Clarify how the application process works and if measures need to be applied for or if they are automatically granted. Established if the grant is linked to an obligation to renovate (e.g. based on Art 6 of the EED on public renovation buildings).
- Define if all central government buildings eligible, or only ones below a certain energy performance level.
- Update the list of central government bodies in Annex I of the Estonian 2017 NEEAP.
- Decide on the grant amount and how it will be distributed. Determine whether it will cover a percentage of project costs, a fixed amount, or be tied to specific performance metrics.
- Implement mechanisms for compliance verification and auditing of grant recipients. Ensure that funded projects adhere to programme requirements and achieve stated objectives.
- Consider providing technical assistance and support to grant applicants. Offer resources, workshops, or training to help recipients implement their projects successfully.

4.4.3 nS3 – Public and municipality buildings renovation support

Compared to nS3, which provides renovation support for central government buildings, the objective of this measure is to increase the energy performance of public and municipality buildings by supporting their renovation. Support will be provided via a renovation grant which aims to cover some of the costs of renovation works.

The renovation grant will cover around 60% of the costs incurred for renovation. The level of the grant may vary based on certain criteria: type of public building (e.g., priority to buildings provided essential services such as hospitals, schools, social housing, etc.), building construction year, energy performance level, etc.

Concerned stakeholders

The beneficiaries of the measure are public bodies and municipalities bodies willing to engage in renovation works. They will also be the ones achieving energy savings.

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator:** government
- ✓ **Implementing body**: Estonian body in charge of public building
- ✓ **Final payer**: taxpayers, as the grant will be funded via public budget
- ✓ **Beneficiary:** public authorities for lower energy bills and ideally better indoor air quality post renovation

Key considerations of the measure

Table 4-15 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-15 Key considerations for Public and municipality buildings renovation support

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Stimulates the renovation of public buildings, in line with EED requirements • Government-led energy-efficient renovations set an example for private sector buildings, encouraging broader adoption of sustainable practices in the community. • Renovation grant resources available at the European level for national use • Renovating public and municipality buildings to improve energy efficiency can lead to significant cost savings on energy bills, resulting in long-term financial benefits for governments and taxpayers.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Public buildings encompass a wide range of architectural styles and ages, and some may have structural limitations that limit the extent of energy performance improvements. • Renovation work may temporarily disrupt services in public buildings, affecting employees and visitors.
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a grant supported by the government, it will have no direct impact on the energy prices and will be paid by taxpayers
Key risks	• Public and municipality buildings may face difficulties navigating complex grant application procedures, leading to delays or deterrence from applying. • Public and municipality bodies might lack in-house technical expertise to effectively plan and execute energy efficiency projects, leading to suboptimal outcomes.
Modelling Assumptions	• **Energy savings target:** 7.9GWh (7.5 GWh heat and 0.4 GWh electricity) in 2025. The calculations assume that all public buildings are renovated in 30 years. • **Calculated savings:** 90 kWh saved/m2 renovated every year (85 kWh/m2/y in heat and 5 kW/m2/y in electricity), meaning we need to renovate ~88 235 m2 every year. To reach the 85 kWh savings, all EPC level F or G municipality buildings have to be renovated up to level D?; • **Investment cost:** 750 EUR/m2 (incl. VAT, with 2% inflation), or EUR 66.2 million; This consists of deep energy renovation and remodelling cost. • **Support (if relevant) to the investment:** randomly fixed at 60%, but it could also be based on the calculation of the funding gap, to avoid over-subsidisation (even though municipalities are also public entities); • **Burden of the investment**: 40% by building owner, with a support of 60% from the government. • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Grant allocation decisions could inadvertently favour certain municipalities over others, leading to inequitable distribution of resources. This could create disparities in energy efficiency improvements between municipalities and raise concerns about fairness in resource allocation.
Implementation steps	• Conduct a comprehensive assessment of municipal buildings to identify energy efficiency improvement opportunities and prioritise renovation projects. • Define the terms of the renovation loans, including interest rates, repayment periods, loan amounts, and eligibility criteria.

	• Offer workshops and training sessions to building managers and administrators to enhance their understanding of the loan programme and how to identify suitable energy efficiency projects.

Outstanding considerations for Estonia

- Determine eligibility criteria and how/if the grant also linked to an obligation to renovate (e.g., based on Art 6 of the EED on public renovation buildings).
- Define if all central government and municipal buildings eligible, or only ones below a certain energy performance level.
- Confirm the amount available (currently stated at 60%). Determine the criteria for eligibility.
- Decide on the grant will be distributed.
- Implement mechanisms for compliance verification and auditing of grant recipients. Ensure that funded projects adhere to programme requirements and achieve stated objectives.
- Consider providing technical assistance and support to grant applicants. Offer resources, workshops, or training to help recipients implement their projects successfully.
- Determine if there is a need to define public bodies (see definition of public body in the 2023 EED Recast).

4.4.4 nS4 – Commercial buildings energy performance investments support

The objective of this measure is to increase the energy performance of commercial buildings by supporting their renovation. Support will be provided via a renovation grant which aims to cover some of the costs of renovation works. Companies who are willing to engage in renovation will need to apply for the grant. To benefit from the renovation grant, applicants will need to comply with a set of predefined eligibility criteria, such as the types of works, and level of energy savings achieved, the type of company, the energy performance of the building, the building construction year, etc.

The renovation grant will cover a share of the costs incurred for renovation. The level of the grant may vary based on certain criteria: size of the enterprise (i.e., larger amount for SMEs which have smaller turnover to encourage them in engaging in energy efficiency), etc. Additionally, the lower rate could be justified through VAT deductions.

Concerned stakeholders

The beneficiary of the measure are commercial building owners/tenants willing to engage in renovation works. They will also be the ones achieving energy savings.

The concerned stakeholders are the following:

- ✓ **Obliged party:** N/A
- ✓ **Administrator**: Government, to set up the grant scheme (define eligibility criteria; evaluate and fine-tune the level of support; monitor the impact on market prices; …)
- ✓ **Implementing body**: Joint organisation of KredEx and Enterprise Estonia
- ✓ **Final payer**: taxpayers, as the grant will be funded via public budget
- ✓ **Beneficiary:** commercial building owners and tenants for lower bills and increased quality after services

Key considerations of the measure

Table 4-16 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-16 Key considerations for Commercial buildings energy performance investments support

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Renovation grant resources available at the European level for national use • Energy-efficient buildings often have higher property values and can attract more tenants, providing potential financial benefits for building owners. • Supporting energy-efficient renovations helps commercial buildings comply with energy performance standards and regulations, avoiding potential penalties or restrictions.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Shortage of skilled labour able to carry out renovation works on the large scale • Renovation work may cause disruptions to business operations, leading to temporary inconvenience for occupants and potential loss of revenue. • In lease agreements, the cost of renovations may fall on the building owner, while tenants benefit from reduced energy bills. This "split incentive" can deter some owners from investing in energy efficiency.
NUTS3 impact	• Companies in more economically developed areas will probably use more grants than in other areas • Cf previous measures
Energy price impact	• Considering this is a grant supported by the government, it will have no direct impact on the energy prices and will be paid by taxpayers
Key risks	• Offering grants to municipal buildings might lead to a shift in private sector investment away from energy efficiency projects. Private entities might opt to wait for government funding rather than investing their own resources, potentially slowing down overall energy efficiency improvements.
Modelling Assumptions	• **Energy savings target:** 43.2 GWh (23.2 GWh heat and 20 GWh electricity) in 2025; • **Calculated savings:** 54 kWh saved/m2 renovated every year (and 29 kWh heat and 25 kWh electricity saved/m2), meaning we need to renovate ~800 000 m2 every year. To reach the 54 kWh savings, all EPC level F or G municipality buildings have to be renovated up to level D; This is calculated as 125% of nS1 savings. • **Investment cost:** 125 EUR/m2 (incl. VAT, with 2% inflation), or EUR 100 million; This is calculated as 125% of nS1 cost. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 12y, then investment cost should be reduced by 33% ((12-8)/12). These 33.3% should be provided as a support, by the government via grants; • **Burden of the investment**: 66.6% by building owner, with a support of 33.3% from the government; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Offering renovation grants could attract investors and developers to certain areas, leading to increased property values and potentially displacing existing businesses or residents. • Larger commercial entities may have more resources to access and utilize renovation grants, leaving smaller businesses at a competitive disadvantage. This could result in market imbalances and reduced diversity within the business sector.

Implementation steps	• Conduct a comprehensive assessment of commercial buildings to identify energy efficiency improvement opportunities and prioritise renovation projects. • Define the terms of the renovation loans, including interest rates, repayment periods, loan amounts, and eligibility criteria. • Offer workshops and training sessions to building managers and administrators to enhance their understanding of the loan programme and how to identify suitable energy efficiency projects.

Outstanding considerations for Estonia

- Determine who qualifies for the grant, the owner or the tenant, or both, depending on which party is willing to engage in the renovation and responsible for the upfront cost of the implemented measures.
- Define a list of eligible renovation works. Does a certain renovation level need to be met or clarify if only deep renovation measures that a achieve a certain energy savings target qualify.
- Establish continuous revision of support levels, based at least on the following parameters: investment costs (considering Estonian cost, also having in mind the possible influence of the grants on market practices); energy savings generated (calculated based on real experience); energy price and evolution.
- Possibly combine or complement with property taxation and energy pricing measures.

4.4.5 nS5 – CO2 certificate sales based on energy savings from commercial buildings renovation, income invested as renovation support

This measure supports commercial building renovation and sells saved CO2 certificates to companies with the aim to be a self-sufficient support scheme. To improve the energy efficiency of commercial buildings, the government makes an initial investment via a grant to undertake renovation projects. These projects may include upgrading insulation, installing energy-efficient HVAC systems, implementing smart building technologies, and other measures to reduce energy consumption.

The reduction in CO2 emissions achieved through energy savings is quantified and converted into CO2 certificates or carbon credits. Each certificate represents a specific amount of avoided CO2 emissions. The commercial building owner or operator can sell these CO2 certificates on the carbon market or to entities looking to offset their own carbon emissions. The certificates serve as a tangible representation of the building's energy efficiency efforts and the resulting environmental benefits.

This will create the market in Estonia for public buildings, to eventually link to the EU ETS which, starting in 2027, will including the buildings sector (see section 4.2.4 Energy pricing).

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: Commercial building owners
- ✓ **Administrator**: Government, to set up and determine CO2 price and establish the market
- ✓ **Implementing body**: Ministry of Climate
- ✓ **Final payer**: Commercial building owners paying for the renovations

- ✓ **Beneficiary:** Commercial building owners benefitting from an investment (i.e., higher quality of goods and services, e.g. higher performance of buildings with reducing energy bills) and generating revenue. The Government, if they are the party claiming the generated funds.

Key considerations of the measure

Table 4-17 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-17 Key considerations for CO2 certificate sales based on energy savings from commercial buildings renovation, income invested as renovation support

Parameter	Description
Pros	• Collects funding for commercial building renovation incentives, but likely very small market when selling 'feel-good-certificates • Ultimately creates a self-funding system for energy renovations
Cons	• A new market for emissions trading needs to be created • High administrative costs to oversee and verify generated savings and certificates • Not a well-known/established system in the buildings sector – will require much up-front research
NUTS3 impact	• We assume mainly tertiary buildings in areas with strong economic development will participate to the scheme, leaving behind actors from areas with lower economic development • Cf. pervious measure
Energy price impact	• Considering this is a voluntary scheme run by building owners and occupiers, it will have no direct impact on the energy prices
Key risks	• Developing accurate methodologies to measure and verify energy savings from commercial buildings can be complex and resource intensive. The risk of inaccuracies or disputes over measurement methods could undermine the credibility of the CO2 certificate programme and erode trust among participants. • There is a risk that businesses might focus solely on achieving energy savings to earn CO2 certificates, without considering broader sustainability goals. This could lead to gaming behaviour, where efforts are directed toward easy-to-implement measures that yield certificates rather than pursuing deeper, more impactful energy efficiency improvements.
Modelling Assumptions	• **Energy savings target:** 4.3 GWh (2.3 GWh heat and 2.0 GWh electricity) in 2025; • **Calculated savings:** 54 kWh saved/m2 renovated every year (and 29 kWh heat and 25 kWh electricity saved/m2), meaning we need to renovate~80 000 m2 every year. To reach the 54 kWh savings, all EPC level F or G tertiary buildings have to be renovated up to level D; This is calculated as 125% of nS1 savings. • **Investment cost:** 125 EUR/m2 (incl. VAT, with 2% inflation), or EUR 10 million; This is calculated as 125% of nS1 cost. • **Support (if relevant) to the investment:** SPBT (simple payback time) = INV (EUR) / [YEARLY SAVINGS (kWh/y) / ENERGY PRICE (eur/kWh)]. If SPBT>8y, then investment is not attractive and investment should be "reduced" (via a support). E.g., if average SPBT is 12y, then investment cost should be reduced by 33% ((12-8)/12). These 33.3% should be provided as a support, by the government via grants; • **Burden of the investment**: 66.6% by building owner, with a support of 33.3% from the government; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Depending on building ownership and occupancy patterns, there is a risk that the benefits of the CO2 certificate programme might not be distributed equitably among various stakeholders. Larger and more resourceful entities might disproportionately benefit, while smaller

	businesses or less economically developed regions might struggle to participate and access the programme's advantages. • The focus on earning CO2 certificates through energy savings might lead to a narrow perspective on energy efficiency. Businesses could prioritise measures that yield higher certificate returns over comprehensive energy efficiency strategies. This could potentially undermine holistic energy management and long-term sustainability objectives.
Implementation steps	• Develop a comprehensive policy framework that outlines the objectives, eligibility criteria, calculation methodology for energy savings, and the mechanism for issuing and trading CO2 certificates. Define the regulatory and reporting requirements for participants, as well as penalties for non-compliance. • Design accurate measurement and verification protocols to ensure the credibility of reported energy savings. Determine standard methodologies for assessing baseline energy consumption and calculating energy savings achieved. This step is critical to prevent manipulation or overestimation of energy efficiency gains. • Establish a transparent and regulated market for CO2 certificates. Develop a secure platform for issuing, trading, and tracking certificates. Consider collaborating with financial and energy market stakeholders to facilitate smooth transactions and ensure a fair market value for certificates.

Outstanding considerations for Estonia

- What will be the pricing mechanism for CO2 certificates? Determine the appropriate price per certificate, considering market demand, the value of emissions reductions, and overall market dynamics.
- Clarify which administrative body is responsible for administering the certificates.
- Establish how the income from CO2 certificate sales be allocated and clarify if they will be used for further renovation support. Determine the percentage or amount of revenue directed toward supporting renovation projects.
- Clarify if the transaction between revenue generated via the certificates be paid back to the government/and what portion of revenue does the building owner get vs the government.
- Implement a robust reporting and monitoring system to track the impact of renovation projects and the actual emissions reductions achieved through CO2 certificate sales.

4.4.1nS6 – CO2 tax for end energy use of commercial buildings

This fiscal measure imposes a tax on the CO_2 emitted for end energy use of commercial buildings. The primary goal of this tax is to incentivise commercial building owners and tenants to adopt more energy-efficient practices and technologies, ultimately leading to a reduction in greenhouse gas emissions.

To apply the tax accurately, the emissions associated with the end energy use of commercial buildings need to be quantified. This is typically done by considering the type and quantity of energy consumed, such as electricity, natural gas, heating oil, or other fossil fuels, and calculating the resulting CO2 emissions. The CO2 tax is usually collected through energy bills or through a separate tax mechanism applied at regular intervals (e.g., monthly, quarterly, or annually). Energy providers, such as utilities, are responsible for billing and collecting the tax on behalf of the government.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: commercial building owners who will need to pay the CO_2 tax for the energy used in their building
- ✓ Administrator: government
- ✓ **Implementing body**: Ministry of Climate or Estonian Tax and Customs Board and energy suppliers
- ✓ **Final payer**: building occupiers who will face increased energy bills due to the CO_2 tax
- ✓ **Beneficiary:** Government claiming tax revenue

Key considerations of the measure

Table 4-18 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-18 Key considerations for CO2 tax for end energy use of commercial buildings

Parameter	Description
Pros	• Provides an incentive to shift towards low- to zero-carbon energy sources in residential buildings • The tax generates revenue for the government, which can be reinvested in renewable energy projects, energy efficiency programmes, and other sustainable initiatives. • The tax incentivizes businesses to adopt energy-efficient technologies and practices, leading to potential long-term energy cost savings.
Cons	• The tax may increase operating costs for commercial building owners, particularly for carbon-intensive ones. • Implementing and enforcing the tax requires administrative resources and may add complexity to the tax system. • While the tax encourages carbon emission reduction, it may not be sufficient on its own to induce significant behavioural changes among commercial building owners.
NUTS3 impact	• Cf previous measure
Energy price impact	• Indirectly impacts energy price
Key risks	• The introduction of a CO2 tax may lead to market distortions if not applied uniformly or if certain sectors receive exemptions or preferential treatment. This could create an uneven playing field, causing economic disparities between different industries and discouraging investment in energy-intensive sectors.
Modelling Assumptions	• **Energy savings target:** 21.6 GWh (11.6 GWh heat and 10.0 GWh electricity) in 2025; • **Calculated savings:** 54 kWh saved/m2 renovated every year (and 29 kWh heat and 25 kWh electricity saved/m2), To reach the 54 kWh savings, all EPC level F or G tertiary buildings have to be renovated up to level D; This is calculated as 125% of nS1 savings. • **Investment cost:** 125 EUR/m2 (incl. VAT, with 2% inflation), or EUR 54 million. This is calculated as 125% of nS1 cost. • **Burden of the investment**: 100% by building owners; • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• A blanket CO2 tax might disproportionately affect vulnerable groups, including low-income populations and smaller businesses. If not accompanied by targeted policies to protect these groups or support their transition to cleaner energy solutions, the tax could exacerbate social and economic inequalities. • The introduction of a CO2 tax could create market distortions if not implemented carefully. Some businesses may choose to relocate to regions with less stringent regulations or opt for short-term cost-cutting

	measures rather than investing in long-term energy-efficient solutions. This can lead to unintended shifts in economic activity and undermine the overall effectiveness of the tax in reducing emissions.
Implementation steps	• Define the scope, objectives, and parameters of the CO2 tax policy. Determine which types of commercial buildings will be subject to the tax, the tax rate structure, and any exemptions or thresholds. Collaborate with experts, stakeholders, and relevant authorities to ensure a well-informed and balanced policy design. • Establish a robust data collection system to accurately measure the CO2 emissions from commercial buildings' energy use. This may involve working with energy providers, building owners, and relevant agencies to gather consumption data. Set up a monitoring framework to track emissions and assess the effectiveness of the tax over time. • Develop clear guidelines and procedures for businesses to calculate and report their CO2 emissions accurately. Establish a transparent system for tax collection and payment. Implement robust enforcement mechanisms to ensure compliance, such as penalties for non-compliance and regular audits to verify reported data.

Outstanding considerations for Estonia

- Determine how the tax be imposed (i.e., paid by energy suppliers and passed on to commercial buildings' energy bills?).
- Establish if companies need to report their end energy use, or if it is the duty of the energy supplier.
- Establish how will the CO2 emissions be measured and determine a reliable and standardized method for measuring CO2 emissions associated with the end energy use of residential buildings.
- Clarify how the tax be imposed and who will pay it – homeowners or tenants.
- Consider if there should be a transition period or incentives to ease the burden on residents during the initial implementation of the CO2 tax.
- Determine how the CO2 tax be regularly evaluated and adjusted. Establish a mechanism for periodic review and adjustment of the tax rate and structure based on performance and changing circumstances.

4.4.1 nS7 – Property tax (according to EPC levels)

The objective of this measure is to grant a property tax exemption, reduction and/or rebate (to be determined) for buildings that have a level of energy performance as defined by their EPC. Building owners would need to apply to the property tax reduction by proving their compliance with the minimum required energy performance level via an EPC. The level of the reduction may vary based on various criteria: building construction year, energy performance level, etc.

Buildings in the services sector which comply with the minimum required energy performance level may benefit from the property tax exemption, reduction and/or rebate.

Energy savings will be achieved by owners who have upgraded their building to the minimum required energy performance level.

The beneficiaries of the measure are building owners/taxpayers who benefit from a property tax exemption, reduction and/or rebate if their building corresponds to the minimum required energy performance level.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party:** Building owners non-compliant with EPC levels
- ✓ Administrator: government
- ✓ **Implementing body**: local public authorities that are responsible for defining changes in property tax, with national guidelines
- ✓ **Final payer**: taxpayers, as the reduced property tax will decrease the public budget
- ✓ **Beneficiary**: Building owners benefitting from lower tax

Key considerations of the measure

Table 4-19 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-19 Key considerations for Property tax for commercial buildings

Parameter	Description
Pros	• Stimulates the renovation of buildings • Addresses the issue of split incentives • The measure can drive market transformation towards energy-efficient buildings by creating demand for such properties, encouraging developers to incorporate energy-saving features in new constructions.
Cons	• Implementing and managing the property tax incentive programme may require additional administrative efforts for municipalities and local authorities, including processing applications and verifying compliance. • Local authorities need to carefully consider the revenue implications of property tax exemptions or reductions while ensuring that the measure effectively stimulates energy efficiency investments.
NUTS3 impact	• Cf. previous measure
Energy price impact	• Considering this is a fiscal measure supported by the government, it will have no direct impact on the energy price
Key risks	• Linking property tax rates to EPC levels requires establishing a reliable system to collect and verify EPC data for each property. This can be administratively complex, involving coordination with multiple stakeholders, data management systems, and potential audits. The process may require additional resources and investments to ensure accurate and up-to-date information, potentially increasing administrative costs for both authorities and property owners. • Introducing a property tax based on EPC levels could potentially impact property values and market perceptions. Properties with lower EPC ratings might experience reduced market demand and lower valuations due to the associated tax burden. This could lead to resistance from property owners and real estate stakeholders, who might argue that the tax unfairly penalizes properties that are inherently less energy-efficient or more difficult to upgrade.
Modelling Assumptions	• **Energy savings target:** 21.6 GWh (11.6 GWh heat and 10.0 GWh electricity) in 2025; • **Calculated savings:** 54 kWh saved/m2 renovated every year (and 29 kWh heat and 25 kWh electricity saved/m2), To reach the 54 kWh savings, all EPC level F or G tertiary buildings have to be renovated up to level D; This is calculated as 125% of nS1 savings. • **Investment cost:** 125 EUR/m2 (incl. VAT, with 2% inflation), or EUR 50 million. This is calculated as 125% of nS1 cost. • **Support (if relevant) to the investment:** is there a specific tax deduction for all renovated buildings? At which level of renovation? How is the EUR 50 million calculated? ; • **Burden of the investment**: 70% by building owners, and 30% by the government (via tax exemption??); • **Energy price impact:** There is no direct impact on energy price; • See Section 0 for other modelling assumptions

Individual policy impacts & barriers	• Property taxes based on EPC levels could distort the real estate market. Properties with lower EPC ratings may face decreased demand and lower market values due to the associated tax burden. This could create disparities in property values and market dynamics, potentially affecting housing affordability and equity among property owners. • Property taxes based on EPC levels might disproportionately affect vulnerable and low-income households. Such households are more likely to live in older and less energy-efficient properties. Imposing higher taxes on these properties could exacerbate energy poverty and social inequalities, as these households might struggle to afford the additional financial burden.
Implementation steps	• Define the objectives of the property tax scheme, such as incentivising energy efficiency improvements and reducing carbon emissions. Establish clear criteria for property classification based on EPC levels. Determine the tax rates for different EPC categories, considering the desired level of incentivization and the potential impact on property owners. • Set up a standardized process for EPC assessments of properties. Collaborate with certified assessors to evaluate the energy efficiency of buildings and assign EPC ratings. Establish a database or registry to store EPC information for all properties subject to the tax. Ensure transparency and accuracy in the assessment process to maintain credibility and fairness. • Develop an efficient tax collection mechanism that integrates with existing property tax systems or procedures. Establish a clear timeline for tax payment, including deadlines and methods of payment. Implement an enforcement mechanism to address non-compliance, such as penalties for property owners who fail to submit EPC assessments or pay the required tax. Provide resources and support for property owners to understand their obligations and comply with the tax requirements.

Outstanding considerations for Estonia

- Clarify what form will the benefit take - a tax exemption, reduction and/or rebate, etc.
- Determine what level of EPC qualifies (i.e., EPC label F or below) - and if there are different tax rates for different EPC levels. Establish the tax rates for each EPC level, with higher rates for lower energy-efficient buildings and lower rates for higher-performing buildings.
- How frequently will the EPC levels be assessed? Decide on the frequency of EPC assessments to ensure up-to-date and accurate taxation.

4.4.1 nS8 – MEPS for non-residential buildings

In like with nR2 and nR3, which cover MEPs for the residential sector, the objective of this measure is to introduce MEPS for non-residential buildings in Estonia. The measure would require all building owners to have an EPC for their building which presents a minimum energy performance level of class or above. In case of non-compliance with MEPS, building owners will get a penalty. This measure would target all non-residential buildings.

Energy savings will be achieved by building owners when renovating their building to the minimum required energy performance level.

The measure would require all building owners to have an EPC for their building. Therefore, commercial buildings that have an EPC level of a predefined class or below would be obligated to improve the performance of the buildings until a predefined EPC threshold (e.g., class C or above) depending on certain circumstances. The renovations should be done in a predefined timeframe and could be progressive regarding the class level (e.g., targeting EPC class F for the first 10 years, and then class D for the next 10 years). In case of non-compliance with MEPS, building owners will get a penalty.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obligated party**: building owners, who need to renovate the buildings they own to achieve the minimum required energy performance
- ✓ **Administrator**: Government, setting the rules (levels of performance ante and post renovation; trigger points; fines in case of non-compliance; renting regulation; verification and control)
- ✓ **Implementing body**: Ideally the Ministry in charge of Housing, supported by the Ministry of Energy
- ✓ **Final payer**: Building owner to bear the investment costs, and possibly (and partially) the tenants, who could experience an increase in their rent which reflects the investments made by owners to achieve the minimum required energy performance. It is highly recommended to set up rules, in order to avoid all the cost is passed over to the tenants (it could even be avoided, therefore leaving the entire cost to the owner)
- ✓ **Beneficiary:** building occupier (owner or tenant), as they will face lower energy bills and increased comfort

Key considerations of the measure

Table 4-20 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-20 Key considerations for MEPS for non-residential buildings

Parameter	Description
Pros	• Stimulates the renovation of non-residential buildings • Higher energy efficiency in buildings can lead to reduced operational costs for businesses and organizations, improving their financial bottom line over time. • Implemented across the EU and therefore amble best practices available • Energy-efficient buildings generally have higher property values, offering potential financial benefits for building owners and investors. • Energy-efficient buildings often offer better indoor thermal comfort and air quality, leading to increased productivity and well-being for occupants.
Cons	• Can involve large financial burden for small enterprises or local municipalities with limited budget dedicated to energy efficiency • Meeting MEPS requirements may pose technical challenges, particularly for older or historically significant buildings with limited scope for energy improvements. • Some building owners and stakeholders may have limited awareness of energy efficiency measures or lack technical expertise, hindering compliance efforts. • The impact of MEPS on energy consumption and emissions reduction may take time to materialize, especially for buildings with long lifespans
NUTS3 impact	• Cf. previous measure
Energy price impact	• No impact on energy price
Key risks	• One key risk is the challenge of achieving widespread market acceptance and compliance with the new standards. Property owners, developers, and businesses may resist the additional costs associated with upgrading or retrofitting their buildings to meet the required energy performance levels. Non-compliance could lead to legal disputes, penalties, and a lack of progress in achieving energy efficiency goals. • Stringent energy performance standards may result in market distortions, impacting property values and investment decisions. Buildings that do not meet the new standards could experience decreased market value, leading to potential losses for property owners and investors. Conversely,

	buildings that exceed the standards may see increased demand and value, creating a potential disparity in the real estate market.
Modelling Assumptions	• **Energy savings target:** All building owners have obligation to have energy performance level D. Buildings are renovated over 10 years, with 10% each year, or ~129.6 GWh (69.6 GWh heat and 60.0 GWh electricity) in 2025; • **Calculated savings:** 54 kWh saved/m2 renovated every year (and 29 kWh heat and 25 kWh electricity saved/m2), meaning we need to renovate 2.4 million m2 every year. To reach the 54 kWh savings, all EPC level E, or F buildings have to be renovated up to level D This is calculated as 125% of nS1 savings. • **Investment cost:** 125 EUR/m2 (incl. VAT, with 2% inflation), or EUR 300 million; This is calculated as 125% of nS1 cost. • Support (if relevant) to the investment: there is no support for MEPS • **Burden of the investment**: 100% by building owners, as this is an obligation • **Energy price impact**: no impact • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Stringent energy performance standards might place an additional financial burden on businesses and property owners, particularly SMEs. This could act as a disincentive to economic growth, as businesses may hesitate to invest in energy efficiency upgrades due to the associated costs. This impact could be especially pronounced in sectors with lower profit margins or during economic downturns.
Implementation steps	• Define the scope, objectives, and criteria of the minimum energy performance standards (MEPS) policy. Determine the parameters such as energy consumption thresholds, building types, and compliance timelines. Collaborate with relevant stakeholders, including industry representatives, energy experts, and regulatory bodies, to ensure that the policy design aligns with the unique characteristics of non-residential buildings. • Raise awareness and build capacity among building owners, operators, architects, engineers, and contractors about the new energy performance standards. Provide training, workshops, and informational resources to educate stakeholders about the benefits of energy efficiency, available technologies, compliance procedures, and the economic advantages of meeting the standards. • Establish a robust monitoring and reporting mechanism to track compliance with the MEPS policy. This may involve setting up an energy performance database, conducting regular energy audits, and requiring building owners to submit energy consumption data. Develop clear enforcement procedures, including inspection processes and penalties for non-compliance, to ensure that buildings meet the established standards.

Outstanding considerations for Estonia

- Determine the EPC level below which rented buildings qualify.
- Determine the EPC level above which the building should be renovated.
- Determine at which moment the building should be renovated, with the 2 main options
  - At trigger points (when the building is being rented)
  - By a deadline (e.g., by 31/12/2029) for all buildings with a very low EPC level (e.g., above EPC label F)
- Establish renting regulations to avoid unaffordable increase of rents, to balance the cost sharing between owners and tenants
- Establish the type and severity of penalty (i.e., property tax, fine, etc) of building non-compliance.

4.5 Industry

4.5.1 nI1 – Voluntary scheme for the industry, with binding targets based on incentives

Voluntary agreements are collaborative agreements between governments and industries where individual firms or groups negotiate and commit to specific targets and timelines for enhancing energy efficiency (see section 4.2.2). These agreements often incorporate enforceability measures, defining rewards and penalties for compliance.

To generate interest in the scheme, a compelling financial incentive is essential. Currently, securing investment grants for energy efficiency often entails submitting applications and sometimes undergoing audits as prerequisites. Similarly, to encourage industries to participate in the voluntary agreement scheme, an additional requirement linking energy efficiency grants and the agreement can be introduced. This would obligate enterprises to meticulously monitor their energy consumption and make broader strides in improving energy efficiency. Additional subsidies may be needed during the implementation phase to attract more interest in the scheme.

Alternatively, the voluntary agreement scheme can be complementary to existing energy efficiency grants. In such a scenario, substantial financial incentives would be necessary, as energy efficiency investments could still receive support independent of participation in the scheme. Without these substantial incentives, the successful implementation of the scheme may remain uncertain.

Concerned stakeholders

A voluntary scheme means that participation is voluntary. The government could initiate voluntary schemes in different sectors, but it is up to the companies to decide whether or not to participate.

The concerned stakeholders are the following:

- ✓ **Obliged party**: industries participating in the voluntary scheme which need to achieve energy savings
- ✓ **Administrator**: government & industry
- ✓ **Implementing body**: public or private body designated by the government to implement and monitor the agreement & industry
- ✓ **Final payer**: industries making investments to reach energy efficiency targets
- ✓ **Beneficiary**: enterprises benefitting from support schemes in the voluntary agreement framework

Key considerations of the measure

Table 4-21 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-21 Key considerations for Voluntary scheme for the industry, with binding targets based on incentives

Parameter	Description
Pros	• Voluntary measure, which means that the industry is willing to achieve the targets • Low/medium administrative costs as it is monitored in cooperation with participants

	• Various best practices and longstanding experience exist in the EU, which may facilitate the implementation of the scheme • Private sector views voluntary agreements as a better alternative to taxes and obligations and is generally viewed as a positive scheme • Creates more dialogue between public and private sector • Enterprises advertise their participation in the scheme as it helps to create a positive image which in order creates more interest • Voluntary agreement scheme leaves it open for each participant how they will reach energy efficiency targets, allowing implementation of best practices and innovation • Only administrative costs as existing grants will be brought under *VA* and no additional funding for grants is required (additional incentives may be considered during implementation phase)
Cons	• Successful implementation can be hindered from insufficient communication between public and private sector • Enterprises that have already heavily invested in energy efficiency have a disadvantage in participating in the scheme as additional savings are harder to achieve compared with industries that have not focused on energy efficiency • In order to create interest in enterprises, the additional incentive must be significant as enterprises can currently apply for energy efficiency grants without joining the scheme (high cost) or participation in voluntary agreement scheme must be made a requirement for applying support from existing grants • It is hard to start the agreement scheme, needs a group of willing enterprises to start the process
NUTS3 impact	• There are 5 NUTS regions for Estonia: Põhja; Lääne; Kesk; Kirde; Lõuna[75] • It does not matter in which region the company is located, what matters is the company's financial ability to invest in energy efficiency and willingness to join voluntary agreement • Regions with higher industrial activity might attract more investments as a result • Burden of investment lies on the industry and no additional grants are provided in the scheme, regions don't get additional state aid
Energy price impact	• The voluntary agreement has no direct impact on energy price
Key risks	• One of the main risks is the potential lack of participation from industry players. Since participation in voluntary schemes is not mandatory, some companies may choose not to participate, leading to incomplete coverage and limited effectiveness in achieving energy efficiency goals. Even if companies participate, there's a risk of non-compliance with the binding targets due to varying levels of commitment and adherence. • The implementation of binding targets with incentives may not distribute benefits and burdens evenly among industry players. Some companies may find it easier to meet targets due to their size, technological capabilities, or financial resources, while others may struggle, leading to disparities. • Enterprises who have invested heavily into energy efficiency may face a competitive disadvantage as projects with low payback time may already be implemented. As such, a single target may deter such enterprises from joining the voluntary agreement scheme. Such exemplary enterprises may lose the right for energy efficiency grants if they do not participate or can't reach targets set in VA. • Designing, implementing, and administering a voluntary scheme with binding targets and incentives can be complex and resource intensive. Ensuring fair and accurate measurement of energy savings, verifying compliance, and managing incentives can lead to administrative challenges. Additionally, tracking and reporting progress across a diverse range of industries and companies can be logistically demanding.
Modelling Assumptions	• **Energy savings target:** Energy saving target for Voluntary agreements will be 1.9%/y of energy consumption of participants in 2030, starting from 0.1% in 2025, increasing gradually; Participation rate of *VA* in 2025 is

[75] .https://en.wikipedia.org/wiki/NUTS_statistical_regions_of_Estonia

	estimated to be 30% of industrial energy consumption, by 2030 it is estimated to be 80%; • **Calculated savings:** 1.5 GWh in 2025 and 81.9 GWh in 2030. Compared to the ~4 800 GWh consumed by the industry in 2022, it remains limited, but will depend on the efforts made to reach an even more ambitious target; • **Investment cost:** Administrative costs, no specific grant is allocated. Energy efficiency grants are brought under *VA* scheme making participation in *VA* a prerequisite for grant applications. Additional funding might be required during the implementation phase which is not considered in the model; • **Support (if relevant) to the investment:** there is no dedicated support for investments, however there is need to incentivise companies to motivate their engagement in a VA. For increasing participation in *VA*, additional grants may be given out during first 2 years of implementation depending on the success of the agreement scheme in the implementation phase; • **Burden of the investment:** 100% industry; • **Energy price impact:** no direct impact on prices (depends on the incentive); • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Some companies, particularly smaller ones, might lack the necessary information, expertise, and resources to effectively implement energy efficiency measures. Overcoming these gaps requires targeted education and support programmes to enable companies to identify and adopt energy-saving practices. • Industries that are energy-intensive and internationally competitive might worry that binding targets could lead to a loss of competitiveness. Balancing energy efficiency goals with economic competitiveness can be challenging, particularly in sectors exposed to global markets. • Energy efficiency grants for large enterprises participating in the ETS may be complicated as emissions cannot decrease as a result of an additional grant when the enterprise gets free allowances. Enterprises in the ETS may be less inclined to join the agreement as they may not have the same access to grants to help them reach energy efficiency goals.
Implementation steps	• Clearly outline the objectives of the scheme, such as energy efficiency improvement, emissions reduction, and industry engagement. • Establish specific and measurable targets that participating companies are required to achieve within a defined timeframe. • Collaborate with industry associations, companies, and relevant stakeholders to gather input, build support, and address concerns. • Allocate binding energy efficiency targets to participating companies based on their sector, size, and energy consumption patterns. • Develop capacity-building programmes to enhance the energy management skills of participating companies and equip them with tools to achieve the targets. • Provide technical assistance and guidance on adopting energy-efficient technologies, practices, and operational improvements.

Outstanding considerations for Estonia

- Define which industries should be targeted for voluntary agreement.
- Define the scope of their involvement, including the timeframe for implementation and the degree of energy efficiency improvements required.
- Establish monitoring for how the progress of participants be monitored. Establish a system for regular reporting and verification of energy efficiency achievements to ensure transparency and credibility.
- Scheme requires only the administrative costs as existing energy efficiency measures would be brought under voluntary agreement scheme making participation in voluntary agreement scheme a prerequisite for energy efficiency grants.

- For successful implementation, additional funding may be needed. Monitoring the participation actively for the first two years to decide if additional funding is required to raise interest in the voluntary agreement scheme.
- To generate more interest into voluntary agreements, it is recommended to schedule the implementation of voluntary agreements before opening of larger energy efficiency grants so that enterprises would be urged to join the system without any additional incentives.
- Determine if participants will receive technical assistance to identify energy-saving opportunities and implement efficiency measures. Consider offering support to overcome barriers to implementation.

4.5.2 nI2 – Promotion of resource-efficient green technologies of industrial enterprises (RRF)

The objective of this measure is to promote resource-efficient green technologies of industrial enterprises via a grant. Industries may apply to the grant when they aim to purchase a resource-efficient green technology as a replacement for a technology that is not resource-efficient. Energy and resource audit is a prerequisite for applying for the grant.

The application round was opened at 10 o'clock on 7th September 2022 and was closed shortly after the same day as the volume of applications exceeded the budget of 23.6 MEUR[76].

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: industrial enterprises
- ✓ **Administrator:** government
- ✓ **Implementing body**: Center for Environmental Investments
- ✓ **Final payer**: taxpayers, as the grant will be funded with public budget
- ✓ **Beneficiary**: the beneficiaries of the measure are primarily industrial companies who purchase eligible resource-efficient green technologies

Key considerations of the measure

Table 4-22 provides the key considerations for the measure, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-22 Key considerations for Promotion of resource-efficient green technologies of industrial enterprises (RRF)

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Supports innovation in green industry techniques, increases competitiveness and can lead to the development of new industries • Implementing resource-efficient technologies can improve the efficiency of industrial processes, leading to cost savings and increased

[76] KIK energy- and resource efficiency (RRF). https://kik.ee/et/toetatavad-tegevused/ettevotete-ressursitohusus-rrf

	competitiveness for the enterprises in both domestic and international markets • Encouraging the adoption of green technologies can help industrial enterprises comply with environmental regulations and standards, avoiding potential fines or penalties
Cons	• Instrument is not sustainable in the long run as it relies on limited resources of investors • Integrating green technologies into existing industrial processes may require technical expertise and adjustments, posing challenges to some enterprises • Ensuring that the supported enterprises genuinely implement and maintain resource-efficient technologies requires effective monitoring and evaluation, which may involve administrative complexities
NUTS3 impact	• Limited impact on the industry. Regions with higher level of industrial activity benefit more from the grant • It does not matter in which region the company is located, what matters is the company's financial ability to invest in energy efficiency. All industries that pass the requirements are eligible for a grant. • Enterprises in urban areas and areas with higher economic activity (Tallinn, Tartu) may be more active to apply for the grant (more active enterprises) and as such these areas may benefit more from the grant
Energy price impact	• Support scheme has no direct impact on energy price
Key risks	• Implementing resource-efficient green technologies often involves significant upfront investments in terms of purchasing, installing, and integrating new equipment or systems. There is a risk that these investments might not yield the expected returns in terms of cost savings, increased efficiency, or environmental benefits. Enterprises could also face challenges in securing financing for these projects, particularly for small and medium-sized enterprises (SMEs) with limited resources. Additionally, fluctuating energy prices or changes in policy support mechanisms can impact the financial viability of such projects. • Enterprises may buy new equipment but not replace old and inefficient equipment meaning the inefficient unit will remain working. More incentive should be on replacing inefficient units rather than to increase energy efficiency of the plant as a whole.
Modelling Assumptions	• **Energy savings target:** 40.7 GWh new savings in 2025 and 17.43 GWh in 2026, from 2027 no additional annual savings as the measure is already in implementation phase and projects must be completed before 2027[77]; • **Calculated savings:** yearly savings factor of 2.459 GWh/y per MEUR support based on the results of energy efficiency projects carried out in the previous period (2014-2020)[78]**Erreur ! Signet non défini.**; • **Investment cost:** EUR 23.6 million total investment cost from the Cohesion Fund[79]; • **Support (if relevant) to the investment:** Estimated support rate of 40% was considered for calculating total investments based on the support rate for small enterprise. Support rate for projects will vary based on the project and the aid used; • **Subsidy (if necessary) for investment** the subsidy comes from the EU Cohesion Fund. The criteria for the recipients of the support and the minimum and maximum amounts of support as well as the rate of own participation are stipulated by the relevant regulation of the Ministry of Climate; • **Burden of the investment**: 40% from EU funds from 2023; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Inconsistent or unclear policy frameworks can hinder the adoption of resource-efficient green technologies. Enterprises might struggle to

[77] Act for the resource efficiency measure. https://www.riigiteataja.ee/akt/123072022001
[78] Tepsli & SEI (2021). Uuring „EL struktuurivahenditest rahastatud meetmete mõju riigi energiamajanduse esmärkide täitmisele“ Lõpparuanne
[79] KIK energy- and resource efficiency (RRF). https://kik.ee/et/toetatavad-tegevused/ettevotete-ressursitohusus-rrf

	understand the regulations, standards, and incentives applicable to these technologies, leading to uncertainty and reluctance to invest. A lack of long-term policy stability can discourage businesses from making sustainable technology choices. • When policies related to resource-efficient green technologies are fragmented or disconnected, enterprises might face challenges in navigating and complying with multiple regulations. This can lead to confusion and inefficiencies in implementation. • Implementing new technologies often requires a skilled workforce that is knowledgeable about the technology's operation, maintenance, and troubleshooting. If there is a lack of skilled personnel, enterprises might be hesitant to adopt these technologies due to concerns about operational disruptions and increased training costs. • Resistance to change within industrial enterprises can be a significant barrier. Employees might be resistant to adopting new technologies due to concerns about job security, changes in job roles, or unfamiliarity with the technology.
Implementation steps	• Measure was already implemented in 2022. Prerequisite for the grant was energy- and resource audit [80]. Maximum support for one project was 2 MEUR.

Outstanding considerations for Estonia

- Clarify which industrial sectors the programme will target. Identify the sectors with the highest energy consumption and potential for resource-efficient technologies.
- Determine how resource-efficient green technologies will be identified and assessed. Conduct a comprehensive analysis of available technologies and their potential benefits for different industries.
- Clarify if energy and resource audits be conducted to assess the current efficiency levels of industrial enterprises. Audits can identify areas for improvement and guide technology recommendations.
- Establish if industrial enterprises will receive technical assistance in implementing green technologies. Develop support programs to help industries overcome barriers and implement the proposed solutions.

4.5.1 nl3 – Supporting energy efficiency investments in electro-intensive companies

The objective of this measure is to stimulate energy savings from electro-intensive companies by supporting the implementation of energy efficiency measures through grants. Electro-intensive companies, also known as electricity-intensive companies, are businesses or industries that have high electricity consumption as a significant part of their production processes or operations. These companies rely heavily on electricity to power their equipment, machinery, and facilities, and electricity costs can be a substantial portion of their overall operating expenses. Although investment costs for energy efficiency projects can be high in such industries, energy saving potential is also very high.

electro-intensive industries typically have energy-intensive processes that require a continuous and significant supply of electricity.

[80] KIK energy- and resource efficiency (RRF). https://kik.ee/et/toetatavad-tegevused/ettevotete-ressursitohusus-rrf

The scope of this measure targets electro-intensive companies across various industrial sectors, including manufacturing, mining, chemical processing, and other electro-intensive industries. By providing financial incentives to these companies, the measure seeks to facilitate the adoption of energy-efficient technologies and practices, thereby reducing energy consumption and environmental impact.

Support will be provided via grants. Electro-intensive companies may apply for the grant when they have implemented ISO 50001 and have made an action plan for implementing energy efficiency measures.

Concerned stakeholders

The beneficiaries of the measure are electro-intensive companies who implement eligible energy efficiency measures.

The concerned stakeholders are the following:

- ✓ **Obliged party**: electro-intensive industries
- ✓ **Administrator**: government agencies and regulatory bodies are key enablers of this measure. They are responsible for formulating energy efficiency policies
- ✓ **Implementing body**: Center for Environmental Investments
- ✓ **Final payer**: taxpayers, as the grant will be funded with public budget
- ✓ **Beneficiary**: industries participating in the voluntary agreement scheme

Key considerations of the measure

Table 4-23 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-23 Key considerations for Supporting energy efficiency investments in electro-intensive companies

Parameter	Description
Pros	• Enterprises can focus on the most suitable energy efficiency projects without additional bureaucracy. • By adopting energy-efficient practices, electro-intensive companies can enhance their competitiveness, improve their market position, and demonstrate commitment to sustainable operations.
Cons	• Instrument is not sustainable in the long run as it relies on limited resources of investors • Some energy-saving measures may require technical expertise and careful planning. Collaboration with energy consultants and auditors can address this challenge. • Accurately measuring and verifying the energy savings achieved through implemented measures is essential for the success of the grant programme. • Many large electro-intensive enterprises are in the ETS and get free allowances which means investments grants for reducing emissions will not be eligible (considered as double state aid). Many energy efficiency investments will not be eligible for industries in ETS.
NUTS3 impact	• Measure eligibility is based on the energy consumption intensity and no regional differences are made. Regions with higher number of electro-intensive industries will benefit more. • No significant impact between regions is expected but EE007 (North-East Estonia) might benefit the most as this region has historically had many energy-intensive enterprises. This region has also a high proportion of enterprises in ETS[81].

[81] Enterprises in ETS (EAS). https://eas.ee/wp-content/uploads/2022/06/eli-hksi-kaitiste-nimekiri.pdf

Energy price impact	• Support scheme has no direct impact on energy price.
Key risks	• Providing grants to electro-intensive industries could lead to market distortion by favouring certain industries over others. This may create an uneven playing field, impacting the competitiveness of industries that do not receive similar support. • Overreliance on grants can create a sense of dependency among electro-intensive industries. This could deter these industries from pursuing long-term sustainability and innovation strategies, as they may come to rely solely on grants rather than developing their own competitive and energy-efficient solutions. Without a clear transition plan, industries may struggle to remain viable once the grants phase out or change in nature.
Modelling Assumptions	• **Energy savings target:** 4,1 GWh new energy savings each year during the period of 2025–2030; • **Calculated savings:** Yearly savings factor of 2.459 GWh/y per MEUR support based on the results of energy efficiency projects carried out in the previous period (2014-2020)[82]; • **Investment cost:** 10 MEUR support for 2025-2030, in total with self-financing 50 MEUR; • **Support (if relevant) to the investment:** support rate 20% was estimated as the grant focuses on energy intensive enterprises (support rate expected to be lower for large enterprises); • **Burden of the investment**: 20% government, 80% industry, funded by state aid; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Lengthy and complex application procedures can discourage companies from applying for grants. • Companies might prioritise applying for grants based on short-term financial gains rather than focusing on long-term energy efficiency. • Companies may view grants as short-term solutions and not invest in developing a long-term strategy for continuous energy efficiency improvements. • Energy efficiency grants for large enterprises participating in the ETS may be complicated as emissions cannot decrease as a result of the grant (enterprises get free allowances).
Implementation steps	• Clearly define the programme's goals, such as reducing energy consumption, lowering emissions, or enhancing industrial competitiveness. • Determine the criteria that electro-intensive companies must meet to be eligible for the grant, including sector-specific requirements and energy consumption thresholds. • Define the evaluation criteria for project proposals, considering factors such as energy savings potential, project feasibility, innovation, and economic viability. • Share successful case studies and best practices with industry stakeholders to encourage the adoption of energy efficiency measures beyond grant recipients.

Outstanding considerations for Estonia

- Determine what percentage of the cost should the grant cover.
- Clarify which specific sectors will the support address and who will oversee qualification of relevant energy efficiency measures.
- Today excise duty reduction exists already for these companies, determine how/if an excise duty exemption is considered if additional grant is given.

[82] Tepsli & SEI (2021). Uuring „EL struktuurivahenditest rahastatud meetmete mõju riigi energiamajanduse eesmärkide täitmisele“ Lõpparuanne

- Define eligible energy efficiency measures.

4.5.1 nl4 – Investment support for the food industry to ensure security of energy supply

The primary objective of this measure is to enhance the security of energy supply within the food industry by encouraging and supporting energy efficiency investments. Energy efficiency measures play a crucial role in reducing energy consumption, optimizing processes, and decreasing the reliance on external energy sources, ultimately enhancing the sector's resilience to energy supply disruptions.

Under this measure, a grant programme would provide financial assistance and incentivise food industry to implement energy efficiency measures. The grant would serve as a means to facilitate the adoption of energy-saving technologies and practices, which can lead to significant reductions in energy usage and operational costs for businesses in the food industry.

Qualifying measures can encompass a wide range of initiatives, such as upgrading to more energy-efficient equipment, implementing process optimization strategies, adopting renewable energy solutions, or improving energy management practices.

By offering financial support through the grant, the measure aims to overcome potential barriers that may hinder companies from investing in energy efficiency projects. These barriers could include the initial high costs of energy-efficient equipment or technology upgrades, limited awareness of energy-saving opportunities, or uncertainties regarding the return on investment.

Only the measures that are listed in the eligibility list may benefit from the grant.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: food industry
- ✓ **Administrator**: government
- ✓ **Implementing body**: agricultural Registers and Information Board (PRIA)
- ✓ **Final payer**: taxpayers, as the grant will be funded with public budget
- ✓ **Beneficiary**: the beneficiaries of the measure are food industry companies, including SMEs who implement eligible energy efficiency measures and participate in voluntary agreement scheme

Key considerations of the measure

Table 4-24 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-24 Key considerations for Investment support for the food industry to ensure security of energy supply

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Improving energy efficiency in the food industry can help reduce energy consumption and reliance on external energy sources, contributing to overall energy security. • Energy-efficient food production can enhance a company's market position, attract eco-conscious consumers, and meet sustainability requirements for supply chain partners.

Cons	• Instrument is not sustainable in the long run as it relies on limited resources of investors • Managing the grant programme and evaluating the eligibility of applicants can involve administrative challenges and potential delays. • Implementing energy-efficient measures in complex food processing and production facilities may involve technical challenges and the need for specialized expertise.
NUTS3 impact	• Grant rate does not differentiate between regions. Grant is given out based on the financial ability and eligibility of the applying enterprise. Food industry is not concentrated in any of the NUTS3 regions and as such no significant regional differences are expected.
Energy price impact	• Support scheme has no direct impact on energy price
Key risks	• Choosing projects that don't align with long-term energy security needs and lacking effective monitoring can lead to suboptimal outcomes. • Energy price volatility and sudden regulatory changes can impact project viability and implementation.
Modelling Assumptions	• **Energy savings target** 3.44 GWh of new energy savings each year in the period of 2025-2030; • **Calculated savings:** yearly savings factor of 2.459 GWh/y per MEUR support[83]; • **Investment cost:** EUR ~1.4 million per year of government support, with a total budget of EUR 14 million over ten years (8,4 MEUR in the period 2025-2030); • **Support (if relevant) to the investment:** the support is provided by the cohesion fund. There is no rule to calculate the required level of support. Support rate of 40% was used in calculations; • Burden of the investment: 40% government (cohesion fund), 60% food industries; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Heavy reliance on subsidies might discourage businesses from seeking long-term sustainable solutions or exploring alternative approaches. • Complex administrative procedures and lengthy approval processes can discourage businesses from participating in the programme.
Implementation steps	• Assess the food industry's energy supply vulnerabilities, considering factors like energy sources, distribution, and potential disruptions. Clearly outline the goals of the investment support programme, such as enhancing energy efficiency, reducing reliance on volatile energy sources, and ensuring uninterrupted operations. • Define clear criteria for businesses to qualify for the support programme, considering factors such as energy consumption, level of vulnerability, and commitment to long-term improvements. • Engage with industry associations, businesses, and experts to gather insights and ensure the programme addresses industry-specific challenges. • Launch awareness campaigns to inform food industry stakeholders about the investment support programme, its benefits, and how to apply.

Outstanding considerations for Estonia

- Determine what percentage of the measures will the grant cover.
- Establish clear eligibility criteria for food industry companies to participate in the programme. This may include factors such as annual energy consumption, business size, or willingness to commit to specific energy efficiency goals.
- Identify a comprehensive list of energy efficiency measures and technologies that are eligible for support under the programme. Consider a diverse range of measures to cater to different needs within the food industry.

[83] Tepsli & SEI (2021). Uuring „EL struktuurivahenditest rahastatud meetmete mõju riigi energiamajanduse esmärkide täitmisele“ Lõpparuanne.

4.5.1 nI5 – Supporting energy efficiency investments in companies

The objective of this measure is to support energy and resource efficiency investments in industries via a grant, to make industries more resource- and energy efficient. In order to apply to the grant, industries must conduct energy- and resource audits as prerequisite. After implementation of the project, a KPI (resource use per production unit) is monitored for up to 5 years. If required results are not achieved, explanations are required, in some cases grant can be requested back if the results are not achieved.

The beneficiaries of the measure are industrial companies. Only the measures that are listed in the eligibility list may benefit from the grant. The requirements are similar to the nI2 measure in paragraph 4.5.2.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: industrial enterprises
- ✓ **Administrator:** government
- ✓ **Implementing body**: Center for Environmental Investments
- ✓ **Final payer**: taxpayers, as the grant will be funded with public budget
- ✓ **Beneficiary**: the beneficiaries of the measure are primarily industrial companies who purchase eligible resource-efficient green technologies and participate in voluntary agreement scheme

Key considerations of the measure

Table 4-25 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-25 Key considerations for Supporting energy efficiency investments in companies

Parameter	Description
Pros	• An obligation to monitor energy- and resource use up to 5 years incentivises industries to achieve the results described in the project plan • Monitoring system encourages industries to add efficiency as a valuation criterion during procurement process which grants more efficient technologies fair competition compared with less efficient but cheaper alternatives
Cons	• Grant can be used to increase production volume as it is one way to oblige with GBER and total energy use may increase, although energy use per production unit decreases. • Existing equipment may not be replaced but new equipment can be bought to increase the overall energy efficiency without eliminating the inefficient parts of the production. • Grant is not sustainable in the long run as it relies on limited resources of investors.
NUTS3 impact	• Limited impact on the industry. Regions with higher level of industrial activity benefit more from the grant. • It does not matter in which region the company is located; what matters is the company's financial ability to invest in energy efficiency. All industries that pass the requirements are eligible for a grant. • Enterprises in urban areas and areas with higher economic activity (Tallinn, Tartu) may be more active to apply for the grant (more active enterprises) and as such these areas may benefit more from the grant.
Energy price impact	• Support scheme has no direct impact on energy price.
Key risks	• If not designed well, grants can distort market dynamics by creating artificial demand for certain technologies or products, potentially negatively affecting competition and innovation.

	• Grants can encourage companies to prioritise short-term gains rather than pursuing sustainable, long-term energy efficiency objectives. • Delays in grant processing and disbursement can lead to frustration among companies and hinder the timely implementation of energy efficiency projects.
Modelling Assumptions	• **Energy savings target:** 14.14 GWh new annual energy savings in period of 2025-2030; • **Calculated savings:** yearly savings factor of 2.459 GWh/y per MEUR support (based on a study on past experience)**Erreur ! Signet non défini.**; • **Investment cost:** EUR 34.5 million in grants, in total 86.25 MEUR with self-financing; • **Support (if relevant) to the investment:** the support is provided by the cohesion fund. The criteria for the recipients of the support and the minimum and maximum amounts of support as well as the rate of own participation are stipulated by the relevant regulation of the Ministry of Climate. 40% support rate was used in the calculations. • **Burden of the investment**: 40% from cohesion fund from 2023, 60% industries; • **Energy price impact:** no direct impact on prices; See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Grants can encourage companies to prioritise short-term gains rather than pursuing sustainable, long-term energy efficiency strategies. • The grant may prioritise and approve applicants based on the speed of their application submissions until the budget is met which may mean that the grant will be allocated within minutes from opening. Project evaluation based on set criteria should be considered to increase the impact of the measure.
Implementation steps	• Assess the current energy consumption patterns, and areas of inefficiency as the focus of the grant. Define clear objectives, such as targeted energy savings, emissions reductions, or specific technology adoption. • Establish eligibility requirements based on company size, sector, energy intensity, and/or commitment to energy efficiency improvements.

Outstanding considerations for Estonia

- Design the grant structure, including the amount of financial assistance available to each industry and any performance-based incentives tied to achieving energy and resource efficiency targets.
- Specify the types of energy and resource efficiency investments that will be eligible for grant support. This may include upgrading equipment, process optimization, renewable energy adoption, and waste reduction initiatives. Incentivise replacing inefficient equipment to additional equipment.

4.5.1 nl6 – Energy consulting and networking events for small and medium companies (SMEs)

This measure aims to raise awareness and provide technical, administrative and financial advice to SMEs on energy efficiency, through support for energy consulting and participation in networking events. Support will be provided to SMEs in the form of a grant. Energy consulting would take the form of a One-Stop-Shops (OSS) accessible to SMEs to receive advice and support for implementing energy efficiency measures. The OSS will also organize networking events during which SMEs can share best practices and success stories on energy efficiency.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party:** SMEs
- ✓ **Administrator**: government & private consulting companies

- ✓ **Implementing body**: a public or private body assigned by the government as responsible for the OSS
- ✓ **Final payer**: taxpayers, as the measure will be financed by public budget
- ✓ **Beneficiary**: SMEs

Key considerations of the measure

Table 4-26 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-26 Key considerations for Energy consulting and networking events for small and medium companies (SMEs)

Parameter	Description
Pros	• Stimulates the implementation of energy efficiency measures • Raising awareness on the benefits of energy efficiency • Sharing best practices • SMEs that adopt energy-efficient practices can improve their market competitiveness, attract environmentally conscious customers, and meet sustainability criteria for business partnerships
Cons	• Does not impose any obligation on companies • Providing grants for energy consulting and support entails a financial burden on the government or relevant organizations, especially if there is a large number of SMEs seeking assistance • Managing the grant programme and ensuring proper allocation of funds to eligible SMEs may involve administrative complexities and potential delays
NUTS3 impact	• Different regions within Estonia may have varying levels of energy consumption, economic development, and infrastructure, especially given certain rural areas with higher industrial activity, or urban areas, such as Tallinn, with more developed/advanced infrastructure and workforce with access to additional training • There is higher chance to get investments implemented in economically more active areas (higher economic development, like in larger cities Tallinn, Tartu) • It is easier to hold networking events in cities to increase participation, enterprises in urban areas might have better access to the benefits of the measure
Energy price impact	• Support scheme has no direct impact on energy price
Key risks	• SMEs might hesitate to participate due to time constraints, scepticism about the effectiveness of the events, or concerns about disruption to their operations • SMEs often have limited financial and human resources to dedicate to attending events, implementing energy efficiency measures, or undertaking comprehensive energy audits • Without consistent follow-up and support, the initial enthusiasm generated by networking events may wane, leading to limited sustained action in adopting energy-efficient practices
Modelling Assumptions	• **Energy savings target:** Based on the volume of the measure 1.04 GWh/y new annual energy savings; • **Calculated savings:** Yearly savings factor of 1.454 GWh/y per MEUR support was used based on the savings and volume of the grant[84]; • **Investment cost:** annual investment 0,7 MEUR, total budget 4.3 MEUR divided equally between 2025-2030; • **Support (if relevant) to the investment:** Money for support comes from the EU Cohesion Fund, the implementing agency is the Ministry of

[84] Finantsakadeemia OÜ uuring: *Energiatõhususe direktiivi ülevõtmisest tulenev kohustus energiasäästu meetmete loomiseks, mõõtmiseks, seireks, kontrolliks ja raporteerimiseks*. Juuli 2020.

	Climate. A specific regulation (under development) establishes the criteria for grant recipients, grant amounts and the rate of self-financing. • **Burden of the investment**: 100% government, funded by state aid; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Implementing energy efficiency measures requires specialized technical knowledge that SMEs might lack, making it challenging to implement recommended changes effectively. • Policies should address the lack of awareness about available programmes, highlighting the benefits of participation in energy consulting and networking events.
Implementation steps	• Identify the energy efficiency challenges faced by SMEs in the region. Conduct surveys or assessments to understand their energy consumption patterns, current practices, and areas for improvement. • Invite energy efficiency experts, industry professionals, and government representatives to present and facilitate discussions. These experts can provide insights, best practices, and guidance to SME participants. • Provide event attendees with access to resources, guides, and tools related to energy efficiency. Make presentations and materials available online for further reference.

Outstanding considerations for Estonia

- Determine if the OSS be virtual/on-line support, or physical hubs
- Clarify at what stage will the OSS provide guidance (i.e., At the start? Technical support throughout?)
- Define what kind of support the OSS will provide in addition to networking and knowledge sharing (i.e., technical support, legal, financial, etc.)

4.6 Transport

A first type of energy efficiency policies that can be implemented in the transport sector are minimum performance standards. A second type of energy efficient transport policies are related to fuel taxation, adding a carbon pricing element to the consumer prices for these fuels, ensuring that there is a signal passing to consumers to stimulate investments in energy efficiency and energy diversification.

A third type of energy efficient transport policies are **financial support and incentives** to promote the purchase and use of cleaner vehicles. As per the European Environmental Agency, four categories of taxes and incentives exist across the EU:[85]

- For the acquisition of vehicles (e.g., registration taxes, purchase subsidies, bonus/malus schemes whereby low-carbon vehicles receive a tax deduction (bonus) and polluting cars above a certain threshold are heavily taxed (malus) or scrappage-for-replacement schemes).
- Recurring taxes and incentives (e.g., annual circulation taxes, road tolls, congestion or low emission zone charges, free parking or preferential land use).
- For company vehicles (e.g., as benefit-in-kind taxation of employees using a company car privately, proportional to CO2 emissions).
- Infrastructure-level taxes and incentives (e.g., government funds for the installation of refuelling and charging facilities for low emission vehicles).

Policies aimed at **promoting and raising awareness** about energy efficient transport are a fourth type. This includes policies and measures to stimulate eco-driving (e.g., trainings, in-car feedback instruments), dissemination of information regarding the efficiency of vehicles and low-carbon transport modes, etc.

The last type of energy efficient transport policies are those that promote **modal shifts** and/or increased intermodality, such as urban planning (e.g. increasing the space available for public transport and soft transportation modes, rollout of EV charging stations) or financial support and incentives to encourage the shift towards low carbon and soft mobility (e.g. subsidize the use of public transports, allowances for biking home-to-work).

There are also a number of policies and regulations that have been implemented at EU level in order to stimulate the increase in energy efficiency of the transport sector, which are further described below.

4.6.1 nT1 – Promotion of clean and energy efficient road transport vehicles in public procurement

This measure aims to integrate specific criteria regarding the energy efficiency of road transport vehicles into the public procurement process in order to stimulate a shift. These criteria should reflect a decrease in carbon emissions and energy use of public road transport vehicles. In the EU, Directive 2019/1161 on the promotion of clean and energy-efficient road transport vehicles (Clean Vehicles Directive) aims to boost the deployment of low- and zero-emissions road vehicles (i.e., cars, vans, trucks and buses).[86] It addresses procurement (public purchase, lease, rent and relevant services contracts) for public transport services. The Directive sets minimum procurement targets for clean light-duty vehicles[87] and clean heavy-

[85] Appropriate taxes and incentives do affect purchases of new cars — European Environment Agency (europa.eu)
[86] Clean Vehicles Directive (europa.eu)
[87] Clean light-duty vehicle are defined by the Directive as any car or van meeting the following emission threshold: (a) until Dec 2025, no more than 50 g/km CO_2 and up to 80% of applicable real diving emission limits for NO_X and PN, (b) from Jan 2026, only zero-emission vehicles.

duty vehicles[88] for each Member State. These targets are expressed as minimum percentages of clean vehicles in the total number of road transport vehicles covered by all procurement contracts. Targets are set for years before 2030. The Directive will be revised in 2027 to introduce new targets beyond 2030.

This measure must align with measures nT3, nT4, nT5, and nT6.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: public authorities who need to adapt the public procurement for road transport vehicles
- ✓ **Administrator:** government
- ✓ **Implementing body**: Ministry/body in charge of the fleet of public road transport vehicles
- ✓ **Final payer**: taxpayers, as the integration of criteria for regarding the energy efficiency of road transport vehicles may increase the price of vehicles purchased through public procurement and hence require a higher budget
- ✓ **Beneficiary**: individual citizens, especially in urban areas

Key considerations of the measure

Table 4-27 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-27 Key considerations for Promotion of clean and energy efficient road transport vehicles in public procurement

Parameter	Description
Pros	• Allows to increase the contribution of public authorities to sustainable consumption and production • Stimulates a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market
Cons	• Developing standardized and harmonized energy efficiency criteria that are compatible with different vehicle types and technologies can be complex, especially when considering various vehicle categories and operational requirements. • The measure's success may depend on the availability and variety of energy-efficient road transport vehicles in the market. Limited options may pose challenges in meeting the procurement needs of public transportation services.
NUTS3 impact	• Public authorities should all have the same ability to renew their fleet across the country, regardless of the areas they are located. Municipalities are limited by their financial means, but government agencies are centralized and thus no intrinsic regional difference is expected.
Energy price impact	• The purchase of more efficient vehicles has no direct impact on energy price.
Key risks	• Energy-efficient vehicles may have a limited presence in the market, making it challenging for procurement officials to find suitable options that meet their requirements. This could result in a lack of competition and potentially higher costs for the available vehicles. • New energy-efficient technologies may not have a proven track record in all operational conditions. Concerns about vehicle performance, range,

[88] Clean heavy-duty vehicles are defined by the Directive as any truck or bus using one of the following alternative fuels: hydrogen, battery electric (incl. plug-in hybrid), natural has (both CNG, LNG, incl. biomethane), liquid biofuels, synthetic and paraffinic fuels, LPG.

	and reliability could deter procurement officials from selecting these vehicles.
Modelling Assumptions	• **Energy savings target:** 13.8 GWh of additional savings each year, with 1.19 MWh saved per vehicle affected. The total represents ~ 0.14% of the transport consumption (~9 700 GWh); • **Calculated savings:** Public sector fleet is assumed to overturn at constant rate (rental and leased vehicles) with constant improvements in fuel efficiency. 25% average turnover of fleet based on operating lease length. 1.51% of fleet affected (Fleet size = 771,717).[89] Public fuel usage in Estonia is based on OSPA; • **Investment cost:** €958 million over 10 years. €30k per vehicle, plus 2% annual inflation; • **Support (if relevant) to the investment:** vehicles are purchased by public authorities, but could be a combination of local and central funding; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Energy-efficient vehicles, particularly electric ones, require specific charging infrastructure. The lack of charging stations in public spaces or government facilities could limit the feasibility of adopting such vehicles, as they might not be practical for day-to-day operations. • Implementing policies and procedures to ensure proper energy efficiency assessment and compliance can be administratively complex and resource intensive. • Energy-efficient vehicles may have other factors increasing their total cost of ownership, such as higher tire wear or maintenance cost.
Implementation steps	• Conduct a thorough market analysis to identify available energy-efficient vehicle options. Evaluate various technologies, such as electric, hybrid, or fuel-efficient internal combustion engines, and their suitability for different use cases. Select vehicle types that align with operational requirements, routes, and user needs. • Integrate energy efficiency considerations into the public procurement process. Specify energy performance requirements in tender documents and contracts. Ensure that vehicles meet established standards and undergo testing and certification procedures. Implement mechanisms for ongoing monitoring and reporting of energy consumption to assess the effectiveness of the policy.

Outstanding considerations for Estonia

- Clearly defining the energy efficiency criteria for road transport vehicles to be eligible for public procurement is essential. Deciding on specific metrics, such as fuel consumption, emission levels, or energy performance certificates, will determine which vehicles are considered clean and energy-efficient. Addressing the infrastructure requirements for supporting clean and energy-efficient vehicles is crucial. This includes ensuring the availability of charging stations or refuelling stations for electric and alternative fuel vehicles - alignment and implementation with nT3, nT4, nT5, and nT6 is essential.

4.6.2 nT2 – Subsidy for public transport usage instead of personal cars

The objective of this measure is to support the use of public transport instead of personal vehicles. There are different options possible:

- ✓ Reduced price of public transport for users without a personal car

[89] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

- ✓ Subsidy for companies to pay public transport to employees who do not have a company car

The objective of this measure is to encourage and promote the use of public transport over personal vehicles as a more sustainable and efficient mode of transportation. The measure aims to reduce individual car usage and traffic congestion, lower carbon emissions, improve air quality, and enhance overall urban mobility. It seeks to create a modal shift where more people choose public transport options for their daily commuting and travel needs. The scope of this measure covers various aspects of public transport enhancement and incentives to make it a more attractive and viable choice for commuters.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: Public transport authorities
- ✓ **Administrator:** government
- ✓ **Implementing body**: Ministry of Regional Affairs and Agriculture, as the Ministry in charge of public transport
- ✓ **Final payer**: taxpayers as the grant/support would be funded with public budget
- ✓ **Beneficiary**: The beneficiaries of this measure are users who use public transport instead of their personal car

Key considerations of the measure

Table 4-28 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-28 Key considerations for Subsidy for public transport usage instead of personal cars

Parameter	Description
Pros	• Supports the use of low carbon transportation • A shift towards public transport can help alleviate traffic congestion on roads, leading to smoother traffic flow and shorter commuting times. • With fewer vehicles on the road, there will be a positive impact on air quality, reducing pollution and improving public health.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Convincing individuals to change their travel behaviour and shift from personal vehicles to public transport may require significant awareness campaigns and incentives. • Public transport must be reliable, convenient, and accessible to attract more users. Addressing these aspects may require continuous efforts. • Encouraging public transport usage may also require adjustments in urban planning to create pedestrian-friendly neighbourhoods and transit-oriented developments
NUTS3 impact	• The area of effect is expected to be constrained in cities (Tallinn & Tartu) as those have dense enough public transport network to compete with passenger car without extensive reworking.
Energy price impact	• Subsidy for public transport has no impact on energy price
Key risks	• Providing subsidies for public transit can strain government budgets, especially if the programme attracts a large number of participants. There's a risk of overcommitting financial resources, potentially leading to budget deficits or cuts in other essential services. • If not well-targeted, subsidies might benefit those who already regularly use public transit, rather than effectively incentivising new users to switch from personal vehicles. This could lead to inefficiencies and misuse of public funds.

	• Subsidies might inadvertently lead to unintended consequences, such as increased congestion due to higher public transit ridership, or distortions in the transportation market, affecting private operators and other modes of transportation.
Modelling Assumptions	• **Energy savings target:** 23.3 GWh of additional savings in 2025 and 0.2 GWh every year after; • **Calculated savings:** Based on case studies, direct subsidies have an effect on reducing passenger car travel. Using these percentages on current fleet consumption gives an estimate on the effect of the measure. This is expected to perform as subsidy for passenger travel providing viable alternative with minimum hassle for the end user. The suitable use would be token-based with either smartphone app or smart card for validation. 0.5% of travels affected[90] (Fleet size = 771,717).[91] Public fuel usage in Estonia is based on OSPA. • **Investment cost:** €3.86 million over 10 years. €100 per affected vehicle; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Providing subsidies requires financial resources, and governments might be reluctant to allocate funds from other priorities to subsidize public transit. Budget limitations can hinder the feasibility of offering substantial subsidies. • Designing, implementing, and administering a subsidy programme involves coordination among multiple stakeholders, such as government agencies, transit operators, and financial institutions. This complexity can slow down the implementation process. • Subsidy programmes need to be integrated with other transportation and urban planning strategies to ensure a holistic approach. Failure to align subsidies with improvements in transit infrastructure, routes, and connectivity can limit their impact.
Implementation steps	• Conduct a comprehensive analysis of local transportation patterns, congestion levels, environmental concerns, and commuting behaviours to determine the need for subsidies. • Determine the appropriate subsidy amount per trip or ticket, considering factors like affordability, impact on ridership, and available budget. • Collaborate with public transit agencies to seamlessly integrate the subsidy into ticketing systems, fare structures, and mobile apps.

Outstanding considerations for Estonia

- Defining the target audience and eligibility criteria for the subsidy programme is essential. Considerations should be made regarding who will be eligible for the subsidy, such as specific demographics, income levels, or geographic locations. Determining the appropriate subsidy amount and the duration of the programme is crucial. Analysing the cost-effectiveness of the subsidy and its potential long-term impact on encouraging public transport usage is essential.

4.6.3 nT3 - Priority lanes for micro-mobility

This measure aims at providing more space to micro-mobility (i.e., small, lightweight vehicles operating at speeds typically below 25 km/h such as bikes, scooters, etc.) in public spaces. This will be done by constructing new or releasing existing priority lanes for micro-mobility. By creating new priority lanes or

[90] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[91] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

repurposing existing spaces, the measure aims to enhance the safety, accessibility, and convenience of micro-mobility modes for commuters and travellers. The scope of this measure covers various aspects of urban planning and infrastructure development to encourage and facilitate the use of sustainable and low-speed micro-mobility options.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: public authorities in charge of Urban Planning
- ✓ **Administrator**: government
- ✓ **Implementing body:** Municipalities and local authorities
- ✓ **Final payer**: taxpayers as the measure would be funded with public budget
- ✓ **Beneficiary:** The beneficiaries of this measure are users of micro-mobility – typically urban individuals who do not own a car or bike

Key considerations of the measure

Table 4-29 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-29 Key considerations for Priority lanes for micro-mobility

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • Encouraging micro-mobility promotes physical activity, leading to better health and well-being for users. • Micro-mobility options provide an effective solution for last-mile connectivity, bridging gaps between public transport stops and final destinations. • By segregating micro-mobility users from motor vehicles, safety is improved, leading to a potential reduction in traffic accidents and injuries.
Cons	• Developing priority lanes and parking areas for micro-mobility may require modifications to existing infrastructure, which could be challenging in densely populated urban areas. • Ensuring user compliance with traffic rules and safety measures is crucial to prevent accidents and conflicts with other road users. • Managing parking areas and sharing stations for micro-mobility vehicles may require dedicated resources and monitoring to avoid clutter and misuse.
NUTS3 impact	• The effect is only at locations where micro mobility users are discouraged by the volume of mixed traffic. Therefore, it's only suitable for locations with high volumes of traffic, I.e., urban areas.
Energy price impact	• Investment in infrastructure and adaptation for micro mobility has no impact on energy prices
Key risks	• Introducing dedicated lanes for micro-mobility and bicycles may reduce the space available for other vehicles, potentially leading to traffic congestion and delays for motorized traffic. • Allocating exclusive lanes for micro-mobility and bicycles can lead to conflicts with drivers who perceive the change as favouring one group over another, potentially leading to opposition and resistance. • Many urban areas have limited available road space, making it challenging to allocate separate lanes for micro-mobility and bicycles without impacting other modes of transport.
Modelling Assumptions	• **Energy savings target:** 23.3 GWh of additional savings each year; • **Calculated savings:** Based on case studies, safer and shorter routes for non-car traffic make the other modes of transport more competitive and as such more people will use them instead of personal passenger car. 0.5%

	of travels affected[92] (Fleet size = 771,717).[93] Public fuel usage in Estonia is based on OSPA. • **Investment cost:** €160 million over 10 years. EUR 200 000 per km of construction and 800 km of required construction per year; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Introducing micro-mobility lanes might require reallocating space, including reducing parking spots or redesigning intersections. This can create challenges for parking management and could lead to conflicts between different stakeholders. • Local regulations and zoning laws might not be aligned with the introduction of micro-mobility lanes. Addressing legal and regulatory barriers could be complex and time-consuming. • If micro-mobility lanes are introduced without considering the integration with existing public transportation systems, it might lead to reduced usage of buses and trains, affecting the overall sustainability of the transportation network.
Implementation steps	• Conduct a thorough assessment of the existing road network to identify suitable routes for micro-mobility priority lanes. Consider factors such as traffic flow, connectivity, safety, and integration with other modes of transportation. Collaborate with urban planners, transportation experts, and micro-mobility stakeholders to design lanes that optimize the benefits for users and the overall traffic system. • Engage with various stakeholders, including micro-mobility operators, local businesses, community representatives, and transportation agencies. Seek input and address concerns to ensure that the implementation aligns with the needs of all parties involved. This collaborative approach can help build support and mitigate potential conflicts. • Build the necessary infrastructure for micro-mobility lanes, which may include repainting road markings, adding physical barriers, installing signage, and creating designated stopping zones. Ensure that the infrastructure meets safety standards and is accessible for all users, including pedestrians and people with disabilities. • Establish mechanisms for enforcing lane rules and regulations. This may involve deploying law enforcement officers or utilizing technology such as cameras to monitor lane usage. Regularly assess the effectiveness of the lanes, gathering feedback from users and conducting traffic flow analyses to make any necessary adjustments.

Outstanding considerations for Estonia

- Define what promotional measures will be implemented.

4.6.4 nT4 – Electric charging infrastructure for existing inhabitants areas

The objective of this measure is to increase the number of electric vehicles (EV) that can be charged in public spaces. This will be done by installing a large amount of electric charging infrastructure available in existing inhabitance areas. The scope of the measure involves installing a substantial amount of electric charging infrastructure in existing residential areas and other public spaces to support the growing number of EV users.

[92] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[93] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: public authorities in charge of Urban Planning
- ✓ **Administrator:** government
- ✓ **Implementing body**: Ministry in charge of Urban Planning or Mobility and Transport
- ✓ **Final payer:** taxpayers as the measure would be funded with public budget
- ✓ **Beneficiary:** The beneficiaries of this measure are EV users/owners.

Key considerations of the measure

Table 4-30 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-30 Key considerations for Electric charging infrastructure for existing inhabitants areas

Parameter	Description
Pros	• Stimulates the use of electric vehicles • The installation and maintenance of electric charging infrastructure can stimulate economic activity and create jobs in the renewable energy and EV charging industries. • With a larger network of charging stations in public spaces, EV owners will have increased convenience and confidence in the availability of charging facilities, making electric vehicles a more attractive option for potential buyers. • Apartment block parking lots lack charging infrastructure for EVs in Estonia. Therefore, it has often been impractical to own an electric vehicle while living in an apartment building as possibility of charging EV depends on the on the workplace or public charging stations which are inconvenient for everyday use. • Eliminating barriers for owning EV will increase the use of EVs.
Cons	• In areas with a low adoption rate of electric vehicles, the extensive installation of charging infrastructure may result in underutilization, leading to inefficient use of resources. • The installation of charging stations in public spaces may raise concerns about visual impact and the allocation of space in crowded urban areas. Balancing the need for charging infrastructure with other urban planning considerations can be challenging. • Keeping up with evolving EV charging technologies and standards may pose technical challenges for maintaining and upgrading the installed infrastructure over time. • Designated EV parking spots and charging stations can cause frustration in many regions where there are not enough parking spaces and EV charging stations may be blocked by regular cars parking illegally.
NUTS3 impact	• Areas with low-income households will not afford to invest in EVs. As such Ida-Viru County and Valga County may have a higher aid rate and urban areas like Tallinn and Tartu a smaller rate to mitigate the risk that the grant is used mainly by residents of bigger cities. Based on NUTS areas, EE001 North Estonia should be considered higher income area, EE007 North-East Estonia and EE008 South-Estonia disadvantaged areas. • It is likely that areas with higher income will benefit more from the measure, due to the higher capability of purchasing new vehicles.
Energy price impact	• This measure has no direct impact on energy prices
Key risks	• The existing electrical grid and distribution infrastructure might not be equipped to handle the increased demand from widespread electric vehicle (EV) charging. This could lead to power outages, voltage fluctuations, and the need for costly upgrades to accommodate the load. • The high upfront costs of installing EV charging stations, including equipment, installation, and grid connection, can pose financial challenges for municipalities or local authorities. Sourcing funding and

	achieving a cost-effective balance between infrastructure investment and community benefits can be difficult.
Modelling Assumptions	• **Energy savings target:** 1.2 GWh of additional savings each year; • **Calculated savings:** The increase of electric fleet on national scale is assumed to replace the ICE cars at current growth rate without inhibition caused by lack of charging stations. 0.47% of travels affected[94] (Fleet size = 771,717).[95] Public fuel usage in Estonia is based on OSPA. • **Investment cost:** €67 million over 10 years. EUR 14 000 per station and 2400 stations required; • **Burden of the investment**: 50% government and 50% vehicle owners; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Inadequate planning and placement of charging stations could result in traffic congestion around charging locations, leading to disruptions and inconveniences for both EV users and the local community. The spatial changes in the energy consumption puts additional load on electric infrastructure. However, this gives an opportunity for small electricity producers to directly sell their energy to local clients.
Implementation steps	• Conduct a comprehensive assessment of existing infrastructure, electricity capacity, and local demand for EVs. Develop a strategic plan that identifies suitable locations for charging stations, considering factors such as proximity to residential areas, parking availability, and grid capacity. • Engage with local residents, businesses, and community stakeholders early in the planning process. Address concerns, provide information about the benefits of EV charging, and involve the community in decision-making to ensure support for the project. • Install charging stations based on the strategic plan, ensuring that they are user-friendly, accessible, and integrated into the urban environment. Implement a robust monitoring system to track usage, user satisfaction, and infrastructure performance, allowing for adjustments based on real-time data.

Outstanding considerations for Estonia

- Establish how many charging stations per km² or based on per EV.[96]
- Clarify how the charging infrastructure accommodate different types of EVs, including cars, e-bikes, and e-scooters.
- Define the possibilities for integrating renewable energy sources into the charging infrastructure.
- Define where the stations be located and if there will be priority for rural areas vs urban or suburban. Communicate defining criteria.

4.6.5 nT5 – Biomethane infrastructure

To increase the utilization of biomethane as a sustainable fuel for vehicles, a key measure is to develop and implement biomethane infrastructure. This involves the installation of refuelling stations and

[94] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[95] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753
[96] *The suitable number of charging stations per EV depends on a number of factors including: housing stock, average distance travelled and population density. In the EU, the 2014 Alternative Fuel Infrastructure Directive (AFID) regulates the deployment of public electric vehicle supply equipment. The policy recommended that EU member states reach 10 electric light-duty vehicles (LDVs) per public charger by 2020. Proposed new EU legislation (the Alternative Fuelling Infrastructure Regulation) would mandate 1 kW of publicly available charger per BEV and 0.66 kW per PHEV as well as the minimum public charger coverage on highways*. Trends in charging infrastructure - Global EV Outlook 2022 – Analysis - IEA

distribution networks that can dispense biomethane to vehicles. The government will establish a grant for refuelling stations equipped to provide biomethane to vehicles. These stations should be strategically located along major transportation routes, urban centres, and industrial areas to ensure convenient access for vehicle owners. The number and distribution of these stations will play a crucial role in promoting the use of biomethane vehicles.

Building an efficient distribution network is essential for the effective supply of biomethane to refuelling stations. This network should cover a wide geographical area, connecting biomethane production facilities with the refuelling points. Optimizing the distribution routes and ensuring a steady supply of biomethane is vital to meet the growing demand for sustainable fuel.

Strong policy support and favourable regulations from governments play a crucial role in the successful implementation of biomethane infrastructure. Governments can provide financial incentives, grants, or loans to support the installation of refuelling stations and distribution networks. They can also set targets for the adoption of biomethane vehicles and enforce emission standards that encourage the use of low-carbon fuels.

Concerned stakeholders

Establishing partnerships with biogas producers and supporting the growth of biomethane production facilities can ensure a stable and reliable supply of biomethane for the infrastructure. Engaging in long-term contracts with biogas producers will create a win-win situation, driving investment in the production sector and securing a consistent fuel supply for the infrastructure.

The concerned stakeholders are the following:

- ✓ **Obliged party:** Private sector (Gas stations, Utility providers)
- ✓ **Administrator:** government
- ✓ **Implementing body:** Ministry in charge of Urban Planning or Mobility and Transport
- ✓ **Final payer:** taxpayers as the measure would be funded with public budget
- ✓ **Beneficiary:** biofuel vehicle owners and biogas producers

Key considerations of the measure

Table 4-31 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-31 Key considerations for Biomethane infrastructure

Parameter	Description
Pros	• Stimulates the use of biomethane vehicles • Biomethane is a renewable and sustainable fuel derived from organic waste or biomass, which can significantly reduce greenhouse gas emissions and contribute to combating climate change. • Developing biomethane infrastructure promotes energy independence by reducing reliance on fossil fuels and providing a locally sourced, renewable energy option. • By utilizing organic waste and biomass for biomethane production, it offers an effective waste management solution and helps reduce landfilling and methane emissions from decomposing waste. • Investing in biomethane infrastructure drives technological advancements and innovation in the renewable energy sector, creating opportunities for economic growth and job creation.

Cons	• Establishing biomethane infrastructure, such as biogas plants, upgrading facilities, and refuelling stations, requires significant upfront investment, which can be a financial challenge. • Biomethane infrastructure is not yet widespread and may not be readily available in all regions, limiting the accessibility of biomethane as a vehicle fuel. • The production of biomethane relies on organic waste or biomass feedstock, which may raise concerns about land use competition and the availability of suitable feedstock. • Existing vehicle fleets may not be fully compatible with biomethane, requiring additional modifications or new investments, which could be a barrier to adoption.
NUTS3 impact	• Cf previous measure
Energy price impact	• This measure has no direct impact on energy prices
Key risks	• The availability of suitable feedstock for biomethane production, such as organic waste or agricultural residues, could be limited or compete with other uses. This could lead to price volatility and supply challenges for biomethane production, affecting its viability as a fuel source. • Changes in policies, regulations, or incentives related to biomethane production, distribution, or use can impact the economic feasibility of investments. Regulatory uncertainties might discourage private sector involvement and hinder the growth of the biomethane sector.
Modelling Assumptions	• **Energy savings target:** 1.6 GWh of additional savings each year; • **Calculated savings:** All current fuel stations are assumed to also provide biomethane for cars. 0.50% of travels affected[97] (Fleet size = 771,717).[98] Public fuel usage in Estonia is based on OSPA. • **Investment cost:** €108 million over 10 years. EUR 300 000 per station and 180 stations required; • **Burden of the investment**: 50% government and 50% private; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Scaling up biomethane infrastructure requires substantial investments in production facilities, distribution networks, and refuelling stations. If the demand for biomethane as a transport fuel does not match the investment, there is a risk of underutilization and financial losses. • Subsidies or incentives that are not well-targeted or are overly generous might distort market dynamics and hinder healthy competition. This can lead to inefficiencies, overproduction, or lack of innovation in the biomethane sector.
Implementation steps	• Conduct a comprehensive assessment of potential feedstock sources, considering availability, sustainability, and compatibility with local agricultural and waste management practices. This will help ensure a reliable supply for biomethane production. • Facilitate private sector investments in biomethane production facilities, distribution networks, and refuelling stations. Encourage public-private partnerships and collaboration to share risks and resources.

Outstanding considerations for Estonia

- Assess the potential availability of different types of biomass feedstock for biomethane production in Estonia.
- Considering the long-term viability and scalability of biomethane infrastructure is important for sustainable development and future expansion.

[97] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
98 https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis

4.6.6 nT6 – Hydrogen infrastructure

The objective of this measure is to increase the number of vehicles using hydrogen. This will be done by installing hydrogen infrastructure for vehicles. The measure aims to establish and expand hydrogen infrastructure, including refuelling stations, to facilitate the widespread use of hydrogen fuel cell vehicles (FCVs). By creating a robust hydrogen refuelling network, the measure intends to encourage vehicle manufacturers, fleet operators, and individual consumers to transition to hydrogen-powered vehicles, thus contributing to a reduction in greenhouse gas emissions and promoting a greener transport sector.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party:** public authorities in charge of Urban
- ✓ **Administrator:** government
- ✓ **Implementing body:** Ministry in charge of Urban Planning or Mobility and Transport
- ✓ **Final payer:** taxpayers as the measure would be funded with public budget
- ✓ **Beneficiary:** Owners of hydrogen vehicles

Key considerations of the measure

Table 4-32 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-32 Key considerations for Hydrogen infrastructure

Parameter	Description
Pros	• Stimulates the use of hydrogen vehicles • Hydrogen FCVs offer longer driving ranges compared to battery electric vehicles (BEVs) and can be refuelled quickly, similar to conventional gasoline-powered vehicles. • Hydrogen-powered vehicles operate quietly, reducing noise pollution in urban areas.
Cons	• The limited availability of hydrogen-powered vehicle models may initially restrict consumer choices. • Ensuring a reliable and cost-effective hydrogen supply chain is essential for the sustainable operation of hydrogen refuelling stations.
NUTS3 impact	• This affects more the densely populated areas such as EE001. Other areas are not affected.
Energy price impact	• Increased hydrogen consumption should enable more producers entering the market and thus lowering energy price through competition.
Key risks	• Scaling up hydrogen production requires dedicated facilities and reliable sources of hydrogen feedstock. The availability and sustainability of feedstock, such as electrolysis for green hydrogen or natural gas for blue hydrogen, can be uncertain and impact the viability of infrastructure expansion. • Hydrogen has lower energy density compared to traditional fuels, requiring specialized storage and transportation infrastructure. The risk of leaks, explosions, or transportation accidents associated with hydrogen handling needs to be carefully managed.
Modelling Assumptions	• **Energy savings target:** 1.1 GWh of additional savings each year;

	• **Calculated savings:** All current fuel stations are assumed to also provide hydrogen for cars. 0.50% of travels affected[99] (Fleet size = 771,717).[100] Public fuel usage in Estonia is based on OSPA. • **Investment cost:** €54 million over 10 years. EUR 150 000 per station and 180 stations required; • **Burden of the investment**: 50% government and 50% private; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Poorly designed subsidies or incentives may distort the market, favouring specific technologies or players and hindering competition. This can lead to inefficiencies and misallocation of resources, impeding the growth of a competitive hydrogen sector.
Implementation steps	• Develop a comprehensive national hydrogen strategy that outlines the vision, goals, and policy measures for hydrogen deployment in the transport sector. The strategy should consider the entire hydrogen value chain, from production to consumption. • Foster collaboration among stakeholders, including government agencies, industry players, research institutions, and local communities. Engage in public awareness campaigns to educate consumers about hydrogen-fuelled transport and build support for the technology.

Outstanding considerations for Estonia

- Assess the long-term viability and scalability of hydrogen infrastructure in Estonia.

4.6.7 nT7 – Vehicle tax for registration

The objective of this measure, which is already being proposed by the Estonian government, is to impose a tax on thermal vehicles at registration to disincentivize the purchase of personal vehicles. The tax would need to be paid by the thermal vehicle owner as soon as the vehicle has been registered. The level of the tax could vary based on different criteria: type and size of vehicle, carbon emissions, fuel efficiency, etc.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: car owners
- ✓ **Administrator:** government
- ✓ **Implementing body:** Ministry in charge of Mobility and Transport
- ✓ **Final payer:** car owners
- ✓ **Beneficiary:** Government collecting tax revenue

Key considerations of the measure

Table 4-33 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

[99] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[100] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

Table 4-33 Key considerations for Vehicle tax for registration

Parameter	Description
Pros	• Disincentivise the purchase of personal vehicles • The tax revenue generated from the measure can be reinvested into sustainable transport initiatives or other environmental projects.
Cons	• Some potential buyers may perceive the tax as an additional financial burden, leading to initial resistance to the measure. • The tax could disproportionately impact lower-income individuals who may have limited access to cleaner vehicle options.
NUTS3 impact	• Areas with low-income households are probably less inclined to purchase new cars and keep using older cars. This is not related to specific NUTS3 regions as the differences are in smaller scale.
Energy price impact	• This measure has no impact on energy prices
Key risks	• A vehicle tax based on energy efficiency could disproportionately affect low-income households, who may have limited options to afford newer, more energy-efficient vehicles. This could exacerbate social inequality and hinder access to personal mobility. • If the vehicle tax is set too high, it might lead to a delay in vehicle replacement and encourage consumers to keep older, less efficient vehicles. This could counter the overall efforts of achieving energy efficiency gains.
Modelling Assumptions	• **Energy savings target:** 6.75% of travels affected[101], in addition every year; • **Calculated savings:** 3.5 GWh of additional savings each year (Fleet size = 771,717).[102] Public fuel usage in Estonia is based on OSPA. Current tax rate is €192 and proposed tax rate is €1 595. • **Investment cost:** €0.15 million in 2025 for cost implementation; • **Burden of the investment**: 100% government for cost implementation. Tax rate will go from EUR 192 to EUR 1 595, which will impact private vehicle owners.; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• If the tax policy is not aligned with other incentive schemes (e.g., subsidies for electric vehicles), it could create confusion and mixed signals for consumers, reducing the overall effectiveness of energy efficiency promotion.
Implementation steps	• Develop a vehicle tax policy that considers a range of vehicle attributes beyond just energy efficiency, such as emissions, size, and technology. This ensures that the policy is fair, balanced, and aligned with broader environmental and social goals. • Implement the vehicle tax gradually to provide consumers with time to adjust their purchasing decisions and automakers to adapt their production strategies. This reduces abrupt market shifts and allows for a smoother transition. • Launch public awareness campaigns to educate consumers about the benefits of energy-efficient vehicles and how the vehicle tax policy supports cleaner transport options. This can help mitigate resistance and enhance public acceptance.

Outstanding considerations for Estonia

- Communicate the appropriate tax rate, and how will it be structured. Clarify if the tax will be a flat fee, based on vehicle type, weight, or emissions. Considerations need to be made to strike a balance between generating revenue and incentivising environmentally friendly vehicle choices.

[101] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[102] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

- Qualify the projected revenue outcomes and clarify how will the generated funds be allocated.
- Clarify if electric vehicles and other alternative fuel vehicles be exempt from the tax, or will they receive preferential treatment to promote their adoption.

4.6.8 nT8 – Annual vehicle tax

The fiscal measure of imposing an annual tax on thermal vehicles is a policy initiative designed to discourage the use of personal vehicles powered by traditional fossil fuels. The scope of this measure would cover all thermal vehicles owned by individuals or businesses within a specific jurisdiction or country. The targeted parties include vehicle owners who own and operate cars, trucks, and other vehicles running on gasoline or diesel.

The fiscal measure would apply to all thermal vehicles registered within the jurisdiction, regardless of whether they are used for personal or commercial purposes. The scope could also include both new and used vehicles to ensure a comprehensive approach to reducing carbon emissions from the transportation sector. The tax could be applicable to a wide range of thermal vehicles, including cars, SUVs, trucks, vans, and motorcycles. The inclusion of different vehicle types ensures that the measure addresses emissions from all segments of the transportation sector.

The tax could be structured based on the carbon emissions produced by each vehicle. High-emission vehicles would attract a higher tax rate, while low-emission vehicles would be subject to a lower tax rate. This approach incentivizes the adoption of cleaner, more fuel-efficient vehicles. Another criterion for the tax rate could be the fuel efficiency of the vehicle. Highly fuel-efficient vehicles would be subject to a lower tax rate, while less fuel-efficient ones would face a higher tax. This encourages the transition to vehicles with better mileage and reduced greenhouse gas emissions. Different vehicle sizes and types could also be considered when determining the tax rate. For instance, smaller and lighter vehicles may have a lower tax rate compared to larger, heavier ones. This approach encourages the use of compact and environmentally friendly cars.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: Thermal vehicle owners
- ✓ Administrator: Government
- ✓ Implementing body: Ministry in charge of Mobility and Transport
- ✓ Final payer: car owners
- ✓ Beneficiary: The government via the collections of the tax revenue

Key considerations of the measure

Table 4-34 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-34 Key considerations for Annual vehicle tax

Parameter	Description
Pros	• Disincentivizes the use of personal vehicles • An annual vehicle tax can serve as a reliable source of revenue for the government. The funds collected can be allocated to various public services and infrastructure projects.

	• A higher annual tax rate for owning vehicles can discourage excessive car ownership, leading to reduced traffic congestion and lower carbon emissions in urban areas. • Different tax rates based on vehicle size or emissions can promote fairness, ensuring that owners of larger or more polluting vehicles pay their fair share of road usage costs.
Cons	• An annual vehicle tax can be regressive, disproportionately impacting low-income individuals who may heavily rely on personal vehicles for transportation. • Some vehicle owners may attempt to evade or avoid paying the tax, leading to revenue losses and enforcement challenges for authorities. • Different regions or jurisdictions may apply varying tax rates, leading to complexities for vehicle owners who move or travel between areas.
NUTS3 impact	• Areas with low-income households are probably less inclined to purchase new cars, still driving old cars
Energy price impact	• This measure has no impact on energy prices
Key risks	• Imposing an annual vehicle tax based on energy efficiency might be met with resistance from consumers who perceive it as an additional financial burden, especially if they own less energy-efficient vehicles. This could lead to public opposition and reduced policy effectiveness. • An annual vehicle tax based on energy efficiency could disproportionately impact low-income households, potentially hindering their access to personal mobility. This could lead to social equity issues and backlash against the policy.
Modelling Assumptions	• **Energy savings target:** 6.75% of travels affected[103] (Fleet size = 771,717).[104] • **Calculated savings:** Public fuel usage in Estonia is based on OSPA. Current tax rate is €60 and proposed tax rate is €100. 17.6 GWh of additional savings each year • **Investment cost:** €0.15 million in 2025 for cost implementation; • **Burden of the investment**: 100% government for cost implementation. Tax rate will go from EUR 60 to EUR 100, which will impact private vehicle owners.; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• If the tax policy is not well-aligned with other energy-efficient transport incentives, such as subsidies for electric vehicles, it may create confusion and discourage consumers from making energy-efficient choices.
Implementation steps	• Introduce the annual vehicle tax in a phased manner, allowing consumers to adjust their vehicle choices and automakers to adapt their production strategies. This gradual approach minimises market shocks and allows for smoother transitions. • Define exemptions or thresholds to ensure that the policy does not disproportionately burden low-income households or target specific groups unfairly. These exemptions could apply to older vehicles, low-income individuals, or certain vehicle categories.

Outstanding considerations for Estonia

- Determine the appropriate tax rate, and how will it be structured. Clarify if the tax will be based on vehicle type, weight, emissions, or other factors. Considerations need to be made to strike a balance between revenue generation and incentivising eco-friendly vehicle choices.
- Clarify if there will be a differentiation in tax rates based on vehicle characteristics, such as fuel type, engine size, or age.

[103] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[104] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

- Clarify if electric vehicles and other alternative fuel vehicles be exempt from the tax, or will they receive preferential treatment to promote their adoption.

4.6.9 nT9 – Development of convenient and modern public transport

This measure aims to develop a convenient and modern public transport, that is an accessible, convenient, modern, and accessible network that covers a significant portion of the national territory. The primary goal is to provide a reliable and efficient public transport system that is affordable and available to all citizens, regardless of their location or economic status.

The measure should cover a large area of the national territory, including urban, suburban, and rural regions. The focus is on creating an extensive and well-connected public transport network that reaches remote areas and connects cities, towns, and villages.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: Estonian public transport companies
- ✓ Administrator: government
- ✓ Implementing body: Ministry of Climate
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ Beneficiary: All citizens ideally, especially in rural areas or areas currently underserved by public transportation

Key considerations of the measure

Table 4-35 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-35 Key considerations for Development of convenient and modern public transport

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • Reduces the number of private vehicles on the roads, leading to decreased traffic congestion and improved traffic flow. • promotes social inclusion by ensuring that even those with limited mobility or financial means can participate in society
Cons	• requires significant investment in infrastructure, technology, and maintenance • Encouraging people to shift from private vehicles to public transport may require a cultural and behavioural change, which can be challenging to achieve • Ensuring the operational efficiency of the public transport system, including adherence to schedules and reliability, is crucial to gaining public trust and support • If modern public transit projects are not integrated well with existing road networks and traffic management systems, they can lead to disruptions in traffic flow, congestion, and increased travel times for both public transit users and private vehicle owners.
NUTS3 impact	• Cf. previous measure
Energy price impact	• This measure has no direct impact on energy prices
Key risks	• Despite improvements in public transit, there is a risk that people may still prefer using private vehicles due to convenience, perceived comfort, and travel flexibility. If public transit fails to attract a significant number of riders, the investment may not yield the desired energy-efficient outcomes.

Modelling Assumptions	• **Energy savings target:** Based on calculations by Finantsakadeemia OÜ. 20% increase in public transport services (additional lines, more frequent schedule), especially in Harju County. It is assumed that approximately 50 000 people will use public transport instead of private car for daily commuting. • **Calculated savings:** 43.6 GWh of additional savings each year • **Investment cost:** €44.3 million from 2025 to 2030; • **Burden of the investment**: 100% government for cost implementation; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Inadequate coverage of transport infrastructure in certain regions or areas can limit the accessibility of energy-efficient options, particularly in rural or underserved communities. • Limited public awareness and understanding of the benefits of energy-efficient transport options can lead to scepticism or indifference towards adopting such modes of travel.
Implementation steps	• Develop a comprehensive and well-integrated transit plan that considers factors such as population density, travel patterns, urban development, and transportation demand. A holistic approach ensures that the transit network meets the needs of various user groups. • Implement targeted campaigns to promote modal shift from private vehicles to public transit. Educate the public about the environmental, economic, and health benefits of using public transit while addressing concerns such as safety, cleanliness, and convenience.

Outstanding considerations for Estonia

- Establish if certain areas will be prioritised for new measures such as historical underserved, rural areas, or low-income areas in need of transport.

4.6.10 nT11 – Developing the railroad infrastructure (includes the building of Rail Baltic)

This measure focuses on the development and improvement of railroad infrastructure to facilitate efficient rail transport for the general population. The primary goal is to enhance the accessibility, reliability, and convenience of rail travel, encouraging people to opt for train transportation as a sustainable and efficient mode of travel.

In line with this objective, the measure includes the construction and enhancement of Rail Baltic, a major cross-border railway project connecting several European countries. Rail Baltic will serve as a high-speed rail corridor, offering seamless connectivity and improved travel times between different regions.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party:** Estonian rail company
- ✓ **Administrator:** government
- ✓ **Implementing body:** Ministry of Climate
- ✓ **Final payer:** taxpayers, as the measure would be funded with public budget
- ✓ **Beneficiary:** All citizens

Key considerations of the measure

Table 4-36 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-36 Key considerations for Developing the railroad infrastructure (includes the building of Rail Baltic)

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • By linking the Baltic States with the broader European railway network, the Rail Baltic project fosters regional integration, enhancing mobility and facilitating cross-border travel, trade, and tourism.
Cons	• The development of large-scale rail infrastructure projects like Rail Baltic requires significant financial investments. Funding challenges and cost overruns may pose financial burdens to the governments involved. • Rail infrastructure projects are complex and time-consuming. Delays in planning, permitting, and construction can prolong the timeline for completion, leading to extended disruptions and increased costs.
NUTS3 impact	• Due to lack of existing local rail infrastructure, EE004 remains unaffected.
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Incorporating advanced technologies such as high-speed rail or automated systems presents risks related to technology adoption, system integration, and potential maintenance and operational challenges. • If not planned and implemented inclusively, railroad projects could lead to unequal access for certain communities, leaving them underserved and exacerbating social and economic disparities.
Modelling Assumptions	• **Energy savings target:** Based on calculations by Finantsakadeemia OÜ. Construction of electrified railway connection between Estonia, Latvia and Lithuania, which runs form Tallinn via Riga to Lithuanian-Polish border. • **Calculated savings:** 339.4 GWh of additional savings in 2027; • **Investment cost:** €1 351 million from 2021 to 2030; • **Burden of the investment**: 100% government, which large parts are funded by the EU; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Securing suitable land for rail corridors can be challenging, especially in densely populated or developed areas. Negotiations with landowners, potential conflicts with existing land uses, and compensation issues can impede progress. • Fragmented transportation planning that fails to consider the synergies between different modes of transport can hinder the development of efficient rail systems.
Implementation steps	• Conduct a comprehensive assessment of transport needs, traffic patterns, and connectivity. Develop a well-defined plan that outlines the scope, objectives, and potential routes for the railroad infrastructure. • Engage with relevant stakeholders, including local communities, government agencies, environmental groups, and transport experts. Collect feedback and address concerns to ensure a holistic and inclusive approach.

Outstanding considerations for Estonia

- To facilitate smooth and efficient rail travel, interoperability and standardization of equipment and systems across different regions should be considered.

4.6.11 nT12 – Railroad electrification

The objective of this measure is to develop the electrification of railroads in order to decrease the amount of CO2 emitted by rail transport. By transitioning from diesel-powered locomotives to electric trains, the

measure aims to promote a greener and more sustainable rail transportation system. Electrification allows trains to run on electricity, which can be generated from renewable energy sources, leading to significant reductions in greenhouse gas emissions and air pollution.

Concerned stakeholders

National and regional rail transport authorities play a pivotal role in the planning and execution of the electrification projects. They assess the scope and feasibility of electrification in different rail corridors and establish long-term electrification strategies. Managers responsible for railway infrastructure are crucial stakeholders in the electrification process. They oversee the modification and enhancement of rail tracks and facilities to accommodate electrified trains.

The concerned stakeholders are the following:

- ✓ Obliged party: Estonian rail company
- ✓ Administrator: government
- ✓ Implementing body: Ministry of Climate
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ Beneficiary: The measure's primary beneficiaries are rail passengers and freight shippers

Key considerations of the measure

Table 4-37 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-37 Key considerations for Railroad electrification

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • By replacing diesel engines with electric propulsion, the measure helps reduce air pollutants, improving air quality around rail corridors and urban areas.
Cons	• Ensuring sufficient electricity supply and grid connectivity along rail pathways can be a challenge, especially in remote or rural areas. • Electrification projects can involve significant upfront investment for railway infrastructure.
NUTS3 impact	• Cf. previous measure
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Ambiguous or inconsistent electrification policies, such as regulatory uncertainty, lack of incentives, or mixed messages about government commitment, can deter investment and slow down electrification efforts.
Modelling Assumptions	• **Energy savings target:** 88.8 GWh of additional savings from 2021 to 2030; • **Calculated savings:** Based on calculations by Finantsakadeemia OÜ. First sections of the electric railway starting in 2020 up to 2028. The project scope includes construction of new contact lines across 680 km. • **Investment cost:** €381 million from 2021 to 2030, based on costs provided by MKM; • **Burden of the investment**: 100% government, which large parts are funded by the EU; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Adapting existing rail infrastructure to accommodate electrification can be complex and costly. Compatibility issues between different electrification systems, as well as the need to upgrade tracks, stations, and signalling systems, can lead to delays and higher-than-expected costs.
Implementation steps	• Establish streamlined and expedited regulatory procedures for environmental assessments, permitting, and land acquisition. Provide a single point of contact for project coordination and approvals.

	• Engage early on with local communities, businesses, and environmental groups in the planning process to address concerns and build support. Develop comprehensive communication strategies to highlight the benefits of electrification and address misconceptions.

Outstanding Considerations for Estonia

- Define which energy sources will be used for electrification, and how sustainable and environmentally friendly are they.
- Assess if the electrical grid has the capacity to support the increased demand for electricity due to electrification and if there are any potential issues with grid stability and reliability that need to be addressed.
- Analyse what modifications or replacements are needed for the existing fleet of diesel locomotives to transition to electric trains. If so, establish the costs and timelines associated with fleet electrification.

4.6.12 nT13 – Promoting the use of biomethane in buses

The objective of this measure is to promote the use of biomethane in buses by supporting the purchase of buses using biomethane via a grant. The primary goal is to reduce the carbon footprint of public transportation and promote the use of renewable and low-carbon energy alternatives.

The measure focuses on the public transport sector, specifically buses, which are a major contributor to urban emissions. By promoting the use of biomethane in buses, the measure aims to significantly reduce greenhouse gas emissions and air pollution from public transportation.

Concerned stakeholders

The measure will encourage and support biomethane suppliers, such as biogas plants and renewable energy companies, to expand their production and distribution capabilities to meet the growing demand from the public transport sector. Bus operators and public transport agencies will be the main beneficiaries of this measure. They will have the opportunity to receive grants or financial incentives to purchase new buses that run on biomethane.

Local governments and transport authorities play a critical role in the implementation of this measure. They will be involved in coordinating with biomethane suppliers, bus operators, and other stakeholders to facilitate the transition to biomethane-powered buses.

The concerned stakeholders are the following:

- ✓ Beneficiary: Estonian public transport or bus companies
- ✓ Administrator: government
- ✓ Implementing body: Ministry of Climate
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ Beneficiary: Local authorities

Key considerations of the measure

Table 4-38 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-38 Key considerations for Promoting the use of biomethane in buses

Parameter	Description
Pros	• Biomethane is a renewable and low carbon fuel and using it in buses can significantly reduce greenhouse gas emissions and air pollutants, contributing to improved air quality and climate goals. • Biomethane is produced from organic waste and biomass, which can be sourced locally. This enhances energy security and reduces dependence on imported fossil fuels. • Lower emissions from biomethane-powered buses lead to improved public health outcomes, as cleaner air results in reduced respiratory and cardiovascular issues.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Expanding the infrastructure for biomethane production and distribution may require substantial investments and planning to ensure a reliable and consistent supply. • Biomethane-powered buses may have higher upfront costs compared to traditional diesel buses. Grants or financial incentives will be essential to bridge the cost gap and encourage adoption. • Transitioning to biomethane-powered buses may require training and adjustments to maintenance practices to ensure efficient and reliable operation.
NUTS3 impact	• Cf previous measure
Energy price impact	• This measure has no direct impact on energy prices
Key risks	• Ensuring a consistent and reliable supply of biomethane can be challenging due to factors such as feedstock availability, production capacity, and distribution infrastructure. Reliance on limited sources can lead to supply disruptions. • Inadequate availability of biomethane refuelling stations can limit the operational range and accessibility of biomethane-powered buses.
Modelling Assumptions	• **Energy savings target:** 0.8 GWh of additional energy consumption each year; • **Calculated savings:** 6.75% of travels affected[105] (Fleet size = 771,717).[106] Public fuel usage in Estonia is based on OSPA. -22% effect on motive energy consumption • **Investment cost:** No implementation cost; • **Burden of the investment**: 50% government support.; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• /
Implementation steps	• Invest in the development of a robust biomethane refuelling network (nT5) by collaborating with private sector partners and providing incentives for refuelling station construction. • Launch educational campaigns to raise public awareness about the benefits of biomethane as a clean and sustainable transport fuel. Address misconceptions and promote the environmental and economic advantages of biomethane-powered buses.

Outstanding considerations for Estonia

- What percentage of the full purchase cost of the bus using biomethane would the grant cover?
- What infrastructure changes are needed to support the use of biomethane in buses? How will the existing refuelling infrastructure be adapted to accommodate biomethane?

[105] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[106] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

- hat are the quality standards and regulations for biomethane as a vehicle fuel? How will fuel quality and safety be ensured throughout the supply chain?

4.6.13 nT14 – Promoting the use of electricity in buses

The objective of this measure is to accelerate the adoption of electric buses in the public transport sector, with a focus on promoting the use of electricity as a clean and sustainable energy source. The measure aims to support the transition from traditional fossil fuel-powered buses to electric buses by providing financial incentives in the form of grants for the purchase of electric buses.

The scope of this measure includes the deployment of electric buses in urban and suburban public transportation systems, with the primary goal of reducing greenhouse gas emissions, air pollution, and dependence on fossil fuels. By encouraging the use of electricity in buses, the measure contributes to improving urban air quality, combating climate change, and promoting sustainable transportation solutions.

Concerned stakeholders

Electric bus manufacturers and suppliers are essential stakeholders in the implementation of this measure. As demand for electric buses increases, they play a vital role in providing the market with a variety of electric bus models that meet the needs of different transit agencies. The successful adoption of electric buses relies on the availability of a reliable charging infrastructure. Charging infrastructure providers are important stakeholders in this measure, as they will work with public transport agencies to establish and maintain charging stations for electric buses.

The concerned stakeholders are the following:

- ✓ Beneficiary: Public transport agencies and operators are the main recipients of the grants provided under this measure. They are responsible for managing and operating public transportation services and will be encouraged to replace conventional diesel or gasoline-powered buses with electric buses.
- ✓ Administrator: government
- ✓ Implementing body: Ministry of Climate - Local governments and authorities are crucial partners in the implementation of this measure. They are responsible for transportation planning and policy-making, and their support and cooperation are instrumental in creating a conducive environment for electric bus deployment.
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ **Beneficiary:** Citizens and commuters in urban and suburban areas are indirect beneficiaries of this measure. The adoption of electric buses leads to cleaner and quieter public transportation, resulting in improved air quality and reduced noise pollution, benefiting the overall well-being of the community.

Key considerations of the measure

Table 4-39 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-39 Key considerations for Promoting the use of electricity in buses

Parameter	Description

Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks • Electric buses produce zero tailpipe emissions, contributing to a significant reduction in greenhouse gas emissions and air pollutants, leading to improved air quality and public health. • Electric buses are more energy-efficient compared to conventional buses, resulting in reduced energy consumption and operating costs for public transport agencies.
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors • Electric buses typically have higher upfront costs than traditional buses, making financial incentives like grants crucial in bridging the cost gap and encouraging adoption. • Ensuring sufficient range and minimizing charging time for electric buses are challenges that need to be addressed to meet operational demands.
NUTS3 impact	• Cf. previous
Energy price impact	• This measure has no direct impact on energy price
Key risks	• The transition to electric buses requires a robust charging infrastructure (nT4). Ensuring an adequate number of charging stations, their accessibility, and compatibility with various bus models is crucial. Inadequate infrastructure could lead to operational disruptions and range anxiety for electric buses. • Electric buses' operational range and battery life are critical factors. Cold weather conditions in Estonia could impact battery performance, reducing the buses' range and potentially causing service disruptions. Ensuring reliable and efficient operations in all weather conditions is essential.
Modelling Assumptions	• Energy savings target: • **Calculated savings:** Based on calculations by MKM. 0.5 GWh of additional savings in 2023; • **Investment cost:** €0 million from 2021 to 2030; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Delays in obtaining permits for installing charging infrastructure and challenges related to grid capacity can slow down the deployment of electric buses.
Implementation steps	• Conduct an overview of existing infrastructure for electric charging as well as an assessment of available vehicles to ensure there is no disruption to service while buses are charging and making sure range needs are met. • Invest in the development of a well-planned and comprehensive charging infrastructure network. Identify strategic locations for charging stations, including depots, terminals, and key routes, and ensure compatibility with various bus models. • Provide training programmes for bus operators, drivers, and maintenance personnel to ensure they are well-equipped to handle electric buses' unique requirements, from driving techniques to maintenance procedures.

Outstanding considerations for Estonia

- Establish what percentage of the full purchase cost of the electric bus would the grant cover.
- Assess the current and expected future advancements in electric bus technology, and how will they impact fleet procurement decisions.
- Clarify where the electricity comes from, and what are the associated greenhouse gas emissions. Analyse if the use of electricity in buses contribute to overall emissions reduction goals.
- Assess how long does it take to charge electric buses fully and if charging times be minimised to maintain efficient bus operations throughout the day.

4.6.14 nT15 – Acquisition of additional passenger trains

The objective of this measure is to enhance and expand the existing rail transport services by acquiring additional passenger trains. By increasing the rail transport offer, the measure seeks to improve the efficiency, capacity, and overall quality of passenger rail services. The focus is on providing better and more convenient travel options for commuters and travellers, reducing congestion on roads, and promoting sustainable and eco-friendly transportation alternatives. Railway operators, both public and private, are involved in the procurement and operation of the new passenger trains. They collaborate with transport authorities to ensure seamless integration and efficient use of the acquired trains.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: Elron
- ✓ Administrator: government
- ✓ Implementing body: Ministry of Climate, Elron - the national rail operator
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ Beneficiary: The measure's primary beneficiaries are the commuters and travellers who rely on rail transport for their daily commutes and long-distance travel. The increased availability of passenger trains offers them more frequent and convenient travel options.

Key considerations of the measure

Table 4-40 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-40 Key considerations for Acquisition of additional passenger trains

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • The acquisition of additional passenger trains leads to increased service frequency and capacity, providing better mobility options for passengers. • Rail transport is generally more energy-efficient and produces fewer greenhouse gas emissions compared to road-based transportation, contributing to environmental sustainability. • Works in collaboration with other measures, in particular expanded infrastructure
Cons	• The existing rail infrastructure may need to be adapted to accommodate the new trains, which can require additional investments and planning. • Integrating the new trains into existing rail networks seamlessly requires coordination among different stakeholders, including infrastructure managers and railway operators.
NUTS3 impact	• Cf. previous measure
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Introducing new passenger trains should align with the existing rail infrastructure, signalling systems, and platforms. Incompatibility could lead to operational disruptions and increased costs for necessary modifications.
Modelling Assumptions	• **Energy savings target:** acquisition of six hybrid trains; • **Calculated savings:** Based on calculations by Finantsakadeemia OÜ., 10.8 GWh of additional savings each year from 2021 to 2023 for 6 trains • **Investment cost:** €60 million from 2021 to 2030, based on the acquisition of six hybrid trains; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions

Individual policy impacts & barriers	• Lengthy procurement processes and bureaucratic hurdles can delay the acquisition of new trains, impeding efficient implementation and responsiveness to changing transportation needs.
Implementation steps	• Develop a comprehensive long-term rail transportation strategy that aligns with Estonia's energy efficiency and sustainability goals. Identify routes with the highest passenger demand, as well as currently underserved routes, and prioritise their electrification and modernization. • Secure funding from multiple sources, such as government funds, EU grants, and public-private partnerships. Streamline the procurement process (nT1) while ensuring transparency, fair competition, and compliance with procurement regulations.

4.6.15 nT16 – New tram lines in Tallinn

The measure aims to enhance public transportation in Tallinn by constructing new tram lines, thereby expanding the existing network and improving overall accessibility and connectivity within the city. The addition of new tram lines is driven by the objective of providing residents and visitors with more convenient and efficient travel options, ultimately reducing dependence on private vehicles and alleviating traffic congestion.

By building new tram lines, the public transport offer in Tallinn is set to undergo significant improvements. Trams are known for their capacity to carry large numbers of passengers, offering a more sustainable alternative to individual car use. As a result, this measure aligns with the city's broader goals of promoting sustainable mobility, reducing greenhouse gas emissions, and improving air quality.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: AS Tallinna Linnatransport
- ✓ Administrator: Municipal government
- ✓ Implementing body: Ministry in charge of Urban Planning or Mobility and Transport
- ✓ Final payer: taxpayers, as the measure would be funded with public budget
- ✓ Beneficiary: Citizens and visitors of Tallinn

Key considerations of the measure

Table 4-41 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-41 Key considerations for New tram lines in Tallinn

Parameter	Description
Pros	• Stimulates the use of low carbon transport modes • By encouraging more people to use public transport, the new tram lines can help reduce traffic congestion on the city's roads. This can lead to shorter travel times and a smoother flow of traffic for both public transport users and motorists. • Trams are generally more accessible to people with mobility challenges compared to other modes of transport, such as buses with steep steps. The new tram lines can improve the overall inclusivity and accessibility of public transportation in the city.
Cons	• The construction of new tram lines may cause temporary disruptions and inconveniences to residents, businesses, and motorists in the affected areas. Road closures and detours during construction can lead to traffic diversions and longer travel times.

	• Tram tracks require dedicated space on the road, which may lead to conflicts with other road users and pose challenges in densely populated areas with limited available space.
NUTS3 impact	• Cf. previous measure
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Navigating the regulatory landscape, obtaining necessary permits, and complying with environmental and safety regulations can be time-consuming and complex, potentially causing delays in project implementation.
Modelling Assumptions	• Energy savings target: ; • **Calculated savings:** 59.9 GWh of additional savings in 2025, based on calculations by MKM. • **Investment cost:** €55 million in 2025; • Burden of the investment: 100% government; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Building new tram lines requires significant infrastructure development, including tracks, stations, and electrification systems. Technical challenges in ensuring alignment with existing roads, managing intersections, and integrating with other transportation modes can lead to delays and cost overruns. • Effective coordination among various government agencies, city planners, transportation authorities, and other stakeholders is crucial to ensure a streamlined approval process and a well-coordinated implementation plan.
Implementation steps	• Conduct a comprehensive feasibility study to identify potential routes, assess ridership demand, and determine technical and financial viability. Consider factors such as existing traffic patterns, population density, and potential for economic development along the route. • Collaborate with key stakeholders along the value chain (urban planners, architects, engineers, and transportation experts) to design the tram line layout, station locations, and integration with existing infrastructure. Prioritise energy-efficient features, accessibility, and safety.

Outstanding considerations for Estonia

- Plan tram routes carefully to ensure optimal connectivity with existing public transport networks, including buses and trains. Define how the new tram lines will integrate with other modes of transport. Define how the necessary land acquisition and right-of-way agreements been secured for the construction of the tram lines and identify any potential legal or logistical challenges related to land use.

4.6.16 nT17 - Subsidy for micro/active mobility usage instead of personal vehicles

The measure to provide a subsidy for micro-mobility usage instead of personal vehicles aims to incentivise individuals to opt for small, lightweight vehicles such as bikes, scooters, and e-bikes for short-distance trips within the city. The scope of this measure would target urban and suburban areas where short-distance travel is common.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: N/A
- ✓ Administrator: Government
- ✓ Implementing body: Responsible for implementing and managing the subsidy programme, ensuring its effectiveness and reaching the target audience.

- ✓ Final payer: Companies offering bike-sharing, scooter-sharing, and e-bike-sharing services, who would partner with the city to facilitate the subsidy programme.
- ✓ Beneficiary: The main beneficiaries of the subsidy, incentivising them to use micro-mobility options for their daily travel needs.

Key considerations of the measure

Table 4-42 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-42 Key considerations for Subsidy for micro/active mobility usage instead of personal vehicles

Parameter	Description
Pros	• Encouraging micro-mobility usage can lead to a decrease in greenhouse gas emissions and air pollution, contributing to improved air quality and public health. • Increased adoption of micro-mobility options can reduce traffic congestion, especially for short-distance trips, making urban areas more pedestrian and bike-friendly. • Micro-mobility options are generally more cost-effective than personal vehicle ownership, and the subsidy can further incentivise cost-conscious commuters to opt for these alternatives.
Cons	• Micro-mobility vehicles have limited range and may not be suitable for longer commutes or specific travel needs, leading to potential modal restrictions for some individuals. • Adverse weather conditions may discourage micro-mobility usage, especially during extreme heat, rain, or snow, limiting the effectiveness of the subsidy during such times. • Safety concerns and public opinion dislike of poor operating
NUTS3 impact	• These might be more useful in urban areas with a high transport density
Energy price impact	• Investment in infrastructure and adaptation for micro mobility has no impact on energy prices
Key risks	• Subsidized micro-mobility could attract users with varying levels of experience and adherence to traffic rules. Irresponsible riding behaviour, lack of helmet usage, and inadequate knowledge of road safety rules may increase the risk of accidents and injuries. • While subsidizing micro-mobility can be a greener alternative, it's important to consider equity and accessibility for all residents. Low-income communities may face barriers to accessing micro-mobility services, particularly if the subsidy model is not inclusive.
Modelling Assumptions	• **Energy savings target: 0.5**% of travels affected[107] (Fleet size = 771,717).[108] Public fuel usage in Estonia is based on OSPA. 100% effect on motive energy consumption. 42% of urban travel affected.; • **Calculated savings:** 23 GWh of additional energy savings in 2025 and 12 GWh of additional energy savings each year after; • **Investment cost:** EUR 0.39 million each year, based on €100 per vehicle affected; • **Burden of the investment**: 100% government support.; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Establishing clear regulations and licensing requirements for micro-mobility operators and users is essential to ensure safe and responsible usage. Balancing the need for regulation with fostering innovation and competition can be challenging. • Coordinating micro-mobility services with existing public transportation networks requires policy alignment, data sharing, and fare integration.

[107] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[108] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

	Addressing potential conflicts and ensuring smooth transitions between different modes of transport can be complex.
Implementation steps	• Identify areas with high demand for micro-mobility services and invest in appropriate infrastructure (nT3), such as bike lanes, docking stations, and charging infrastructure for electric vehicles ((nT4). • Develop comprehensive regulations that cover safety standards, user behaviour, licensing requirements for operators, data sharing protocols, and liability considerations. Collaborate with stakeholders to strike a balance between innovation and safety.

Outstanding considerations for Estonia

- Define how the grant would be administered and who would qualify.
- Establish the rules or safety measures are in place or need to be in place to implement this measure in line with public safety needs.

4.6.17 nT18 - All Tallinn and Tartu taxis to run on electricity

In order to further offer taxi service in the city to companies and private individuals, setting a condition that companies must use an electric vehicle to transport passengers (the condition can be set when issuing a driving card).

This measure would be heavily reliant on nT4 in terms of charging infrastructure.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: Taxi companies and operators
- ✓ Administrator: Taxi companies and municipalities
- ✓ Implementing body: Taxi companies and municipalities
- ✓ Final payer: Taxi companies and municipalities
- ✓ Beneficiary: General public

Key considerations of the measure

Table 4-43 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-43 Key considerations for All Tallinn and Tartu taxis to run on electricity

Parameter	Description
Pros	• Encouraging the use of electric vehicles in taxi services can significantly reduce greenhouse gas emissions and local air pollution, contributing to improved air quality and public health in the city. • By mandating the use of EVs for taxi services, the measure can stimulate the adoption of electric vehicles in the commercial sector, leading to a larger EV market share and supporting the growth of charging infrastructure. • Implementing green policies in taxi services can improve the city's image and reputation among environmentally conscious citizens and visitors, enhancing its appeal as a sustainable and forward-thinking city.
Cons	• Taxi companies may face higher initial costs when transitioning to electric vehicles, including purchasing EVs, installing charging infrastructure, and training drivers in EV operation and maintenance. • Concerns about EV range and charging infrastructure availability could arise among taxi drivers, potentially impacting their willingness to adopt electric vehicles for their services.

NUTS3 impact	• Cf. previous measure
Energy price impact	• This measure has no direct impact on energy price
Key risks	• A lack of sufficient and accessible charging infrastructure (nT4) could result in range anxiety for taxi drivers. Inadequate charging options could limit the operational viability of electric taxis and hinder their widespread adoption. • The current limitations of EV technology, such as shorter driving ranges compared to conventional vehicles and longer charging times, might affect the ability of taxi drivers to provide continuous service without significant downtime.
Modelling Assumptions	• **Energy savings target:** 0.31% of travels affected[109] (Fleet size = 771,717).[110] • **Calculated savings:** Public fuel usage in Estonia is based on OSPA. 34% effect on motive energy consumption. 0.8 GWh of additional energy savings per year; • **Investment cost:** EUR 0.24 million each year, based on €100 per vehicle affected; • **Burden of the investment**: 50% government support and 50% taxi companies; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Ensuring that the government offers attractive incentives, such as tax breaks, grants, or subsidies, can offset the higher upfront costs of electric taxis and incentivise taxi operators to transition.
Implementation steps	• Collaborate with private and public entities to rapidly expand the charging infrastructure network in major cities like Tallinn and Tartu (nT4). This should include fast-charging stations strategically located to serve the taxi fleet. • Launch public procurement initiatives to encourage taxi companies to transition their fleets to electric vehicles (nT1). Public tenders that prioritise electric taxis could create a substantial demand, encouraging vehicle manufacturers to provide suitable options. • Provide transition support packages that include financial assistance, training, and technical support to help taxi operators make a smooth switch to electric vehicles.

Outstanding considerations for Estonia

- Establish if there would be a grant or other support instrument to facilitate the transition.
- Assess if there is sufficient charging infrastructure to support the increased number of electric taxis. Define how charging stations be strategically located to ensure convenient access for taxi operators.
- Assess where the electricity comes from to charge electric taxis, and what are the associated greenhouse gas emissions.
- Assess how the operational cost of electric taxis compare to conventional gasoline or diesel taxis and if there are long-term cost savings for taxi operators.

4.6.18 nT19 Tallinn and Tartu congestion charge

Congestion charging is a flexible road use tax for cars and vans to reduce motor vehicle traffic during peak hours. The objective of this measure is to alleviate traffic congestion, improve air quality, and promote sustainable transportation alternatives.

[109] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[110] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ Obliged party: Drivers during peak hours
- ✓ Administrator: local transportation authorities
- ✓ Implementing body: Municipal government and transportation authorities
- ✓ Final payer: Drivers
- ✓ Beneficiary: Government collecting the tax revenue

Key considerations of the measure

Table 4-44 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-44 Key considerations for Tallinn and Tartu congestion charge

Parameter	Description
Pros	• By imposing charges during peak hours, congestion charging can discourage unnecessary car trips and encourage the use of alternative transportation modes such as public transit, cycling, or walking. This can lead to a significant reduction in traffic congestion and smoother traffic flow. • Reducing the number of cars during peak hours can contribute to improved air quality in congested urban areas. Lower levels of vehicle emissions can help combat air pollution and its associated health issues. • Congestion charging can generate revenue for the local government, which can be reinvested in improving public transportation services, developing cycling infrastructure, and promoting sustainable urban planning.
Cons	• congestion charging may disproportionately affect low-income residents who rely on their cars for commuting and have limited access to alternative transportation. It may be perceived as regressive, impacting those with lower incomes more than affluent individuals. • Implementing and managing a congestion charging system can be administratively complex, requiring robust technology, proper enforcement mechanisms, and coordination between various agencies. • may face opposition from motorists, businesses, and other stakeholders who perceive it as an additional financial burden. Public support and acceptance are crucial for the successful implementation of such measures.
NUTS3 impact	• cf. previous measure
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Congestion charges might disproportionately affect lower-income individuals who rely on personal vehicles due to limited alternative transportation options. • The introduction of congestion charges could have economic repercussions on businesses, particularly those reliant on vehicle transportation for their operations.
Modelling Assumptions	• **Energy savings target:** 0% of travels affected[111] (Fleet size = 771,717).[112] • **Calculated savings:** Public fuel usage in Estonia is based on OSPA. 0% effect on motive energy consumption. 0 GWh of additional energy savings per year; • **Investment cost:** EUR 0.1 million each year for implementation;

[111] https://toolsofchange.com/en/case-studies/detail/131; https://www.itf-oecd.org/sites/default/files/docs/decarbonising-transport-europe-way-forward.pdf
[112] https://avaandmed.eesti.ee/datasets/soidukite-staatused-eestis; https://www.riigikontroll.ee/DesktopModules/DigiDetail/FileDownloader.aspx?AuditId=2404&FileId=13753

	• **Burden of the investment**: 100% government for cost implementation. Road users cover the cost of charges; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Overcoming public resistance requires effective communication about the benefits of congestion charges, emphasizing reduced traffic congestion, improved air quality, and better public transportation options. • Developing policies to address the potential negative impact on low-income individuals, such as offering exemptions or discounts for specific groups, can help alleviate equity concerns.
Implementation steps	• Conduct thorough traffic and transportation assessments to determine the optimal areas and times for congestion charges. Develop a comprehensive implementation plan that outlines the timeline, fee structure, and exemptions. • Develop a clear communication strategy to educate the public about the rationale behind congestion charges, the benefits they bring, and how revenue will be reinvested in improving public transportation and urban infrastructure. • Ensure that the revenue generated from congestion charges is transparently reinvested into sustainable urban transportation infrastructure and services, such as expanding public transit options and enhancing cycling facilities.

Outstanding considerations for Estonia

- Determine what the tax would be and who/how it would be enforced.
- Clarify if there are any exemptions from the tax.

4.7 Agroforestry

4.7.1 nA1 - Audits in large agricultural holdings

The aim of this measure is to promote energy savings in the agricultural sector by offering support for energy and resource audits in large agricultural holdings. These audits serve as enabling measures, as they don't directly lead to energy savings but play a crucial role in mapping the enterprise's energy consumption and suggesting energy and resource efficiency improvements. To facilitate this process, grants will be provided to large agricultural holdings seeking to conduct energy and resource audits for their operations.

Concerned stakeholders

The beneficiaries of this measure are large agricultural holdings.

The concerned stakeholders are the following:

- ✓ **Obliged party:** enterprises in agriculture sector
- ✓ **Administrator**: agricultural Registers and Information Board (PRIA)
- ✓ **Implementing body**: Ministry of Regional Affairs and Agriculture
- ✓ **Final payer**: taxpayer as the grant will be funded via public budget
- ✓ **Beneficiary**: agricultural enterprises

Key considerations of the measure

Table 4-45 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-45 Key considerations for Audits in large agricultural holdings

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors
NUTS3 impact	• No significant differences between NUTS3 areas. No significant regional differences are expected.
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Many agricultural holdings may lack awareness of the benefits of energy audits or may be resistant to change due to perceived costs and disruptions to their operations. • Conducting comprehensive energy audits requires technical expertise, and there may be challenges in finding qualified professionals to perform accurate assessments and provide practical recommendations.
Modelling Assumptions	• Enabling measure (no impact to modelling results)
Individual policy impacts & barriers	• The diverse nature of agricultural operations makes it challenging to develop standardized energy audit procedures that cater to the specific needs of different types of holdings. • Without appropriate incentives or subsidies, agricultural holdings may be hesitant to undergo energy audits and implement energy-efficient measures due to concerns about costs. • Additional training for new and/or existing energy- and resource auditors may be required before the implementation of the measure.
Implementation steps	• Launch an awareness campaign targeting agricultural stakeholders to highlight the benefits of energy audits and energy efficiency measures, showcasing success stories from similar holdings. • Offer training and workshops for energy auditors specialized in agricultural holdings. Develop certification programmes to ensure a consistent level of expertise across auditors. • Develop a flexible audit methodology that accounts for the diversity of agricultural holdings and their specific energy consumption patterns. This approach should ensure that audits are practical and actionable for each type of operation.

Outstanding considerations for Estonia

- Determining the overall percentage of the cost of the energy audit that the grant will cover.
- Defining the minimum size of a “large agricultural holding.”

4.7.2 nA2 – Energy efficiency measures in the fisheries sector

The objective of this measure is to stimulate energy savings in the fisheries sector by supporting the implementation of energy efficiency measures. Support will be provided via a grant. Companies from the fisheries sector may apply for the grant when they implement energy efficiency measures.

Only the measures that are listed in the eligibility list may benefit from the grant.

Concerned stakeholders

The beneficiaries of this measure are companies in the fisheries sector that implement eligible energy efficiency measures. Voluntary agreement scheme is seen as a prerequisite to apply for the grant to ensure that the fisheries are dedicated to reach energy saving targets.

The concerned stakeholders are the following:

- ✓ **Obliged party**: fisheries
- ✓ **Administrator**: agricultural Registers and Information Board (PRIA)
- ✓ **Implementing body**: Ministry of Regional Affairs and Agriculture
- ✓ **Final payer**: taxpayer as the grant will be funded via public budget
- ✓ **Beneficiary**: fisheries participating in the voluntary agreement scheme

Key considerations of the measure

Table 4-46 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-46 Key considerations for Energy efficiency measures in the fisheries sector

Parameter	Description
Pros	• Supports projects characterized by high upfront costs, long payback periods or other similar risks
Cons	• Instrument is not sustainable in the long run as they rely on limited resources of investors
NUTS3 impact	• As fisheries operate in coastal areas then areas near bigger lakes and areas near seashore benefit the most from the measure.
Energy price impact	• This measure has no direct impact on energy price
Key risks	• Stakeholders within the fisheries sector, including fishermen and vessel operators, may have limited awareness of energy-efficient practices and technologies. Without proper education and understanding, they might resist adopting new measures. • The absence of financial incentives, grants, or subsidies specifically targeted at energy efficiency in the fisheries sector can discourage operators from adopting energy-efficient measures.
Modelling Assumptions	• **Energy savings target:** 6.8 GWh of additional energy savings per year, with implementation from 2027 to 2030; • **Calculated savings:** Savings factor of 2.0 GWh/y per MEUR support, 6.8 GWh/y new energy savings during 2027-2030. • **Investment cost:** MEUR 5.44 support; • **Burden of the investment**: 40% government support, 60% fisheries; • **Energy price impact:** no direct impact on prices; • See Section 0 for other modelling assumptions
Individual policy impacts & barriers	• Modernizing fishing vessels with energy-efficient technologies can be complex due to the specialized nature of the equipment, potential retrofit challenges, and the need for specialized skills and knowledge.
Implementation steps	• Launch awareness campaigns and training programmes to educate fishermen and vessel operators about the benefits of energy efficiency, potential cost savings, and available technologies. • Establish targeted financial incentives, grants, or subsidies to support the adoption of energy-efficient technologies in the fisheries sector. These incentives can offset the initial costs and encourage wider adoption. • Conduct thorough assessments of available energy-efficient technologies to determine their feasibility and suitability for different types of fishing vessels. Provide guidelines to help operators choose the most appropriate solutions.

Outstanding considerations for Estonia

- Determining the overall percentage of the cost of the energy audit that the grant will cover.
- List of qualifying measures still to be defined.

4.8 Cross-sectoral

4.8.1 nC1 – Green procurement

Green procurement requires public authorities to use their purchasing power to choose environmentally friendly goods, services and works. This measure aims to integrate energy efficiency criteria into the public procurement process.

The scope of implementing green public procurement for energy efficiency is to encourage public authorities, institutions, and organisations to prioritise and purchase energy-efficient products and services. The targeted parties are government agencies at various levels (local, regional, and national), public institutions, and any other entities that are involved in public procurement processes. By incorporating energy-efficient criteria into their procurement decisions, these entities can contribute to reducing energy consumption, greenhouse gas emissions, and overall environmental impact while setting an example for the private sector and promoting the adoption of energy-efficient technologies and practices.

Concerned stakeholders

The concerned stakeholders are the following:

- ✓ **Obliged party**: public authorities
- ✓ **Administrator**: government
- ✓ **Implementing body**: Ministry of Climate
- ✓ **Final payer**: taxpayers as public procurement is funded via public budget and the integration of energy efficiency criteria may lead to the purchase of goods, services and works with a higher price

Key considerations of the measure

Table 4-47 provides the key considerations for the measures, highlighting the pros/cons, regional impacts, energy savings, energy price impact, modelling assumptions, and key risks.

Table 4-47 Key considerations for Green procurement

Parameter	Description
Pros	• Allows to increase the contribution of public authorities to sustainable consumption and production • Stimulates a critical mass of demand for more sustainable goods and services which otherwise would be difficult to get onto the market • Takes into account lifecycle energy use and energy efficiency • Operating costs may be lower for products that take into account energy efficiency
Cons	• Public Procurement Act requires that procurements are objective, adding additional criteria complicates tendering process. Initial cost of investment can increase. • Additional criteria may increase initial cost of procurement.
NUTS3 impact	• No impact on different regions of Estonia as obligation for green procurements would be on both local and state level.
Energy price impact	• No direct impact on the price of energy.
Key risks	• The market for energy-efficient products and services might not be well-developed, leading to a shortage of suppliers capable of meeting the procurement requirements. This can result in limited competition and higher costs.

	• The absence of comprehensive guidelines or standards for energy-efficient procurement can create confusion among procurement officers, hindering the adoption of energy-efficient products.
Individual policy impacts & barriers	• Implementing green procurements may be problematic for local authorities because of the requirements for procurements. Usually, price is considered as the most important evaluation criteria, local authorities might need counselling to overcome this barrier.
Implementation steps	• Engage with suppliers, manufacturers, and vendors to understand the availability of energy-efficient products and technologies and encourage them to offer such options. • Conduct thorough lifecycle cost analysis that considers not only upfront costs but also long-term energy savings. This analysis can demonstrate the overall cost-effectiveness of energy-efficient products. • Collaborate with industry associations and market players to promote the development of a competitive market for energy-efficient products and services. Encourage innovation and product diversity.

Outstanding considerations for Estonia

- Define qualifying criteria for public procurement.

5 Pathway analysis/Impact assessment

Chapter 5 provides an in-depth view of the five policy pathways to assess the optimal level of ambition to reach the energy efficiency targets in Estonia. It contains

- Complementing chapter 3, section 5.1 precises the content of each pathway, to clarify exactly which EE measures are included;
- Section 5.2 exposes the methodology and content of the assessment, showing the major assumptions that are used
- Section 5.3 assesses the Energy Efficiency Obligation Scheme (EEOS) pathway
- Section 5.4 assesses the Voluntary Agreement (VA) pathway
- Section 5.5 assesses the Renovation Wave Pathway (RenoWave)
- Section 5.6 assesses the Energy Efficient Transport (EET) pathway
- Section 5.7 assesses the Comprehensive Energy Efficiency Reform 1 (CEER1) pathway
- Section 5.8 assesses the Comprehensive Energy Efficiency Reform 2 (CEER2) pathway

5.1 Pathways' definition and assumptions

5.1.1 Pathway definition

These pathways are composed of the policy measures (described under chapter 4), and have different impacts and implications.

This section therefore includes a discussion of the energy savings potential of each pathway, as well as their compliance with meeting the European Union energy efficiency target of 1.49% energy savings on average between 2024 and 2030, while assessing their impacts.

Each pathway analysis includes an overview of the key differentiating policy measures utilized to make up the pathway (based on the measures and policies discussed in Chapters 4 and 5), as well as an impact assessment of the relevant costs, savings, macro-economic and environmental impacts. The analysis also contains a review of the associated risks, as well as a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis for the composition of measures.

All existing measures are implemented throughout all pathways. In addition, there are several new measures that are implemented throughout all pathways. Therefore, each pathway analysis under this chapter will primarily focus on the unique measures that impact the outcome of the policy pathway analysis.

Table 5-1 Table of (existing and new) measures per pathway

e = existing n = new		Baseline	EEO	VA	Renowave	EET	CEER1	CEER2
Residential								
eR1	Renovation of apartment buildings (2014-2020)	F	F	F	F	F	F	F
eR2	Renovation of private buildings (2019-present)	F	F	F	F	F	F	F
eR3	Renovation of rental apartments (2016-present)	F	F	F	F	F	F	F
eR4	Atmospheric air protection programme (2014-present)	F	F	F	F	F	F	F
nR1	Obligation scheme for residential sector		F					
nR2	MEPS targeting rented/selling dwellings		F	F		F	F	F

nR3	MEPS for all dwelling (regulatory requirements for EPC class E, F, and G or above)				F			
nR4	Renovation grants for single family houses (20-30% support)		F	P	FF	P	F	F
nR5	Tax deduction for renovation works by private persons (=parallel track for single family)			P	F	P	F	F
nR6	Renovation grants for multifamily buildings/housing associations (30% support)			P	FF	P	P	F
nR7	Property tax (according to EPC levels)				P		F	F
nR8	CO2 tax for end energy use of residential buildings			F	P	P		F
Services								
eS1	Renovation of healthcare centres (2016-on-going)	F	F	F	F	F	F	F
eS2	Modernisation of street lighting (2016-on-going)	F	F	F	F	F	F	F
eS3	Renovation of social care homes (2017-on-going)	F	F	F	F	F	F	F
eS4	Renovation of school buildings (2018-on-going)	F	F	F	F	F	F	F
eS5	Renovation of university and R&D institutions (2016-on-going)	F	F	F	F	F	F	F
eS6	Renovation of kindergarten (2017-on-going)	F	F	F	F	F	F	F
eS7	New childcare and pre-primary education infrastructure (2016-on-going)	F	F	F	F	F	F	F
nS1	Obligation scheme for service sector		F					P
nS2	Central government buildings renovation support (100% support)		F	F	F	F	F	F
nS3	Public and municipality buildings renovation support (60% support in average)		FF	F	FF	F	F	F
nS4	Commercial buildings energy performance investments support		F	P	F	P		
nS5	CO2 certificate sales based on energy savings from commercial buildings renovation, income invested as renovation support			P		P		
nS6	CO2 tax for end energy use of commercial buildings			P	P	P		F
nS7	Property tax (according to EPC levels)		P	P	P	P	F	F
nS8	Minimum energy performance standards for non-residential buildings (regulatory requirements for EPC class E and F)		P	P	F	P	F	P
Industry								
eI1	Energy and resource efficiency in industries (2016-on-going)	F	F	F	F	F	F	F
eI2	Electro intensive enterprises tax reduction (2018-on-going)	F	F	F	F	F	F	F
nI1	Voluntary scheme for the industry, with binding targets based on incentives			FF			F	FF
nI2	Promotion of resource-efficient green technologies of industrial enterprises (RRP)		F	F	P	P	P	F
nI3	Energy savings from electro intensive companies		F	F	P	P	P	P
nI4	Investment support for the food industry to ensure security of energy supply		F	F	P	P	P	P
nI5	Supporting energy efficiency investments in companies		FF	F	P	P	P	F
nI6	Energy consulting and networking events for small and medium enterprises (SMEs)		F	F	P	P	P	F
Transport								
eT1	Eco-driving (2011-ongoing)	F	F	F	F	F	F	F
eT2	Walking and cycling roads (2015-2018)	F	F	F	F	F	F	F
eT3	Mobile speed cameras (2019-on-going)	F	F	F	F	F	F	F
eT4	Time-based road toll for heavy duty vehicles (2018-on-going)	F	F	F	F	F	F	F
eT5	Electric car purchase and rental programme (2019-on-going)	F	F	F	F	F	F	F

nT1	Promotion of clean and energy efficient road transport vehicles in public procurement		P	P	P	F	P	F
nT2	Subsidy for public transport usage instead of personal vehicle		P	P	P	FFF	F	FF
nT3	Priority lanes for micro mobility		P	P	P	F	F	F
nT4	Electric charging infrastructure for existing inhabitance areas		P	P	P	F	F	F
nT5	Biomethane infrastructure							
nT6	Hydrogen infrastructure							
nT7	Vehicle tax for registration		P	P	P	F	F	F
nT8	Annual vehicle tax		P	P	P	F	F	F
nT9	Development of convenient and modern public transport		P	P	P	FF	F	FF
nT11	Developing the railroad infrastructure (includes the building of Rail Baltic)		P	P	P	FF	F	F
nT12	The railroad electrification		P	P	P	F	F	F
nT13	Promoting the use of biomethane in buses							
nT14	Promoting the use of electricity in buses							
nT15	Acquisition of additional passenger trains		P	P	P	F	F	F
nT16	New tram lines in Tallinn		P	P	P	F	F	F
nT17	Subsidy for micro mobility usage instead of personal vehicle		P	P	P	F	F	F
nT18	All Tallinn and Tartu taxis run on electricity		P	P	P	F	F	F
nT19	Tallinn and Tartu congestion charge		P	P	P	F	F	F
	Agriculture/forestry							
eA1	Aid for energy and resource-efficient processing of fishery and aquaculture products (2017-on-going)	F	F	F	F	F	F	F
eA2	Support for improving the energy efficiency of coastal fishing vessels (2019- on-going)	F	F	F	F	F	F	F
nA1	Audits in large agricultural holdings		F	F	F	F	F	F
nA2	Energy efficiency measures in the fisheries sector		F	F	F	F	F	F
	Cross-sectoral							
eC1	Excise and value added tax of natural gas	F	F	F	F	F	F	F
eC2	Excise and value added tax of electricity	F	F	F	F	F	F	F
eC3	Excise and value added tax in heating sector	F	F	F	F	F	F	F
eC4	Excise and value added tax of gasoline	F	F	F	F	F	F	F
eC5	Excise and value added tax of diesel fuel and light fuel oil	F	F	F	F	F	F	F
eC6	Value added tax of firewood	F	F	F	F	F	F	F
eC7	Renewable energy fee	F	F	F	F	F	F	F
eC8	Wood chips and waste VAT	F	F	F	F	F	F	F
eC9	Excise duty on specially marked diesel	F	F	F	F	F	F	F
eC10	Electricity smart meters (2015-on-going)	F	F	F	F	F	F	F
eC11	Energy efficiency investments by electricity distribution companies (2020-on-going)	F	F	F	F	F	F	F
eC12	Profit distribution based corporate income tax (1991-on-going)	F	F	F	F	F	F	F
eC13	Oil boiler replacement (2015-on-going)	F	F	F	F	F	F	F
nC1	Green procurement		F	F	F	F	F	F

F	Fully implemented in the measure
FF	Boost of the measure
P	Partially implemented
	Not implemented

Furthermore, it's important to note that measures within the policy pathways can be either fully or partially implemented (reducing their "size" (*)), influencing their respective impact on the overall outcome. Consequently, we place significant emphasis on the measures with full implementation, as they have the most substantial impact on the results. By prioritizing these fully implemented measures, we ensure that our analysis accurately reflects the significant contributions they make to the effectiveness of each policy pathway.

(*) downsizing (or upscaling/boosting) the intensity of a measure depends on public budget availability (to invest or provide support), on feasibility (technical, economic, financial, etc.), and political willingness to implement the dedicated measure.

Chapter 5 follows with a comprehensive comparison of the various pathways proposed and evaluates their suitability for Estonia's energy efficiency measures implementation. The chapter will provide a thorough discussion of the optimal way forward for Estonia, taking into account the country's specific needs and policy objectives. By weighing the potential benefits and challenges of each pathway, the chapter presents a well-informed and strategic approach to guide Estonia towards a sustainable and effective energy efficiency implementation plan.

5.2 Pathway assessment methodology (and assumptions)

This section describes what will be assessed for each pathway. All assumptions are apparent in the XLS Model tool, and some of those are listed below.

Table 5-2 Main model assumptions

Assumption	Value	Location in XLS
Baseline scenario	Based on the results from D2	*Scenario* tab
Primary energy consumption	Primary energy consumption is based on final energy consumption multiplied by a primary energy conversion factor[113] for each fuel type.	*Assumptions* tab
Baseline share of fuel mix	Based on forecast for each sector from 2022 to 2023, with a decrease of oil shale use, and an increase in electricity & biogas use.	*Assumptions* tab
Inflation	Assumed 2% inflation each year. 3% inflation for energy prices.	*Admin* tab
Share of cost supported by public	30% for grants in buildings; 20-100% for support in industry; 0% for MEPS, CO2 taxation, tax deduction, voluntary agreements, obligation scheme, …; 100% for public buildings and infrastructure (e.g., for transport).	*EE measures* tab
Baseline macroeconomic forecast	Forecast of macroeconomic factors (value added, employment, GDP, etc.) are derived from the following sources: • RM's long-term forecast until 2070 • RM's 2023 spring economic forecast • Estonia Statistics: RV086 • Estonia Statistics: RAA0042 It is assumed that GDP shares across the main components remains constant.	*Assumptions* tab
CO2 emissions	Emissions factors per fuel source are based on default values from the 2006 IPCC.[114] Emissions factors include emissions from CO2, CH4 and N2O.	*Assumptions* tab

[113] https://energy.ec.europa.eu/system/files/2018-05/ee_2018_cost-optimal_en_version_0.pdf
[114] https://energy.ec.europa.eu/system/files/2023-02/C_2023_1086_1_EN_annexe_acte_autonome_part1_v4.pdf

Air pollution	Air pollution factors per fuel source are based on factors derived from EEA. The Air pollution factors include SOx, NOx and PM2.5.	*Assumptions* tab
Inflation	Assumed 2% inflation each year. 3% inflation for energy prices.	*Admin* tab
Energy market prices	Baseline energy prices are based on current prices from Estonia Statistics (KE08) and the KPMG study with 3% inflation each year. Breakdown of electricity and gas prices for household and industry is sourced from Eurostat.	*Assumptions* tab
New jobs	• Impact of energy prices on employment is based on the Estonia-specific elasticity of 0.196[115], where 1% increase in energy prices leads to 0.196% increase in employment. • 17 new jobs per MEUR investment in building • 14 new jobs per MEUR investment in industry • 40.4 new jobs per MEUR investment in public transport[116] • 15.8 *lost* jobs per MEUR investment in electric vehicles (net job loss due to EVs requiring less maintenance than conventional vehicles) [117] • 7.3 new jobs per MEUR investment in bicycling infrastructure[118]	*EE measures* tab
Energy tax rates	Energy excise rate forecasts are derived from the KPMG study on impact of tax rates on energy efficiency (also study used to estimate the impact of energy taxes). Assumed 20% VAT rate for electricity for households, gasoline, diesel, natural gas (excluding use in energy intensive industry), heat, firewood and wood chips and waste.	*Assumptions* tab
VAT (baseline) **VAT (with deduction)**	20% 5%	*EE measures* tab
Regional impacts	The split of regional impact varies per measure with the following sources: • For *residential* measures, the regional split is based on the share of dwelling floor area built before 2000 per region, where the type of building is taken into account (Estonia Statistics: RK21202). For instance, for a grant for single houses, only the share of dwelling floor area of single houses per region is taken into account. • For *service* sector measures, the default split is based on the floor area of non-residential buildings built before 2000 per region (Estonia Statistics: RK21202). For some service measures, the split depends on the local budget expenditure on certain services (e.g. street lighting, public health services, primary education, etc.) where applicable (Estonia Statistics: RR301). Renovation support for central government buildings is based on the floor area per region from the State Real Estate Register. • For *industry* measures, the regional split is based on industrial production per region (Estonia Statistics: TO023). • For *transport* measures, the default regional split is based on population per region (Estonia Statistics: RV022U). For measures relating to public transport, the split is based on local budget expenditure on management of public transport. Some measures are	*Assumptions & EE measures* tabs

[115] https://doi.org/10.1016/j.jeem.2019.04.002
[116] https://www.tmleuven.be/en/project/neujobs
[117] https://www.tmleuven.be/en/project/neujobs
[118] https://www.tmleuven.be/en/project/jobcreationcycling

	specifically localised to 1-2 regions, such as new tram lines in Tallinn. • For *agricultural* measures, the regional split is based on utilised agricultural area (Estonia Statistics: PMS403).

5.2.1 Main results

This section concerns the main results of the pathway, including final/primary energy consumption, cost savings from energy efficiency measures, and investment needs.

Energy consumption and savings (final and primary)

The model provides the final and primary energy consumption of every year for all sectors, starting from 2021, considering the baseline scenario developed in D2, and including the energy savings of the EE measures. All results of the level of energy consumption and savings can be found in the XLS file under the *Pathway Analysis* tab, under *Primary and final energy consumption broken down by relevant sectors and region, and achieved energy savings*. This section contains the follow results from 2021 to 2030:

- Final energy consumption (GWh);
- Road transport final energy consumption (GWh);
- Primary energy consumption (GWh), per sector and per region;
- Final energy savings (GWh), per sector and per region;
- Final annual energy saving rates (%), per sector and per region;
- Primary energy savings (GWh), per sector and per region.

Assumption	Value	Location in XLS
Baseline scenario	Based on the results from D2	*Scenario* tab
Primary energy consumption	Primary energy consumption is based on final energy consumption multiplied by a primary energy conversion factor[119] for each fuel type.	*Assumptions* tab
Baseline share of fuel mix	Based on forecast for each sector from 2022 to 2023, with a decrease of oil shale use, and an increase in electricity & biogas use.	*Assumptions* tab

Investment needs & cost savings of the measures

The model also contains the investment needs and cost savings relating to implementing the pathway measures from 2021 to 2030. All results of investment needs and costs can be found in the XLS file under the *Pathway Analysis* tab, under *Investment costs (including taxes) and cost savings broken down by sector and region, and total energy costs*. This section contains the follow results from 2021 to 2030:

- Total investment costs (MEUR) (incl. tax), per sector and region;
- Total public investment costs (MEUR) (incl. tax), per sector and region;
- Total private investment costs (MEUR) (incl. tax), per sector and region;
- Total cost savings (MEUR) (incl. tax), per sector and per region;
- Total public cost savings (MEUR) (incl. tax), per sector and per region;
- Total private cost savings (MEUR) (incl. tax), per sector and per region.

Asset owners (buildings, industrial plants, cars) will generate cost savings depending on the energy savings and energy prices. These savings apply to:

[119] https://energy.ec.europa.eu/system/files/2018-05/ee_2018_cost-optimal_en_version_0.pdf

- Public entities, via the public building stock increased energy performance;
- Private entities, via the private building stock increased energy performance (residential and non-residential), industrial plants increased energy efficiency, and car users decreased consumption.

Assumption	Value	Location in XLS
Inflation	Assumed 2% inflation each year. 3% inflation for energy prices.	*Admin* tab
Share of cost supported by public	30% for grants in buildings; 20-100% for support in industry; 0% for MEPS, CO2 taxation, tax deduction, voluntary agreements, obligation scheme, …; 100% for public buildings and infrastructure (e.g., for transport).	*EE measures* tab

Renovated building area

The modelling includes the volume of renovated building area for residential and service (public and private) buildings. All results of energy savings achieved can be found in the XLS file under the *Pathway Analysis* tab, under *Renovated building area*. This section contains the follow results from 2021 to 2030:

- Total renovated building area (million m2) per building type (residential, central government, municipalities and commercial buildings);
- Annual renovation rate (%) per building type (residential, central government, municipalities and commercial buildings).

5.2.2 *Impact assessment (quantitative)*

The impact assessment is conducted for the following set of indicators (on the 2021-2030 period):

- Socio-economic impacts:
  - GDP;
  - Disposable income and energy poverty;
  - Employment and labour;
  - Taxes and additional income;
- GHG emissions reduction & other environmental impacts (air pollution);
- Regional impacts.

The impact assessment for energy prices is in Section 6.2.3, with an analysis of the impact of energy taxation and obligation schemes on energy prices.

Impact on GDP

The impact analysis includes impact on GDP of the pathways, which is based on the impact on value added in terms of the impact on investment costs and cost savings. All results of GDP impact can be found in the XLS file under the *Pathway Analysis* tab. This section contains the follow results from 2021 to 2030:

- Impact on value added (MEUR);
- Impact on GDP (MEUR), broken down by compensation of employees, consumption of fixed capital, operating surplus and mixed income, taxes on production and imports and subsidies.

Assumption	Value	Location in XLS
Baseline macroeconomic forecast	Forecast of macroeconomic factors (value added, employment, GDP, etc.) are derived from the following sources: • RM's long-term forecast until 2070 • RM's 2023 spring economic forecast	*Assumptions* tab

	• Estonia Statistics: RV086 • Estonia Statistics: RAA0042 It is assumed that GDP shares across the main components remains constant.

Disposable income and energy poverty

The impact on disposable income takes into account how measures directly and indirectly impact income in terms of:

- Renovation costs (-)
- Personal transport costs (-)
- Increase in taxes (-) (related to renovation activities, personal transport, and energy taxes)
- Increase in employment (+)
- Energy savings (incl. avoided taxes) (+) (related to renovation activities, personal transport and energy taxes)

Energy poverty is measured in terms of the percentage of household disposable income spent on energy costs.

All results of impact on disposable income and energy poverty can be found in the XLS file under the *Pathway Analysis* tab. This contains the follow results:

- Household disposable income (MEUR) broken down by the impacts listed above;
- Household energy costs as a share of household disposable income (%).

Employment and labour productivity

Assumption	Value	Location in XLS
New jobs	• Impact of energy prices on employment is based on the Estonia-specific elasticity of 0.196[120], where 1% increase in energy prices leads to 0.196% increase in employment. • 17 new jobs per MEUR investment in building • 14 new jobs per MEUR investment in industry • 40.4 new jobs per MEUR investment in public transport[121] • 15.8 *lost* jobs per MEUR investment in electric vehicles (net job loss due to EVs requiring less maintenance than conventional vehicles) [122] • 7.3 new jobs per MEUR investment in bicycling infrastructure[123]	*EE measures* tab

Taxes and additional incomes

In addition to the cost savings, the benefits of the EE measures (and pathways) on public expenses and incomes depend on energy taxes based on energy prices, energy consumption and tax rates. The impact of the pathways on taxes is taken into account in the following ways:

- The indirect impact on taxes via measures (taxes from activities induced by measures, i.e. renovation, investment in industry efficiency, etc.);
- The direct impact on taxes via measures (i.e. increase in energy taxes, property taxes, CO2 tax, etc.);

[120] https://doi.org/10.1016/j.jeem.2019.04.002
[121] https://www.tmleuven.be/en/project/neujobs
[122] https://www.tmleuven.be/en/project/neujobs
[123] https://www.tmleuven.be/en/project/jobcreationcycling

- Reduction in taxes via energy savings.

All results of impact on taxes and additional incomes can be found in the XLS file under the *Pathway Analysis* tab, under *Impact on government taxes and revenue*. This contains the follow results:

- Forecasted government revenues (MEUR) with the impact of the measures broken down by indirect impact from investments, direct impact from tax measures and reduction in taxes via energy savings measures.

Assumption	Value	Location in XLS
Energy tax rates	Energy excise rate forecasts are derived from the KPMG study on impact of tax rates on energy efficiency (also study used to estimate the impact of energy taxes). Assumed 20% VAT rate for electricity for households, gasoline, diesel, natural gas (excluding use in energy intensive industry), heat, firewood and wood chips and waste.	*Assumptions* tab
VAT (baseline) **VAT (with deduction)**	20% 5%	*EE measures* tab

Impact on GHG emissions and environmental factors

The analysis includes the impact on GHG emissions and air pollution based on the energy savings and emissions/air pollutant factors per fuel. All results of GHG emissions and air pollutant impact can be found in the XLS file under the *Pathway Analysis* tab, under *Environmental impact - GHG emissions and air pollution*. This section contains the follow results from 2021 to 2030:

- GHG emissions reduction (ktCO2e) per sector;
- Air pollution emissions reduction (kt) for SOx, NOx, and PM2.5.

Assumption	Value	Location in XLS
CO2e emissions	Emissions factors per fuel source are based on default values from the 2006 IPCC.[124] Emissions factors include emissions from CO2, CH4 and N2O.	*Assumptions* tab
Air pollution	Air pollution factors per fuel source are based on factors derived from EEA. The Air pollution factors include SOx, NOx and PM2.5.	*Assumptions* tab

Regional impact

The model includes for each measure, a % of impact for each region in the *EE measures* tab, based on the assumptions of allocation of dwellings, services, industry, transport in the 'Assumptions' sheet.
In the *Pathway analysis* tab, there is a split of final energy savings and investment costs and cost savings per NUTS3 region.

Assumption	Value	Location in XLS
Regional impacts	The split of regional impact varies per measure with the following sources: • For *residential* measures, the regional split is based on the share of dwelling floor area built before 2000 per region, where the type of building is taken into account (Estonia Statistics: RK21202). For instance, for a grant	*Assumptions & EE measures* tabs

[124] https://energy.ec.europa.eu/system/files/2023-02/C_2023_1086_1_EN_annexe_acte_autonome_part1_v4.pdf

	for single houses, only the share of dwelling floor area of single houses per region is taken into account. • For *service* sector measures, the default split is based on the floor area of non-residential buildings built before 2000 per region (Estonia Statistics: RK21202). For some service measures, the split depends on the local budget expenditure on certain services (e.g. street lighting, public health services, primary education, etc.) where applicable (Estonia Statistics: RR301). Renovation support for central government buildings is based on the floor area per region from the State Real Estate Register. • For *industry* measures, the regional split is based on industrial production per region (Estonia Statistics: TO023). • For *transport* measures, the default regional split is based on population per region (Estonia Statistics: RV022U). For measures relating to public transport, the split is based on local budget expenditure on management of public transport. Some measures are specifically localised to 1-2 regions, such as new tram lines in Tallinn. • For *agricultural* measures, the regional split is based on utilised agricultural area (Estonia Statistics: PMS403).	

Impact on energy prices for various sectors

The impact analysis includes the impact on energy prices for heat, electricity and gas prices in terms of impact from inflation, energy taxation and obligation schemes. All results of energy price impact can be found in the XLS file under the *Pathway Analysis* tab, under *Impact on costs and prices*. This section contains the follow results:

- Impact of inflation and energy taxation in terms of average yearly increase in price from 2021 to 2030 (EUR/MWh), total change in price from 2021 to 2030 (EUR/MWh) and % increase;
- Impact of *EEOS* in terms of average *additional* yearly increase in price from 2021 to 2030 (EUR/MWh), total *additional* change in price from 2021 to 2030 (EUR/MWh) and *additional* % increase.

The impact is broken down by user type (households and other users) and by consumption level per user type.

Assumption	Value	Location in XLS
Inflation	Assumed 2% inflation each year. 3% inflation for energy prices.	*Admin* tab
Energy market prices	Baseline energy prices are based on current prices from Estonia Statistics (KE08) and the KPMG study with 3% inflation each year. Breakdown of electricity and gas prices for household and industry is sourced from Eurostat.	*Assumptions* tab

5.2.3 *Implementation assessment (qualitative)*

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment will be conducted for the following topics:

The advantages and disadvantages (PROS and CONS),

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides the advantages and disadvantages to combine the different measures of the pathway.

Potential barriers

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides the potential barriers that may emerge when combining the different measures of the pathway.

Actors / concerned stakeholders

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides additional insights to engage the actors or concerned stakeholders that were not addressed at the level of EE measures, and that may emerge when combining the different measures of the pathway.

Key risks

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides additional analysis of key risks that were not addressed at the level of EE measures, and that may emerge when combining the different measures of the pathway.

Policy impacts

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides additional considerations of political challenges that were not addressed at the level of EE measures, and that may emerge when combining the different measures of the pathway.

Alignment with EEF

at the level of a pathway (assuming the details of each EE measure was addressed under chapter 4), it provides high level analysis of how the EEF principle is addressed through the specific combination of the different measures into the pathway.

Main considerations beyond 2030

The pathway measures are planned until 2030. The model does not extend beyond 2030. However we will provide some takeaways and recommendations on how the continuation of increased savings could be shaped for the 2035 and 2050 horizons.

All EE measures have an effect on the long term, as investment in EE can lead to years or even decades of financial and energy savings. However, these effects vary beyond initial implementation, some measures leading to a continuous trend in additional energy savings every year, while others simply maintaining the level of saving.

In the model, the effect of the EE measures has been designed to run until 203, but their effect. continue beyond, as explain in Table 5-3.

Table 5-3 EE measures effects in the long term

Type of EE measure	Initial timescale of the measure	Effect duration
Obligation scheme	Normative measures have a continuous effect (share % increase), if the scope expands (i.e., start with worst performing and expand)	Continuously obliged to find additional savings
MEPS	Normative measures have a continuous effect, if the scope	Investment in new building, with a continuously increasing scope (and additional savings)

	expands (i.e., start with worst performing buildings)	
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
Property taxation	Its design can foresee a continuous increase of the property taxation level of worst performing buildings	Continuously expand the scope of attractive investments
CO2 tax / fuel tax	Continuously increase the price of energy (under market conditions, via the ETS extension)	Continuously expand the scope of attractive investments
Voluntary Scheme	The *VA* is established, and its effect continue beyond 2030. Its design can foresee a continuous increase of savings rule, and ongoing dialogue with concerned industries to increase	New investments will be made according to industry action plan,
Public procurement	The procurement rule is established, and continues beyond 2030	New savings with new purchase, until the full stock has been changed
Subsidy public transport	Stop in 2030 (or reduce) public money	the use of public transport can continue (if it has demonstrated interest, and remain attractive) or stop (if not convincing). It will depend on many factors
Infra transport (charging)	The public investment stops in 2030, but private can take over and continue deploying	It assumes more and more users will make use of the deployed infrastructure
Infra public transport (fleets, train, tram)	These are one-time large investments, requiring O&M	Infrastructure in alternative transport still operates, and are maintained in order to deliver their services (e.g. micro lanes, train lines, bus fleets, etc.) It assumes more and more passengers will make use of the deployed infrastructure and fleets.
Vehicle tax	Adapted taxation rate has been established	Its effect continues with the acquisition of new vehicles, until the whole vehicle stock has been changed (10 years?)
Congestion charge	Congestion charges have been established	To a certain extent, it continues to convince people not to use their individual vehicle

5.3 Energy efficiency obligations Scheme (EEOS) pathway

Energy Efficiency Obligation Schemes (EEOS) pathway is based on White Certificate Obligation Schemes, like in various European countries, as outlined in section 4.2.1. *EEOS* impose energy-saving obligations on certain energy operators, called 'obligated parties,' who may trade energy savings certificates (white certificates) with others in a market-based system – see Figure 4-2 Direct OP - end-user interaction, Figure 4-3 Third party installer, and Figure 4-4 Certificate exchange platform/OTC trading for examples of different models for EEOs.

The obligation under *EEOS* applies to energy operators, including distributors, suppliers, retail energy sales companies, and consumers. Other stakeholders from various sectors may also participate voluntarily in *EEOS* to trade white certificates. The government is responsible for implementing, managing, and financing the scheme and its supporting tools, such as the trading platform. Energy operators are accountable for identifying cost-effective energy efficiency investments and conducting them in collaboration with the asset owners.

The Energy Efficiency Obligation Scheme (EEOS) should be seen as the primary measures and applies to the residential sector (nR1), and the service sector (nS1). In addition, the following measures are implemented in full for:

- MEPS targeting rented buildings (nR2)
- Renovation support for central government buildings (nS2), and for other public entities (nS3)
- Promotion of resource-efficient green technologies of industrial enterprises (RRP) (nl2)
- Energy savings from electro intensive companies (nl3)
- Investment support for the food industry to ensure security of energy supply (nl4)
- Supporting energy efficiency investments in companies (nl5)
- Energy consulting and networking events for small and medium enterprises (SMEs) (nl6)

The building sector is slightly complemented by a few grants in single family houses (nR4), while the service sector is complemented with property taxation, and some MEPS. For the industry only the voluntary agreement option is not considered (all support are included). And for transport, all measures are only partially implemented. **This pathway focuses on buildings and industry**.

5.3.1 Main results

Energy consumption and savings

The *EEOS* pathway does not achieve Estonia's energy efficiency targets. With an average annual final energy savings rate of 1.22% from 2024 to 2030, where obligation schemes for the residential and non-residential building sector, as a measure, would lead to a 1.49% annual energy savings rate on average. The final consumption is projected to decrease to 30.3 TWh by 2030, which is slightly above the target of less than 30 TWh. The primary energy consumption shows a decrease to 47.2 TWh in 2030. The *EEOS* pathway does lead to sufficient renovation of central government buildings in terms of the NECP target. It is important to note that the *EEOS* pathway does not meet the energy efficiency target for the transport sector.

Table 5-4 Comparison of *EEOS* outcomes and EE targets for meeting NECP objectives

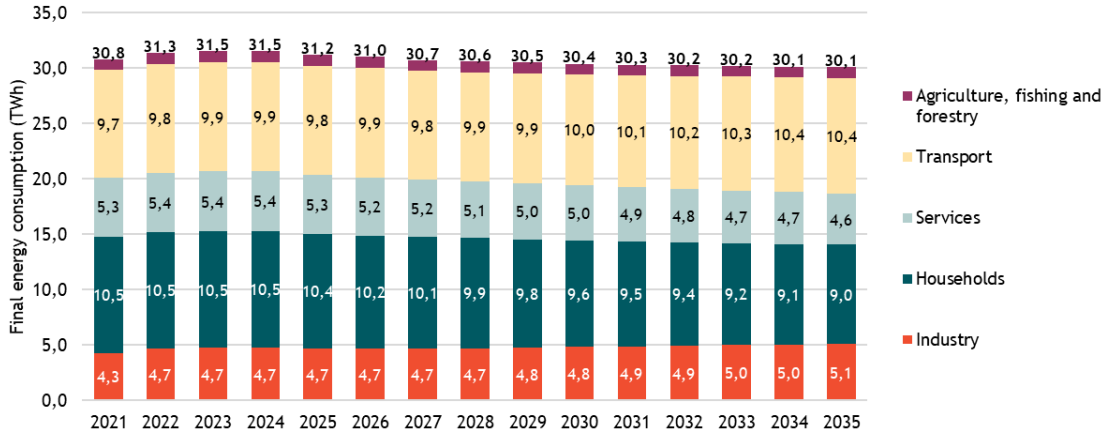
EED/NECP 2030 target	Baseline	EEO	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0.00%	1.11%	1.90%	
Annual final savings rate, 2024-2030 average (%)	0.15%	1.14%	1.49%	
Final energy consumption in 2030 (TWh)	32.9	30.4	30.0	
Primary energy consumption in 2030 (TWh)	51.6	47.5	45.7	
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0.14	0.87		0.30
Industry annual energy savings (2021-2030) (GWh)	118	564		232[125]
Transport fuel consumption (TWh)	10.5	9.6		8.3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, Estonian final energy consumption drops by 0.3 TWh, from 30.7 TWh to 30.4 TWh, peaking in 2024 at 31.5 TWh. Most of this reduction comes from the household and services sector.

[125] The NECP 2030 target is industrial energy savings of 460 GWh of primary energy per year, which is 232 GWh of final energy savings per year

Figure 5-1 Annual final energy consumption for the *EEOS* pathway per sector (2021-2030), TWh



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

In the context of energy efficiency obligation schemes, initially, costs will be partially borne by energy operators, as they need to invest in energy efficiency improvement projects and/or buy certificates to compensate their (potential) shortage and meet the obligation. Then, costs will most likely be passed on to all their consumers through increased prices. Overall, EEOS' involve a higher investment costs than the baseline scenario, of approximately €1.0 billion cumulatively between 2021 and 2030. Investment largely comes from the private sector for the building sector, with households accounting for 30% of total investment costs, for the renovation of dwellings.

Table 5-5 includes a breakdown of total investment needed by the private and public sectors, including a division between household investment and company investment. Implementing this pathway accounts for a total cumulative (2021-2030) cost savings of ~€1.4 billion. It is important to note that cost savings will occur beyond 2030, which are not taken into account in this analysis.

Table 5-5 *EEOS* investment costs and cost savings (cumulative 2021-2030), MEUR

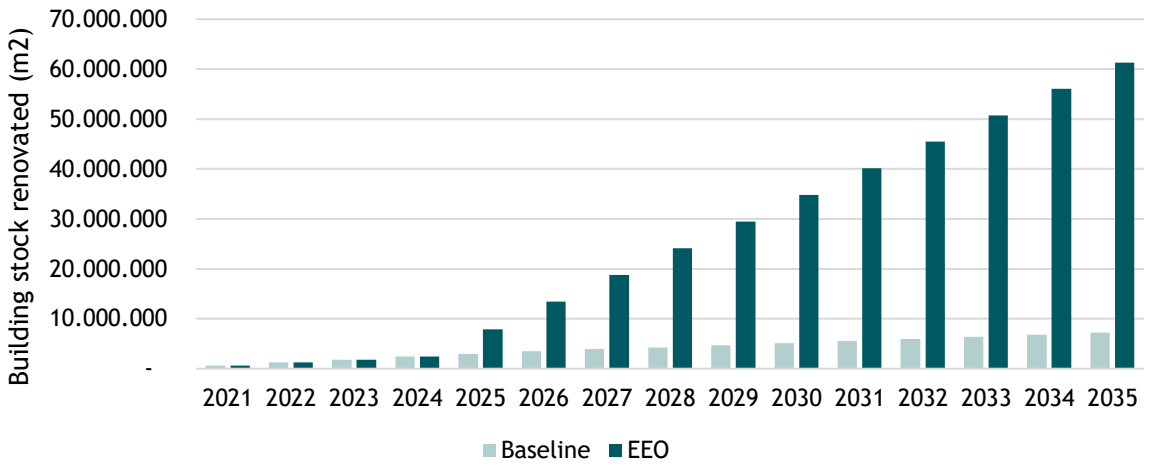
	Baseline	EEO
Total Investment costs (MEUR)	**1588**	**10042**
Public sector	331	2888
Private sector	1257	7154
Household	119	4809
Companies	1138	2345
Total cost savings (MEUR)	**489**	**1408**
Public sector	42	109
Private sector	447	1299
Household	118	618
Companies	328	681

Source: Trinomics, Energex & TalTech

Renovation of building stock

The *EEOS* pathway initiates a significant increase in renovation of the building stock (34.8 mln. m^2 renovated from 2021 to 2030, and 61.3 by 2035), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030). This is mainly driven by the obligation scheme as well as MEPS for the service sector.

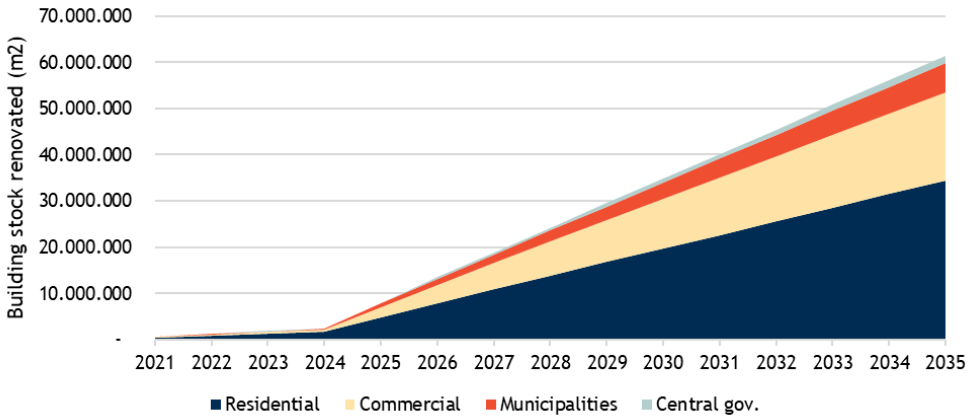
Figure 5-2 Cumulative renovated building stock from 2021 to 2030, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 19.6 mln. m^2 of dwellings and 10.8 mln. m^2 of commercial buildings being renovated from 2021 to 2030. For the public sector, at total of 3.7 mln. m^2 of the public building stock is renovated, of which 2.9 mln. m^2 is municipality-owned and 0.7 mln. m^2 is owned by the central government. This goes beyond the NECP target of renovating 0.3 mln. m^2 of central government owned buildings.

Figure 5-3 Cumulative renovated building stock from 2021 to 2030 per building type, m2



Source: Trinomics, Energex & TalTech

5.3.2 *Impact assessment*

The impact assessment of the *EEOS* pathway shows that the private sector bears the majority of costs for the measures, impacting consumer prices. The following analysis assesses macro-economic impacts, including GDP growth, disposable income, average energy costs, job creation, tax revenue, and greenhouse gas emissions reductions.

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

As the cost will most likely be borne by consumers, the implementation of an *EEOS* could have a negative impact on vulnerable consumers who will be facing higher prices. The way the cost will be passed to the final consumer is in the sole responsibility of the obligated party (energy operators), unless redistribution rules are set up by the government. The pathway would lead to an overall 3.3% increase in GDP from the baseline, leading to an average annual job creation of over 14,000, mainly coming from renovation works.

Table 5-6 Macroeconomic impacts of the *EEOS* pathway (Cumulative 2021-2030), MEUR

	Baseline	EEO
Total impact on GDP (MEUR)	**2552**	**14068**
Average annual impact on GDP (%)	1%	3,3%
Total GDP in 2030 (MEUR)	45214	47180
Compensation of employees	21608	22547
Consumption of fixed capital	7393	7714
Operating surplus and mixed income	10648	11111
Taxes on production and imports	6249	6520
Subsidies	-683	-712
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**14,18**
Employment in 2030 (thousand employees)	665	686
Impact of measures	0,82	14,16
Industry	0,24	0,46
Construction	0,59	12,77
Transport	-0,01	0,94
Impact of energy prices	0,01	0,02
Labour productivity (GDP/employee) (EUR)	63358	63801
Total impact on disposable income (MEUR)	**897**	**726**
Renovation costs (-)	-119	-4794
Personal transport costs (-)	0	-16
Increase in taxes (-)	-322	-1806
Increase in employment (+)	1219	6723
Energy cost savings (+)	118	618
Energy cost share of disposable income (%)	7,98%	7,61%
Total impact to tax revenues (MEUR)	**1007**	**2877**
Impact on taxes via measures (indirect)	72	2020
Ìmpact on taxes via tax meaures (direct)	1020	1100
Reduction in taxes via savings (MEUR)	-85	-242

Source: Trinomics, Energex & TalTech

GHG emissions reduction & other environmental impacts

Regarding GHG emissions reductions, the *EEOS* pathway leads to an overall reduction of 3.9 MtCO2 total emissions cumulatively between 2021 and 2030. The largest portion of this is from the services sector, which experiences a 0.92 MtCO2 additional emissions reduction compared to the baseline. The pathway also has a greater impact on air pollutants than the baseline pathway.

Table 5-7 Environmental impacts of the *EEOS* pathway (Cumulative 2021-2030)

	Baseline	EEO
Total GHG emissions reduction (MtCO2)	**1,26**	**3,91**
Industry	0,56	1,04
Households	0,37	1,05
Services	0,13	1,05
Transport	0,06	0,60
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		
SOx	0,69	1,57
NOx	0,72	2,05
PM2.5	0,64	2,09

Source: Trinomics, Energex & TalTech

Regional impacts

The *EEOS* pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Lõuna-Eesti. This is mainly because Lõuna-Eesti contains 37% of the single-house building stock (in terms of area) which are more resource intensive compared to renovation of apartment buildings.

Table 5-8 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	6,4	3758	616	494
Lääne-Eesti	2,0	1663	197	735
Kirde-Eesti	1,3	873	122	586
Lõuna-Eesti	3,4	2583	328	665
Kesk-Eesti	1,5	1163	144	682
Total	14,5	10042	1407,6	594

Source: Trinomics, Energex & TalTech

5.3.3 *Implementation assessment (qualitative)*

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS),

The *EEOS* pathway offers several notable advantages. Firstly, it promotes cost-effective energy savings by allowing entities that find it easier to achieve these savings to do so, while others can purchase certificates from them. This differs from grants, which require frequent adjustments to maintain attractiveness without over-subsidizing. Secondly, the pathway benefits from various best practices and extensive experience within the EU, streamlining its implementation. Thirdly, the *EEOS* pathway can drive the development of mass markets, particularly in manufacturing and installation, by encouraging energy suppliers to invest in energy-saving initiatives within the building sector.

Fourthly, obligation schemes can reshape the market by generating demand for energy-efficient technologies and practices. As obligated parties invest in energy-saving projects, this spurs innovation and the creation of more efficient products and solutions. Fifthly, for larger consumers, such as service buildings, the *EEOS* pathway efficiently promotes the most cost-effective energy efficiency solutions.

Fifthly, obligation schemes are the most straightforward measure to change the paradigm looking at energy as a service rather than a product, as the same private actors (energy operators) would have to manage both dimensions: selling a product (e.g. fuel in MWh) while ensuring a final service (e.g. heat).

Sixthly, given that energy operators would be the driving force, they would also be able to accompany building owners that are obliged to comply with MEPS (on worst performing buildings). The obligation scheme would accelerate the building of knowledge related to residential and non-residential stock renovation.

However, there are also some disadvantages to consider. Firstly, it can result in high administrative costs, especially when dealing with small-scale energy savings units, typically involving a few MWh per project. Secondly, the *EEOS* pathway can be relatively complex for small-scale energy savings units to navigate. Thirdly, there's the potential for the *EEOS* pathway to impact vulnerable households, possibly leading to higher energy prices unless a dedicated program is in place to address their needs and ensure equitable redistribution.

Potential barriers

Energy efficiency obligation programs (EEOPs) can have unintended consequences for vulnerable or low-income consumers. This is because obligated parties may pass on the costs of meeting energy efficiency targets to consumers, which can lead to higher energy prices. This can disproportionately affect those with limited financial means, who may already be struggling to afford their energy bills.
This can lead to energy poverty, which is a situation where households cannot afford to meet their basic energy needs. Energy poverty can have a number of negative consequences, including poor health, social isolation, and reduced productivity.
To protect vulnerable households from the negative impacts of EEOPs, it is important to put in place adequate measures. This could include providing financial assistance to help low-income households afford their energy bills, or implementing measures to ensure that energy prices are fair and affordable for all consumers.
Another difficulty arises from the lack of knowledge of energy operators, which would then need to building their expertise in the field of energy efficiency market (appliances, techniques, construction, etc.).

Actors / concerned stakeholders

The core actors are the energy operators, the obligate parties, that need to be involved since the inception phase. They should ideally be involved in designing the scheme: define the responsibilities, define the saving units, agree on the scope (type of buildings, industrial plants), design the verification/control system, identify knowledge gap, etc. Operators must fully grasp what is required, to transform the obligation into a new business opportunity. Also, the construction sector (construction companies, architects, engineering) needs to be associated, to integrate building/industrial components into the design.
This would require a strong collaboration with all concerned ministries (building, industry, climate/energy).

Key risks

This section maps uncertainties and risks in the *EEOS* pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed.

Technological/skills: Implementing energy efficiency obligation schemes may involve complex technologies that require specialized knowledge and expertise. Ensuring the successful integration and operation of these technologies can be challenging, especially for smaller energy operators.

Determining (calculating) the saving of each EE project (investment or behaviour) requires deep knowledge, and monitoring expertise (from public implementing body). To mitigate these measures, provide training and capacity building to energy operators (suppliers) and relevant stakeholders to ensure they have the necessary skills and knowledge to implement and manage energy efficiency projects effectively.

Create a flexible obligation framework that allows for adjustments based on technological advancements. Regularly review and update the list of eligible technologies to accommodate new innovations.

Identifying the most cost-effective EE projects require energy operators (suppliers) to be well informed about market products, which are currently not their core business.

Social: Energy efficiency obligation programs might face opposition or lack of public acceptance, especially for obligated parties (energy suppliers and building owners), due to the administrative burden, need to adapt commercial strategies, and perception of additional financial burdens without clear benefits.

Industries with high energy consumption may resist energy efficiency obligations, citing potential impacts on competitiveness and production costs.

Commercial strategies of energy operators will need to find the right approach to work with all consumers, to convince them to invest in EE projects, while providing the right level of support.

To mitigate these risks, public awareness and communication about the positive impacts of energy efficiency are crucial to gaining support. Intense dialogue with obligated parties, especially energy suppliers and industrial consumers. Setting up accompanying measures, like short or mid-term incentives or support. Supporting energy operators with awareness campaign.

Economic: Costs incurred by energy operators to meet their obligations may be passed on to consumers through increased energy prices. This could lead to higher energy bills for the other not concerned households and businesses (those not having invested in EE projects), potentially causing financial strain, especially for vulnerable consumers with limited resources to absorb additional costs.

Energy efficiency obligation programs often require significant initial investment from energy operators to implement energy-saving projects and meet the set targets. These upfront costs can be substantial, posing financial challenges to energy companies, especially smaller ones, if they lack the necessary resources to invest in energy efficiency initiatives.

Mitigation strategies include Implementing consumer protection policies can help mitigate the impact of cost pass-through to consumers. This can involve setting price caps, imposing to operators to target first certain categories of consumers or providing financial support to vulnerable consumers to offset any potential increase in energy prices. Additionally, transparent communication about the program's objectives and costs can enhance consumer understanding and acceptance.

Regular monitoring of the energy market and the performance of energy operators can help identify any potential market distortions and address competitiveness concerns. Authorities can introduce flexibility in the program's design to allow energy operators to adjust their strategies and collaborate to achieve targets efficiently without compromising competitiveness.

Environmental: Energy efficiency programs may inadvertently lead to the substitution of energy-efficient technologies or practices with environmentally harmful alternatives. For example, if a program focuses solely on energy efficiency improvements in the electricity sector, it may incentivise a shift towards electric heating systems, which could increase electricity demand and potentially be sourced from non-renewable or high-emission sources, leading to adverse environmental impacts.

To avoid limited scope and relevance, energy efficiency obligation programs should take a holistic approach. They should target multiple sectors and technologies, addressing a wide range of energy-saving opportunities. This ensures that the program remains relevant and adaptable to changing market dynamics and technological advancements.

Administrative: Setting up an *EEOS* requires to agree on the list of accepted EE projects (investment or behaviour), on the savings calculation method to determine their savings, on the method of verification, on the control measures, on the way to determine compliance and on the fines

Savings calculation method for industrial consumers can become highly complex in some processes, and are hard to standardise. Limiting the number of targeted stakeholders could lead to avoid a huge number of beneficiaries to reach out their targeted “market.”

Policy impacts

Imposing to private actors to bear the responsibility to increase energy savings globally requires a strong political cohesion, to ensure a one voice position towards the obligated parties (energy operators for obligation scheme, and building owners for MEPS). Coordination and alignment with the concerned ministries are pre-requisites to start the discussion with the obligated actors.
Government representatives will be heavily involved in technical discussions to design the schemes (e.g. eligible investments and expected savings that are accountable, level of performance expected and time

horizon), while market aspects (e.g. cost of investments, energy/fuel prices) will be "outsourced" to the obligated parties (driven by competitiveness).
Another key aspect to discuss ahead is the way to address energy poverty, either as a priority focus group (towards building renovation), either by avoiding an increase of their energy bill (through increase of energy prices).

Alignment with EEF

MEPS and obligation scheme will require to encompass fuel switching to progressively lead to the full decarbonisation of the building and industrial stock, while avoiding conflicting interest if other measures are stimulating the switch towards zero carbon fuels which might hamper EEF. This is doable, but requires to continuously adapt the schemes.

Main considerations beyond 2030

The measures of the *EEOS* pathway focus mainly on the following, with the according effect beyond 2030

Type of EE measure	Initial timescale of the measure	Effect duration
Obligation scheme	Normative measures have a continuous effect (share % increase), if the scope expands (start with worst performing)	Continuously obliges to find additional savings
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)

To conclude this pathway will probably have a continuous effect well beyond 2030, as its core measures will continuously expand their scope and generate additional savings every year.
Some grants are still necessary to support the entry into force of various obligations, and could easily be switched of in 2030, when obligations ramp up.
All transport investments, although with a more limited impact, will also continue bringing additional savings every year.

5.4 Voluntary Agreement (VA)

This pathway implements usage of voluntary agreements primarily between governments and industry (manufacturing, retail, chemical, information technology, etc), which include negotiated commitments for achieving defined energy savings targets. The pathway largely targets industry or buildings but includes some measures for transport as well.

In contrast to traditional command-and-control policies, voluntary agreements are all about customization. They bring together public authorities and individual firms or groups of firms to negotiate and agree on targets and timelines for enhancing energy efficiency or reducing greenhouse gas emissions. For this study, our main focus is on voluntary agreements targeting energy efficiency improvements. Typically, these agreements also incorporate mechanisms to ensure compliance through the use of rewards and penalties. To attract private actors to engage in *VA*, there is a need for incentives, which can take various forms: financial (e.g. tax exemption); market driven (e.g. the current market, i.e. customers for the industry, is pulling the demand for more energy efficient products); long term decarbonisation commitment (when the industry has to commit to fully decarbonise on the middle or long term, it should take concrete intermediate actions).

Voluntary agreements come in a variety of shapes, legal statuses, structures, and provisions. They can differ in terms of the participants involved and the level of enforceability they possess. It's a flexible and diverse landscape that allows for tailored solutions to drive sustainable change.

The key policies and associated measures of the Voluntary Agreement pathway are:

- CO_2 tax for end energy use of residential buildings (nR8)
- Voluntary scheme for the industry, with binding targets based on incentives (nl1)

But of course, considering that these measures are not enough to significantly contribute to the EE targets, additional measures are also taken, such as

- In residential: MEPS, with a few grants and VAT deduction, a partial carbon taxation;
- In service: grants for public buildings; light grants for commercial buildings; partial CO2 certificates, CO2 taxation, property taxation, and MEPS
- In industry: a reduction in all supporting measures (only as complementary to the VA)
- In transport: partial implementation of all measures
- In agro forestry: full implementation of the measures

5.4.1 Main results

Energy consumption and savings

The Voluntary Agreement pathway **does not achieve Estonia's energy efficiency targets**, with an average annual final energy savings rate of 1,19% from 2024 to 2030, where voluntary agreements as a standalone measure leads to 0.09% energy savings annually. Although this could be reviewed with an increased ambition level. The final consumption is projected to decrease to 30.4 TWh by 2030, which does not meet the target of less than 30 TWh. The primary energy consumption also decreases to 47.3 TWh, though not to the level of the EED target (45.7 TWh). It is important to note that the Voluntary Agreement pathway does not meet the energy efficiency targets for the transport sector or renovation target for central government buildings.

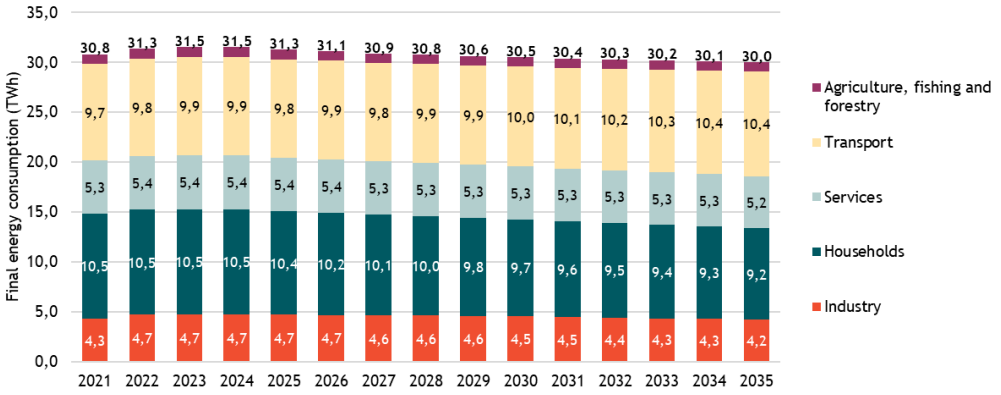
Table 5-9 Comparison of Voluntary Agreement outcomes and EE targets for meeting NECP objectives

NECP 2030 objective	Baseline	VA	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0,06%	1,23%	1,90%	1,90%
Annual final savings rate, 2024-2030 average (%)	0,14%	1,09%	1,50%	1,50%
Final energy consumption in 2030 (TWh)	32,8	30,5	30,0	33,3
Primary energy consumption in 2030 (TWh)	51,5	47,7	45,7	63,9
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0,12	0,48		0,30
Average industry annual energy savings (2021-2030) (GWh)	313	865		460
Transport fuel consumption (TWh)	10,5	10,0		8,3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, Estonian final energy consumption drops by 0.2 TWh, from 30.7 TWh to 30.5 TWh, with a peak of 31.5 TWh in 2024. Most of this reduction comes from the household and services sector. Industrial energy use increases as the increase in production surpasses the reductions from energy efficiency measures, but an ambitious and efficient *VA* scheme could bring much more savings that currently simulated. Transport also increases.

Figure 5-4 Annual final energy consumption for the Voluntary Agreement pathway per sector (2021-2030), TWh



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

In the context of voluntary agreements, the costs of implementation and who bears the costs differ based on the sector involved. In the private sector, industrial actors, and private companies, among others, bear the expenses as they invest in energy efficiency improvements to meet the *VA* targets, and therefore reduce their energy consumption, and bills. Usually EE projects pay back times will have to remain under a threshold (i.e. 5 years) to be considered by companies. Higher pay back would not be considered. Alternatively, energy operators can commit to increase energy savings, or reduce their energy supply, according to a VA. Consequently, the consumers not directly benefiting from the EE projects may experience increased prices as these costs are often passed on to them. Conversely, when VAs are implemented in the public sector, such as by local governments or municipalities, the funding for energy efficiency improvements comes from the public budget, placing the responsibility on taxpayers to cover the associated costs.

Overall, VAs involve higher investment costs than the baseline scenario, of approximately €10.56 billion Cumulative between 2021 and 2030. This is due to the cost of implementation for new measures and getting equipment/facilities/buildings up to standard. Table 5-10 includes a breakdown of total investment needed by the private and public sectors, including a division between household investment and company investment. It is important to note that cost savings will also occur beyond 2030, which are not taken into account in this analysis.

Table 5-10 Voluntary agreement investment costs and cost savings (Cumulative 2021-2030), MEUR

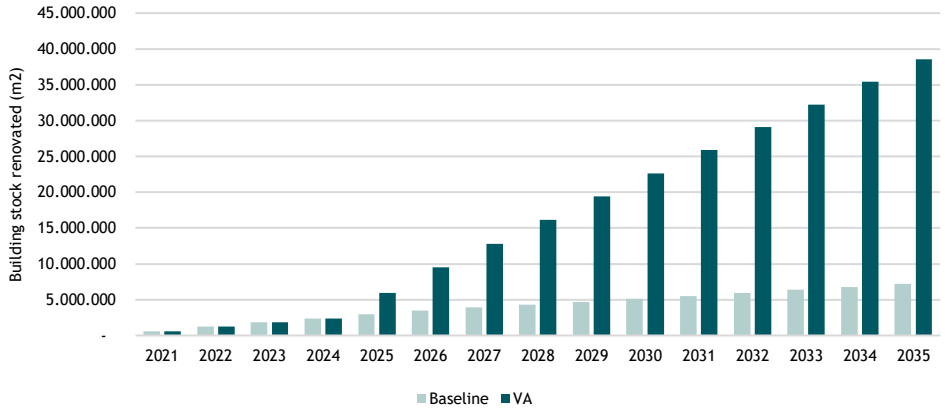
	Baseline	VA
Total Investment costs (MEUR)	**1588**	**10565**
Public sector	331	3210
Private sector	1257	7354
Household	119	4297
Companies	1138	3058
Total cost savings (MEUR)	**489**	**1314**
Public sector	42	102
Private sector	447	1212
Household	118	582
Companies	328	630

Source: Trinomics, Energex & TalTech

Renovation of building stock

The *VA* pathway initiates a significant increase in renovation of the building stock (22.6 mln. m^2 renovated from 2021 to 2030, 38.5 mln. m2 by 2035), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030). This is mainly driven by MEPS for targeted rented/sold dwellings and the service sector.

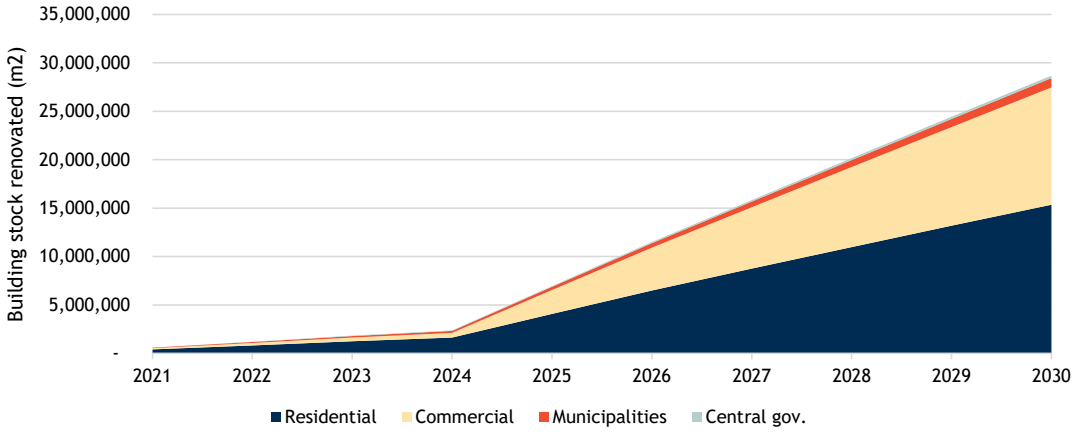
Figure 5-5 Cumulative renovated building stock from 2021 to 2035, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 15.4 mln. m^2 of dwellings and 14.8 mln. m^2 of commercial buildings being renovated from 2021 to 2030. For the public sector, at total of 2.4 mln. m^2 of the public building stock is renovated, of which 1.86 mln. m^2 is municipality-owned and 0.48 mln. m^2 is owned by the central government, which meets the NECP target of renovating 0.3 mln. m^2 of central government owned buildings.

Figure 5-6 Cumulative renovated building stock from 2021 to 2030 per building type, m2



Source: Trinomics, Energex & TalTech

5.4.2 *Impact assessment*

The impact assessment of the *VA* pathway reveals that in the private sector, industrial actors, private companies, and energy operators bear the expenses, possibly impacting consumer prices in the case of

energy operators. In contrast, VAs in the public sector are funded through the public budget, involving taxpayers in covering the costs. The analysis assesses macro-economic impacts, including GDP growth, disposable income, average energy costs, job creation, tax revenue, and greenhouse gas emissions reductions.

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

Table 5-11 outlines the macro-economic impacts of the implementation of the Voluntary Agreement Pathway. The pathway leads to a 3.4% increase in GDP. The pathway leads to a drop in average energy cost as share of household income from 7.92% in the baseline scenario to 7.58%. The *VA* pathway leads to average annual job creation of 13,800 jobs. Compared to the baseline, there is almost 2 billion EUR increase in tax revenue.

Table 5-11 Macroeconomic impacts of the Voluntary Agreement pathway (Cumulative 2021-2030), MEUR

	Baseline	VA
Total impact on GDP (MEUR)	**2552**	**14594**
Average annual impact on GDP (%)	1%	3,4%
Total GDP in 2030 (MEUR)	45214	47294
Compensation of employees	21608	22602
Consumption of fixed capital	7393	7733
Operating surplus and mixed income	10648	11138
Taxes on production and imports	6249	6536
Subsidies	-683	-714
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**13,81**
Employment in 2030 (thousand employees)	665	685
Impact of measures	0,82	13,80
Industry	0,24	0,63
Construction	0,59	12,23
Transport	-0,01	0,94
Impact of energy prices	0,01	0,01
Labour productivity (GDP/employee) (EUR)	63358	63912
Total impact on disposable income (MEUR)	**897**	**1708**
Renovation costs (-)	-119	-4281
Personal transport costs (-)	0	-16
Increase in taxes (-)	-322	-1552
Increase in employment (+)	1219	6975
Energy cost savings (+)	118	582
Energy cost share of disposable income (%)	7,98%	7,58%
Total impact to tax revenues (MEUR)	**1007**	**2975**
Impact on taxes via measures (indirect)	72	1401
Ìmpact on taxes via tax meaures (direct)	1020	1813
Reduction in taxes via savings (MEUR)	-85	-239

Source: Trinomics, Energex & TalTech

GHG emissions reduction & other environmental impacts

Regarding GHG emissions reductions, the *VA* pathway leads to an overall reduction of 3.6 MtCO2 total emissions cumulatively between 2021 and 2030. The largest portion of this is from the services sector, which experiences more than four times the reduction in CO2 emissions from the baseline pathway. Similar to GHG emissions, the pathway also has a greater impact on air pollutants than the baseline pathway.

Table 5-12 Environmental impacts of the Voluntary Agreement pathway (Cumulative 2021-2030)

	Baseline	VA
Total GHG emissions reduction (MtCO2)	**1,26**	**3,63**
Industry	0,56	1,29
Households	0,37	1,00
Services	0,13	0,58
Transport	0,06	0,60
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		
Sox	0,69	1,61
NOx	0,72	1,96
PM2.5	0,64	1,92

Source: Trinomics, Energex & TalTech

Regional impacts

Similar to the *EEOS* pathway, the *VA* pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Lõuna-Eesti and Kesk-Eesti, which are highly concentrated with single-houses (in terms of area) which are more resource intensive compared to renovation of apartment buildings.

Table 5-13 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	6,4	4112	609	551
Lääne-Eesti	1,7	1661	167	878
Kirde-Eesti	1,3	1003	124	664
Lõuna-Eesti	3,0	2614	288	774
Kesk-Eesti	1,3	1174	124	809
Total	13,7	10565	1313,2	676

Source: Trinomics, Energex & TalTech

5.4.3 *Implementation assessment (qualitative)*

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS)

The Voluntary Agreement Pathway offers several advantages. Firstly, it provides a tailored approach, with solutions for specific stakeholder needs and objectives, ultimately leading to the most cost-effective energy savings. Secondly, it encourages stakeholder participation from various actors, fostering collaboration and ownership of energy efficiency initiatives. This approach also operates as a market-based mechanism, allowing for the trading of energy savings certificates, thereby incentivizing efficient practices. Additionally, the pathway is scalable and can be implemented across different sectors and levels, accommodating diverse energy efficiency goals. It also presents opportunities for innovation and technology adoption, driving the use of innovative energy-efficient technologies and practices. Collaboration is another key advantage, as it offers opportunities for public-private partnerships and collaboration between stakeholders. Successful participation can enhance stakeholders' reputation and market appeal, and voluntary agreements can complement existing energy efficiency policies, ultimately boosting overall effectiveness. Industrial roadmaps should first focus on Energy Efficiency, but *VA* would also constitute a good entry point for fuel switching, moving to renewable energy or zero carbon sources.

However, there are some disadvantages to consider. The voluntary nature of these agreements may result in lower participation and limited effectiveness compared to mandatory measures, if incentives are not high enough. Initial investments for energy efficiency improvements may be seen as a barrier for some stakeholders. Limited enforcement mechanisms could undermine the success of voluntary agreements, and varying participation levels and commitments among stakeholders may lead to uneven outcomes.

Potential barriers

Without offering compelling benefits or recognition, stakeholders may be less motivated to participate actively or may even choose to disengage from the project or initiative. In other words, if individuals or groups involved do not see the value in their involvement, they are less likely to remain committed and engaged. Therefore, it's crucial to create a value proposition that clearly outlines what stakeholders stand to gain from their participation, whether it's in the form of tangible rewards, enhanced skills and knowledge, or recognition for their contributions.

Furthermore, economic fluctuations can introduce uncertainty into the equation, potentially impacting stakeholders' investment decisions and their willingness to commit to the long-term success of a project or partnership. During times of economic instability, organizations and individuals may become more risk-averse, leading to hesitations in making long-term commitments or investments. To address this, it's essential to incorporate risk mitigation strategies into your project planning, such as diversifying funding sources, creating contingency plans, and regularly assessing the economic landscape to adapt as needed. By doing so, you can enhance stakeholder confidence and resilience in the face of economic challenges, thus ensuring the sustainability of your initiatives.

Actors / concerned stakeholders

The successful implementation of the voluntary agreement pathway, which encompasses the introduction of a CO2 tax for end energy use, MEPS for buildings, and a voluntary emissions reduction program for industry, involves various stakeholders playing distinct roles, as discussed in Chapter 4.

For the CO2 Tax and MEPS for buildings, Building occupiers, whether tenants or owners, are the obligated parties who will bear the responsibility of paying the CO2 tax based on the energy consumption within their respective buildings. The administrative tasks are overseen by both the government and energy

providers. They are responsible for setting tax rates, collecting taxes, and ensuring compliance with energy performance standards. The Ministry in charge of Energy or the Estonian Tax and Customs Board is responsible for implementing and overseeing the regulatory framework, including the CO_2 tax and MEPs for buildings. Building owners and tenants residing in energy-efficient homes with low energy consumption stand to benefit. Additionally, the government benefits from increased tax revenue generated through the CO_2 tax.

In terms of implementing a voluntary scheme for industry, both the government and industry entities play roles in administering and overseeing the voluntary emissions reduction program. A designated public or private entity, appointed by the government, is responsible for implementing and monitoring the agreement in collaboration with the participating industries. Industries willing to make investments to meet energy efficiency targets assume the role of the final payer, as they bear the costs associated with implementing energy-saving measures. Enterprises that actively participate in the voluntary agreement framework benefit from support schemes designed to facilitate and incentivize energy efficiency improvements.

Key risks

This section maps uncertainties and risks in the Voluntary Agreements pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed.

Technological/skills: High up-front costs of replacing and implementing new energy efficiency technologies, especially before the end-of-life of existing technologies, especially if the payback period is long. New technologies often require a new or updated skilled workforce. Shortage of trained personnel can hinder success of deployment. A potential mitigation strategy is Provide financial incentives and support mechanisms, such as grants, subsidies, and low-interest loans, to help mitigate the high upfront costs. Invest in workforce training programmes to build a skilled and knowledgeable workforce capable of deploying, maintaining and troubling shooting new technologies/equipment.

Social: Since VAs are voluntary, participants need to be (1) aware of the programme, (2) well-informed of the benefits, and (3) willing to participate. Therefore, awareness raising, and information is essential for programme success. Potential mitigation strategies Awareness campaigns which engage with communities to be more aware of the benefits of energy renovation as well as of the financial options (i.e., grants) available. Engage stakeholders, including technology providers, industry experts, and end-users, in the decision-making process to gain valuable insights and foster collaborative efforts in addressing technological risks.

Economic: The introduction of voluntary agreements could create market distortions if certain obligated parties face higher costs of compliance compared to others. This could lead to an uneven playing field and potential market inefficiencies. Some energy efficiency measures may have longer payback periods, making it challenging for obligated parties to see immediate returns on their investments, and thereby reducing their willingness to participate in voluntary agreements.

Voluntary agreements may involve long-term commitments, and changes in market demand or fluctuations in energy prices could impact the cost-effectiveness of the agreed-upon measures. When costs are borne by consumers, the implementation of a *VA* could have an impact on vulnerable consumers who will be facing higher prices.

Potential mitigation measures include Allowing flexibility in the timing and sequencing of energy efficiency measures can enable obligated parties to adapt to market conditions, reduce upfront costs, and manage financial risks. Collaborating with public entities, private businesses, and financial institutions can leverage resources, share costs, and distribute economic risks more evenly. Establishing dedicated funds or financing mechanisms specifically for energy efficiency projects can help address the challenge of longer payback periods and support obligated parties in undertaking measures with longer-term benefits. Providing clear, stable, and predictable energy efficiency policies can reduce uncertainty and encourage obligated parties to invest with confidence.

Environmental: Increasing construction activities (for renovation as well as transport infrastructure) can generate more waste and pollution. To mitigate this risk, Incorporate life-cycle assessments into the design phase of renovations. Strengthen waste management of construction-related waste to promote recycling and re-use of materials.

Administrative: Voluntary agreements often require obligated parties to comply with specific energy efficiency targets and report on their progress regularly. This can result in an administrative burden for both the obligated parties and the implementing authorities.

Adequate data and information are essential for setting realistic targets, monitoring progress, and evaluating the effectiveness of voluntary agreements. However, there might be challenges in obtaining accurate and up-to-date data, particularly from various stakeholders who may be involved in the agreement. Voluntary agreements may run in parallel with other energy efficiency initiatives or policies. Ensuring coordination and integration with existing programs can be complex, and overlapping efforts may lead to inefficiencies.

To mitigate this risk, Various best practices and longstanding experience exist in the EU, which may facilitate the implementation of the scheme. Simplify and standardize reporting requirements to reduce the burden on obligated parties. Implementing digital reporting systems can make data submission more efficient.

Facilitate data collection and sharing among stakeholders through collaborative platforms or data repositories. Encourage transparency and cooperation in data sharing. Conduct periodic meetings with stakeholders to address concerns, gather feedback, and ensure active involvement in decision-making processes. Establish a well-defined governance structure with clear roles and responsibilities for each participating entity. This will promote accountability and effective coordination. Ensure alignment and integration of voluntary agreements with other energy efficiency policies to avoid duplication of efforts and maximize impact. Regularly evaluate the effectiveness of voluntary agreements and use the findings to improve their design and implementation over time.

Policy impacts

Given that the Voluntary Agreement Pathway impacts primarily the buildings sector and industry, there are several policy impacts that affect various sectors the economy and society. A CO2 tax can influence the housing market. Energy-efficient homes may see increased demand and value, while older, less efficient homes may become less attractive. Implementing MEPS might lead to higher rents or property prices, which could pose affordability challenges for tenants or potential buyers, especially in a competitive real estate market.

Policymakers may need to consider measures to ensure housing affordability and accessibility. The regressive nature of energy taxes may necessitate policies to address income inequality. A portion of the tax revenue can be used to fund social welfare programs, energy assistance for low-income households, or progressive tax structures.

Some companies, particularly smaller ones, might lack the necessary information, expertise, and resources to effectively implement energy efficiency measures. Overcoming these gaps requires targeted education and support programmes to enable companies to identify and adopt energy-saving practices. Industries that are energy-intensive and internationally competitive might worry that binding targets could lead to a loss of competitiveness. Balancing energy efficiency goals with economic competitiveness can be challenging, particularly in sectors exposed to global markets.

Energy efficiency grants for large enterprises participating in the Voluntary Agreement may be complicated as emissions cannot decrease as a result of an additional grant when the enterprise gets free allowances. Enterprises in the scheme may be less inclined to join the agreement as they may not have the same access to grants to help them reach energy efficiency goals.

Alignment with EEF

MEPS will require to encompass fuel switching to progressively lead to the full decarbonisation of the building stock, while avoiding conflicting interest if other measures are stimulating the switch towards zero carbon fuels which might hamper EEF. Grants programmes should be aligned with support to alternative fuels, particularly with the deployment of heat pumps, in residential and non-residential sectors.

Main considerations beyond 2030

The measures of the *VA* pathway focus mainly on the following, with the according effect beyond 2030

Type of EE measure	Initial timescale of the measure	Effect duration
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
CO2 tax / fuel tax	Continuously increase the price of energy (under market conditions, via the ETS extension)	Continuously expand the scope of attractive investments
Voluntary Scheme	The *VA* is established, and its effect continue beyond 2030. Its design can foresee a continuous increase of savings rule, and ongoing dialogue with concerned industries to increase	New investments will be made according to industry action plan,

To conclude, this pathway will probably have a continuous effect beyond 2030 thanks to MEPS and CO2 taxation, which will continuously incentivise energy users to generate additional savings every year. Grants are still necessary to support the entry into force of MEPS, and could be switched of in 2030, depending on the level of the CO2 tax.
The same applies to non-residential property taxation which is slightly introduced under this pathway.

All transport investments, although with a more limited impact, will also continue bringing additional savings every year.

5.5 Renovation Wave (Renowave)

In 2020, the European Commission released the 'Renovation Wave for Europe', a strategy aimed at boosting the renovation of the EU building stock.[126] The strategy aims to at least double the annual energy renovation rate of residential and non-residential buildings by 2030 and to foster deep energy renovations.[127] The objective is to maintain this renovation rate and depth in order to reach EU climate neutrality in 2050. To achieve the objectives of the Renovation Wave, the European Commission has identified seven main areas of actions: [128]

1. Strengthening **information**, legal certainty and **incentives** for public and private owners and tenants to undertake renovations.
2. Ensuring adequate and **well-targeted funding**.
3. Increasing the **capacity** to prepare and implement projects (through amongst others scaling up EU technical assistance).
4. Promoting comprehensive and **integrated renovation interventions** for smart buildings, integration of renewable energy and enabling to measure actual energy consumption.
5. Making the **construction ecosystem** fit to deliver sustainable renovation, based on circular solutions, use and reuse of sustainable materials and the integration of nature-based solutions.
6. Using renovation as a lever to address **energy poverty** and access to healthy housing for all households, including for persons with disabilities and for older people.
7. Promoting the **decarbonisation** of heating and cooling.

The strategy also emphasises the need to address three specific areas: (1) energy poverty and worst-performing buildings; (2) public buildings and social infrastructures; and (3) decarbonisation of the heating and cooling sector which accounts for more than 80% of total energy consumption of residential buildings.

The Renovation Wave Strategy is in direct alignment and response to the 2020 European Commissions' release of the 'Renovation Wave for Europe' strategy to at least double the annual energy renovation rate of residential and non-residential buildings in Europe by 2030, with an emphasis on deep renovation.[129] Therefore, this policy pathway primarily targets the building sector.

The key policies and associated measures of the Renovation Wave pathway are:

- MEPS for all dwelling (regulatory requirements for EPC class E, F, and G or above) (nR3)
- Renovation grants for single family houses (20-30% support) (nR4)
- Tax deduction for renovation works by private persons (=parallel track for single family) (nR5)
- Renovation grants for multifamily buildings/housing associations (30% support) (nR6)

[126] Renovation wave (europa.eu)
[127] Deep energy renovation is defined by the 2021 proposal the revision of Directive 2010/31/EU as 'a renovation which transforms building or building unit: (a) before 01/01/2030, into a nearly zero-energy building; (b) as of 01/01/2030, into a zero-emissions building.
[128] Renovation Wave Communication (europa.eu)
[129] Deep energy renovation is defined by the 2021 proposal the revision of Directive 2010/31/EU as 'a renovation which transforms building or building unit: (a) before 01/01/2030, into a nearly zero-energy building; (b) as of 01/01/2030, into a zero-emissions building.

- Commercial buildings energy performance investments support (nS4)
- MEPS for non-residential buildings (regulatory requirements for EPC class E and F) (nS8)

Additional EE measures are taken for the industry with partial grants and support, for the transport sector with all measures being partially implemented, and the measures for the agro forestry being fully implemented.

5.5.1 Main results

Energy consumption and savings

The *RenoWave* pathway surpasses the baseline scenario in achieving Estonia's energy efficiency targets outlined in the NECP 2030, however **the pathway does not meet all targets.** With an average annual final energy savings rate of 1.5% from 2024 to 2030, it exceeds slightly the energy efficiency target. Additionally, the final consumption is projected to decrease to 29.6 TWh by 2030, which meets the target of less than 30 TWh, and the target for renovating 0.3 million m2 of central government buildings. However, the final energy savings rate in 2030 does not align with the EED target of 1.9% (1.517%). Further, the *RenoWave* pathway does not meet the energy efficiency targets for the industry and transport sectors .

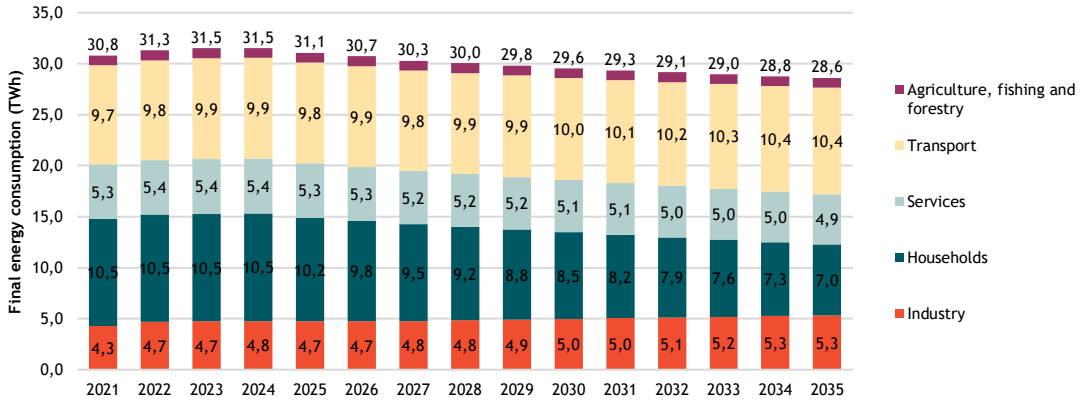
Table 5-14 Comparison of Renovation Wave outcomes and EE targets for meeting NECP objectives

NECP 2030 objective	Baseline	RenoWave	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0,06%	1,51%	1,90%	1,90%
Annual final savings rate, 2024-2030 average (%)	0,14%	1,50%	1,50%	1,50%
Final energy consumption in 2030 (TWh)	32,8	29,6	30,0	33,3
Primary energy consumption in 2030 (TWh)	51,5	46,3	45,7	63,9
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0,12	0,59		0,30
Average industry annual energy savings (2021-2030) (GWh)	313	418		460
Transport fuel consumption (TWh)	10,5	10,0		8,3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, the final energy consumption drops by 1.1 from 30.7 TWh, to 29.6 TWh. Most of this reduction comes from the household and services sector (2.2 TWh reduction via renovation measures in 2030), while transport and industry consumption continues to increase.

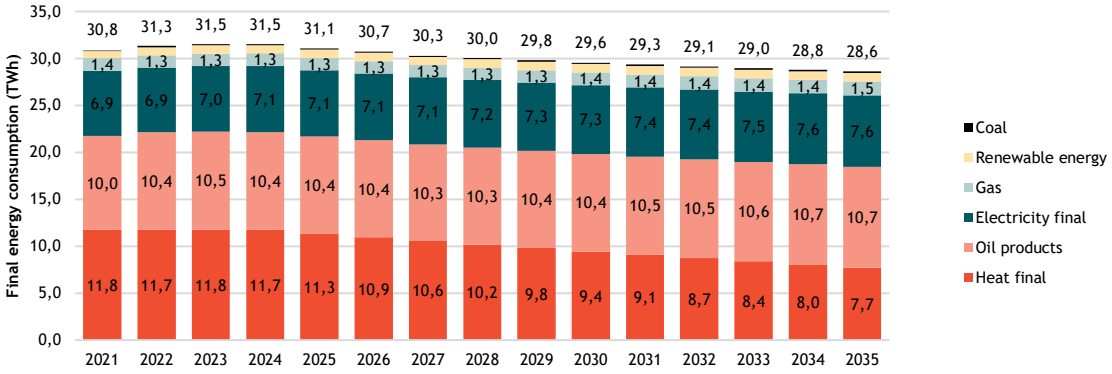
Figure 5-7 Annual final energy consumption for the Renovation Wave pathway per sector (2021-2035), TWh



Source: Trinomics, Energex & TalTech

In terms of final energy by fuel source, even gains are made across sectors, with large gains in reduction of oil products and final heat, as shown in figure 5-8.

Figure 5-8 Final energy consumption by fuel source



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

Costs of the Renovation Wave depends on the measures it consists of. However, it is most likely that public and private building owners will be impacted as they will have to invest in renovation and energy efficiency improvements. Overall, there is an increase in total investment for the Renovation Wave Pathway from the baseline from €1.6 billion in the baseline to €17.3 billion in the Renovation Wave. A much larger share of the investment comes from the households, as they are most impacted by renovation measures.

Table 5-15 Renovation Wave investment costs and cost savings (Cumulative 2021-2030), MEUR

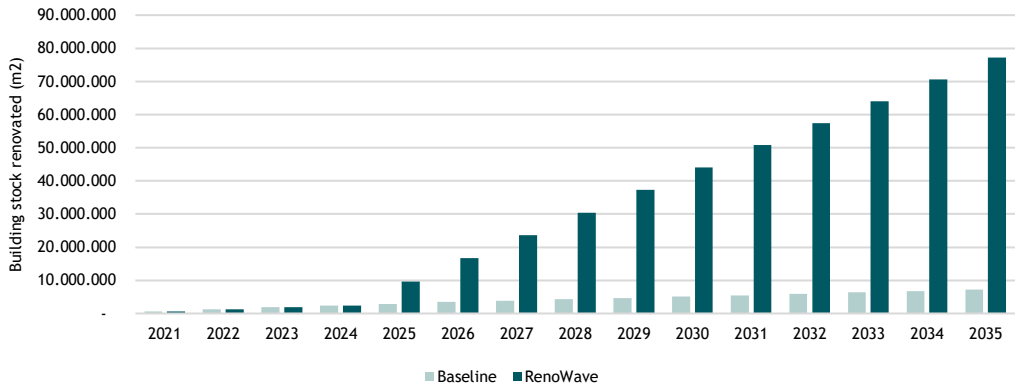
	Baseline	RenoWave
Total Investment costs (MEUR)	**1588**	**17851**
Public sector	331	4287
Private sector	1257	13564
Household	119	10710
Companies	1138	2854
Total cost savings (MEUR)	**489**	**1712**
Public sector	42	105
Private sector	447	1607
Household	118	1032
Companies	328	575

Source: Trinomics, Energex & TalTech

Renovation of building stock

The Renovation Wave pathway initiates a significant increase in renovation of the building stock (44 mln. m^2 renovated from 2021 to 2030, and 77.2 mln. m2 by 2035), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030). This is mainly driven by MEPS for all dwellings and the service sector as well as the uptake of many renovation support measures.

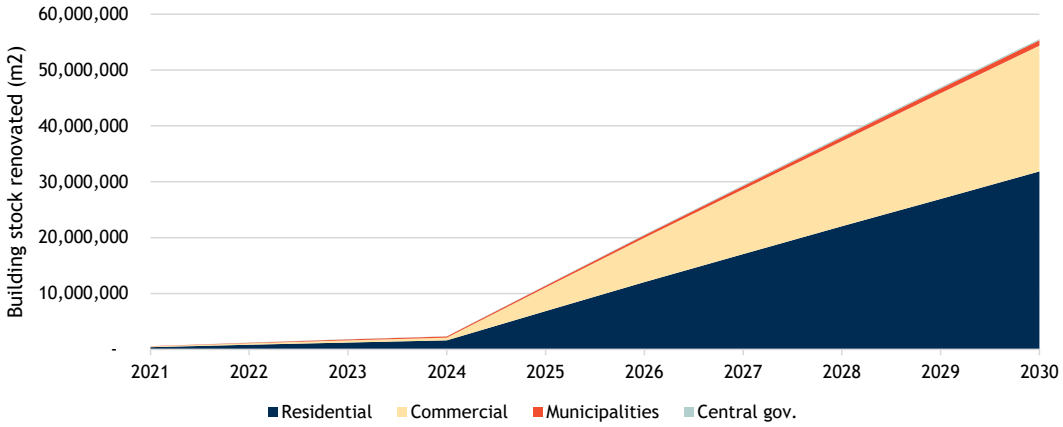
Figure 5-9 Cumulative renovated building stock from 2021 to 2035, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 33.5 mln. m^2 of dwellings and 7.5 mln. m^2 of commercial buildings being renovated from 2021 to 2030. For the public sector, at total of 2.9 mln. m^2 of the public building stock is renovated, of which 2.3 mln. m^2 is municipality-owned and 0.57 mln. m^2 is owned by the central government, which meets the NECP target of renovating 0.3 mln. m^2 of central government owned buildings.

Figure 5-10 Cumulative renovated building stock from 2021 to 2030 per building type, m2



Source: Trinomics, Energex & TalTech

5.5.2 *Impact assessment*

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

Regarding the socio-economic impacts, the Renovation Wave leads to a 5.6% increase in GDP. The average energy cost as share of household disposable income decreases from the baseline (7.98% to 7.33%). Additionally, the Renovation Wave pathway adds 26,280 jobs annually between 2021 and 2030, the highest among the pathways, and leads to a almost 3.9 billion EUR increase in tax revenue, thanks to an important

increase in renovation activity. Table 5-16 shows a more detailed breakdown of the macroeconomic impacts of the pathway.

Table 5-16 Macroeconomic impacts of the Renovation Wave pathway (Cumulative 2021-2030), MEUR

	Baseline	RenoWave
Total impact on GDP (MEUR)	**2552**	**24035**
Average annual impact on GDP (%)	1%	5,6%
Total GDP in 2030 (MEUR)	45214	48972
Compensation of employees	21608	23404
Consumption of fixed capital	7393	8007
Operating surplus and mixed income	10648	11533
Taxes on production and imports	6249	6768
Subsidies	-683	-739
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**26,28**
Employment in 2030 (thousand employees)	665	707
Impact of measures	0,82	26,26
Industry	0,24	0,33
Construction	0,59	24,99
Transport	-0,01	0,94
Impact of energy prices	0,01	0,01
Labour productivity (GDP/employee) (EUR)	63358	64122
Total impact on disposable income (MEUR)	**897**	**-1623**
Renovation costs (-)	-119	-10694
Personal transport costs (-)	0	-16
Increase in taxes (-)	-322	-3431
Increase in employment (+)	1219	11486
Energy cost savings (+)	118	1032
Energy cost share of disposable income (%)	7,98%	7,33%
Total impact to tax revenues (MEUR)	**1007**	**4879**
Impact on taxes via measures (indirect)	72	3366
Ìmpact on taxes via tax meaures (direct)	1020	1804
Reduction in taxes via savings (MEUR)	-85	-291

Source: Trinomics, Energex & TalTech

GHG emissions reduction and other environmental impacts

Overall, the measures of the Renovation Wave pathway lead significant GHG emissions savings of 4.2 MtCO2, with the majority of savings coming from households and services. Similar to GHG emissions, the pathway also has a greater impact on air pollutants than the baseline pathway.

Table 5-17 Environmental impacts of the Renovation Wave pathway (Cumulative 2021-2030)

	Baseline	RenoWave
Total GHG emissions reduction (MtCO2)	**1,26**	**4,17**
Industry	0,56	0,77
Households	0,37	1,81
Services	0,13	0,83
Transport	0,06	0,60
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		
SOx	0,69	1,64
NOx	0,72	2,89

PM2.5	0,64	3,12

Source: Trinomics, Energex & TalTech

Regional impacts

Similar to the previous pathways, the Renovation Wave pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Lõuna-Eesti, Kirde-Eesti and Kesk-Eesti. As with the other pathways, this is mainly because these regions contain more detached dwellings, which are more resource intensive compared to renovation of apartment buildings.

Table 5-18 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	7,5	6757	738	800
Lääne-Eesti	2,3	2652	228	1062
Kirde-Eesti	1,7	1820	166	967
Lõuna-Eesti	4,1	4567	402	1024
Kesk-Eesti	1,8	2055	176	1053
Total	17,4	17851	1711,2	929

Source: Trinomics, Energex & TalTech

5.5.3 *Implementation assessment (qualitative)*

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS),

The Renovation Wave pathway offers several advantages. Firstly, it provides access to a range of funding mechanisms, including EU funds, grants, and loans, facilitating investment in renovation projects. Secondly, the rapid advancements in energy-efficient technologies provide innovative and cost-effective solutions for renovations. Most energy efficiency measures are readily deployable with existing technologies. Moreover, the extensive and diverse building stock in the EU presents substantial market opportunities for renovation measures, leading to substantial energy savings. This pathway also generates a significant number of jobs on an annual basis.

Furthermore, energy-efficient renovations can act as a catalyst for economic growth by creating new employment opportunities and stimulating growth in the construction and manufacturing sectors. Additionally, increased energy efficiency contributes to reduced reliance on external energy sources, thereby enhancing energy security for the EU. The integration of smart technologies in renovations can optimize energy usage and improve building performance.

However, there are challenges to consider. The substantial initial investment required for renovation measures can deter building owners from pursuing energy-efficient solutions. In this pathway, large supports are required from the public sector. MEPS to apply to all dwellings might face difficulties and is

probably complex to implement. Some building owners and occupants may have limited awareness of the benefits and cost savings associated with energy-efficient renovations, posing a barrier to adoption. Additionally, there may be a shortage of skilled professionals and a lack of expertise in the field of energy-efficient renovations, which can hinder progress in this area.

Potential barriers

The implementation of significant energy renovation requirements nationally, spanning residential, commercial, and public buildings, encounters several noteworthy barriers. Foremost among these challenges is the high initial cost associated with such renovations, often dissuading building owners from undertaking energy-efficient upgrades. Financing can be a major hurdle, especially for smaller building owners and low-income households, as securing affordable loans or grants may prove difficult. The split incentives problem further complicates matters, particularly in rental properties, where landlords may be hesitant to invest in energy improvements when tenants pay the energy bills, leading to a misalignment of interests. However, a large application of MEPS may help overcome this barrier.

Technical and logistical challenges also impede progress, with a shortage of qualified contractors and technicians in the energy renovation field causing delays. The disruptive nature of renovation projects can discourage building owners, as they may lead to inconvenience for occupants or businesses. Market-related issues include limited demand for energy-efficient buildings and concerns that renovation investments may not be reflected in property resale values. Cultural resistance to change in construction and real estate industries, a focus on short-term gains over long-term energy savings, and government budget constraints add further layers of complexity.

Addressing these multifaceted barriers requires a holistic approach encompassing financial incentives, public awareness campaigns, regulatory reforms, technical support, and capacity building, with cooperation among government agencies, industry stakeholders, and the public being imperative for successful nationwide energy renovation initiatives.

Actors / concerned stakeholders

In the context of the renovation wave pathway, the concerned stakeholders primarily target the same audience, albeit with distinct categorization based on whether the buildings are public/individual or commercial/publicly owned. Building owners are tasked with the responsibility of renovating their properties to meet the minimum required energy performance standards. In most of the measures of the Renovation Wave, government entities oversee the administration of these renovation requirements and the Ministry in charge of Housing, with support from the Ministry of Energy, plays a central role in implementing and coordinating the renovation efforts.

Building occupiers, whether they are owners or tenants, are crucial players in the renovation process. If building owners occupy their own properties, they bear the financial burden of renovation work. However, in cases where buildings are occupied by tenants, building owners should bear the investment costs, potentially passing a portion of these expenses to tenants through increased rents. To ensure fairness and affordability, it is advisable to establish clear rules to prevent the undue transfer of renovation costs to tenants, and in some cases, this can be entirely avoided, with building owners covering the full cost.

Ultimately, the primary beneficiary of these renovation efforts is the individual energy consumer, often the unit tenant. They stand to gain from the enhancements in energy efficiency, which translate into

higher-quality energy devices and improved building envelopes. These improvements lead to reduced energy bills, contributing to cost savings and greater energy sustainability for the occupants.

Key risks

This section maps uncertainties and risks in the Renovation Wave pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed.

Technological/ skills: A major risk for the Renovation Wave, is having **sufficient skilled labour** in the construction industry to implement the required energy efficiency renovations. There are constraints on **material availability** due to the Covid-19 pandemic and the Russian invasion in Ukraine, which has created disturbances to international supply chains. To mitigate the technological and skills risks, ensuring there is sufficient skilled labour can be supported by developing and promoting training programmes for potential/existing construction professionals on energy efficiency renovation techniques. There are several ways to boost material availability, such as promoting local production to reduce reliance on imports, promoting resource efficiency in the construction materials industry, and promoting recycling/re-use of materials.

Social: Particularly relating to the implementation of MEPS, there are risks in terms of implementation due to lack of public acceptance as well as equity concerns as MEPS would disproportionally impact vulnerable or low-income households. Although MEPS would ultimately improve energy costs for these low-income households, the renovation costs can be burdensome. The transport measures are mainly the development of sufficient infrastructure to support public transport and private transport with sustainable fuels. However, there is a risk that citizens are not aware of these new developments and/or the benefits.

Grant programmes can be targeted towards vulnerable/low-income households who are to be affected by MEPS. Awareness campaigns which encourage the use of new public transport infrastructure (new tram lines, priority lanes for micro mobility, etc.)

Economic: The current **fluctuations of energy prices** create uncertainty for the cost-effectiveness of energy-savings measures. Consider loan schemes where repayment is based on actual cost savings to reduce the impact of fluctuating energy prices.

Environmental: Increasing construction activities (for renovation as well as transport infrastructure) can generate more waste and pollution. Incorporate life-cycle assessments into the design phase of renovations.

Administrative: Ensuring compliance with MEPS regulation could be a challenge in terms of enforcing inspections and penalties for non-compliance. Given the amount of grants, there is a lot of issues to access and information sharing, as well as monitoring compliance of measures.

Policy impacts

Energy renovation policies for buildings can have significant implications for other national policies that are already in place. These impacts can either complement or conflict with existing policy objectives. For instance, energy renovation policies align seamlessly with climate and environmental policies, as they contribute to the reduction of greenhouse gas emissions from the building sector, supporting national climate commitments. Additionally, these policies can enhance energy security and independence by

curbing energy consumption and reducing reliance on imported energy sources. Moreover, they stimulate job creation and economic growth, particularly in the construction and renovation sectors, which aligns with broader employment and economic development goals.

However, conflicts can also arise. Energy renovation requirements may raise construction and renovation costs, potentially leading to increased housing prices or rents, which can conflict with affordable housing policies. Industries impacted by energy efficiency measures, especially energy-intensive ones, may face higher operational costs, potentially conflicting with economic and business regulatory policies designed to maintain industry competitiveness. Taxation policies can also be influenced, as energy renovation incentives may alter the tax revenue landscape. Reduced energy consumption may affect energy suppliers and utilities, necessitating adjustments in utility regulations to address the economic implications.

Additionally, the introduction of new building codes and energy efficiency regulations can create regulatory complexity, potentially conflicting with efforts to streamline regulatory processes. Lastly, funding energy efficiency programs and incentives may require budget allocations that could conflict with fiscal policies aiming to reduce government spending or debt.

Alignment with EEF

MEPS applying to all residential and non-residential buildings will require to encompass fuel switching to progressively lead to the full decarbonisation of the building and industrial stock, while avoiding conflicting interest if other measures are stimulating the switch towards zero carbon fuels which might hamper EEF. Grants programmes should be aligned with support to alternative fuels, particularly with the deployment of heat pumps, in residential and non-residential sectors.

Main considerations beyond 2030

The measures of the *RenoWave* pathway focus mainly on the following, with the according effect beyond 2030

Type of EE measure	Timescale of the measure	Effect duration
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
Property taxation	Its design can foresee a continuous increase of the property taxation level of worst performing buildings	Continuously expand the scope of attractive investments
CO2 tax / fuel tax	Continuously increase the price of energy (under market conditions, via the ETS extension)	Continuously expand the scope of attractive investments

To conclude, this pathway will probably have a continuous effect beyond 2030 thanks to MEPS, to property and CO2 taxation (although these 2 measures remain limited), which will continuously incentivise energy users to generate additional savings every year.
Grants are still necessary to support the entry into force of MEPS, and could be progressively switched off after 2030-2035, depending on the level of the CO2 tax and property taxation.
All transport investments, although with a more limited impact, will also continue bringing additional savings every year.

5.6 Energy efficiency transport (EET)

The Energy Efficiency Transport (EET) pathway focuses primarily on the transport sector, with the government taking a leading role in implementing energy-efficient transport policies, and investing in the required infrastructure. However, other stakeholders may also be involved in the implementation, depending on the measures adopted. The costs of these policies can vary depending on their nature, and in many cases, the final users are expected to bear a significant portion of the costs.

Various energy efficiency policies can be implemented in the transport sector by national, regional, and local authorities. These include minimum performance standards, carbon pricing through fuel taxation, financial incentives to promote cleaner vehicle purchase and use, policies for eco-driving and raising awareness about energy-efficient transport, and measures to encourage modal shifts like urban planning and financial support for low-carbon and soft mobility options.

In addition to the additional new shared measures of the other pathways, the key policies and associated measures of the Energy Efficiency Transport pathway are:

- Subsidy for public transport usage (nT2) and micro-mobility usage (nT17) instead of personal vehicle
- Priority lanes for micro-mobility (nT3)
- Electric charging infrastructure for existing inhabitancy areas (nT4)
- Vehicle tax for registration (nT7)
- Annual vehicle tax
- Development of convenient and modern public transport (nT9)
- Developing the railroad infrastructure (includes the building of Rail Baltic) (nT11)
- The railroad electrification (nT12)
- Acquisition of additional passenger trains (nT15)
- New tram lines in Tallinn (nT16)
- All Tallinn and Tartu taxis run on electricity (nT18)
- Tallinn and Tartu congestion charge (nT19)

EE measures are also taken in the other sectors, but a lesser extent.

5.6.1 Main results

Energy consumption and savings

The *EET* pathway **does only achieve 2 Estonia's energy efficiency targets**. With an average annual final energy savings rate of 1.4% from 2024 to 2030, which just does not meet the 1.49% EED target. The final consumption is projected to decrease to 29.7 TWh by 2030, which is just below the target of less than 30 TWh, and the total renovated area of central public buildings also achieves the target. It is important to note that the *EET* pathway, despite extensive transport measures, does not meet the energy efficiency targets for the transport and industry sectors.

Table 5-19 Comparison of Energy Efficiency Transport pathways outcomes and EE targets for meeting NECP objectives

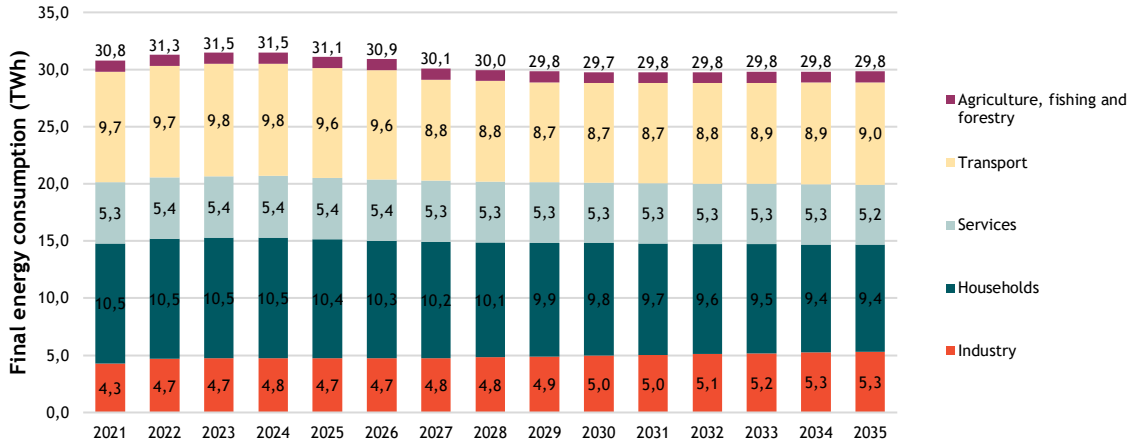
NECP 2030 objective	Baseline	EET	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0,06%	1,09%	1,90%	1,90%
Annual final savings rate, 2024-2030 average (%)	0,14%	1,40%	1,50%	1,50%
Final energy consumption in 2030 (TWh)	32,8	29,7	30,0	33,3
Primary energy consumption in 2030 (TWh)	51,5	47,3	45,7	63,9
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0,12	0,48		0,30
Average industry annual energy savings (2021-2030) (GWh)	313	418		460

Transport fuel consumption (TWh)	10,5	8,7		8,3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, Estonian final energy consumption drops by 1 TWh, from 30.7 TWh to 29.7 TWh, peaking at 31.5 TWh in 2024. Most of this reduction comes from the transport and services sector, as well as households.

Figure 5-11 Annual final energy consumption for the Energy Efficiency Transport pathway per sector (2021-2035), TWh



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

For the *EET* pathway, the cost of implementation is spread between the private and public sector, with the public sector accounting for 47% of investment and 53% for the private sector (Table 5-20). In the private sector, industrial actors, manufacturers, private companies and municipalities, bear the expenses as they invest in energy efficiency upgrades to meet new standards, or requirements. Consequently, consumers may experience increased prices as these costs are often passed on to them. The public provides support, and massively invest in transport infrastructure and public transport more globally (fleets, services, etc.), which leads to an increased share of the total investment for the public sector, compared to all other pathways.

Overall, *EET* has a higher investment cost than the baseline scenario, of approximately €12.6 billion cumulatively between 2021 and 2030. Table 5-20 includes a breakdown of total investment needed by the private and public sectors, including a division between household investment and company investment.

Table 5-20 Energy Efficiency Transport investment costs and cost savings (Cumulative 2021-2030), MEUR

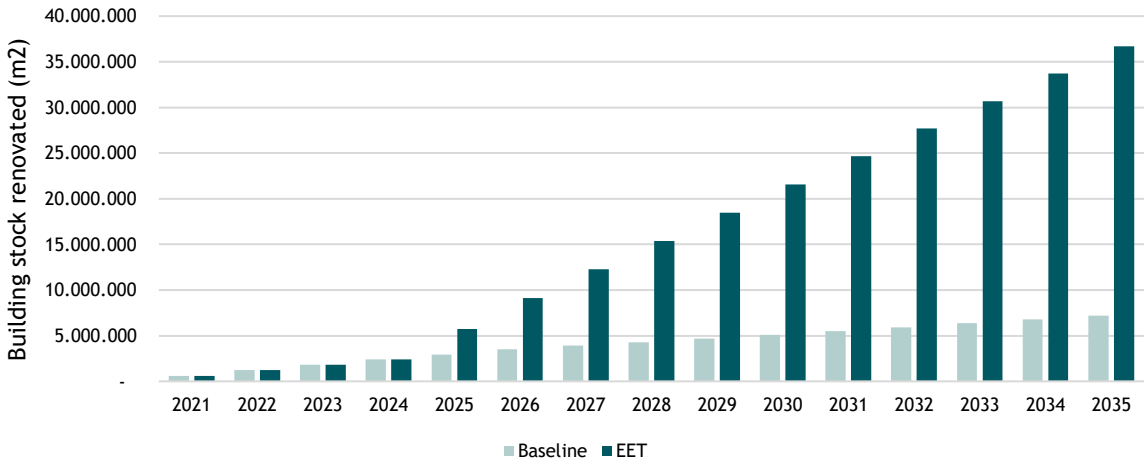
	Baseline	EET
Total Investment costs (MEUR)	**1588**	**12594**
Public sector	331	5951
Private sector	1257	6643
Household	119	3952
Companies	1138	2691
Total cost savings (MEUR)	**489**	**1752**
Public sector	42	163
Private sector	447	1589
Household	118	825
Companies	328	764

Source: Trinomics, Energex & TalTech

Renovation of building stock

The *EET* pathway initiates a significant increase in renovation of the building stock (27.6 mln. m^2 renovated from 2021 to 2030), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030). This is mainly driven by MEPS for targeted rented/sold dwellings and the service sector.

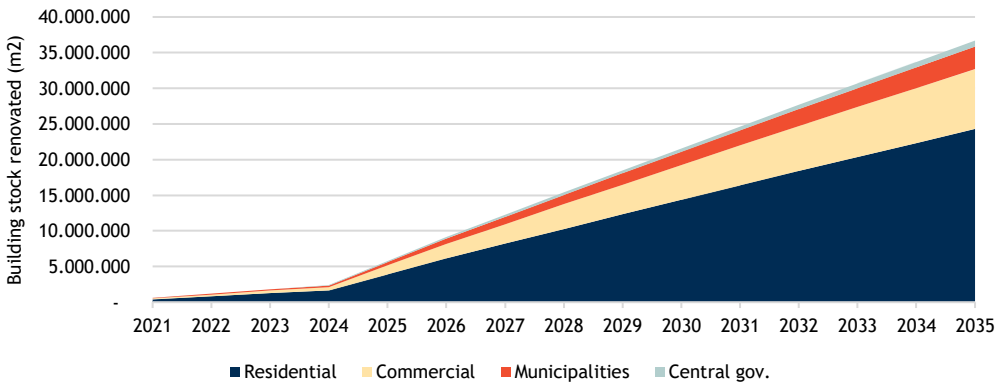
Figure 5-12 Cumulative renovated building stock from 2021 to 2035, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 14.4 mln. m^2 of dwellings and 17.2 mln. m^2 of commercial buildings being renovated from 2021 to 2030, and 36.7 mln. m^2 in total by 2035. For the public sector, at total of 2.4 mln. m^2 of the public building stock is renovated, of which 1.86 mln. m^2 is municipality-owned and 0.48 mln. m^2 is owned by the central government, which meets the NECP target of renovating 0.3 mln. m^2 of central government owned buildings.

Figure 5-13 Cumulative renovated building stock from 2021 to 2035 per building type, m^2



Source: Trinomics, Energex & TalTech

5.6.2 *Impact assessment (quantitative)*

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

Table 5-21 outlines the macro-economic impacts of the implementation of the *EET* Pathway. The pathway leads to a 4.1% increase in GDP. The average energy cost as share of household disposable income

decreases from the baseline (7.98% to 7.49%). The pathway leads to average annual job creation of 16,67 jobs annually between 2021 and 2030, and leads to a 1.7 billion EUR increase in tax revenue.

Table 5-21 Macroeconomic impacts of the Energy Efficiency Transport pathway (Cumulative 2021-2030), MEUR

	Baseline	EET
Total impact on GDP (MEUR)	**2552**	**17625**
Average annual impact on GDP (%)	1%	4,1%
Total GDP in 2030 (MEUR)	45214	47311
Compensation of employees	21608	22610
Consumption of fixed capital	7393	7735
Operating surplus and mixed income	10648	11142
Taxes on production and imports	6249	6538
Subsidies	-683	-714
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**16,68**
Employment in 2030 (thousand employees)	665	682
Impact of measures	0,82	16,67
Industry	0,24	0,33
Construction	0,59	11,34
Transport	-0,01	4,99
Impact of energy prices	0,01	0,01
Labour productivity (GDP/employee) (EUR)	63358	64085
Total impact on disposable income (MEUR)	**897**	**3882**
Renovation costs (-)	-119	-3913
Personal transport costs (-)	0	-39
Increase in taxes (-)	-322	-1414
Increase in employment (+)	1219	8423
Energy cost savings (+)	118	825
Energy cost share of disposable income (%)	7,98%	7,49%
Total impact to tax revenues (MEUR)	**1007**	**2736**
Impact on taxes via measures (indirect)	72	1577
Ìmpact on taxes via tax meaures (direct)	1020	1613
Reduction in taxes via savings (MEUR)	-85	-453

Source: Trinomics, Energex & TalTech

GHG emissions reduction & other environmental impacts

Regarding GHG emissions reductions, the *EET* pathway leads to an overall reduction of 4.5 MtCO2 total emissions cumulatively between 2021 and 2030. The largest portion of this is from the transport sector. Similar to the other pathways, there is a significantly greater impact on air pollution compared to the baseline pathway.

Table 5-22 Environmental impacts of the *EET* pathway (Cumulative 2021-2030)

	Baseline	EET
Total GHG emissions reduction (MtCO2)	**1,26**	**4,50**
Industry	0,56	0,76
Households	0,37	0,92
Services	0,13	0,57
Transport	0,06	2,09
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		

SOx	0,69	2,82
NOx	0,72	1,91
PM2.5	0,64	2,00

Source: Trinomics, Energex & TalTech

Regional impacts

Similar to the previous pathways, the *EET* pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Lõuna-Eesti and Kesk-Eesti. As with the other pathways, this is mainly because these regions contain more detached dwellings, which are more resource intensive compared to renovation of apartment buildings.

Table 5-23 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	9,0	5255	912	484
Lääne-Eesti	2,8	2702	293	856
Kirde-Eesti	1,3	968	122	666
Lõuna-Eesti	3,1	2540	302	726
Kesk-Eesti	1,3	1128	122	801
Total	17,4	12593	1750,8	623

Source: Trinomics, Energex & TalTech

5.6.3 *Implementation assessment (qualitative)*

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS)

The Energy Efficient Transport Pathway offers several advantages. Firstly, Estonia demonstrates a strong commitment to sustainability and energy efficiency, backed by clear government support for promoting energy-efficient transport initiatives. Secondly, the rise of electric mobility and the availability of electric vehicles create an opportunity to reduce emissions and enhance energy efficiency. Thirdly, investments in cycling lanes and pedestrian-friendly infrastructure can promote active transportation, reducing dependence on cars. Lastly, the implementation of integrated transport systems and multimodal transportation can optimize energy utilization and enhance overall efficiency.

However, the Energy Efficient Transport Pathway also presents some drawbacks. Firstly, the limited infrastructure for electric vehicles and alternative refuelling stations may impede the adoption of energy-efficient transport. The scarcity of charging stations, for instance, could discourage people from transitioning to electric vehicles. Likewise, insufficient public transportation stops could deter individuals from using such services.

Secondly, resistance within the public to adopt new transportation habits or technologies could delay the implementation of energy-efficient measures. People may be hesitant to embrace change or may lack awareness of the benefits associated with energy-efficient transport. For instance, some individuals might be reluctant to shift to public transportation due to their familiarity with personal vehicle usage.

Potential barriers

Budget constraints can be a major barrier to implementing energy-efficient transport measures. This is because such measures can be expensive, and the government may have limited funding available. Additionally, there may be competing priorities for funding, such as education or healthcare.

Actors / concerned stakeholders

In the Energy Efficient Transport pathway, a diverse group of stakeholders plays pivotal roles, shaping the outcomes of this strategy. Among these stakeholders, individuals occupy a central position. This includes those who own cars, intend to purchase new vehicles, or frequently rely on public transportation.

Individuals who own cars or plan to buy new vehicles might experience negative effects when policies like penalties for private car usage are in place. These penalties can lead to increased costs and restrictions on personal vehicle use. However, these same individuals also stand to benefit significantly from the enhancement of public transportation measures. Improved public transportation can offer them more convenient, cost-effective, and eco-friendly alternatives to private car use. Reduced traffic congestion and improved air quality in cities can enhance their overall quality of life.

For governments, particularly at the national level, there are substantial benefits as well. When penalties and taxes are imposed on private car usage, government revenue increases, providing additional funds for public infrastructure development and services. Additionally, governments can achieve sustainability and environmental goals, reduce energy consumption, and lower greenhouse gas emissions by promoting energy-efficient transport options.

The main entities responsible for implementing and coordinating the Energy Efficient Transport pathway are government agencies and ministries. In this context, the Ministry of Regional Affairs and Agriculture plays a crucial role as the ministry in charge of public transport. This ministry oversees the development, regulation, and management of public transportation systems, ensuring that they align with energy efficiency and sustainability objectives.

National transport authorities and municipal transport ministries are also key implementers. They are responsible for executing policies at the national and local levels, respectively. National transport authorities oversee transportation networks, regulations, and standards, while municipal transport ministries focus on urban and regional transportation infrastructure, services, and accessibility.

Key risks

This section maps uncertainties and risks in the Energy Efficient Transport pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed.

Technological/Skills: The integration of new energy-efficient technologies with existing transport infrastructure and systems could pose technical challenges, requiring careful planning and coordination. For example, the establishment of a widespread and reliable electric vehicle charging infrastructure is

crucial for the adoption of electric vehicles but may face challenges related to cost, accessibility, and coordination between different stakeholders. Additionally, a shortage of skilled workers and technicians proficient in handling and maintaining energy-efficient transport technologies, such as electric vehicles and advanced vehicle systems, may impact the efficient operation and maintenance of these technologies.

To address these challenges, it is essential to ensure adequate training and capacity building for transport operators, drivers, and maintenance personnel. This can be done through specialized training programs and workshops for policymakers, transport planners, and engineers to enhance their technical expertise in energy-efficient transport technologies. Additionally, governments can encourage local manufacturing and production of energy-efficient transport technologies to reduce reliance on imports and mitigate supply chain risks. Finally, governments can provide financial support, grants, and incentives to organizations and individuals adopting energy-efficient transport technologies, easing the burden of upfront investment costs.

Social: regarding social risks, some segments of the population may resist adopting new energy-efficient transport measures due to significant changes in behaviour or lifestyle. Cultural norms, like attachment to car ownership and resistance to using public transport, can create social barriers to acceptance. Encouraging energy-efficient practices may require effective social marketing and behaviour change campaigns. Concerns about equity and social inclusion arise as not all segments of the population may access or afford energy-efficient transport options. Low-income individuals and marginalized communities could face barriers to adopting these technologies or services.

Implementing energy-efficient transport measures may involve substantial changes to existing transportation infrastructure, such as developing electric vehicle charging stations. Social challenges may emerge from disruptions to communities or disagreements over infrastructure placement.

To combat such risks, conduct comprehensive awareness campaigns to educate citizens about the benefits of energy-efficient transport and dispel misconceptions. Highlight the positive impacts on society, economy, and the environment to promote behaviour change. Design measures with inclusivity in mind, considering the needs and preferences of diverse social groups. Engage citizens and stakeholders in decision-making, seeking feedback and addressing concerns. Conduct social equity assessments and implement targeted interventions to address disparities. Offer financial incentives, subsidies, or tax benefits to make energy-efficient transport options more affordable for low-income individuals. This will encourage wider adoption and promote equitable access to these measures.

Economic: Economically, implementing energy efficiency measures often requires significant upfront investment. The costs of upgrading infrastructure, transitioning to new technologies, or implementing supportive policies can be substantial and pose financial risks, especially for public budgets or private investors. Securing adequate financing for energy efficiency projects can be challenging, especially for small businesses or organizations. Limited access to funding or high-interest rates may deter potential investors.

To address these risks, the government can Provide financial incentives, grants, or low-interest loans to support the adoption of energy efficiency measures. These incentives can encourage businesses and individuals to invest in sustainable transportation solutions and offset some of the initial costs. Prioritise energy-efficient technologies that have proven reliability, long-term durability, and scalability. Opt for

solutions that can adapt to future technological advancements, reducing the risk of premature obsolescence.

Environmental: While energy efficient transport measures may directly reduce emissions from vehicles, there is a risk of indirect emissions elsewhere in the lifecycle of these measures. For example, the production, disposal, and recycling of new technologies and materials used in energy-efficient vehicles or infrastructure may generate additional greenhouse gas emissions. Certain energy-efficient technologies and infrastructure, such as electric vehicles and charging stations, may require significant natural resources for their production. The extraction and processing of these resources can have environmental impacts, including habitat destruction, water pollution, and biodiversity loss. The expansion of energy-efficient transport infrastructure, such as new roads or charging stations, may require land development and potential disruption of natural habitats. Poorly planned projects could lead to habitat fragmentation, endangering wildlife and ecosystems.

To mitigate these risks, implementers can conduct a comprehensive LCA for energy efficient technologies and infrastructure can help identify and quantify the environmental impacts throughout their entire life cycle. This approach enables better decision-making, ensuring that measures with the lowest overall environmental footprint are prioritised. Conducting energy efficient transport measures should be accompanied by careful land use planning and environmental impact assessments. Avoiding critical habitats and protected areas can help preserve biodiversity and minimise habitat disruptions.

Administrative: Public procurement processes can be lengthy and bureaucratic, delaying the acquisition and deployment of energy efficient transport technologies. Streamlining procurement procedures and adopting flexible procurement frameworks can expedite the process. To mitigate administrative risks, Simplify and standardize the procurement procedures to reduce bureaucratic hurdles and minimise delays. Establish clear guidelines and templates for procurement documents to expedite the process. Pre-qualify suppliers or service providers based on specific criteria and qualifications. This approach can help speed up the selection process and ensure that only qualified and capable vendors participate. Establish framework agreements with pre-selected suppliers for energy efficient transport technologies. These agreements can facilitate faster procurement by providing a pre-approved list of suppliers and negotiated terms, enabling quicker decision-making.

Policy impacts

The implementation of increased measures for energy-efficient transport can have a substantial impact on various other national policies that may already be in place. These impacts can be both complementary and conflicting, depending on how well-coordinated and harmonized the policies are.
On the positive side, energy-efficient transport measures align seamlessly with broader climate and environmental policies. They contribute to the reduction of greenhouse gas emissions, thus supporting national and international climate commitments. Additionally, these measures can enhance energy security and independence by reducing energy consumption, which is in line with national energy policy goals.

However, conflicts and challenges may arise as well. Increased energy efficiency measures may require significant financial investments, potentially conflicting with fiscal policies aimed at reducing government spending or debt. Affordability and accessibility of transportation can also be impacted. While energy-efficient transport can reduce operating costs for individuals, initial investments in efficient vehicles or public transportation infrastructure may pose affordability challenges for some, potentially conflicting

with policies aimed at enhancing social equity and affordability. For example, by implement a tax on new private vehicle registration, individuals may be inclined to keep using their old, less efficient vehicles, rather than upgrade to a more efficient or electric vehicle.

Alignment with EEF

Investment in transport public assets, in alternative transport modes, and stimulative measures towards their use are a key priority to ensure the EEF is driving the decarbonisation of the transport sector. Given the global limitation of resources, the shift to sustainable fuels should be first driven by a significant increase in energy efficiency.[130]

The emergence of alternative fuels should not hamper EEF.

Main considerations beyond 2030

The measures of the *EET* pathway focus mainly on the following, with the according effect beyond 2030

Type of EE measure	Initial timescale of the measure	Effect duration
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
Subsidy public transport	Stop in 2030 (or reduce) public money	the use of public transport can continue (if it has demonstrated interest and remain attractive) or stop (if not convincing). It will depend on many factors
Infra transport (charging)	The public investment stops in 2030, but private can take over and continue deploying	It assumes more and more users will make use of the deployed infrastructure
Infra public transport (fleets, train, tram)	These are one shot massive investments, requiring O&M	Infrastructure in alternative transport still operates, and are maintained in order to deliver their services (e.g. micro lanes, train lines, bus fleets, etc.) It assumes more and more passengers will make use of the deployed infrastructure and fleets.
Vehicle tax	Adapted taxation rate has been established	Its effect continues with the acquisition of new vehicles, until the whole vehicle stock has been changed (10 years?)
Congestion charge	Congestion charges have been established	To a certain extent, it continues to convince people not to use their individual vehicle

To conclude, this pathway will probably have a continuous effect beyond 2030 thanks to the development of the required infrastructure, and to MEPS, which will continuously incentivise energy users to generate additional savings every year.

However, grants are still necessary to support the entry into force of MEPS or stimulate citizens to use alternative options to replace their individua car. Property taxation will continue to incentivise the non-residential buildings to renovate, beyond 2030.

5.7 Comprehensive energy efficiency reform 1 (CEER 1)

[130] https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2023)733103

The Comprehensive Energy Efficiency Reform 1 (CEER1) pathway is a holistic approach that brings together various measures from the previously discussed pathways to create a comprehensive and integrated example. The main objective of *CEER1* is to achieve significant energy efficiency improvements across different sectors and domains. The measures largely consist of building renovation and transport measures, while accompanying the industry to increased energy savings via Voluntary Agreements.

This pathway incorporates a mix of policy interventions, technological advancements, and behavioural changes to maximize energy savings and reduce greenhouse gas emissions. It encompasses measures targeting buildings, transportation, industries, and public services, among others. By combining these measures, *CEER1* aims to create a synergistic effect that amplifies the impact of individual actions.

The key policies and associated measures of the *CEER1* pathway are:

- MEPS for rented residential buildings (nR2)
- Renovation grants for single family houses (20-30% support) (nR4)
- Tax deduction for renovation works by private persons (=parallel track for single family) (nR7)
- Property tax (according to EPC levels) (nR7, nS7)
- Minimum energy performance standards for non-residential buildings (regulatory requirements for EPC class E and F) (nS8)
- Subsidy for public transport usage (nT2) and micro-mobility usage (nT17) instead of personal vehicle
- Priority lanes for micro-mobility (nT3)
- Electric charging infrastructure for existing inhabitancy areas (nT4)
- Biomethane and hydrogen infrastructure (nT5, nT6)
- Vehicle tax for registration (nT7)
- Annual vehicle tax (nT8)
- Development of convenient and modern public transport (nT9)
- Developing the railroad infrastructure (includes the building of Rail Baltic) (nT11)
- The railroad electrification (nT12)
- Promoting the use of biomethane in buses and the use of electricity in buses (nT13, nT14)
- Acquisition of additional passenger trains (nT15)
- New tram lines in Tallinn (nT16)
- All Tallinn and Tartu taxis run on electricity (nT18)
- Tallinn and Tartu congestion charge (nT19)

5.7.1 Main results

Energy consumption and savings

The *CEER1* pathway **does not meet all energy efficiency targets**. The *CEER1* scenario overall overperforms the baseline scenario in terms of meeting Estonia's EE targets laid out in the NECP 2030 (Table 5-24). However, the average annual final energy savings rate from 2024 to 2030 is 1.33% (which is below the EE target of 1.49%), while final consumption drops to 29.9 TWh by 2030 (EE target is less than 30 TWh). The primary energy consumption drops to 47.1 TWh, which is above the less than 45.7 TWh EED target. Further, the final energy savings rate in 2030 is less than the EED target of 1.9% (1.32%), due to a slow-down of the measures. This pathway does meet the EE targets for central government buildings or transport individually.

Table 5-24 Comparison of scenario outcomes and EE targets

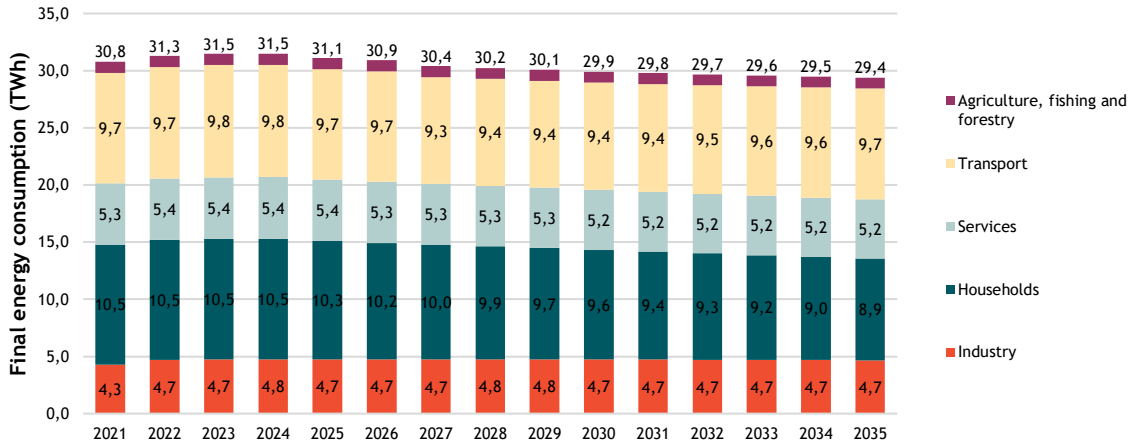
NECP 2030 objective	Baseline	CEER1	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0,06%	1,32%	1,90%	1,90%
Annual final savings rate, 2024-2030 average (%)	0,14%	1,33%	1,50%	1,50%

Final energy consumption in 2030 (TWh)	32,8	29,9	30,0	33,3
Primary energy consumption in 2030 (TWh)	51,5	47,1	45,7	63,9
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0,12	0,59		0,30
Average industry annual energy savings (2021-2030) (GWh)	313	647		460
Transport fuel consumption (TWh)	10,5	9,4		8,3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, the final energy consumption drops by 1.3 TWh, from 30.7 TWh to 29.4 TWh (Figure 5-14). Most of this reduction comes from the household and services sector (1.4 TWh reduction via renovation measures). Industrial energy use increases as the increase in production surpasses the reductions from energy efficiency measures. Transport measures lead to a 0.3 TWh reduction from 2021 to 2030.

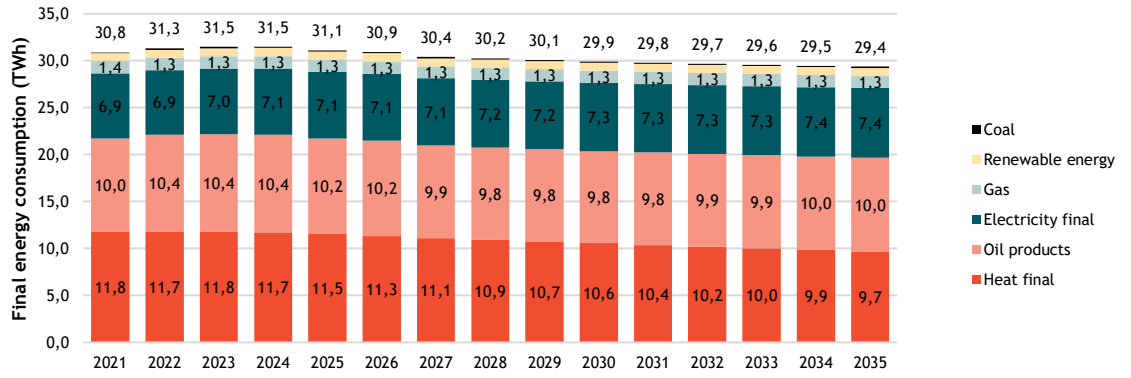
Figure 5-14 Annual final energy consumption per sector (2021-2035), TWh



Source: Trinomics, Energex & TalTech

Given the boost in renovation, the greatest impact on consumption in terms of fuels is on heat (-1.2 TWh by 2030), while there is an increase in electricity consumption (+0.4 TWh) (Figure 5-15). There is also a small reduction of oil products (-0.2 TWh) and natural gas (-0.1 TWh), mainly from transport measures. There is little to no impact on the use of coal and renewable energy.

Figure 5-15 Annual final energy consumption per fuel source (2021-2035), TWh



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

The *CEER1* needs much greater investment over the next decade compared to the Baseline scenario. From 2021 to 2030, the EE measures in the *CEER1* pathway would require a €12.5 billion investment, of which 65% is covered by the private sector. This is because of the renovation measures, namely MEPS, which require intensive investment from building owners. It is important to note that cost savings will still occur beyond 2030, which are not taken into account in this analysis.

Table 5-25 Investment costs and cost savings (Cumulative 2021-2030), MEUR

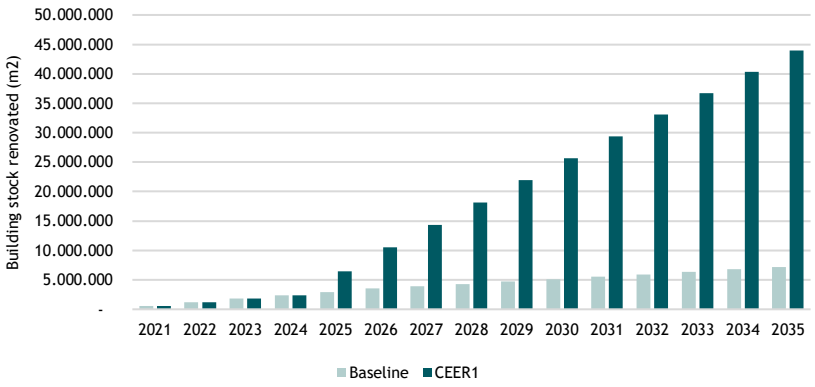
	Baseline	CEER1
Total Investment costs (MEUR)	**1588**	**12458**
Public sector	331	4395
Private sector	1257	8064
Household	119	4828
Companies	1138	3235
Total cost savings (MEUR)	**489**	**1627**
Public sector	42	143
Private sector	447	1484
Household	118	812
Companies	328	672

Source: Trinomics, Energex & TalTech

Renovation of building stock

The *CEER1* pathway initiates a significant increase in renovation of the building stock (29.4 mln. m^2 renovated from 2021 to 2030, and 44 mln. m^2 by 2035), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030). This is mainly driven by MEPS for targeted rented/sold dwellings and the service sector as well as support measures.

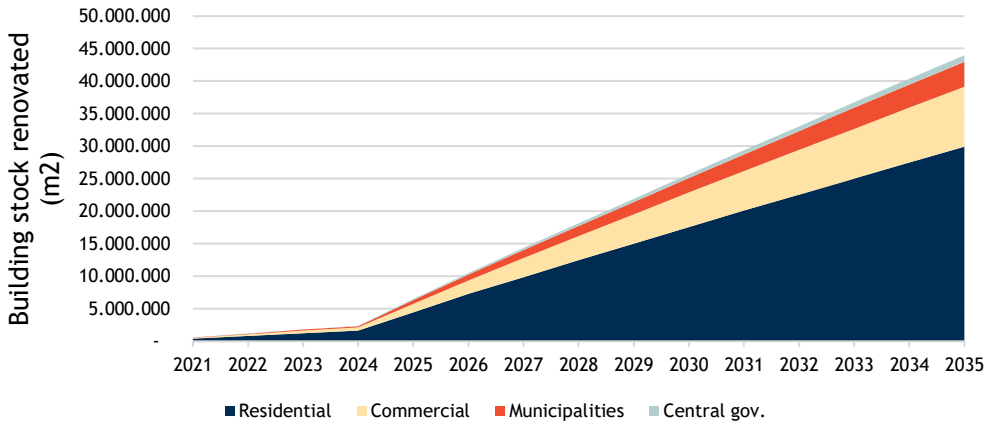
Figure 5-16 Cumulative renovated building stock from 2021 to 2035, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 20.1 mln. m^2 of dwellings and 5.2 mln. m^2 of commercial buildings being renovated from 2021 to 2030. For the public sector, at total of 2.8 mln. m^2 of the public building stock is renovated, of which 2.23 mln. m^2 is municipality-owned and 0.59 mln. m^2 is owned by the central government, which meets the NECP target of renovating 0.3 mln. m^2 of central government owned buildings.

Figure 5-17 Cumulative renovated building stock from 2021 to 2035 per building type, m2



Source: Trinomics, Energex & TalTech

5.7.2 Impact assessment

This section analyses the impact of the *CEER1* pathway on: the macroeconomic impact in terms of impact on GDP, employment, labour productivity, disposable income and tax revenues; as well as the environmental impact.

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

Due to the greater investment required, the *CEER1* pathway also has a greater impact on the economy. The average annual impact of the *CEER1* pathway on GDP is 4.1%; this leads to an increase of €17.3 billion to GDP over the period from 2021 to 2030. Additionally, the pathway also leads to a greater impact on employment compared to the Baseline pathway. The pathway leads to 16,4000 new jobs on average every year from 2021 to 2030.

Table 5-26 Macroeconomic impact (Cumulative 2021-2030), MEUR

	Baseline	CEER1
Total impact on GDP (MEUR)	**2552**	**17306**
Average annual impact on GDP (%)	1%	4,1%
Total GDP in 2030 (MEUR)	45214	47559
Compensation of employees	21608	22729
Consumption of fixed capital	7393	7776
Operating surplus and mixed income	10648	11200
Taxes on production and imports	6249	6573
Subsidies	-683	-718
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**16,40**
Employment in 2030 (thousand employees)	665	686
Impact of measures	0,82	16,39
Industry	0,24	0,47
Construction	0,59	13,57
Transport	-0,01	2,36
Impact of energy prices	0,01	0,01
Labour productivity (GDP/employee) (EUR)	63358	64065
Total impact on disposable income (MEUR)	**897**	**2614**
Renovation costs (-)	-119	-4789

Personal transport costs (-)	0	-39
Increase in taxes (-)	-322	-1639
Increase in employment (+)	1219	8270
Energy cost savings (+)	118	812
Energy cost share of disposable income (%)	7,98%	7,48%
Total impact to tax revenues (MEUR)	**1007**	**3268**
Impact on taxes via measures (indirect)	72	1822
Ìmpact on taxes via tax meaures (direct)	1020	1804
Reduction in taxes via savings (MEUR)	-85	-358

Source: Trinomics, Energex & TalTech

GHG emissions reduction & other environmental impacts

The EE measures from the *CEER1* pathway led to a reduction of 4.17 MtCO2. Most of this reduction comes from building renovation (1.71 MtCO2) and more efficient transport (1.35 MtCO2).

Table 5-27 Environmental impact (Cumulative 2021-2030)

	Baseline	CEER1
Total GHG emissions reduction (MtCO2)	**1,26**	**4,17**
Industry	0,56	0,96
Households	0,37	1,08
Services	0,13	0,63
Transport	0,06	1,35
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		
SOx	0,69	2,25
NOx	0,72	2,11
PM2.5	0,64	2,18

Source: Trinomics, Energex & TalTech

Regional impacts

Similar to the previous pathways, the *CEER1* pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Lõuna-Eesti and Kesk-Eesti. As with the other pathways, this is mainly because these regions contain more detached dwellings, which are more resource intensive compared to renovation of apartment buildings.

Table 5-28 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	7,9	4971	788	529
Lääne-Eesti	2,3	2204	233	863
Kirde-Eesti	1,4	1110	136	689
Lõuna-Eesti	3,3	2882	330	763
Kesk-Eesti	1,4	1290	139	812
Total	16,4	12457	1626,4	662

Source: Trinomics, Energex & TalTech

5.7.3 Implementation assessment (qualitative)

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS)

The measures of *CEER1* communicates a strong commitment to energy efficiency, notably supported by the government and the dedicated transport ministry. The pathway is supported by the availability of diverse funding mechanisms, including EU funds, grants, and loans, facilitates investment in multiple EE measures, leveraging resources effectively. The rapid evolution of energy-efficient technologies offers innovative and cost-effective renovation solutions, with many measures already technology-ready and poised for deployment, generating significant annual job opportunities.

Furthermore, the progression of electric mobility and the proliferation of e-vehicles present opportunities to reduce emissions and promote energy efficiency, aligning with Estonia's sustainable goals. Investments in cycling lanes and pedestrian-friendly infrastructure can further encourage active transportation and reduce car dependency, enhancing the pathway's effectiveness. Implementing integrated and multimodal transport systems optimizes energy use and overall efficiency while stimulating economic growth by generating new jobs and boosting the construction and manufacturing sectors. Moreover, heightened energy efficiency diminishes reliance on external energy sources, heightening energy security for the EU. The integration of smart technologies into renovations further optimizes energy utilization and improves building performance.

Nevertheless, certain challenges and disadvantages persist. Insufficient charging infrastructure for electric vehicles and a lack of alternative fueling stations can hinder the widespread adoption of energy-efficient transport. Resistance from the public to embrace new transportation habits or technologies might impede the pathway's implementation. The substantial initial investments required for renovation measures can discourage building owners from pursuing energy-efficient solutions, particularly in the absence of clear incentives. Limited awareness among some building owners and occupants regarding the benefits and cost savings associated with energy-efficient renovations may also pose obstacles. Additionally, a shortage of skilled workers and professionals with expertise in energy-efficient renovations can act as a limiting factor, potentially slowing down the progress of the pathway. In addressing these disadvantages, comprehensive planning and targeted interventions are essential to maximize the benefits of the EE pathway while mitigating potential challenges.

Potential barriers

Resistance from building owners and occupants can be a significant obstacle to the progress of energy-efficient measures in the building sector. This resistance often arises due to various factors, including concerns about the initial costs associated with energy-efficient renovations. Building owners may hesitate to make substantial investments in energy efficiency improvements, especially if they believe it will take a long time to recoup the expenses through reduced energy bills. Similarly, tenants may resist changes that could lead to rent increases. Additionally, the inconvenience caused by renovations, such as noise, dust, and disruptions to daily routines, can deter building occupants from embracing energy-efficient measures. Moreover, the absence of financial incentives or regulatory requirements can further diminish the motivation for energy-efficient renovations.

Conversely, the shortage of skilled labor and professionals experienced in energy-efficient building renovations poses a distinct challenge. This shortage can result in concerns regarding the quality and effectiveness of energy-efficient upgrades. Without a workforce equipped with the necessary skills and expertise, there is a risk of suboptimal or poorly executed renovations that fail to deliver the expected energy savings and improvements. It can also lead to delays in project completion, increased costs, and frustration among building owners and occupants. Addressing this shortage requires investments in training and education programs to develop a skilled workforce capable of implementing energy-efficient building measures effectively.

Actors / concerned stakeholders

The actors concern those from the Voluntary Agreement (for the industry), those from the *RenoWave* (for the building) and those from the *EET* (for transport).

Key risks

This section maps uncertainties and risks in the *CEER1* pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed.

Technical/Skills: A key concern within the *CEER1* concerns the renovation measures. There is limited availability of skilled labour in the construction industry for executing necessary energy-efficient renovations. The ongoing Covid-19 pandemic and geopolitical disruptions, like the Russian invasion of Ukraine, have strained international supply chains, impacting material availability. To address these challenges, proactive steps can be taken, including the development and promotion of training programs aimed at equipping potential and existing construction professionals with expertise in energy-efficient renovation techniques. Additionally, material availability can be improved through strategies such as promoting local production to reduce dependency on imports, enhancing resource efficiency within the construction materials sector, and encouraging recycling and the reuse of materials.

Social: From a social perspective, there are specific concerns, particularly regarding Minimum Energy Performance Standards (MEPS). These concerns encompass potential resistance from the public and equity issues, as MEPS may disproportionately affect vulnerable or low-income households. While MEPS can eventually lead to reduced energy costs for these households, the initial renovation expenses may pose a burden. On the transport front, the focus lies on developing adequate infrastructure to support sustainable public and private transportation fuelled by sustainable sources. Nevertheless, there's a risk that citizens may not be sufficiently informed about these developments and their associated benefits. To address these social challenges, proactive measures include awareness campaigns that engage communities to enhance their understanding of the advantages of energy-efficient renovations and the financial options available, such as grants. Additionally, grant programs can be targeted specifically toward vulnerable or low-income households affected by MEPS, and awareness campaigns can promote the utilization of new public transport infrastructure, such as new tram lines and priority lanes for micro-mobility solutions.

Economic: The current volatility in energy prices introduces uncertainty regarding the cost-effectiveness of energy-saving measures. To address this concern, one potential mitigation approach is to consider implementing loan schemes where repayment is tied to actual cost savings, thereby mitigating the impact of fluctuating energy prices.

Environmental: Increased construction activities associated with both renovation and transport infrastructure projects can lead to heightened levels of waste generation and environmental pollution. To mitigate these environmental challenges, it is essential to incorporate life-cycle assessments during the design phase of renovation projects. Additionally, strengthening waste management practices related to construction waste can encourage recycling and the reuse of materials, thereby reducing environmental impacts.

Administrative: Ensuring compliance with Minimum Energy Performance Standards (MEPS) regulations may pose challenges, particularly concerning the enforcement of inspections and penalties for non-compliance. Mitigation measures should focus on the need for effective coordination, monitoring, and implementation, given that this pathway comprises numerous ad hoc, small-scale measures that require diligent oversight.

Policy impacts

Given the cross-sectoral implementation of energy efficiency measures within *CEER1,* there are potential conflicting policy impacts to consider. Implementing multiple measures simultaneously without proper coordination can lead to overlap and inefficiency. Different policies may target the same energy-saving goals, resulting in redundant efforts and resources. For example, implementing a property tax by EPC level and not aligning with Minimum Energy Performance Standards, or simultaneously offering a grant that is too low to reach the determined MEPS.

The interests of different sectors may sometimes conflict. For example, policies promoting energy-efficient public transportation might compete with policies supporting the automotive industry, potentially leading to political tensions and policy reversals. Allocating resources and funding to multiple sectors can be challenging. Policymakers may need to make difficult decisions about how to distribute limited resources across different initiatives. For example in the transport sector, determining where to allocate funds first, to micro-mobility, or increased public transport.

Policies targeting one sector may inadvertently affect other sectors. For instance, stringent energy efficiency requirements for buildings may increase construction costs, potentially impacting the real estate industry and housing affordability.

Alignment with EEF

MEPS applying to all residential and non-residential buildings will require to encompass fuel switching to progressively lead to the full decarbonisation of the building and industrial stock, while avoiding conflicting interest if other measures are stimulating the switch towards zero carbon fuels which might hamper EEF. Grants programmes should be aligned with support to alternative fuels, particularly with the deployment of heat pumps, in residential and non-residential sectors.
Investment in transport public assets, in alternative transport modes, and stimulative measures towards their use are a key priority to ensure the EEF is driving the decarbonisation of the transport sector.
Given the global limitation of resources, the shift to sustainable fuels should be first driven by a significant increase in energy efficiency.[131] The emergence of alternative fuels should not hamper EEF.

[131] https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2023)733103

Main considerations beyond 2030

The measures of the *CEER1* pathway focus mainly on the following, with the according effect beyond 2030

Type of EE measure	Initial timescale of the measure	Effect duration
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
Property taxation	Its design can foresee a continuous increase of the property taxation level of worst performing buildings	Continuously expand the scope of attractive investments
Voluntary Scheme	The *VA* is established, and its effect continue beyond 2030. Its design can foresee a continuous increase of savings rule, and ongoing dialogue with concerned industries to increase	New investments will be made according to industry action plan,
Public procurement	The procurement rule is established, and continues beyond 2030	New savings with new purchase, until the full stock has been changed
Subsidy public transport	Stop in 2030 (or reduce) public money	the use of public transport can continue (if it has demonstrated interest and remain attractive) or stop (if not convincing). It will depend on many factors
Infra transport (charging)	The public investment stops in 2030, but private can take over and continue deploying	It assumes more and more users will make use of the deployed infrastructure
Infra public transport (fleets, train, tram)	These are one shot massive investments, requiring O&M	Infrastructure in alternative transport still operates, and are maintained in order to deliver their services (e.g. micro lanes, train lines, bus fleets, etc.) It assumes more and more passengers will make use of the deployed infrastructure and fleets.
Vehicle tax	Adapted taxation rate has been established	Its effect continues with the acquisition of new vehicles, until the whole vehicle stock has been changed (10 years?)
Congestion charge	Congestion charges have been established	To a certain extent, it continues to convince people not to use their individual vehicle

To conclude, this pathway will probably have a continuous effect beyond 2030 thanks to MEPS, to property and CO2 taxation (although these 2 measures remain limited), which will continuously incentivise energy users to generate additional savings every year.

Grants are still necessary to support the entry into force of MEPS, and could be progressively switched off after 2030-2035, depending on the level of the CO2 tax and property taxation.

It will also have a continuous effect beyond 2030 thanks to the development of the required infrastructure which will continuously incentivise energy users to generate additional savings every year, if citizens remain are incentivised and interested to use these alternatives.

The two missing measures are CO2 taxation, and obligation scheme.

5.8 Comprehensive energy efficiency reform 2 (CEER 2)

The Comprehensive Energy Efficiency Reform 2 (CEER2) pathway further enhances the *CEER1* pathway as a more ambitious holistic approach that brings together various measures from all the previous pathways with higher ambition and implementation across buildings, industry and transport. The main objective of *CEER2* is to achieve significant energy efficiency improvements across different sectors and domains. *CEER2* starts from the measures under *CEER1* and strengthens some of them. The measures largely consist of building renovation, all transport measures, while boosting the industry to increase its energy savings via Voluntary Agreements.

While the measures of *CEER2* are similar to those of *CEER1,* there is more emphasis/support for grants (multifamily), the implementation of a CO2 tax, the implementation of obligation schemes for non-residential, accelerated energy savings in the industry via strengthened *VA*, and more promotion of public transport. By combining these measures, *CEER2* aims to create a synergistic effect that amplifies the impact of individual actions.

The key policy measures that are added or specifically further enhanced in *CEER2* from *CEER1* are:

- ***Increased*** Renovation grants for multifamily buildings/housing associations (30% support) (nR6)
- CO2 tax for end energy use of residential buildings (nR8)
- Obligation scheme for the service sector (nS1)
- CO2 tax for end energy use of commercial buildings (nS6)
- ***Increased*** Voluntary schemes for industry, with binding targets based on incentives (nl1)
- ***Increased*** Promotion of resource-efficient green technologies of industrial enterprises (RRP) (nl2)
- Supporting energy efficiency investments in companies (nl5)
- ***Increased*** Subsidy for public transport usage instead of personal vehicles (nT2)
- ***Increased*** Development of convenient and modern public transport (nT9)

5.8.1 Main results

Energy consumption and savings

The *CEER2* pathway **meets all EED targets**. This pathway overall overperforms the baseline scenario in terms of meeting Estonia's EE targets laid out in the NECP 2030 (Table 5-24). The average annual final energy savings rate from 2024 to 2030 is 1.86% (in line with the EE target of 1.49%) and final consumption drops to 28.7 TWh by 2030 (EE target is less than 30 TWh). Additionally, the final energy savings rate in 2030 is above the EED target of 1.9% (1.96%). However, the pathway does not meet the NECP transport target, the only target which is not met.

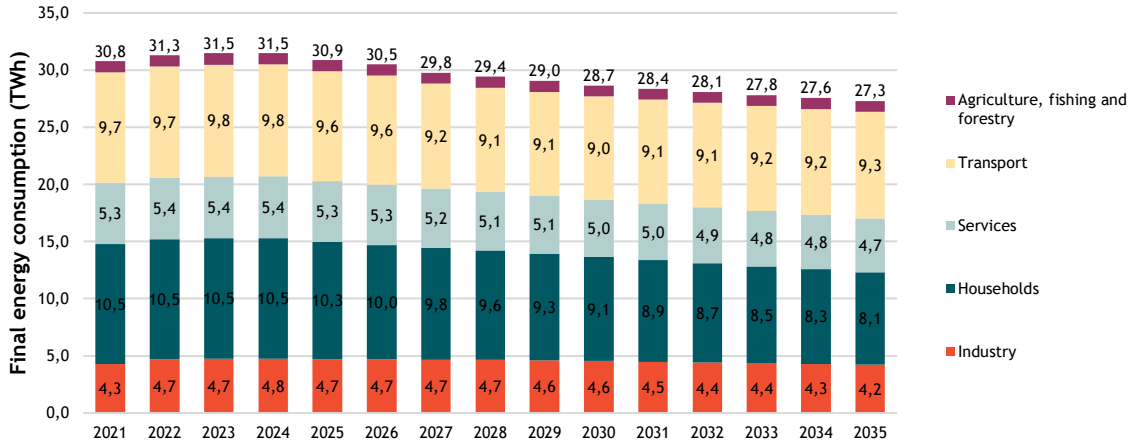
Table 5-29 Comparison of scenario outcomes and EE targets

NECP 2030 objective	Baseline	CEER2	EED	NECP 2030
Annual final energy savings rate in 2030 (%)	0,06%	1,96%	1,90%	1,90%
Annual final savings rate, 2024-2030 average (%)	0,14%	1,86%	1,50%	1,50%
Final energy consumption in 2030 (TWh)	32,8	28,7	30,0	33,3
Primary energy consumption in 2030 (TWh)	51,5	45,1	45,7	63,9
Total renovated area of central gov. buildings from 2021 to 2030 (mln m2)	0,12	0,92		0,30
Average industry annual energy savings (2021-2030) (GWh)	313	836		460
Transport fuel consumption (TWh)	10,5	9,0		8,3

Source: Trinomics, Energex & TalTech

From 2021 to 2030, the final energy consumption drops by 2.1 TWh, from 30.8 TWh to 28.7 TWh. Most of this reduction comes from the household and services sector (1.7 TWh reduction via renovation measures). Industrial energy use increases as the increase in production surpasses the reductions from energy efficiency measures. Transport measures lead to a 0.7 TWh reduction from 2021 to 2030.

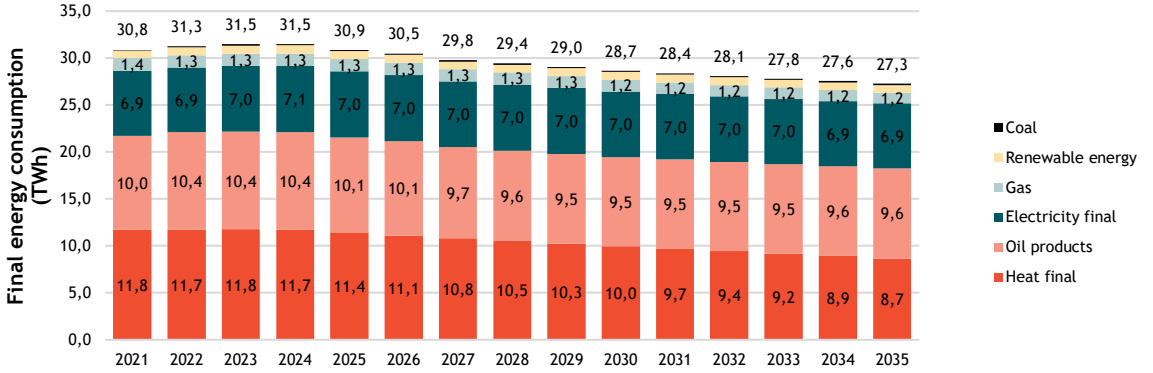
Figure 5-18 Annual final energy consumption per sector (2021-2035), TWh



Source: Trinomics, Energex & TalTech

Given the boost in renovation, the greatest impact on consumption in terms of fuels is on heat (-1.8 TWh), while electricity increases slightly (+0.1 TWh), between 2021 and 2030 (Figure 5-15). There is also a reduction of oil products (-0.5 TWh), mainly from transport measures. There is little to no impact on the use of coal and renewable energy.

Figure 5-19 Annual final energy consumption per fuel source (2021-2035), TWh



Source: Trinomics, Energex & TalTech

Investment needs and cost savings

The *CEER2* needs much greater investment over the next decade compared to the Baseline scenario. From 2021 to 2030, the EE measures in the *CEER2* pathway would require a €17.3 billion investment, of which 67% is covered by the private sector (mainly households). This is because of the renovation measures, namely MEPS, which require intensive investment. It is important to note that cost savings will still occur beyond 2030, which are not taken into account in this analysis.

Table 5-30 Investment costs and cost savings (Cumulative 2021-2030), MEUR

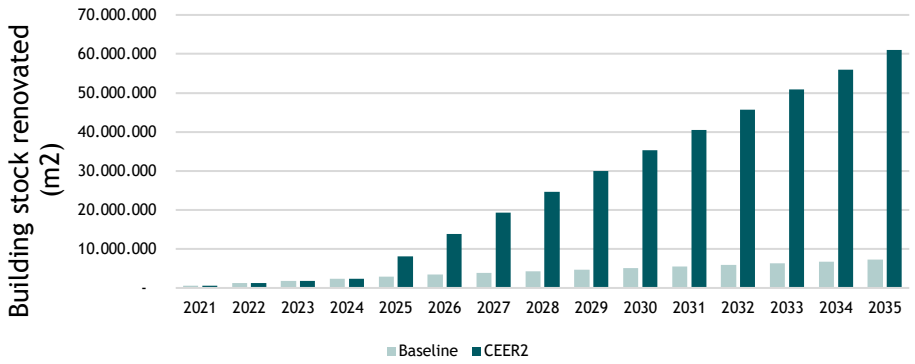
	Baseline	CEER2
Total Investment costs (MEUR)	**1588**	**17281**
Public sector	331	5749
Private sector	1257	11532
Household	119	6353
Companies	1138	5179
Total cost savings (MEUR)	**489**	**2063**
Public sector	42	163
Private sector	447	1900
Household	118	1102
Companies	328	798

Source: Trinomics, Energex & TalTech

Renovation of building stock

The *CEER2* pathway induces a significant increase in renovation of the building stock (35.3 mln. m^2 renovated from 2021 to 2030), in comparison to the baseline pathway (5.1 mln. m^2 renovated from 2021 to 2030).

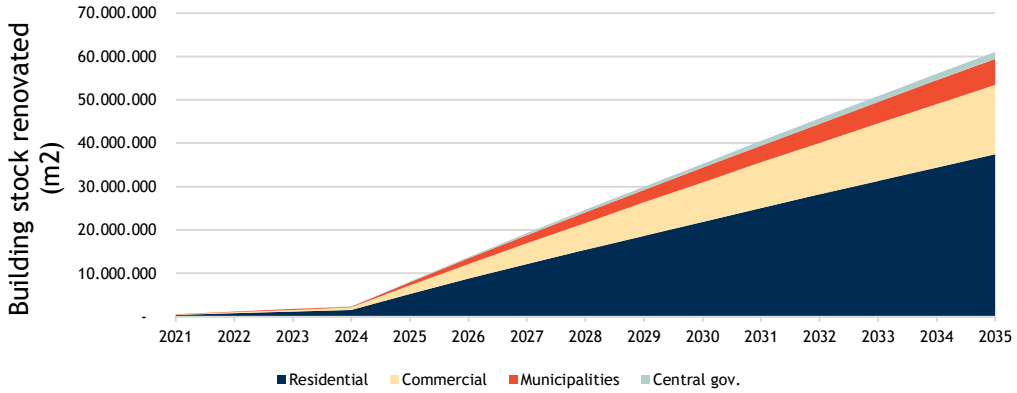
Figure 5-20 Cumulative renovated building stock from 2021 to 2035, m2



Source: Trinomics, Energex & TalTech

Most of the renovated building stock is residential and commercial, with a total of 21.9 mln. M^2 of dwellings and 9.1 mln. M^2 of commercial buildings being renovated from 2021 to 2030. For the public sector, at total of 4.3 mln. M^2 of the public building stock is renovated, of which 3.4 mln. M^2 is municipality-owned and 0.9 mln. M^2 is owned by the central government. This does meet the NECP target of renovating at least 0.3 mln. M^2 of central government owned buildings.

Figure 5-21 Cumulative renovated building stock from 2021 to 2035 per building type, m2



Source: Trinomics, Energex & TalTech

5.8.2 *Impact assessment*

This section analyses the impact of the *CEER2* pathway on: the macroeconomic impact in terms of impact on GDP, employment, labour productivity, disposable income and tax revenues; as well as the environmental impact.

Socio-economic impacts (GDP, employment, labour productivity, disposable income, energy poverty and tax revenues)

Due to the greater investment required, the *CEER2* pathway also has a greater impact on the economy. The average annual impact of the *CEER2* pathway on GDP is 5.6%; this leads to an increase of €23.8 billion to GDP over the period from 2021 to 2030. Additionally, the pathway also leads to a greater impact on employment compared to the Baseline pathway. The pathway leads to 22,760 new jobs on average every year from 2021 to 2030.

Table 5-31 Macroeconomic impact (Cumulative 2021-2030), MEUR

	Baseline	CEER2
Total impact on GDP (MEUR)	**2552**	**23767**
Average annual impact on GDP (%)	1%	5,6%
Total GDP in 2030 (MEUR)	45214	48761
Compensation of employees	21608	23303
Consumption of fixed capital	7393	7972
Operating surplus and mixed income	10648	11483
Taxes on production and imports	6249	6739
Subsidies	-683	-736
Total impact on employment (average job creation per year, thousand employees)	**0,83**	**22,76**
Employment in 2030 (thousand employees)	665	697
Impact of measures	0,82	22,74
Industry	0,24	0,59
Construction	0,59	19,61
Transport	-0,01	2,55
Impact of energy prices	0,01	0,01
Labour productivity (GDP/employee) (EUR)	63358	64407
Total impact on disposable income (MEUR)	**897**	**4007**
Renovation costs (-)	-119	-6314

Personal transport costs (-)	0	-39
Increase in taxes (-)	-322	-2100
Increase in employment (+)	1219	11358
Energy cost savings (+)	118	1102
Energy cost share of disposable income (%)	7,98%	7,25%
Total impact to tax revenues (MEUR)	**1007**	**4365**
Impact on taxes via measures (indirect)	72	2204
Ìmpact on taxes via tax meaures (direct)	1020	2606
Reduction in taxes via savings (MEUR)	-85	-446

Source: Trinomics, Energex & TalTech

GHG emissions reduction & other environmental impacts

The EE measures from the *CEER2* pathway led to a reduction of almost 5.42 MtCO2. Most of this reduction comes from building renovation (2.36 MtCO2) and more efficient transport (1.7 MtCO2).

Table 5-32 Environmental impact (Cumulative 2021-2030)

	Baseline	CEER2
Total GHG emissions reduction (MtCO2)	**1,26**	**5,42**
Industry	0,56	1,20
Households	0,37	1,39
Services	0,13	0,97
Transport	0,06	1,70
Agriculture, fishing and forestry	0,14	0,16
Air pollution emissions reduction (kt)		
SOx	0,69	2,75
NOx	0,72	2,72
PM2.5	0,64	2,85

Source: Trinomics, Energex & TalTech

Regional impacts

Similar to the previous pathways, the *CEER2* pathway mainly impacts the more densely populated regions, such as Põhja-Eesti and Lõuna-Eesti, which respectively include the two largest cities of Estonia – Tallinn and Tartu. However, the net cost of energy savings, in terms of net euro cost per MWh saved, is lowest in Põhja-Eesti and highest in Kesk-Eesti. As with the other pathways, this is mainly because this region contains mostly detached dwellings, which are more resource intensive compared to renovation of apartment buildings.

Table 5-33 Energy savings and investment cost and cost savings per region, cumulative 2021-2030

Region	Final energy savings (TWh), 2021-2030	Total investment cost (MEUR), 2021-2030	Total cost savings (MEUR), 2021-2030	Net cost of energy savings (EUR/MWh)
Põhja-Eesti	10,1	6727	1016	563
Lääne-Eesti	2,8	2956	280	968
Kirde-Eesti	1,8	1563	172	782
Lõuna-Eesti	4,2	4157	419	880
Kesk-Eesti	1,8	1878	175	952
Total	20,7	17280	2062,2	734

Source: Trinomics, Energex & TalTech

5.8.3 Implementation assessment (qualitative)

In addition to the previous quantitative impact assessment, a more qualitative implementation assessment includes the advantages, disadvantages, barriers, risks, potential policy impacts, and pathway alignment with the energy efficiency first principle.

The advantages and disadvantages (PROS and CONS)

Like the *CEER1,* the measures of *CEER2* communicate a strong commitment to energy efficiency, with even more ambition. However, to make the pathway possible, a diversity of funding mechanisms, including EU funds, grants, and loans, facilitates investment in multiple EE measures, is needed. The rapid evolution of energy-efficient technologies however offers innovative and cost-effective renovation solutions, with many measures already technology-ready and poised for deployment, generating significant annual job opportunities.

Furthermore, the continued progression of electric mobility, proliferation of e-vehicles, and emphasis on public transport present opportunities to reduce emissions and promote energy efficiency, aligning with Estonia's overall goals. Investments in cycling lanes and pedestrian-friendly infrastructure can further encourage active transportation and reduce car dependency, enhancing the pathway's effectiveness. Implementing integrated and multimodal transport systems optimizes energy use and overall efficiency while stimulating economic growth by generating new jobs and boosting the construction and manufacturing sectors.

Nevertheless, certain challenges and disadvantages persist, especially given increased ambition. Insufficient charging infrastructure for electric vehicles and a lack of alternative fueling stations can hinder the widespread adoption of energy-efficient transport causing frustration and even slower implementation, in turn increasing resistance from the public to embrace new transportation habits. The substantial initial investments required for renovation measures can discourage building owners from pursuing energy-efficient solutions, particularly in the absence of clear incentives. Limited awareness among some building owners and occupants regarding the benefits and cost savings associated with energy-efficient renovations may also pose obstacles. Additionally, a shortage of skilled workers and professionals with expertise in energy-efficient renovations can act as a limiting factor, potentially slowing down the progress of the pathway. In addressing these disadvantages, comprehensive planning and targeted interventions are essential to maximize the benefits of the EE pathway while mitigating potential challenges.

Potential barriers

Resistance from building owners and occupants can be a significant obstacle to the progress of energy-efficient measures in the building sector. This resistance often arises due to various factors, including concerns about the initial costs associated with energy-efficient renovations. Building owners may hesitate to make substantial investments in energy efficiency improvements, especially if they believe it will take a long time to recoup the expenses through reduced energy bills. Similarly, tenants may resist changes that could lead to rent increases. Additionally, the inconvenience caused by renovations, such as noise, dust, and disruptions to daily routines, can deter building occupants from embracing energy-efficient measures. Moreover, the absence of financial incentives or regulatory requirements can further diminish the motivation for energy-efficient renovations.

Conversely, the shortage of skilled labor and professionals experienced in energy-efficient building renovations poses a distinct challenge. This shortage can result in concerns regarding the quality and

effectiveness of energy-efficient upgrades. Without a workforce equipped with the necessary skills and expertise, there is a risk of suboptimal or poorly executed renovations that fail to deliver the expected energy savings and improvements. It can also lead to delays in project completion, increased costs, and frustration among building owners and occupants. Addressing this shortage requires investments in training and education programs to develop a skilled workforce capable of implementing energy-efficient building measures effectively.

Actors / concerned stakeholders

The same actors as under *CEER1* concern *CEER2* pathway.

Key risks

This section maps uncertainties and risks in the *CEER2* pathway, including technological challenges, skill gaps, social, economic, and environmental factors. Mitigation strategies are identified, and policy adoption and implementation risks are assessed. Since the *CEER2* encompasses many of the previously discussed and included measures, many of the risks are the same, yet intensified, due to the ambition of the *CEER2* pathway.

Technical/Skills: Given the included involvement of renovation measures, and since there is limited availability of skilled labour in the construction industry for executing necessary energy-efficient renovations, there is an increasing demand for skilled contractors, and thus significant delays in implementation. To address this challenge, proactive steps such as the development and promotion of training programs aimed at equipping potential and existing construction professionals with expertise in energy-efficient renovation techniques. Additionally, material availability can be improved through strategies such as promoting local production to reduce dependency on imports, enhancing resource efficiency within the construction materials sector, and encouraging recycling and the reuse of materials.

Social: There is slightly less emphasis within *CEER2* on MEPS than in *CEER1,* however the measure is still in place, and therefore the main risk of public acceptance and the potential negative affect on vulnerable or low-income households persists. While MEPS can eventually lead to reduced energy costs for these households, the initial renovation expenses may pose a burden. Targeted grant programmes can be can be established for vulnerable or low-income households affected by MEPS.

Economic: The current volatility in energy prices introduces uncertainty regarding the cost-effectiveness of energy-saving measures. To address this concern, one potential mitigation approach is to consider implementing loan schemes where repayment is tied to actual cost savings, thereby mitigating the impact of fluctuating energy prices.

Environmental: Increased construction activities associated with both renovation and transport infrastructure projects can lead to heightened levels of waste generation and environmental pollution. To mitigate these environmental challenges, it is essential to incorporate life-cycle assessments during the design phase of renovation projects. Additionally, strengthening waste management practices related to construction waste can encourage recycling and the reuse of materials, thereby reducing environmental impacts.

Administrative: Given the increased ambition of the measure, keeping up with all administrative tracking, implementation, compliance and monitoring will be a real challenge. If the administrative processes are too burdensome, or unable to keep up with new measures, construction, permitting, etc, this may cause a significant roadblock to implementation.

Policy impacts

The policy impacts of *CEER2* are similar to *CEER1,* however slight differences should be taken into consideration. Overall, given the cross-sectoral implementation of energy efficiency measures within the pathway, there are potential conflicting policy impacts to consider. Implementing multiple measures simultaneously without proper coordination can lead to overlap and inefficiency. Different policies may target the same energy-saving goals, resulting in redundant efforts and resources.

Furthermore, if measures are considered too costly or difficult to implement, subsequent governments or administrations may choose to reverse or scale back ambitious energy efficiency policies, leading to inconsistency and uncertainty in long-term planning.

The interests of different sectors may sometimes conflict. For example, policies promoting energy-efficient public transportation might compete with policies supporting the automotive industry, potentially leading to political tensions and policy reversals. Allocating resources and funding to multiple sectors can be challenging. Policymakers may need to make difficult decisions about how to distribute limited resources across different initiatives. For example in the transport sector, determining where to allocate funds first, to micro-mobility, or increased public transport.

Policies targeting one sector may inadvertently affect other sectors. For instance, stringent energy efficiency requirements for buildings may increase construction costs, potentially impacting the real estate industry and housing affordability.

Alignment with EEF

The alignment is similar to CEER2.

Main considerations beyond 2030

The measures of the *CEER2* pathway focus mainly on the following, with the according effect beyond 2030.

Table 5-34 main considerations beyond 2030

Type of EE measure	Initial timescale of the measure	Effect duration
MEPS	Normative measures have a continuous effect, if the scope expands (start with worst performing buildings)	Investment in new building, with a continuously scope increase (and additional savings)
Incentives (grants, tax deduction)	Stop in 2030 (or reduce) public money	No more investments after the implementation/stop
Property taxation	Its design can foresee a continuous increase of the property taxation level of worst performing buildings	Continuously expand the scope of attractive investments
Voluntary Scheme	The *VA* is established, and its effect continue beyond 2030. Its design can foresee a continuous increase of savings rule, and ongoing dialogue with concerned industries to increase	New investments will be made according to industry action plan,
Public procurement	The procurement rule is established, and continues beyond 2030	New savings with new purchase, until the full stock has been changed
Subsidy public transport	Stop in 2030 (or reduce) public money	the use of public transport can continue (if it has demonstrated interest, and remain attractive) or stop (if not convincing). It will depend on many factors

Infra transport (charging)	The public investment stops in 2030, but private can take over and continue deploying	It assumes more and more users will make use of the deployed infrastructure
Infra public transport (fleets, train, tram)	These are one shot massive investments, requiring O&M	Infrastructure in alternative transport still operates, and are maintained in order to deliver their services (e.g. micro lanes, train lines, bus fleets, etc.) It assumes more and more passengers will make use of the deployed infrastructure and fleets.
Vehicle tax	Adapted taxation rate has been established	Its effect continues with the acquisition of new vehicles, until the whole vehicle stock has been changed (10 years?)
Congestion charge	Congestion charges have been established	To a certain extent, it continues to convince people not to use their individual vehicle

To conclude, this pathway will probably have a continuous effect beyond 2030 thanks to MEPS, to property and CO2 taxation (although these 2 measures remain limited), which will continuously incentivise energy users to generate additional savings every year.
Grants are still necessary to support the entry into force of MEPS, and could be progressively switched off after 2030, depending on the level of the CO2 tax and property taxation.
It will also have a continuous effect beyond 2030 thanks to the boost in developing the required infrastructure and incentivising citizens to use alternative transport modes, which will continuously motivate energy users to generate additional savings every year, considering that the interest will be largely demonstrated.
All EE measures are in one way or another included in this pathway, given that CO2 taxation, and obligation scheme for non-residential have been added.

6 Overall comparison of suitability of pathways

Based on the pathways assessed in Chapter 5 – Energy Efficiency Obligation Schemes (EEOS), Voluntary Agreement (VA), Renovation Wave, Energy Efficient Transport (EET), and the Comprehensive Energy Efficiency Reform 1 (CEER 1) and 2 (CEER2), Chapter 6 provides a side-by-side comparison and discussion of all the pathways in relation to meeting energy targets, achieving energy savings, and socio-economic impacts.

6.1 Main results comparison

6.1.1 *Energy savings achieved, and annual savings*

The pathways are compared against the main EED and NECP targets, including: final and primary energy consumption in 2030, annual final savings rate in 2030 and 2024-2030 average, cumulative final energy savings, industry final energy savings, fuel consumption of road transport and renovated area of central government buildings.

Final energy consumption in 2030 (EED target)

Of the six pathways (excluding the baseline), only the Renovation Wave, EET, CEER 1 and CEER 2 meet the Estonian contribution to the EU final energy consumption binding target set within the Energy Efficiency Directive Recast (Article 4). The Estonian contribution to the binding EU final energy consumption should amount to **no more than 30 TWh in 2030** (down from the previous 33.3 TWh established under the 2018 EED).

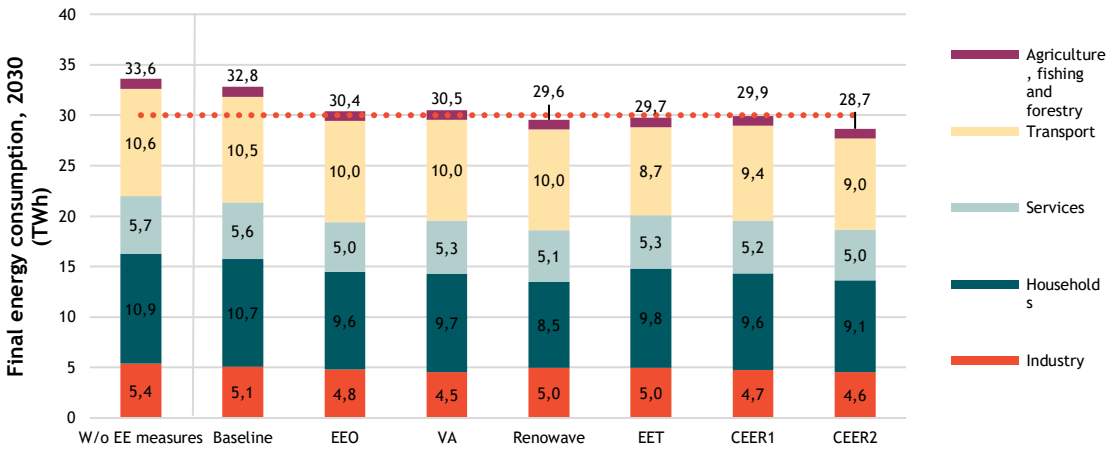
Table 6-1 Final energy consumption (TWh) in 2030 across pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Final energy consumption in 2030 (TWh)	30,0	32,8	30,4	30,5	29,6	29,7	29,9	28,7

Source: Trinomics, Energex & TalTech

Figure 6-1 shows the level of final energy consumption in 2030 for each pathway, which should be compared to the 30TWh target.

Figure 6-1 Final energy consumption in 2030 (TWh)



Source: Trinomics, Energex & TalTech

The levels of consumption of the *EEO and VA* pathways are however not far from the target, as they exceed the 30TWh only with ~1% (e.g., for *EEO* excess is of 0.3TWh).
It is shown that only the baseline (i.e., the current measures) is well above the target, and only slightly below the scenario without EE measures (i.e. expected consumption with economic and development growth, and a "natural" reduction of energy use thanks to more performant energy systems).

Primary energy consumption in 2030 (EED target)

Of the six pathways (excluding the baseline), only the Renovation Wave and CEER 2 meet the Estonian contribution to the EU primary energy consumption indicative target set within the Energy Efficiency Directive Recast (article 4). The Estonian contribution to the binding EU primary energy consumption should amount to **no more than 45.7 TWh in 2030**.

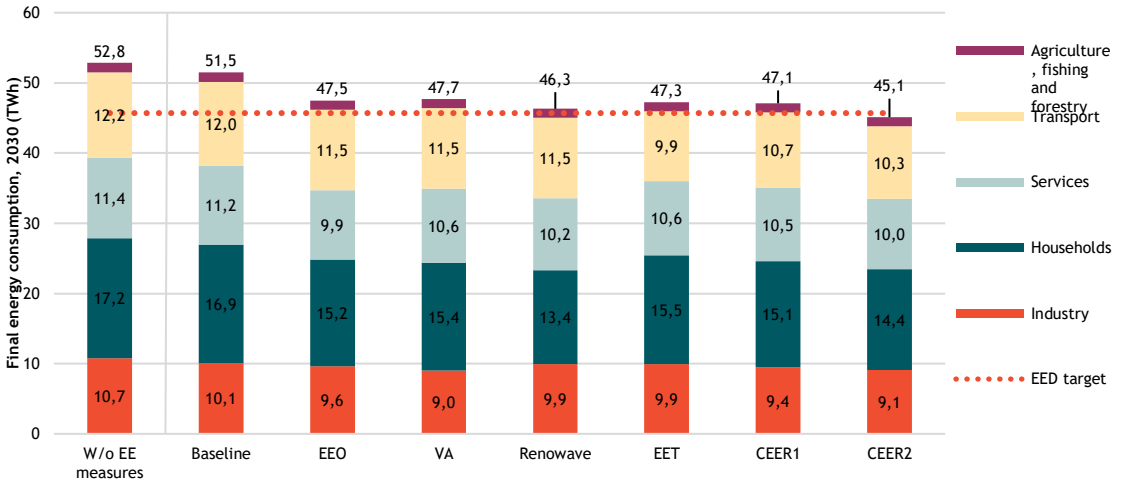
Table 6-2 Primary energy consumption (TWh) in 2030 across pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Primary energy consumption (TWH) in 2030	45,7	51,5	47,5	47,7	46,3	47,3	47,1	45,1

Source: Trinomics, Energex & TalTech

Figure 6-2 shows the level of primary energy consumption in 2030 for each pathway, which should be compared to the 45.7 TWh target, highlighting that only CEER2 reaches the target.

Figure 6-2 Primary energy consumption in 2030 (TWh)



Source: Trinomics, Energex & TalTech

Annual final energy savings rate in 2030 (EED target)

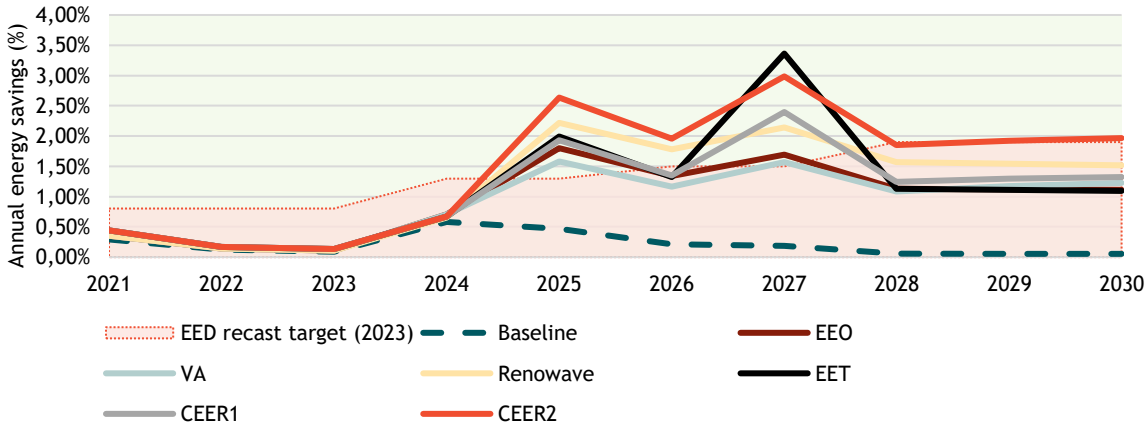
Of the six pathways (excluding the baseline), only the CEER 2 pathway meets the Energy Efficiency Directive Recast annual energy savings target of 1.9% in 2030. Figure 6-3 shows the level of average annual energy savings achieved by Pathway, in comparison to the current recast levels, which are increasing over the 2024-2030 period (1.3% in 2024 & 2025, 1.5% in 2026 & 2027, 1.9% in 2028, 2029 & 2030).

Table 6-3 Annual final energy savings rate (%) in 2030 across pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Annual final energy savings rate in 2030 (%)	1,90%	0,1%	1,11%	1,23%	1,51%	1,09%	1,32%	1,96%

Source: Trinomics, Energex & TalTech

Figure 6-3 Annual saving rates between 2021 and 2030 (%) against target



Source: Trinomics, Energex & TalTech

For the first part of the period (2021-2024), the rates remain well below the EED target for all pathways. This is due to the fact that the new measures only enter into force in 2025, until 2030, and that the existing measures are not enough to reach the target.

Estonia shall decide how to phase the calculated quantity of new savings over the period, provided that the required total cumulative end-use energy savings have been achieved by the end of the 2021-2030 obligation period. This means that the annual saving rate should be analysed with the cumulative savings (cf. Indicator below). Cumulative savings mean the later a measure is implemented, the less it will contribute (shorter duration to cumulate savings). Therefore, the limited contribution of the existing measures during the first part of the period (2021-2024) requires to be significantly compensated during the next periods. This explains why the new measures are boosting energy savings in 2025. In 2026, the absolute savings are similar to what they were in 2025, but their relative contribution reduces compared to 2025 due to the growth increase. In 2027, the railroad infrastructure starts to bring important savings accounted in 1 year, and consequently increasing the savings significantly compared to 2026. This effect is also more clear on the pathways with a strong transport component (i.e. *EET*, CEER 1 & CEER 2).

Average annual final savings 2024-2030 (EED target)

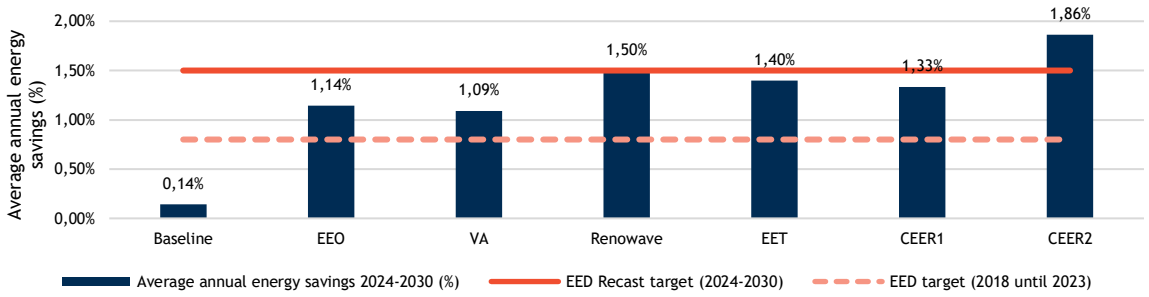
Of the six pathways (excluding the baseline), only the Renovation Wave, CEER 1 and CEER 2 meet the Energy Efficiency Directive Recast annual energy savings target of 1.49% in average over the 2024-2030 period. Figure 6-4 shows the level of average annual energy savings achieved by Pathway, in comparison to both the previous EED target (0.8%), and the current recast level (1.49%).

Table 6-4 Average annual final savings (%), 2024-2030 average, across pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Average annual final savings rate, 2024-2030 (%)	1,50%	0,1%	1,14%	1,09%	1,50%	1,40%	1,33%	1,86%

Source: Trinomics, Energex & TalTech

Figure 6-4 Pathway progress to average annual energy savings target



Source: Trinomics, Energex & TalTech

Cumulative final energy savings (EED target)

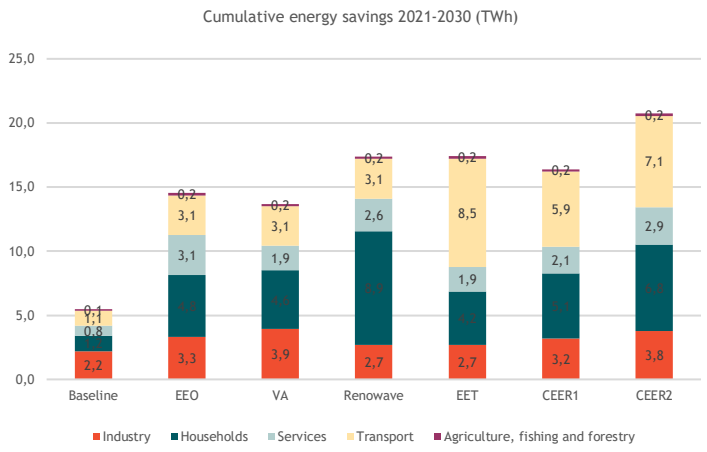
Of the six pathways (excluding the baseline), even the CEER 2 does not meet the Energy Efficiency Directive Recast cumulative savings of 21.279 TWh over the 2021-2030 period (representing a 44% increase from the previous 2018 EED target of 14.767 TWh). Figure 6-5 shows the cumulative savings in final energy for each pathway.

Table 6-5 Cumulative (final) energy savings (TWh) over the 2021-2030 period, across pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Cumulative energy savings	21,28	5,5	14,5	13,7	17,4	17,4	16,4	20,7

XLS source: Pathway Comparison - AT6

Figure 6-5 Cumulative (final) energy savings over the 2021-2030 period (TWh)



Source: Trinomics, Energex & TalTech

CEER 2 was supposed to fulfil this cumulative savings over the obligation period, but given that the first half of the obligatory period (2020-2025) will not contribute to cumulate savings, the efforts for the second half (2025-2020) would be unrealistic to achieve the target. However, CEER2 can be close to the target by boosting/strengthening some key measures in all sectors, particularly the following (compared to CEER 1):

- Increasing by the 50% the voluntary scheme for the industry, with binding targets based on additional incentives;
- Continuing the promotion of resource-efficient green technologies of industrial enterprises, with national budget;
- Continuing to support energy efficiency investments in companies, to accelerate voluntary engagements;
- Reinforcing energy consulting and networking events for small and medium enterprises (SMEs);
- Continuing renovation grants for multifamily buildings/housing associations (30% support) at the level of the RenoWave;
- Introducing the CO2 tax for end energy use of residential buildings, in line with the ETS extension;
- Introducing an obligation scheme for service sector;
- Introducing the CO2 tax for end energy use of commercial buildings, in line with the ETS extension;
    - While reducing the Minimum energy performance standards for non-residential buildings (regulatory requirements for EPC class E and F);
- Reinforcing the subsidy for public transport usage instead of personal vehicle;
- Reinforcing the development of convenient and modern public transport.

These additional efforts are needed to compensate for the limited performance at the beginning of the period.

Industry annual energy savings from 2021 to 2030 (NECP target)

In its NECP, Estonia plans to reach primary energy savings of 460 GWh in 2023 (equivalent to 232 GWh final energy). Considering the limited performance during the first part of the period (until 2024), to reach the target, a significant increase will be necessary over the last part of the period (2025-2030). Going beyond the 232 GWh final savings over 2021-2030 on average is however feasible for *all* pathways (see Table 6-6).

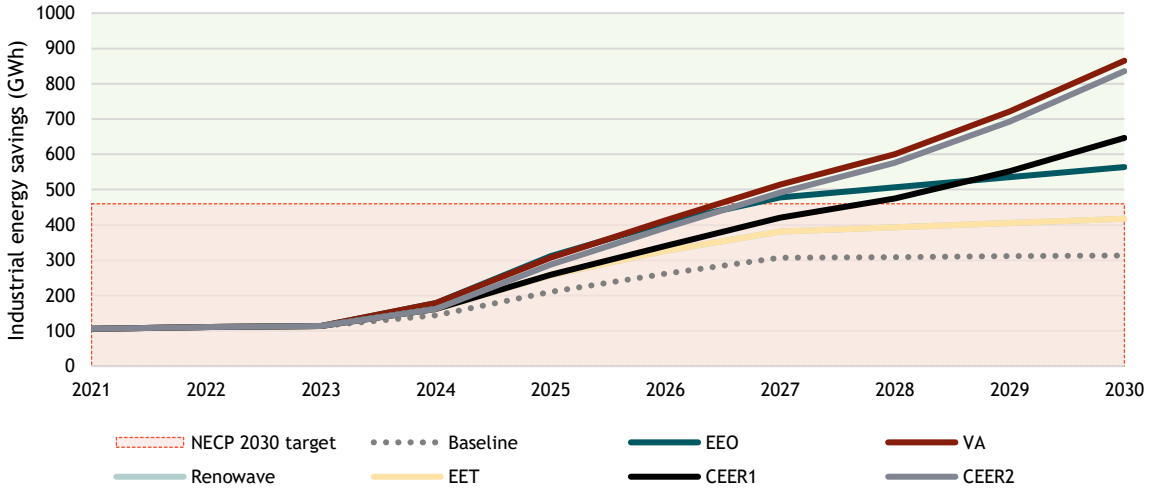
Table 6-6 Average annual energy savings in the industry over the 2021-2030 (TWh)

	Target vaue	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Industry annual energy savings (2021-2030) (GWh)	232[132]	313	564	865	418	418	647	836

Source: Trinomics, Energex & TalTech

[132] The NECP 2030 target is industrial energy savings of 460 GWh of primary energy per year, which is 232 GWh of final energy savings per year

Figure 6-6 Annual energy savings in the industry over the 2021-2030 period (TWh)



Source: Trinomics, Energex & TalTech

Road transport fuel consumption in 2030 (NECP target)

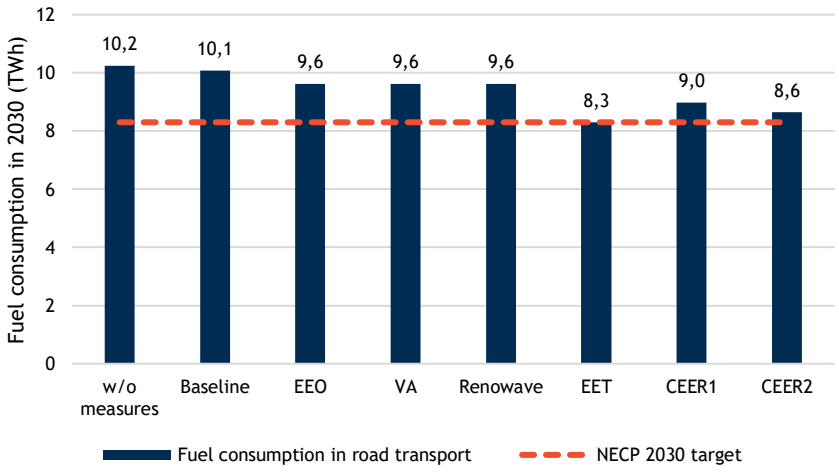
The transport energy efficiency target for Estonia's NECP is 8.3 TWh. As previously discussed in chapter 5, only the EET pathway reaches this target. The CEER 2 pathway, followed by the CEER 1 pathway, also with ample transport measures, come close, with 8.6 TWh for CEER 2 where transport measures have been boosted, and 9.0 TWh for CEER1 (Figure 6-7).

Table 6-7 Road transport fuel consumption (TWh) in 2030 across all pathways

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Road transport fuel consumption (TWh) in 1030	8,3	10,1	9,6	9,6	9,6	8,3	9,0	8,6

Source: Trinomics, Energex & TalTech

Figure 6-7 All pathways - Fuel consumption, Transport 2030



Source: Trinomics, Energex & TalTech

Summary of energy saving targets

Table 6-8 Pathway results effectiveness toward EED & NECP targets shows a comparison of pathway results to Estonia's 2030 targets. It shows how each pathway performs in terms of meeting these targets. None of the pathways fully achieve all the EED/NECP 2030 targets. CEER 2 comes close by meeting 7 out of the 10targets, meeting 5 out of the 6 EED targets. Despite its significant contributions, it does not meet the NECP transport sector, which was fixed in the frame of the NECP, and not the EED. They therefore rely fully to internal (i.e. Estonian) decision. It remains crucial to emphasise that CEER 2 complies with all EU targets, except the final energy savings of public sector/buildings supposed to reach 1.9% savings/y in average (CEER2 reaches 1.6%). Going beyond what is now proposed in transport and the industry will certainly become hard to reach, or even unrealistic unless there is an important political will to significantly reduce the use of cars (with citizens consequently using more public transport, walking and cycling), and to accelerate the savings within the industry to the point of technology breakthrough if savings have to go beyond a certain level (with the associated risk to put too much pressure on the concerned industries).

The *RenoWave* pathway follows up by reaching 3 out of the 6 EED targets, missing the annual savings of 1.9% in 2030, due to a slow down from 2028, the primary energy consumption in 2030 and the final energy savings of public sector/buildings targets. The major differences between *RenoWave* & CEER 2 are:

- RenoWave applies MEPS to all dwellings (which is probably unrealistic, before 2030 at least), while CEER 2 applies MEPS only to rented/selling dwellings (at trigger point);
- But then CEER 2 strengthens the property taxation (according to EPC level) for all dwellings compared to RenoWave;
- CEER 2 introduces an obligation scheme for all non-residential buildings (like in the *EEO* pathway);
- RenoWave applies the Commercial buildings energy performance investments support, while CEER 2 does not;
- CEER 2 doubles the property taxation level for all non-residential buildings, compared to *RenoWave*, while slightly reducing MEPS to avoid double counting because of the obligation scheme to the same buildings;

Then CEER 1 only meets 2 out of the 6 EED targets, which has conducted to strengthen some measures within CEER 2 (see comparison above under the cumulative savings). Also EET only meet 2 out of the 6 EED targets, while EEO & VA only meet 1 out of the 6 EED targets.

This assessment highlights that while the pathways offer substantial potential for energy efficiency improvements and progress towards EED and NECP 2030 goals, additional efforts or complementary measures might be necessary to fully meet all the targets. Therefore, a further combination of multiple pathways or adjustments to the existing ones like CEER 2, along with additional policy measures, may be required to attain complete alignment with Estonia's EED objectives.

Overall changes to the 2030 energy target, in line with the EED recast are shown in Table 6-8.

Table 6-8 Pathway results effectiveness toward EED & NECP targets

EED targets	Target value	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Final energy consumption in 2030 (TWh)	30,0	32,8	30,4	30,5	29,6	29,7	29,9	28,7

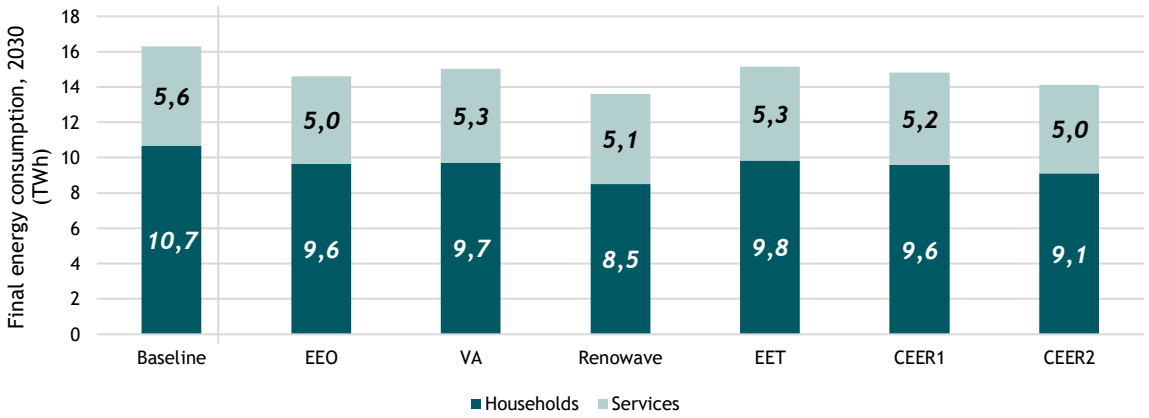
Cumulative energy savings 2021-2030 (TWh)	21,3	5,5	14,5	13,7	17,4	17,4	16,4	20,7
Annual final energy savings rate in 2030 (%)	1,90%	0,1%	1,11%	1,23%	1,51%	1,09%	1,32%	1,96%
Average annual final savings, 2024-2030 average (%)	1,50%	0,1%	1,14%	1,09%	1,50%	1,40%	1,33%	1,86%
Reduction of final energy consumption of all public bodies, each year, in average 2021-2030 (%)	1,9%[133]	0,0%	1,6%	0,9%	1,2%	0,9%	1,1%	1,6%
Renovation of total floor area of buildings owned by public bodies, each year, 2021-2030 (%)	3,0%[134]	0,9%	6,5%	3,5%	4,3%	3,5%	4,2%	6,4%
NECP specific targets	**Target value**	**Baseline**	**EEO**	**VA**	**Reno Wave**	**EET**	**CEER1**	**CEER2**
Total renovated area of central government buildings	0,30	0,12	0,87	0,48	0,59	0,48	0,59	0,92
Industry annual energy savings	232	313	564	865	418	418	647	836
Transport fuel consumption	8,3	10,1	9,6	9,6	9,6	8,3	9,0	8,6

Source: Trinomics, Energex & TalTech

6.1.2 Renovated building area

Beyond the target for central government buildings, residential (households) and commercial (services) buildings energy efficiency measures have great potential in reaching Estonia's overall energy efficiency targets. The six pathways can deliver between 2.3 TWh to 4.1 TWh of savings from the baseline scenario, depending on the included measures (Figure 6-8). The achievable savings are directly in line with the number and intensity of the related measures. The Renovation Wave pathway, with the most buildings related measures, yields the most savings from the households and services sectors.

Figure 6-8 Final energy consumption of buildings (households and services)



Source: Trinomics, Energex & TalTech

[133] Member States shall ensure that the total final energy consumption of all public bodies combined is reduced by at least 1,9 % each year, when compared to 2021

[134] Member State shall ensure that at least 3 % of the total floor area of heated and/or cooled buildings that are owned by public bodies is renovated each year

Public building renovation and energy savings targets (EED)

The EED recast requires Members States to ensure that

- The total final energy consumption of all public bodies combined is reduced by at least 1,9 % each year, when compared to 2021 (art 5[135])
- At least 3 % of the total floor area of heated and/or cooled buildings that are owned by public bodies is renovated each year (art 6)

The pace of renovation of all pathways seems to be enough to reach the 3% target fixed by the EED, but the depth of renovation is probably not high enough as none of the pathways is able to reach the 1.9% target also fixed by the EED. Of course this is mainly due to the weak perfomance over the first half of the obligation period (2020-2025), as the rate significantly increases for the second half (2025-2030) with an average of 2.7% savings instead of the 1.6% for the whole period, for the CEER2 pathway.

Table 6-9 Reduction of final energy consumption & renovation of public buildings

EED targets	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Reduction of final energy consumption of all public bodies, each year, in average 2021-2030 (%)	1,9%	0,0%	1,6%	0,9%	1,2%	0,9%	1,1%	1,6%
Renovation of total floor area of buildings owned by public bodies, each year, 2021-2030 (%)	3,0%	0,9%	6,5%	3,5%	4,3%	3,5%	4,2%	6,4%

Source: Trinomics, Energex & TalTech

Total renovated area of central government buildings (NECP target)

Estonia's NECP target for the total renovated area of central government buildings is 296,185 m2 from 2021 to 2030. This target is met by all pathways.

Table 6-10 Total renovated area of central government buildings over 2021-2030 (mln m2)

	Target value	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Total renovated area of central gov. buildings (2021-2030) (mln m2)	0,30	0,12	0,87	0,48	0,59	0,48	0,59	0,92

Source: Trinomics, Energex & TalTech

6.1.3 *Investment needs, cost and cost savings of the measures*

In terms of the overall financial costs, all pathways (except the baseline) require significant initial investment starting in 2024 (see Figure 6-9) and will level out and decrease in the remaining years once initial investment and implementation of the measures is underway.

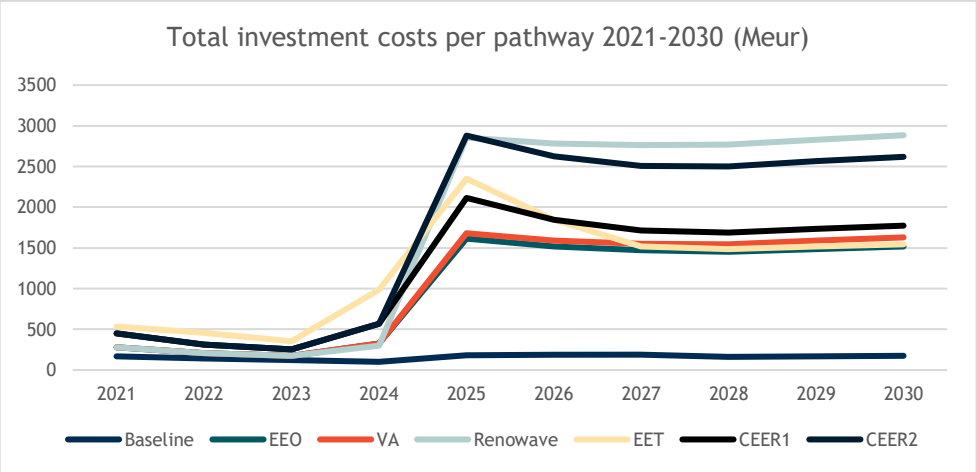
Among all the pathways, the Renovation Wave stands out as the one with the most significant investment requirement, amounting to €17.85 billion, as shown above. This investment is nearly twelve times higher than the investment needed in the baseline scenario. The high initial investment in the Renovation Wave pathway can be attributed to the comprehensive and ambitious measures it entails, focusing on large-scale renovation projects and energy efficiency improvements in buildings and infrastructures. As the

[135] EED Recast (2023)

implementation of the Renovation Wave progresses, the costs will begin to level out and decrease in the subsequent years, leading to larger financial savings and payback in the long term.

The other pathways, although requiring considerable initial investments as well, are designed to result in cost reductions and increased efficiency as the proposed measures take effect. These pathways provide opportunities for significant progress in terms of sustainability and climate mitigation, making them compelling options despite their upfront costs.

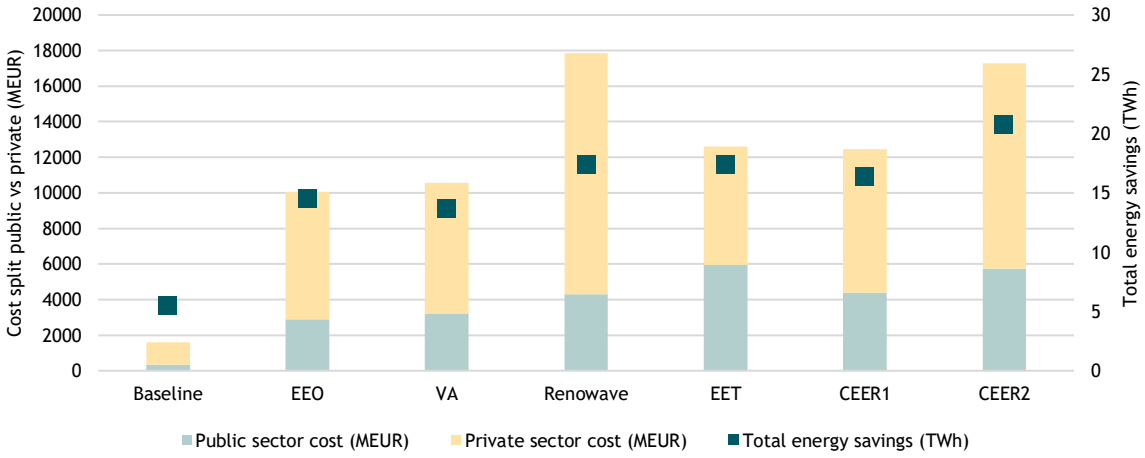
Figure 6-9 Total investment cost per pathway 2021-2030



Source: Trinomics, Energex & TalTech

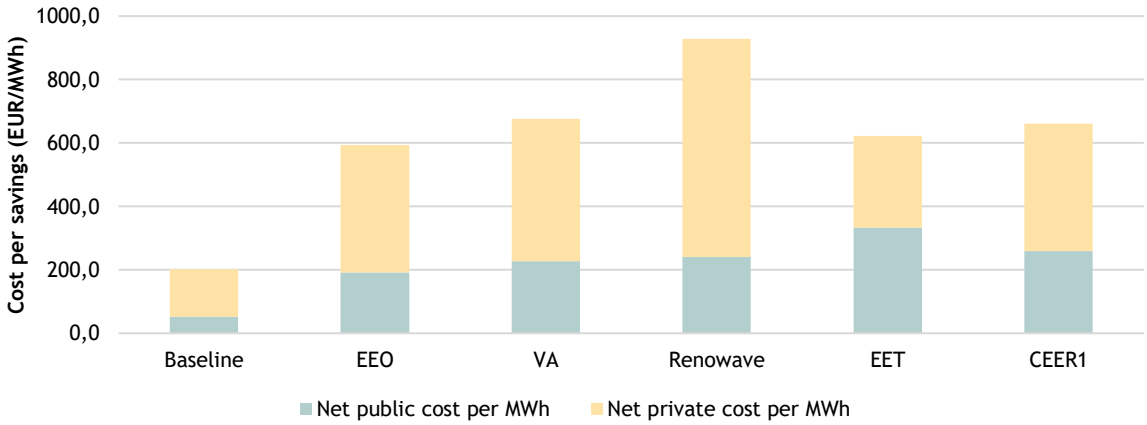
Figure 6-10 shows the investment needs of all 6 pathways, split between public and private, including an overall indication of the total energy savings of that measure. Therefore, the *RenoWave* calls for the highest investment, with an overall investment of €17.85 billion, while it ranks second regarding savings, as CEER 2 generates the highest savings (Figure 6-11). CEER 1 achieves almost the same level of savings as the RenoWave. Private (individual) spending is the most important for the pathways with a large renovation component, in particular the *RenoWave*, which focuses on renovating the building stock.

Figure 6-10 All pathways - cost split public vs. private



Source: Trinomics, Energex & TalTech

Figure 6-11 All pathways - cost savings split public vs. private

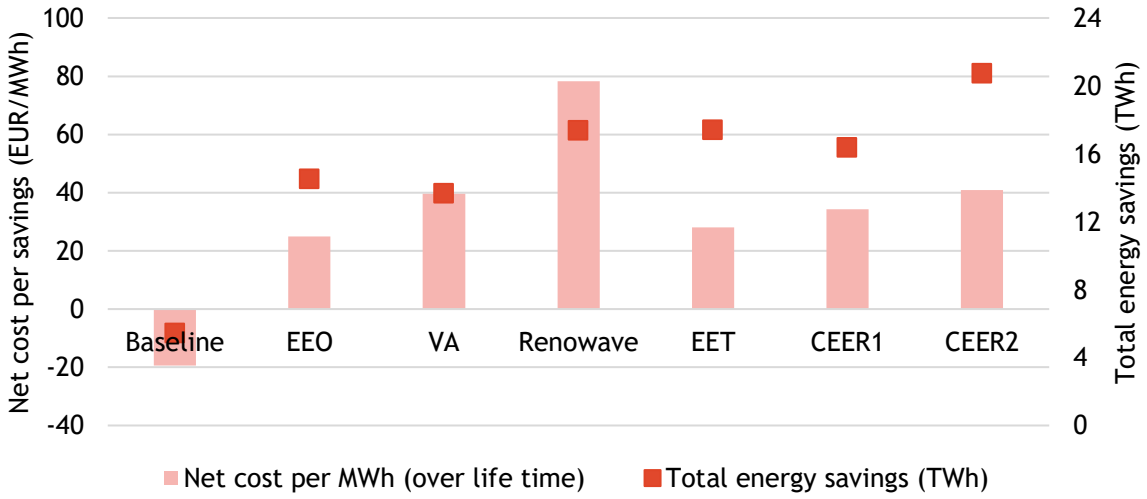


Source: Trinomics, Energex & TalTech

When analysing the efficiency of different pathways in terms of net costs per MWh saved over an average life time of 25 years for the new investments[136], three pathways stand out as particularly efficient: the *EET*, the CEER 1 & CEER 2, as illustrated in Figure 6-12. In the case of the *EET*, CEER 1 & CEER 2 pathways, the investments made in energy-saving measures, such as upgrading infrastructure, improving technologies, and enhancing energy efficiency, result in significant reductions in energy consumption. The net effect is that the net costs are the lowest while leading to higher energy savings.

On the other hand, when looking at the *EET* pathway and the CEER 1 pathway, the costs per MWh saved are similar over the 2021-2030 period, while the cost per MWh saved is the highest for the *RenoWave* pathway.

Figure 6-12 Net costs per energy savings achieved



Source: Trinomics, Energex & TalTech

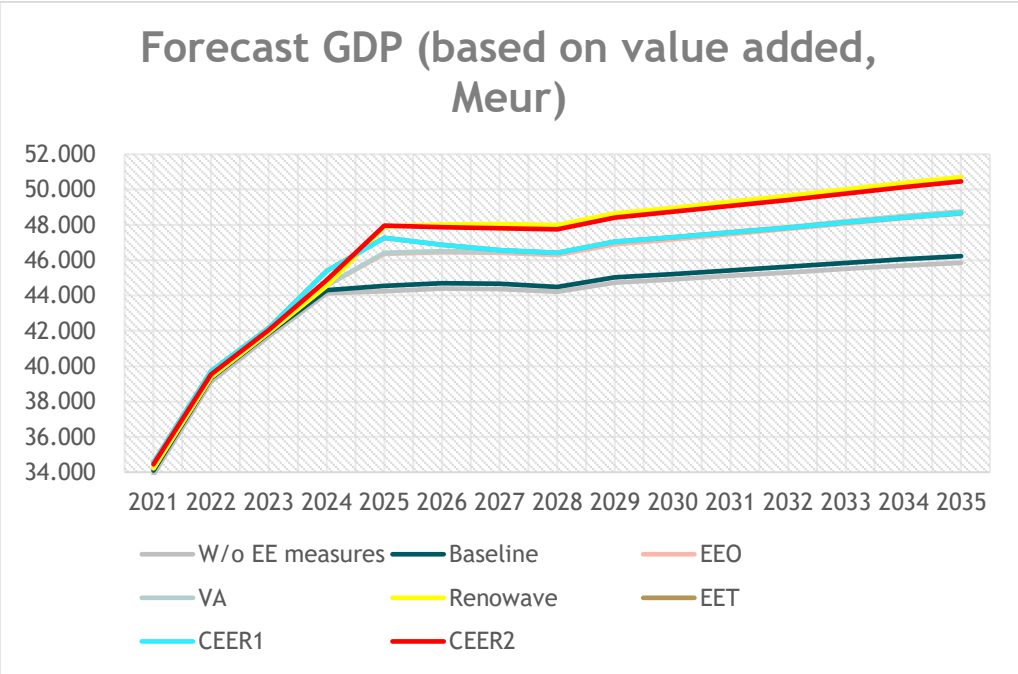
[136] The net cost is the difference between the cumulative investment cost over 2021-2030 and the savings made during 2021-2030 period in addition to the savings made in 2030 (which results from all investments made over the 10 years) multiplied by 20 corresponding to 20 years of operation for investments made in 2030, and 30 years for those made in 2021 (an average of 25 years). The net cost is then divided by the total savings over the 2021-2050 for those investments made during 2021-2030 period.

6.2 Impact assessment comparison

6.2.1 Impact on GDP

The impact on GDP is mainly driven by the investment needs, as each pathway stimulates investment into the economy, such as through increasing building renovation, efficient equipment in industry and/or transport infrastructure. Therefore, the pathways requiring the greatest investment tend to also have the greatest impact on GDP. As a result, the Renovation Wave has the greatest impact on GDP from 2025 to 2030, when the new measures for all pathways are implemented.

Figure 6-13 Comparison of impact on GDP across pathways, 2021-2035

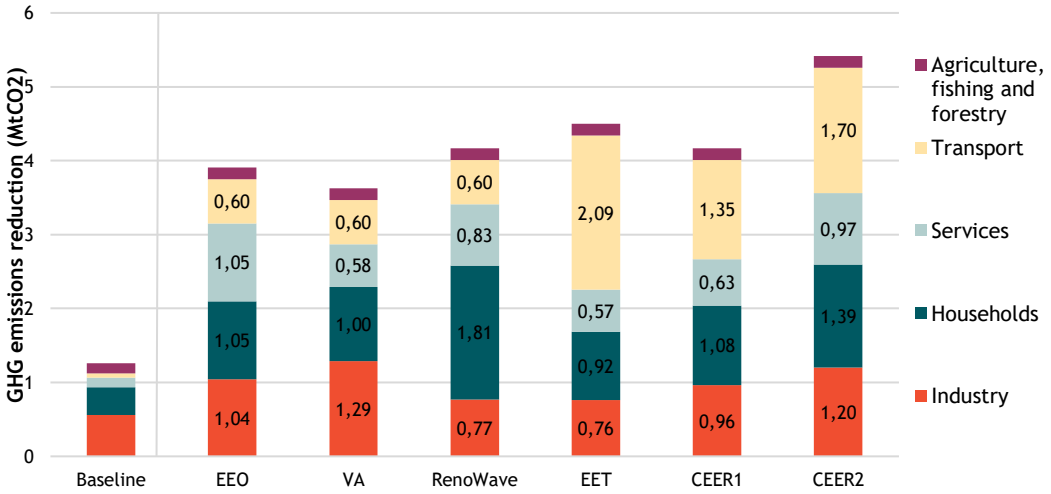


Source: Trinomics, Energex & TalTech

6.2.2 Impact on GHG emissions and environmental factors

Figure 6-14 shows the total GHG emissions reduction from 2021 to 2030 per pathway, broken down by the sector source. All pathways produce significantly more emissions reduction compared to the baseline. The *CEER2* pathway provides the greatest CO2 reduction, with a reduction of almost 6 MtCO2e. Whereas the EEOS, *VA* and *EET* pathways provide the lowest emissions reduction. Given the focus on building renovation, the Renovation Wave pathway has the greatest emissions reduction for households and service sector.

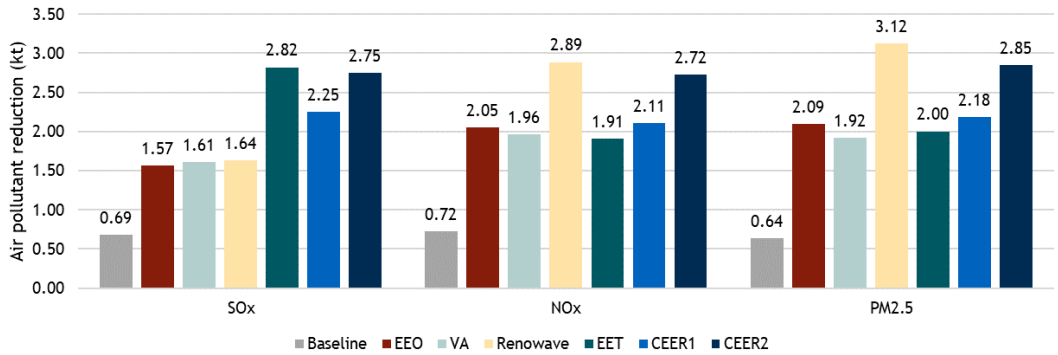
Figure 6-14 Comparison of GHG emissions reduction (2021-2030) per pathway



Source: Trinomics, Energex & TalTech

Figure 6-15 provides an overview of the reduction of Sox, NOx and PM2.5 per pathway from 2021 to 2030. Notably, the Renovation Wave leads to the greatest reduction in nitrogen oxides and particulate matter, as this pathway focuses on reduction of heat production for households, which is a significant source for these air pollutants.

Figure 6-15 Comparison of air pollutants reduction (2021-2030) per pathway



Source: Trinomics, Energex & TalTech

6.2.3 *Impact on energy prices for various sectors*

The pathways mainly impact energy prices through the increase of energy taxation, which constitutes around a 30-40% increase in energy prices (see Table 6-11). Increases includes both inflation (3%) and energy taxation. Further, the obligations schemes also impact energy prices, with a 1-8% additional increase in energy prices from 2021 to 2030. For electricity and gas, the impact slightly varies across consumption brackets, where these results can be found in the XLS in the *Pathway Analysis* tab, under *Impact on energy costs and prices*.

Table 6-11 Impact on energy prices for households and other sectors (EUR/MWh)

	Impact of inflation and energy taxation	Impact of EEOS

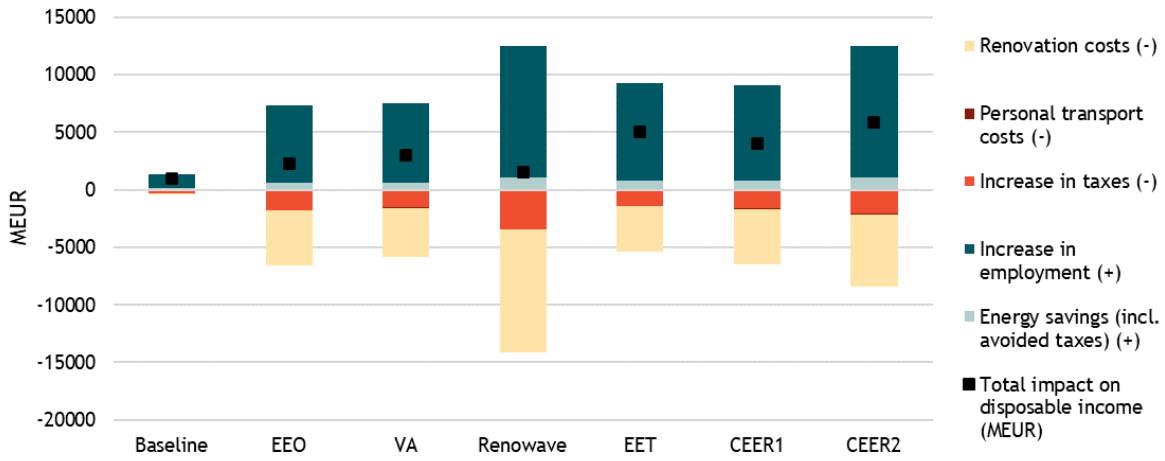
		2021 price	Average yearly increase in price	2030 price	Total price difference	% increase	2021 price	Additional average yearly increase in price	2030 price	Additional price difference	Additional increase (%)
Heat price (EUR/MWh)	Households	77,2	2,4	101,3	24,1	31%	77,2	0,6	107,5	6,2	8%
	Other	64,6	2,0	84,9	20,2	31%	64,6	0,2	86,5	1,6	3%
Electricity (EUR/MWh)	Households	99,2	3,3	132,5	33,4	34%	99,2	0,1	134,0	1,5	1%
	Other	78,6	2,7	105,7	27,1	35%	78,6	0,1	107,2	1,5	2%
Gas price (EUR/MWh)	Households	40,6	1,5	56,1	15,5	38%					
	Other	39,7	1,5	54,9	15,2	38%					

Source: Trinomics, Energex & TalTech

6.2.4 *Disposable income and energy poverty*

All pathways lead to a net positive impact on disposable income, mainly driven by the increase employment from renovation, industrial efficiency measures and development of transport infrastructure. The *CEER2* pathway has the most positive impact on disposable income from 2021 to 2030. While the Renovation Wave pathways leads to the greatest increase in income from additional employment, this pathway also has the greatest renovation costs.

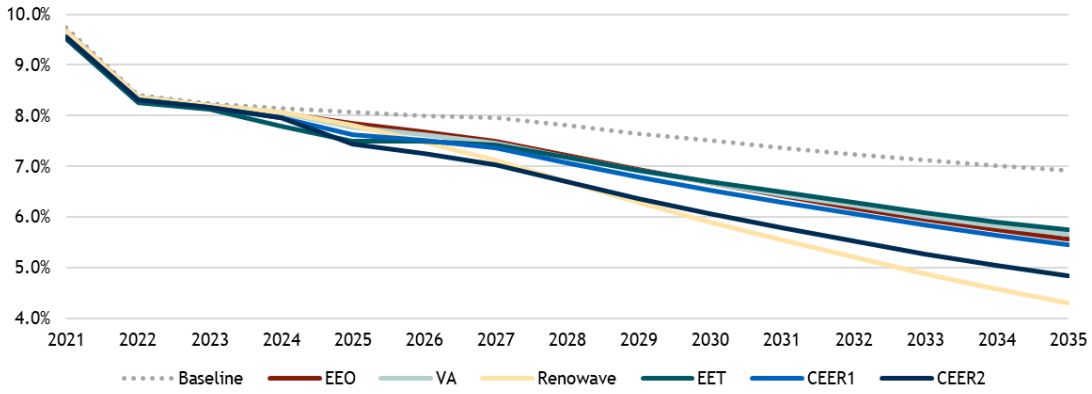
Figure 6-16 Comparison of impact on disposable income (MEUR) from 2021 to 2030 per pathway



Source: Trinomics, Energex & TalTech

As an indicator of the impact on energy poverty, Figure 6-17 compares the share of disposable income spent on energy. As the Renovation Wave leads to the greatest renovation of households, this pathway has the most impact on reducing energy costs as a share of household income. It is important to note that this parameter does not take into account the variance of energy costs across households in different income brackets.

Figure 6-17 Comparison of energy costs as a share of disposable income (%) from 2021 to 2030 per pathway

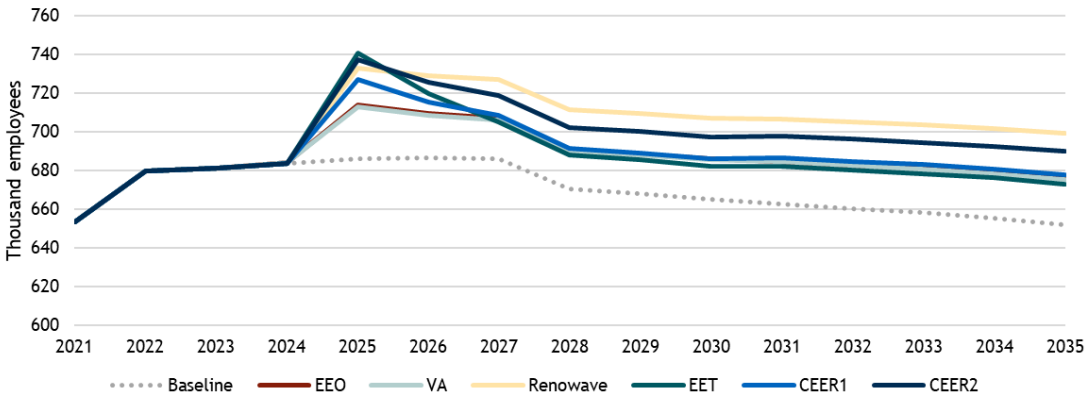


Source: Trinomics, Energex & TalTech

6.2.5 Employment and labour productivity

From 2025 onwards, all pathways lead to a significant increase in employment compared to the baseline. This is mainly driven by employment induced by renovation, hence the Renovation Wave pathway leads to the greatest boost in employment. The declining trend of employment occurring across all pathways is a result of the baseline forecast for employment in Estonia.

Figure 6-18 Comparison of total employment from 2021 to 2030 per pathway



Source: Trinomics, Energex & TalTech

Table 6-12 provides a comparison of labour productivity (GDP/employee) across the pathways. The *CEER2* pathway leads to the greatest labour productivity.

Table 6-12 Comparison of labour productivitiy (2021-2030 average) per pathway

	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Labour productivity (GDP/employee) (EUR)	63 330	63 720	63 831	63 984	64 019	63 983	64 293

XLS source: Pathway Analysis - E863

6.2.6 Taxes and additional incomes

Overall, the pathways lead to a 8 to 10 billion EUR increase in tax revenues from 2021 to 2030, which translates to about 800 million to 1 billion EUR per year on average. Most of this increase is from the direct impact of tax measures, mainly being energy taxes which is the constant across all pathways.

Whereas, the remaining increase is from other measures which induce taxes from investments. Simultaneously, tax revenues are reduced by the decrease in energy consumption leading to reduction in energy taxes.

The Renovation Wave pathway leads to the greatest increase in taxes, mainly coming from tax revenues generated from renovation activities, followed by the *CEER2* pathway. The *VA* and *EET* pathways have the least impact on pathways.

Table 6-13 Comparison of impact on taxes and revenues (cumulative 2021-2030) per pathway

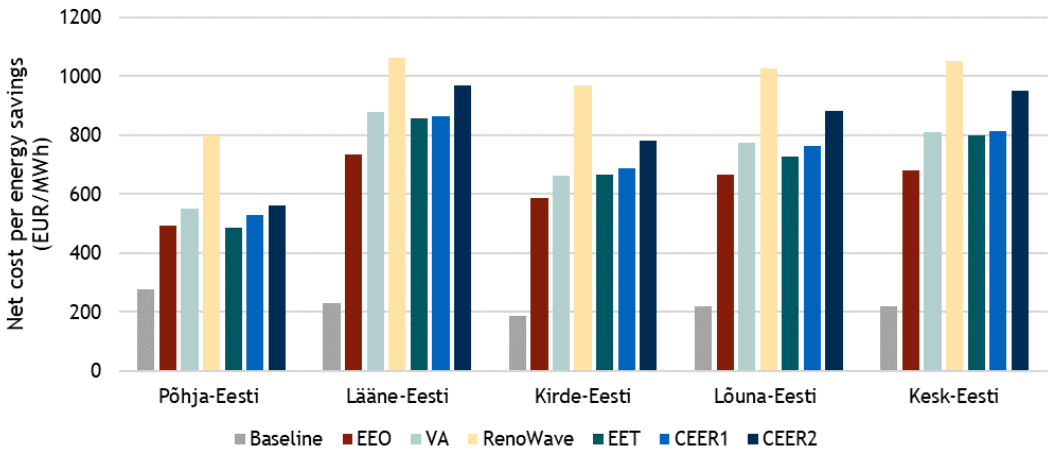
	Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2
Total impact to tax revenues (MEUR)	1007	2877	2975	4879	2736	3268	4365
Impact on taxes via measures (indirect)	72	2020	1401	3366	1577	1822	2204
Impact on taxes via tax measures (direct)	1020	1100	1813	1804	1613	1804	2606
Reduction in taxes via savings (MEUR)	-85	-242	-239	-291	-453	-358	-446

Source: Trinomics, Energex & TalTech

6.2.7 Regional impact

Figure 6-19 provides a comparison of the trade-off of costs and energy savings per region for the various pathways. As mentioned in Section 5 for each pathway, the variance across the regions in net cost per MWh is heavily dependent difference in share of detached dwellings and apartments across regions. For renovation works, detached dwellings are more resource intensive compared to apartments, such that regions with more detached dwellings have greater net cost per MWh saved. Therefore, generally, net cost per MWh saved tends to be lower in Põhja-Eesti (including Tallinn), where 45% of the apartment building stock (in terms of area) is located.

Figure 6-19 Comparison of average net cost of energy savings per region from 2021 to 2030 per pathway



Source: Trinomics, Energex & TalTech

6.3 Summary

Regarding the specific benefits and considerations per pathway, Table 6-14 shows a summary comparison of the six scenarios plus the baseline. The colour scale is based on which pathway per category provides the most benefit in green (i.e., highest final energy savings, most jobs created), or largest impact (i.e., highest investment cost, net cost, impact on GDP) in pink.

Overall, the baseline scenario, while requiring the least investment, given it is composed of existing/already implemented measures, is the least impactful and farthest from the targets.
Regarding EED energy targets, the CEER 2 delivers the highest results and most savings, which is then followed by the Renovation Wave pathway and CEER 1. Both CEER 2 and *RenoWave* allow to reach the public owned buildings renovation rate set at 3% in the EED. Regarding final energy consumption by sector, in all pathways, the greatest savings are from households, followed by services – signifying great potential for savings from measures in building renovations. The prominence of buildings in contributing to energy savings is closely linked to the energy consumption patterns of residential buildings. Over 50% of Estonia's energy demand comes from the residential and service sector, due to heating, cooling, lighting, and electrical appliances used by households. As a result, implementing energy-efficient measures in buildings, particularly residential ones, can lead to considerable reductions in energy consumption and subsequent energy savings.

Table 6-14 Summary pathway results comparison - energy savings towards EED targets

	Year	Unit	EED target	NECP 2030	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Final energy consumption	2030	TWh	30,0	33,3	32,8	30,4	30,5	29,6	29,7	29,9	28,7
Cumulative energy savings	2021-2030	TWh	21,3	/	5,5	14,5	13,7	17,4	17,4	16,4	20,7
Final energy savings rate	2030	%	1,90%	1,90%	0,1%	1,11%	1,23%	1,51%	1,09%	1,32%	1,96%
Final energy savings rate, average	2024-2030	%	1,50%	1,50%	0,1%	1,14%	1,09%	1,50%	1,40%	1,33%	1,86%
Primary energy consumption	2030	TWh	45,7	63,9	51,5	47,5	47,7	46,3	47,3	47,1	45,1
Final energy savings of public sector/buildings	2021-2030	%	1,9%		0,0%	1,6%	0,9%	1,2%	0,9%	1,1%	1,6%
Renovation rate of public owned buildings	2021-2030	%	3,0%		0,9%	6,5%	3,5%	4,3%	3,5%	4,2%	6,4%

Source: Trinomics, Energex & TalTech

Regarding NECP specific energy targets, the CEER 2 again delivers the highest results and reaches the various targets fixed in the NECP, except for the 2030 transport fuel consumption, for which none of the pathways is able to reach the target. The CEER 1 pathway only reaches 2 of the targets, but is close to reach the primary energy consumption, which remains indicative in the EED, and heavily bound to the decarbonisation of the electricity system.

Table 6-15 Summary pathway results comparison - energy savings towards NECP targets

	Year	Unit	EED target	NECP 2030	Baseline	EEO	VA	Reno Wave	EET	CEER1	CEER2
Total renovated area of central government buildings	2021-2030	mln. m2		0,30	0,12	0,87	0,48	0,59	0,48	0,59	0,92
Industry annual energy savings	2030	GWh		232 (*)	313	564	865	418	418	647	836
Transport fuel consumption	2030	TWh		8,3	10,1	9,6	9,6	9,6	8,3	9,0	8,6

Source: Trinomics, Energex & TalTech

(*) the target set in ENMAK 2030 is 460 GWh savings in 2023 in primary energy (action 2.8 "Energy savings by manufacturing companies", in the global objective 2 "More efficient use of primary energy: Estonia's energy supply and consumption is more economical"), which corresponds to 232 GWh in final energy, which is then compared to the 2021-2030 average (considering that the 2023 target cannot be met in any case)

As shown in table 6-15, CEER 2 provides the highest reduction in GHG emissions, according to its highest energy savings, with cumulative emissions saved over the 2021-2030 period at 5.97 Mt CO2e, which is almost 20% higher than the second pathway in reducing GHG emissions (the *RenoWave* pathway with 5.05 Mt CO2e). Cumulative investment cost over 2021-2030 is the highest for the *RenoWave* pathway with ~EUR 23.3 billion invested (very high renovation intensity), which is closely followed by CEER 2 with ~EUR 20.2 billion (13% lower). On the other hand, the cumulated cost savings accounts for ~EUR 2.2 billion over the same period for the CEER 2, while cost savings are only at ~EUR 1.9 billion for the RenoWave. This seems to emphasise that the CEER 2 is probably more balanced than the *RenoWave*, with regards to cost and energy savings.

Given the intensity of the measures to heavily renovate residential and non-residential buildings, the *RenoWave* pathway, with the most important investment needs, also has the highest impact on jobs creation (construction is the most intensive in job creation), with an average annual job creation of ~34,100 jobs, nearly twice as much as the last pathway for job creation, the *VA* pathway. CEER 2, the second pathway in terms of job creation, leads to the creation of ~25,700 jobs in average on annual basis. The impact on GDP is also the most important for the *RenoWave* (7.3% increase), similarly to the impact on tax revenues (6.4% increase compared to the scenario without Energy Efficiency measures), mainly due to job creation and overall investment.

The CEER 2 pathway has the highest positive impact on disposable income, with an average annual increase of ~5.4% compared to the scenario with Energy Efficiency measures, which is significantly higher than the increase of the *RenoWave* pathway, due to the heaviness of renovation costs. For the CEER 2 the investments costs are counterbalanced by the savings generated for energy consumers (i.e., households).

The average energy cost as a share of household disposable income is the lowest for the CEER 2 and *RenoWave*, with a similar level of 7.2 %, which is slightly below the other pathways (ranking around 7.4-7.5%) and significantly lower than the baseline (7.8%). This is mainly explained by the importance of the renovation of buildings and especially dwellings in both CEER 2 and RenoWave.

Table 6-16 Summary pathway results comparison over 2021-2030 period - impact indicators

Baseline	EEO	VA	RenoWave	EET	CEER1	CEER2

GHG emission reduction, cumulative	MtCO2	1,26	3,91	3,63	4,17	4,50	4,17	5,42
Investment costs (total), cumulative	MEUR	1.588	10.042	10.565	17.851	12.594	12.458	17.281
of which public support, cumulative	*MEUR*	*331*	*2.888*	*3.210*	*4.287*	*5.951*	*4.395*	*5.749*
Cost savings, cumulative	MEUR	489	1.408	1.314	1.712	1.752	1.627	2.063
Impact on GDP	%	0,6%	3,3%	3,4%	5,6%	4,1%	4,1%	5,6%
Impact on disposable income	%	0,8%	1,9%	2,5%	1,3%	4,1%	3,3%	4,8%
Impact on employment (Average annual job creation)	Thous and emplo yees	0,83	14,18	13,81	26,28	16,68	16,40	22,76
Impact on tax revenue	%	0,6%	1,8%	1,9%	3,1%	1,7%	2,0%	2,7%
Average energy cost as a share of household disposable income	%	7,98%	7,61%	7,58%	7,33%	7,49%	7,48%	7,25%
Average GDP	MEUR	42.823	43.975	44.027	44.971	44.330	44.298	44.944
Average tax revenue	MEUR	16.042	16.229	16.239	16.430	162.152	16.268	16.378

Source: Trinomics, Energex & TalTech

Given that the primary measures of the CEER 1 are a combination of largely renovation and transport measures, and the *EEO* targets high-cost industrial measures, CEER 1 requires slightly less investment, leading to greater short-term cost savings (keeping in mind payback periods differ by sector and savings will be achieved past 2030 – the scope of this analysis).

Among the various pathways analysed, the Voluntary Agreements pathway emerges as the least effective, ranking just above the baseline scenario in terms of energy savings performance. This can be attributed to the fact it focuses mainly on the industrial sectors, which is not the major energy consumer. Also, as explained above, the expected savings are more than likely underestimated (and remain small) compared to providing intensive grants to the industry, leading to limited global savings. Hence, the savings could be revised by ensuring the level of ambition becomes high enough, which would also be required for all other measures in the industry (similarly to all sectors). However, while voluntary agreements can encourage certain actors to make energy efficiency improvements on a case-by-case basis, they may not provide sufficient incentives or enforceable mechanisms to drive widespread and substantial energy savings if they are not accompanied by effective incentives. In contrast to other pathways with more mandatory and targeted measures, the voluntary nature of the agreements might result in varying levels of commitment and action from participants, leading to limited overall impact, if no additional measures are taken (e.g., supports, fiscal advantages, tax exemptions, etc.). This is why the *VA* measure has been complemented by the support measures under the CEER 1 and CEER 2 pathways.

7 Conclusion: pathway selection and recommendations

7.1 Pathway selection

7.1.1 A pathway addressing all sectors

We recommend selecting the Comprehensive Energy Efficiency Reform 2 (CEER2) to fulfil the EED targets, which overall is the most balanced pathway while achieving the most EED targets and being the most cost effective. The *CEER2* pathway is a comprehensive strategy combining the key measures from the aforementioned pathways, and boosting some specific measures as outlined above.

It is necessary to develop further energy efficiency in all sectors and subsectors, and spread efforts across sectors, while considering the following constraints:

- Buildings (residential and service) can cost-effectively improve their energy performance and reduce energy consumption, through deep renovation having also co-benefits of improved indoor climate and well-being, service-life and life quality, which means that the room for significant impact is important;
- Industrial plants can still increase energy efficiency, but industrial processes have limits to savings and cannot significantly reduce energy consumption without decreasing competitiveness;
- Energy efficiency in transport mainly relies on reducing the use of personal cars (less persons*km, and less ton*km) calling to develop public transport;
- Agro-forestry has limited room to improve efficiency.

Consequently, there is more room to significantly reduce energy consumption in buildings, than in the industry and agro-forestry. Energy efficiency in transport relies heavily on spatial planning, public transport infrastructure long-term investments and consequent behavioural changes that somewhat depend on users' willingness.

Residential buildings and transport are each representing ~1/3 of final energy use and should be addressed as first. But renovating of dwellings is much more improvements than energy savings making it very expensive (as shown in the *RenoWave* pathway boosting grants to accelerate the renovation rate), and energy efficiency in transport has some limit and requires important behavioural changes which takes time (none of the pathways is able to reach the transport target fixed by the "*transpordi ja liikuvuse arengukava aastani 2035*" (which is refered in NECP)to consume less than 8.3TWh, while the sector faces a clear growth). Non-residential buildings and industry (inc. agro forestry) are each representing ~1/6 of final energy use. These 2 sectors could be left aside regarding financial support measures (to concentrate efforts on residential and transport), but non-residential offers substantial perspective for energy savings with regulatory minimum energy performance standards MEPS (currently very bad level of performance, potential for substantial energy savings), while industry should be accompanied along its decarbonisation path, to remain competitive and attractive at EU scale. For that reason, there are no mandatory schemes or obligations proposed for industry. Consequently, the important efforts towards energy saving targets set by the EED has to be spread properly between sectors. The targets are too ambitious to leave any sector aside. This explains why the CEER 2 pathway

articulates actions in all sectors, with the goal to drive notable enhancements in energy efficiency across the entire economy, and hence all sectors:

- In residential buildings, *CEER2* combines renovation grants, MEPS (for rented/selling buildings), property taxation and a minimal level of CO2 tax. Among these long-term measures renovation grants may be seen as intermediate especially in single family dwellings, to support the transition to mandatory renovation via MEPS and disadvantageous property taxation. Renovation grants in multifamily dwellings represent single largest saving potential in the case of deep renovation and are likely needed for longer period to avoid renovation locks and other negative implications otherwise caused by MEPS. Tax reduction for renovation is also an intermediate measure but could possibly stay for a longer period. All these measures are forming a coherent and efficient set to improve residential building stock energy performance, in a rapid and cost-effective way;
- In non-residential buildings, *CEER2* combines an obligation scheme for all buildings, MEPS to strengthen and accelerate the effect of the obligation, property taxation and a minimal level of CO2 tax. These long-term measures require however to be accompanied by renovation support for public buildings (central and municipal). However, no support for commercial buildings is deemed necessary, as the savings are expected to come via obligation schemes and MEPS. All these measures are forming a coherent and efficient set to improve non-residential buildings energy performance, in the most rapid and cost-effective way;
- In the industry, a strong voluntary scheme is considered as the most appropriate option, engaging a long-term dialogue between the government and the industry, to ensure sustainable savings, and possibly full decarbonisation. To incentivise the industrial actors, supports are necessary, to help investing (via promoting resource-efficient green technologies, support energy efficiency investments in energy intensive industry & other companies, support for the food industry, energy consulting and networking for SMEs), or to motivate commitment towards energy efficiency targets (and reduced GHG emissions). The measures were chosen considering two main outcomes - increase energy efficiency of industry without hurting competitiveness;
- In transport, to propose alternatives to personal cars like public transport & micro modes, and encourage users to choose these alternatives, CEER 2 combines:
    - Investments in the required infrastructure (priority lanes for micro mobility, EV charging, development of convenient public transport, railroad and its electrification, tram line in Tallinn,
    - Direct investments or incentives to invest in the required vehicles (additional passenger trains, EV taxis in Tallinn & Tartu,
    - Incentives to use alternatives (subsidy for public transport usage, subsidy for micro mobility usage),
    - Price adjustment to de-incentivise the use of personal cars (congestion charge),
    - Price adjustment to incentivise the purchase of more efficient cars (vehicle tax for registration and annual vehicle tax).
- In agroforestry, *CEER2* proposes to accompany enterprises to manage better energy use and to support energy efficiency measures in fisheries

The fuel tax measure should also be considered as a long-term supporting policy option, as it would direct consumers towards energy efficiency and incentivises best performing consumers.

In each sector, these combinations are necessary to ensure the right balance

- Accelerating the transition (via expensive support) and ensure long term affordability (moving to norms and price signal);
- Avoiding too expensive options requiring massive investments and support from the public, and possibly influence behavioural changes thanks to price signal;
- Incentivising investments and changes by providing support, and then by progressively de-incentivising (via normative measures);
- Setting up realistic and the least complex options (it is hard to say simple, as none of the measures can be considered to be simple), from a technical and administrative point of view;
- Engaging the concerned actors, namely consumers and professionals;
- Designing all measures in a coherent package to ensure the measures are complementing each other;
- Allowing easy and fair distribution of costs, to deal with energy poverty concerns.

7.1.2 Justification at the measure level

In addition to the previous section, the following table summarizes the content of the *CEER2* pathway, and justifies for each measure why it has been selected and should be part of the Estonian roadmap towards the EED targets.

EE measure	Intensity[137]	Justification of selection
MEPS targeting rented/selling dwellings	100%	Cost efficient (driven by market interest), it is based on reliable EPCs, and can remain complex to control. Building owners would have no choice than to engage and renovate (might be politically sensitive). This is particularly adapted to address energy poverty
Renovation grants for single family houses (20-30% support)	100%	Grant is certainly the less cost-efficient measure (authorities calculating the level of support based on market data influenced by the same support) but may alleviate negative implications of MEPS. However, it can be simple, providing a fixed rate. Though, it also requires building owners & occupiers to be willing to renovate, on voluntary basis. Energy poverty can be easily tackled (e.g., via adapted level of support)
Tax deduction for renovation works by private persons (=parallel track for single family)	100%	Tax deduction is an obvious option (common practice across Europe), even simpler than grants, even though it will probably not be enough to lead to massive renovation and hence be complementary to grants, MEPS, or even to an obligation scheme.
Renovation grants for multifamily buildings/housing associations (30% support)	100%	KredEx grants are well established, with proven performance and efficiency and can be easily continued. There is also good evidence about negative implication what will happen if renovation grants does not have strict technical requirements (poor ventilation, mould problems, etc.) Though, it also requires building owners & operators to be willing to renovate, on a voluntary basis, with the advantage to benefit from scale effect (large building compared to single house). To balance the market need and grant offering the support percentage can be adjusted (existing 30% might not be optimal). Energy poverty can be easily tackled.
Property tax (according to EPC levels) [residential & non-residential]	100%	Property taxation is an interesting option to stimulate the market on the long term, leading to the progressive integration of energy performance in asset value, rather than on occupier. It is not the simplest option but can lead long term market structure. It will not be enough to lead to massive renovation and hence be complementary to grants, MEPS, tax deduction, or even to obligation scheme.

[137] Intensity is the percentage of the measure taken up. For instance, 65% of a measure means that 65% of the original investment is taken up, which leads to 65% of the original energy savings estimated.

CO_2 tax for end energy use of residential buildings [residential & non-residential]	50%	This is the most cost-effective measure on long term, as energy/carbon pricing leading to higher energy prices increases attractiveness of EE investments, and therefore will reduce the need for grants, while increasing state budget income. The measure is simple but requires strong political support. Energy poverty should be tackled by specific programmes and measures to help low-income households to increase the energy performance of their dwellings first. This will already come with the extension of ETS (ETS2) to building (and transport), and is therefore slightly considered under CEER 2
Obligation scheme for service sector	100%	Probably the most cost efficient (driven by market interest), although it remains complex (calculation method, accounting, control, etc.). It requires to engage heavily energy operators in setting up the scheme but can make a real difference in the service buildings which count large saving potentials.
Central government buildings renovation support (100% support)	100%	Grant is the less cost-efficient measure (authorities calculating the level of support based on market data influenced by the same support). However, it can be simple, providing a fixed rate. Though, it also requires building owners & occupiers (public institutions) to be willing to renovate, on voluntary basis. there should be a clear push from authorities, to take an exemplary role
Public and municipality buildings renovation support (60% support in average)	100%	Grant is the less cost-efficient measure. However, it can be simple, providing a fixed rate. Though, it also requires building owners & occupiers (local authorities) to be willing to renovate, on voluntary basis. There should be a clear push from authorities, to take an exemplary role
Minimum energy performance standards for non-residential buildings	70%	Cost efficient (driven by market interest), it is based on reliable EPCs, and can remain complex to control. Building owners would have no choice than to engage and renovate (might be politically sensitive). This is particularly adapted to address worst performing buildings.
Voluntary scheme for the industry, with binding targets based on incentives	150%	Cost efficient regarding EE investments (driven by market interest). It requires to heavily engage with the industry (via their federations / associations), stimulating the dialogue for middle and long-term decarbonisation paths (also possibly tackling Security of Energy Supply and fuel switch). Incentives should be provided, to commit the industry. The cost of such incentive should be properly tailored to remain cost effective. Existing grants and measures may be brought under the *VA* scheme to provide maximum cost-efficiency, only administrative costs for the measure will remain or new incentives must be significant for enterprises to join *VA* scheme. This measure is probably the most appropriate to ensure the industry moves ahead with decarbonisation in a cost-effective way. The level of ambition can be tailored to the EED target. Compared to the other pathways, CEER 2 increases the intensity of this measure
Promotion of resource-efficient green technologies & Supporting energy efficiency investments in companies	100%	Grant is certainly the less cost-efficient measure (authorities calculating the level of support based on market data influenced by the same support). However, it can be simple, providing a fixed grant. Though, it also requires industrial plant operator to be willing to invest in EE, on voluntary basis. Partial support is required to support *VA* (nl1)
Energy savings from electro intensive companies & investment support for the food industry to ensure security of energy supply	50%	Grant is certainly the less cost efficient measure (authorities calculating the level of support based on market data influenced by the same support). However, it can be simple, providing a fixed grant. Though, it also requires industrial plant operator to be willing to invest in EE, on voluntary basis. Partial support is required to support VA
Energy consulting and networking events for small and medium enterprises (SMEs)	100%	Grant is certainly the less cost efficient measure (authorities calculating the level of support based on market data influenced by the same support). However, it can be simple, providing a fixed grant. Though, it also requires industrial plant operator to be willing to invest in EE, on voluntary basis. Partial support is required to support *VA* (nl1)
Promotion of clean and energy efficient road transport vehicles in public procurement	40%	Although the impact will remain limited, the exemplary role expected from public entities is important, to show which clean and energy efficient road transport vehicles should be promoted. Providing grant to launch a market is certainly cost efficient, as market still needs to be developed. This measure can be simple. However, there is no guarantee of success if it remains voluntary.

		For the *CEER2*, only partial implementation is deemed to be enough.
Subsidy for public transport usage instead of personal vehicle	200%	In some key areas, public transport is available and adapted to the need of many workers/commuters, but not used. Consequently, incentivising potential users is needed, to replace the use of their individual cars. This is probably the only option to motivate economic actors to change their behaviours, even though this will represent a cost for the government. For the *CEER2*, it is considered to be essential, and is even boosted.
Priority lanes for micro mobility	100%	Adapting the infrastructure is a clear prerequisite to propose alternatives to individual cars, although it will probably not be enough to lead to behavioural changes. Such investment, requiring new spatial planning and vision, is made for the long run, and can be amortised on the long term. This will benefit all users, including low-income households.
Electric charging infrastructure for existing inhabitance areas	100%	Developing the infrastructure is a clear prerequisite to propose alternatives to ICE, although it will probably not be enough to lead to massive move to EVs. Without public intervention, there is limited likelihood that the private will deploy massively charging infra, and make it available to all, at an affordable price.
Vehicle tax for registration & Annual vehicle tax	100%	Vehicle taxation is a key option to stimulate the market on the long term, leading to the progressive integration of energy performance & emissions in the purchase of vehicles. It can be rather simple option but can lead long term market trend. It could be an important measure to lead to massive purchase of low emitting and energy efficient vehicles.
Development of convenient and modern public transport	200%	This is key complement to provide alternative transport modes to personal vehicles, and the main option to lead to decrease the use of individual cars, and is boosted in CEER2
Developing the railroad infrastructure & railroad electrification	100%	This is key complement to provide alternative transport modes to personal vehicles, and the main option to lead to decrease the use of individual cars.
Acquisition of additional passenger trains	100%	Complementary to the previous measure
New tram lines in Tallinn	100%	This is key complement to provide alternative transport modes to personal vehicles, and the main option to lead to decrease the use of individual cars
Subsidy for micro mobility usage instead of personal vehicle	100%	In some key areas, public transport is available and adapted to the need of many workers/commuters, but not used. Consequently, incentivising potential users is needed, to replace the use of their individual cars. This is probably the only option to motivate economic actors to change their behaviours, even though this will represent a cost for the government.
All Tallinn and Tartu taxis run on electricity	100%	Replacing diesel taxis by EV cars will bring direct savings, while switching to long-term low carbon fuels.
Tallinn and Tartu congestion charge	100%	in addition to all measures to incentivise the use of alternatives to individual cars, there is also a need to have measures to directly de-incentivise the use of individual cars.
Audits in large agricultural holdings	100%	Audits are necessary but not enough to bring savings, unless the expected savings are massive, which is more than likely not the case in the agriculture and forestry sector. This could complement a Voluntary Scheme for agricultural and forestry activities
Energy efficiency measures in the fisheries sector	100%	Grant is certainly the less cost-efficient measure (authorities calculating the level of support based on market data influenced by the same support). However, it can be simple, providing a fixed grant. Though, it also requires agricultural and forestry plant operator to be willing to invest in EE, on voluntary basis. This could complement a Voluntary Scheme for agricultural and forestry activities
Green procurement	100%	Although the impact will remain limited, the exemplary role expected from public entities is important.

7.2 Recommendations for Estonia's energy efficiency action plan (next step)

The selection of the CEER 2 pathway only indicates which measures should be taken, and what their intensity should be (the intensity transposes the level of ambition). It is still necessary to address the following aspects:

- Precise the scope of each measure, going at the level of subsectors (e.g., distinction between apartments and houses, between SMEs and large industries, etc.);
- Precise the intensity of each measure, describing (per subsector) to which level of ambition the measure should go (e.g., the level of EPC label for MEPS, the m2 to be renovated, etc.) and how much this would cost;
- Identify synergies and complementarities between the measures, and how they should be organised in a coherent way (time, budget, and organisation wise). This could possibly lead to amend or even discard some measures (e.g., it could become complex to set up MEPS and obligation scheme for non-residential buildings. Therefore, one could be strengthened and the other left out);
- Develop the enabling policy measures that are needed to ensure all the selected main measures can be implemented smoothly, in due time, and efficiently. This could also require some adjustments in the design (i.e., scope & intensity) of the measures;
- Propose a realistic timeline for each measure, in coordination with all others.

All these aspects will be addressed under D4, which is the Energy Efficiency action plan, where the following flagship measures will be addressed

- Voluntary Agreement (VA) for the industry
- Property taxation for all types of buildings
- Minimum Energy Performance Standards (MEPS) for Buildings

Trinomics B.V.
Westersingel 34
3014 GS Rotterdam
The Netherlands

T +31 (0) 10 3414 592
www.trinomics.eu

KvK n°: 56028016
VAT n°: NL8519.48.662.B01