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Climate change adaptation in the Norwegian and Swedish electricity sectors

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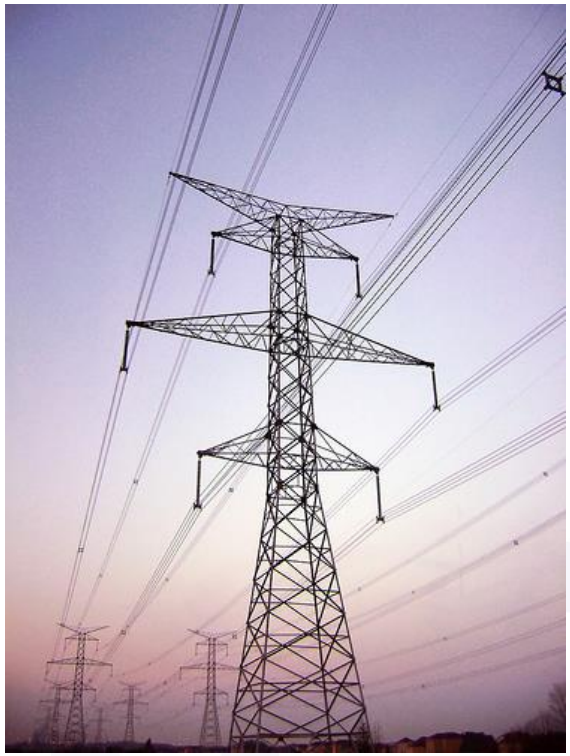
Presentation outline

- Part 1: Electricity sectors Norway and Sweden
  - Comparison of Norway and Sweden and adaptive capacity; historical changes and implications for CCA
  - Formal regulations and incentive structures
  - Informal practices and organizational culture
- Part 2: Actual adaptation practices Norway and Sweden
  - Comparison of four different companies


ICELAND
Reykjavik
Reykjanes
Svartsengi
Brennimelur
Nesjavellir
Sog
Sultartangi
Burfell
Hrauneyjafoss
Vatnsfell
Sigalda
Mjólka
Akureyri
Krafla
Blanda
Egilsstaðir
Karahnjúkar
Höfn
0 50 100 150 200 250 km
NORWAY
SWEDEN
FINLAND
RUSSIA
ESTONIA
LATVIA
Oslo
Stockholm
Helsinki
Aland
Varanger
Hammerfest
Kirkenes
Nikel
Serebryanska
Murmansk
Kaitakoski
Olenegorsk
Monchegorsk
Titan
Kolskaya
Utsjoki
Alta
Tromsø
Balsfjord
Ivalo
Narvik
Tornehamn
Ofoten
Vajukoski
Isoniemi
Knazhegubskaya
Louhi
Ritsem
Sallen
Harsprånget
Pirttikoski
Petäjäskoski
Asmunti
Tuomela
Kemimaa
Sellee
Letsi
Svartisen
Rana
Svartbyn
Røssåga
Ajaure
Pikkarala
Pyhänselkä
Poduzhemskaya
Putkin
Knyoporolskaya
Onda
Kalajoki
Vuolijoki
Haapavesi
Uusnivala
Ventusneva
Alapitkä
Кондопога
Петрозаводск
Umeå
Alajärvi
Tuovila
Vaskiluoto
Seinäjoki
Huutokoski
Vihtavuori
Tunnsjodal
Järpströmmen
Trondheim
Nea
Petäjävesi
Jämsä
Toivila
Kristiina
Свирь
Sunndalsøra
Ålesund
Sundsvall
Visulahti
Imatra
Vuoksi
Tahkoluoto
Kangasala
Ylikkälä
Выборг
С.Э. ТЭС
Сясь
Ulvila
Meri-Pori
Huittinen
Hikiä
Korla
Kymi
Olkiluoto
Hyvinkää
Anttila
Rauma
Forssa
Nurmijärvi
Loviisa
Lansisalmi
Lieto
Salo
Tammisto
Kopula
Espoo
Inkoo
Forsmark
Aurland
Bergen
Eidfjord
Rjukan
Sylling
Jilla-Førre
Stavanger
Skien
Hasle
Halden
Borgvik
Sira-Kvina
Feda
Kristiansand
Skogssäter
Norrköping
Harku
Tallinn
Iru
Aruküla
Rakvere
Püssi
Kiisa
Paide
Tartu
Sindi
Tsirguliina
Valka
Valmiera
Ruusmäe
Narva
Кингисепп
Balti
Eesti
Ленинградская АЭС
Sosnovyybor
Санкт-Петербург
Гатчина
Ленинградская
Чудово
Киришская ГРЭС
Новгород
Старая Русса
Псков
Псковская ГРЭС
Великорецкая
Nordel

Norway and Sweden

- How has sector changes influenced climate change adaptive capacity?
- 1980s-2010
- Reforms
  - Norway 1991
  - Sweden 1996



Norway

- 98% Hydropower
- 300.000 Km grid
- Central, regional and **local grid**
- About 140 grid companies
- Reform: 1991

Sweden

- 45 % hydropower
  45 % nuclear power
- 530.000 Km grid
- Central, Regional and **local grid**
- About 170 grid companies
- Reform: 1996

Adaptive capacity

- Adaptive capacity understood as the ability to implement adaptation or the process of it
  - Largely an organisational question
- Formal laws and regulations
  - Available resources and clear responsibility structure for adaptation
- Organizational culture
  - Adaptation represent legitimate considerations

General changes in Norway and Sweden

Pre reform

- Culturally engineer dominated
- Vertically integrated
- Self (not)-regulated
- Directly controlled

Post reform

- Culturally economist dominated
- Unbundled
- (Re-)regulated
- Incentive regulation

Change in cultural factors

Norway

- "Efficiency crisis" → Energy Act 1991
- From *engineer* to *economist*
- Short term focus (efficiency)
- Legacy lead to efficiency geared regulatory scheme and further lock-in

Sweden

- External pressure (no efficiency crisis)
- Normatively balanced
- Increased efficiency focus…
- But more long-term focus
- Legacy lead to balance in regulatory schemes

Regulatory changes Norway

Period	Type of Regulation
Pre-reform, -1991	Self-regulatory system. Goal: Function, not efficiency
1991-1997	Price cap regulation ('light handed regulation')
1997-2001	Economic incentive regulation (by DEA). Goal: Economic efficiency
2001-2012	Incentive regulation + KILE + some more direct regulations (Still strong efficiency focus)
2012(?)→	More nuanced incentive parameters. KILE + Increased direct regulations (N-1?)

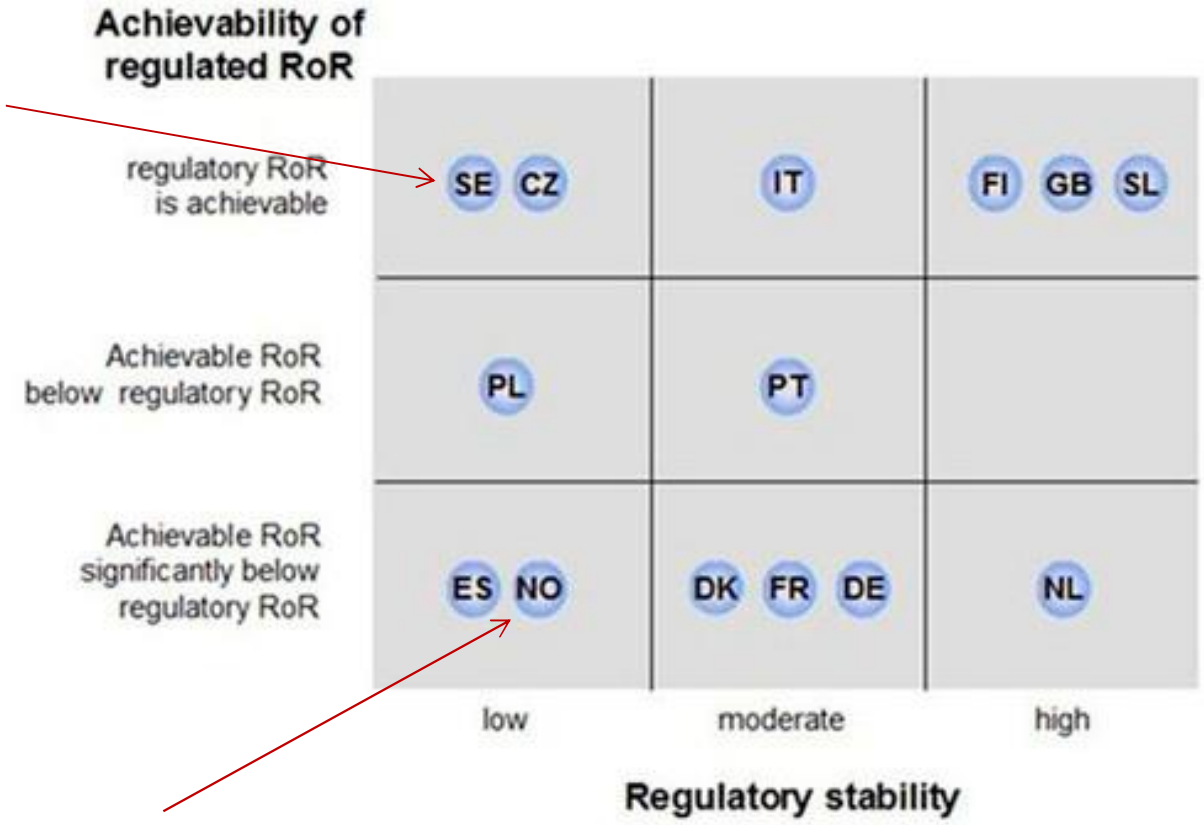
- 2001: KILE as a formal «patch fix»

Regulatory changes Sweden

Period	Type of regulation
Pre reform, -1996	Self-regulatory system/ no formal regulation
1996-1999	No formal regulation
1999-2003	Price cap regulation, 'light handed regulation'
2003-2007	Norm Model Regulation, *ex post*
2007-2012	'Intermediate' regulation, 'light handed regulation'
2012-	*Ex ante* regulatory framework

- 2005: Fines for failures 12h, 24h

Rate of Returns / stability



Source: Eurelectric 2011

Norway CCA capacity

- Radical Organizational culture
  - Radical move from engineer's legitimacy to economist
  - Undermines *willingness* to invest in adaptations
  - No transforming "extreme weather crisis"
- Formal structure
  - Reduces *ability* to invest in adaptations
  - Strong responsibility gap

Sweden CCA capacity

- Less cultural transformation
  - Coexistence engineer/economist (leaning)
  - Stable long-term scope
  - Storm *Gudrun* strong (cultural) legitimizer for engineer's paradigm
- Formal structure
  - Weak, frequent change → org. culture important
  - Resources available (for investments in infrastructure)
  - Smaller tesponsibility gap than for Norway

Sum up: National context

- Formal structure
  - Swedish regulatory framework is ‘weaker’ (than in Norway), leading to more room for culture
  - Swedish regulations allow for more financing of adaptations
- Organizational culture
  - Swedish legitimate behaviour is more balanced between function and economic efficiency than the Norwegian
  - Sweden has experience with ‘national’ weather events boosting adaptation legitimacy

2: What about adaptation in practice?

- Is there a difference between company characteristics in regards of how much they adapt?
- 4 companies:
  - Norway and Sweden
    - Formal structure
    - Organizational culture
  - Large and small
  - Experience and no experience with weather events

Case selection: 4 companies

		Control variables	
		Large, more experience	Small, less experience
Country	Norway	**Agder Energi (171.000)**	**Stange Energi (10.000)**
	Sweden	**E.ON Sweden (1,000.000)**	**Kramfors Energiverk (5000)**

Findings: Size

- Smaller companies tend to look ‘backwards’ when looking for vulnerabilities
  - ‘Too much’ attention on handling the regulatory framework
  - Few systems for mapping future vulnerabilities
- Larger companies have capacities
  - Better at combining attention between different considerations – also future vulnerabilities
  - Able to merge adaptation with other business considerations
  - Anticipatory approach

Findings: Experience (events)

- Companies with experience adapt more
- But:
  - Not fully comparable since all experiences are different
  - The cultural context is probably important for interpretation of incidents
  - Incidents ‘add a layer’ on the other factors (national context and company size)

Ex: Security of supply against extreme weather

- Norway
  - Low investments levels and huge lag, (but somewhat increasing)
  - Often measures are thought of as too costly (Politics Vs. Economy)
- Sweden
  - Investments increased, more robust grid
  - LARGE increase in investments since 2005 (Gudrun + expectations about increased real value of infrastructure)
- =Undergrounding in Sweden, not in Norway!

Conclusions: How do the companies adapt?

- National context
  - Swedish companies tend to adapt more than the Norwegian companies
- Company size
  - The larger companies have a more anticipatory approach to vulnerability reduction than smaller companies
- Experience
  - Companies with experience from extreme weather events have a more anticipatory approach and adapt more

Thank you

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