



Håkan Johansson – ABB Global Smart Grid ISI – Tallinn November 27, 2013

Sweden's experience of profitable joint energy projects.

Smart Grid - an enabler for a sustainable energy system

A new energy mix and new applications

Drivers for changes in the world of electricity



- **Remote** generation in big plants
 - Wind power, esp. offshore
 - Hydro power



- **Distributed** generation in small units
 - Photovoltaic
 - Combined heat and power generation



- **Volatile** generation
 - Wind power
 - Solar power



- Striving for more **efficiency**
 - Better utilization of infrastructures
 - More precise allocation of investments
- **New applications**, e.g.
 - E-mobility
 - Data centers
 - Heating and cooling
- Regional to **continental grids**
 - HVDC
 - FACTS

Consequences all over the system of power generation, transmission, distribution and consumption.
In the end this will require a new system design and a **new way** of looking into the future network

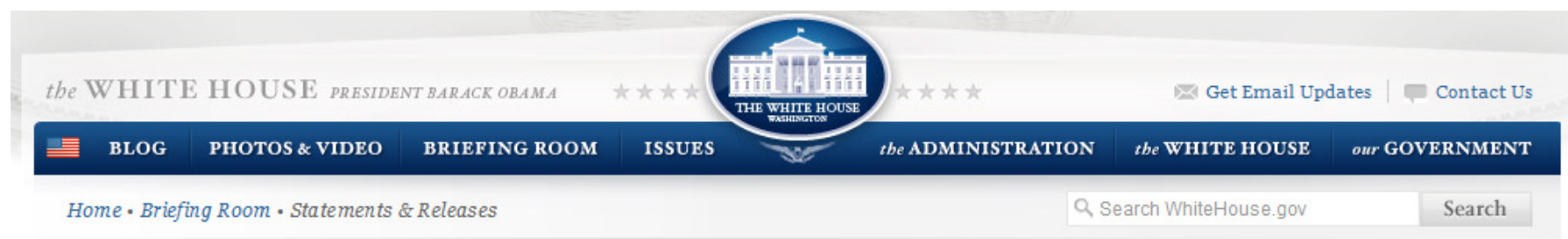
Evolution of Swedish energy system

- Traditionally very dependent on import and use of fossil fuels
- Today's electricity mix based on hydro and nuclear. Hydro main renewable source .
 - 2:nd biggest renewable source is bioenergy, primarily for heating
- Deregulated electricity market 1996. Some subsidies still apply
- Focus on the need for business models to attract investors. Political drivers needed!?
- New incentives for active consumers
- The grid owner is responsible for transmission of electricity incl. losses and have to balance (buy) the electricity consumed in the power system
 - Electricity trading companies
 - Retailers
 - Balance responsible
 - Traders

Evolution of Swedish energy system

- Go ahead for a SE, NO, DK and FI common market to make it easier for customers to buy electricity at competitive prices.
 - 800 companies selling 400 TWh/Year to 14 million customers at a value of 300+ BSEK (\approx 35+ BEUR)
- Everything is not about Smart Grids but it will make investments in infrastructure more important.
- Swedish government propose the TSO take the cost to enable new actors to connect to the grid. Today a barrier.
- New political incentives, directives, laws etc. both from EU and SE government to be considered.
- Ageing infrastructure
- Currently extensive evaluation of necessary test installations

September 4, 2013



Fact Sheet: The United States and Sweden -- Global Leaders on Clean Energy and Climate Change

The United States and Sweden share a common interest in pursuing innovative approaches to promoting clean energy and taking action on climate change, both domestically and internationally. Today, the President visited Sweden's Royal Institute of Technology to see first-hand some of the innovative technologies being developed in Sweden that can help us reach our goals at home and around the world. The President will continue to seek opportunities to broaden and deepen our collaboration with Sweden in this important field.

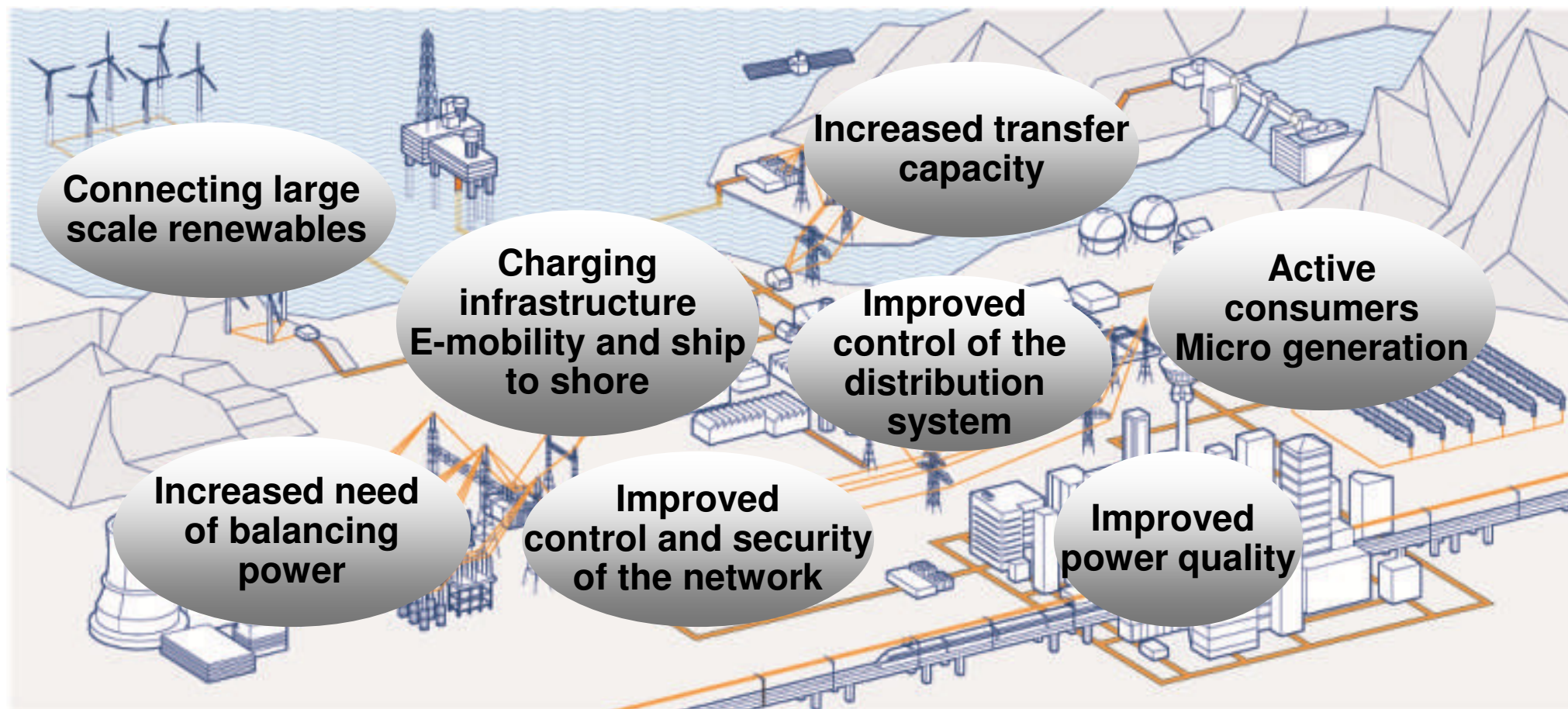
Investing in Clean Energy at Home

Sweden is a global leader in deploying clean energy solutions. Sweden has had a remarkable journey since the 1970s and transitioned from being a highly oil-dependent country to a leader in clean technology. Between 1990 and today, Sweden cut its greenhouse gas emissions by 20 percent while enjoying real economic growth of 59 percent. Sweden has a national vision of becoming an economy with no net emissions of greenhouse gases in the atmosphere by 2050.

Learning from Each Other

In 2010, the United States and Sweden launched the Swedish-American Green Alliance (SAGA) to promote public-private partnerships between our two countries on clean energy and sustainable development. SAGA brings together U.S. and Swedish cities, universities, think tanks, students, and businesses to exchange best practices and pursue innovative solutions.

Smart Grid, a puzzle based on: an evolution challenging the entire power system

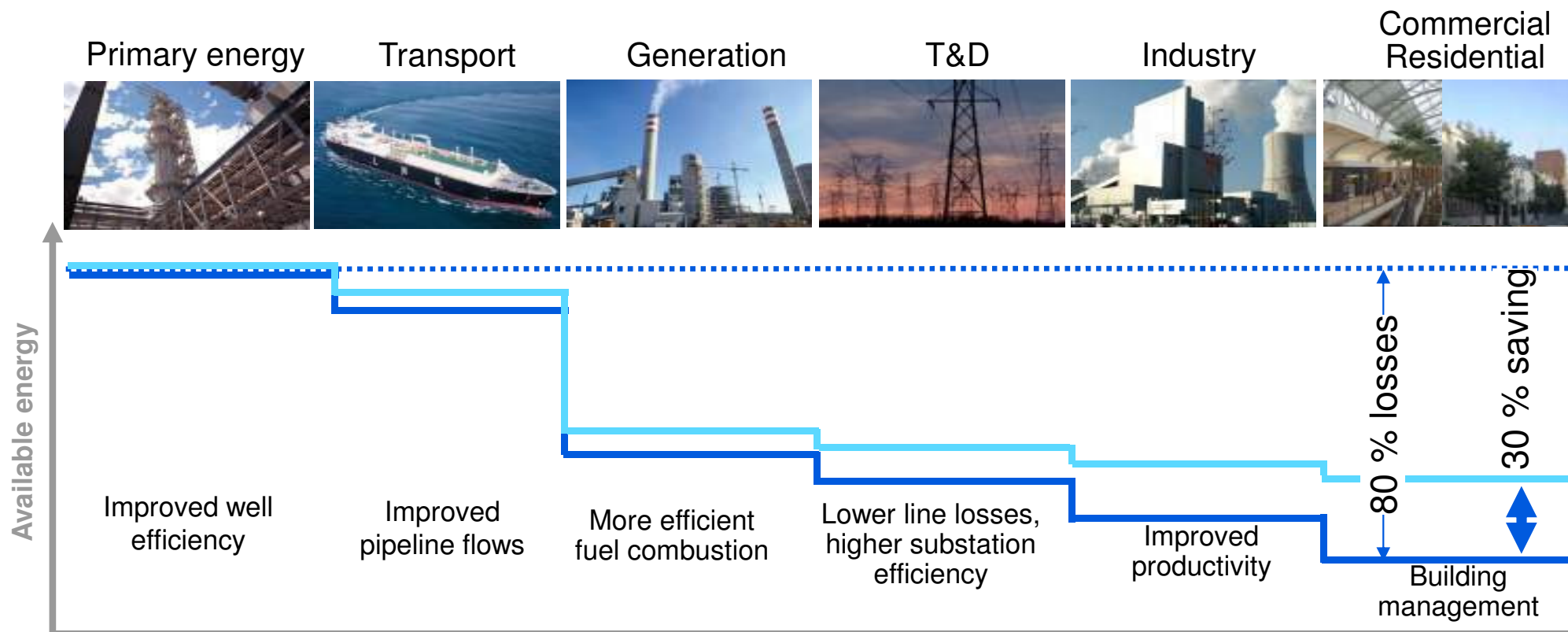


Business Models

Standards

Energy Efficiency

Efficient generation, transport and better utilization of electricity



Up to 80 percent losses along the energy value chain

Some losses inherent to the generation of electricity

Network losses in EU are an estimated 50 TWh, the annual consumption of 13 million households*

Energy efficiency along the value chain can reduce losses by 30 percent

A "world-class" contract confirms the vision and stakeholder commitment for the development



- Local sustainability program
 - Local public areas
 - **Energy system**
 - Local recycling
 - Water and waste water treatment
 - **Transportation**
 - **Homes and services**
 - Life styles and business
- New technology solutions
- New business models
- New market regulations
- Knowledge sharing and commercialize new solutions



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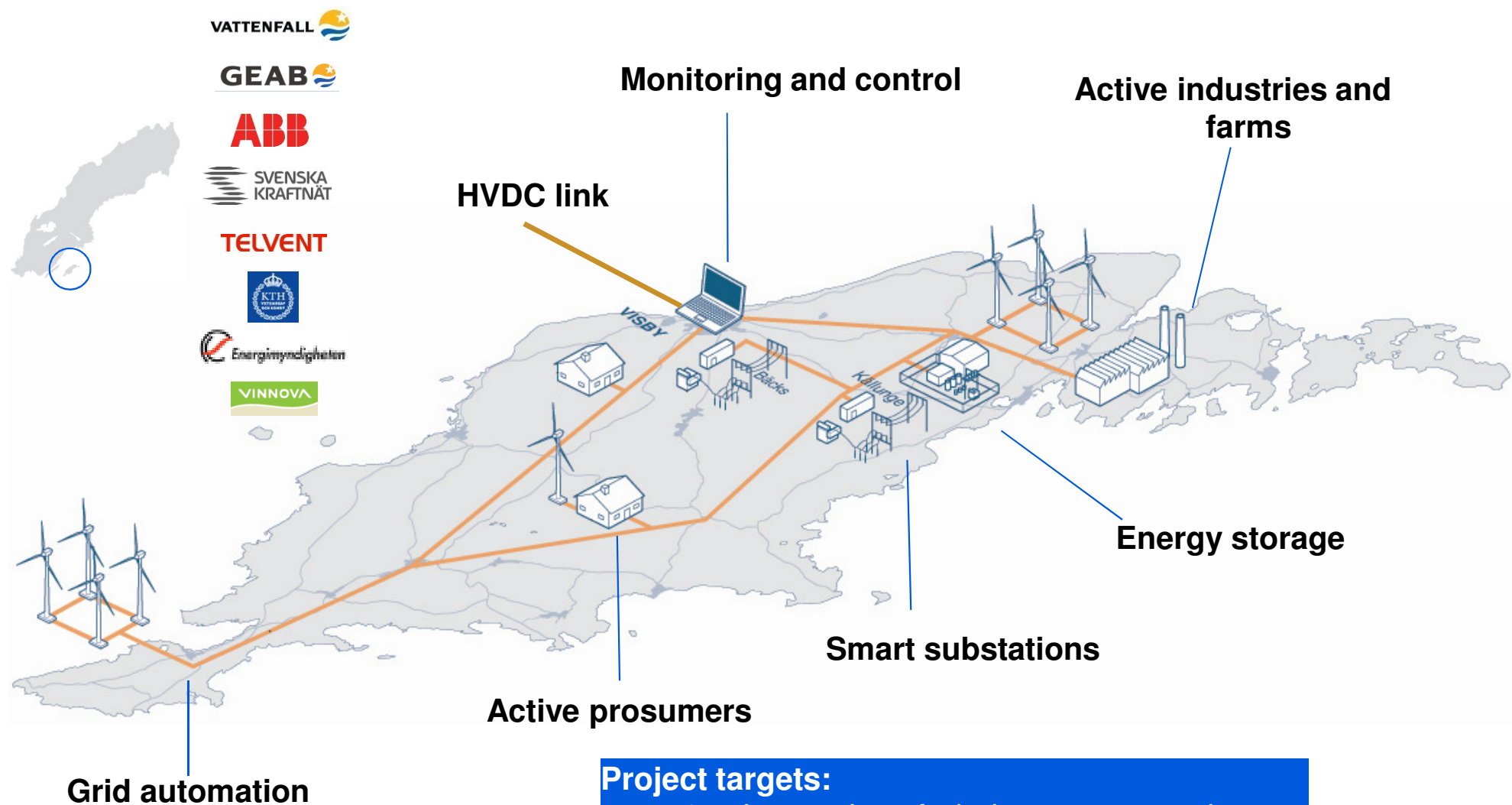
At the future zero-emission Stockholm Royal Seaport - the most advanced smart grid project in the world. Sweden's Vinnova knows innovation!

9 Jun

- Full system- and customer perspective coverage
- An open national arena for innovation and research around smart grids for urban areas.
- Stockholm Royal Institute of Technology, a hub for research
- Small and medium sized companies
- The energy industry

- **New roles and functions in the sustainable energy system**
- **New customer roles and behaviors**

Smart Grid Gotland – a fullscale test platform



FEAB; Gothenburg, Sweden

Year of commissioning - 2011



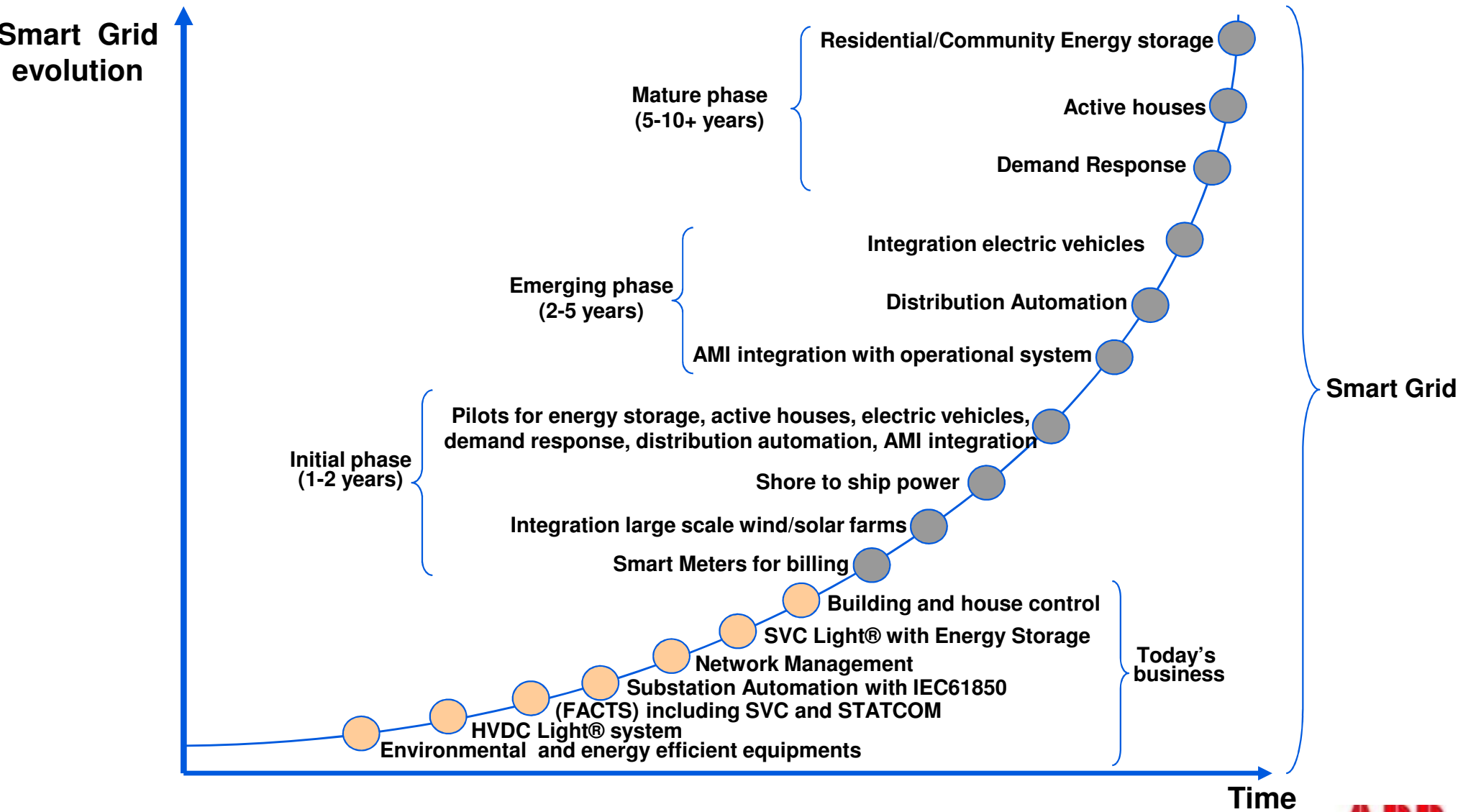
- Wind power integration
- Peak shaving
- EV charging
- Active consumers
- Dynamic pricing under evaluation

Recruit new competence

- New technologies and technical challenges
- New business models and enterprises
- New people with new competences
- Create an early interest
- Promote innovation and education
- Networking



Smart Grid Roadmap



Conclusions



Smart Grid is the evaluation of today's systems and the enabler for a more sustainable energy system with a more consumer driven electricity market which includes:

- integration of renewable energy sources, efficient energy consumption, AMI etc.

Both transmission and distribution

- both automation/IT and power devices
- both technology, business models and regulatory/market frameworks
- New political incentives, directives, laws etc. to reduce climate footprint
- Smart Grid is still a learning process. An important arena to develop and demonstrate solutions for the future power system together with all stake holders including authorities and end users. **Implementation started!**
- Most of the components and systems needed exists today but new standards must be developed
- Smart Grid creates new jobs and attract new competences*
- Everyone has to reconsider the individual energy consumption behavior

* WW 3.5 mill. 2010 in renewables alone, acc. to Renewable Energy Policy Network (REN 21)

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