

The Swedish Government Inquiry on Smart Grids

Math Bollen

Skopje, 13 December 2010



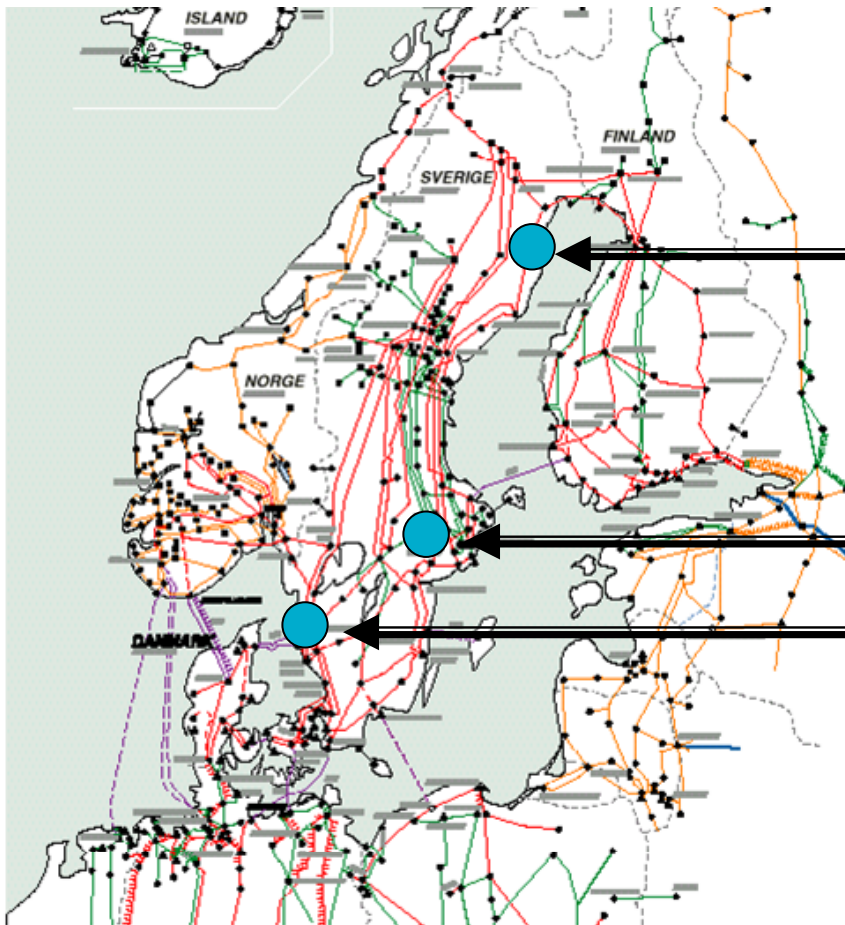
Smart grid inquiry

- What are smart grids?
- Why do we need smart grids?
- State of deployment and development
- Conclusions and recommendations

- Hourly meter reading
- Net charging



About myself



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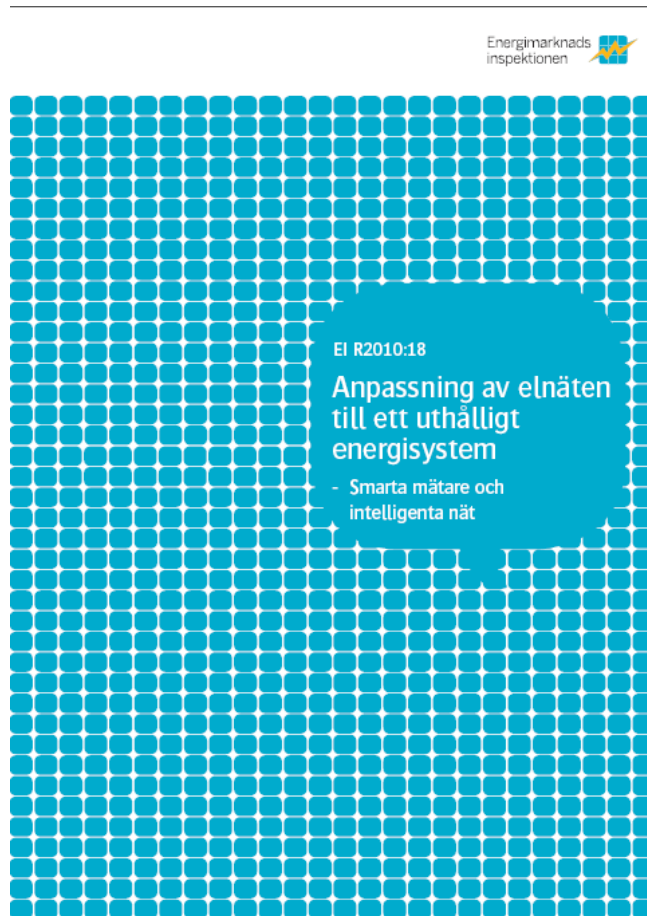
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Government Inquiry



- **4 March 2010: Government decision that Energy Markets Inspectorate should conduct an inquiry after smart meters and intelligent network**
- **1 December 2010: report became available**

Background

- **Transition towards a sustainable energy system puts requirements on the electricity network. Adaptation of the electricity network to this transition is needed:**
 - Enabling an increased integration of renewable energy in the power system;
 - Reduction of peak load;
 - Supporting a more efficient use of energy;
 - Allowing more active customers

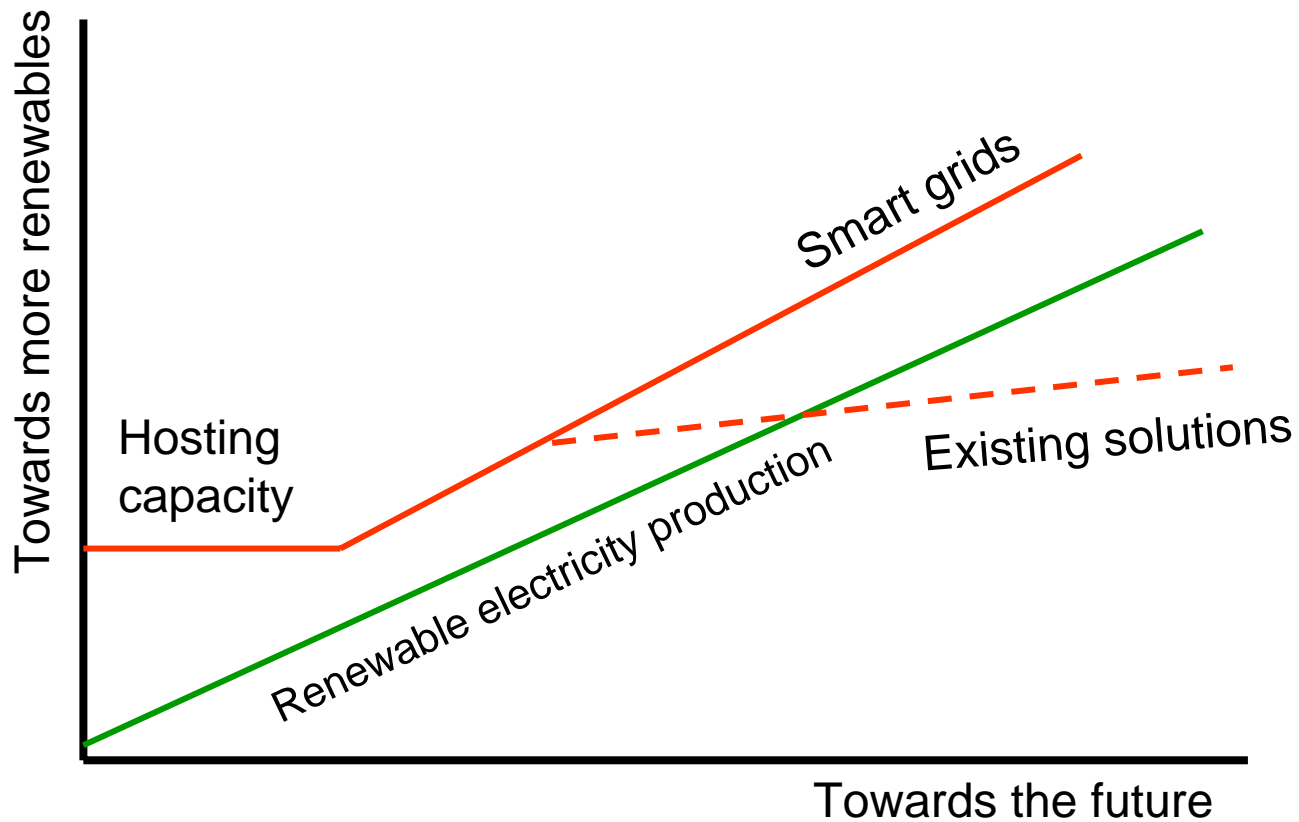


What are intelligent networks ?

- **Intelligent network, or smart grid: the collection of new technology, functionality and regulation on the electricity market that cost-effectively**
 - enables integration and use of renewable electricity production,
 - results in reduced energy consumption,
 - contributes to power reduction with load peaks;
 - and creates conditions for more active customers.



Enabling increased introduction of renewable electricity production

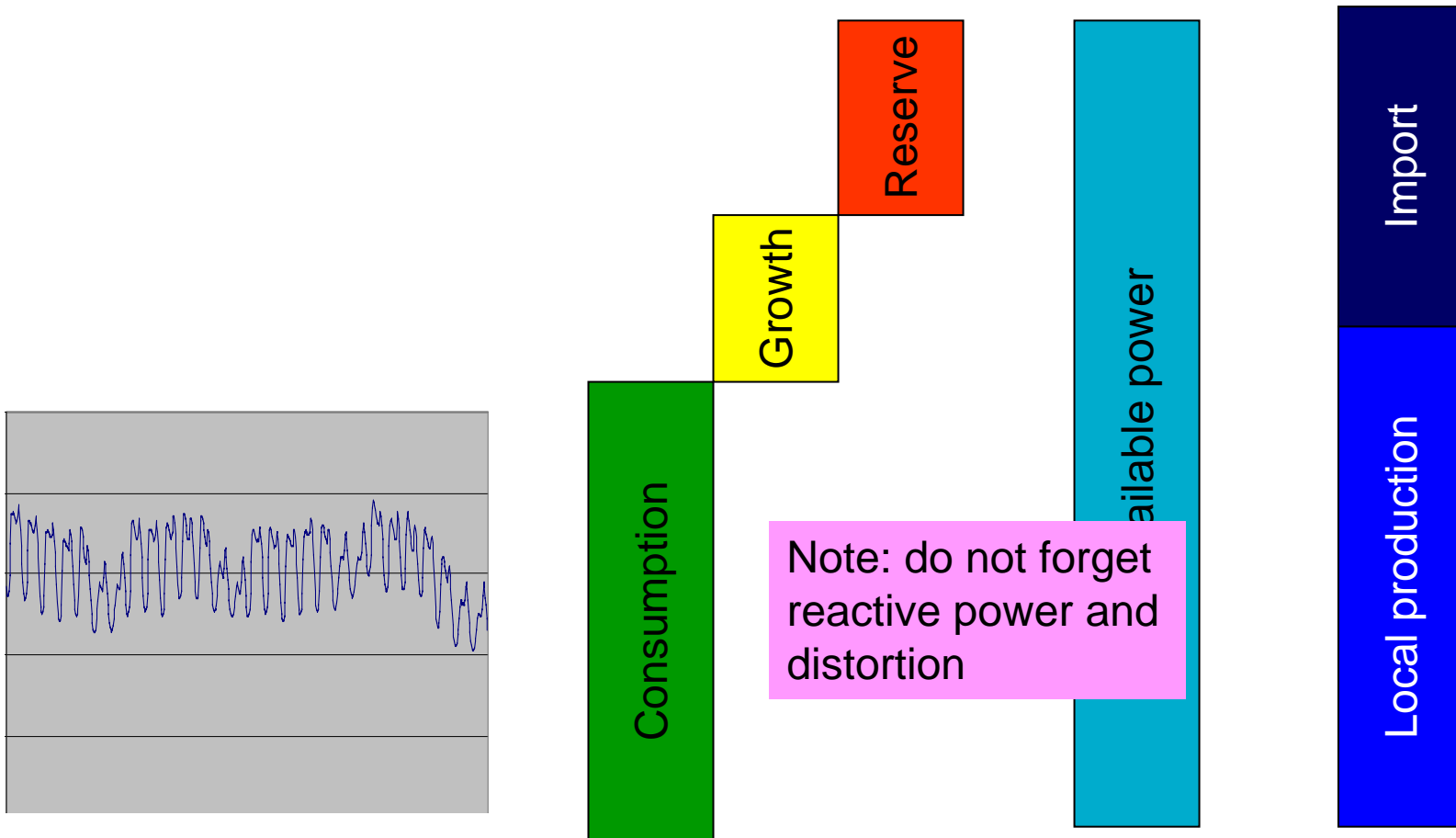


Need for flexibility

- **Production changes at a faster time scale than the network can adapt using existing technology.**
- **Any smart-grid technology that can offer flexibility has a clear advantage above existing technology.**



Reduction of peak loads



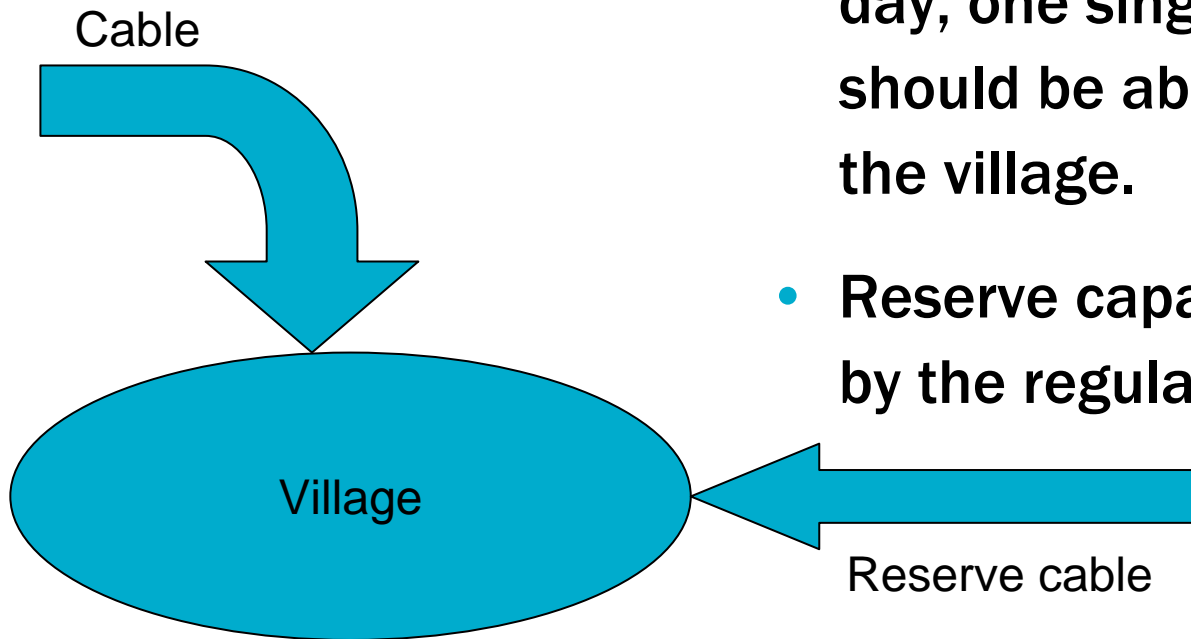
The existing situation

- Consumption is up to the consumers
- Load growth should be estimated
- Reserves are based on rules and guidelines
- Local production is an open market

- All that's left to impact: the network



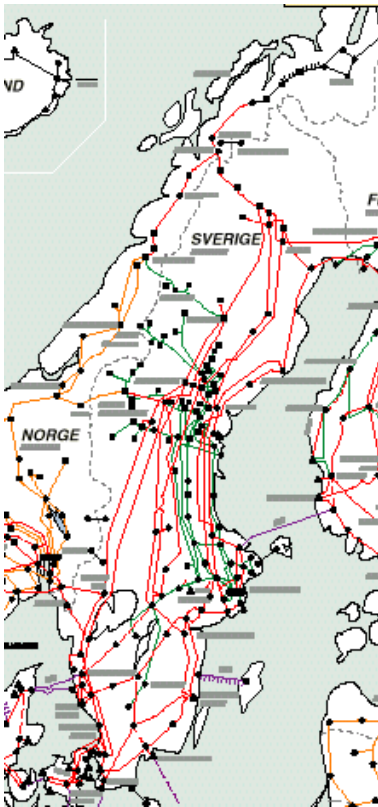
The design case in local distribution



- During the coldest winter day, one single cable should be able to supply the village.
- Reserve capacity is decided by the regulator.



The design case at national level



- **Production capacity should at least be equal to**
 - Maximum load during 10-year winter: 28 200 MW
 - Primary reserve: 325 MW
 - Secondary reserve: 1200 MW
 - 10% Unavailability of production: 3000 MW
- **Windpower: 6% available**
- **Import capacity: zero**

More efficient use of energy

- **Losses in the network (out of 150 TWh consumption)**
 - 2.8 TWh in transmission
 - 2.3 TWh in subtransmission
 - 3.9 TWh in distribution
- **Information to the customers about consumption patterns**
- **Energy-efficient consumption**
- **Electrification of the transport sector**



More active customers

- to choose between different suppliers
- different services or contract with the same supplier
- Impact electricity costs by shifting consumption in time.
- Distinction between electricity price and network tariffs.



Current state of smart grid deployment and development

- What has been done / how are the challenges addressed today ?
- What will happen soon ?
- What is under development or research ?
- What are the barriers against further development or research ?

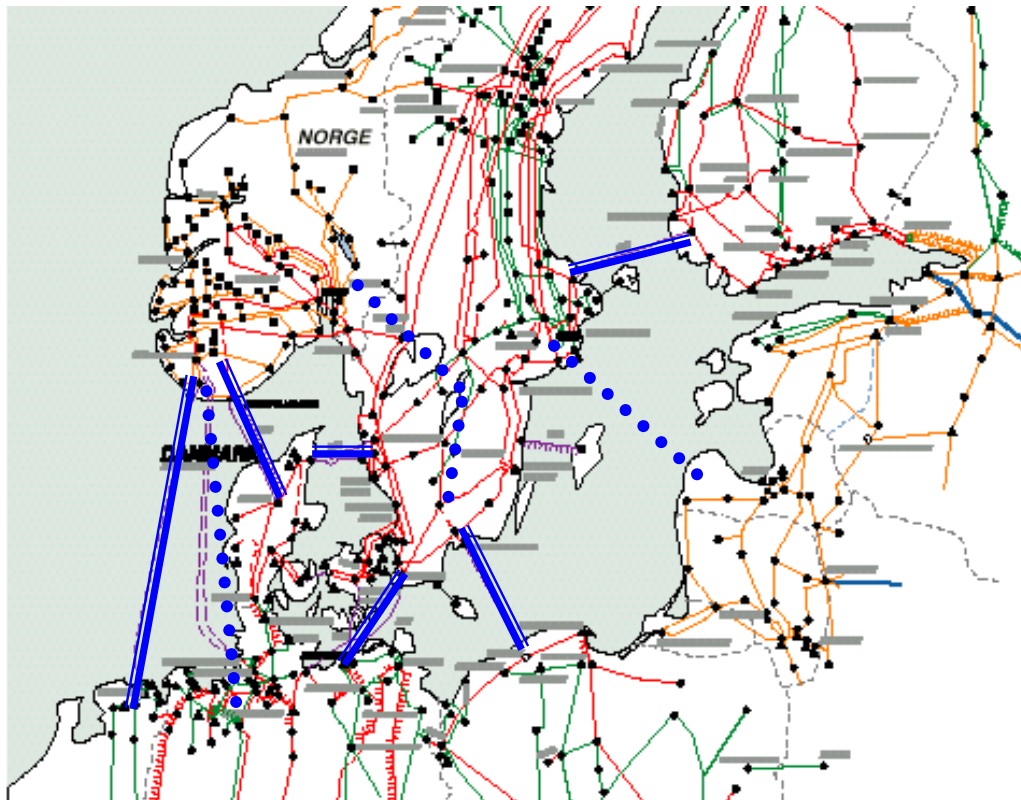


Enabling increased introduction of renewable electricity production

- Connection agreements for production units
- Strengthening the transmission system
- Research and development in many countries
 - Active distribution networks (control, storage, etc); advanced voltage control and protection
 - Large-scale energy storage;
 - Fault-ride through and ancillary services with windparks
 - HVDC and FACTS



Connections to the outside world



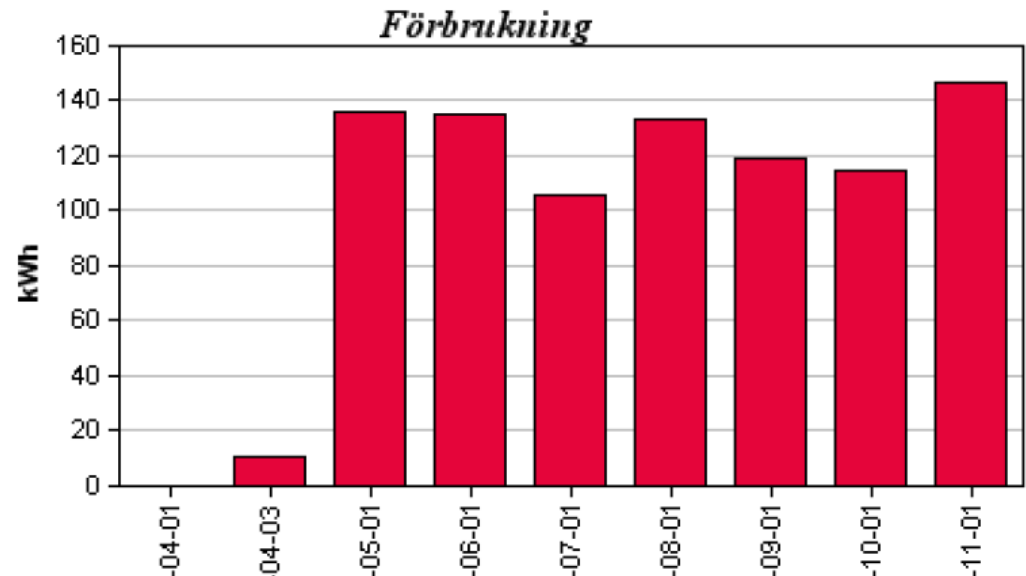
Reduction of peak loads

- **Power-based tariffs, where customers pay network tariffs based on their highest hourly consumption every month.**
- **583 MW demand reduction as tertiary reserve for the transmission-system operator.**
- **Joined operation of wind- and hydropower; pumped storage for balancing.**
- **Several European and international R&D projects on demand control.**



More efficient use of energy

- Feedback of consumption to the customers; on a monthly or hourly basis.
- Research on how to inform customers to change their consumption patterns.



More active customers

- Monthly meter reading for all customers (5.2 million);
- Hourly meter reading for all customers above 63 A and for many below 63 A;
- Hourly meter reading for all customers above 8000 kWh / year (1.2 million) from 2015.



Barriers against smart grids

- Unclear about financing of research, development, demonstration and deployment of smart grids.
- Lack of incentive for network operators to invest in smart grids.
- Network tariffs do not give incentive for customers to reduce their peak load.
- Lack of a national plan for the future development of the electricity network.
- Lack of knowledge about new technology and how to make use of it.



Conclusion 1

- **Creation of a knowledge platform to gather and spread knowledge on research, development and demonstration. Creating an independent coordination council to the platform.**



Conclusion 2

- **No need for changes in the way of funding for research, development and demonstration of smart grids.**
- **Deployment of smart grids can be funded under the existing tariff regulation.**



Conclusion 3

- **The TSO develops an action plan for the adaptation of the Swedish electricity network to achieve the political aims for introduction of renewable energy production and conversion of the energy system.**
- **To include a method for spreading of the costs with connection of renewable energy production.**



Conclusion 4

- Incentives for investment in smart grids will be included in the regulation.



Conclusion 5

- Hourly meter reading should be introduced for the majority of customers.



Conclusion 6

- The structure of the network tariffs will be studied, with the aim of reducing load peaks.



Conclusion 7

- **Requirements on the functionality of information to customers will be defined, to allow customers to react actively to price signals from the markets.**



Conclusion 8

- **The roles and responsibilities of the different actors in the electricity markets will be investigated, to remove further barriers against the introduction of smart grids.**



Conclusion 9

- The division between “local networks”, “regional networks” and the “trunk network” will be evaluated.



Hourly meter reading



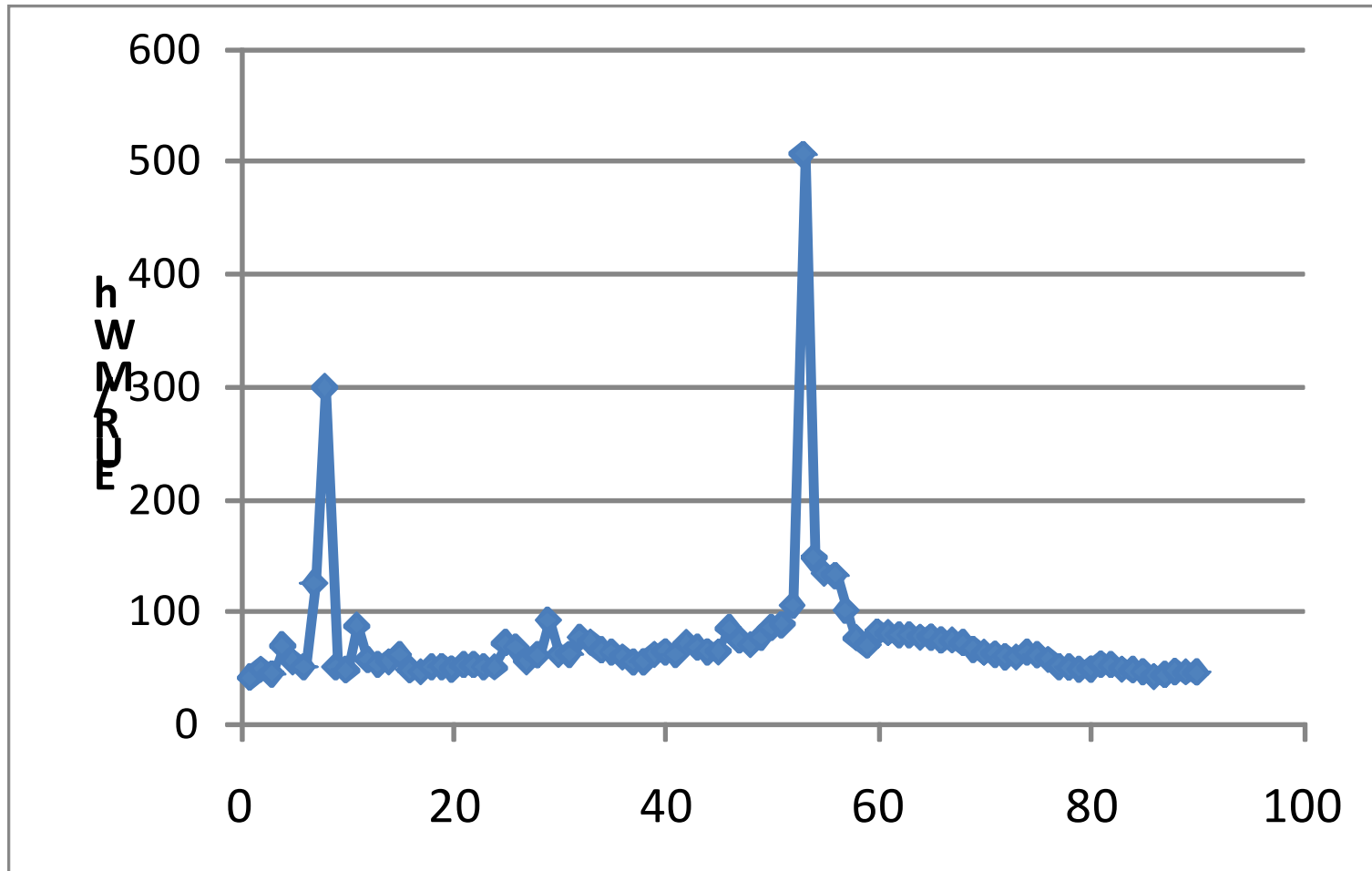
- Increased influence of customers on the electricity market – hourly meter reading for customers with a connection of at most 63 A
- Hourly metering for customers above 8000 kWh/year from 2015; but monthly balancing

Opening of the electricity market

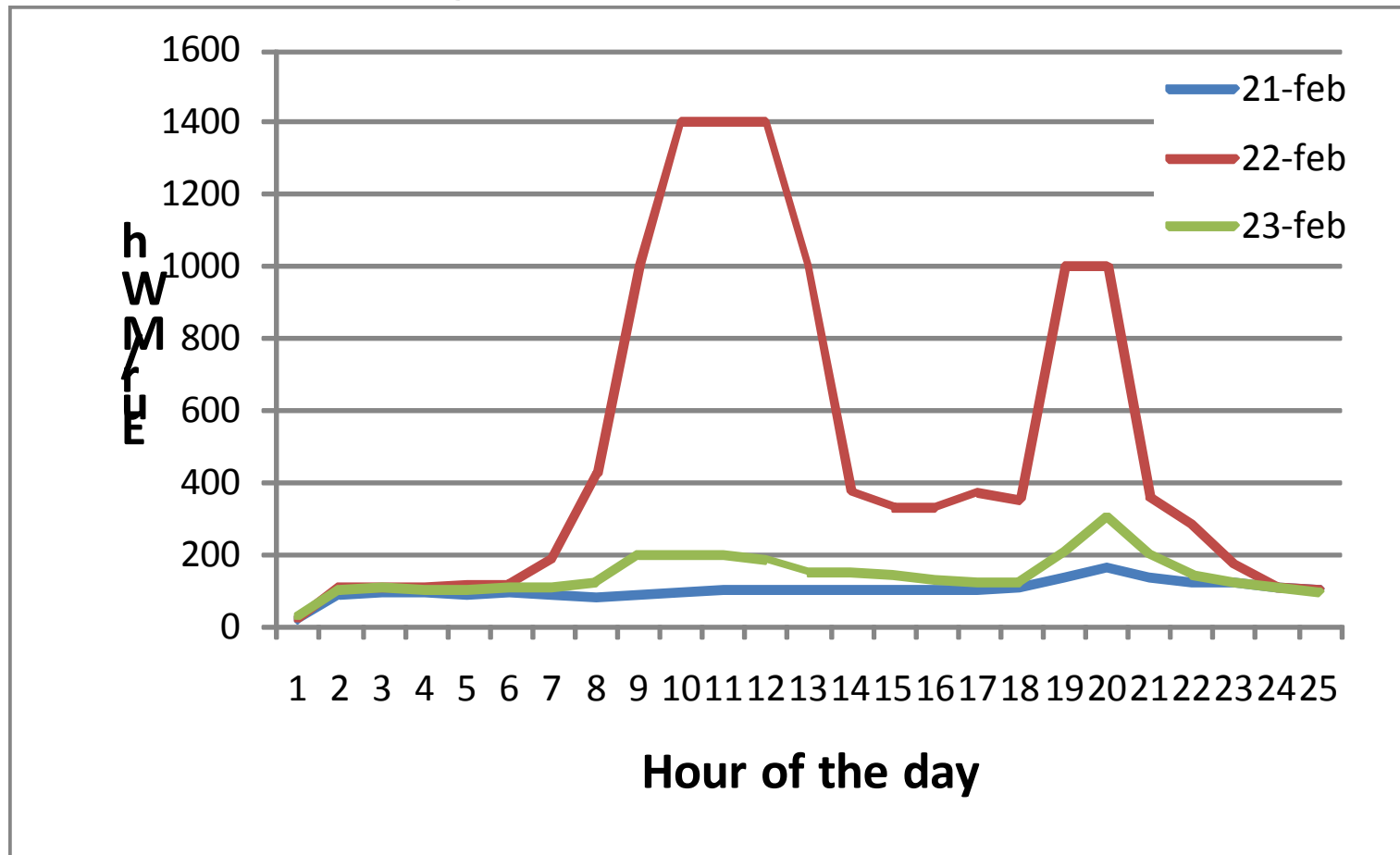
- High price-peaks have resulted during February 2010.
 - Outage of several nuclear units;
 - Extreme cold
- The regulator says: this shows that the market functions as it should.
- The customers say:



Elspot daily, Jan - Mar 2010



Elspot hourly, 21-23 Feb 2010



Elspot DK1 (west) DK2 (east)

Elspot prices at Nord Pool Spot (SEK/MWh)



The Swedish metering reform – Act 2

- **Compulsory functionalities: hourly meter reading for 1.2 million customers from 2015**
- **Voluntary functionalities with many network operators**
 - Hourly metering interval
 - Two-way communication
- **The opens up the possibility for new services, markets, operation and planning of the network**

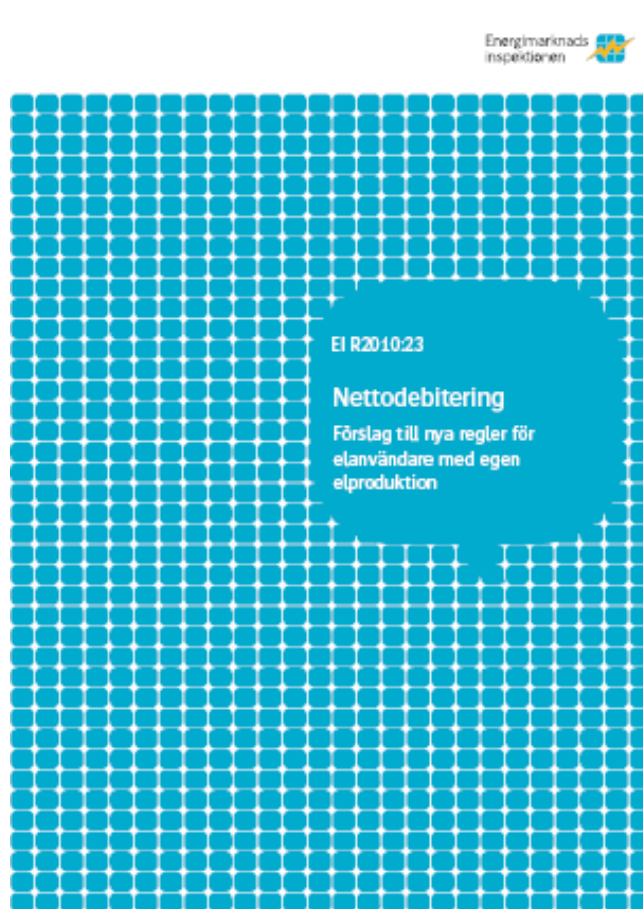


Possibilities - 2011

- Hourly-based electricity markets
- Disconnecting individual customers in case of an operational emergency
- Consumption patterns for network planning
- Feedback of consumption patterns to customers
- Power-based and time-of-use network tariffs



Net charging



- Net charging – proposal for new rules for electricity consumers with their own production.



Conclusions

- **Net metering is not in agreement with existing tax rules in Sweden.**
- **Metering of production and consumption per hour.**
- **Electricity trader that sells electricity to the customer shall also buy any production. The price is up to the market to decide.**
- **Network tariffs to be based on net monthly values.**



What next ?

- Hourly meter reading will come available for more and more customers.
- New price structures and network tariffs will become available.
- The knowledge platform will form the base for building up sufficient knowledge on smart grids.
 - Link to smart meters (hourly reading and two-way communication).
 - A number of demonstration projects to start in a few years time.

