

Market Based demand Response

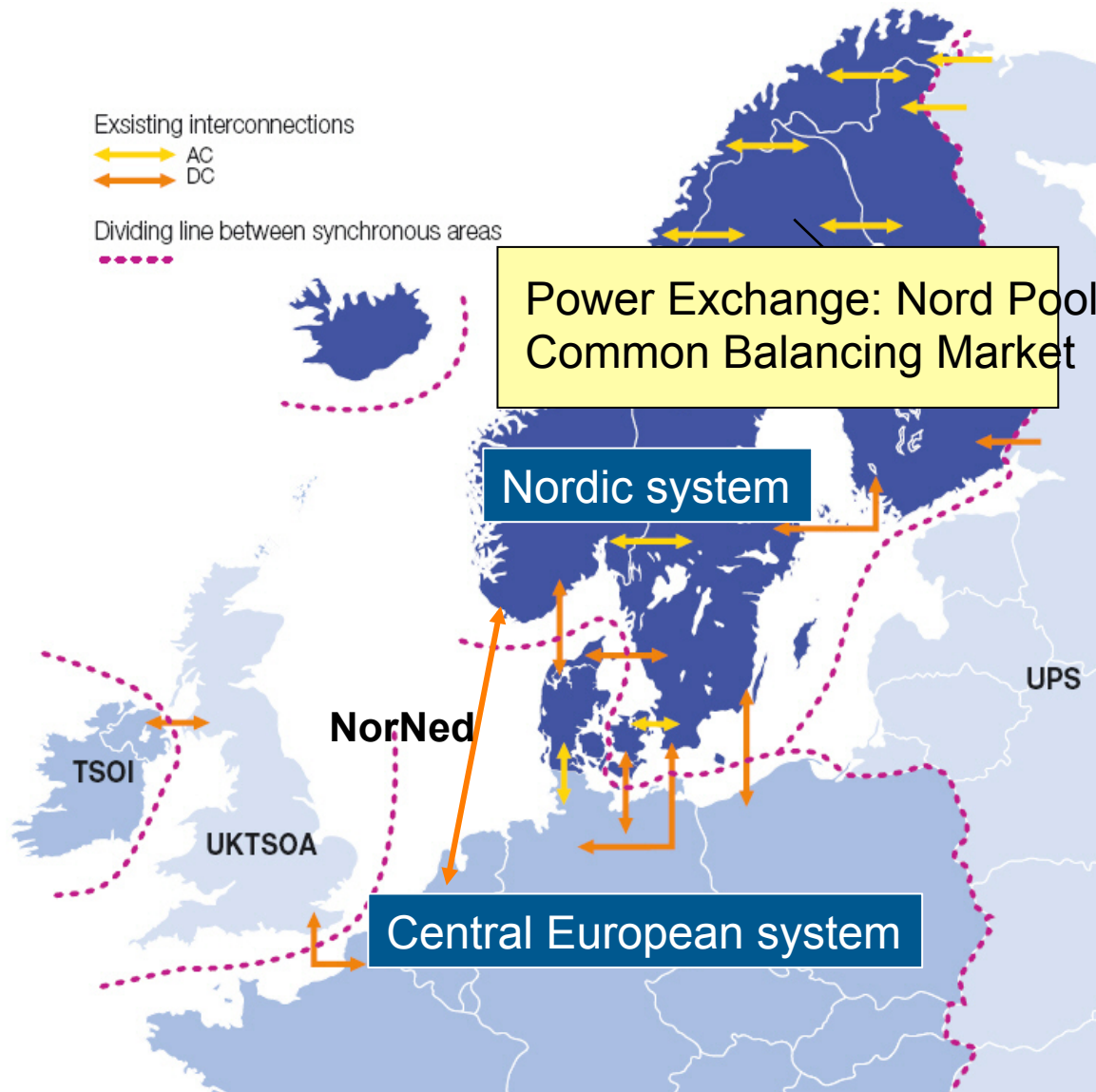
Results from Norwegian Research Projects

IAE/DSM workshop, Trondheim
18 April, 2012

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Outline

- Introduction
- Market Based Demand Response – Value of demand side price elasticity
- Examples from Norwegian pilot tests – lessons learned
 - Load shifting – remote control
 - Innovative Power contract: "Fixed Price with return option"
- EcoGrid EU (FP7) Large scale smartgrid demonstration of an advanced market concept

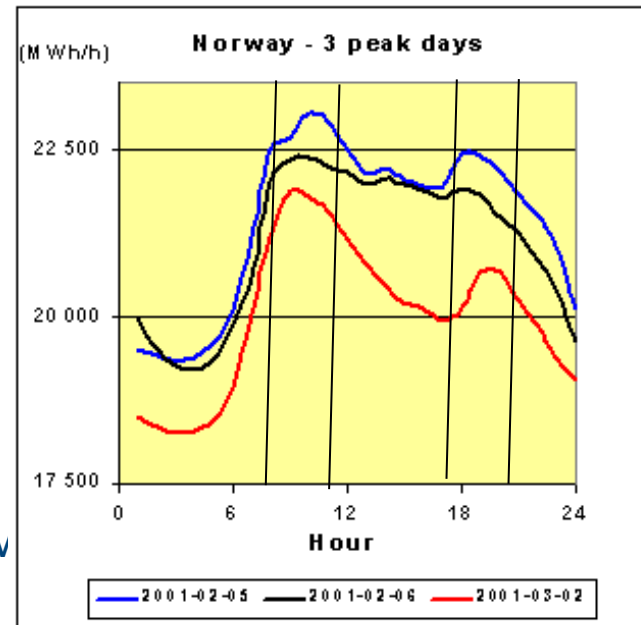


- Nordic system: 91 GW (47 GW hydro)
- Central European system: 667 GW

- Development towards integration in Europe
- Market coupling DA (TLC, CWE)
- Implicit auction on all HVDC links
- Integration of balancing markets

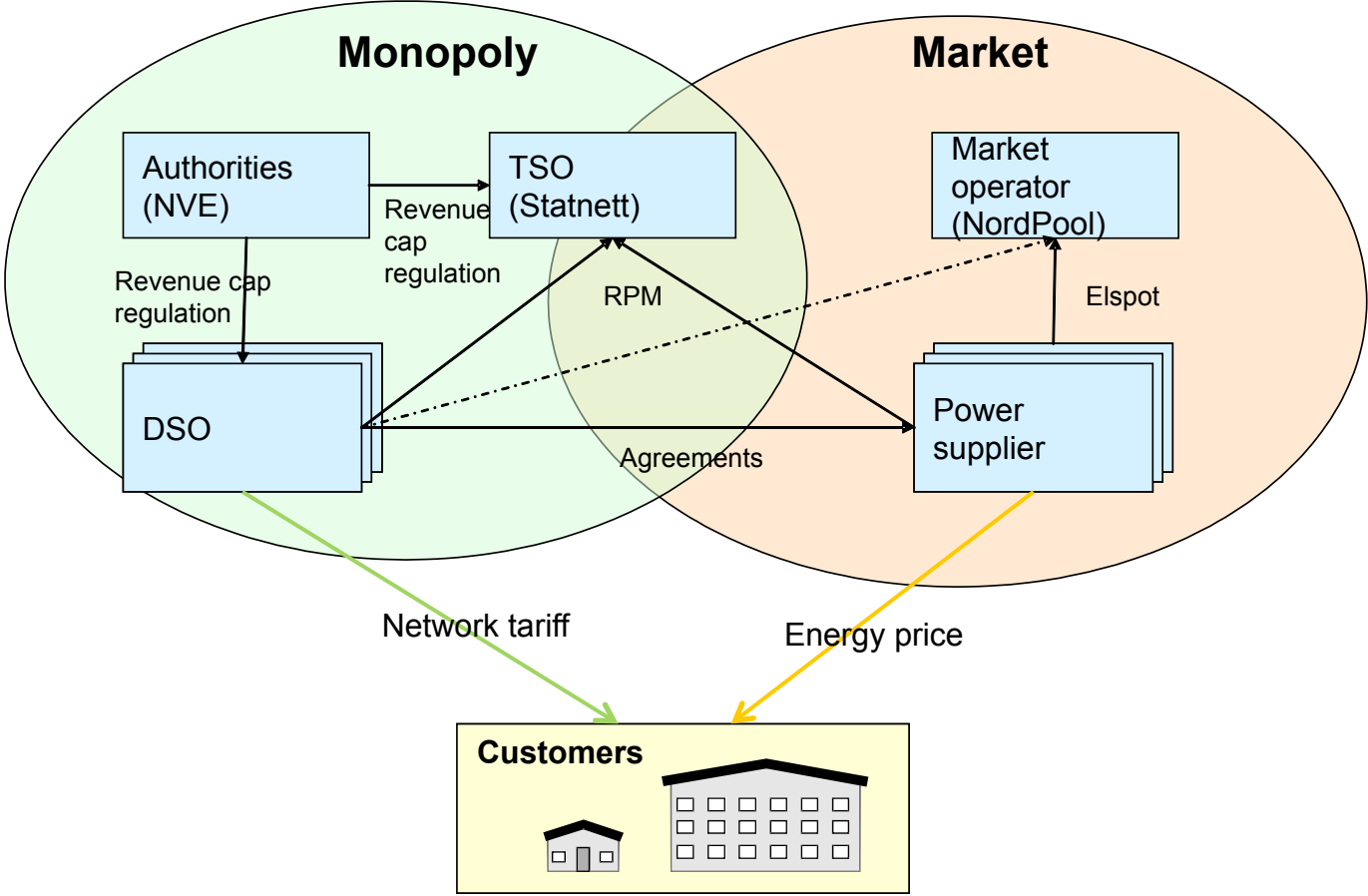
Electricity consumption in Norway

- Total 127 TWh (07)
 - Heating: ca 35 TWh
 - Large industrials: ca 40 TWh
- Peak load: 23 994 MW
- A large (theoretical) DR potential
 - Industry ~3 000 MW
 - Residential and commercial: ~1 700 M

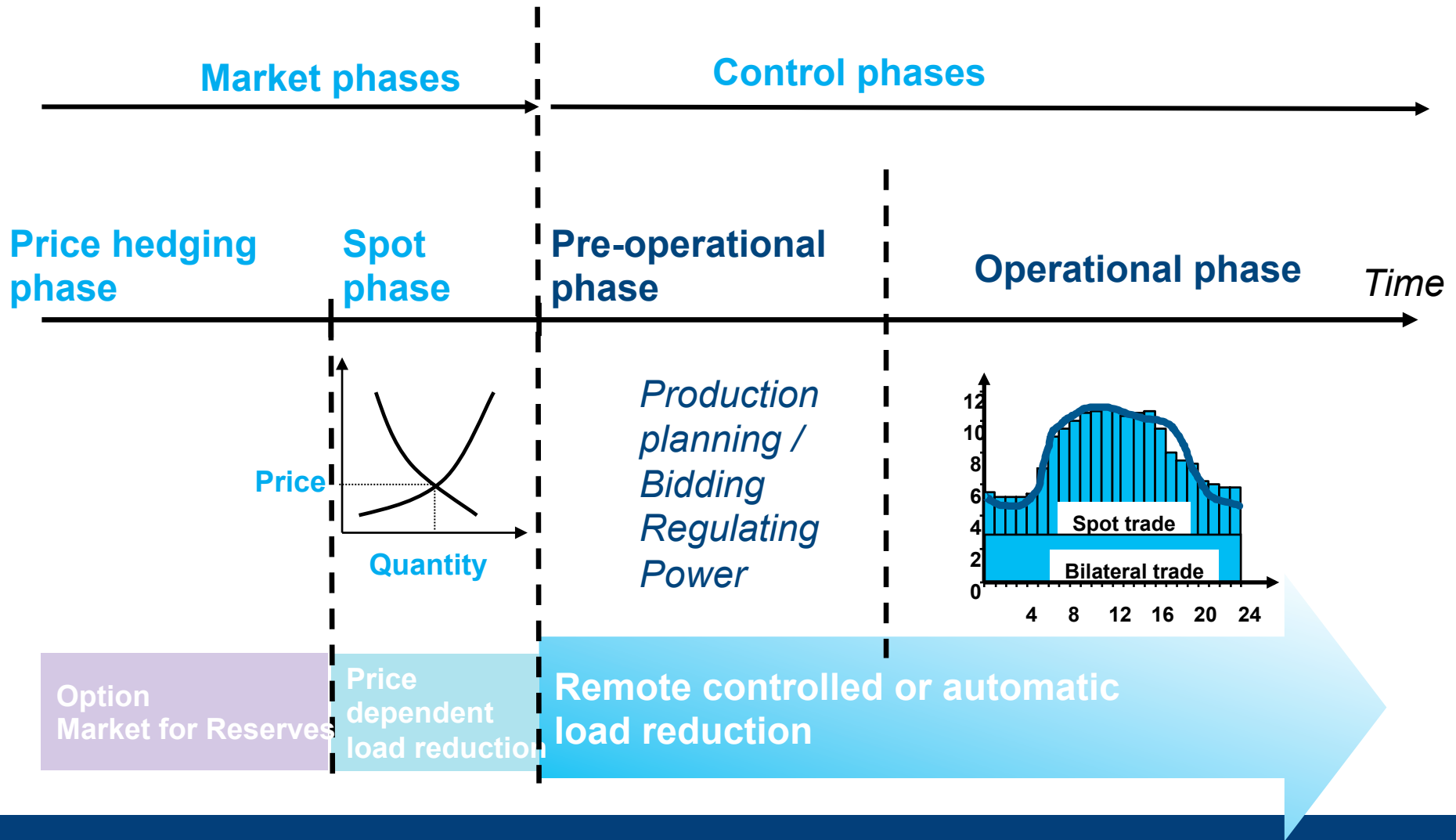


- Production (99 % Hydro): average 130 TWh/Year 50 TWh variation between wettest and driest year

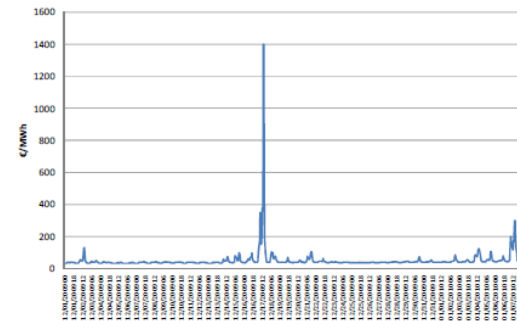
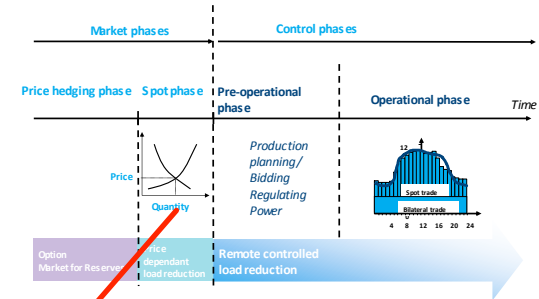
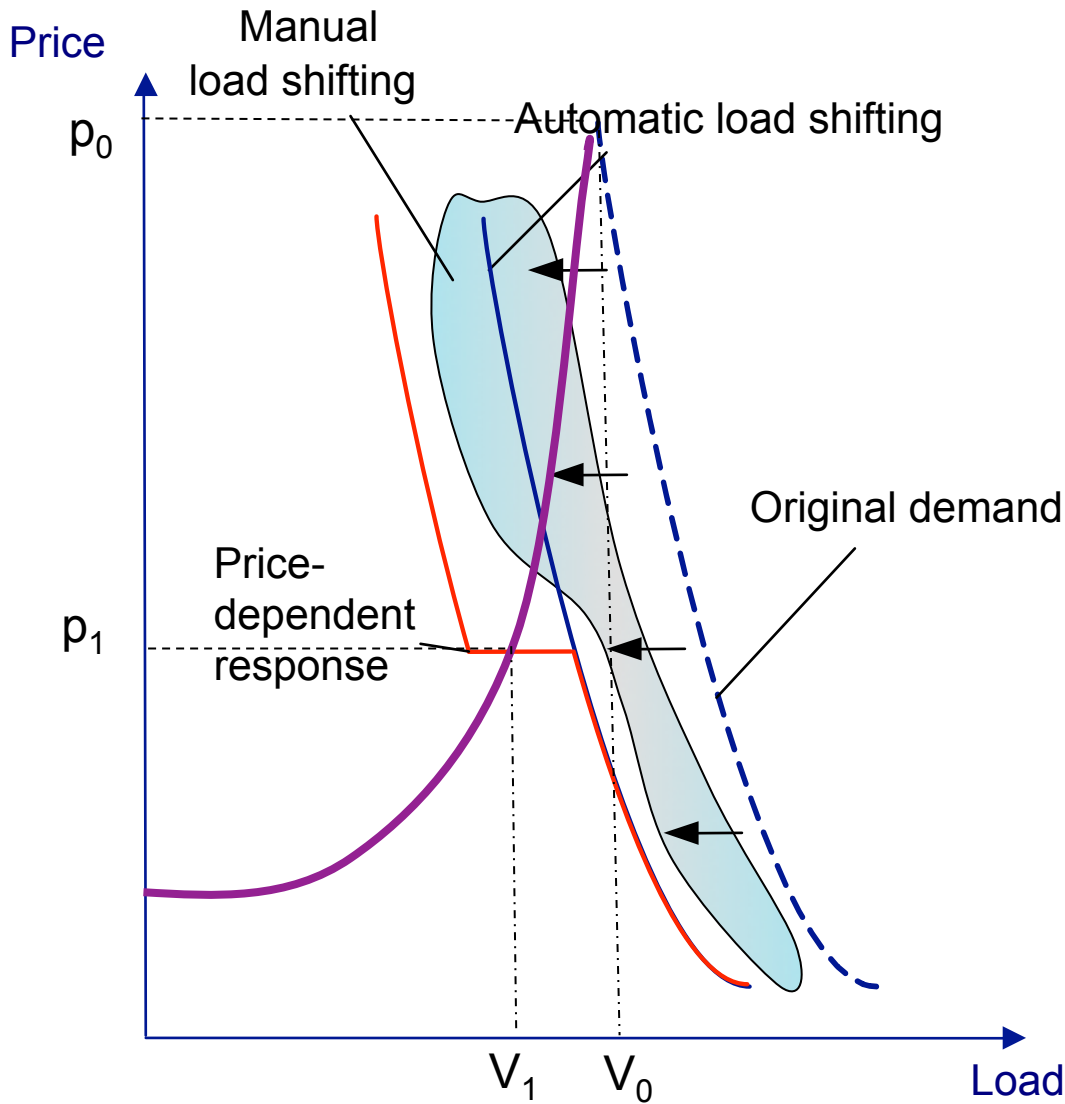
Monopoly - competition



Demand side participation in market and system operation

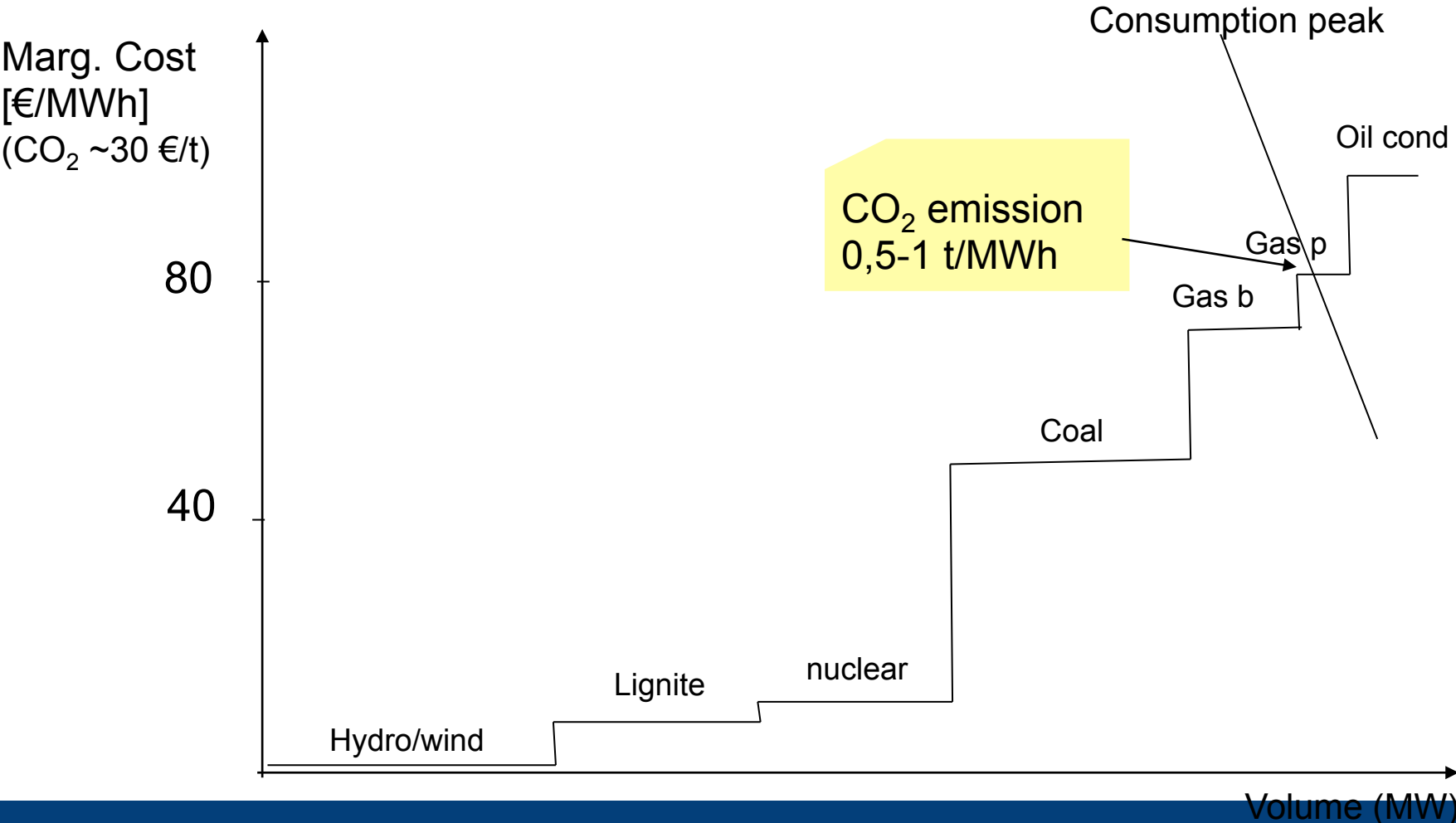


Value of demand side price elasticity

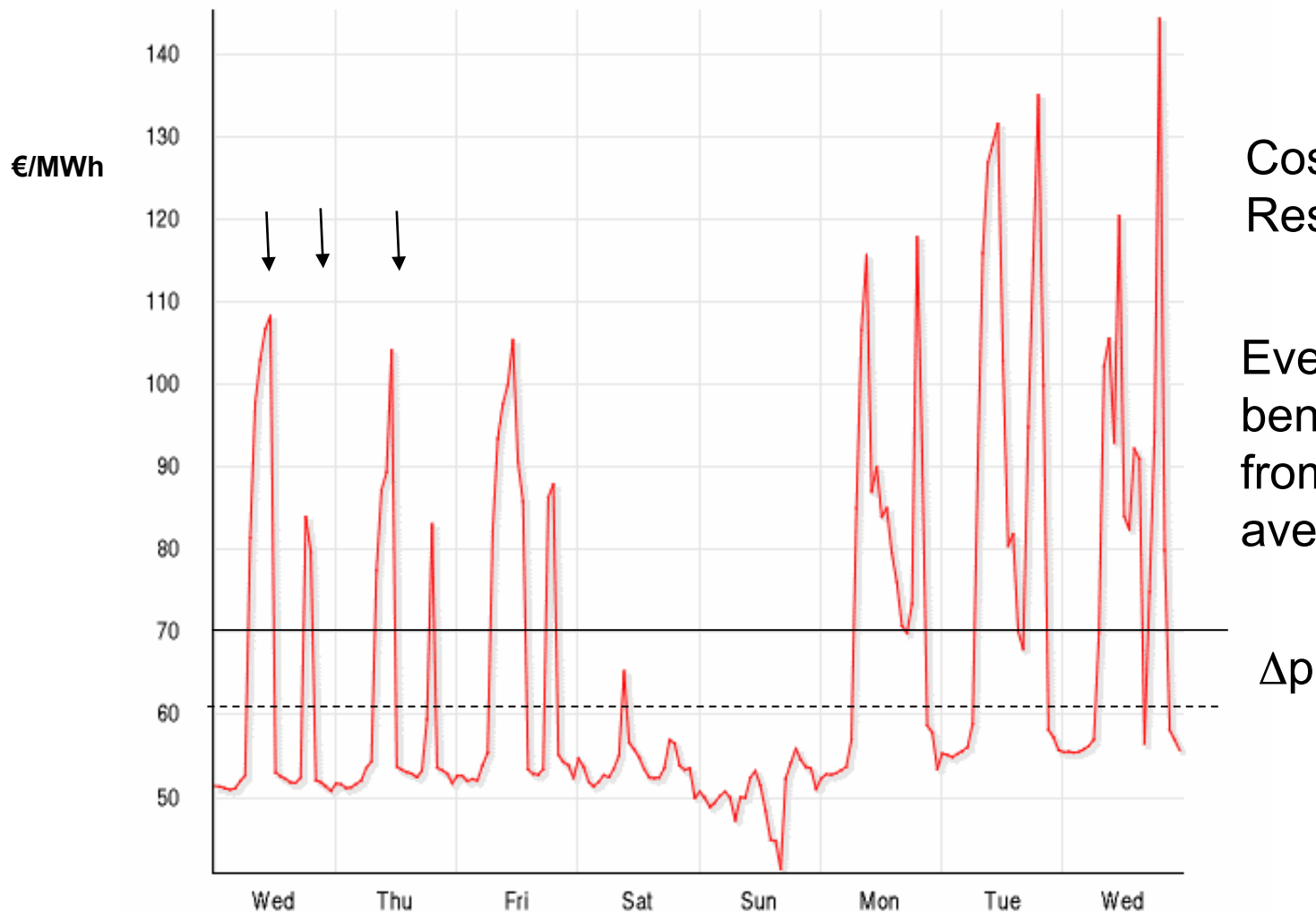


Less than 100 MW load reduction would have reduced the price from 13 NOK to 1 NOK

Price and CO2 emission impact



Benefit for customers

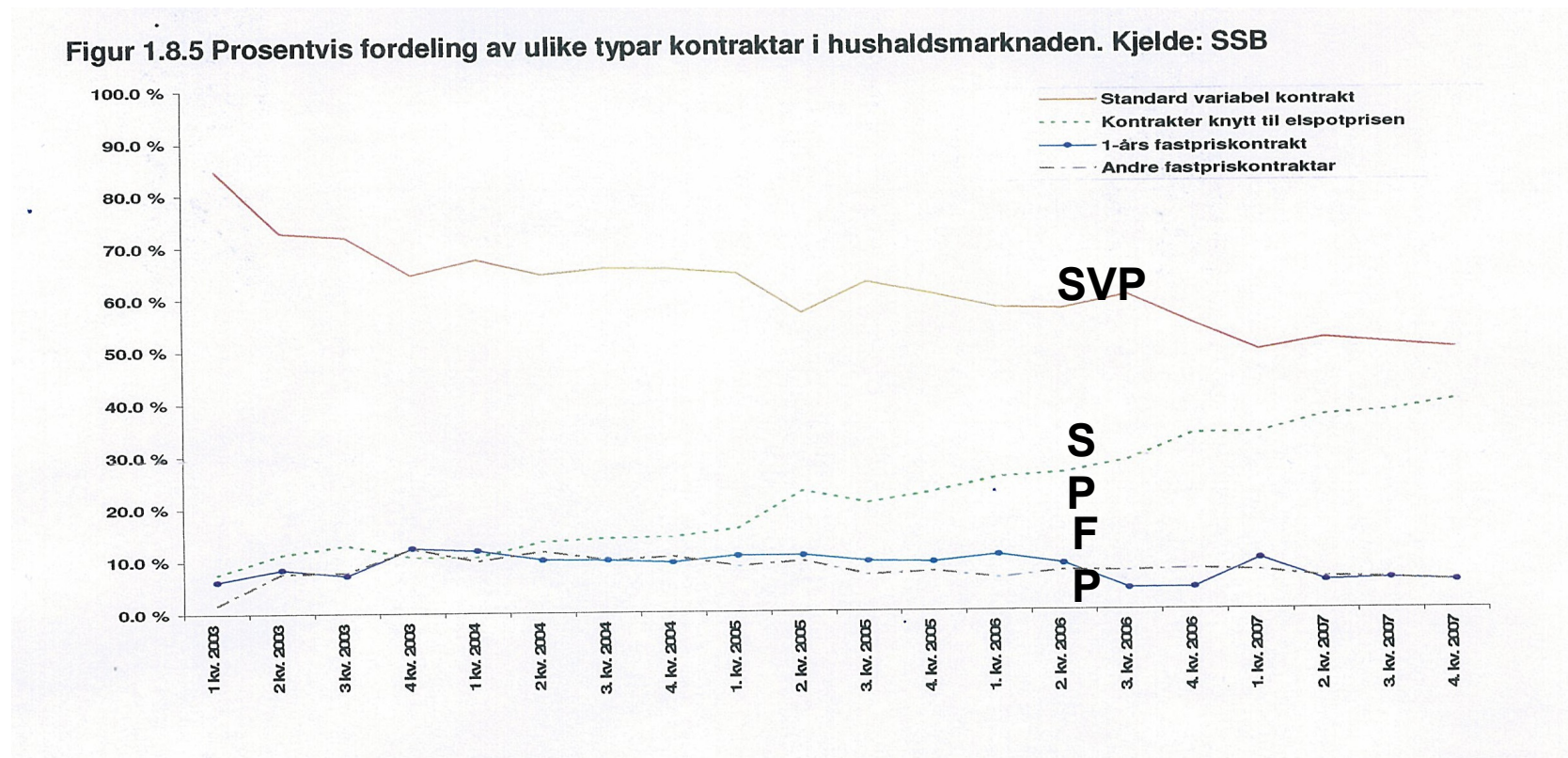


Cost reduction for the Responsive customer

Every customer will benefit from the reduced average price

Present contract types Norway

- Standard Variable Price (SVP)
- Spot Price (SP)
- Fixed Price (FP)



Status AMR Norway

- Full roll out of Automated Metering and Control systems (AMS) by the end of 2016
- Functional requirement
 - Register and store with a sampling frequency of 60 min (optional 15 min)
 - Disconnect or limit power output
 - Exchange price information
 - Prepared for both output and input of energy on customer (prosumer) level

 - Standardized interface for communication with external equipment (display)
 - Connectable to other meter equipment
 - Secure storage of data in case of voltage interruption
 - Data security measures

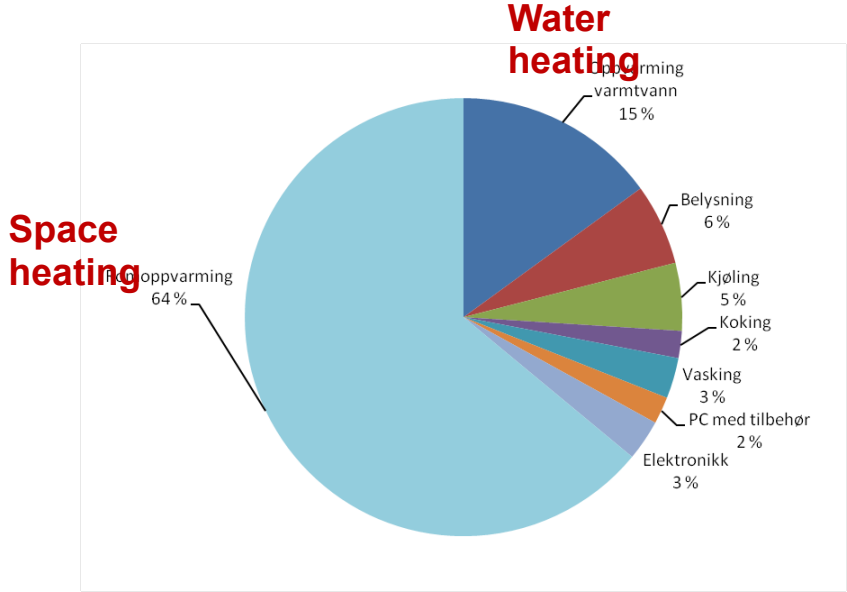
Market based Demand Response Project

(2005-2008)

Pilots

1. "Remotely controlled Load shifting" – peak load reduction
2. "Fixed Price with Return option" - reduction of energy in shortage periods
3. Automatic Demand Response (ADR)
4. "Smart house – ToD tariff" – housing cooperative

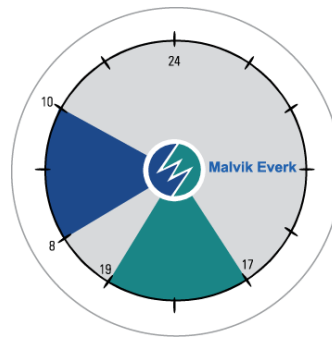
Household electricity consumption in Norway



Approx 80% of electricity consumption relates to water and space heating. Source: : EU/ REMODECE

Pilot I “Remotely controlled Load shifting – ToD tariff“

- Test group: 41 household customers
- Network tariff: Time of Day tariff with high price in periods with expected shortage (+ 0,10 € , Mon-Fri, hour 9-11 and 17-19)
- Energy price
 - Hourly spot price (free choice of supplier)
- Remote control of water heaters (2-14 kW) via AMR in the defined periods
- ”EI-button” reminder

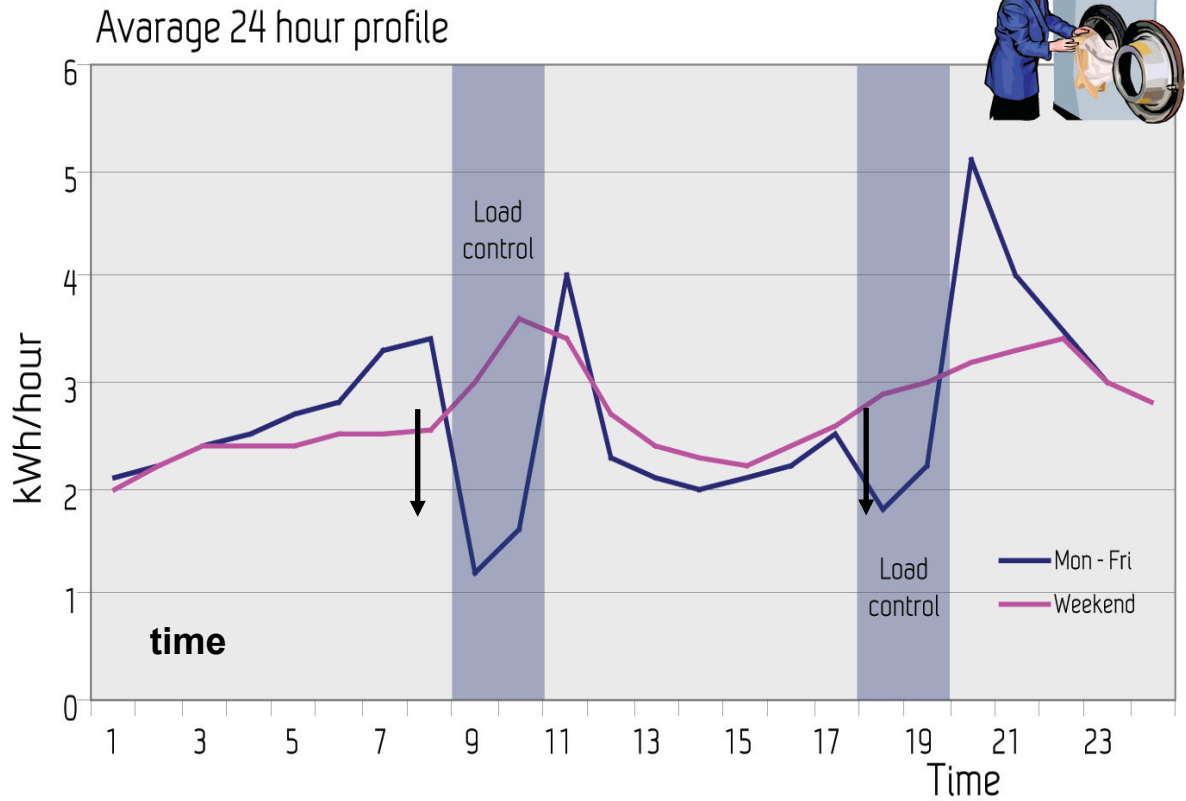
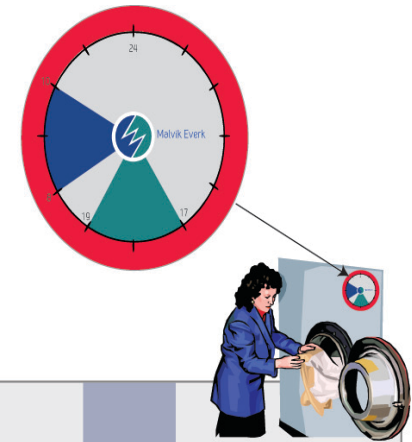


Pilot I Results

Positive response from all customers.
No cold water complaints.

Automatic load reduction in peak load periods gives a stable demand response

Accumulated 600 -1000 MWh/h load reduction in peak hour indicated.

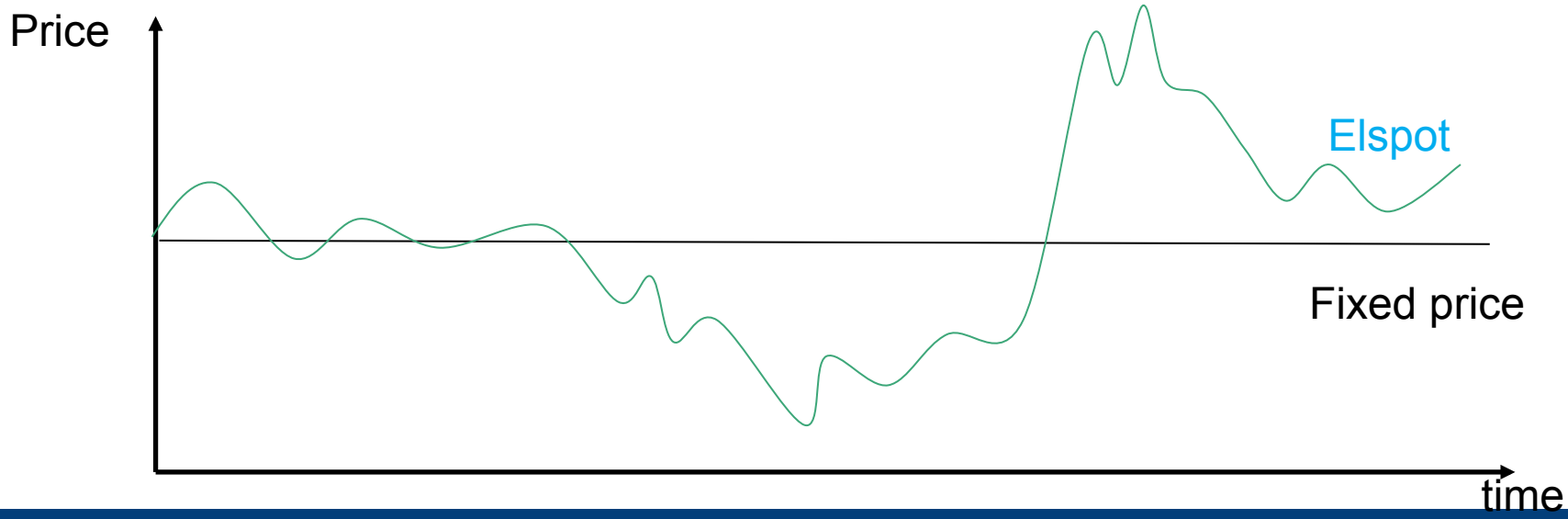
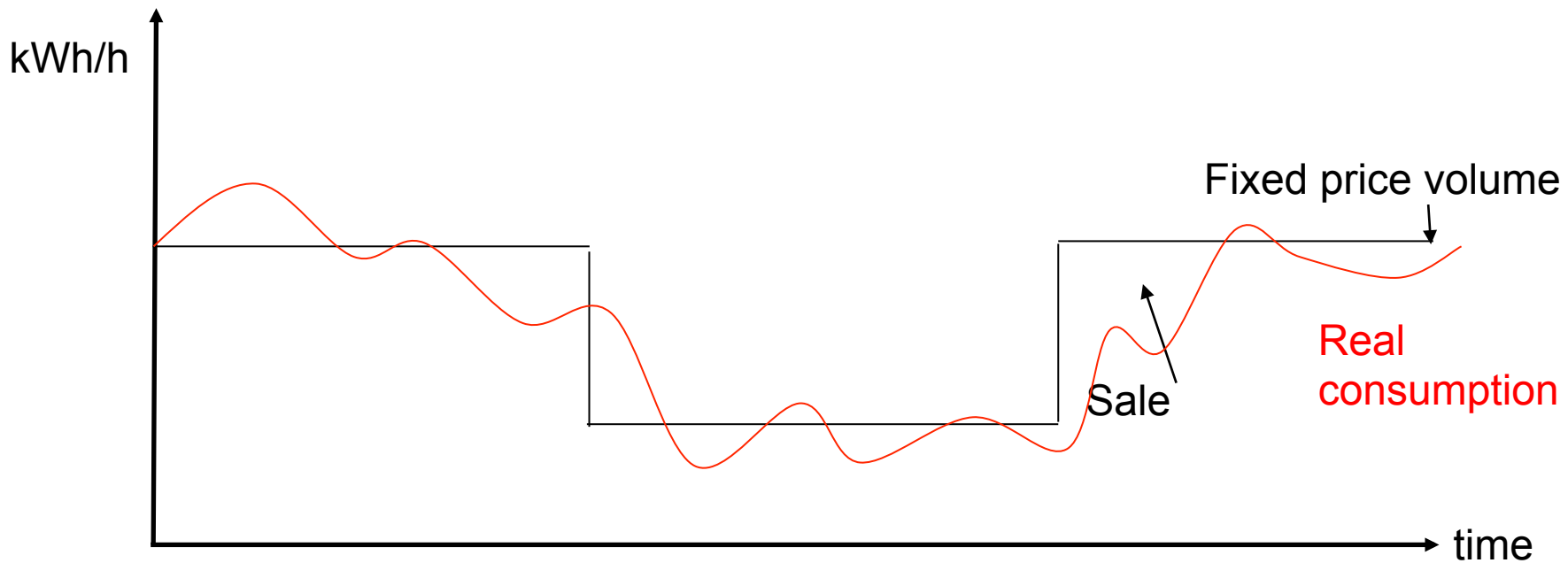


Pilot II

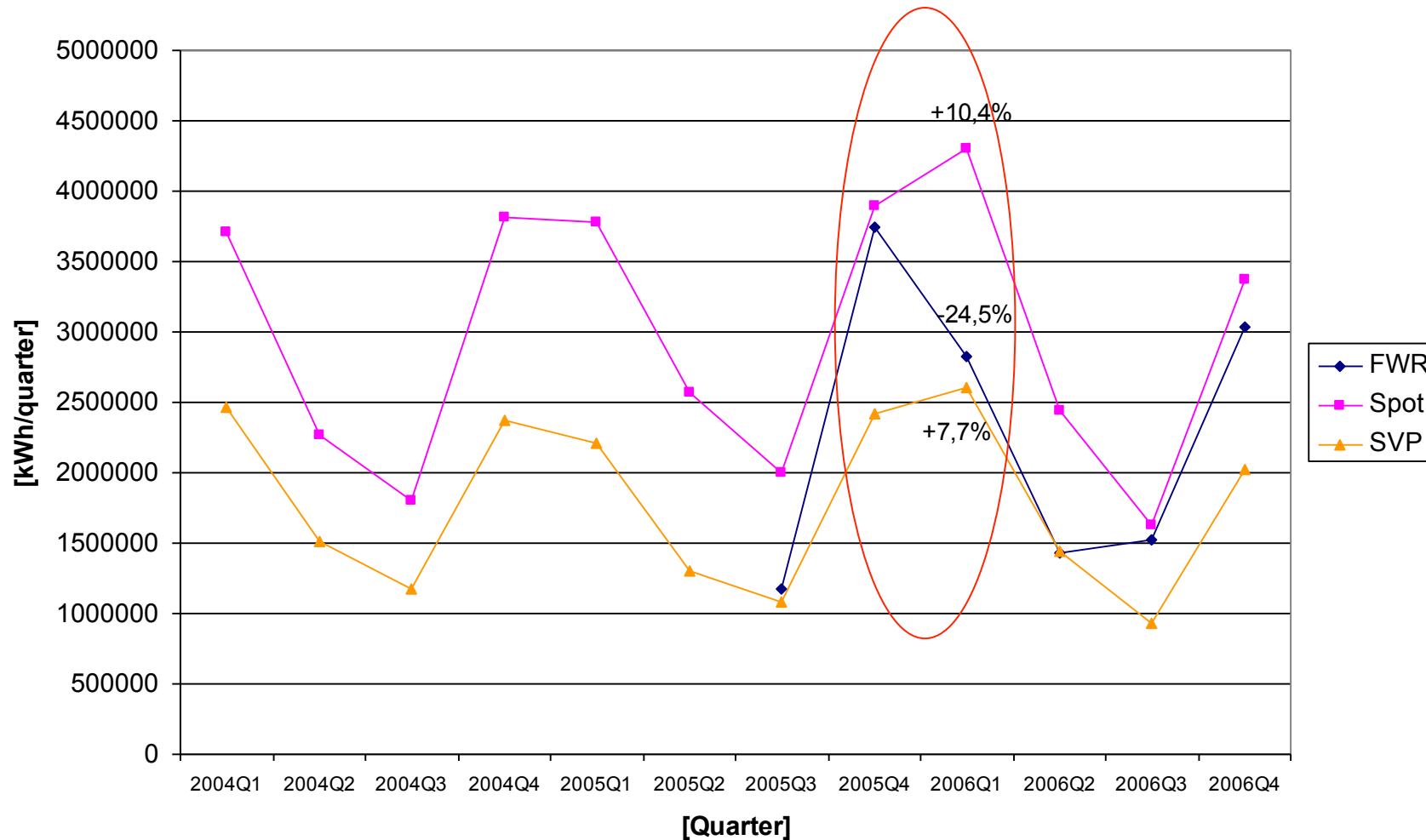
Fixed price with return option (FWR)

- Fixed Volume - financial contract combined with spot price settlement
 - Objective /characteristics
 - Give incentives to load reduction in periods with shortage
 - Retaining the advantages of fixed price contracts with regard to predictable costs
 - Reduce the risk for the supplier.
- 2500 household customers





Demand response from FWR customers compared to alternative contracts

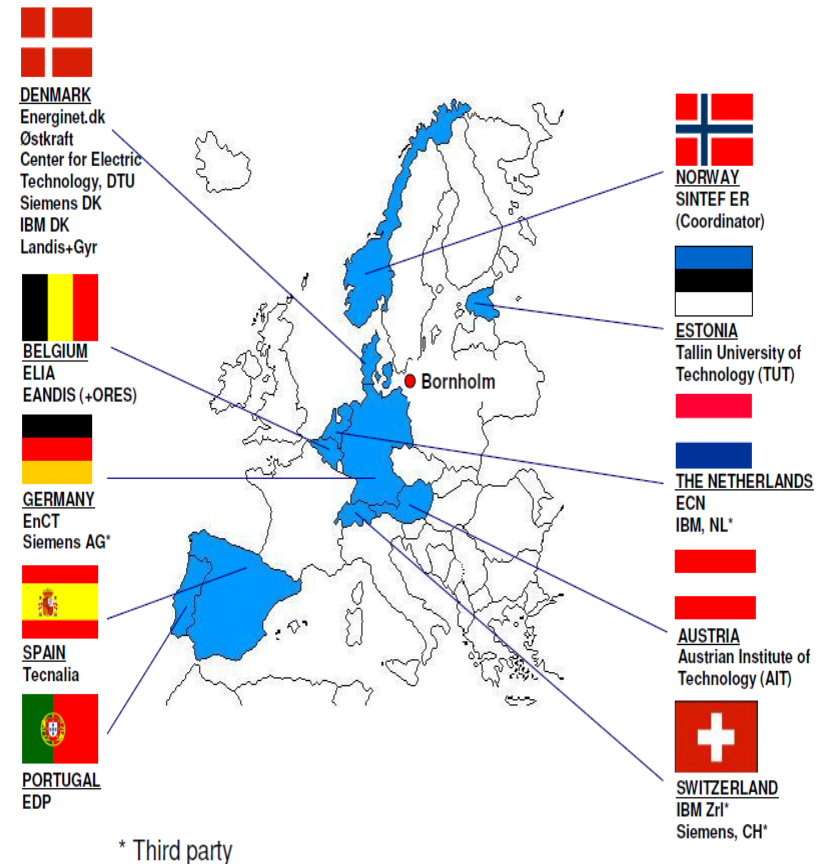


EcoGrid EU (FP7 Energy – 2010-2)

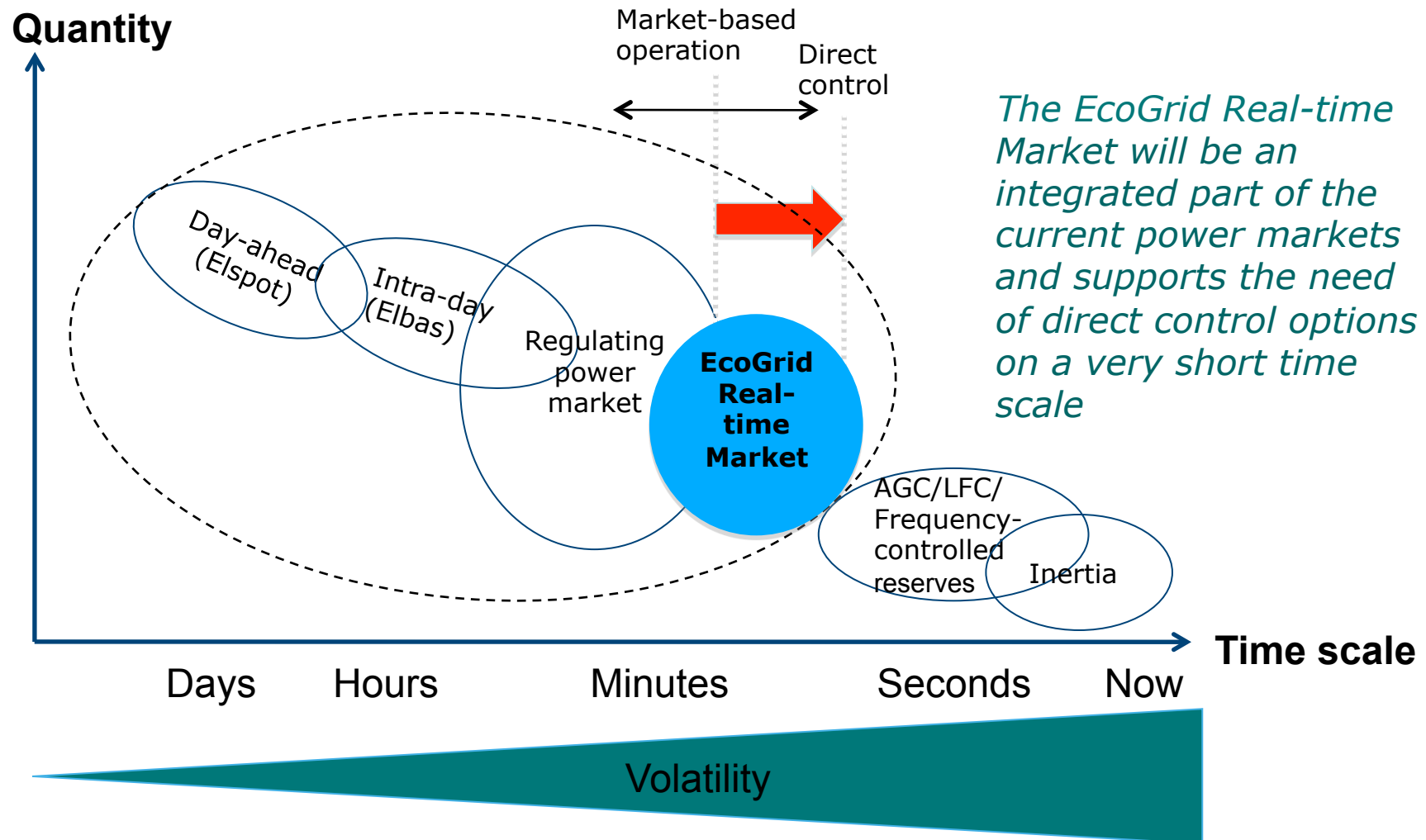
2011-15, 20, 6 M€

- Main objectives:
 - To demonstrate operation of a power system with more than 50 % renewable sources
 - To implement ICT systems and innovative market solutions - offering TSOs additional and more efficient balancing services
 - To enhance small consumer and local producers to participate in the power market through real-time operation, energy storage and savings

EcoGrid EU Partners



The Scope of a Real-time Market



EcoGrid EU market concept

Test period autumn 2012 – spring 2014

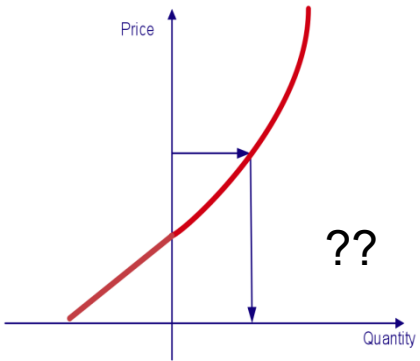
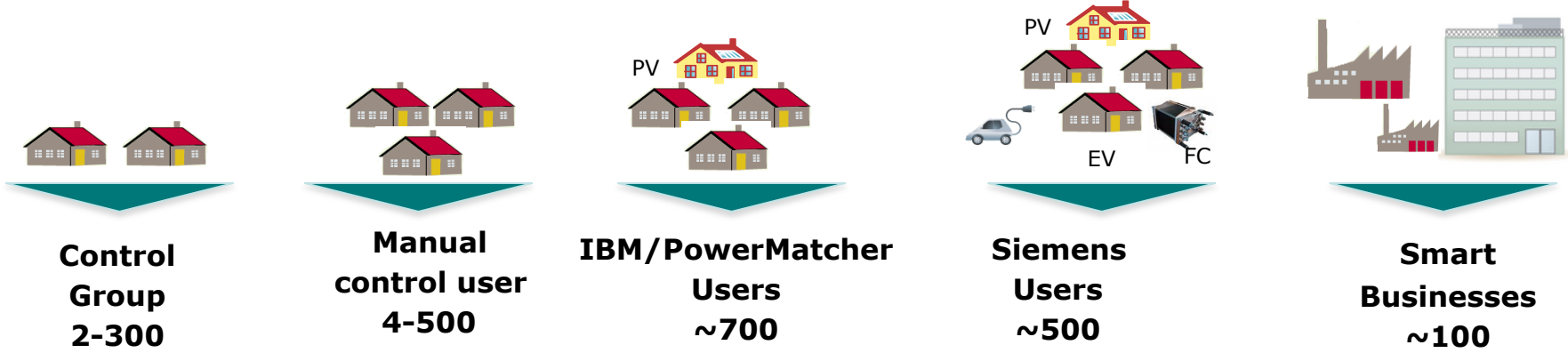
Test site: Bornholm
Operated by the Danish DSO
Østkraft

Demonstration in a real
system with > 50 % RES

Part of the Nordic energy
market

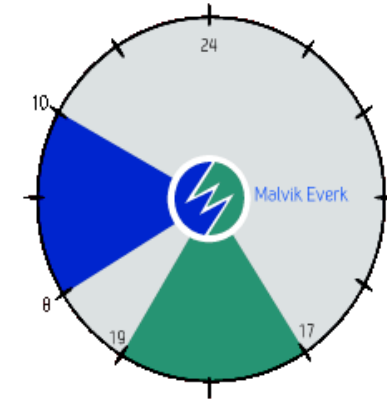


EcoGrid EU Planned test groups



Summing up

- ❖ Demand response can effectively be integrated into the power market.
- ❖ Full AMR-rollout will empower also the smaller customers to profit from adaptation to different market situation.
- ❖ Demand response have significant value – relative small decline in demand can contribute to substantial reductions in price in shortage situations.
- ❖ Temporary reduction in domestic space heating and load shifting of water heaters are the most convenient demand response objects in Norway, and the accumulated potential is large.
- ❖ Demand response closer to operation necessary to cope with future challenges related to high share of intermittent production as demonstrated the EcoGrid EU project on Bornholm (Denmark).
- ❖ PARADOX: Success with Demand Response will reduce the price differences and thereby the potential payback for necessary investments .
- **Additional incentive mechanisms, e.g. ToD tariffs, needs to be considered in order to achieve wanted socio-economic benefits!**



Thank you for your attention!

