

# Market based demand Response

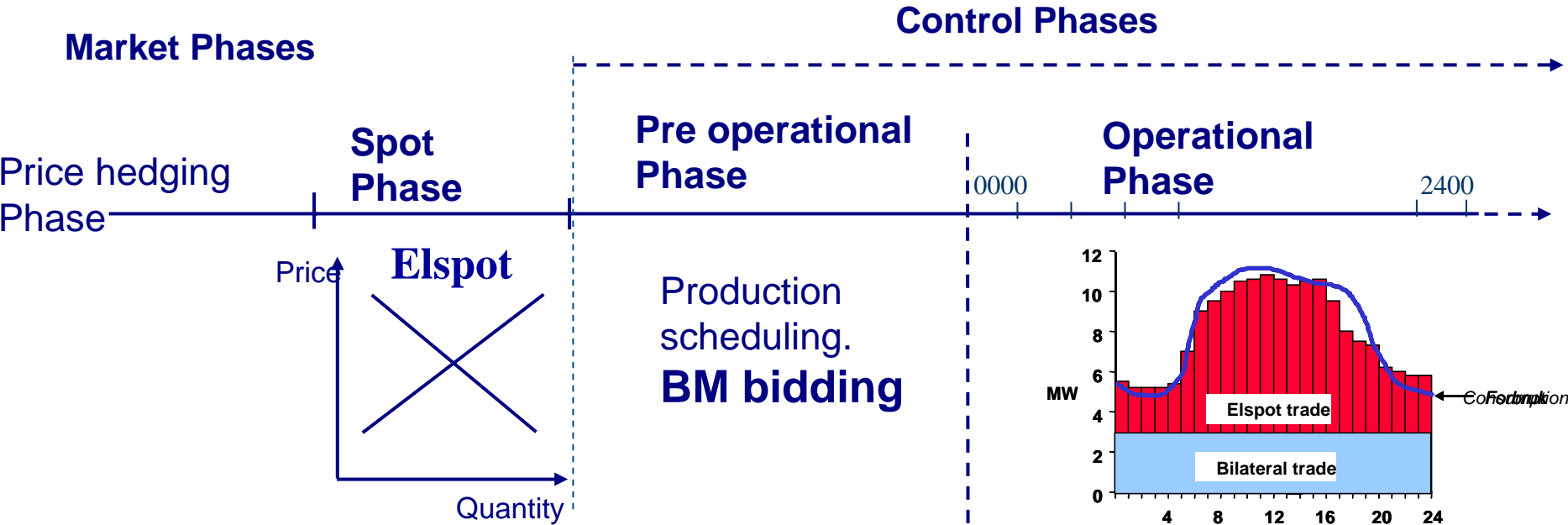
**DRR-seminar  
Gardermoen 25 April 05**

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# Market based DR - Main aspects

- Manual or automatic reduction of consumption on hourly basis in high price periods in the day ahead market or for balancing purposes
- Duration: One to a few hours
- Expected response should be reflected in the bids in the market (Elspot, Balancing Market (BM)) to avoid extraordinary costs for the market players.

# Market based Demand Response



Option Market

Price-dependant load reduction

Remote controlled load reduction



# Vision

To improve **Demand Side price elasticity** and to create **“Regulation objects”** from consumption as alternatives to investments in new production

Requirements:

- Price flexibility on hourly basis
- Controllability

■ Hourly metering

■ Remote and/or local load control



**Two Way  
Communication  
(TWC)**

■ Improvement in data management procedures

**MVDB/CIS**

■ Improvement in End User markets

**Market Design**



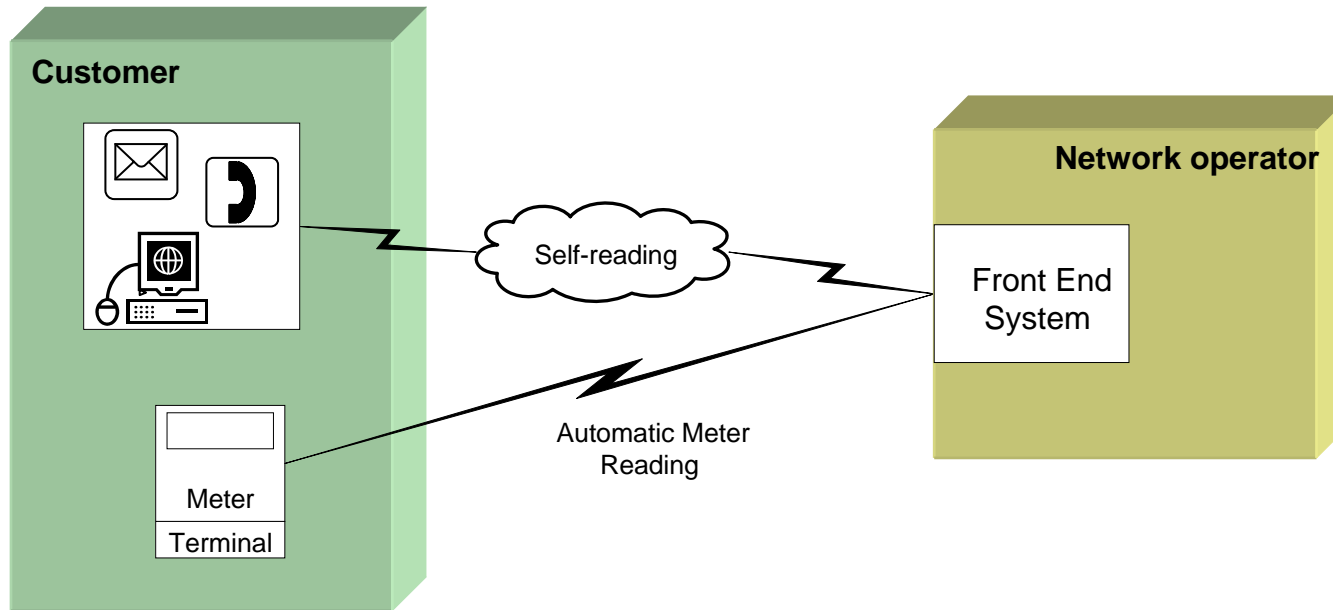
# Status hourly metering Norway

- Presently hourly metering is available from all consumers with yearly consumption **> 100 000 kWh**

**80 000 customers  
~60-70 % of the load**

- Residential customers >8000 kWh/year ???

# Alternative time resolution metering, collection and settlement/billing



| Time resolution                     | Hour | 4 times/day | Day | Week | Month | Quarter | Year |
|-------------------------------------|------|-------------|-----|------|-------|---------|------|
| Metering                            | X    | X           | X   | X    | X     | X       | X    |
| Collection<br>(Self reading or AMR) |      |             | X   | X    | X     | X       | X    |
| Settlement/billing                  |      |             |     |      | X     | X       | X    |

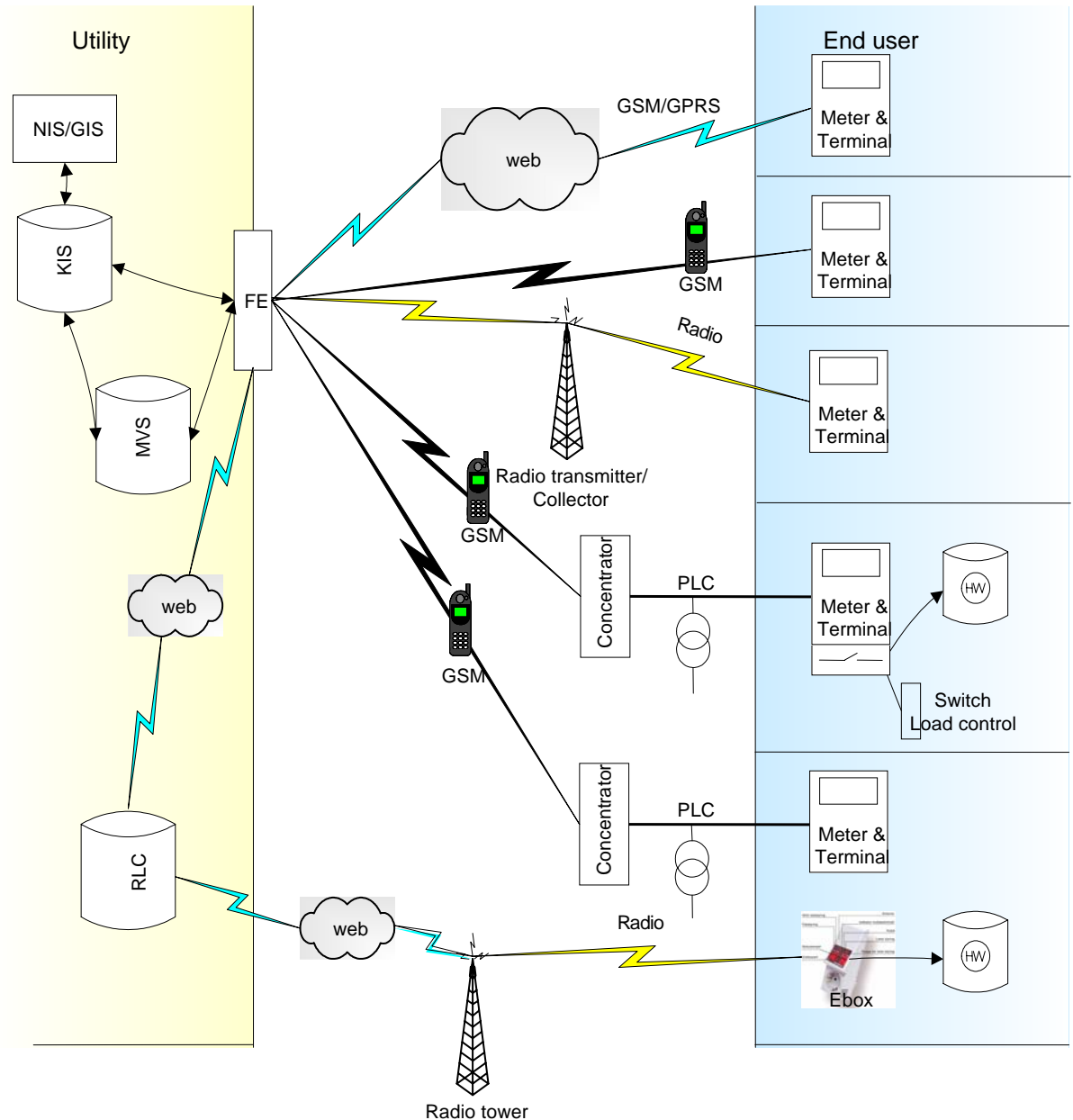
# Large scale test project

Two way communication to 10 894 residential customers

AMR- Hourly metering

RLC- available for 50 % of the customers

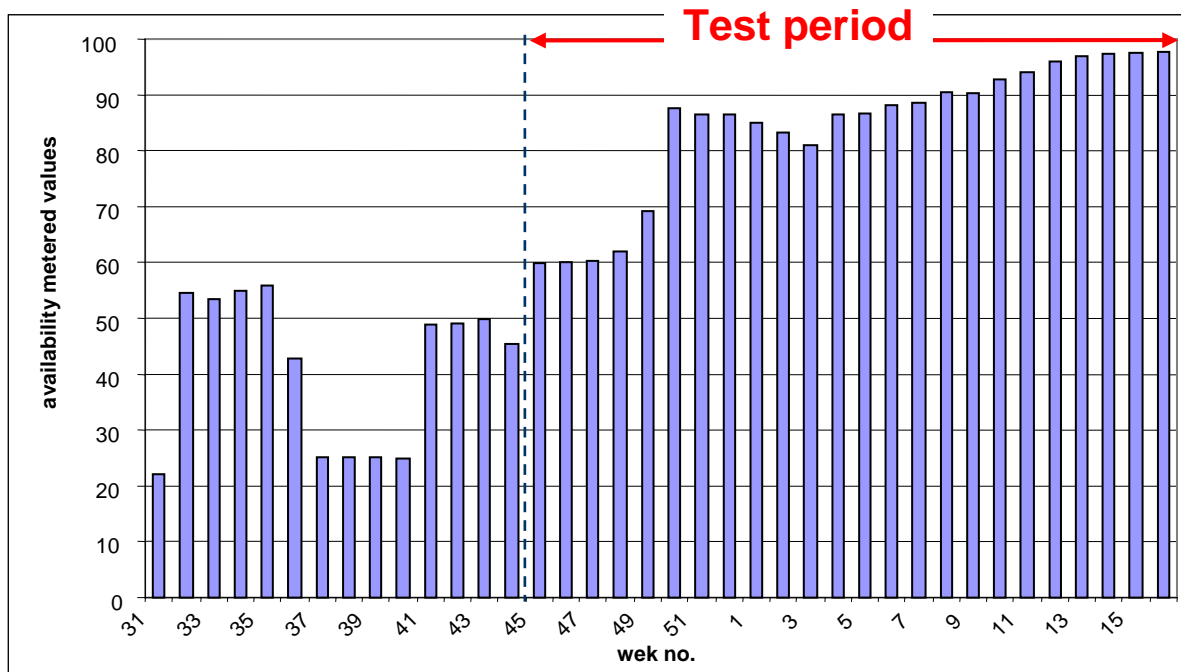
6 technology vendors involved





# Main challenges Technology

- Data quality (referred to market settlement requirements)
- Standardization of interfaces



Quality test

# Customer incentives for reducing consumption

## ■ Network tariffs

- ToU Energy Tariff (= Fixed part + Network losses + Variable Energy part)
- Energy part only activated in peak hours

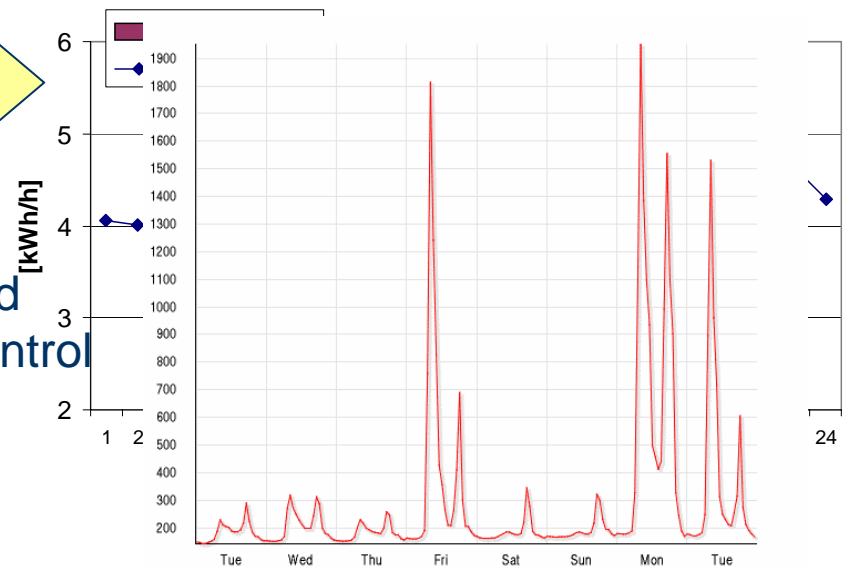
Peak load hours

## ■ Supplier products

- Spot price on hourly basis
- Spot price on hourly basis combined with agreements for remote load control

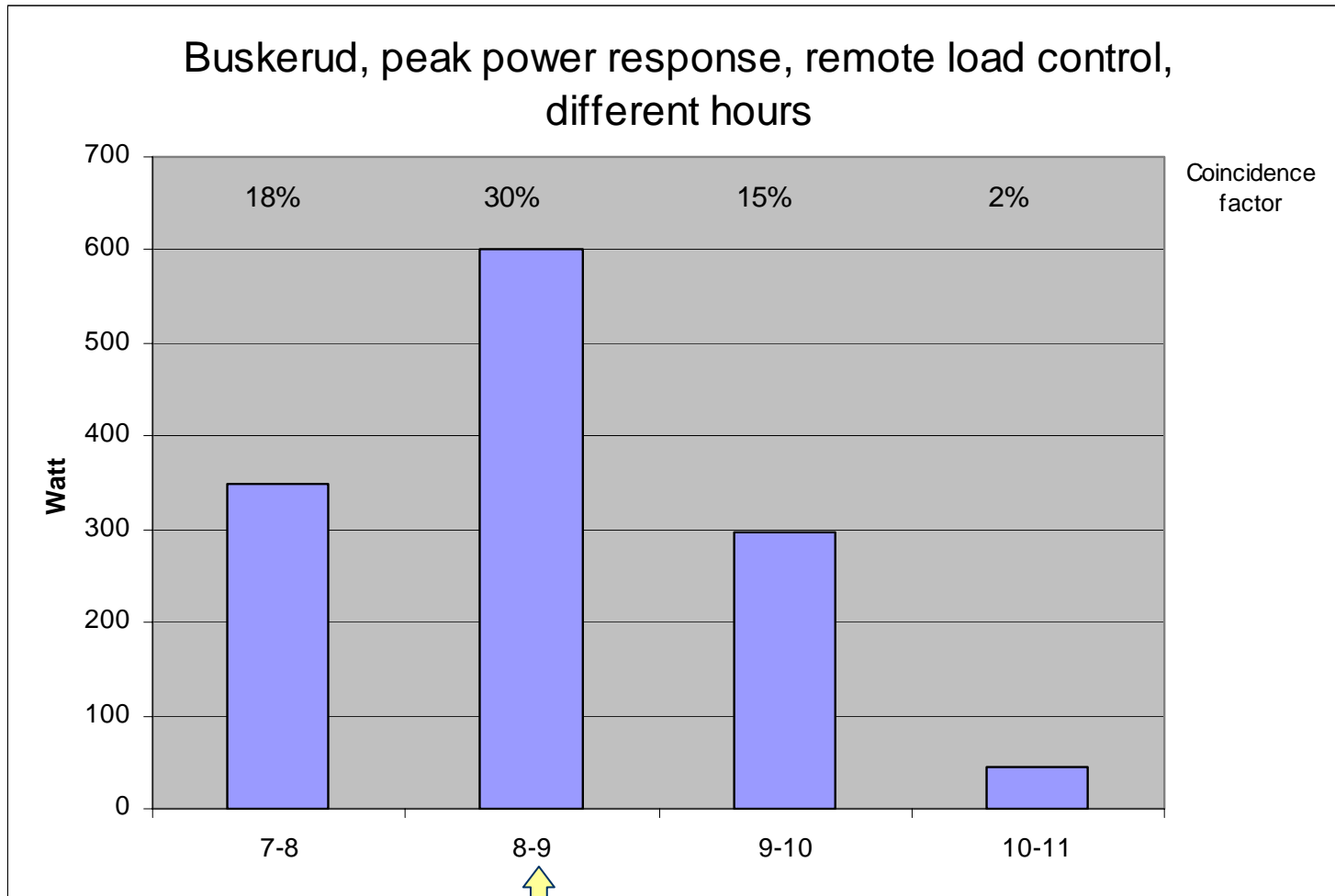
## ■ Criteria for load control

- Spot price criterion
- Reserves criterion



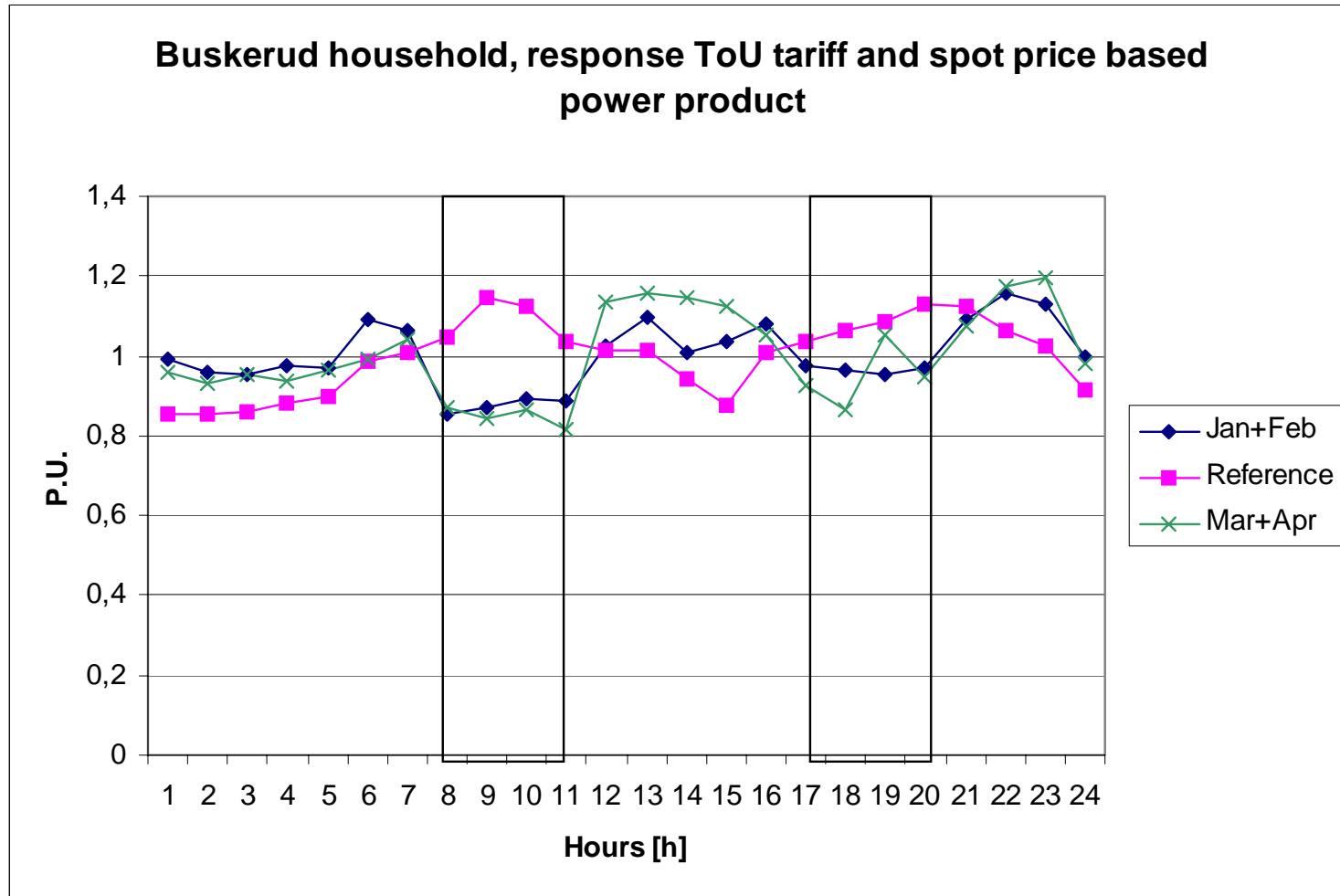
# Test result

## RLC water heaters at different hours

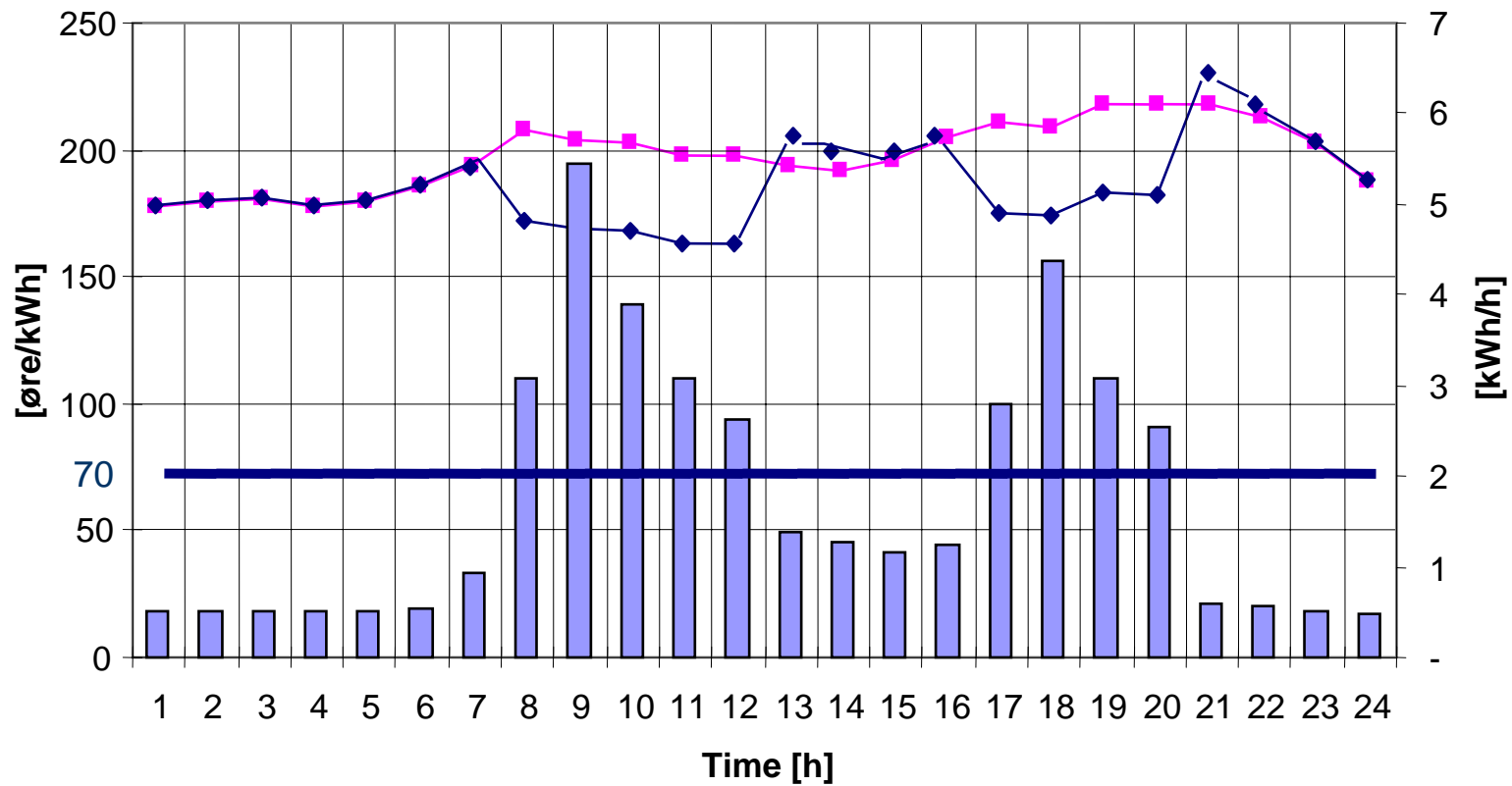


Nordic peak hour

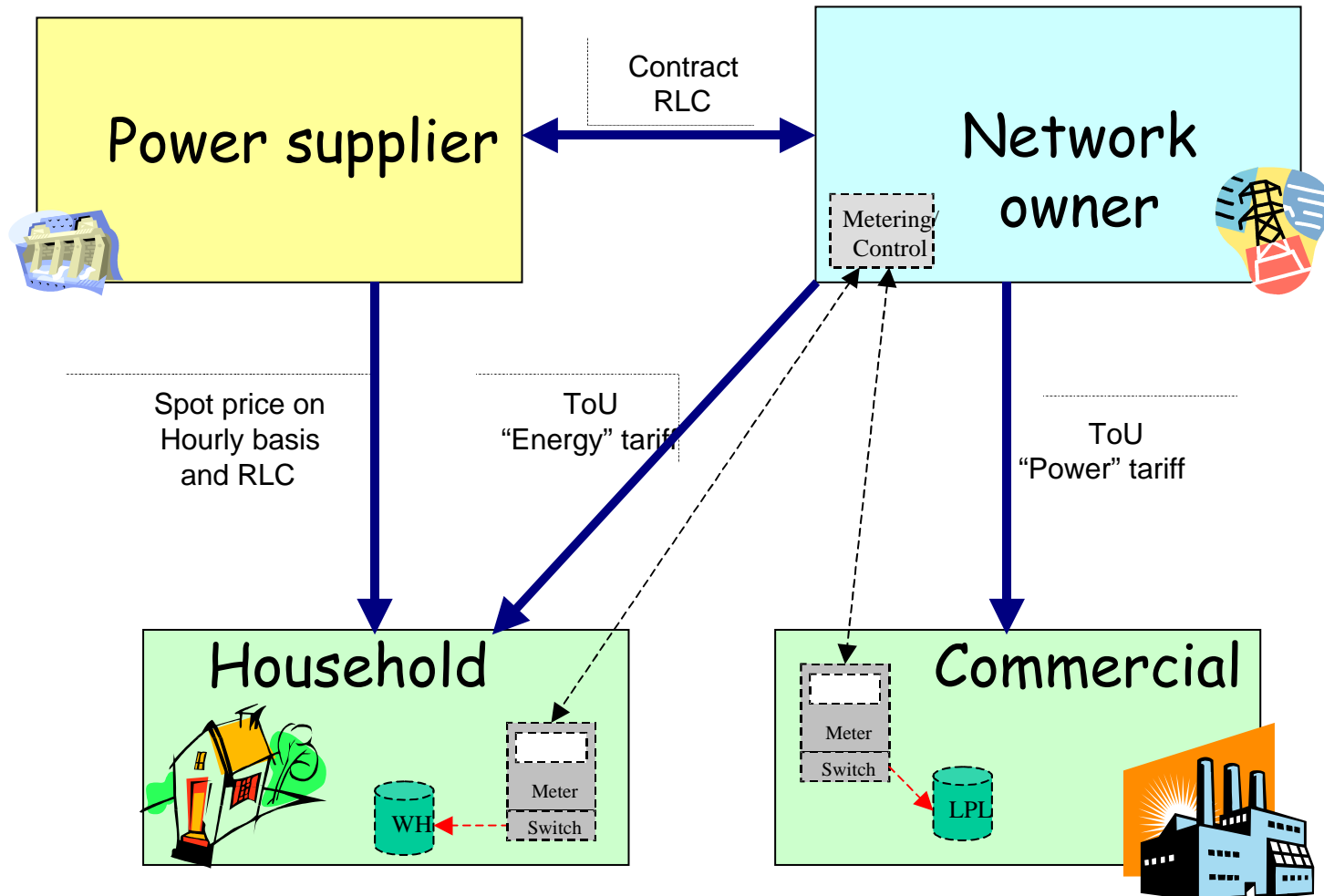
# Customer response to price signals



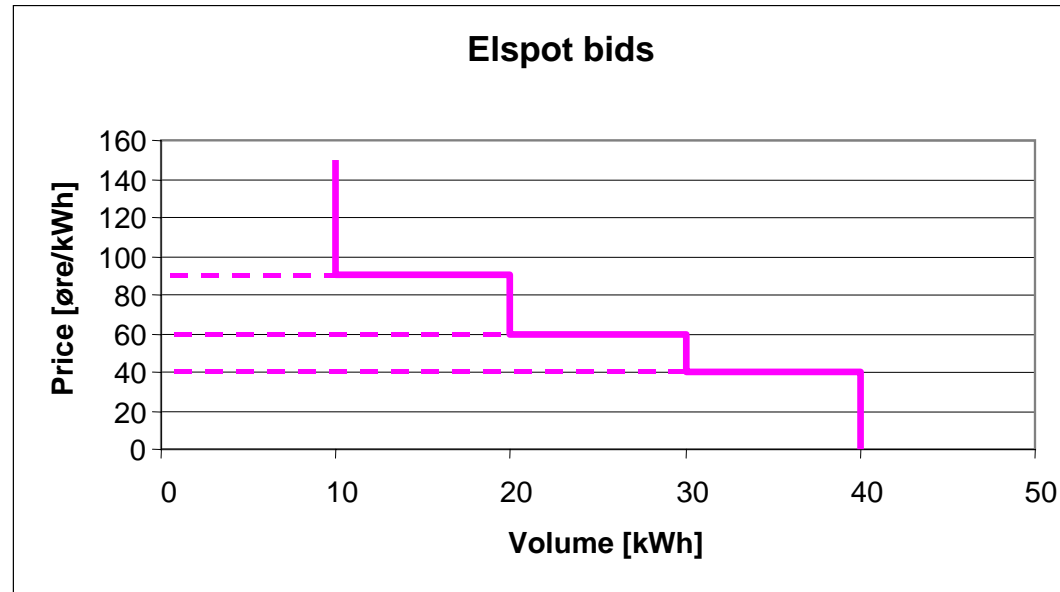
# Response on spot price



# Price signals and contracted RLC

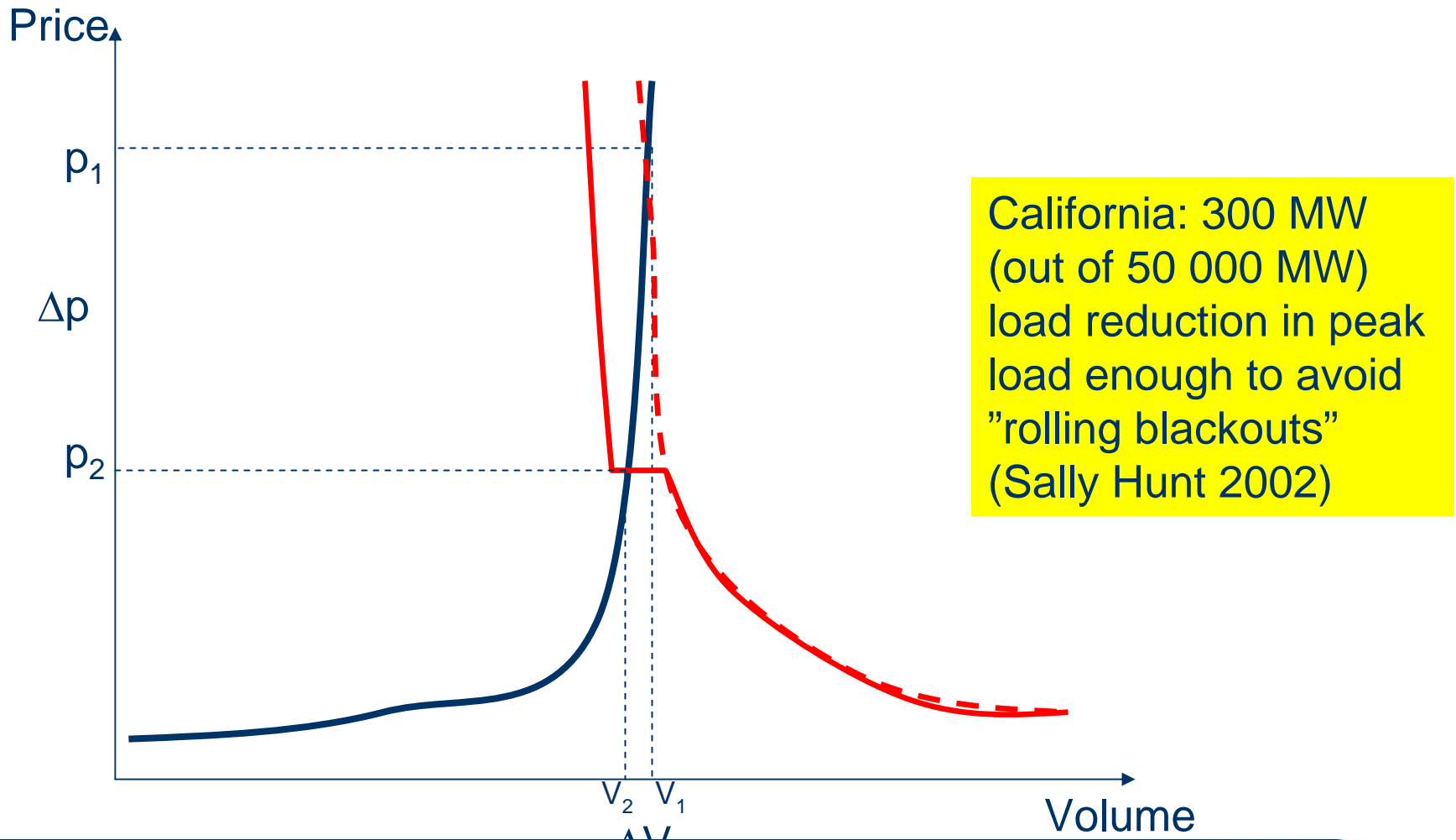


# Flexible bidding Elspot



| Hour \ Price | 0  | 40 | 40,1 | 60 | 60,1 | 90 | 90,1 |
|--------------|----|----|------|----|------|----|------|
| 1            |    |    |      |    |      |    |      |
| 2            |    |    |      |    |      |    |      |
| 3            | 40 | 40 | 30   | 30 | 10   | 10 | 10   |
| 4            |    |    |      |    |      |    |      |
| Etc,         |    |    |      |    |      |    |      |

# Value of demand side price elasticity





- Registered reduction in consumption as response to price signals was 0,2 – 1,0 kWh/h
- 0,5 kWh/h response from remote load control of electrical water heaters

**50 % participation of Norwegian household customers:**

**→ 600 MW potential load reduction in peak hour**

# Automatic load reduction (“Spot price criterion”) Evaluation (preliminary)

- **Spot price is the cheapest product in the long run. (Financial contract as backup recommendable.)**
- **Automatic load reduction when price is high valuable for those who does not want to watch the spot price.**
- **Load reduction in peak hours gives significant system benefit**
- **Drawback: Only payback to the customer when price difference during daytime is high. So far only a limited number of hours/year**

⇒ Interday ToU network tariff necessary to provide sufficient economical incentives ?

# Market based demand response (DRR Norway demonstrators 05-06)

- Demo I: Automatic load reduction when spot price exceeds predefined level
- Demo II; Remote reduction of aggregated load when called upon as "regulation object" in the balancing market
- Main aspects:
  - Challenge: Development of cost effective concepts for remote load control, market participation and accounting of multiple loads
  - Development based on recent research and test activities
  - Cooperation between two technology vendors (Elink and Powel)