Hourly metering and remote load control: technology and incentives for demand response in a large scale test project

– Preliminary results and experiences

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Outline

- Background
- Project "End user flexibility by efficient use of ICT"
- Description of technology
- Experiences technology
- Tariffs and power products
- Peak power response
- Cost/benefit
- Recommendations
Background

- In the Nordic countries:
  - Lack of peak power capacity
  - Large customers (consumption above 100,000 kWh per year) are hourly metered

- Sweden requires monthly metering of all customers from middle of 2009

- Norway:
  - Large political focus on end user flexibility
  - End user flexibility at smaller customers?
Metering and remote load control. Actors involved and interfaces between them

Transmission System Operator

Power Supplier

Network Operator

Customer

Settlement data

Standard interface

EDIEL/EDIFACT

Non-standardised interface

Meter data

Load control
In principle description of two way communication

- **Customer level**
  - Meter
  - Terminal

- **Communication level**
  - Front end
  - Concentrator

- **Central level**
  - Meter Value Server
  - CIS
End user flexibility by efficient use of ICT

- EBL-K (Norwegian Electricity Industry Association) project
- Project period: 2001-2004
- Two-way communication is established to 10 894 customers at 2 network operators: Buskerud Kraftnett and Skagerak Nett
- Main goal: Increase consumer flexibility in shortage periods for energy and power by:
  - Establishing a decision basis and propose framework for a prioritized development of infrastructure based on the futures`ICT solutions
  - Develop, test and evaluate solutions that stimulates consumption flexibility

http://www.energy.sintef.no/prosjekt/Forbrukerflex/engelsk/uk_index.asp
# Metering and load control

## Metering of electricity consumption

<table>
<thead>
<tr>
<th></th>
<th>Hourly metering</th>
<th>Daily metering</th>
<th>Load control</th>
<th>Energy consumption [kWh/year]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Households</strong></td>
<td>9045</td>
<td>1440</td>
<td>49%</td>
<td>8.000-40.000</td>
</tr>
<tr>
<td><strong>Industrial</strong></td>
<td>407</td>
<td>3</td>
<td>23%</td>
<td>40.000-100.000</td>
</tr>
</tbody>
</table>

Load control mainly of water heaters
Overview communication technology

Customer level

Communication level

Central level

5 different vendors are tested
Overview load management technology

6 different vendors are tested
Experiences two way communication technology

- More problems with technology than expected
  - Immature technology
  - Problems with integration between two way communication system and other IT-systems
  - Vendors without experiences with large scale establishment
  - Utilities without experiences with this type of projects

- Considerably improvement in technology during project period
  - Communication percent up to 97% - at least 3.5% of meter values are incorrect

- Subjects for further improvement identified
Quality of hourly metering Buskerud Kraftnett

Quality Buskerud per March 04

Percent 24 hour data

Week number
“Price signals” used in the project

- Network tariff (NO)
  - Time of use tariff with high price in periods with shortage
    (Shortage defined by time: Mon-Fri, hour 7-11 and 16-19, November - March)

- Energy price (Supplier)
  - Spot price products
  - Spot price products with agreement of remote load control

- Remote load control based on spot price
  - Buskerud: Hour with highest spot price + hour before or after
  - Skagerak: Every hour with spot price above a predefined limit
Buskerud Kraftnett – Network operator

Power supplier

Power contract with spot price on an hourly basis, with an agreement of load control

Network operator

Agreement for load control

Time of use

Power tariff

Household

Time of use

Energy tariff

Industrial

Time of use

Power tariff

Network operator

Metering/Load control
Preliminary test result (1:2)

Comparison of electricity consumption
Week 10 and 11 - 2004

Load disconnection
hour 9-10 and
hour 19-20.

1228 customers

Average reduction
450 W
Preliminary test result (2:2)

Buskerud, Spot price and Time-of-use energy tariff
(ref.: week 42, 03, active: week 4, 04)

Max reduction morning 32%
Max reduction afternoon: 21%
## Cost/benefit

### Table

<table>
<thead>
<tr>
<th></th>
<th>SKN</th>
<th>BKN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of points</strong></td>
<td>4000</td>
<td>4100</td>
</tr>
<tr>
<td><strong>Investment [Euro/point]</strong></td>
<td>407</td>
<td>358</td>
</tr>
<tr>
<td><strong>Investment costs [Euro/pnt,y]</strong></td>
<td>-59</td>
<td>-52</td>
</tr>
<tr>
<td><strong>Operational costs [Euro/pnt,y]</strong></td>
<td>-52</td>
<td>-24</td>
</tr>
<tr>
<td><strong>Cost reductions [Euro/pnt, y]</strong></td>
<td>35</td>
<td>12</td>
</tr>
<tr>
<td><strong>Net benefit [Eur/point,year]</strong></td>
<td><strong>-76</strong></td>
<td><strong>-64</strong></td>
</tr>
</tbody>
</table>

1 Euro = 8.4 NOK  
Interest 7.5 %  
Depreciation period 10 years

Investment costs are including costs for establishment of load management

Costs reduction: more effective solutions for collection of meter values, reduction in current leakage, reduction in need for strengthening of the network etc
Recommendation/conclusion

- Work for standardization between systems for two-way communication and other IT-systems.
- Work for standardization of interfaces for information exchange in two-way communication systems.
- Contribute to improved cost/benefit for two-way communication.
- Contribute to a situation where utilities share information and experiences with each other (especially in countries with several utilities).
- Evaluate experiences with load management.