IEA DSM Task 17
Follow Up Activities

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Follow Up Activities

- Evaluation, Measurement and Verification (EM&V) of DR:
  - associated difficulties on how to measure the effects of a DR services

- Forecast and Reliability –
  - associated power system reliability issues and DR.

- (Cost Benefit Analysis for DR)
  - CBA focus on DR services and products
Evaluation, Measurement and Verification (EM&V) of DR
EM&V is a key requirement for establishing successful DR programs.

The following topics need to be covered with respect to this problem:

- **Quantification** of expected gains
- Identification of customer’s **baseline** demand/usage
- How are **energy consumption reductions** measured – no common standards exists.
- **Different evaluation criteria** between TSO, BRP and retailer may exist
- **Level of M&V**: aggregator vs. household (pre-qualification requirements)
- Lack of EM&V is seen as a **market barrier** for consumer centered DR services
One of the main objectives of EM&V is to quantify the provision of a service according to the product specification:

- Qualify potential resources as an entry gate to participation
- Verify resource conformance during and after participation
- Determine amount of product delivered as part of financial settlement
Evaluation, Measurement and Validation

From the above mentioned issues the following EM&V requirements can be derived in order to qualify and deploy DR services and products:

• Methodology of baseline metering (i.e. metering configuration)
• Measurement / Metering of DR product delivery
• Communication requirements i.e. availability, control signal response, security (CIA)
• Exchanging the metered information, including format and protocol
• Measurement interval, reading frequency / sampling and accuracy
• SLAs of the DR product
Forecast and Reliability – DR Modelling
Forecast and Reliability – DR Modelling

- Power System Operation an important part is the **day ahead forecast**

- Impact on many **planning processes** from dispatch, scheduling and optimization of generator to markets

- **Accuracy** has a strong impact on operational issues
Forecast and Reliability – DR Modelling

Research questions

• Accurate DR forecasting and modeling of DR behavior for integration into power system operation

• Understanding the external parameter dependencies;

• Reasons for variations and deviations of estimated DR behavior

• System interaction and critical parameters
  • e.g., penetration levels, communication latency, price variations, DR signal intervals or durations, temperature, rare events

• Reliability of forecasts and impact assessment in case of different behavior failure of DR service

• Mitigation and control of problems due to DR failures
Forecast and Reliability – DR Modelling

Modelling

- requirements on buildings
- building type
- other information on building properties

simple physically based dynamic models

modelled response to load control
(e.g. pulse response)

modelled response to outdoor temperature
(e.g. step response)

Measurements and models of electricity demand responses
(Pekka Koponen, VTT, 2012)
Evaluation, Measurement and Validation

Example of determine the DR response validation in the EcoGridEU project
Evaluation, Measurement and Validation

Example of determine the DR response validation in the EcoGridEU project

2000 Participating Customers in the Demonstration

- **Manual Control**
  - 200 households with smart meters
  - No access to specific information
  - Must move their energy consumption on their own

- **Automatic Control**
  - 500 households with smart meters
  - Receiving simple market price information
  - All houses have heat pumps or electric heating – responding autonomously to price signals

- **Aggregated automatic Control**
  - 700 automated households with Siemens equipment and smart meters
  - All houses have heat pumps or electric heating – responding autonomously to price signals

- **Smart Businesses**
  - 500 automated households with IBM-Green Wave Reality equipment and smart meters
  - Up to 100 costumers with smart meters
  - Including small business and public customers
  - Connected smart appliances – responding to control signals
Evaluation, Measurement and Validation

Example of determine the DR response validation in the EcoGridEU project

• Experimental groups not comparable to the control group due to differences in group composition in terms of
  • Heating systems (type, wood stoves)
  • Usage (Holiday houses)

• Market model is mostly nonlinear
  • Models systems response, but not statistically treatable

• Therefore a purely linear model was used
Example of determine the DR response validation in the EcoGridEU project

- Sample reaction
- Although linear, not always the same reaction to the same price due to influence from the past
Evaluation, Measurement and Validation

Example of determine the DR response validation in the **EcoGridEU** project

- Differentiated model
  - changes in consumption, not consumption for statistical reasons

- Influence from future and past
  - Day ahead because of the agent listening to forecast
  - RTP up to a certain time back
  - Weather up to a certain time back

- Sample output

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Evaluation, Measurement and Validation

Example of determine the DR response validation in the EcoGridEU project

Manual customers (blue reference, red manual group)

• Very high prices
Evaluation, Measurement and Validation

Example of determine the DR response validation in the EcoGridEU project

Manual customers (blue reference, red manual group)

- Very low prices
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