

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

Evaluation, Measurement and Validation

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

Evaluation, Measurement and Validation

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

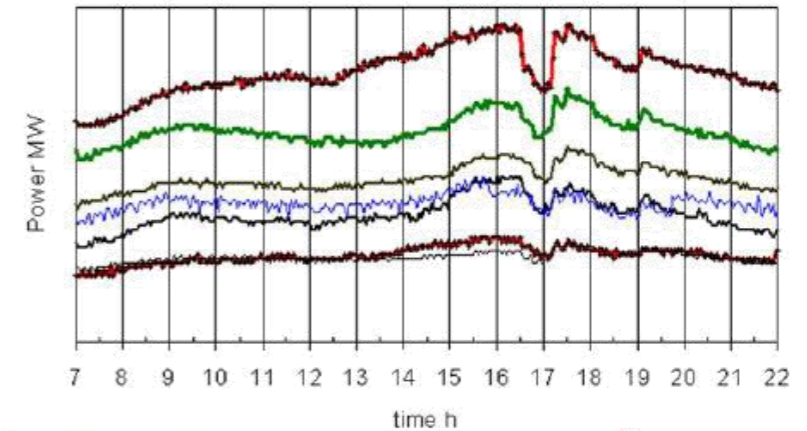
- Accurate DR forecasting and modeling of DR behavior for **integration** into power system operation
- Understanding the **external parameter** dependencies;
- Reasons for **variations and deviations** of estimated DR behavior
- **System interaction** and critical parameters
 - e.g., penetration levels, 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

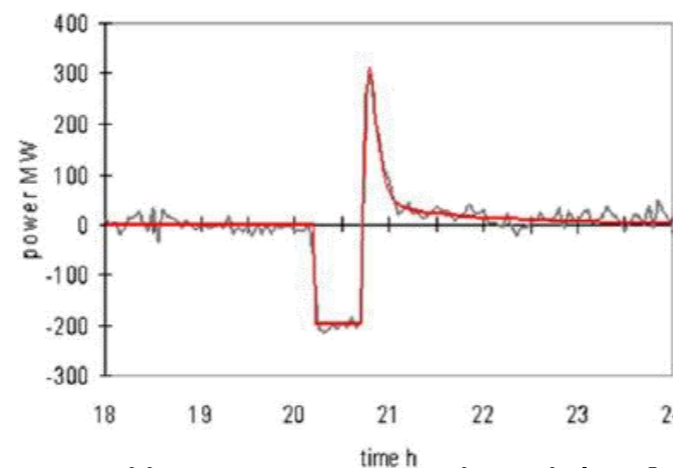
requirements on buildings
building type
other information on building properties

measurements from smart meters
and/or substations

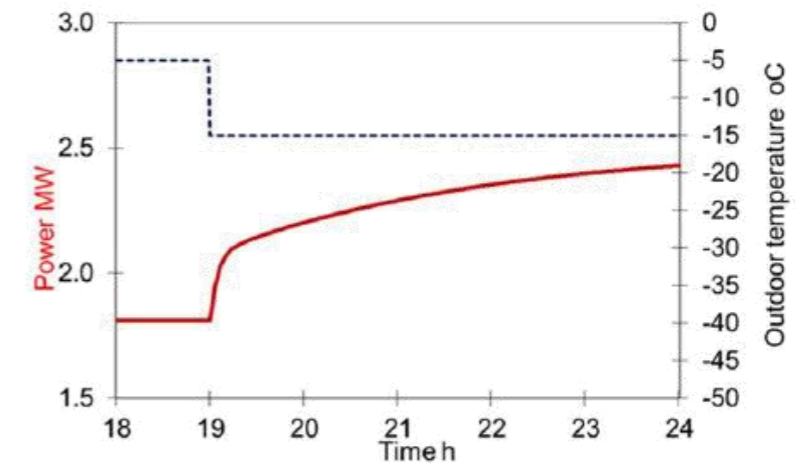


simple physically based dynamic models

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








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



Evaluation, Measurement and Validation

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

2000 Participating Customers in the Demonstration

				
	Manual Control	Automatic Control	Aggregated automatic Control	Smart Businesses
200 households with smart meters	500 households with smart meters	700 automated households with IBM-Green Wave	500 automated households with Siemens equipment and smart meters	Up to 100 costumers with smart meters
No access to specific information	Receiving simple market price information	Reality equipment and smart meters	All houses have heat pumps or electric heating	Including small business and public customers
	Must move their energy consumption on their own	All houses have heat pumps or electric heating – responding autonomously to price signals	– responding to control signals	Connected smart appliances – responding to control signals

Evaluation, Measurement and Validation

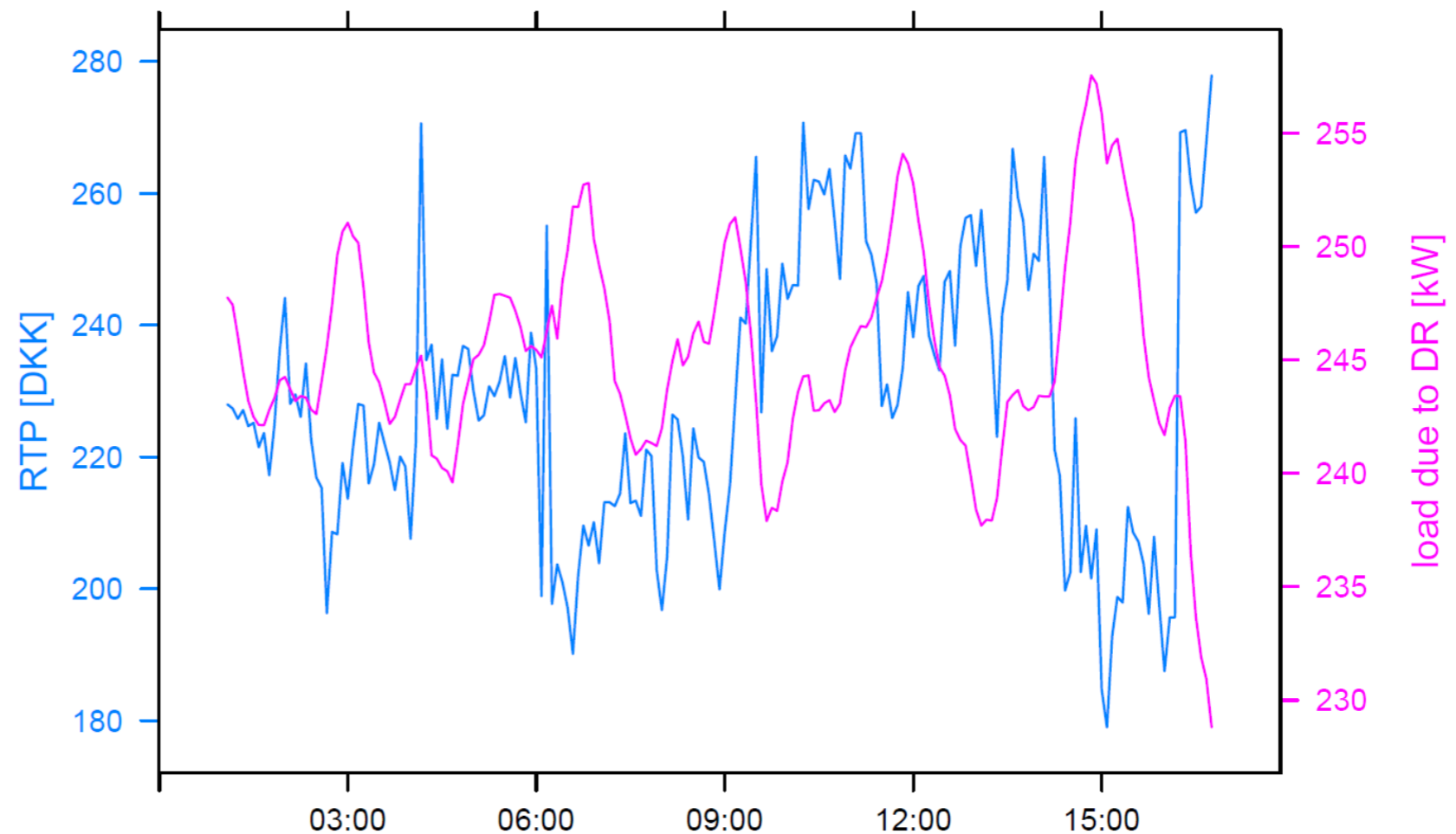
Example of determine the DR response validation in the **EcoGridEU** project

- 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

Evaluation, Measurement and Validation

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

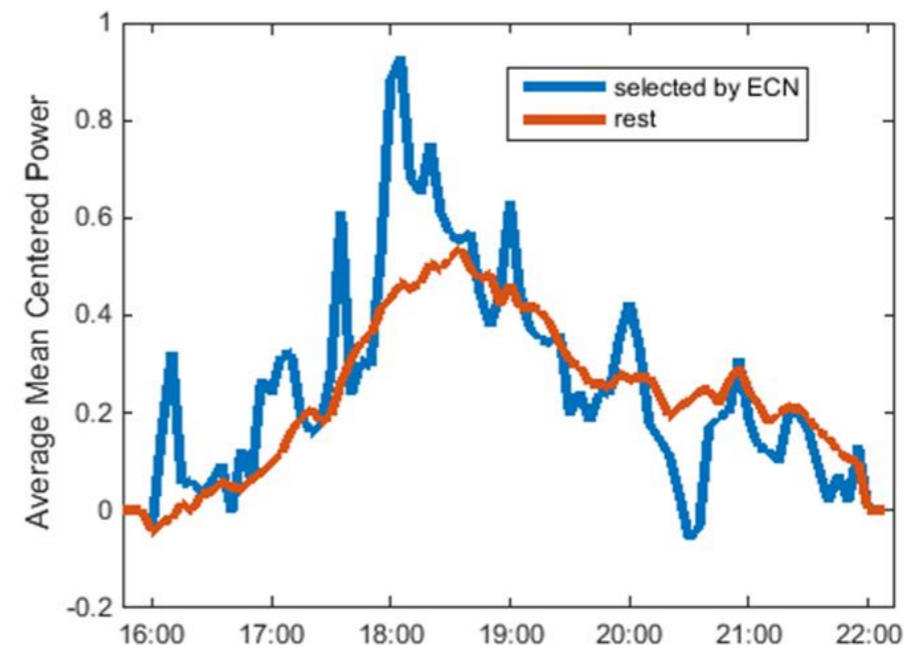
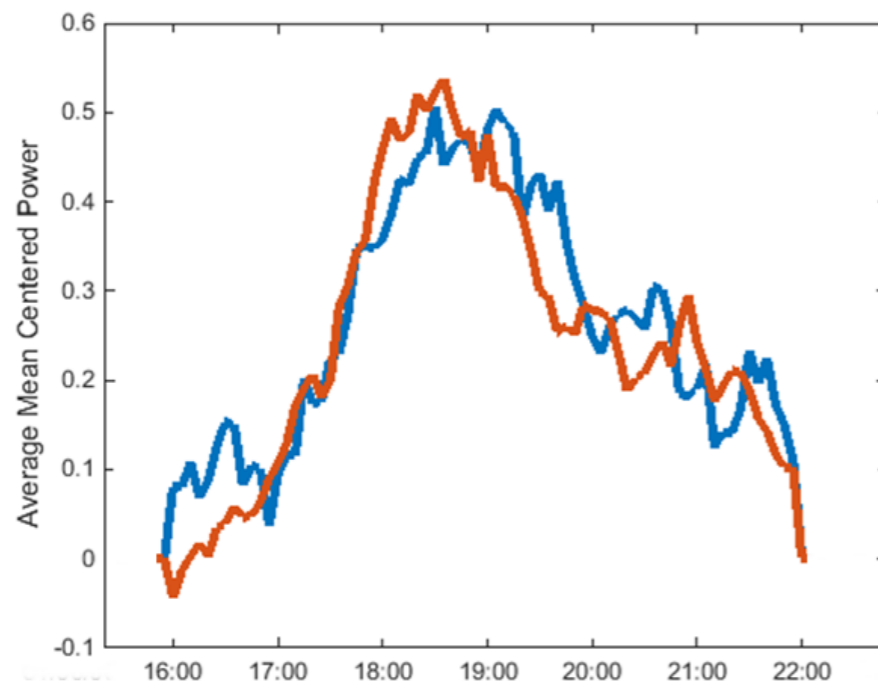
	reference	manual	IBM dir.el	IBM HP	Siemens d.e+ HP
rt_lag1	-0.001 (0.003)	0.002 (0.003)	-0.032*** (0.004)	-0.054*** (0.004)	-0.175*** (0.005)
rt_lag2	0.003 (0.004)	-0.001 (0.004)	-0.083*** (0.005)	-0.074*** (0.005)	-0.183*** (0.006)
rt_lag3	0.004 (0.004)	-0.004 (0.004)	-0.056*** (0.006)	-0.030*** (0.005)	0.082*** (0.006)

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

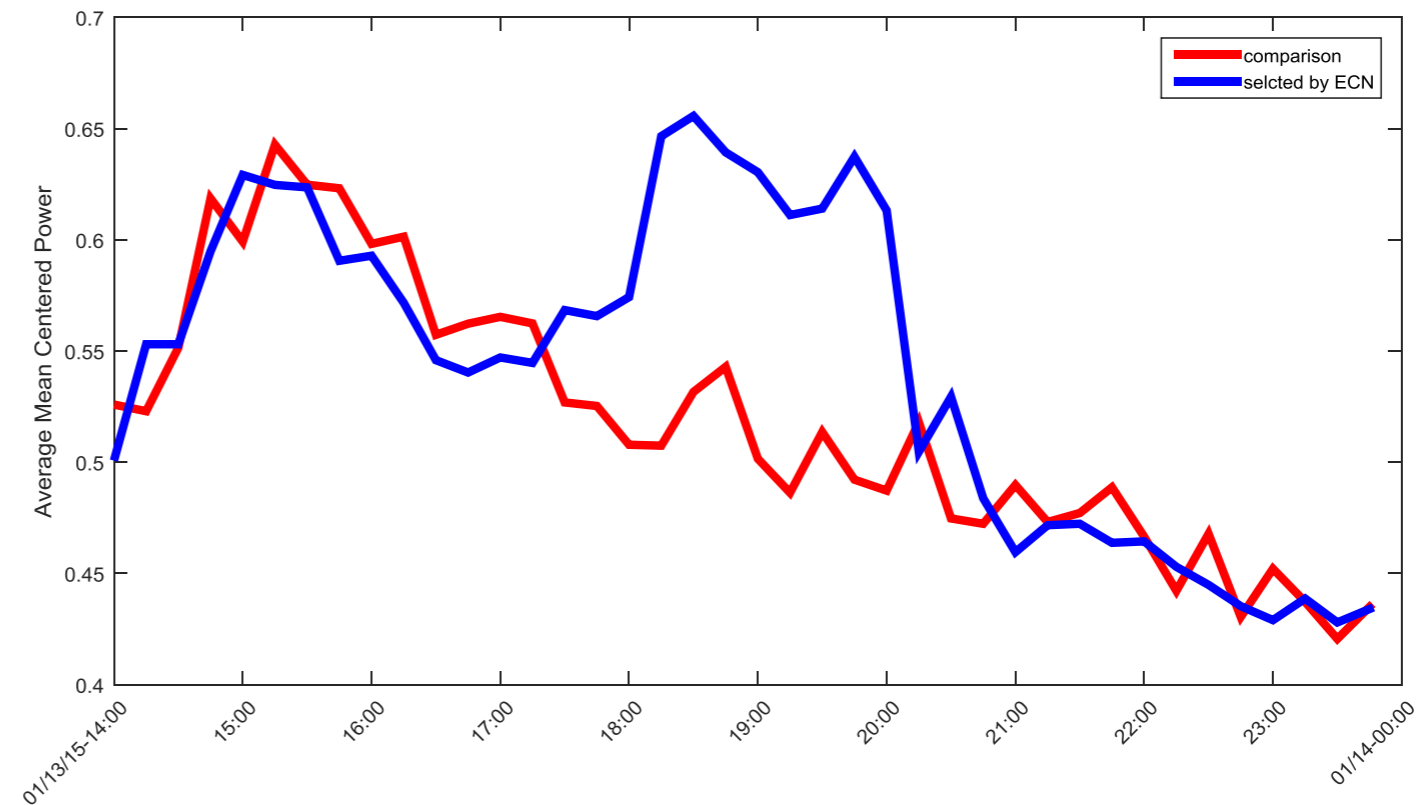


Evaluation, Measurement and Validation

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

Manual customers (blue reference, red manual group)

- Very low prices



Questions

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