

Microgeneration and new end-use technologies in ADDRESS, INCA and SEESGEN-ICT

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IEA DSM 17 workshop in Sophia Antipolis, France

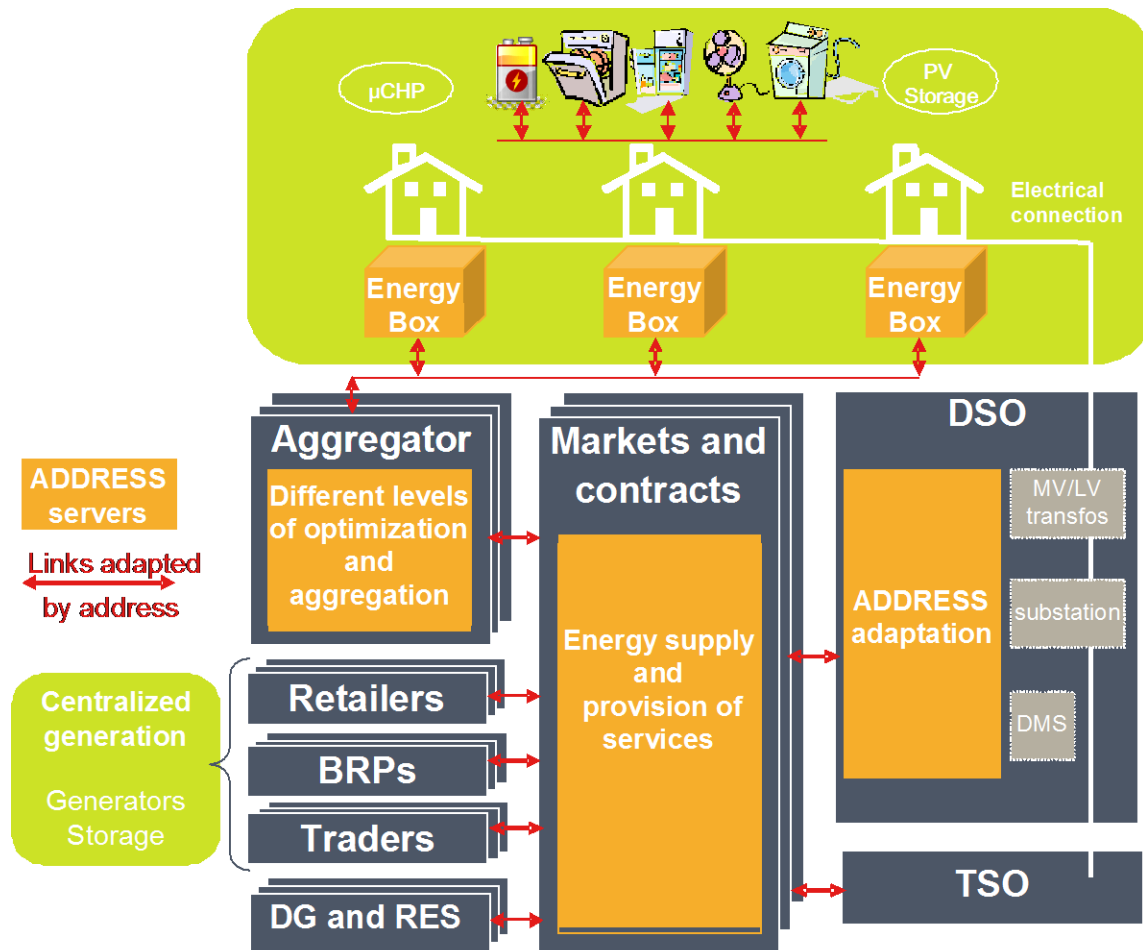
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ADDRESS project

(Active Distribution networks with full integration of Demand and distributed energy RESourceS)

- ADDRESS considers "active demand", flexible demand of power at consumer level, which may consist of both demand response and distributed generation
- Provides enabling technologies, algorithms and prototypes for
 - local control or DER at consumer level
 - VPP control,
 - communication,
 - reliable grid operation
- Validate and assess the solutions developed with field tests in France, Italy and Spain

ADDRESS conceptual architecture



Address conceptual architecture

Aggregator

- Gathers consumers' flexibility to build Active Demand (AD) products
- Offers/sells them to the power system participants via markets and contracts

Consumers

Households and small businesses directly connected to distribution network

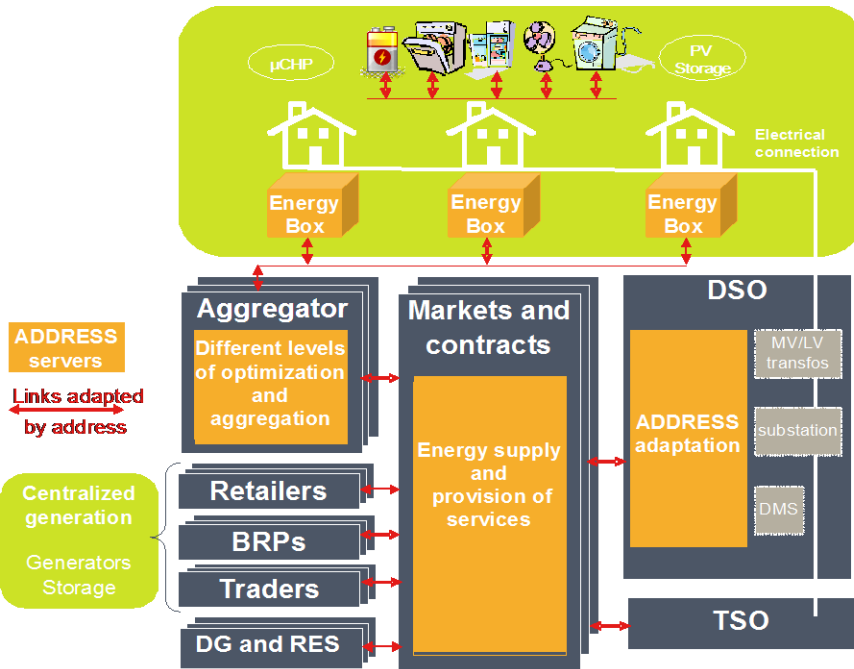
- Provide demand flexibility
- Energy Management box (Ebox): gateway to the consumer
- Optimisation and control of appliances and DER

DSO

- Ensures secure and efficient network operation when AD is present
- Can purchase services from aggregator

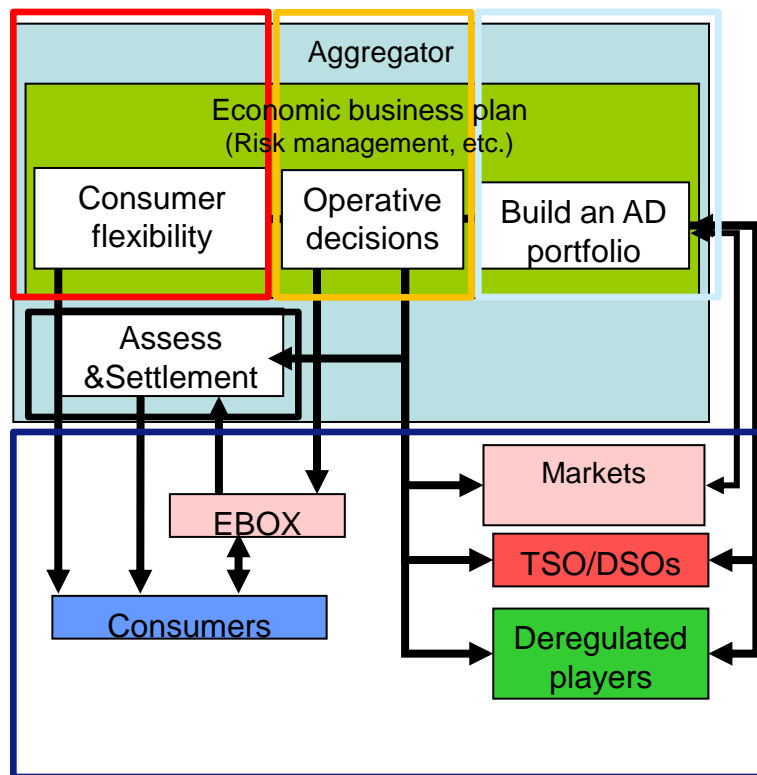
Markets and contracts

- All types of commercial relationships (organized markets, call for tenders, bilateral negotiations)
- Energy supply
- Balancing services
- Relief of overload & network congestion
- Ancillary services: steady state V control, reserves



Aggregator core modules

Aggregators need to have the following key modules, to be implemented within the project following ADDRESS strategic approach:

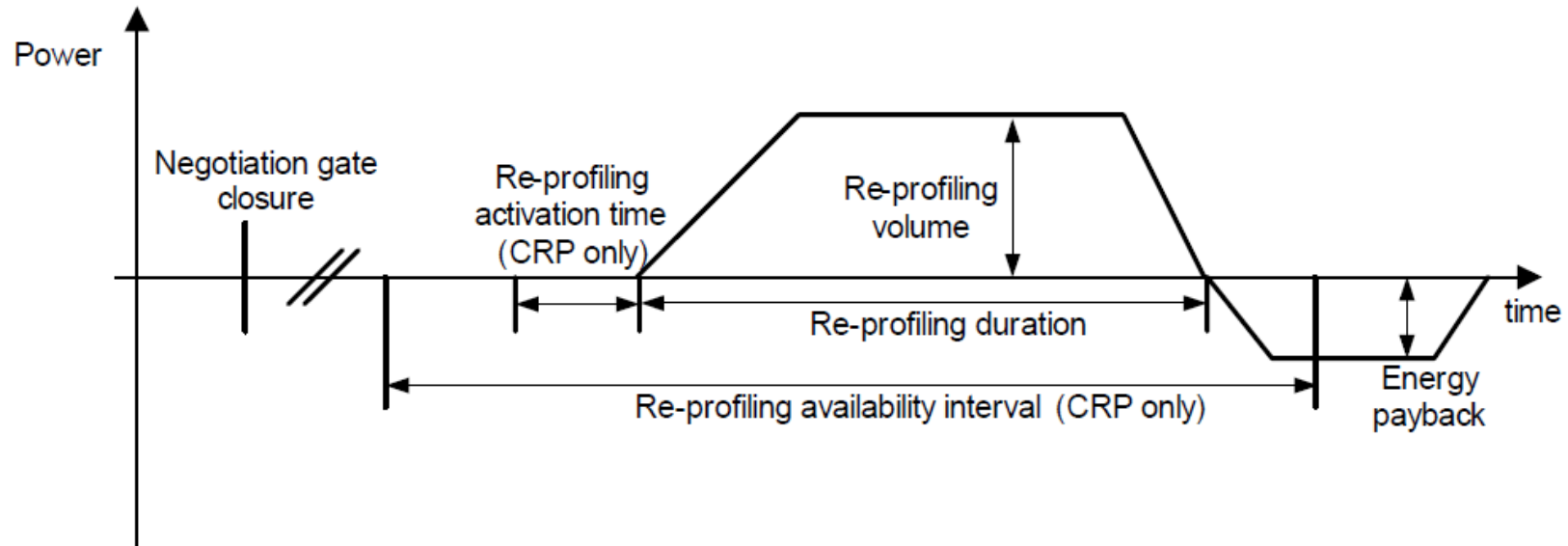


- **Consumption and flexibility forecasting:** Forecast flexibility in the short and long term (this forecasting is tuned as feedback & consumer understanding is achieved).
- **Market and consumer portfolio management:** Consumers and other players contractual relationship, long term operations (strategy) and risk management.
- **Operational optimization:** Algorithms (short term) to interact with other players selling and activating demand flexibility.
- **Markets short term price forecasting**
- **Settlement and billing:** Assessing services delivery and performing billing.

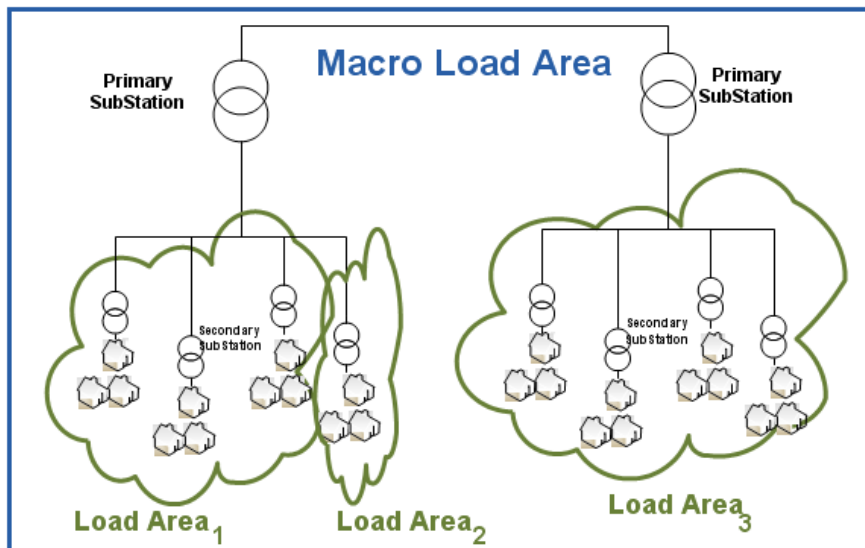
Active demand products description

Product description template:

- Availability interval
- Activation time
- Requested power curve or reserved power curve
- Price structure
- Ramping limits
- Location information



Location information



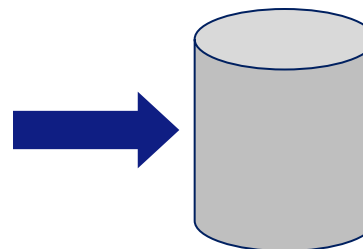
Load areas

- For service localization + technical validation needs for DSO
- Represent consumers “equivalent” from distribution network operation point of view
- Can encompass: part or whole LV lines, one or more MV/LV substations, MV feeders, busbars...

Macro Load Areas

- Similar concept as load areas but are aimed for the TSO needs (e.g. one or more HV/MV substations)

Consumer ID (point of supply code)	Local Area Code	Macro Load Area code
xxxxxxxxxxxx	yyyyyyyyy	zzzzzzzzzz



Information available for market players

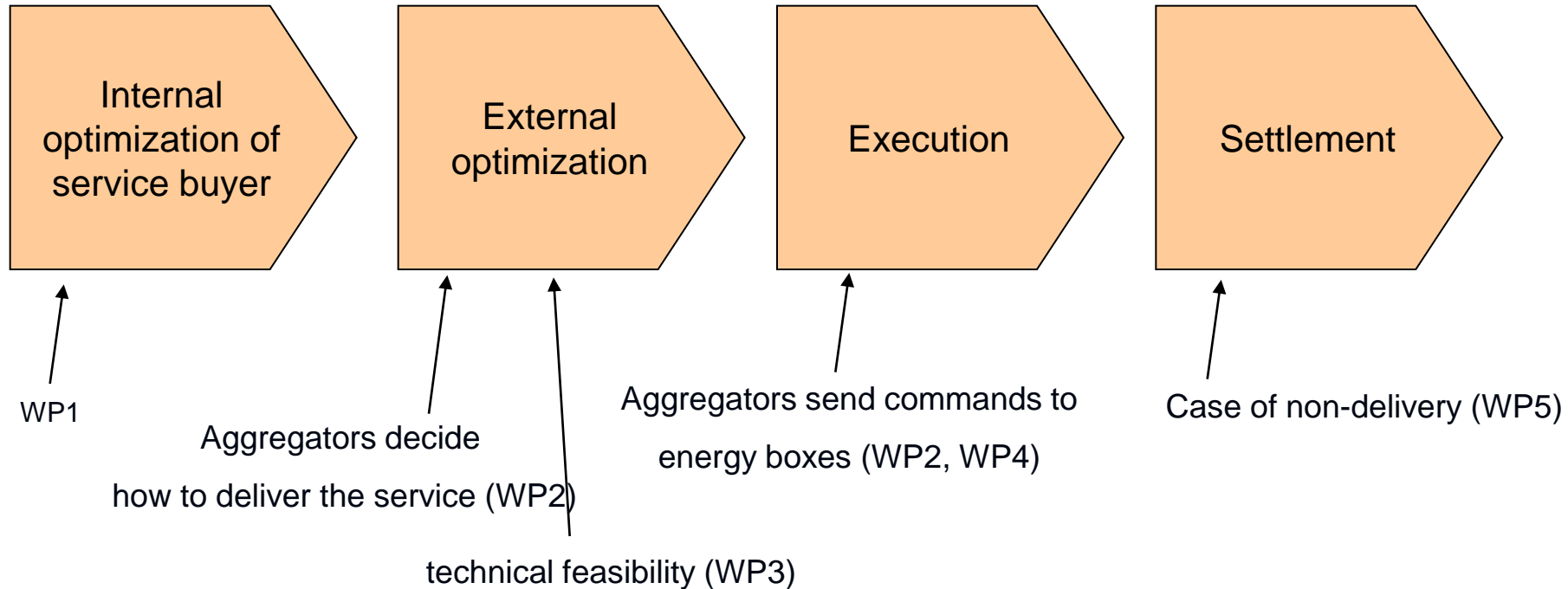
ADDRESS active demand services

- In the project 31 different AD services were identified, however some with only minor differences
- For deregulated players 24 AD services, which include
 - optimization of sales and purchase of electricity
 - reduction of imbalance costs
 - reserve service to fulfill obligations towards TSO
- For regulated players (DSO and TSO) 7 services including
 - voltage control
 - tertiary reserve
 - smart load reduction

Services for network companies

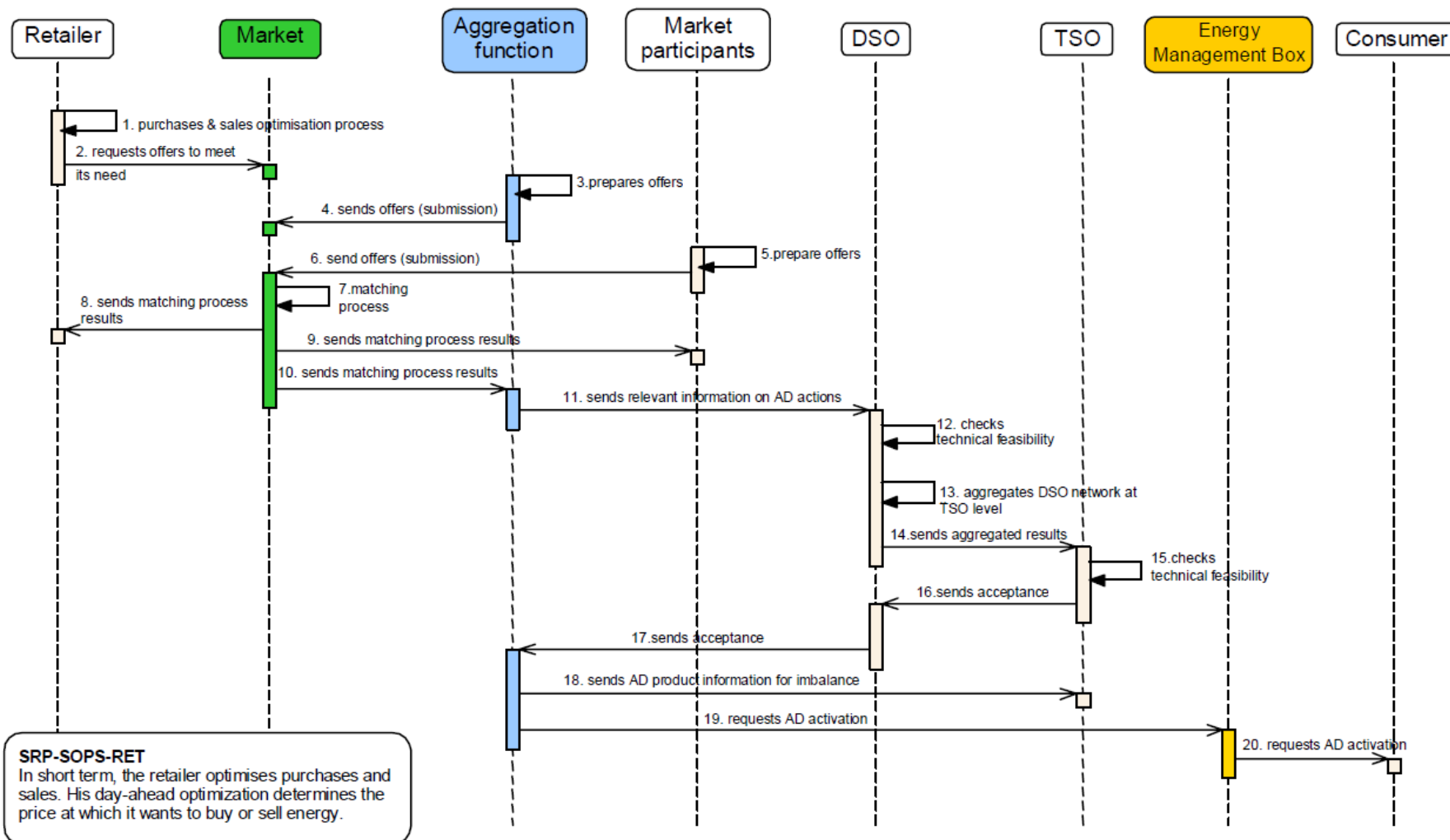
Player		Service type	AD Service
DSO	TSO		
X	X	Voltage regulation and power flow control	Scheduled Re-Profiling for Voltage Regulation and Power Flow Control (slow) - SRP-VRPF-SL
X	X		Conditional Re-Profiling for Voltage Regulation and Power Flow control (fast) - CRP-VRPF-FT
	X	Tertiary Active Power Control	Bi-directional Conditional Re-Profiling for Tertiary Reserve (fast) - CRP-2-TR-FT
	X		Bi-directional Conditional Re-Profiling for Tertiary Reserve (slow) - CRP-2-TR-SL
X	X	Smart Load Reduction	Scheduled Re-Profiling Load Reduction (slow) - SRP-LR-SL
X	X		Scheduled Re-Profiling Load Reduction (fast) - SRP-LR-FT
X	X		Conditional Re-Profiling Load Reduction (fast) - CRP-LR-FT

Generic stages of an AD service deployment

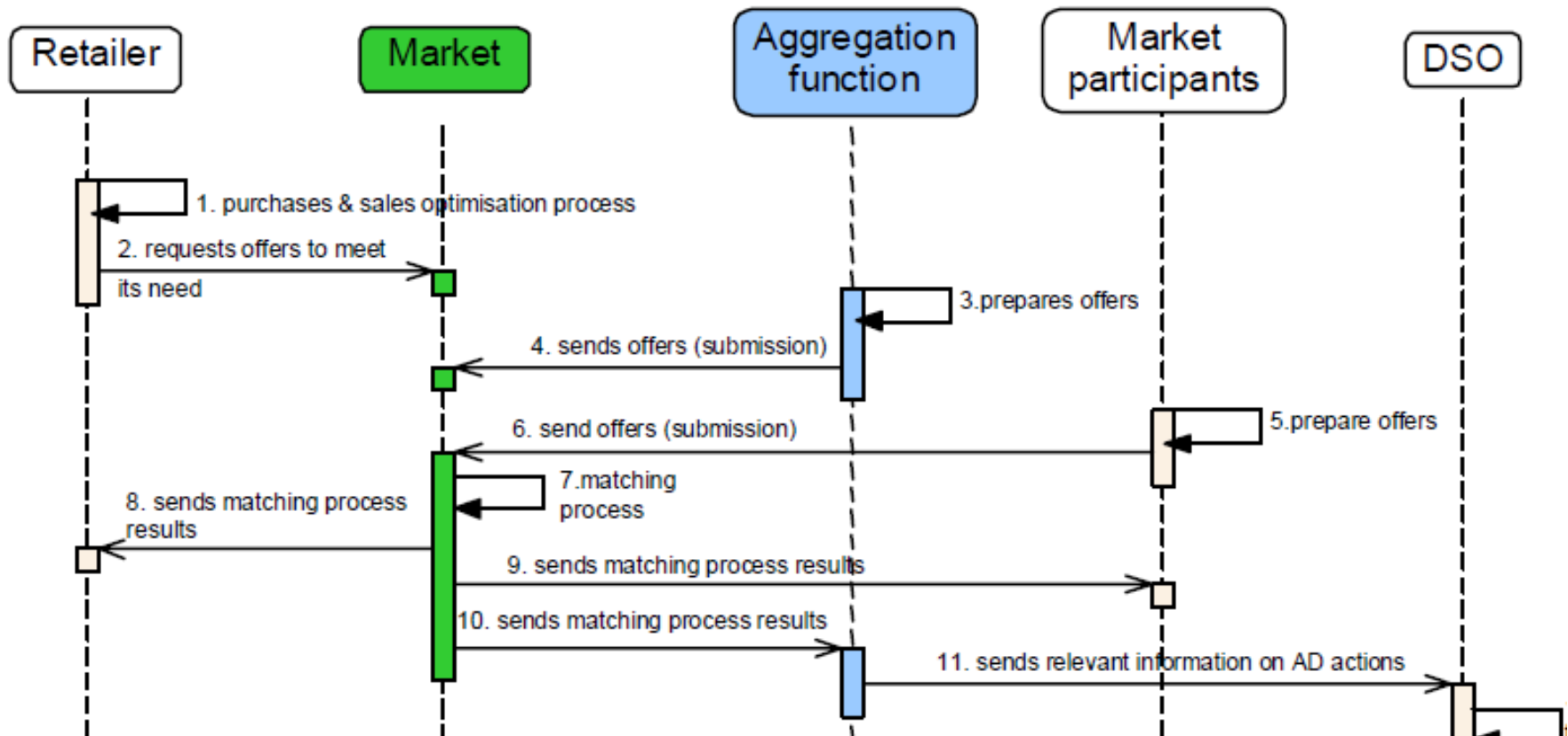


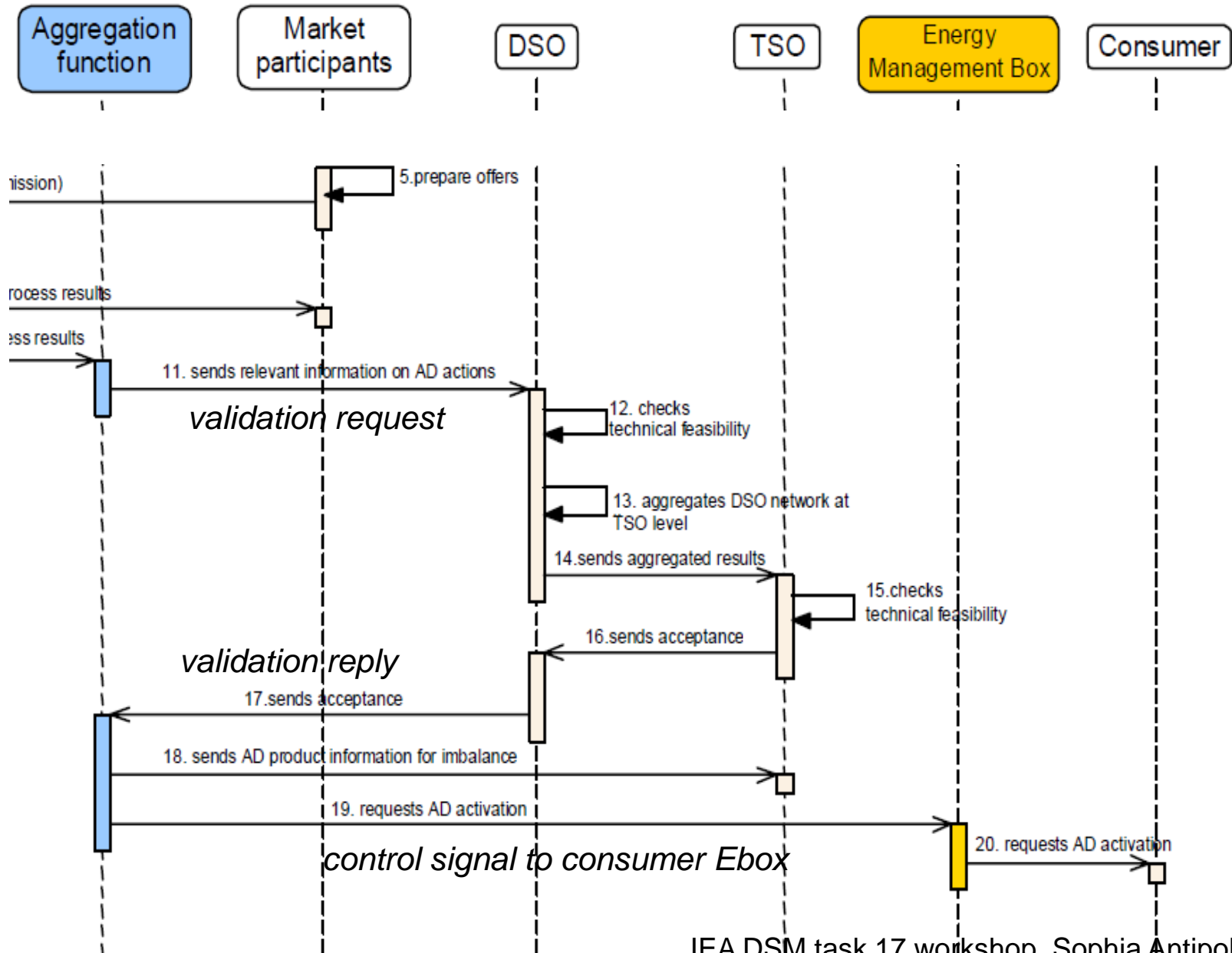
Service deployment sequence diagram

SRP-SOPS-RET(Short-term Load shaping to optimise purchases and sales)

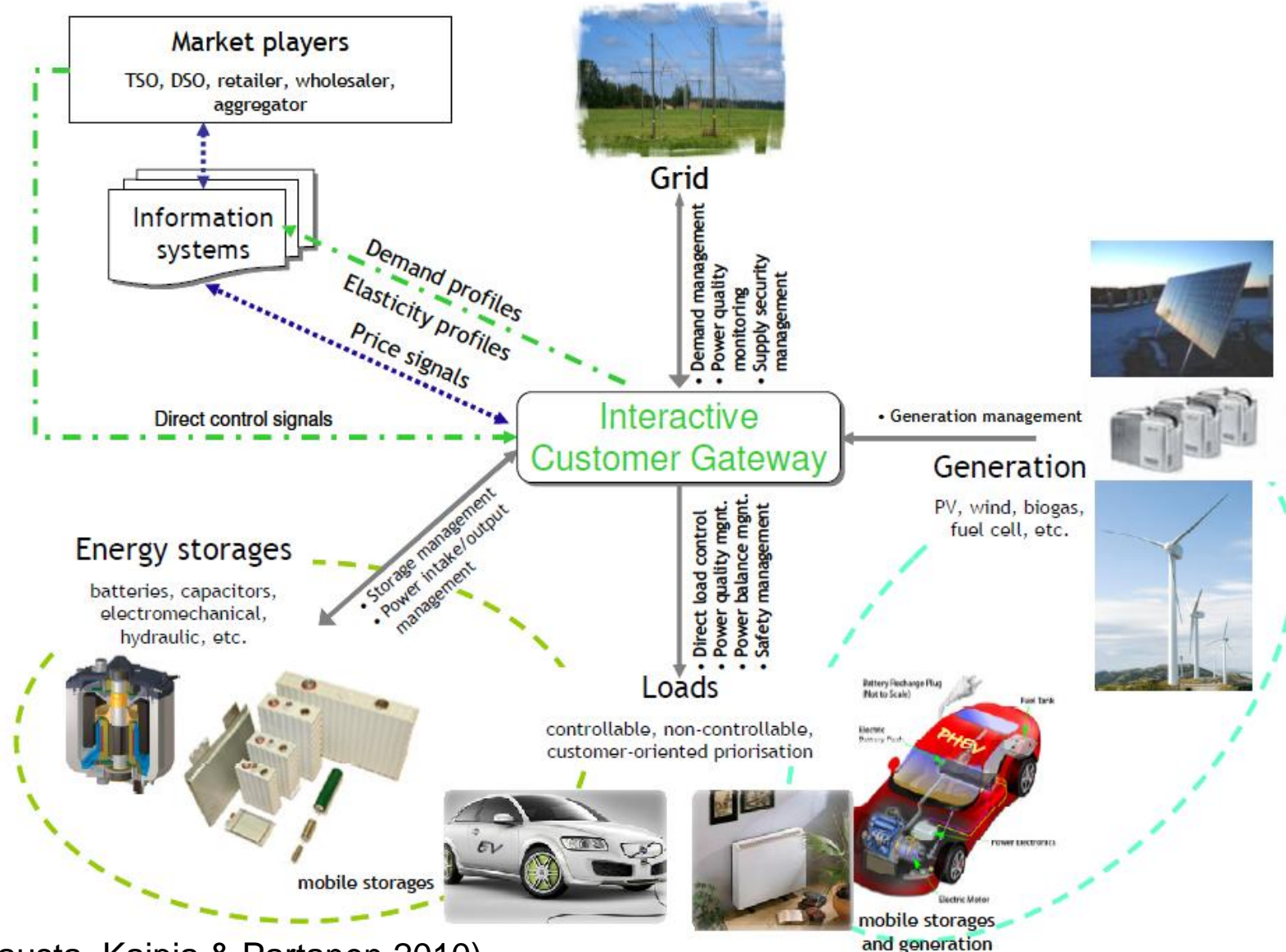


SRP-SOPS-RET(Short-term Load shaping to optimise p





Finnish INCA (Interactive customer gateway)



INCA services

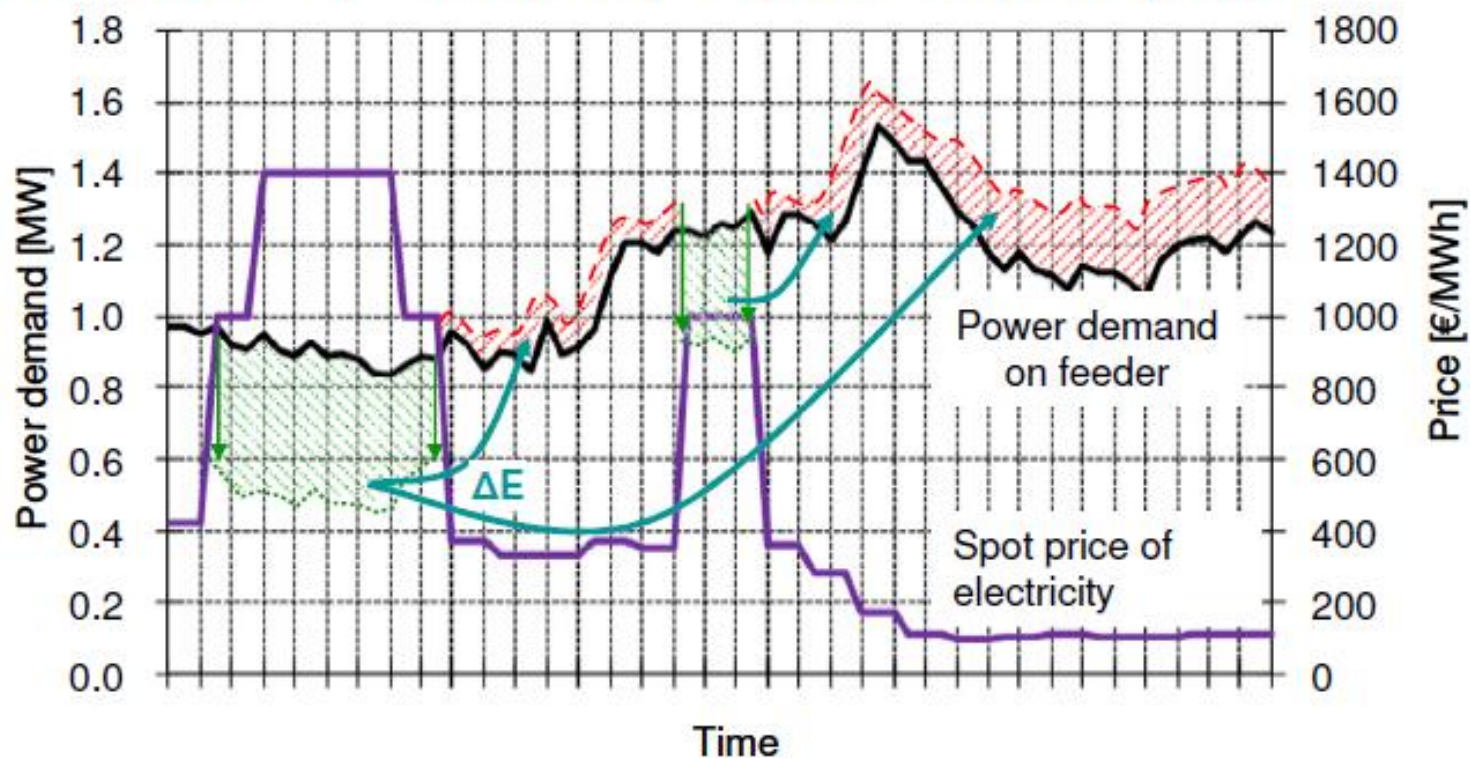
Main functions	Information to and from customer gateway	Task for the customer gateway	Time scale
TSO; Management of power balance and reserve power	Input: System frequency measured in the gateway Output: Estimate of available elasticity	Reduce loads/supply power to the grid based on the droop determined for the gateway	s–min
DSO, supplier, aggregator; optimisation of system loads (determination of optimal grid powers)	Input: Hourly grid powers determined by the market player Input/output: Estimate of available elasticity Output: Estimate of grid powers within minimum and maximum limits	Keep the objectives for hourly grid powers	1–168 h
Customer; Minimisation of total energy costs	Input: Estimate of market price Input: Distribution tariff information (in case of dynamic tariffs)	Optimise control for loads, energy storage and generation	1–24 h

Suggested measurements at the customer gateway

- Voltage quality
 - 10 min averages of THD up to the 40th harmonic for the previous year
 - times of THD exceeding 8 %
 - times of voltage dips
- Loss of mains situations
 - times for the previous year
- Power consumption
 - 3 min averages for the past week
 - 1 hour averages for the past year
- Available demand response (estimate)
 - 3 min averages for the past week
 - 1 hour averages for the past year
- Environmental variables
 - indoor & outdoor temperature

Contradicting goals of the grid and market

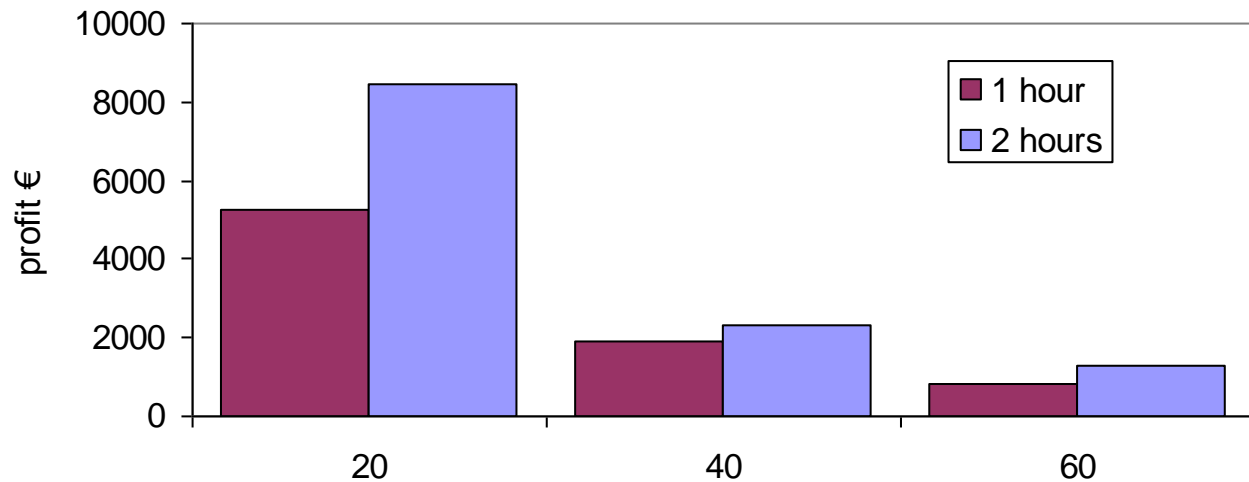
Shift of loads and reduction of peak power from DSO perspective.



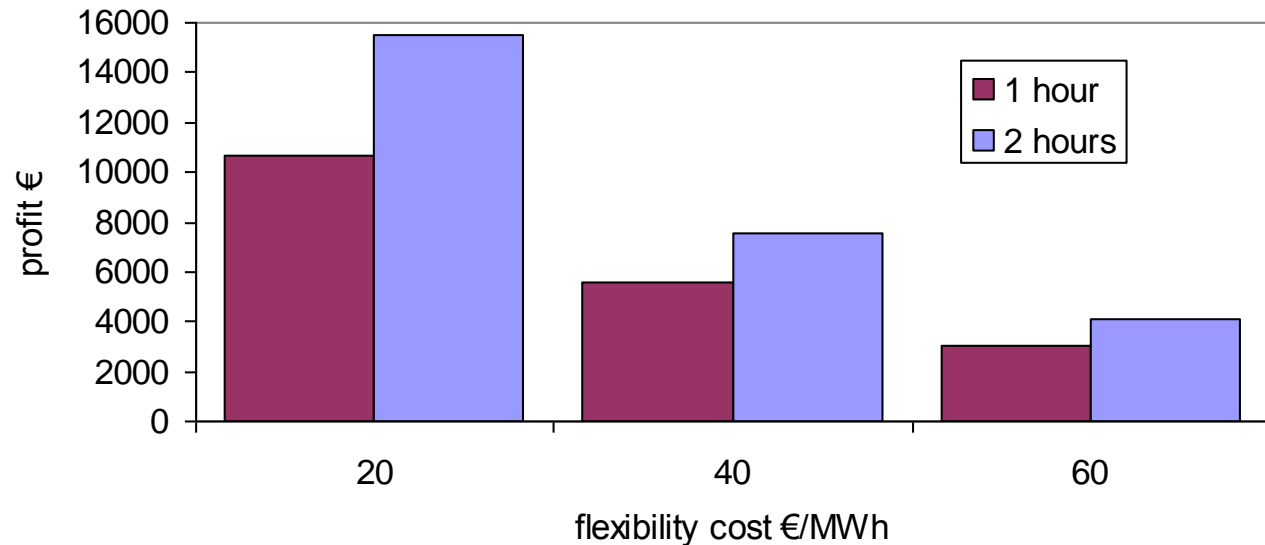
Shift of loads and reduction of peak power from electricity sales perspective.

Simulations of market-based demand response on intra-day market in INCA

Real prices



150 % prices



SEESGEN-ICT (Supporting energy efficiency in smart generation grids through ICT)

- A thematic network which has been running since summer 2009 and is now in its final stage
- Will produce a number of recommendations concerning e.g.
 - interoperability
 - information security
 - information availability
 - energy efficiency of ICT
- Recommendations will be published in June on <http://seesgen-ict.erse-web.it/>

Thank you