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Aggregation services for flexible buildings
A market perspective

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Aalborg, April 2019

Aggregator - 5 key questions to be answered

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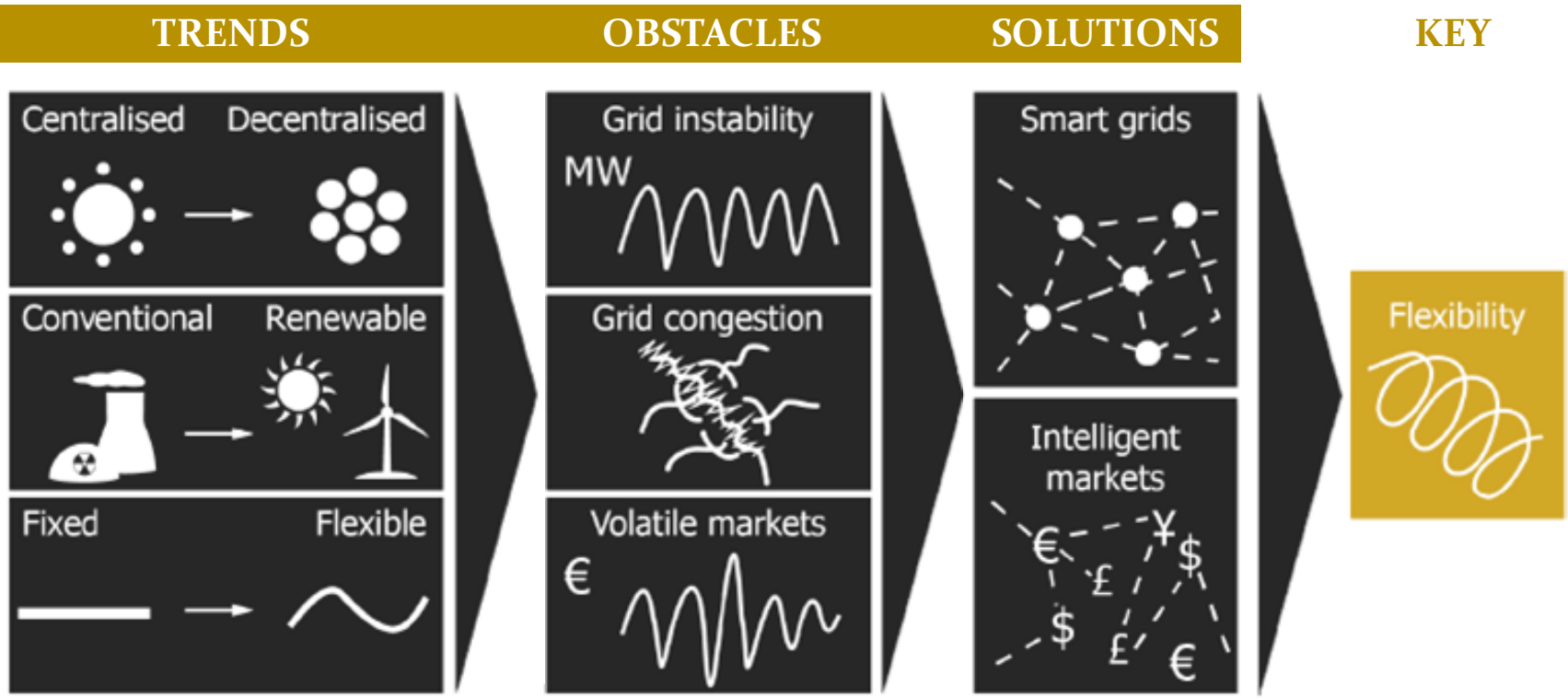
The needed of a new Agent

Significant change of energy systems



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The needed of a new Agent

Significant change of energy systems

Energy Efficiency Directive 2012/27/EU, art 15.8

Member States shall promote access to and participation of demand response in balancing, reserve and other system services markets

EU winter package “Clean Energy for All Europeans”, 2016

The role of the aggregator is reinforced and countries are incentivized to promote DR

Aggregator Concept

Key enabler of “FLEXIBILITY”

Aggregator is the **key mediator** between the consumers and the markets and the other electricity system participants

WHAT?

Collecting **flexibility products from its prosumers portfolio.**

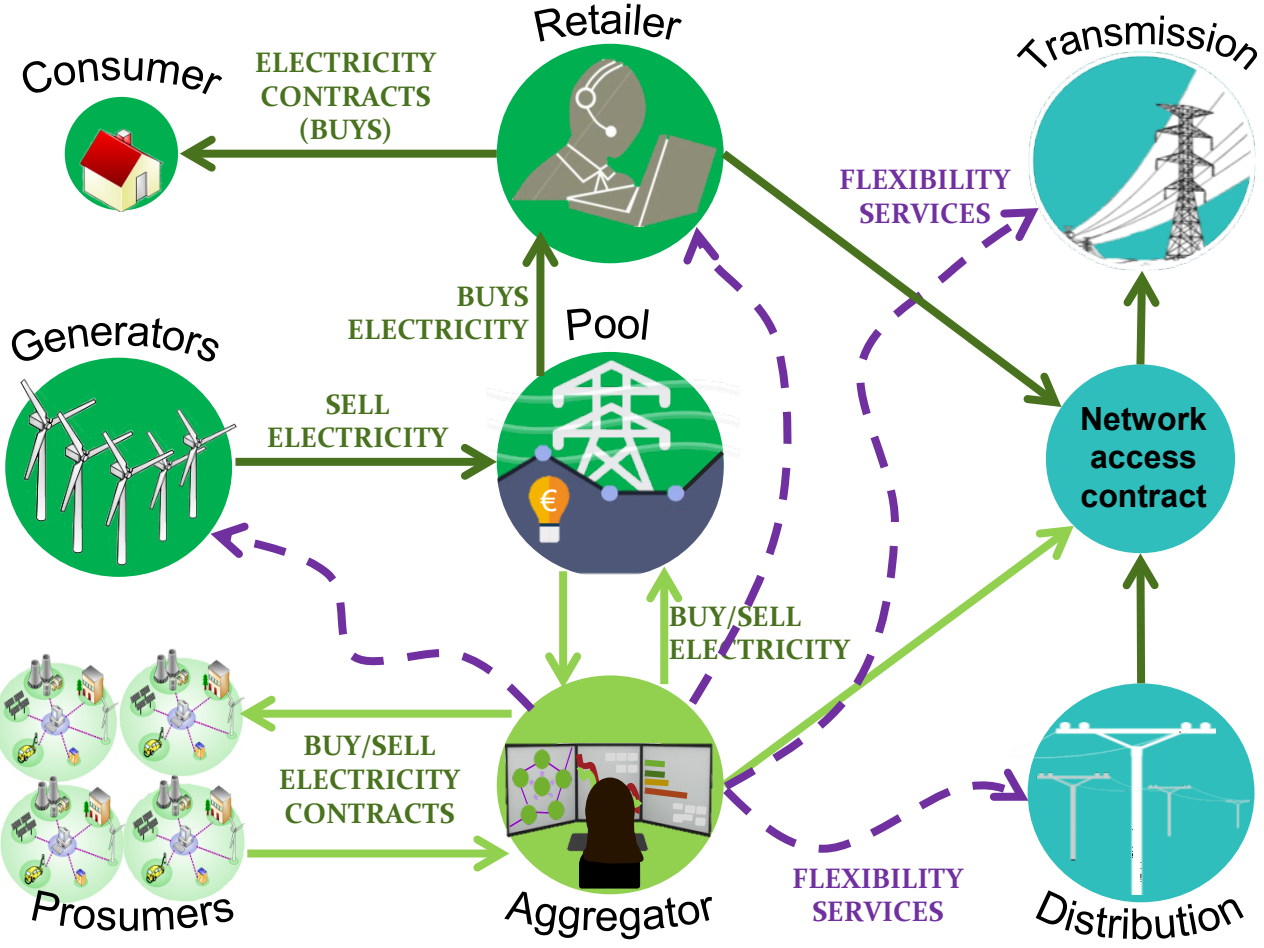
HOW?

Optimizing its trading in electricity markets aiming to maximize its profits.

This new agent would provide direct revenue to the businesses and homeowners, besides ensuring higher **stability** and efficiency in the grid

Aggregator Concept

Key enabler of “FLEXIBILITY”



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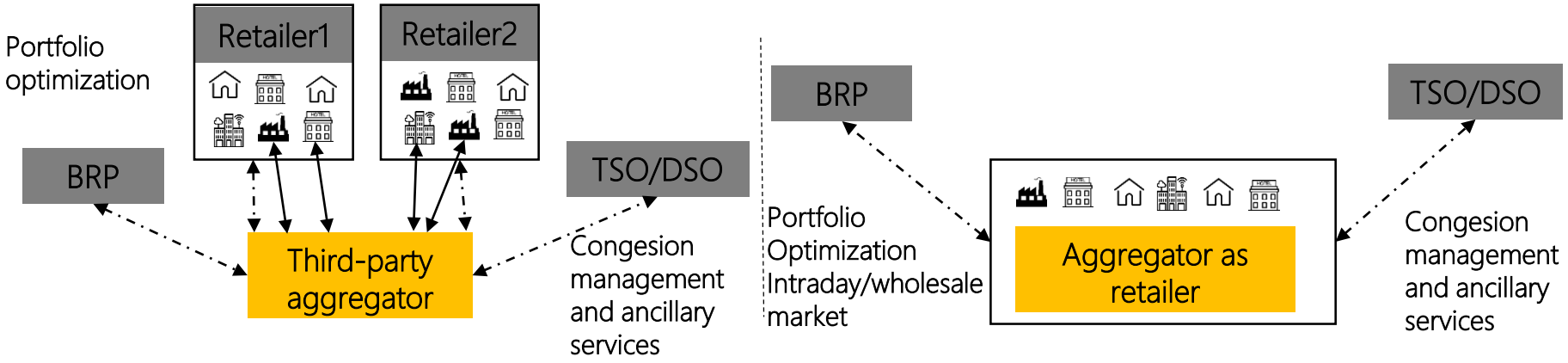
Aggregator Concept

Key enabler of “FLEXIBILITY”

BUSINESS MODELS



ADDITIONAL IMPLICIT SERVICES

- Consumption monitorization
- Consumption optimization

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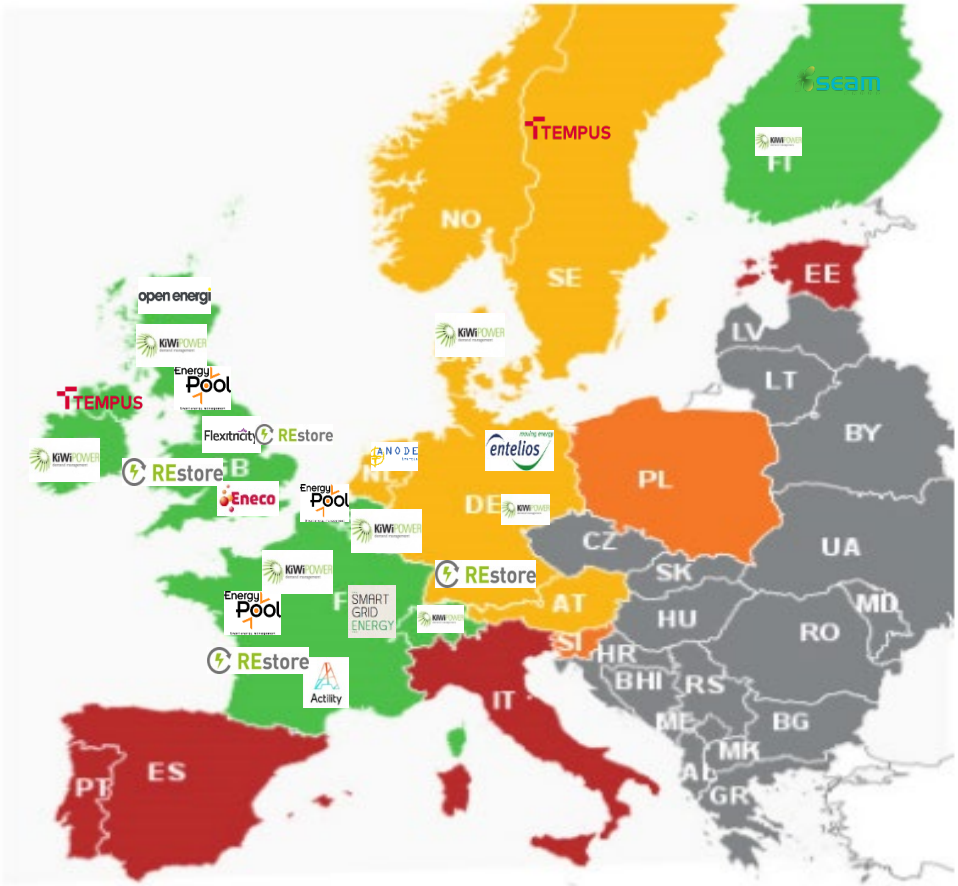
Aggregator Concept

Key enabler of “FLEXIBILITY”

- Commercially active
- Partial opening
- Preliminary development
- Closed
- Not assessed



TECHNICAL REQUIREMENTS

- Prequalification
- Minimum bid size
- Notification time
- Max. activations per day
- Product resolution
- Symmetricity
- Duration of delivery

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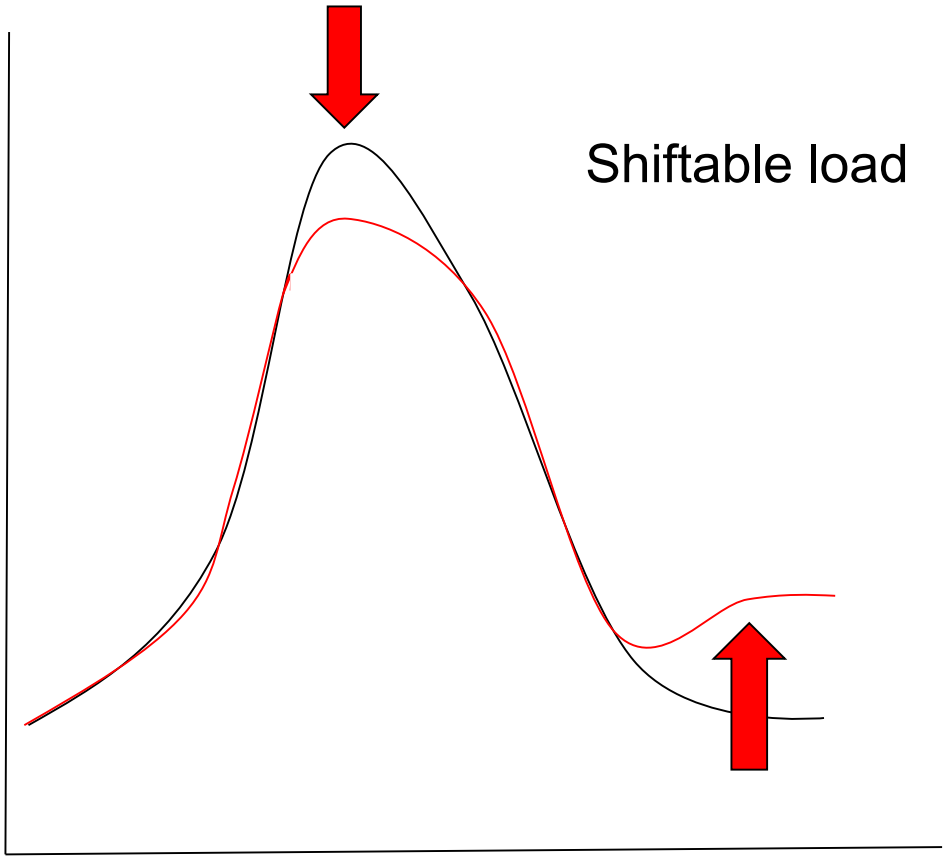
Aggregator Concept

European Markets

Country	Market	Minimum bid of the offer [MW]	Notification time	Maximum number of activations	Product resolution	Simmetry	Service duration	Tender time	Capacity payment [€/MW/h]	Utilization payments [€/MWh]
Belgium	FCR	1	15 s	Continuously activated	1 week	NO	15 min	Weekly	10-20	0
	FRR		15 min	8/month	15 min		2 hours	Daily or monthly	4.5	Depending on the type of unit
	RR		8 h	40/year	Winter period		12 hours	Annual	6-8	70-90
Finland	FCR	0.1-1	1 s – 3 min	Continuously activated	1 hour	NO	No stop	Daily or monthly	14	SI
	FRR	10	15 min	1/year			15 min	45 minutes before the activation	0	Depending on the price of the wholesale market
	RR			Never activated from 2012			NA	Annual	Depending on the offer	NO
France	FCR	1	15 s	Continuously activated	1 week	YES	15 min	Weekly	10.6	NO
	FRR	1-10	13-30 min	2/day		NO	30 min-2h	Annual	0.57-1.18	Wholesale market price
UK	FCR	1	2 –30 s	Continuously activated	2 hours	YES	Indefinite	Monthly	3.5	1.5
	FRR	50	2 min	10/day	1 month	NO	15 min		5	100
	RR	1-3	4-7 h	Traded with the user	Some hours	NO	2-4 h	Bimonthly	1.5-4.2	100

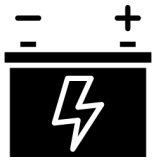
Management

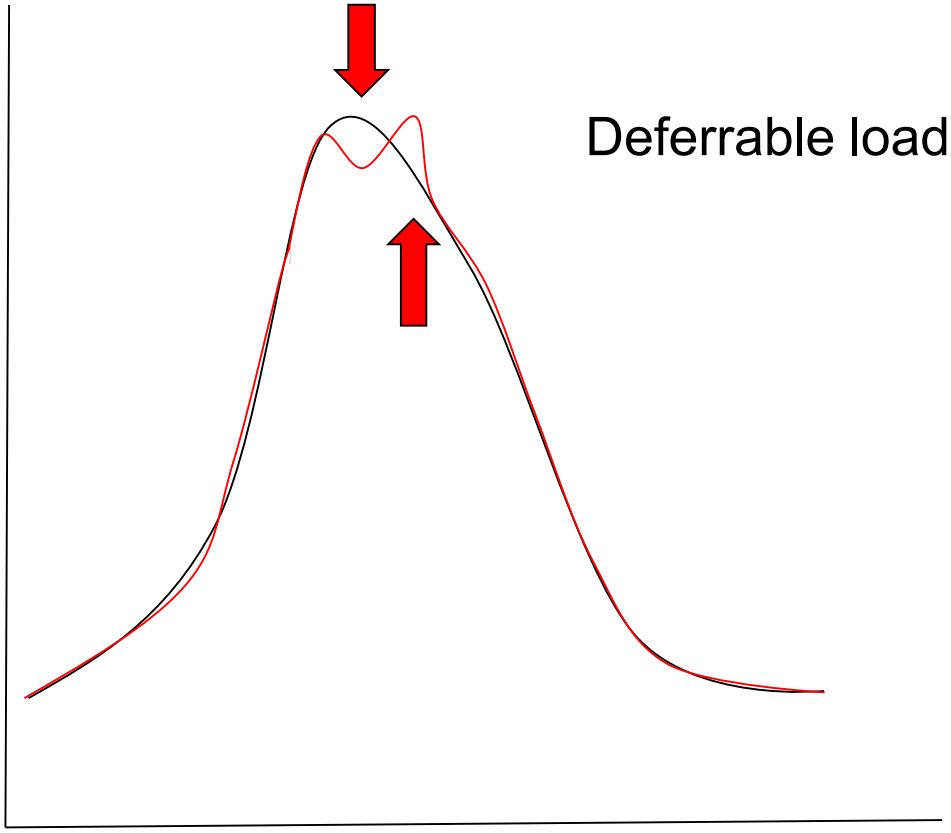
Type of Flexibility



Management

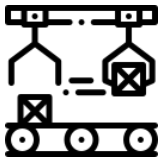
Type of Flexibility

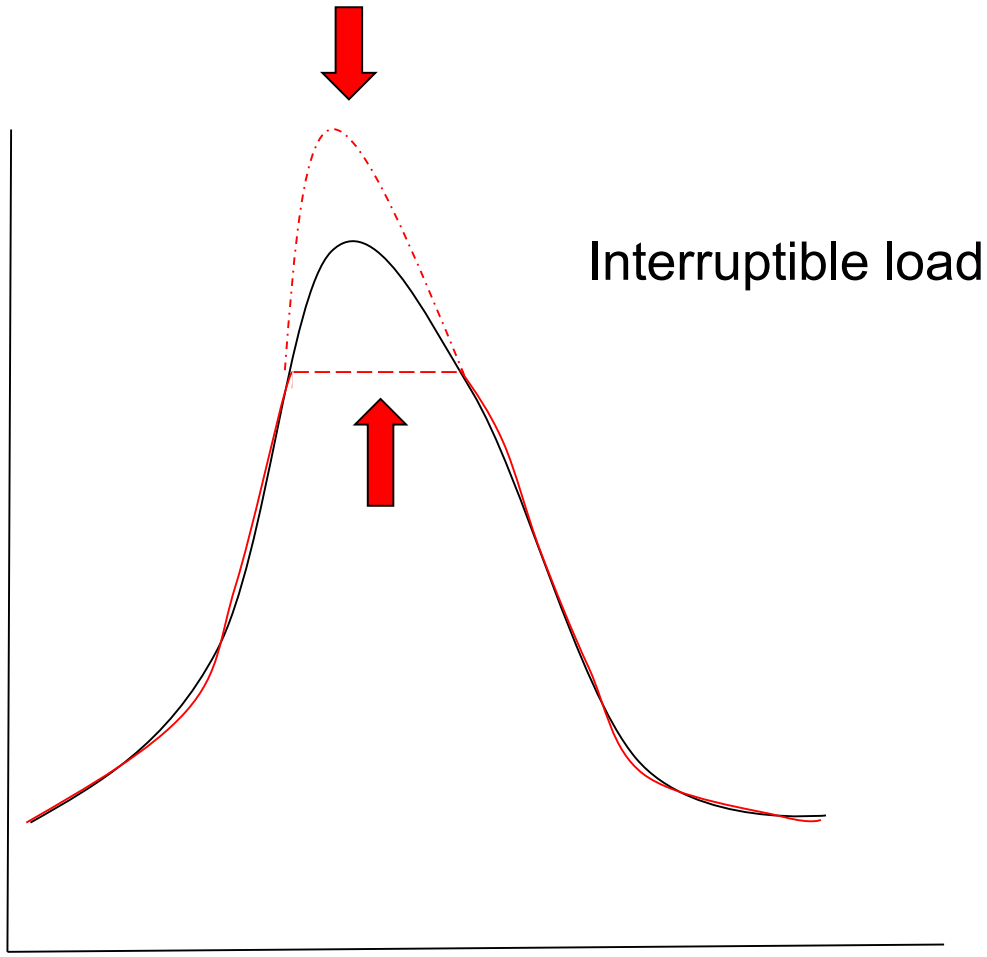




Management

Type of Flexibility





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Management

Aggregator strategy

Centralized or System Oriented

The Aggregator decides who should be activated and how.

Decentralized or Prosumer Oriented

The Aggregator sends incentives or messages and the prosumers are the ones deciding if they are interested or not.

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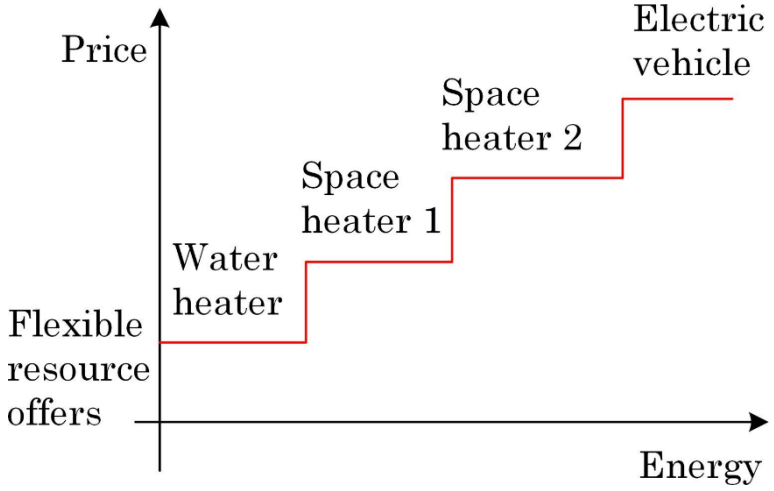
Management

Centralized aggregator

Strategy 1

Needs monitoring and constant knowledge to take decisions

The Aggregator acts like an HEMS!



- Cost of generation curtailment
- Cost to reschedule shiftable loads
- Cost of battery charge/discharge
- Cost to activate curtailment loads
- Cost of disconnect generation (in the cases where power cannot be controlled)

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P. Olivella-Rosell *et al.*, "Optimization problem for meeting distribution system operator requests in local flexibility markets with distributed energy resources," *Appl. Energy*, no. April, 2017.

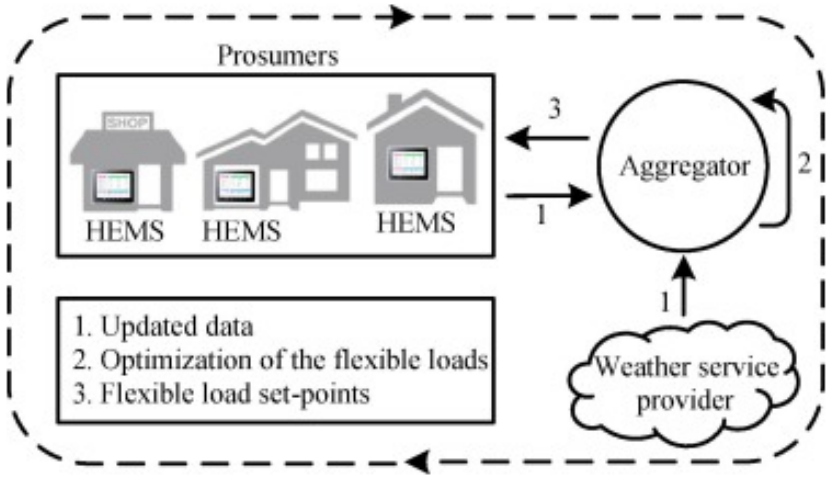
Management

Centralized aggregator

Strategy 2

Needs monitoring and constant knowledge to take decisions

The Aggregator acts on EMS!



The aggregator gets **all** the info from EMS

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J. Iria, F. Soares, and M. Matos, "Optimal supply and demand bidding strategy for an aggregator of small prosumers," Appl. Energy, no. June, pp. 1–12, 2017.

Management

Decentralized aggregator

The Aggregator does not needs to know perfect details of the functionality of its portfolio but it needs a good strategy to make them act as it expects.

Cooperative Strategies

Community of prosumers

↓

elimination of intermediates (enterprises)

↓

Increase the revenues of prosumers
(Not searching the maximum of each individual)

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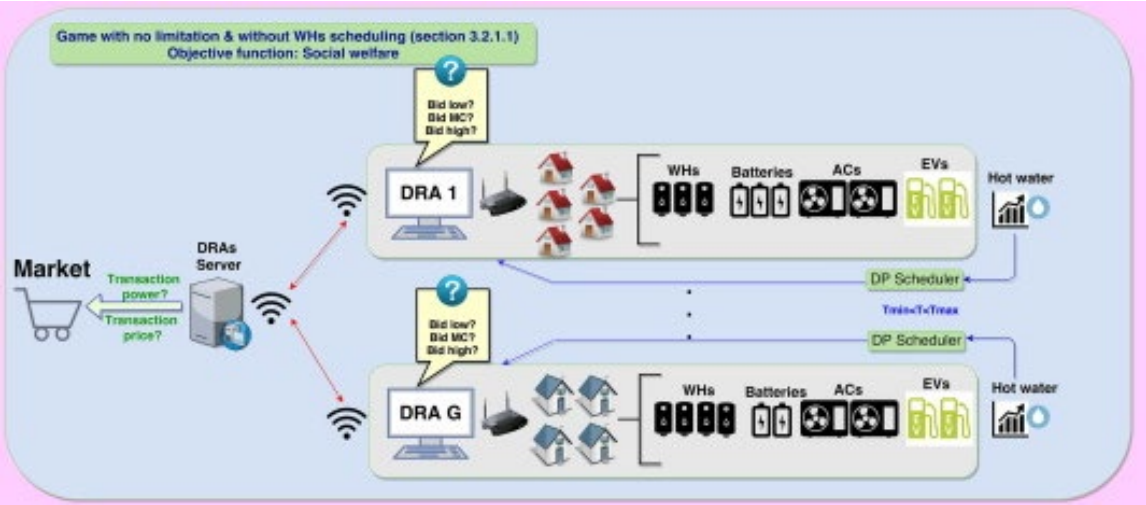
L. A. Hurtado, E. Mocanu, P. H. Nguyen, M. Gibescu, and I. G. Kamphuis, "Enabling cooperative behavior for building demand response based on extended joint action learning," IEEE Trans. Ind. Informatics, vol. 3203, pp. 1–10, 2017

Management

Decentralized aggregator

Competitive Strategies

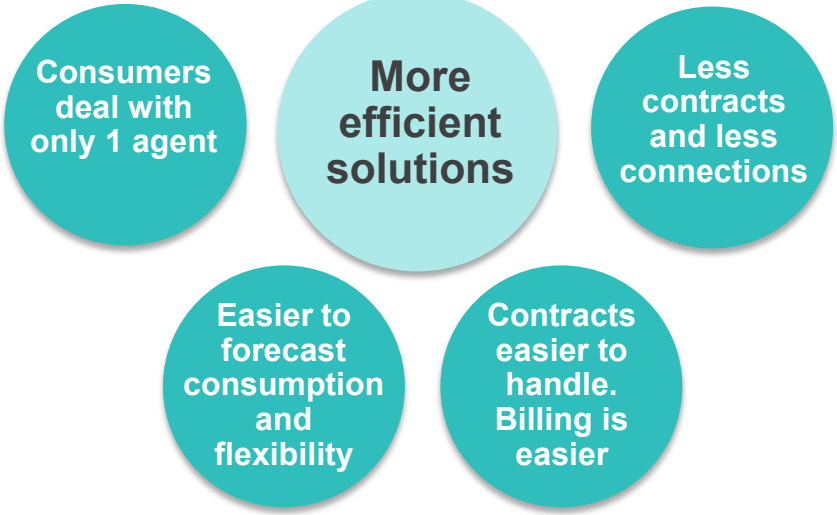
Bidding processes enhancing the one that better plays the game



M. Motalleb and R. Ghorbani, "Noncooperative game theoretic model of DRA competition for selling stored energy," Appl. Energy, vol. 202, pp. 581–596, 2017.

Applications and advantages

Aggregation is considered as a key innovation on the power system to face future challenges posed by growing demand and RES integration



Validation of flexibility Products

To validate flexibility products prior to its activation.

Procurement of flexibility products

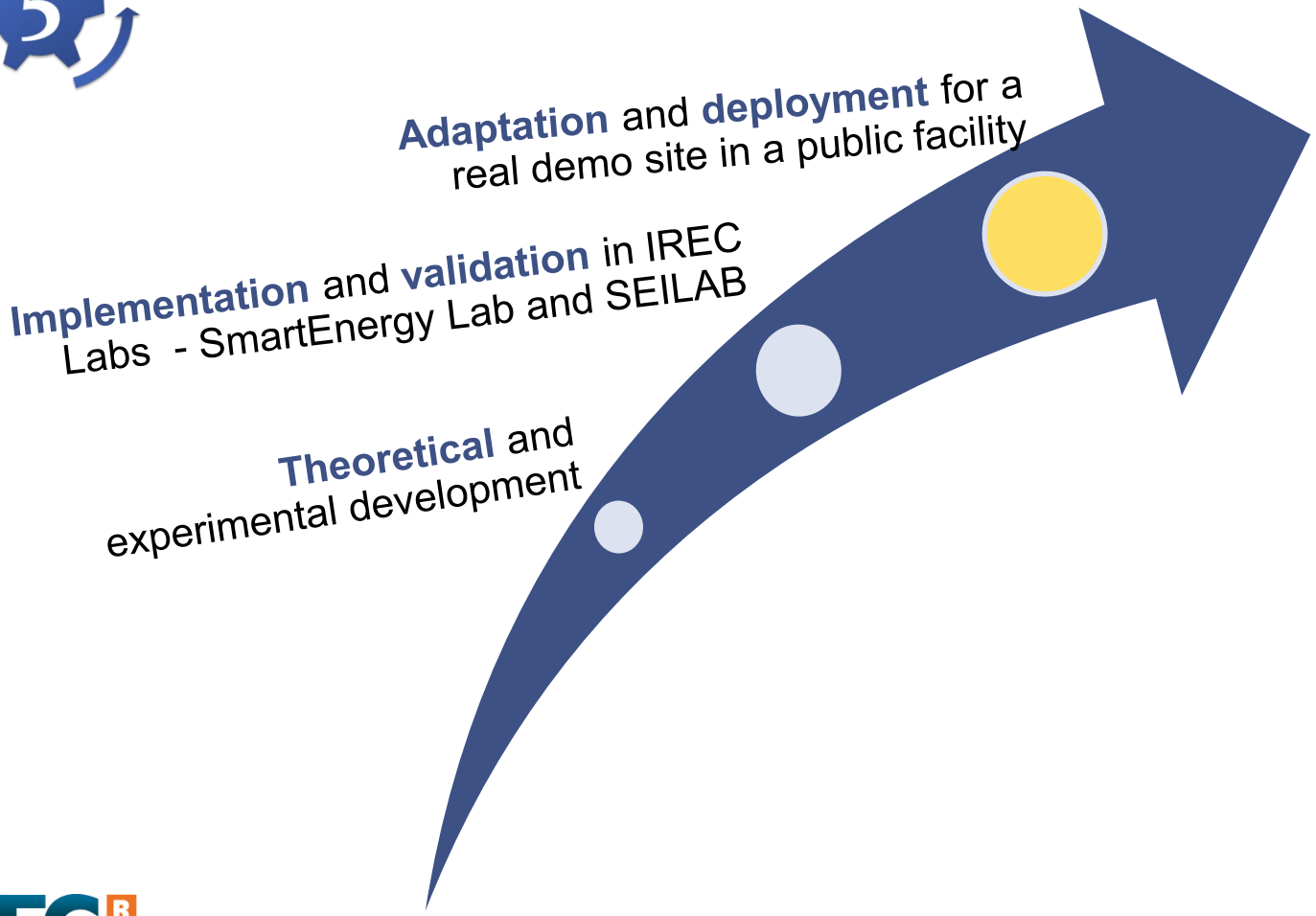
The DSO can access and procure flexibility products offered by aggregators to use them for a number of purposes:

- distribution network reinforcement deferral
- congestion management, etc.

Responsibility

The aggregator is totally responsible for their own imbalances, so they will have to deal with their own energy paybacks when participating in wholesale markets.

Our experience



Our experience

IDE4L
ideal grid for all

Commercial aggregator developed and tested in IREC SmartLab with real data from A2A Reti Electriche.
http://ide4l.eu/project/

REFER

- Overview of the regulation on aggregator agent in Europe
- Aggregator tool for a set of tertiary buildings (public library) with RES and storage systems (on going)

SmartNet

Aggregator and market simulator software the aggregation of a set of radio base stations to build up about 50 kW of flexible demand. (on going)
http://smartnet-project.eu/

SABINA

Cloud based aggregator tool to exploit synergies between electrical flexibility and thermal inertia of buildings. (on going)
http://sabina-project.eu/

Thank you
for your attention

Energy Systems Analytics
Research Group

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