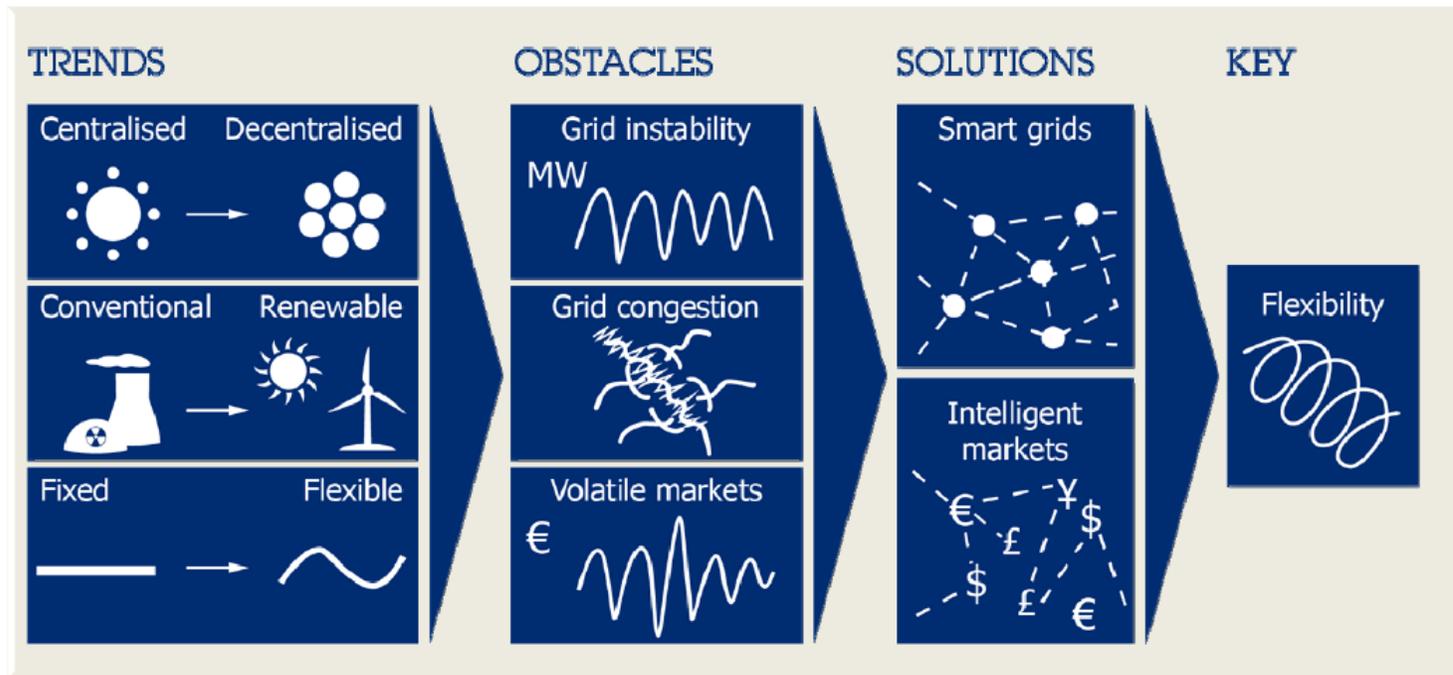


# agregació

## la gestió de la flexibilitat

Santi Martínez Farrero

## Low carbon economy requires significant changes of energy systems



## Sistema actual

### Serveis d'ajustament del sistema

- REE**      **Solución de restricciones técnicas**  
Servicio de ajuste cuya finalidad es resolver las restricciones técnicas del sistema, mediante la limitación y modificación, en su caso, de los programas de producción de las unidades de generación y de consumo de bombeo que resuelven las restricciones técnicas identificadas con el menor coste para el sistema, y el posterior reequilibrio de generación y demanda para compensar las modificaciones de programa incorporadas para resolver las restricciones técnicas identificadas.
-

## Sistema actual

### Serveis d'ajustament del sistema

**REE**

**Oferta (Generació)**

**Serveis complementaris**

**Reserva de potència addicional a pujar (horitzó diari)**

**Regulació secundària (entre 20 segons i 15 minuts)**

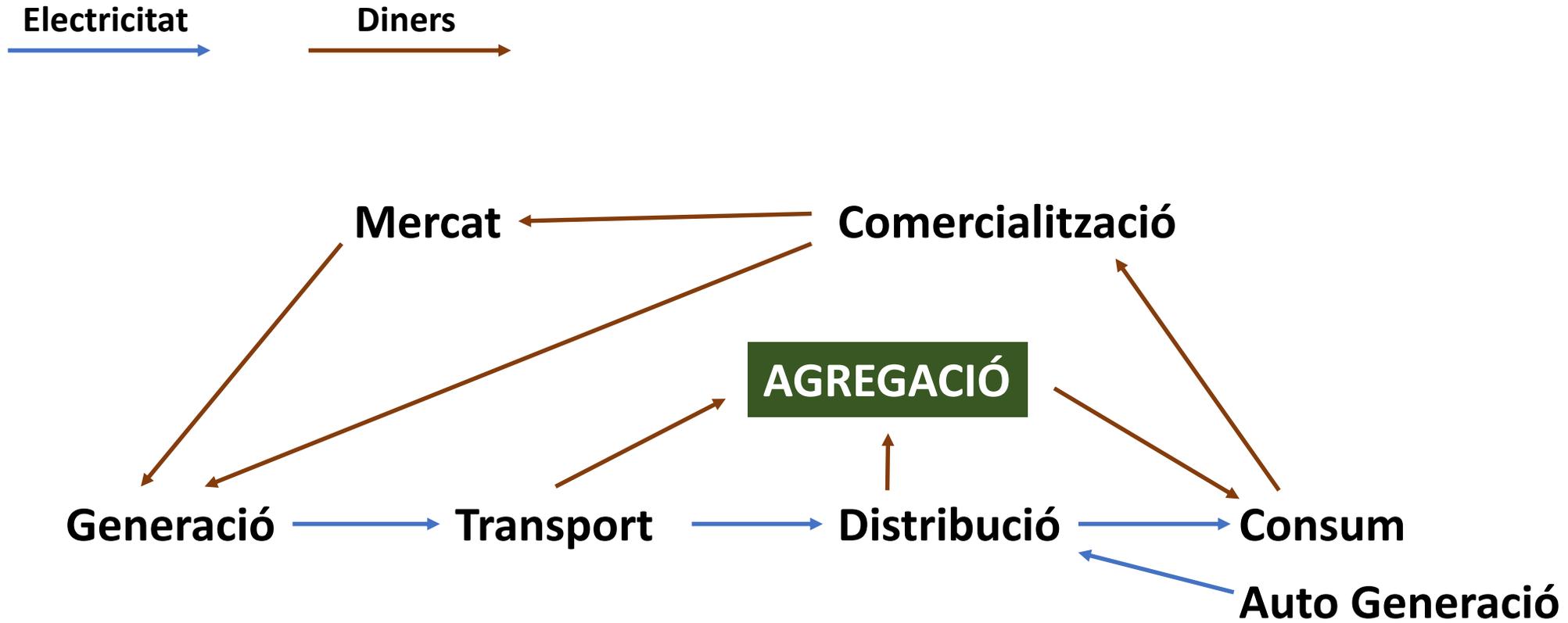
**Regulació terciària (entre 15 minuts i 2 hores)**

**Demanda (Consum)**

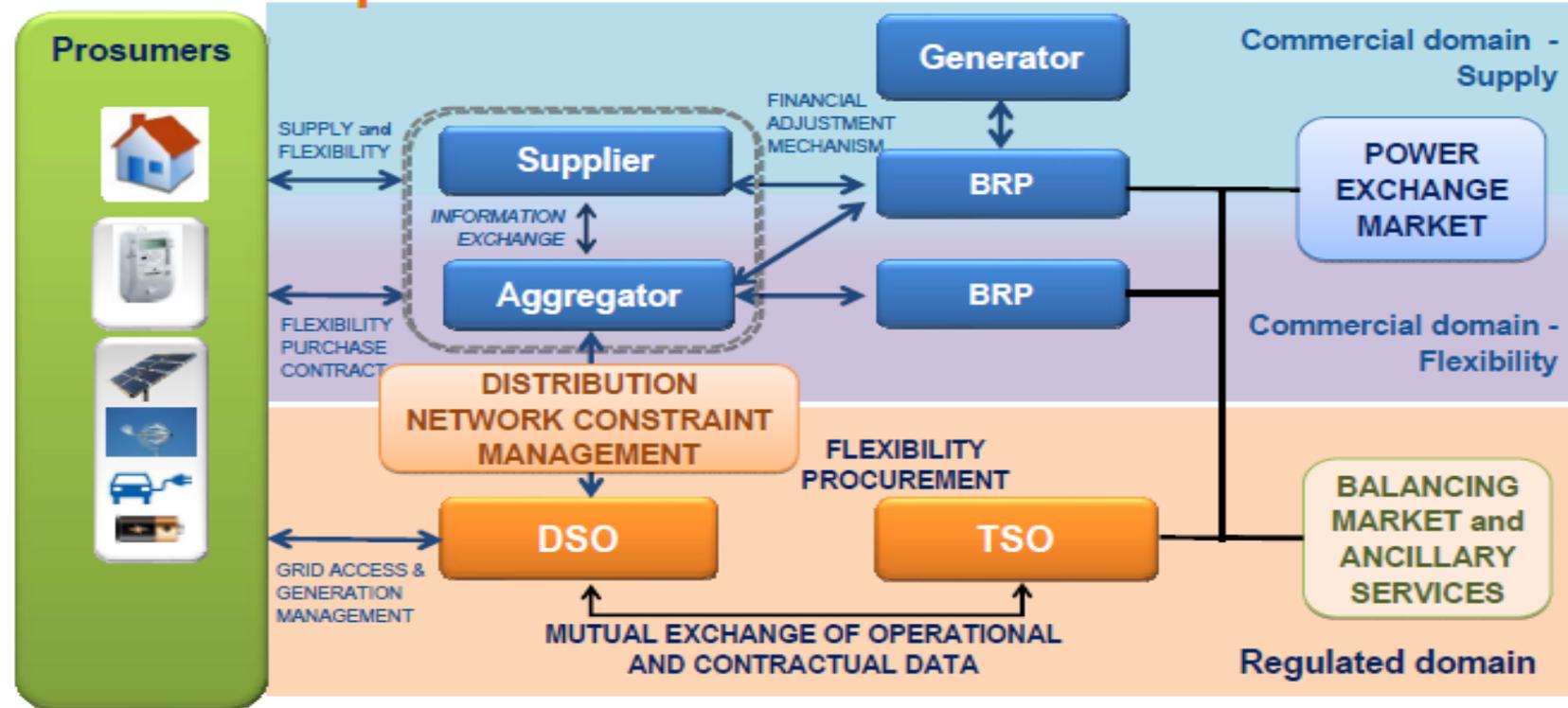
**Interrompibilitat**

---

# Agregadora



## EG3: potential relations between actors



**Propuesta del Operador del Sistema de “*Terms and Conditions*” (T&C) para “*Balancing Service Providers*” (BSP) y “*Balance Responsible Parties*” (BRP) en el sistema eléctrico peninsular español**

## Consulta REE

<b>Término en inglés</b>	<b>Término en español</b>	<b>Concepto conforme a la normativa vigente</b>
<b><i>Balancing Service Provider (BSP)</i></b>	Proveedor de servicios de balance	Sujeto proveedor de servicios de balance
<b><i>Balance Responsible Party (BRP)</i></b>	Sujeto de liquidación responsable del balance	Sujeto de liquidación responsable de los desvíos y de la liquidación de las energías de balance
<b><i>Imbalance adjustment</i></b>	Ajuste del desvío	Suma de las transacciones de energía en los mercados de ajuste del sistema posteriores al PHF (gestión de desvíos, terciaria, secundaria, restricciones en tiempo real y órdenes de interrumpibilidad)
<b><i>Allocated volume</i></b>	Volumen asignado	Medida asignada a un sujeto de liquidación

## Consulta REE

<b><i>Final position</i></b>	Posición final	Programa horario final (PHF)
<b><i>Imbalance</i></b>	Desvío	Desvío
<b><i>Connection</i></b>	Punto frontera	Punto frontera
<b><i>Replacement reserves</i></b>	Reservas de sustitución	Energía de gestión de desvíos
<b><i>Manual frequency restoration reserve</i></b>	Reservas manuales de recuperación de la frecuencia	Energía de regulación terciaria
<b><i>Automatic frequency restoration reserve</i></b>	Reservas automáticas de recuperación de la frecuencia	Energía de regulación secundaria

## Artículo 5

### Servicios de balance

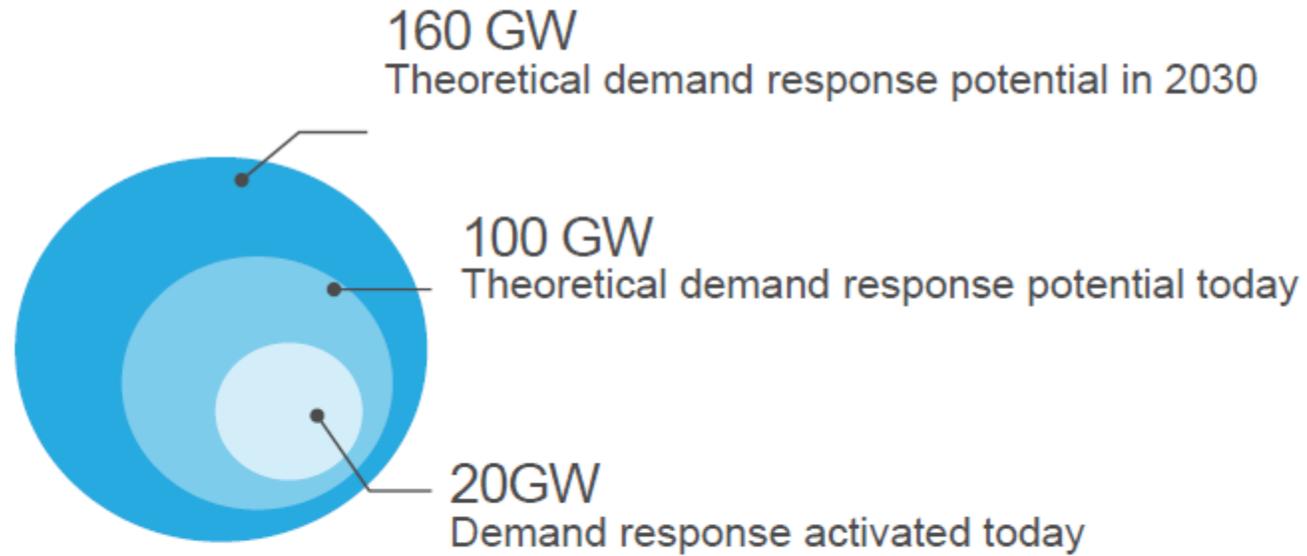
1. A efectos del presente documento, los productos de balance “*Replacement Reserve*” (RR), “*automatic Frequency Restoration Reserve*” (aFRR) y “*manual Frequency Restoration Reserve*” (mFRR), se corresponderán con los actuales servicios de balance de gestión de desvíos generación-consumo (referenciado en adelante como “servicio de gestión de desvíos”), regulación secundaria y regulación terciaria, respectivamente.

## Artículo 2

### Requisitos para convertirse en BRP (Art 18.6.b de la GL EB)

1. Podrán ser BRP los titulares de instalaciones de producción, los comercializadores, los consumidores directos, los gestores de carga, los comercializadores que hayan suscrito un contrato con otras comercializadoras para ser BRP de sus puntos frontera y los representantes en nombre propio y por cuenta ajena de los anteriores en los términos y condiciones establecidos en los procedimientos de operación.
2. Cada BSP será automáticamente el BRP de todas sus unidades de programación que no estén integradas en una zona de regulación.
3. El sujeto titular de una zona de regulación será el BRP de los puntos frontera de todas y cada una de las unidades de programación integradas en dicha zona de regulación.

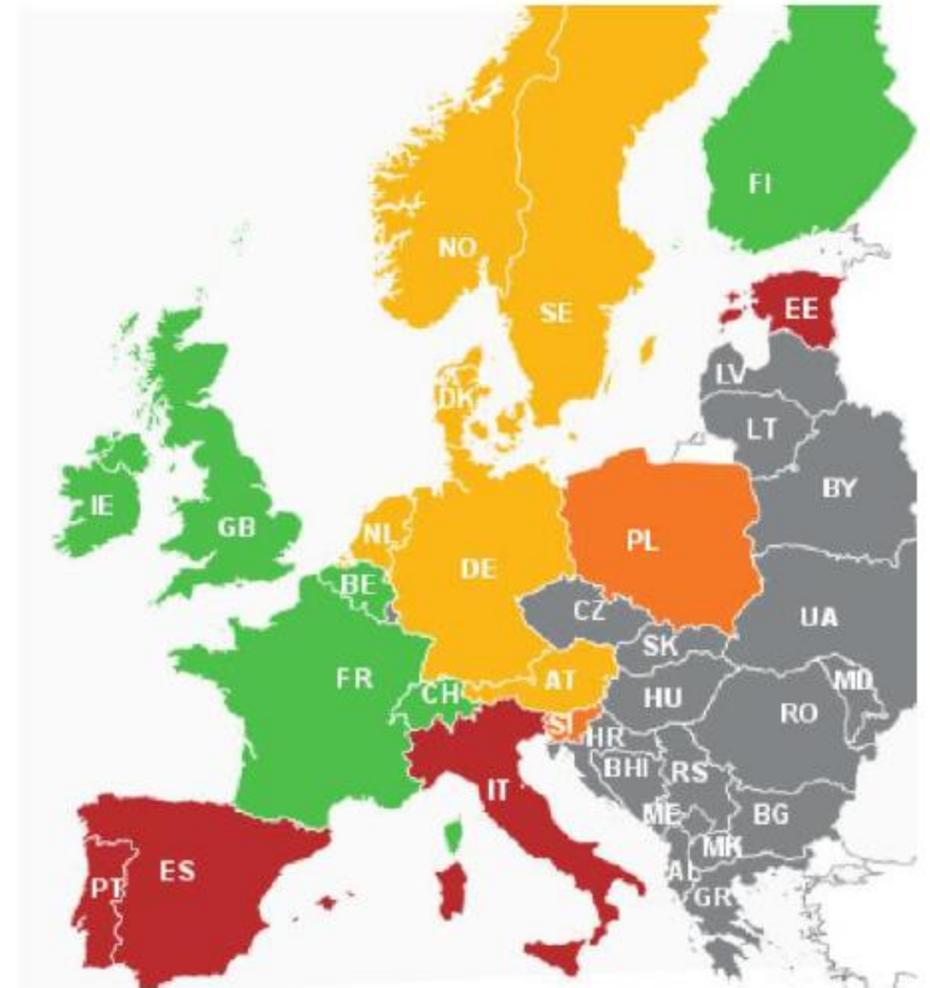
# Demand Response Potentials in Europe



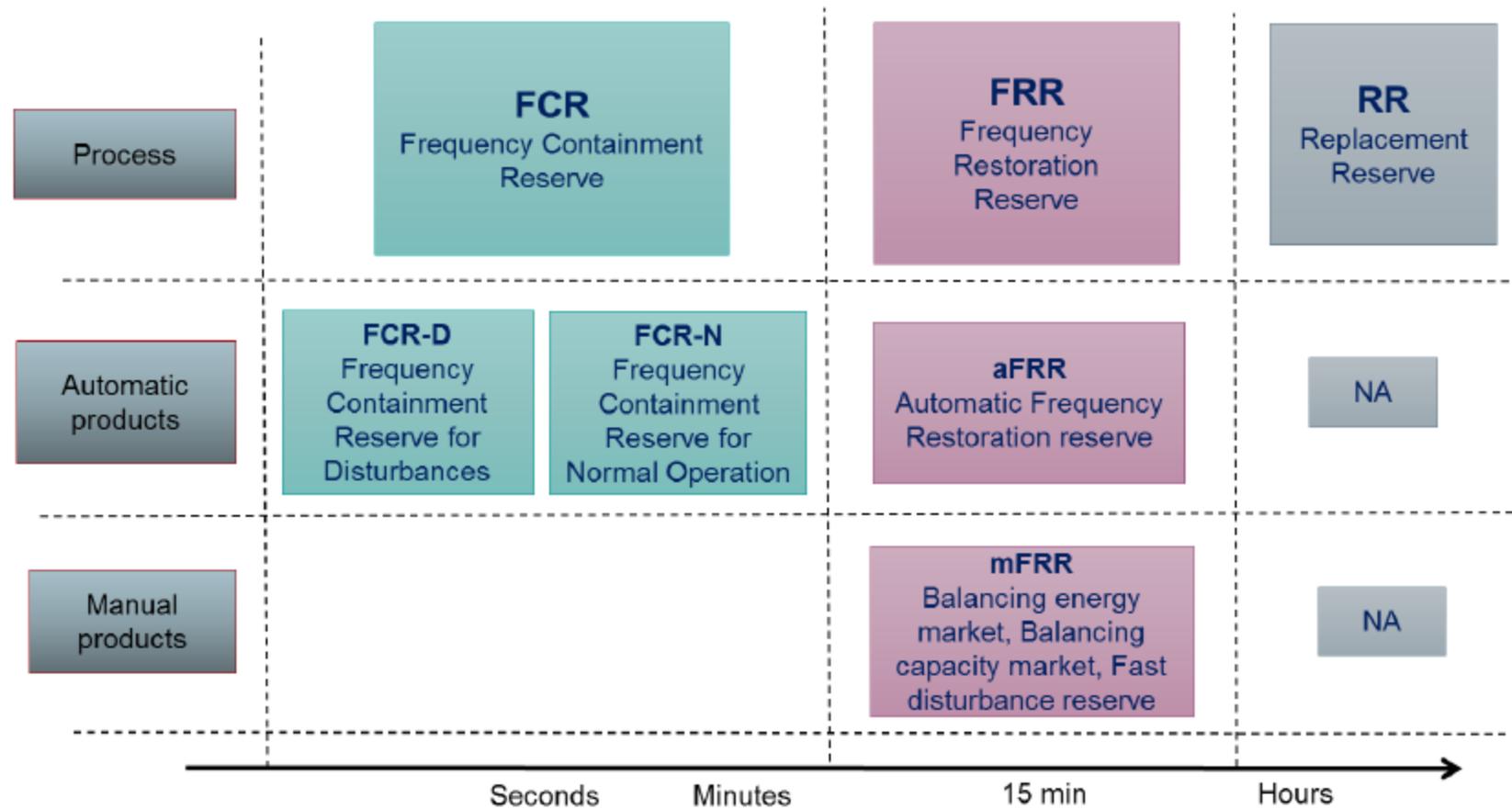
## Example:

Regulatory conditions for Explicit  
DR in Europe today - *SEDC*  
*Demand Response Map*

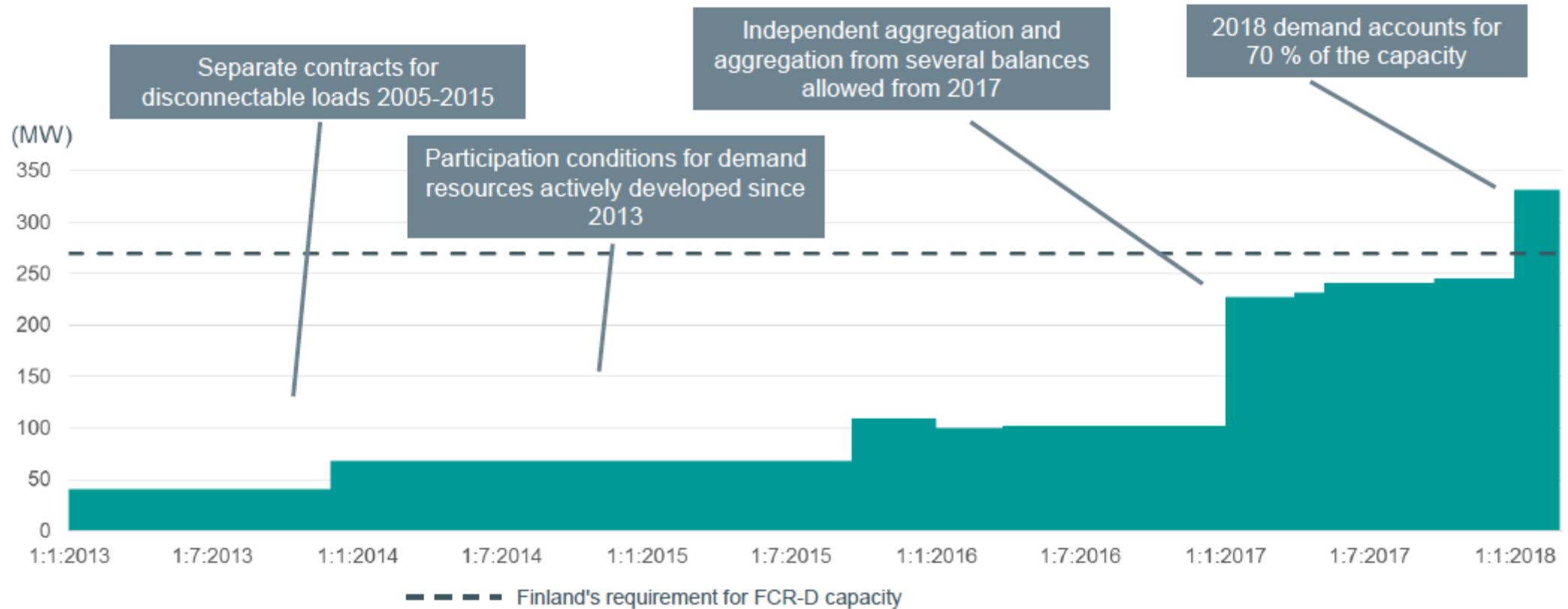
- Commercially active
- Partial opening
- Preliminary development
- Closed
- Not assessed



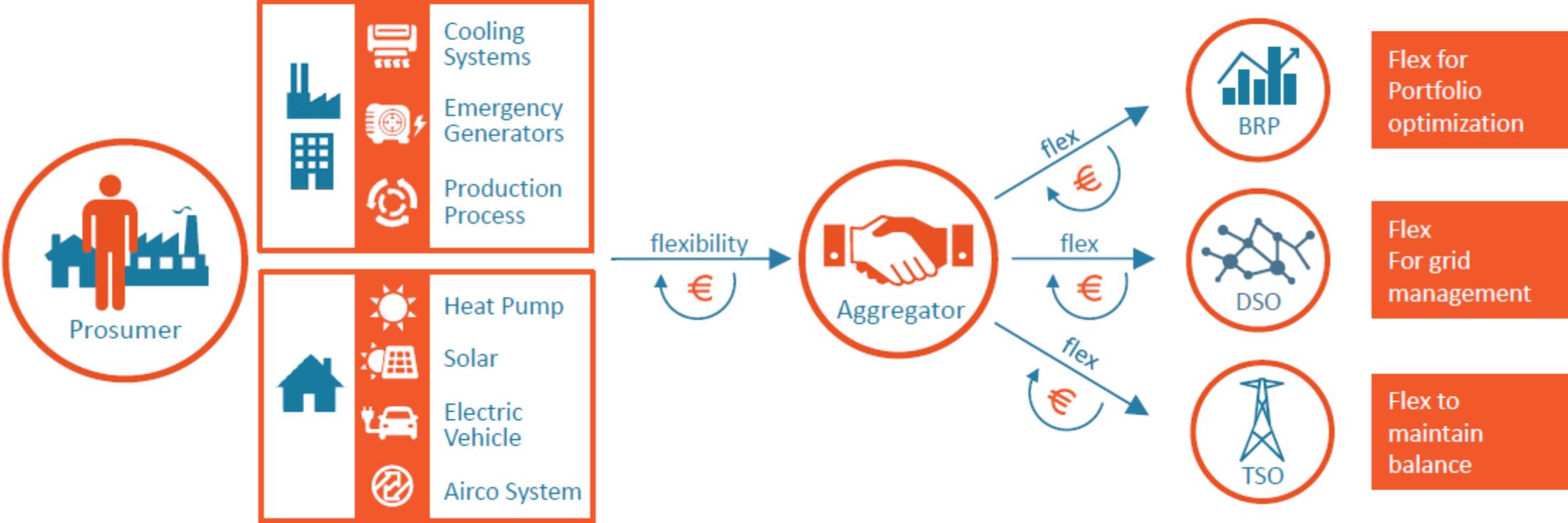
# Reserve products in the Nordic power system



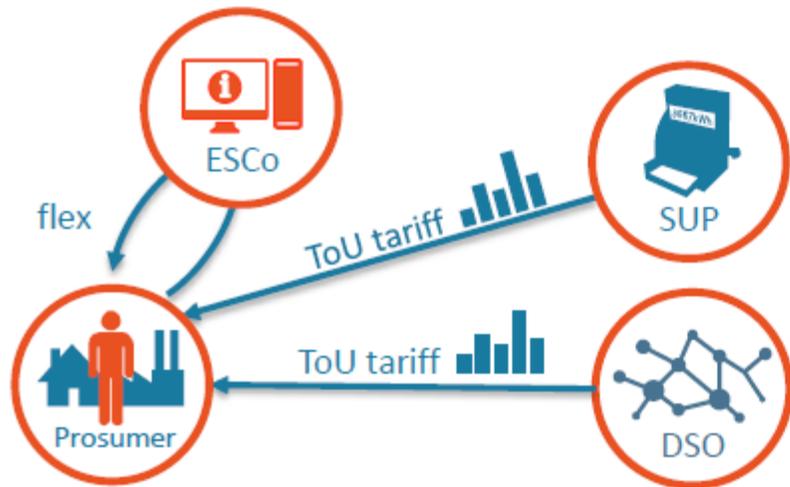
# Development of demand capacity in FCR-D



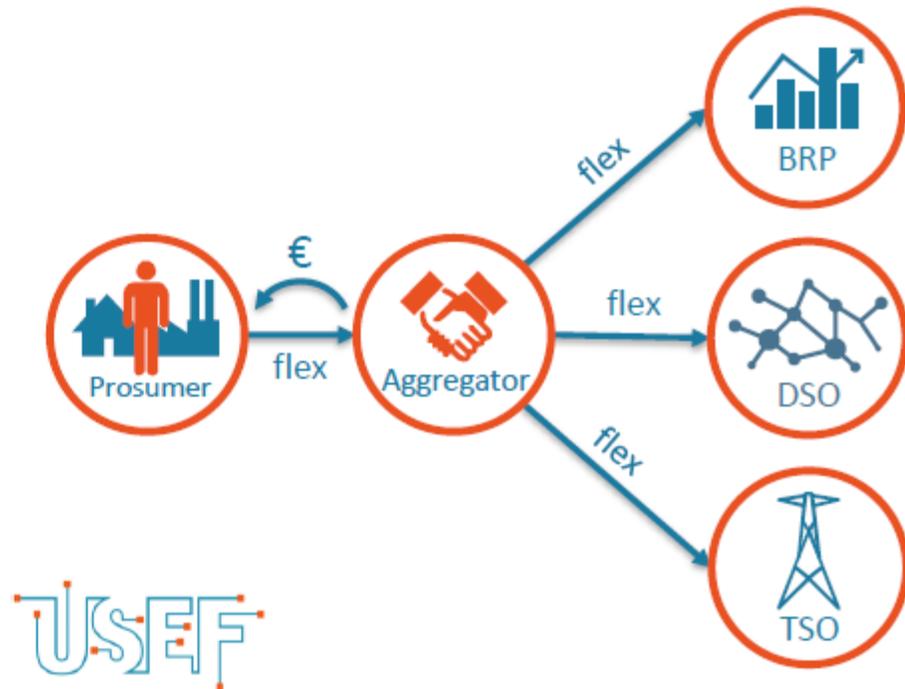
# How is value created from flexibility? A central role for the aggregator

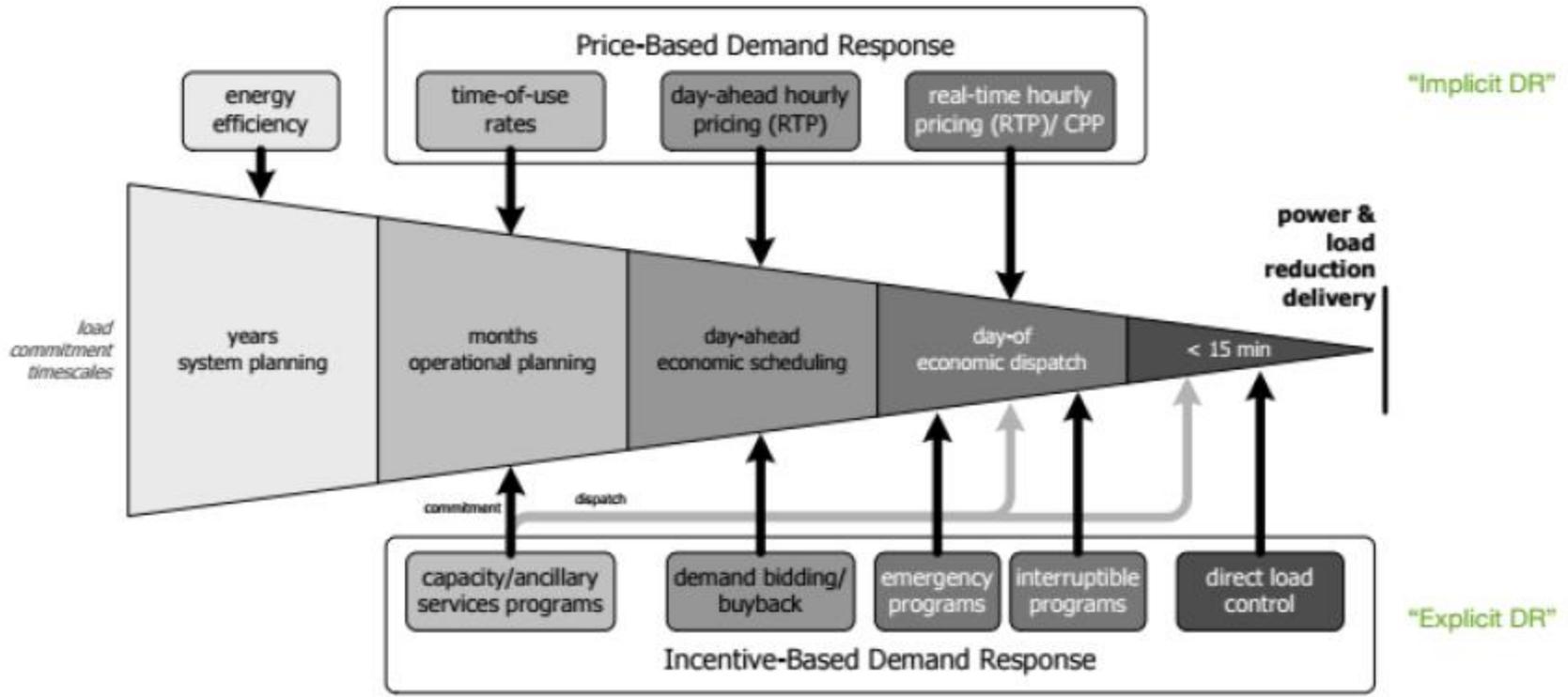


## implicit Demand Response



## explicit Demand Response





# USEF 2.0

## Explicit flexibility value chain



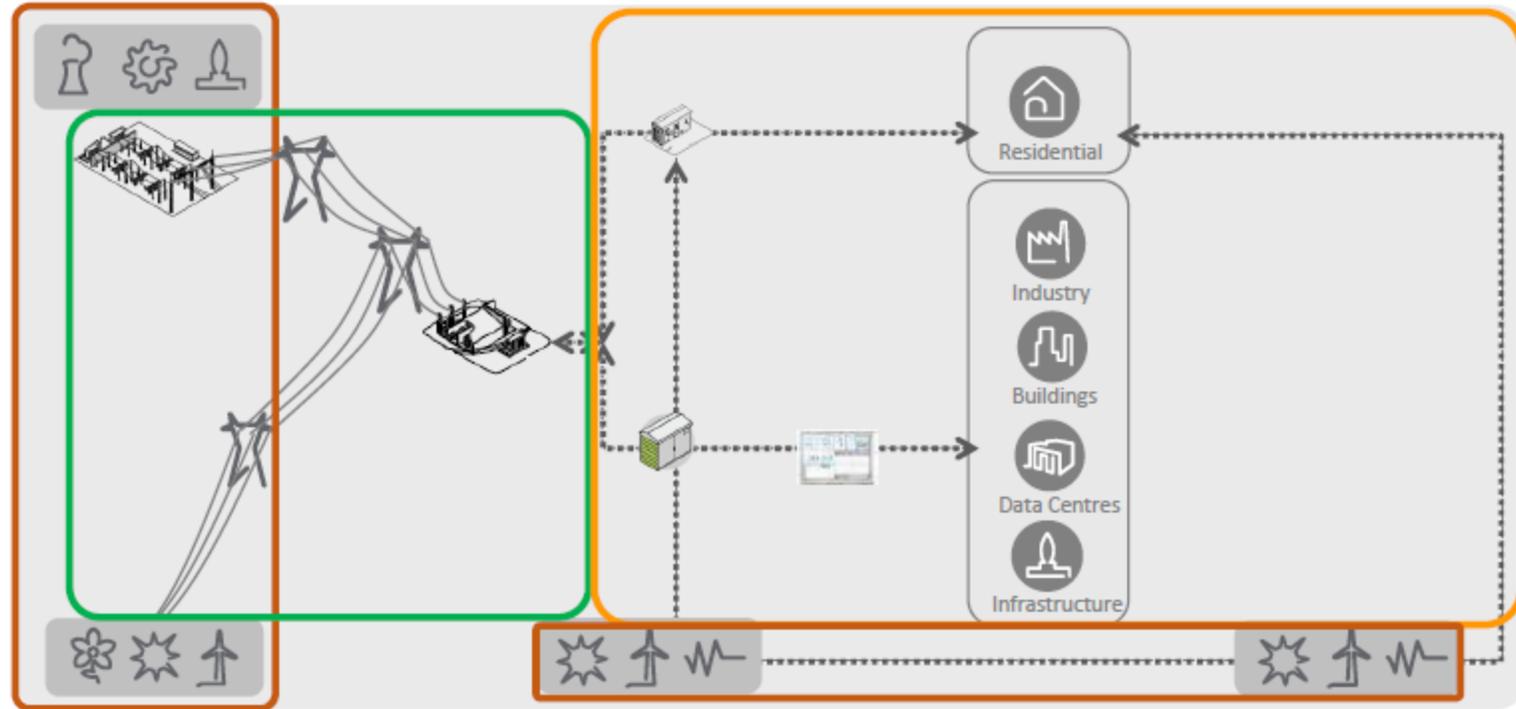
Category	Remuneration	Service
Constraint management	H	Voltage control
	H	Congestion management
	H	Grid capacity management
	H	Redundancy (n-1) support
	H	Controlled Islanding
Adequacy	C	Capacity payments
	C	National capacity markets
	H	Strategic reserve
	H	Hedging
Wholesale	E	Day ahead optimization
	E	Intraday optimization
	E	Self/passive balancing
	E	Generation optimization
Balancing	C	FCR
	E	aFRR
	E	mFRR
	H	RR



Remuneration	
E	energy only
C	capacity only
H	capacity & energy

## Demand Response aggregation by Energy Pool

### Demand Response within the Smart Grid



Supply-side  
management



Network  
Management



Demand-side  
management

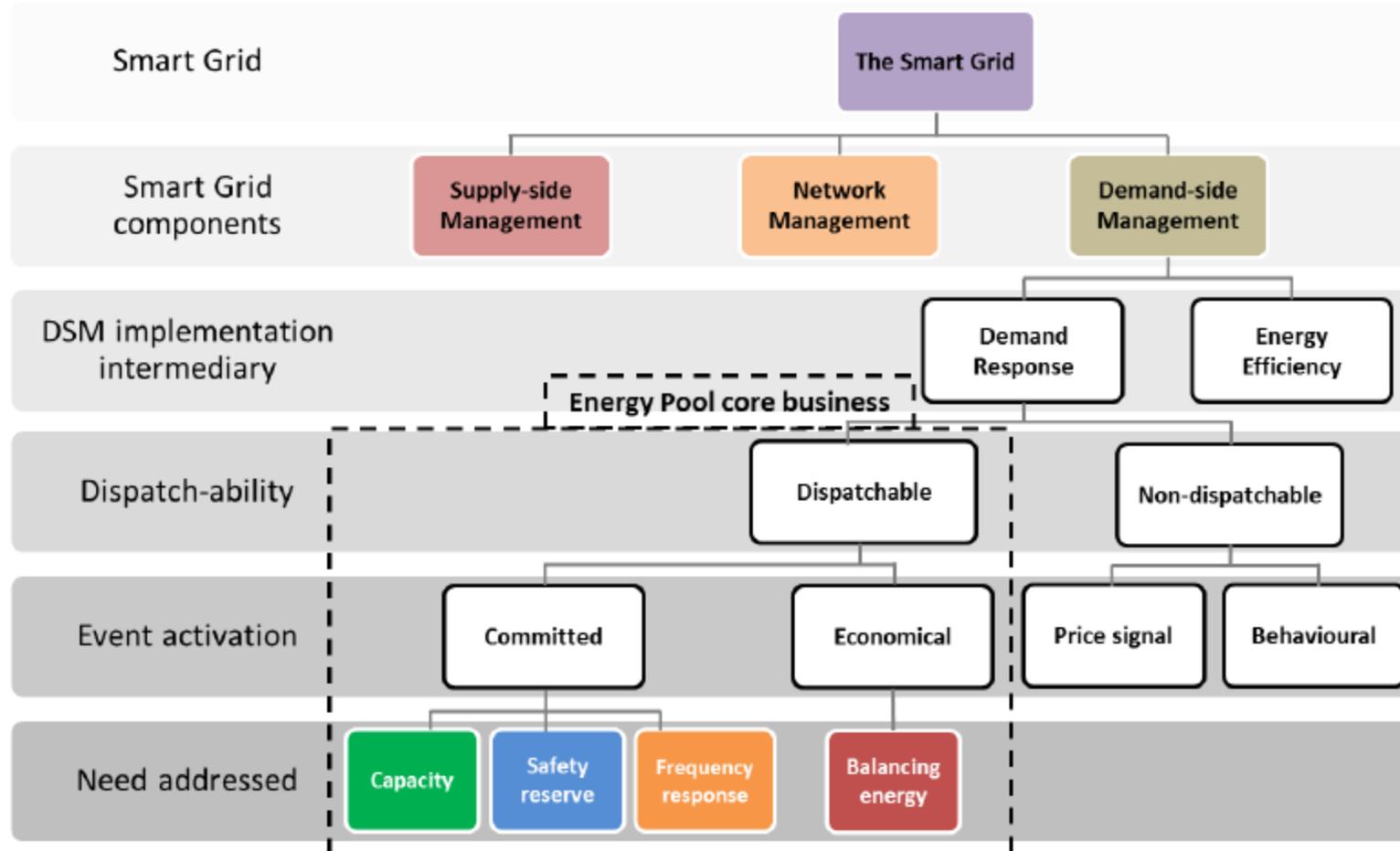


The  
Smart Grid



## Demand Response aggregation by Energy Pool

### Demand Response within the Smart Grid



## Demand Response aggregation by Energy Pool

DR resources : electricity consumers

Energy Pool core business

	Industry 	Commercial / Buildings 	Residential 
Individual curtailment capacities	Large	Small	Very small
Speed of implementation	Fast	Medium	Slow to medium (Private vs. Meter roll-out)
MW acquisition cost	Low	Medium	High
Annual availability	8000 h/ year	1000-8000 h/year	Less than 1000 h/ year
End-user priority	Production schedule, orders	Customer service	Comfort, health
Curtailable process complexity	High	Low	Low

## Demand Response aggregation by Energy Pool

DR resources : electricity consumers



### Electro-intensive industry

Steel, cement, aluminum, industrial gas, chemicals, metallurgical or chemical electrolysis, pulp & paper...



On-site generation



Food industry



Cold storage



Combined heat & power



Water treatment & distribution



Hospitals



Data centers



Air conditioning

## Demand Response aggregation by Energy Pool

### Role of the Demand Response aggregator

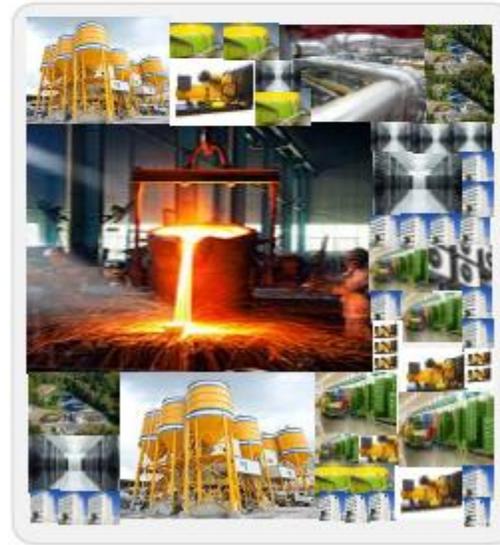
Demand Response is green, cost effective and as reliable as electricity generation, but requires a specific expertise : This is the role of the aggregator

Dispatching and operating this ...



1 x 200 MW

... is not the same as dealing with this !

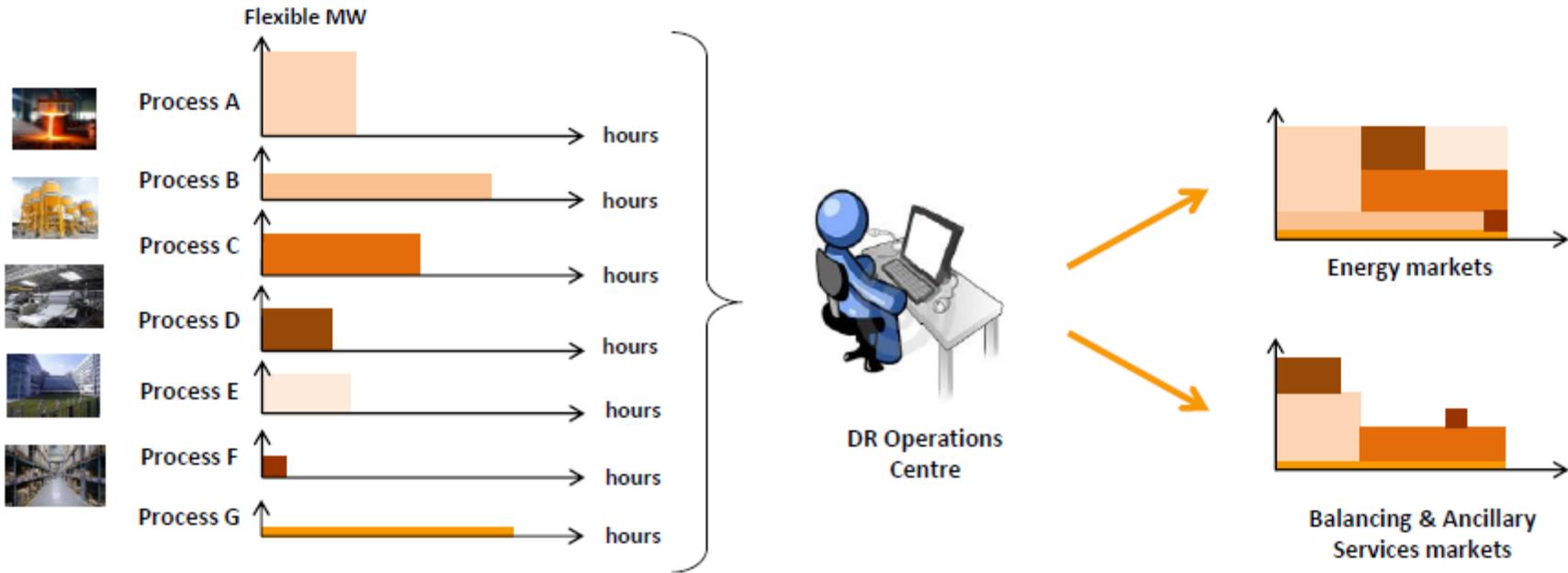


200 x 1 MW

## Demand Response aggregation by Energy Pool

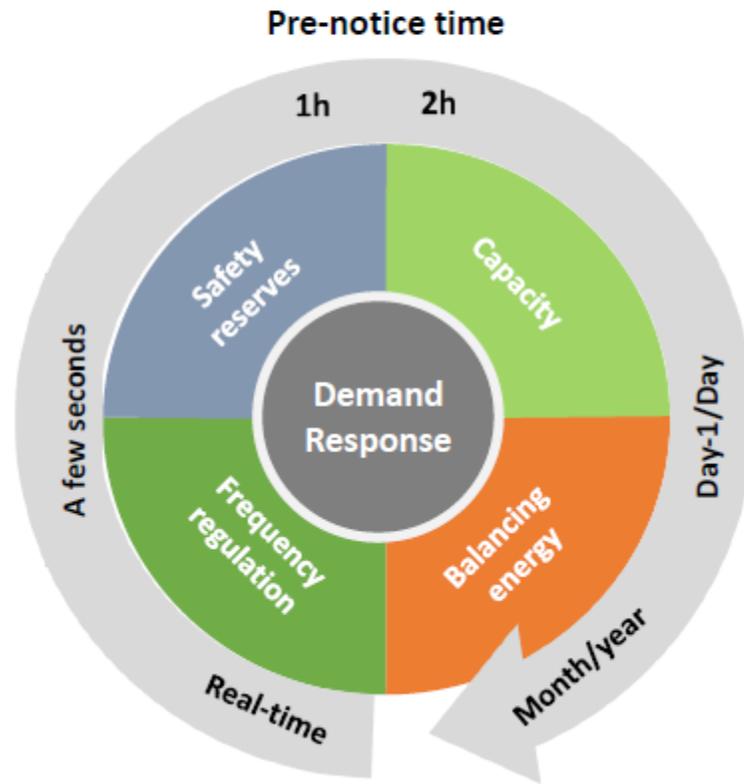
### Role of the Demand Response aggregator

Aggregation increases DR volume and reliability of commitments on the markets, while providing a full optimization of the consumers' loads



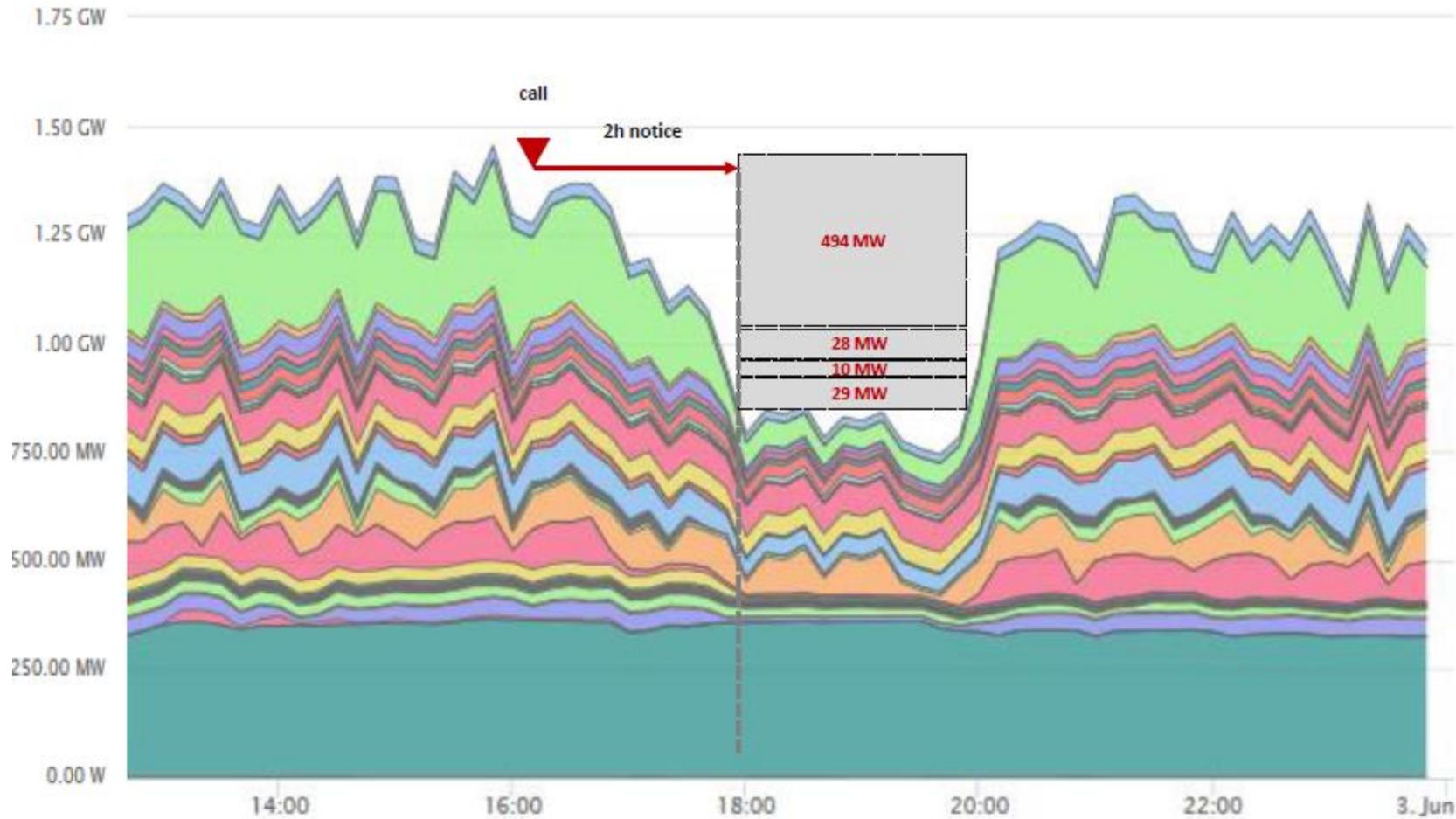
## Demand Response aggregation by Energy Pool

### Services provided by Demand Response



## Examples of DR achievements in Europe

### Case study - European curtailment record on June 2nd 2016



**561 MW** curtailed during 2h = **1,1 GWh**



**46** end-users sites participating



Equivalent to a consumption of **2 244 000** inhabitants



**673 tons** of CO<sub>2</sub> saved

	Perception	What the aggregation can bring
Loss of control?	<i>"Automated Demand Response implies that REstore, a third party, acquires direct control over our office building / plant"</i>	<ul style="list-style-type: none"> <li>■ REstore never takes direct control on plant machinery or building equipment.</li> <li>■ REstore merely sends <i>requests</i>, which can be accepted /rejected by the consumer's building management system, based on pre-agreed industrial boundaries</li> </ul>
No flexible power available?	<i>"We do not have any flexible power at hand in our building / plant"</i>	<ul style="list-style-type: none"> <li>■ REstore has a team of Industry Experts that actively work with Plant Managers to identify flexible power.</li> <li>■ Depending on what he assets can do, different products / values can be foreseen</li> </ul>
Plant output affected?	<i>"Any activation of flexible power would reduce the output of the manufacturing plant/reduce its utilisation rate"</i>	<ul style="list-style-type: none"> <li>■ REstore typically contracts plant machinery which is not a bottleneck process. Curtailment of such machinery will therefore not effect plant output</li> </ul>

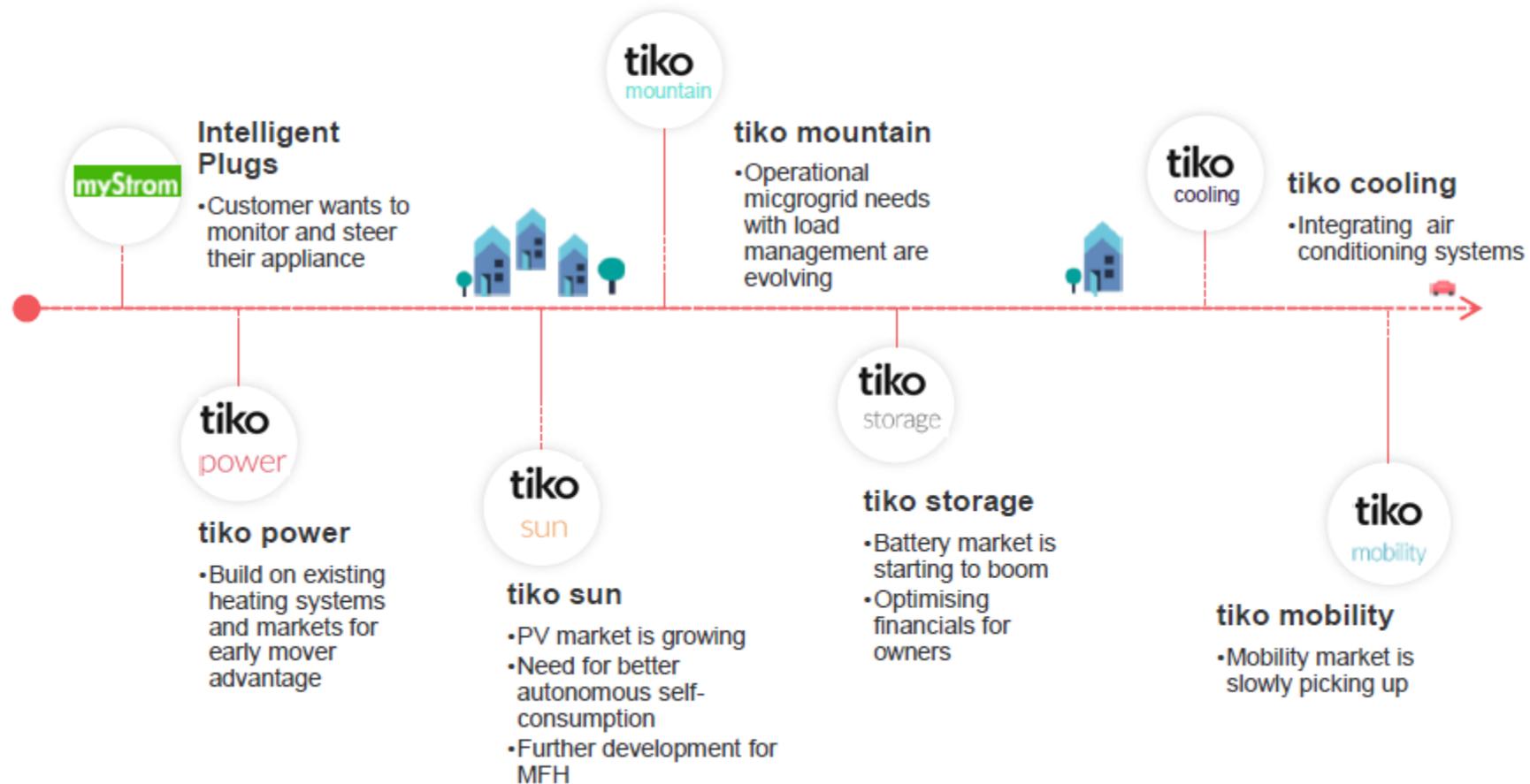
# tiko: a flexible, industrial grade, real-time platform

more than 100 different device suppliers connected



# tiko grows its solutions line along market development

Growing the platform through connection of any kind of electrical devices



## Hardware – easy and fast to install

### Communication module

- Secure 3G connectivity
- Ethernet connection possible
- Socket can still be used

Option 1: removable



Option 2: wall mounted



### Control module

- Power
- Wattmeter
- Relay
- Flexibility

Option 1: one piece



Option 2: modular



# The app and web application increases energy efficiency of the customer and creates savings

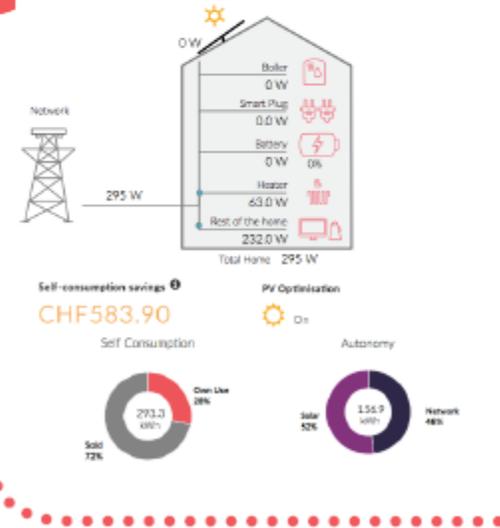
## Visualisation & Alarming



## Savings with remote control



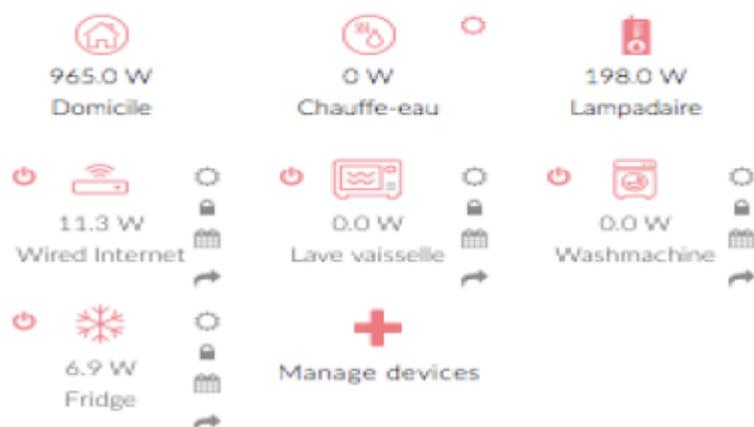
## Self-consumption



# tiko increases customer retention also with...

...small appliances synchronized with PV and comfort per room

## Controlled devices 1



## Sensors



# Aggregating and operating in real time DR for small consumers: on-site connection to various loads

» Open to many end-devices

Local Hardware...

COMMUNICATION PILOT  
(BluePod®)



MODULATOR



PLC, Zigbee, Z-Wave, Wifi...

Remote upgrades for new services

... open to many types of end-devices

RESIDENTIAL APPLIANCES



Electric heaters



Boilers



ACs



Thermostats

Home Energy  
Management  
Systems

C&I INSTALLATIONS



HVACs



Rooftops



Chillers



Air Terminal  
Units

Building  
Management  
Systems

OTHERS



EV



Solar Roofs



Storage

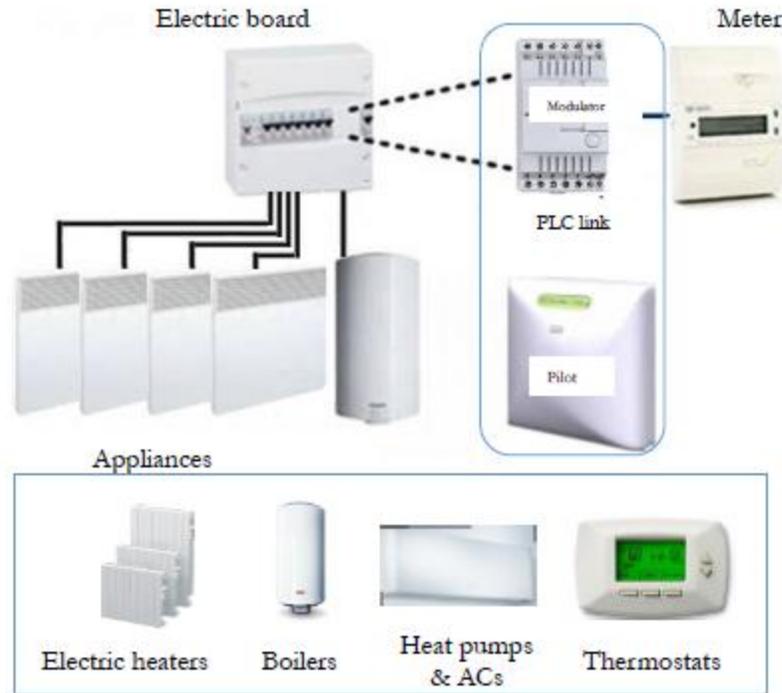


LEDs,  
Sensors

...

# Voltalis for homes

## *The Internet of Electricity*



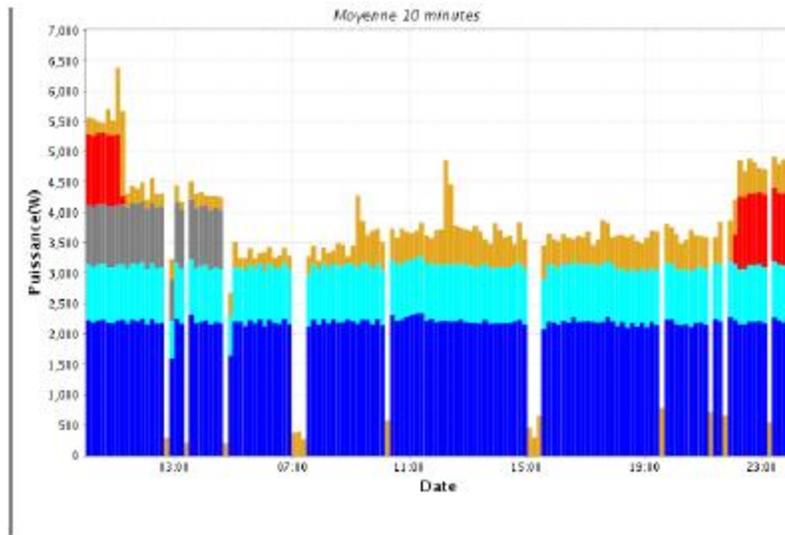
**100,000 homes (and eq.)  
for more than 5 years**

Loads in Spain: e.g. air conditioners,  
heat pumps, water boilers, e-vehicles

- Real time detailed metering
- Distant management and short load curtailments
- Applicable to all flexible loads (HVAC, heat pumps, water pumps, etc.)

# Detailed real-time data for each consumer

- Transparent and available to consumers **for free**



- // Detail per type of use (appliance), here over 24 h
- // Targeted appliances shed
- // A complement to smart meters
- // **Quick adoption, long lasting flexibility**

VOLTALIS

24th April 2018



# Precise Consumption Monitoring

» Smart Information to Empower End-users on their Consumption



# Attractive Offering to End-Consumer

>> Cost savings (with same comfort)

**For Free**



**Friendly Interface**



**Up to 15% Savings**

**Same Comfort**

- Adaptive and precise cycling strategy
- 5 year experience with excellent satisfaction rates

**Eco Friendly**

- **Significant CO<sub>2</sub> emission reduction thanks to avoided generation**
- Zero waste, Zero emission, Zero risk

**Social**

- **Benefits for the grid**
- Reduced risk of blackouts

**... and more services**

Santi Martínez Farrero  
santifarrero@gmail.com