



**Demand side flexibility from households**

**Benefits for all consumers and business**

*Energy transition dialogue in Luxembourg*

*Mondorf, October 24<sup>th</sup>, 2019*

# VOLTALIS

*In a nutshell*

***Making all homes smart free of charge***

## **Large numbers**

- ✓ **100,000+ boxes** in homes and C&I sites (offices, retail,...)
- ✓ **1 million connected appliances**
- ✓ **400+ municipalities & landlords as partners**

## **Big Data in real time**

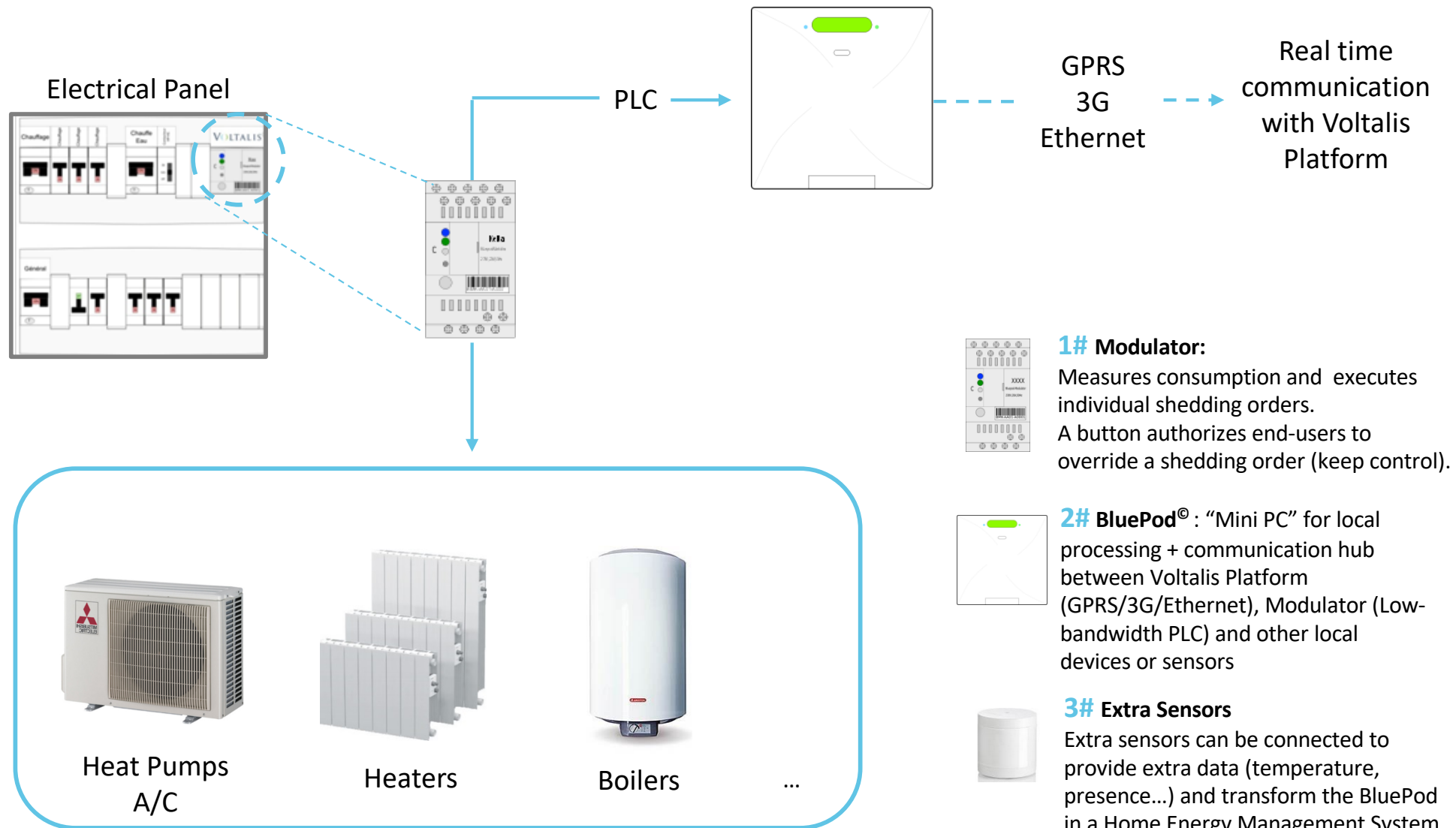
- ✓ **1 billion data** collected / processed in real time everyday
- ✓ **4+ billion individual shedding orders** executed
- ✓ **200+ billion entries** in the database

***+200,000 homes coming soon***

***The only large scale residential demand control operator***

# Any household with flexible loads to participate

» Typical installation in a home to make it smart **today**

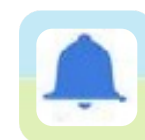


# For End-Users: Savings & HEMS

» Friendly personal interface & services for each end-user



Monitoring – Comparison - Advice



Alerts



Heat up only  
if at home



Virtual Smart  
Thermostat



Home Power  
Balancer



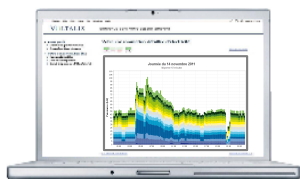
Price Plans  
TOU



# Attractive Solution for Households

» Cost savings (with same comfort) \_\_\_\_\_

## Contribute to the Energy Transition For Free



**Friendly  
Interface**



**Up to 15%  
Savings**

### Same Comfort

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

### Eco Friendly

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

### Solidarity

- Benefits for the grid
- Reduced risk of blackouts
- Better integration of renewables

... and more services

# Votalis Internet of Energy Technology

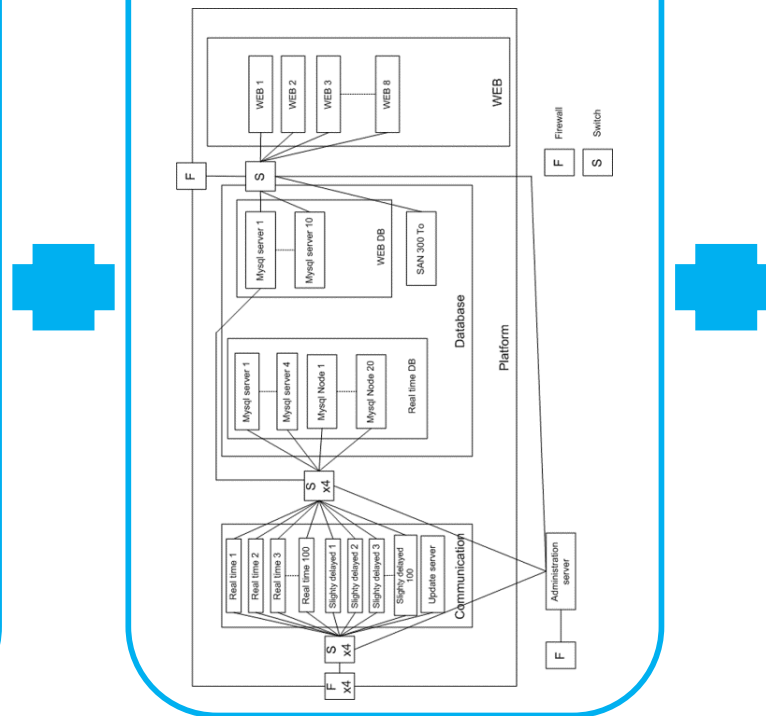
## SMARTBOX



Measure/Action



## PLATFORM



## ALGORITHMS

### Notations

- $G(t)$  (resp  $G^m(t)$ ) is the total unshed load (resp total shed load)
- $G_k(t)$ : normalized unshed load (ie  $G_k(t) \in [0,1]$ ) of water boilers beginning at time  $k$
- forecast  $G^f(t) = \sum \alpha_k G_k^{t-k-1}(t)$

Forecast: shedding of  $(1-x)\%$  of  $G_k(t)$  from times  $t_1$  to  $t_2$  ( $d$  tops)

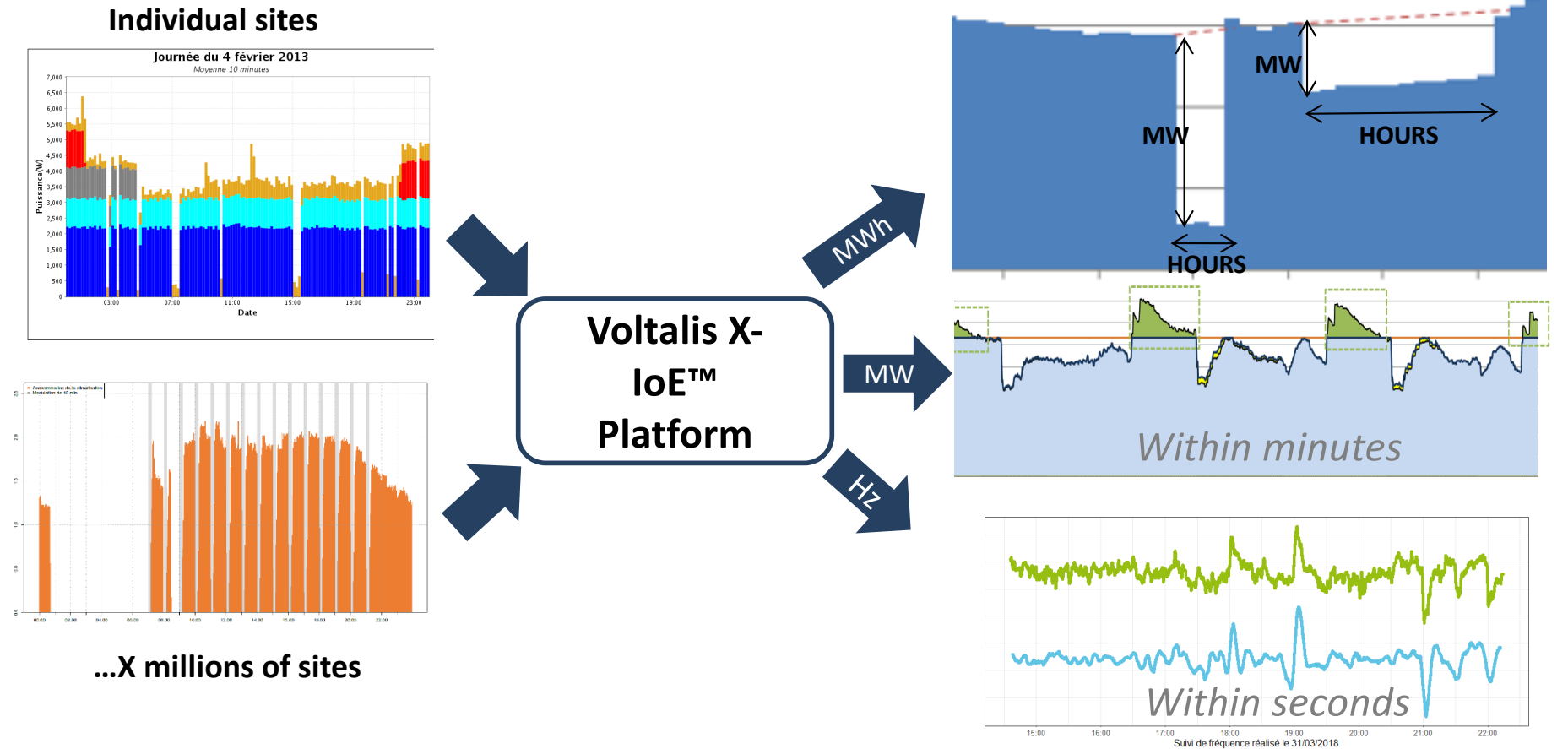
- For  $k > t_1$ , the shedding order has no impact on  $G_k$ :  $G_k^m(t) = G_k(t)$
- Else:
  - $\forall t < t_1, G_k^m(t) = G_k(t)$
  - $\forall t_1 \leq t \leq t_2, G_k^m(t) = x G_k(t)$
  - $\forall t > t_2, G_k(t) = x G_k(t) + (1-x) G_k(t-d)$

- Responsive
- Global + Local
- Machine Learning

Aggregation of Millions of Appliances - Real Time

# Macro-Aggregation of Micro-Flexibilities

» Covers the needs of the grid and markets on any time scale



Dispatchable

Available

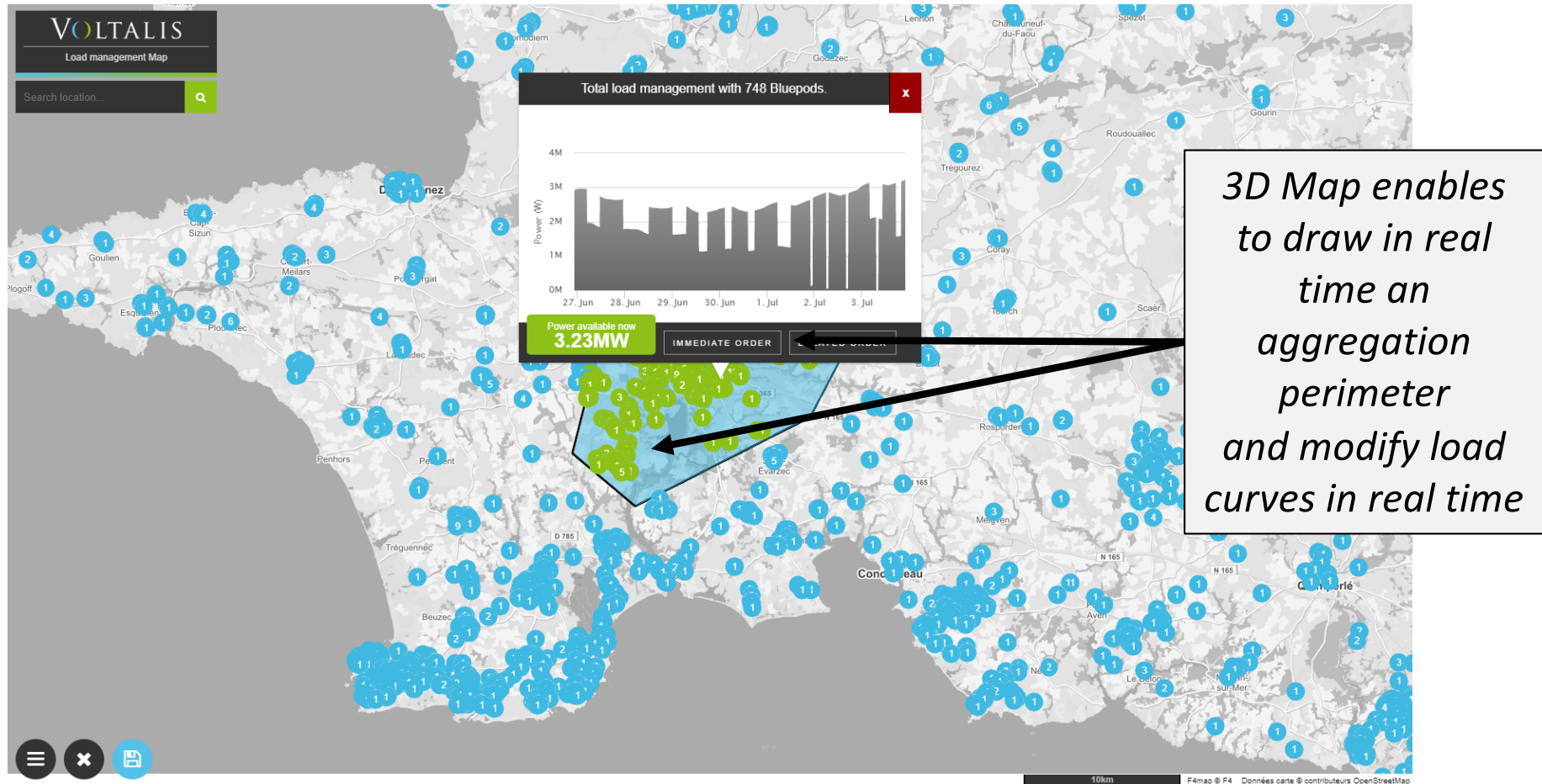
Precise

Zero emission

Alleviates grid const.

# Demand Control as an asset used by T&DSOs

» Aggregation at any Scale: Country, Region, City, Block of Houses...



// Balance intermittencies and solve congestion issues in real time

// Avoids some grid reinforcements that would be rarely used



# Households, or any premises, e-Vs, storage,...

» Turn all smart appliances smart today!

Local Hardware...

## COMMUNICATION PILOT (BluePod®)



- ✓ Gateway
- ✓ « Mini PC » for local computing

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

## MODULATOR



- ✓ 4 submeters (0,5% accuracy)
- ✓ 4 relays

+ Remote upgrades for new services

... open to many types of end-devices

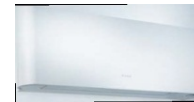
## RESIDENTIAL APPLIANCES



Electric heaters



Boilers



ACs



Thermostats

Home Energy  
Management  
Systems

## C&I INSTALLATIONS



HVACs



Rooftops



Chillers



Air Terminal  
Units

Building  
Management  
Systems

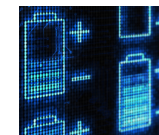
## OTHERS



EV



Solar Roofs



Storage



Sensors

...

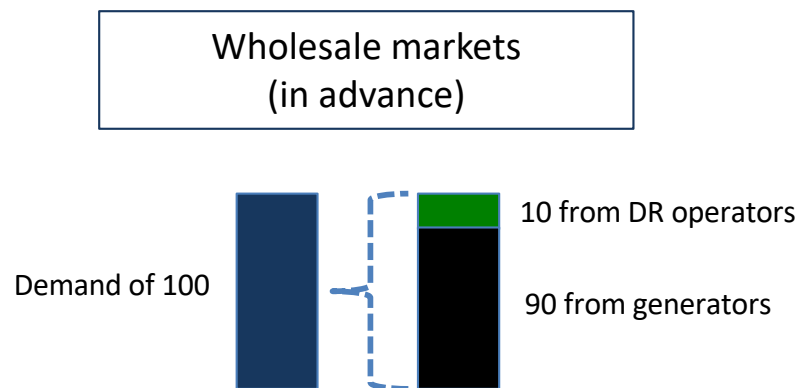
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**DR in the market**

**How to funnel benefits to all**

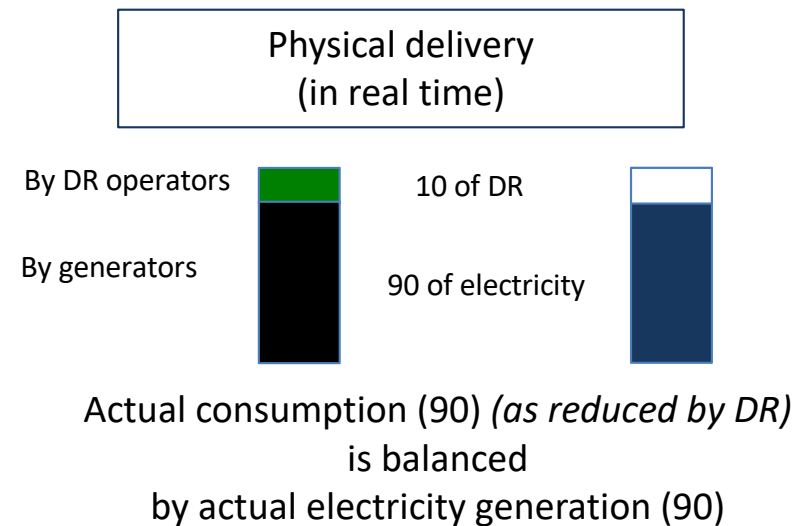
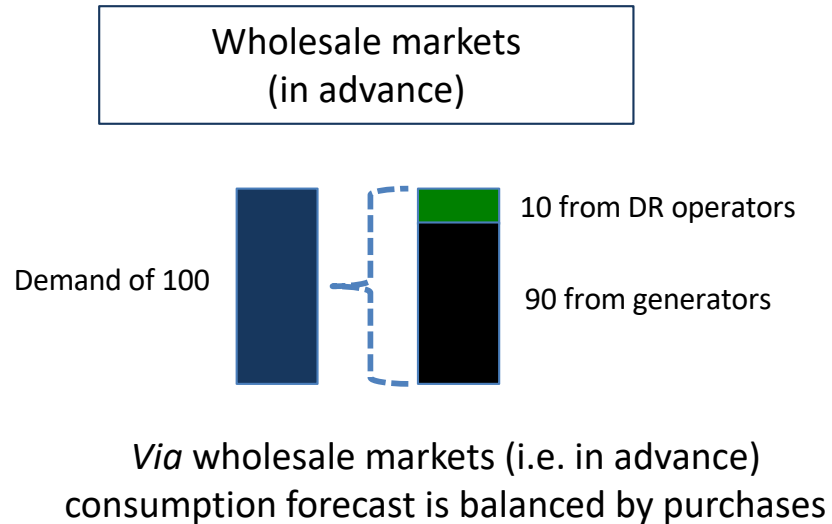
*And thus ensure flexibility will grow and  
ease the energy transition*

# DR in the wholesale markets

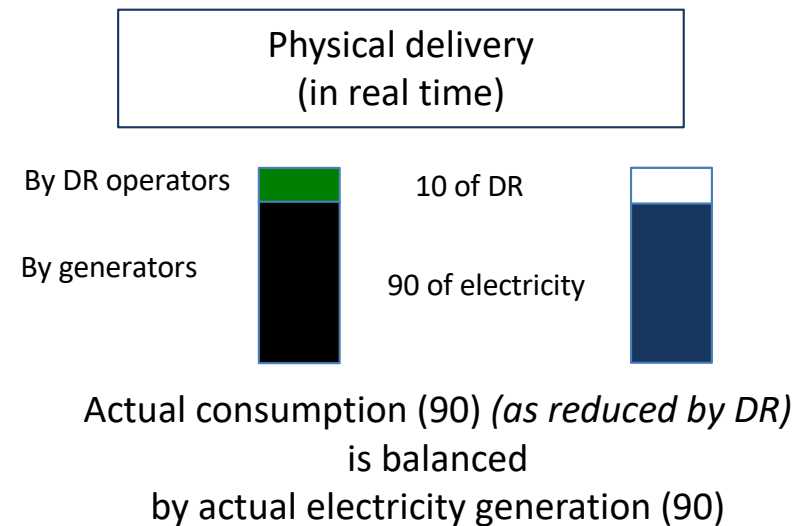
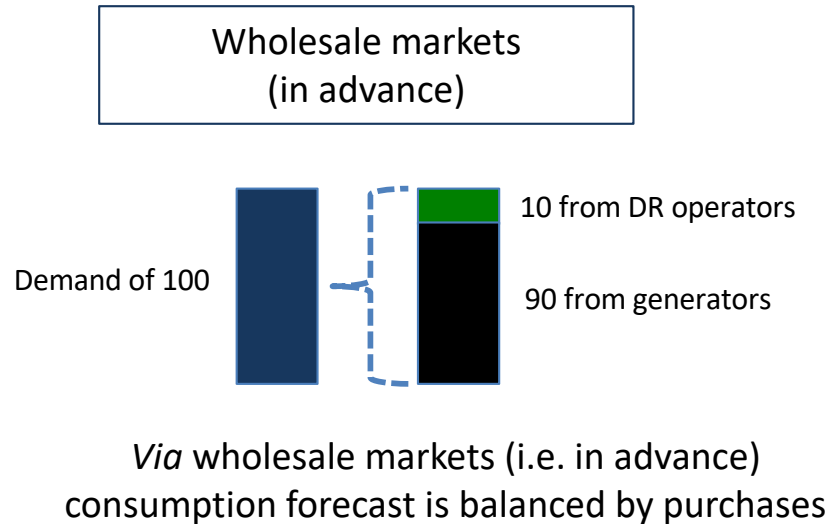


*Via* wholesale markets (i.e. in advance)  
consumption forecast is balanced by purchases

# DR in the wholesale markets

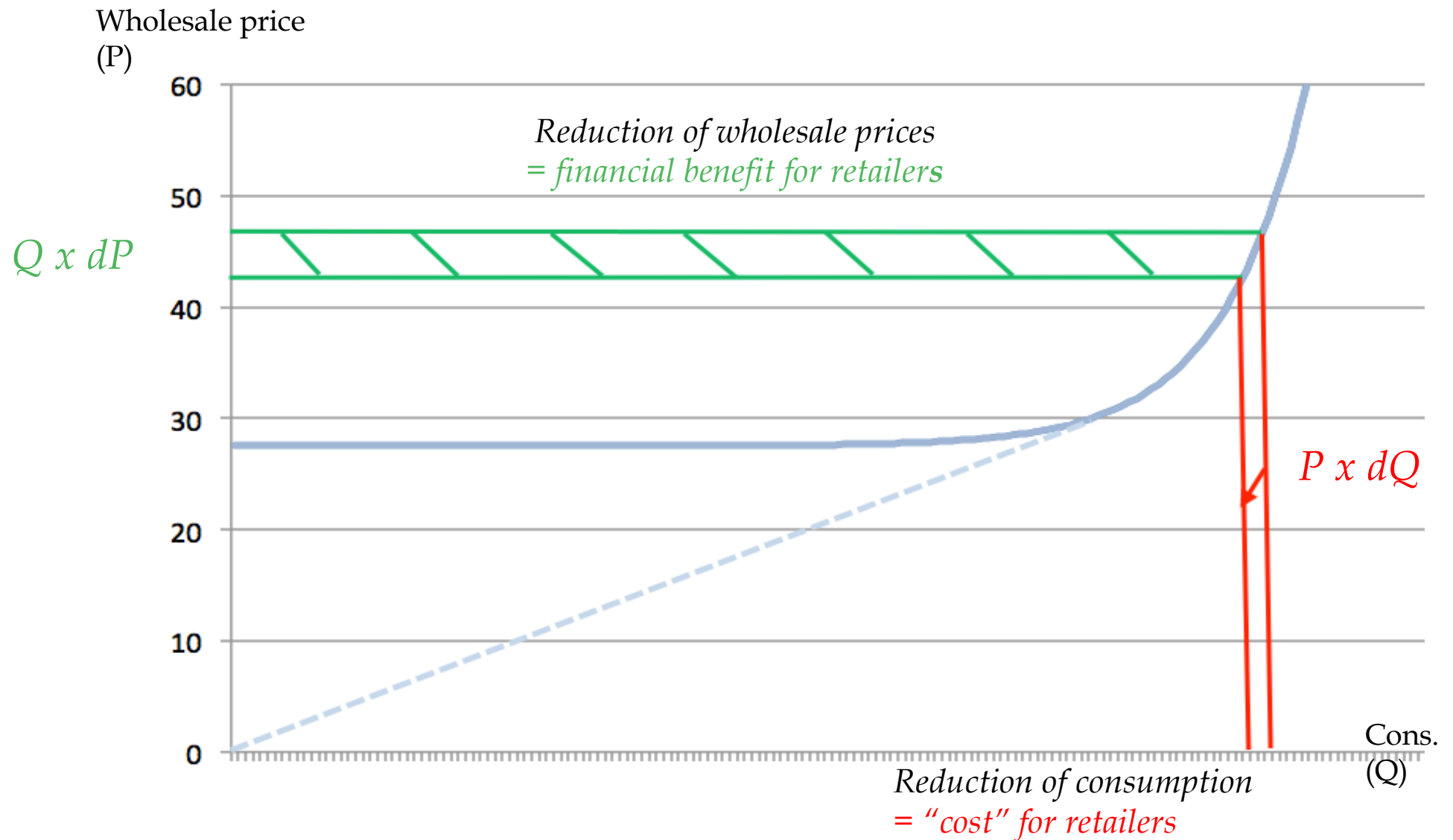


# DR in the wholesale markets



- DR ensures energy is neither generated nor consumed, in two steps
  - DR avoids generation via the market
  - DR reduces consumption physically
- DR ensures balance *instead of* generation
  - DR avoids expensive generation

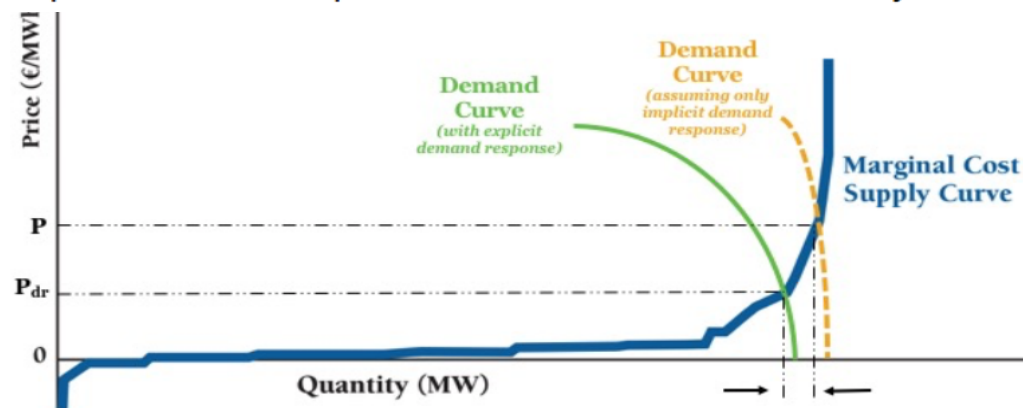
# Selling DR on Energy Markets to Avoid High Prices



# DR in European electricity markets

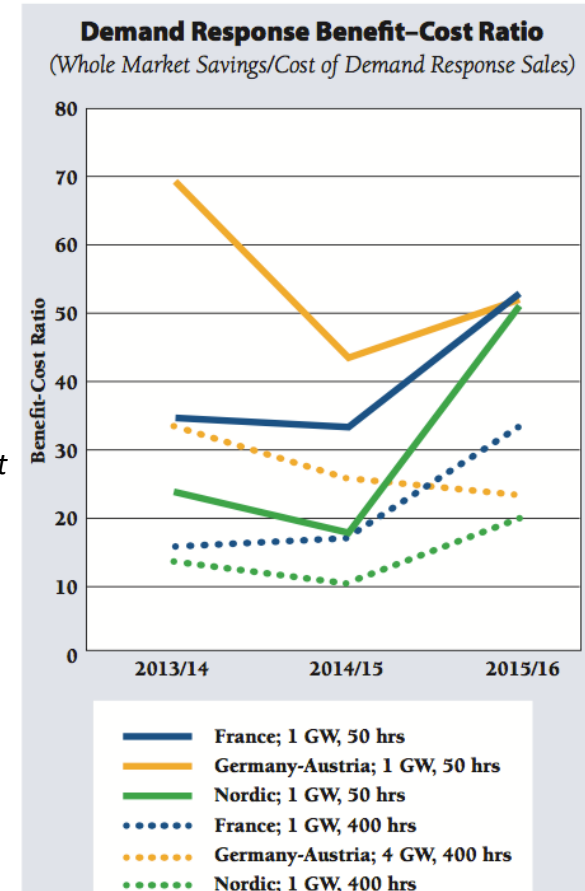
## Benefit / Cost Ratio >> 10

Explicit Demand Response Reduces Wholesale Electricity Prices



Source: The Regulatory Assistance Project

	Market	Year	Average decrease in spot price on application of DR (€/MWh)	Whole market retailer benefit [M€]	Compensation payment to retailers (based on French compensation model) [M€]	DR sales [M€]	Retailer market benefit/ (Cost = DR sales)
400h/1GW	FRA	2013/14	13.01	379.27	28.06	24.68	15.37
		2014/15	11.81	344.57	27.93	20.77	16.59
		2015/16	18.99	515.54	21.42	15.72	32.80
	GER-AUT	2013/14	20	635.83	24.44	19.13	33.24
		2014/15	13.83	458.89	22.66	17.9	25.64
		2015/16	11.29	355.13	18.4	15.58	22.79
	NORDIC	2013/14	7.71	186.32	19.69	14.26	13.07
		2014/15	5.49	135.12	18.08	13.47	10.03
		2015/16	10.21	272.75	14.75	13.98	19.51



Benefits from market-based DR: reduce sourcing costs for retailers

450 GWh/mkt = 1.6 G€/y  
benefits for retailers

# Benefits at the heart of the new market design

## *Consumers' voice paved the way*



### ELECTRICITY AGGREGATORS:

#### STARTING OFF ON THE RIGHT FOOT WITH CONSUMERS

- Consumers should not bear the cost of payments/compensation between suppliers and independent aggregators. If the need for such payments is verified, these should be financed by all market participants benefiting due to the trade of flexibility in the wholesale market.

#### ➤ Compromise found in new Directive (EMD)

- Member States may implement a compensation paid to retailers of curtailed consumers
- Clear distinction between compensation to suppliers versus who pays it
- Compensation should not be a barrier to DR => share among various parties
- How to share taking account of benefits
  - compensation paid by those who benefit directly, i.e. all retailers
  - ... also by DR subject to the **net benefit principle**

Only when and to the extent that benefits to retailers would not exceed costs for retailers

*=> Net benefit for all retailers, to be ultimately transferred to all consumers*



## Demand control offered to hundreds of thousand homes



## Benefits for all Consumers and all Stakeholders



**Thank you!**

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**VOLTALIS**