



DEMAND SIDE RESPONSE A NO REGRET OPTION

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REstore

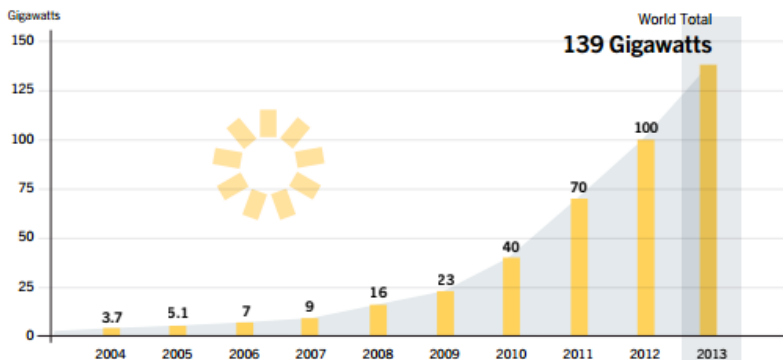
London | Antwerp | Paris

www.restore.eu

Renewables will mostly likely remain part of the solution to tackle climate change and keep growing

SOLAR PV

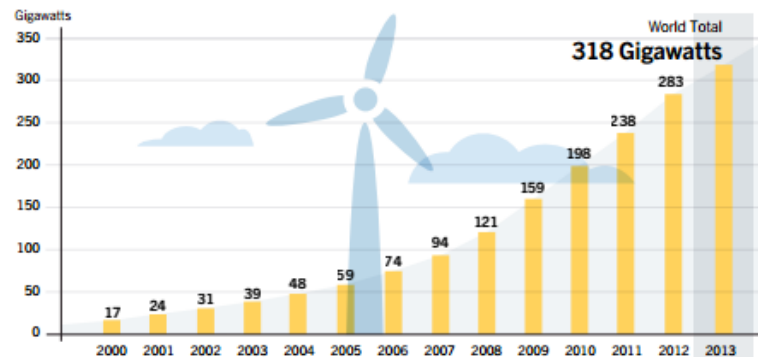
Solar PV Total Global Capacity, 2004–2013



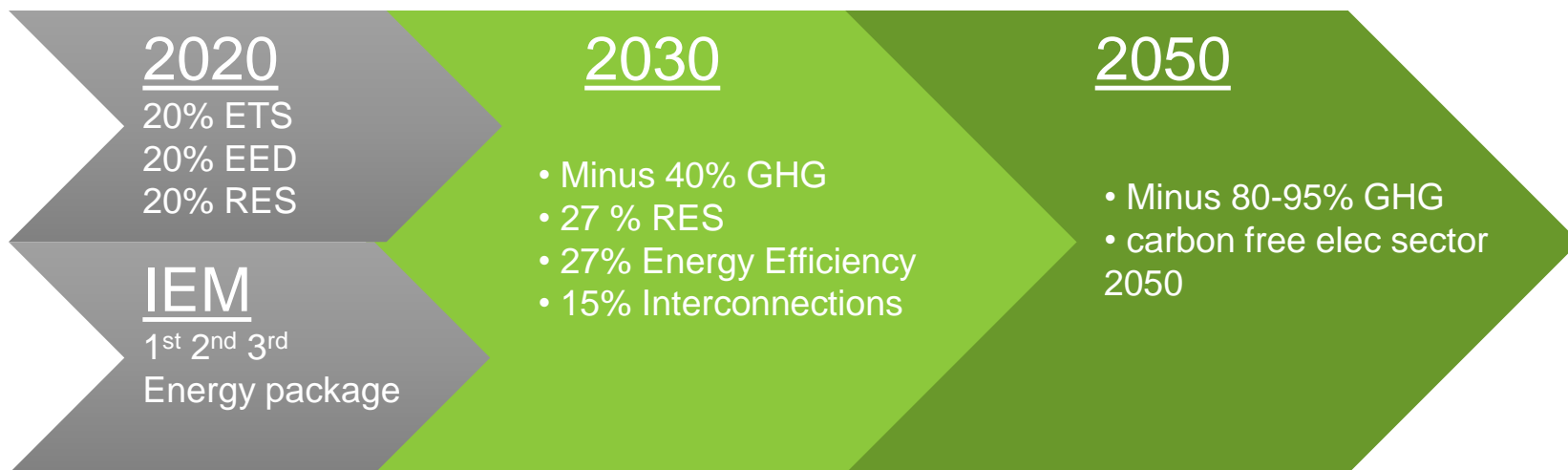
Source: REN21: key findings 2014

WIND POWER

Wind Power Total World Capacity, 2000–2013

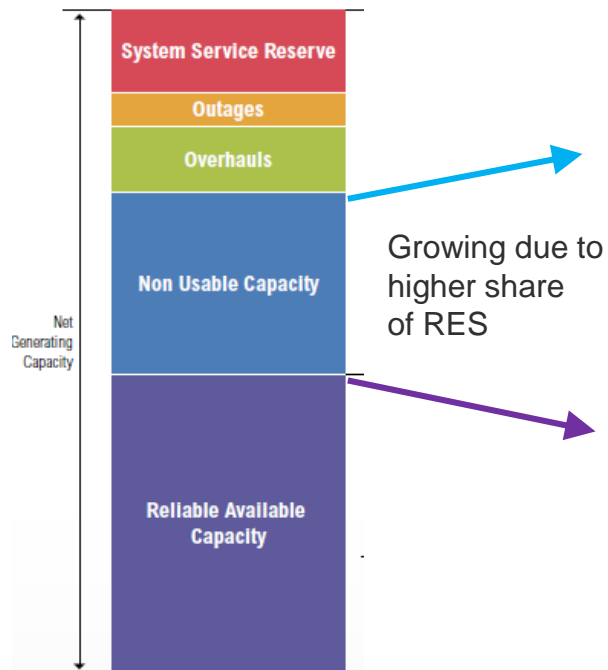


EU Climate & Energy framework



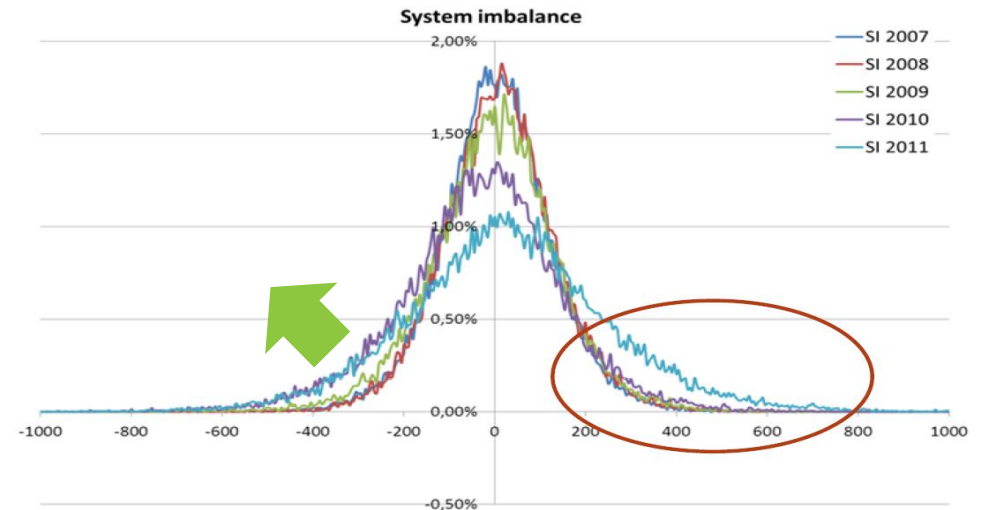
Growing share of renewables leads to several challenges in the electricity system

Long term adequacy Less running hours for reliable capacity



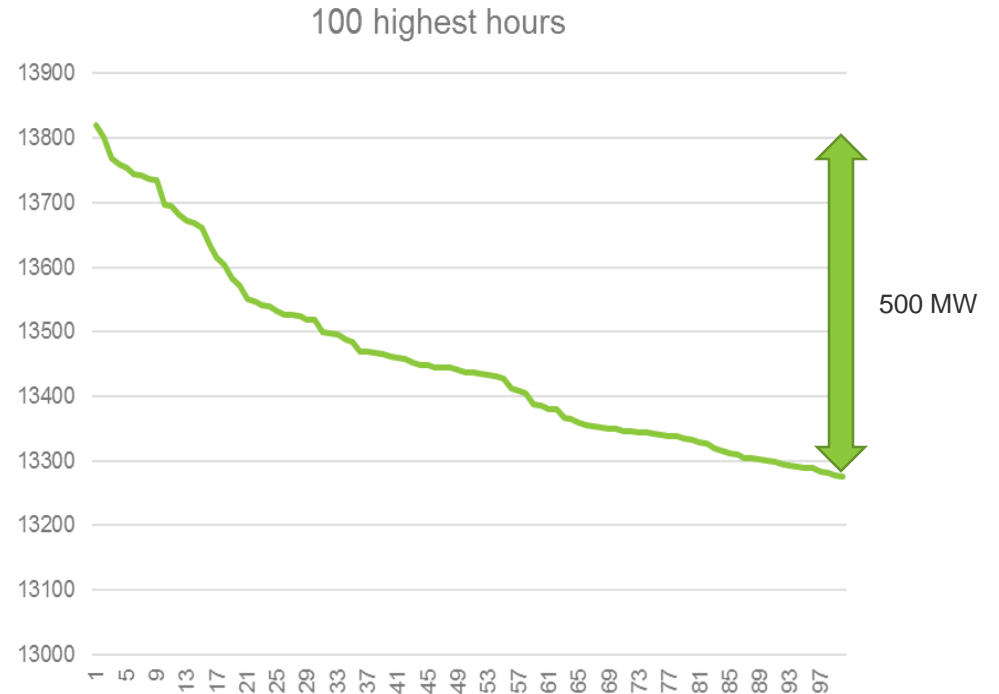
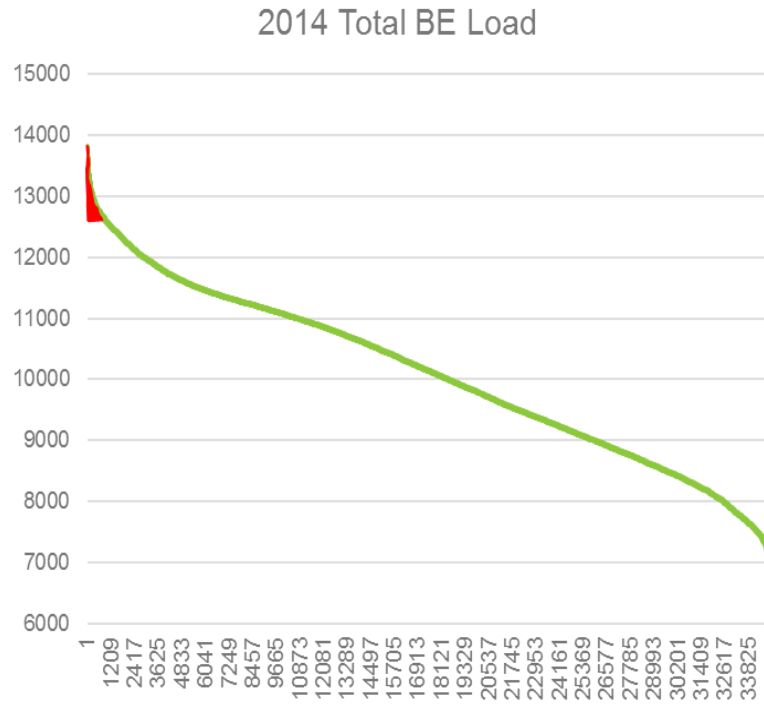
Source: ENTSO-e

Short term balancing Increasing number & size of imbalances...



Source: Elia Group

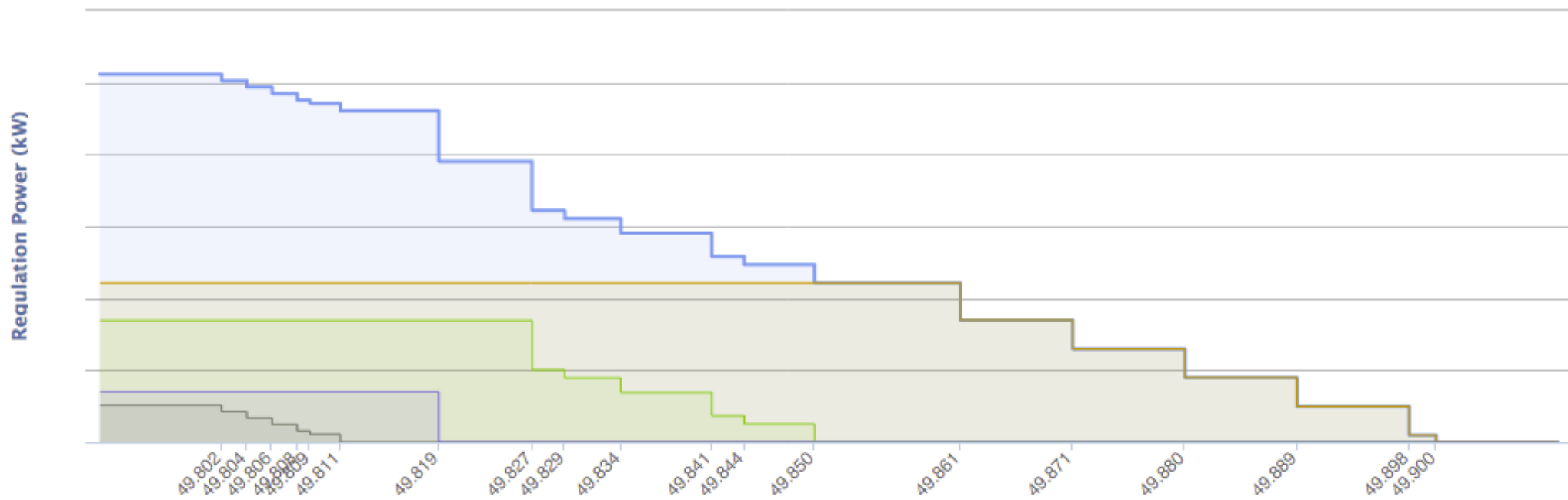
Voluntary demand side response is part of the solution to manage the transition in a cost effective way



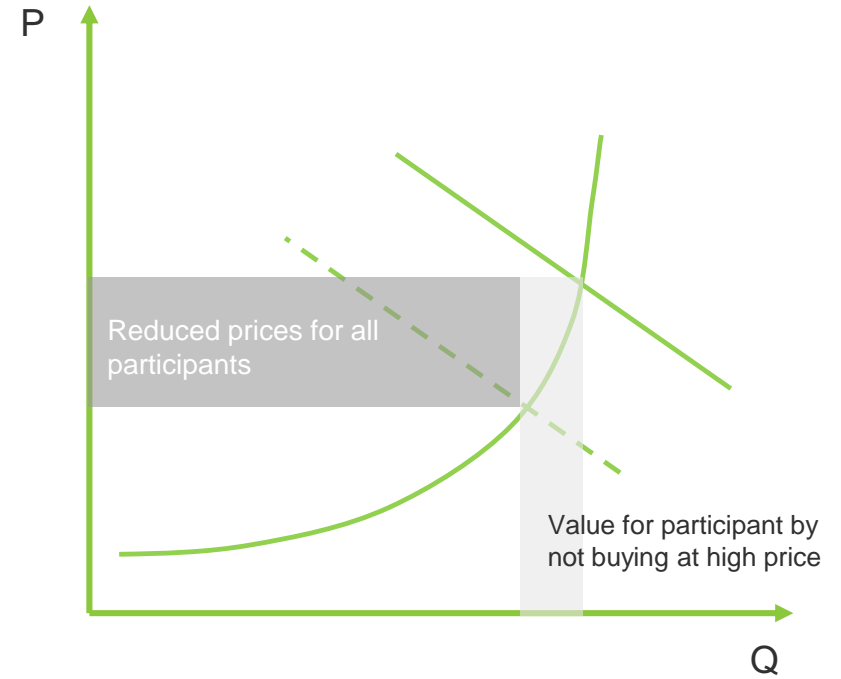
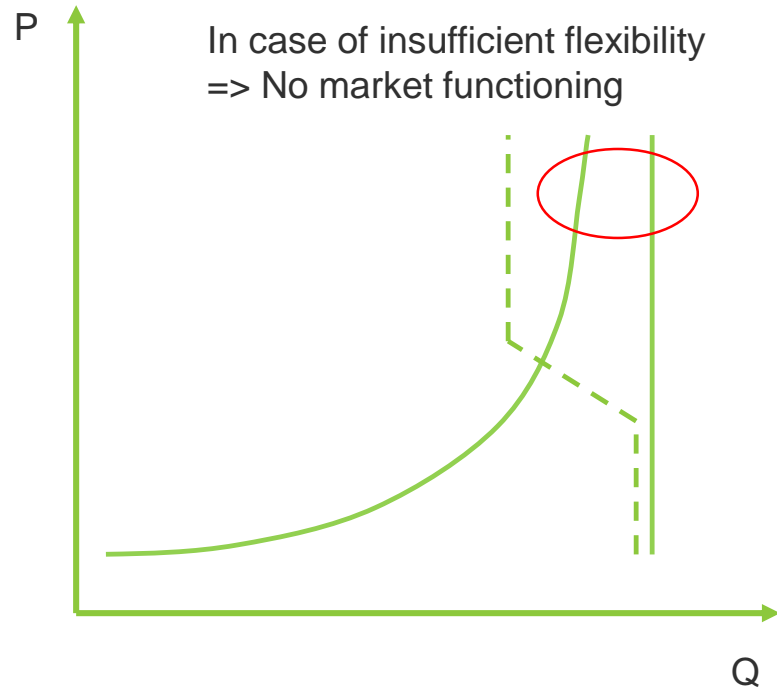
Investing into new generation units to cover the very exceptional high load hours is uneconomical

REstore's technology platform Flexpond™ is the only platform in Europe capable of offering Primary Reserve with a DR portfolio. In 2014 it achieved a track record of delivering 100% of the requested power

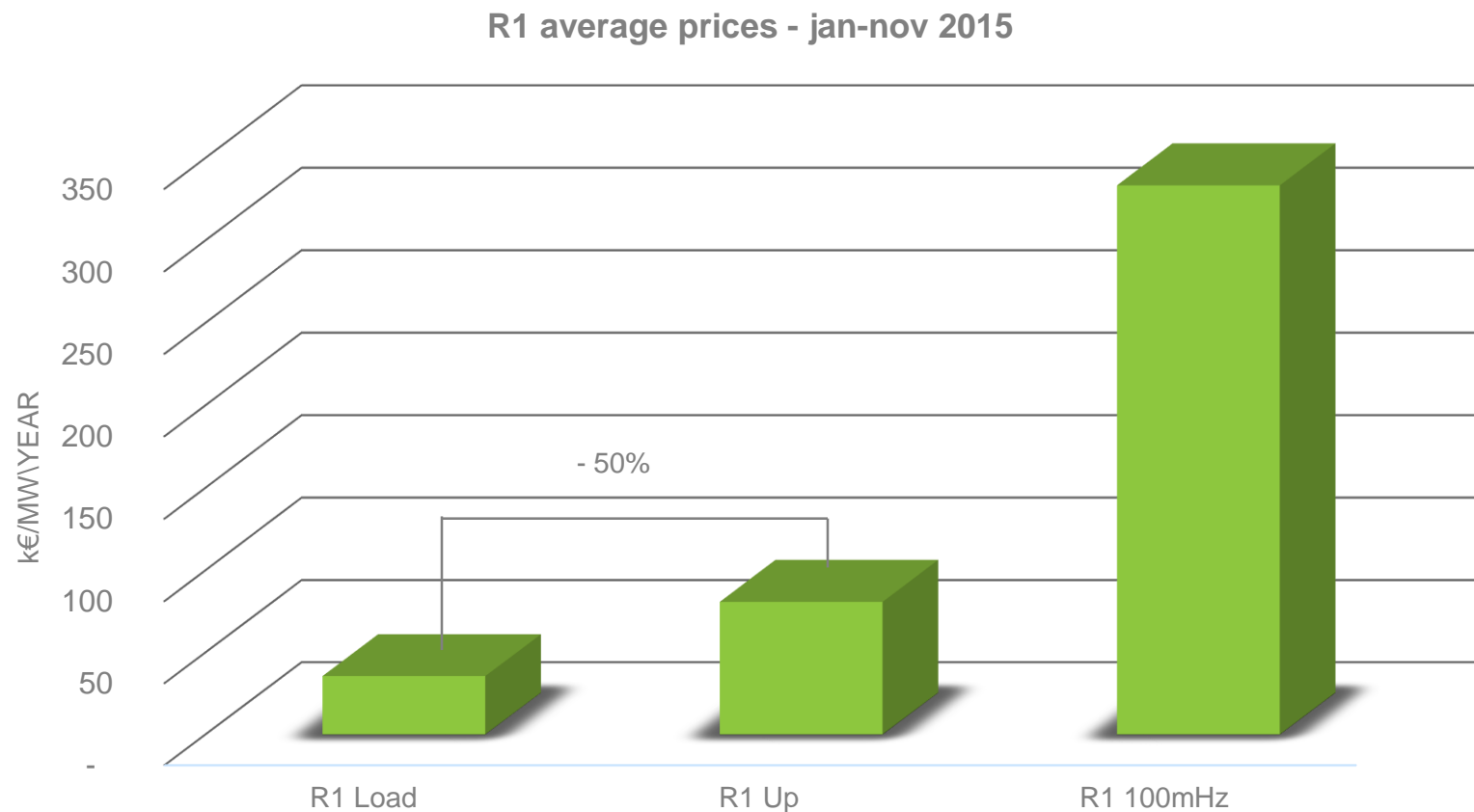
R1 Calibration
Click and drag in the plot area to zoom in



Demand side response is a must in a well functioning market



Demand Side Response is proven to be a very cost-effective solution (1)

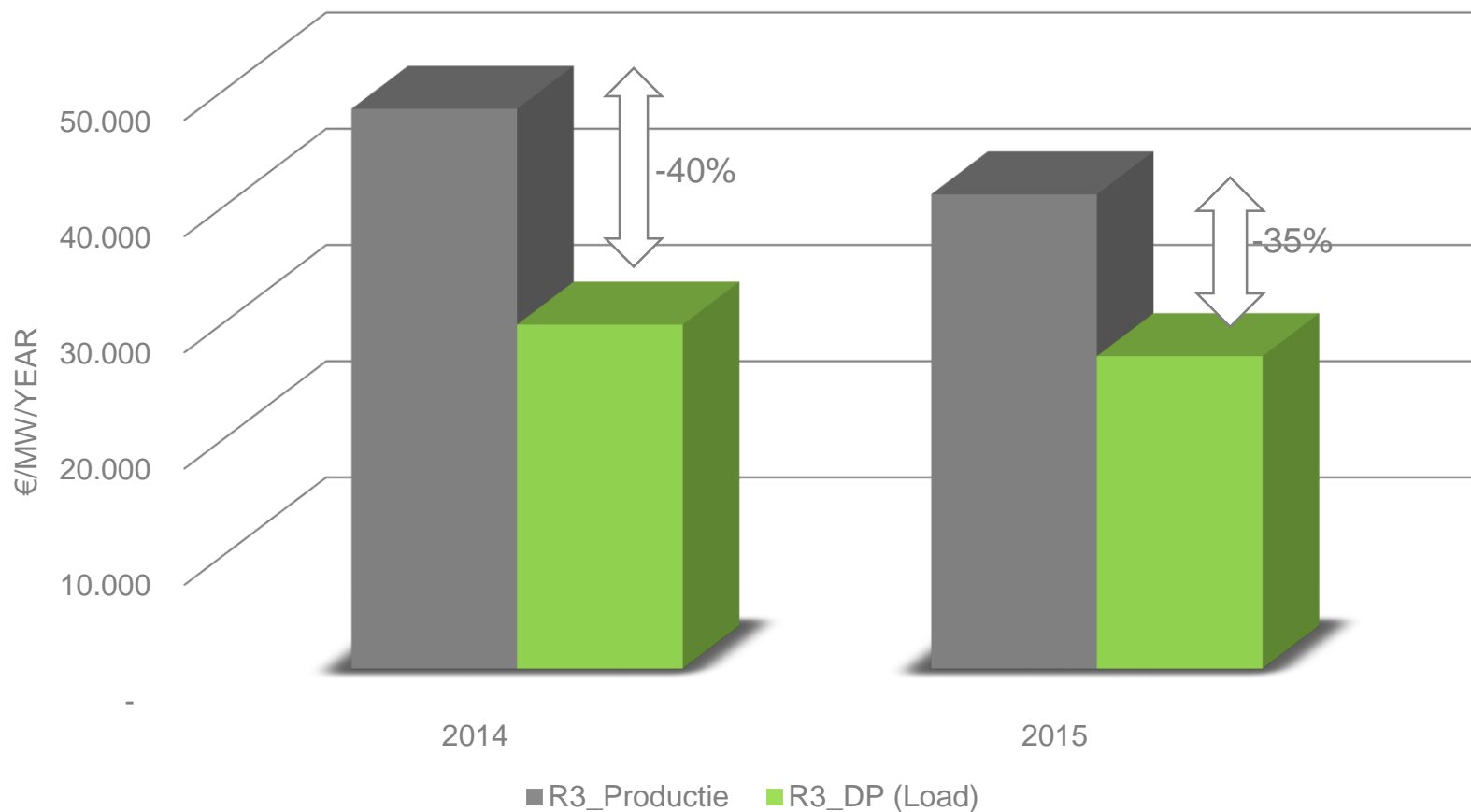


Source: Elia website

■ Mean (jan-nov)

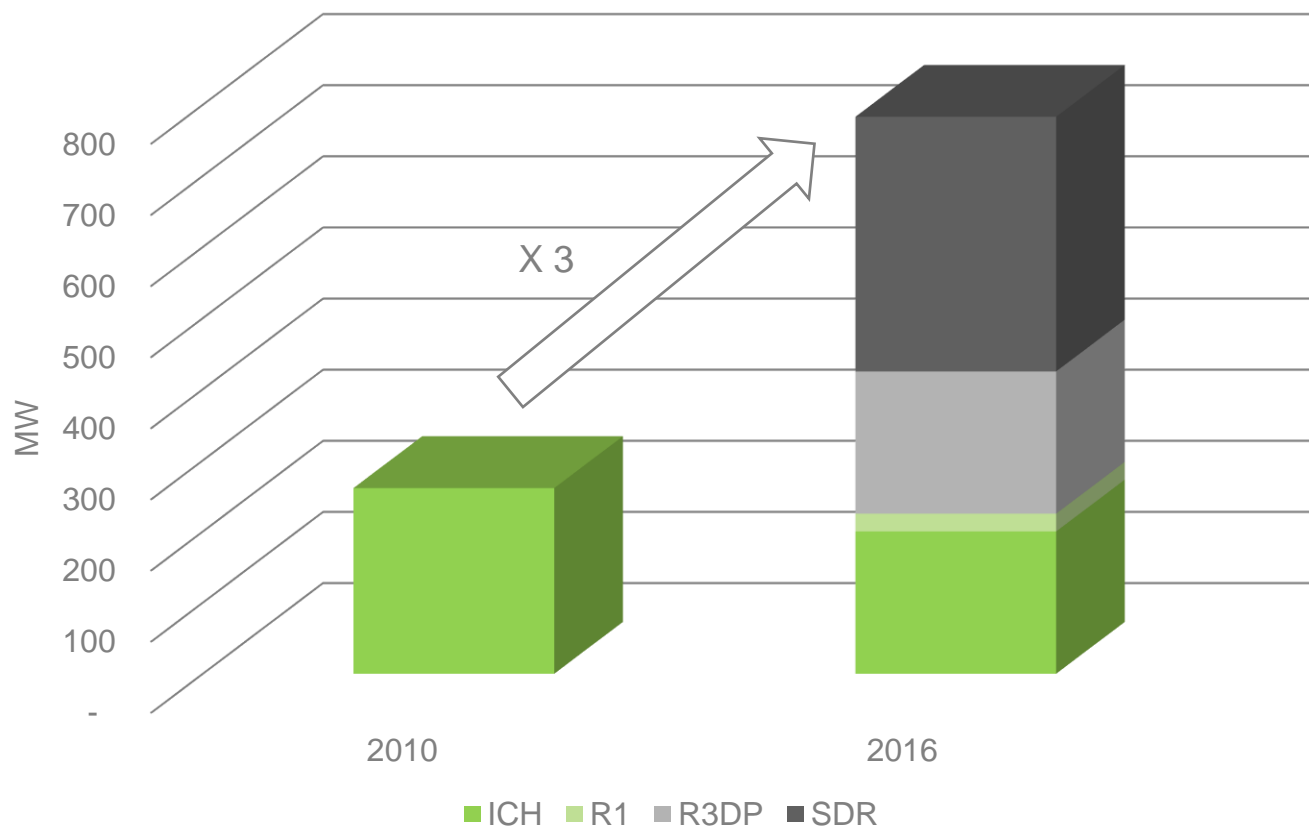


Demand Side Response is proven to be a very cost-effective solution (2)



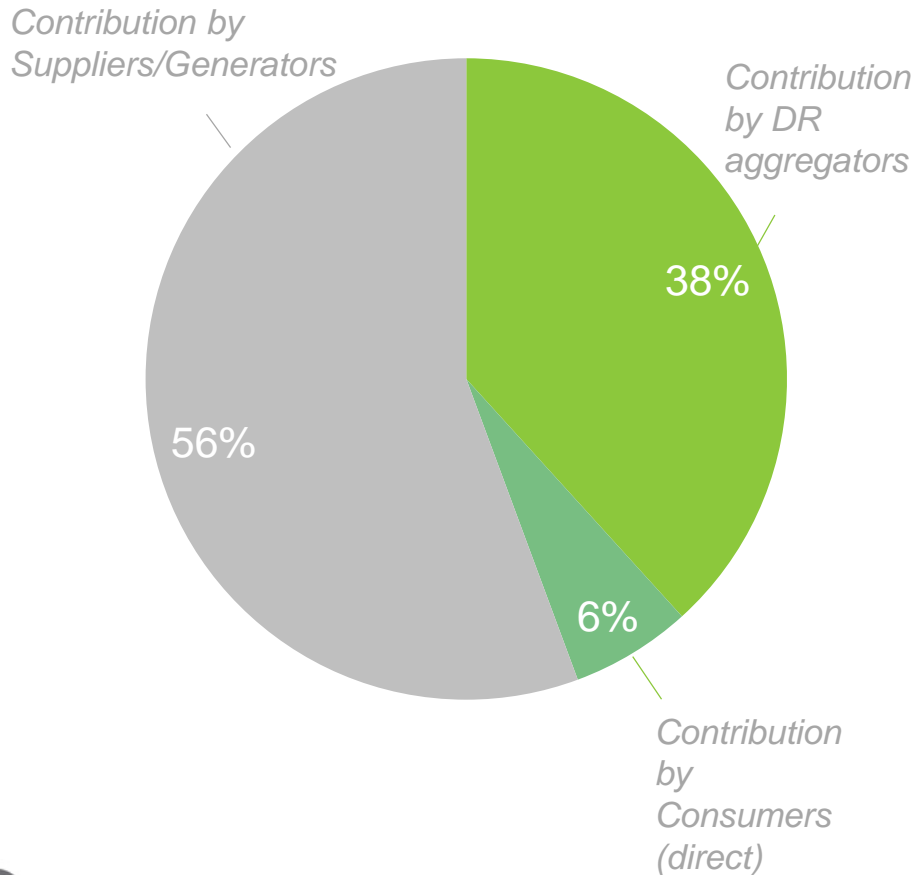
Source: Elia website

Demand Side Response volumes have tripled over the last 6 years

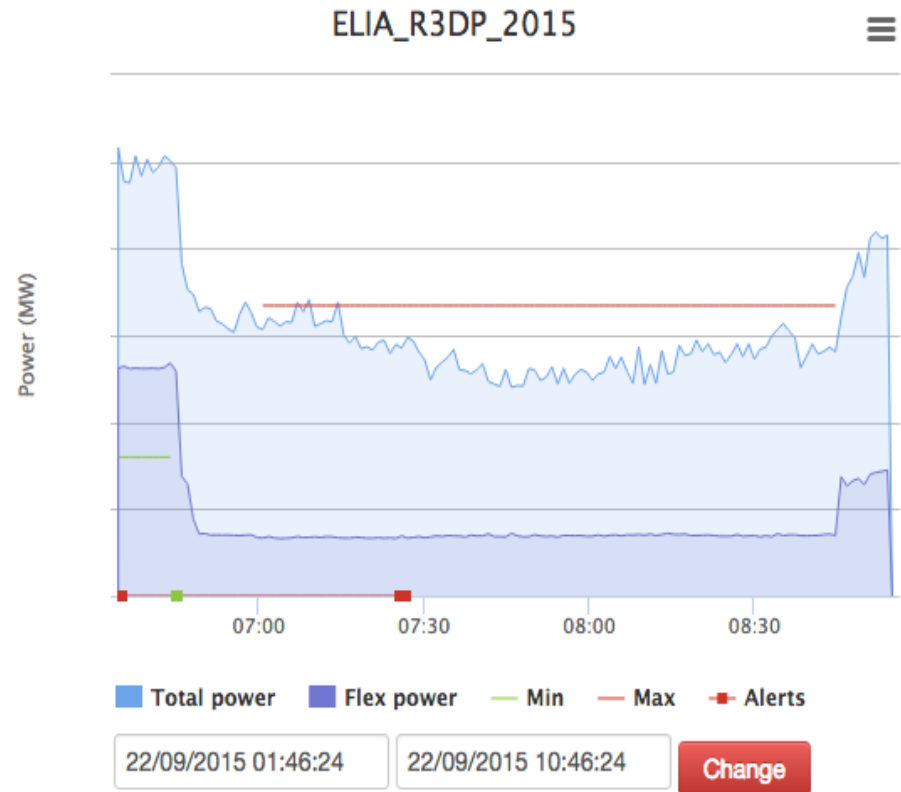


When given a fair chance, independent DR aggregators deliver above expectations, both in terms of additional liquidity as well as on reliability

% of DR in Strategic Reserves (BE)



DR delivered (BE)



How flexible will industry need to be ?



HOW FLEXIBLE DOES INDUSTRY NEED TO BE ?

The initial aggregation role was to 'pull the plug' on a set of loads

Old – Demand Response

DR Aggregation 1.0



- Pure **intermediary**
- Helping the grid operator to 'pull the plug' on a group of loads
- **Passive portfolio effect**

DR Aggregation 2.0: Through Big Data analytics, and “Internet-of-Things” connectivity, Flexpond identifies and smartly controls flexible power. Flexibility that was useless or untouchable yesterday can be valorized today.

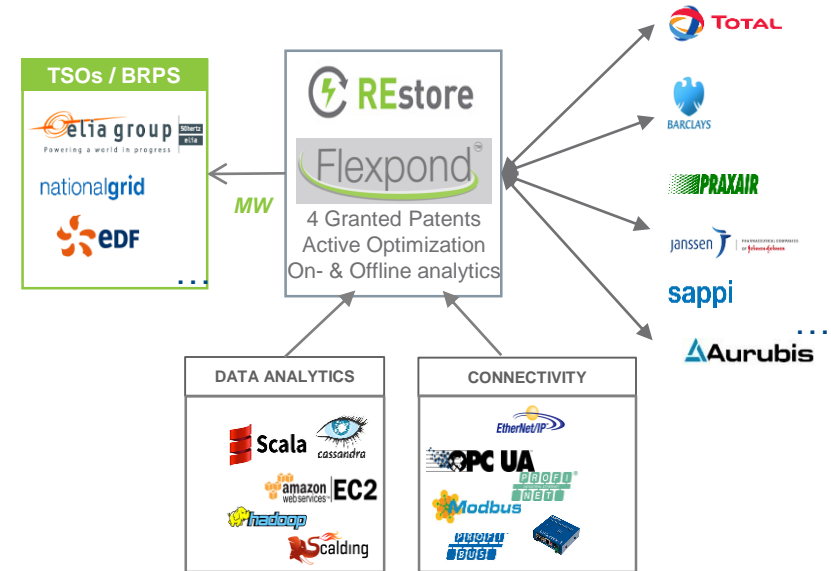
Old – Demand Response

DR Aggregator 1.0



- Pure intermediary
- Helping the grid operator to ‘pull the plug’ on a group of loads
- Passive portfolio effect

Demand Response 2.0



- 100% Automated
- Active portfolio management
- Risk Management
 - Protecting Industrial Boundaries
 - Increasing Revenues

REstore's patented technology platform Flexpond™ enables to increase availability, speed up reaction times and consequently create more value

Demand Response 2.0

- REstore's Active Portfolio Management
- REstore is 100% Automated Proprietary Flexpond™ platform
- REstore's Risk management

HOW ? Granted patents:

- US 2012/013 3337 May 2012
- US 8 417 391 Apr 2013
- US 2013/017 8991 Jul 2013
- US 2013/017 8993 Jul 2013
- US 8 825 219 Sep 2014
- US 8 838 281 Sep 2014
- US 2015/005 7824 Feb 2015

US 20150057824A1

(19) **United States**
 (12) **Patent Application Publication** (10) **Pub. No.:** US 2015/0057824 A1
 (43) **Pub. Date:** Feb. 26, 2015

(54) **AUTOMATED DEMAND RESPONSE ENERGY MANAGEMENT SYSTEM** (52) **U.S. CL.**
 CPC *G05B 13/02* (2013.01)
 USPC 700/296

(71) Applicant: **RESTORE NV, ANTWERP (BE)**
 (72) Inventors: **Jos GHEERARDYN, Brugge (BE); Jan-Willem ROMBOUTS, Antwerp (BE)**

(21) Appl. No.: **14/454,621**
 (22) Filed: **Aug. 7, 2014**

Related U.S. Application Data

(60) Continuation of application No. 13/779,505, filed on Feb. 27, 2013, now Pat. No. 8,825,219, which is a division of application No. 13/327,411, filed on Dec. 15, 2011, now Pat. No. 8,417,391.

Publication Classification

(51) **Int. Cl.**
G05B 13/02 (2006.01)

(57) **ABSTRACT**
 The power flexibility of energy loads is maximized using a value function for each load and outputting optimal control parameters. Loads are aggregated into a virtual load by maximizing a global value function. The solution yields a dispatch function providing: a percentage of energy for each individual load, a time-varying power level for each load, and control parameters and values. An economic term represents the value of the power flexibility to different players. A user interface includes for each time interval upper and lower bounds representing respectively the maximum power that may be reduced to the virtual load and the maximum power that may be consumed. A trader modifies an energy level in a time interval relative to the reference curve for the virtual load. Automatically, energy compensation for other intervals and recalculation of upper and lower boundaries occurs. The energy schedule for the virtual load is distributed to the actual loads.

Energy Management System

US 0008838281B2

United States Patent (10) **Patent No.:** US 8,838,281 B2
Rombouts et al. (45) **Date of Patent:** Sep. 16, 2014

AUTOMATED DEMAND RESPONSE ENERGY MANAGEMENT SYSTEM 5,927,598 A 7/1999 Broe (Continued)
 Applicant: **REstore NV, Antwerp (BE)**
 Inventors: **Jan-Willem Rombouts, Antwerp (BE); Jos Gheerardyn, Brugge (BE)**
 Assignee: **Restore NV, Antwerp (BE)**

FOREIGN PATENT DOCUMENTS
 EP 1 176 690 A2 1/2002
 JP 2003 116219 4/2003

US 0008825219B2

United States Patent (10) **Patent No.:** US 8,825,219 B2
Gheerardyn et al. (45) **Date of Patent:** Sep. 2, 2014

AUTOMATED DEMAND RESPONSE ENERGY MANAGEMENT SYSTEM (56) **References Cited**
 U.S. PATENT DOCUMENTS
 Applicant: **REstore NV, Antwerp (BE)**
 Inventors: **Jos Gheerardyn, Brugge (BE); Jan-Willem Rombouts, Antwerp (BE)**
 Assignee: **REstore NV, Antwerp (BE)**

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 4,341,345 A 7/1982 Hammer et al.
 5,927,598 A 7/1999 Broe (Continued)

US 20130178993A1

United States Patent Application Publication (10) **Pub. No.:** US 2013/0178993 A1
ROMBOUTS et al. (43) **Pub. Date:** Jul. 11, 2013

AUTOMATED DEMAND RESPONSE ENERGY MANAGEMENT SYSTEM (52) **U.S. CL.**
 CPC *G05B 13/02* (2013.01)
 USPC 700/291

Applicant: **REstore NV, Antwerp (BE)** (57) **ABSTRACT**

US 0008417391B1

United States Patent (10) **Patent No.:** US 8,417,391 B1
Rombouts et al. (45) **Date of Patent:** Apr. 9, 2013

AUTOMATED DEMAND RESPONSE ENERGY MANAGEMENT SYSTEM 2010/0222934 A1* 9/2010 Iino et al. 700/291
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 2012/0083930 A1* 4/2012 Ilic et al. 700/287

FOREIGN PATENT DOCUMENTS
 Assignee: **REstore NV, Antwerp (BE)** WO WO 2008/118396 10/2008

REstore has minimized “operational impact on a manufacturing plant” from DR programs (through use of its Flexpond™ platform)

	Perception	Reality
Loss of control?	<i>“ Automated Demand Response implies that REstore, a third party, acquires direct control over our manufacturing plant ”</i>	<ul style="list-style-type: none"> ■ REstore never controls plant machinery directly. REstore only sends <i>requests</i>, which can be accepted /rejected by the consumer’s control system / operator. ■ Availability of flexible power is determined by Industrial Boundaries pre-defined by the consumer.
No flexible power available?	<i>“ We do not have any flexible power at hand in our manufacturing process”</i>	<ul style="list-style-type: none"> ■ Processes that have a less-than-perfect availability can be valorized through REstore’s active portfolio management. ■ REstore has a team of Industry Experts that actively works with customers to identify flexible power. They are experienced industrialists and ex-plant managers.
Plant output affected?	<i>“Any activation of flexible power will reduce the output of the manufacturing plant, so reduce its utilisation rate”</i>	<ul style="list-style-type: none"> ■ A large potential of flexible power is found in buffered processes. ■ REstore typically contracts plant machinery which is not a bottleneck process. Curtailment of such machinery will therefore not affect plant output.

REstore has been awarded for its leadership

Frost & Sullivan



Platts Global Energy Award



Storage Award – European Utility Week



Global Cleantech Cluster Association



Industrial consumers work with REstore for reasons of technology-enabled “access-to-market” and “risk management”. REstore is the European leading aggregator.

Selection of Flex-providers:

Various Industrial Sectors



TOTAL

