



# Alstom Grid Lessons Learnt in International Demand Response

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May, 2014**

*We are shaping the future*

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# Alstom Grid Energy Management leadership

30 years of experience in energy management

30 years ago

**Grid  
Stability**



+

5 years ago

**Renewable  
Integration**



+

3 years ago

**Demand  
Response**



+

Today

**Smart  
City**

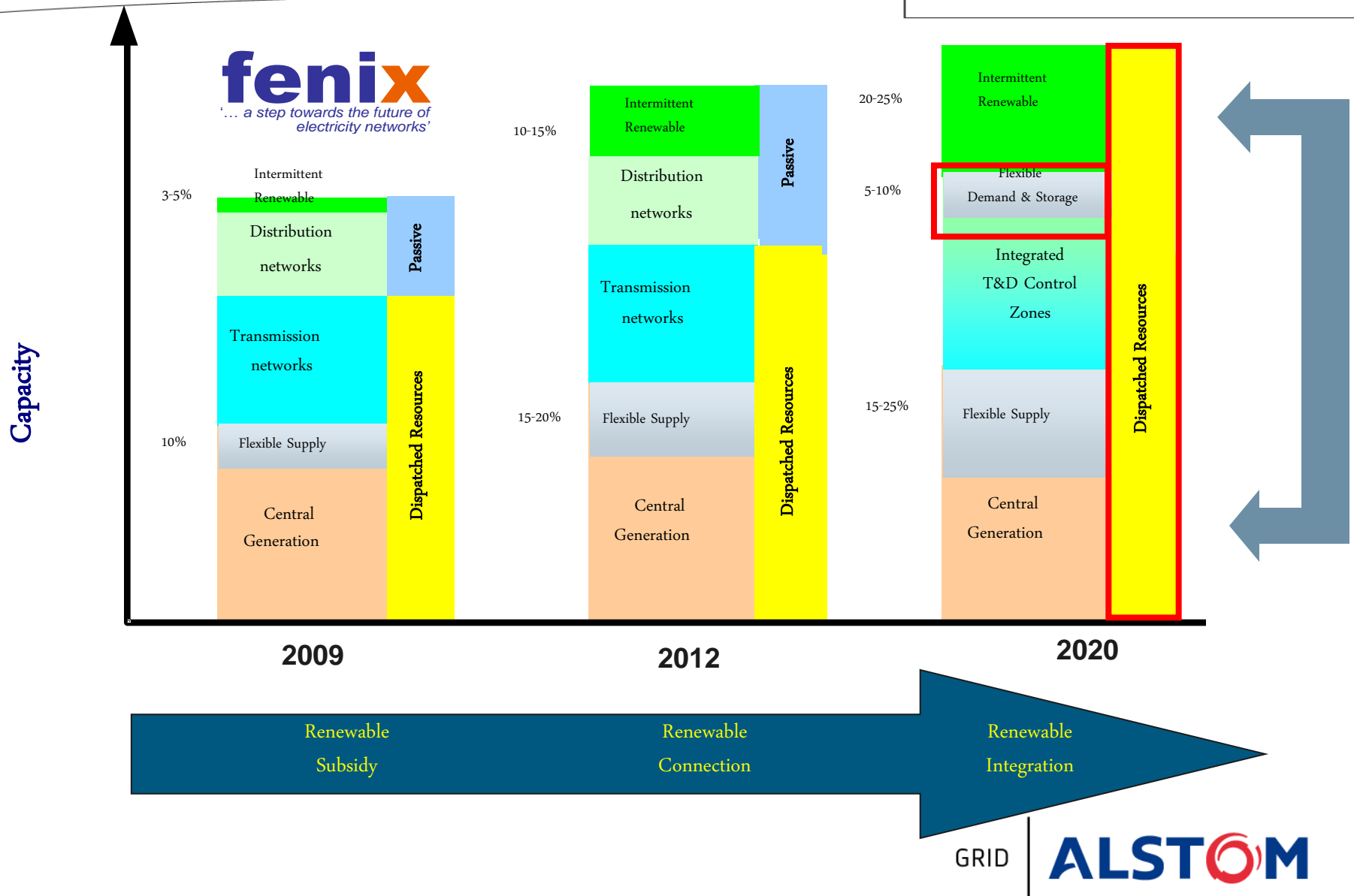


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# The New System Flexibility Challenge

Shaping the Smart Grid



# The Grid 2.0

From centralised Energy Management towards bi-directional Energy Management



**Today**  
a simple, one way model for energy



## Tomorrow

an open, flexible, interconnected and interactive model for energy:

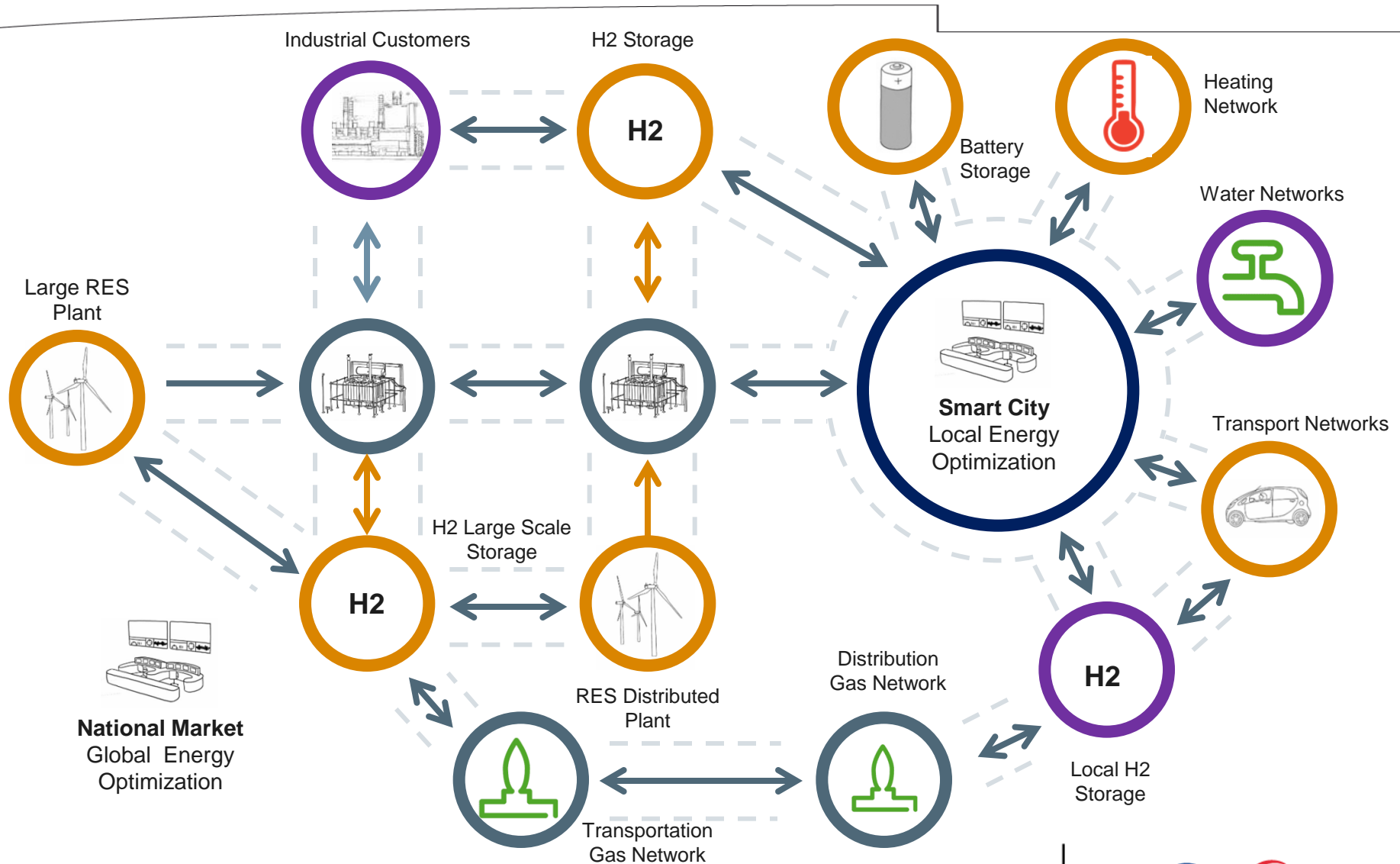
- I Distributed Energy Resources integration
- II Integrated Grid controls for AC-DC Grid
- III Integrated & active distribution grid management
- IV Smart metering & grid automation integration

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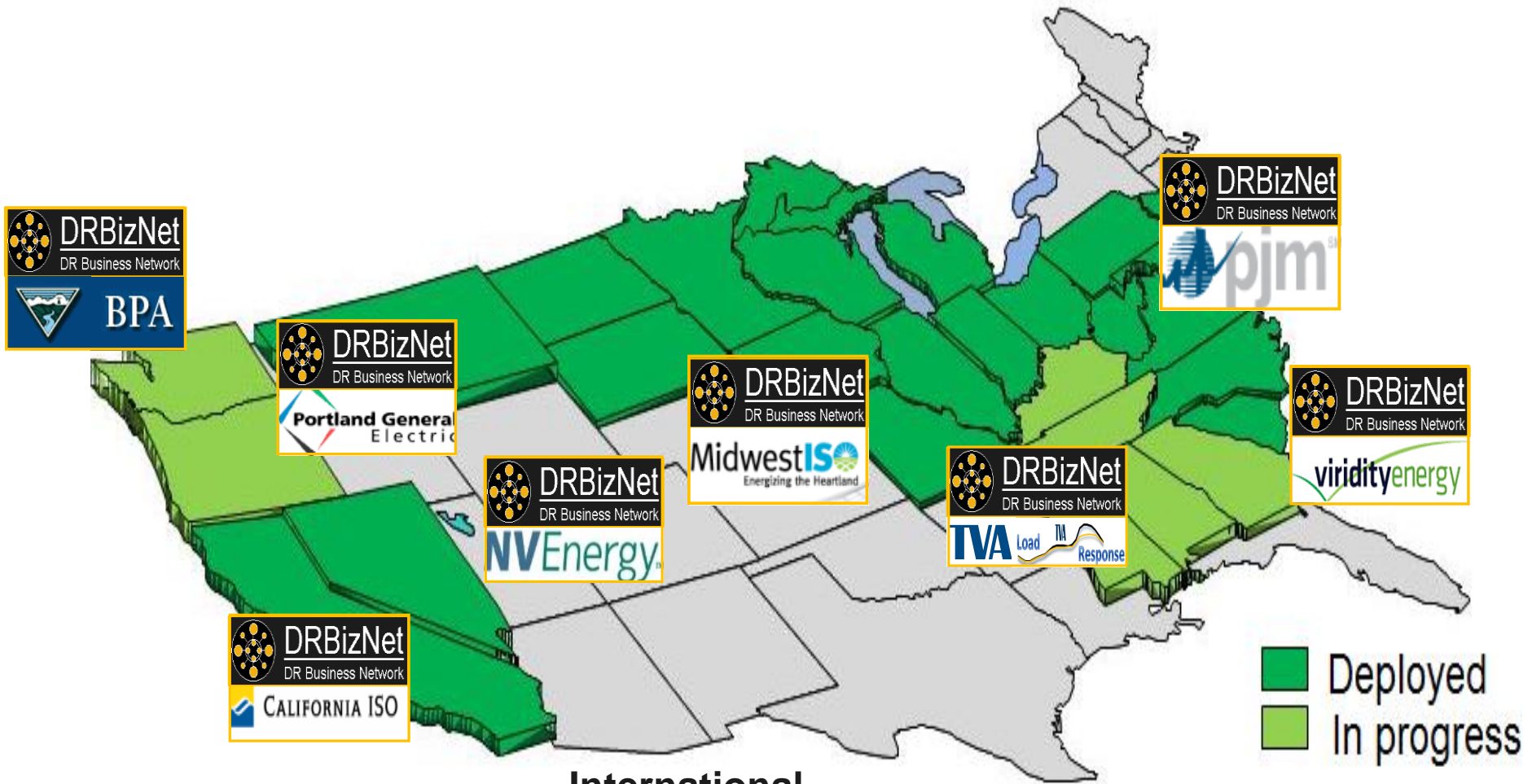
# How can it work ? Integrated Smart Networks



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# Alstom DR Experiences



## International

New Zealand (Transpower)

France (ERDF, Dalkia)

Hong Kong (CLP)

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# Key DR Success factors

Shaping the Smart Grid

- Improve **visibility** and **control** of 'active loads' within TSOs/DSOs
- **Automate and streamline** demand response integration, from the customer thermostat to the grid control room
- **Target most Flexible DERs**  
Electrical Heating, Heat Pumps, Distributed Gen, batteries, EVs
- Scale and adapt while **regulation** matures



# Business Model Inertia

DR also conflicts with traditional business models

Resistance to move beyond pilots or 'low-hanging fruit' of large industrial DR or residential AC programs

But needs a critical mass of investment and participation to have noticeable impact

Regulations often serve the status quo



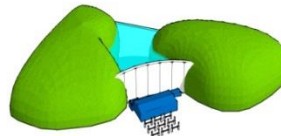
**Retailing**



**Distribution**



**Transmission**



**Generation**

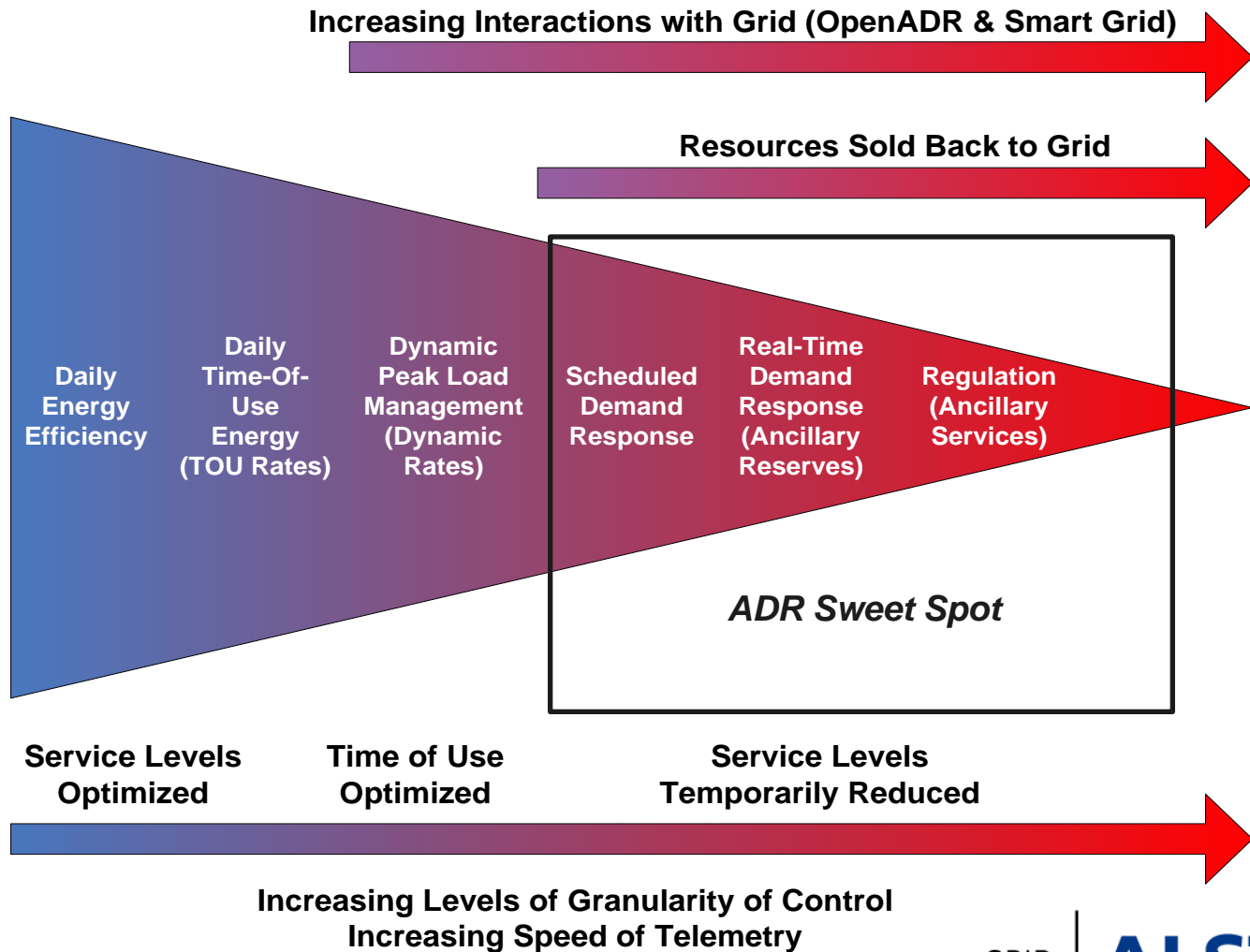
- **Sell watts, not nega-watts**
- **10-30 year decision cycles**
- **Asset base revenue models**
- **Engineering, construction cultures oriented to build**
- **Mistrust of unreliable and unobservable resources**
- **Naturally competitive with bulk generation**



# DR Scale Up Model

## Time Scale of DR

Source: LBNL

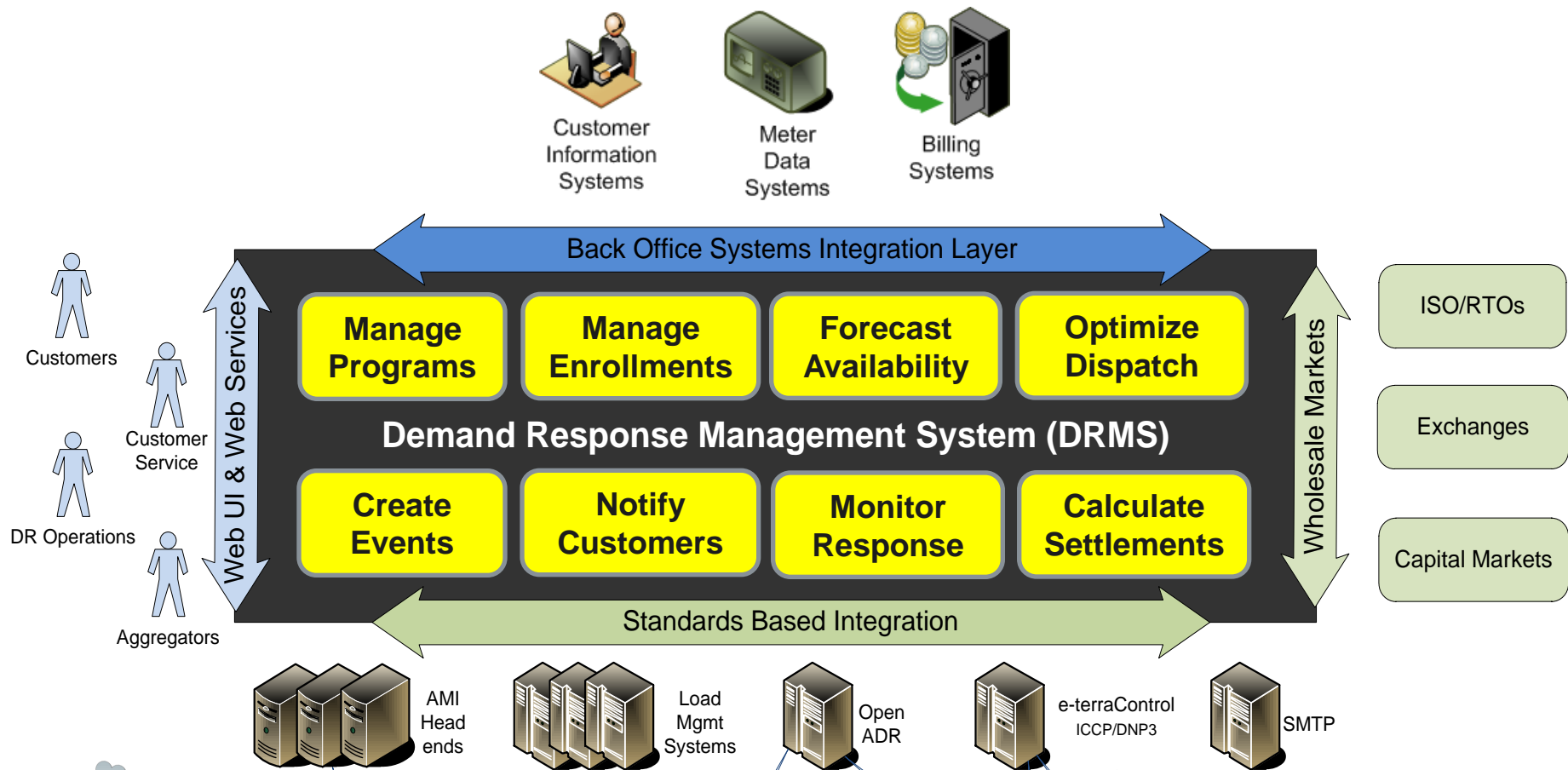


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# Business Process Integration & Automation are key for DR Scale up

A single DER Management Platform to optimise DER operation across programs and providing a single point of dispatch.



# Integrating a wide range of Load Control subsystems

Low-tech, low-cost devices for Residential DR

Higher-cost and capable devices for high-yielding Commercial & Industrial DR

Direct Load Control Switch  
(~\$25)



Programmable Communication  
Thermostat  
(~\$75)



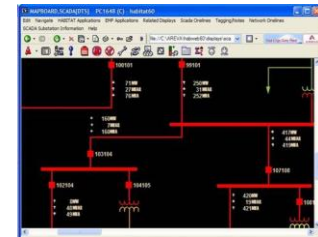
Home Energy Manager  
(~\$200)



Remote Terminal Units & Loggers  
(~\$1000)



SCADA (~\$\$\$)



Yield

Commercial  
& Industrial

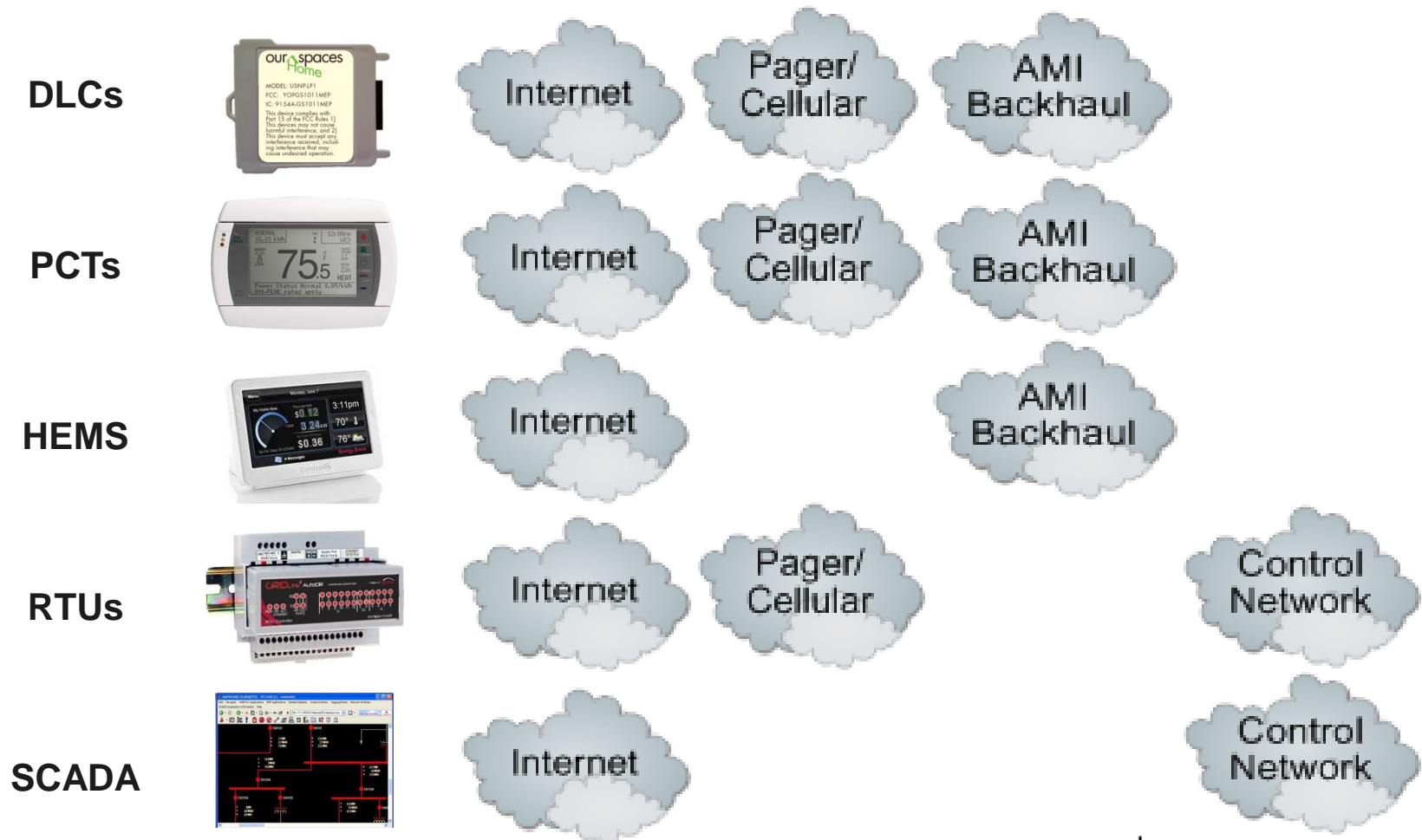
← Residential

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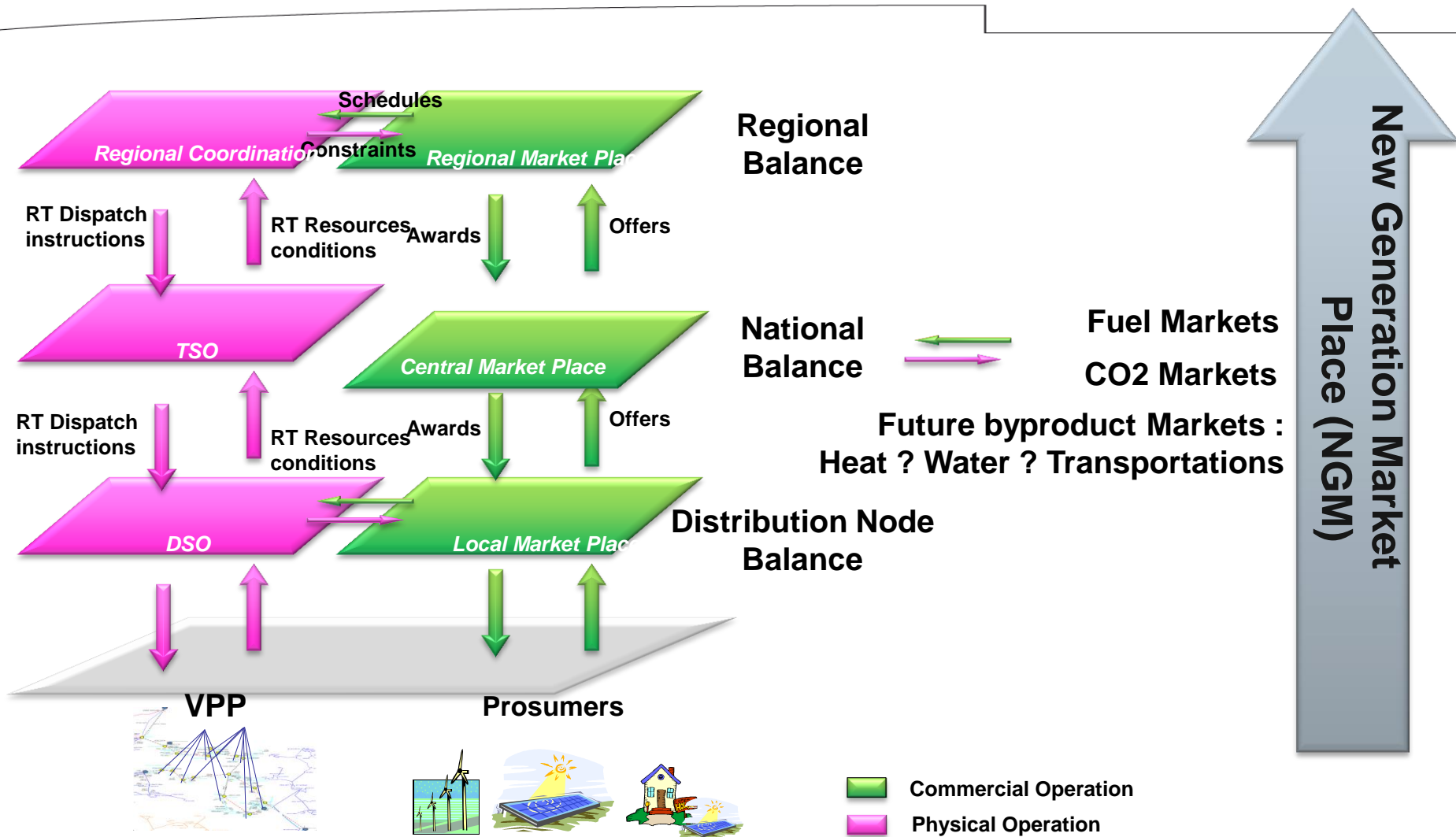
# Managing Real-time Coms : need to be selective

## Communication performance vs cost trade-offs





# New Regulatory step : towards multi-tier markets



# New framework required for DER

Shaping the Smart Grid

| Typical Energy Transactions     |                          |            | Flexible<br>MW | Time<br>horizon | Reaction<br>time | Duration |
|---------------------------------|--------------------------|------------|----------------|-----------------|------------------|----------|
| Consumer<br>(KWh<br>efficiency) | Energy Efficiency        |            | 100,000        | Week            | Days             | Days     |
|                                 | Load Management          |            | 500            | Hours           | Minutes          | Minutes  |
|                                 | Power<br>Quality         | Islanding  | < 10           | Seconds         | Minutes          | Minutes  |
|                                 |                          | Quality    |                |                 | Seconds          | Seconds  |
| Market<br>Operation             | Peak/Off Peak Week Ahead |            | 10,000         | Week            | Days             | Days     |
|                                 | Peak/Off Peak Day Ahead  |            | 100 - 1,000    | Day             | Hours            | Hours    |
|                                 | Energy Infra Day         |            | < 100          | Hours           | Minutes          | Minutes  |
| Grid<br>Operation               | Grid<br>security         | Reserve    | < 200          | Hours           | Minutes          | Hours    |
|                                 |                          | Regulation | < 100          | Minutes         | Minutes          | Seconds  |
|                                 |                          | Emergency  | < 10           | Minutes         | Minutes          | Minutes  |
|                                 | Power Quality            |            | < 200          | Minutes         | Seconds          | Minutes  |

DER do not need to be able to tap in all revenue stream

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# Top 6 Regulatory hurdle for Smart Systems

- Key SmartGrid challenges :

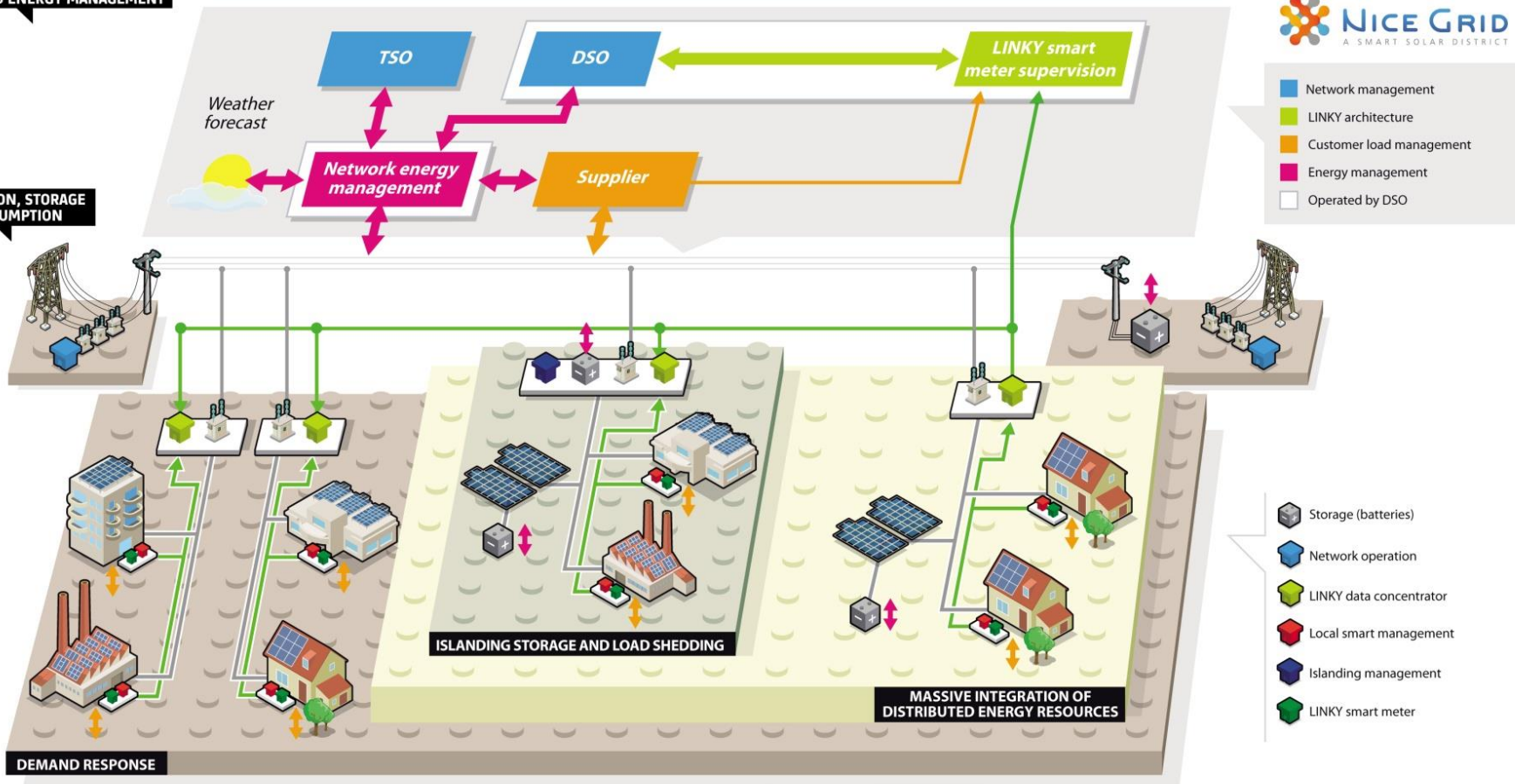
1. Level playing integration of Distributed Renewable within wholesale markets (including new Renewable tariffs for Self consumption)
2. New Balancing & ancillary service mechanism for level playing integration of DER flexibility across the Energy System
3. Regulatory framework for storage integration, roles of storage and grid operators and services offered to the system
4. Prosumer Data management principles (data ownership, opt-in mechanisms, DSO rights)
5. New mechanisms for Energy Management at Distribution Grid Node (grid operator role, interfaces with other network, city role)
6. Prosumer integration principles (service quality, standards, security, privacy)



# New System Operator Role at Distribution Level

## MICROGRID ENERGY MANAGEMENT

## PRODUCTION, STORAGE AND CONSUMPTION

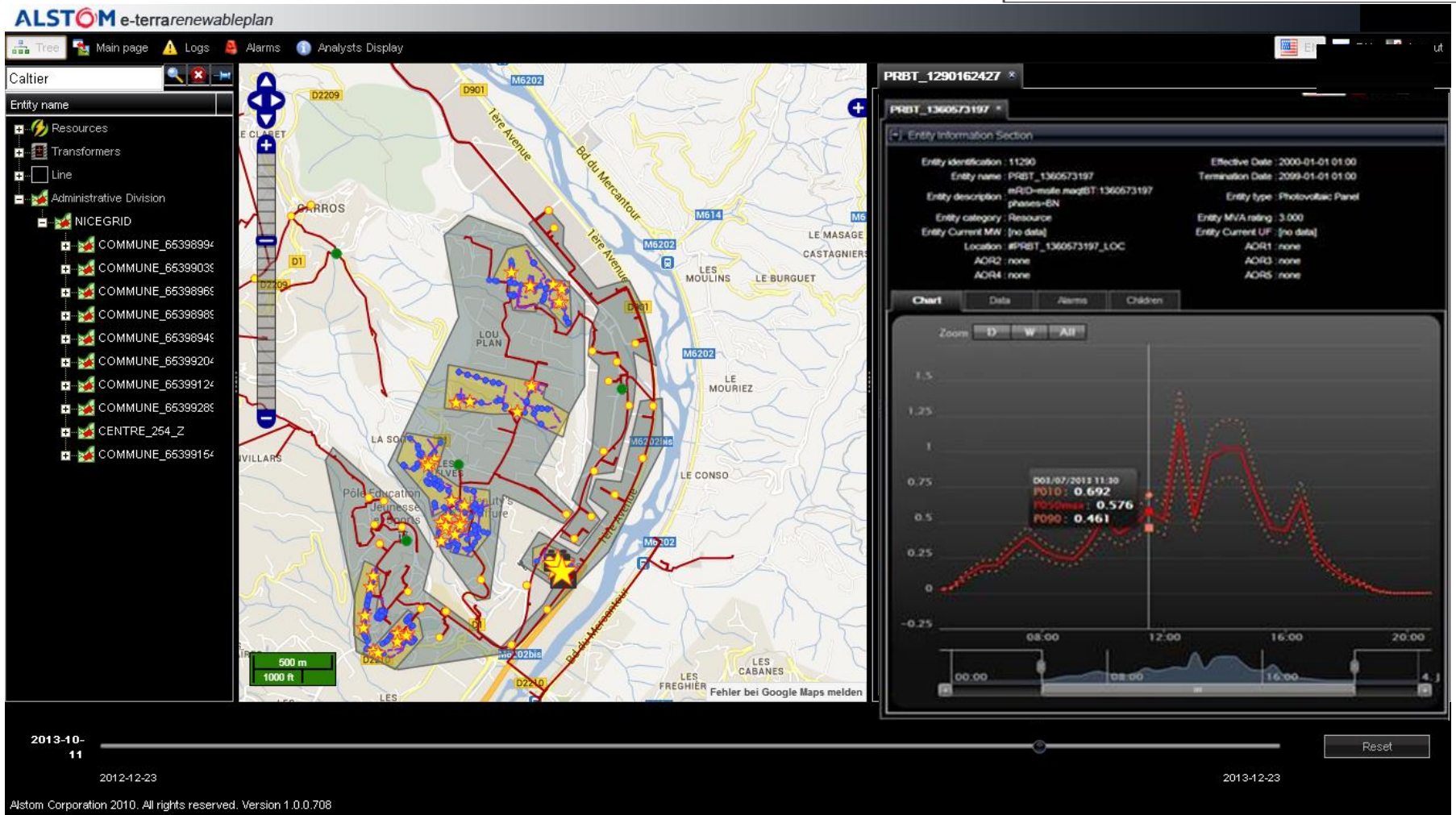


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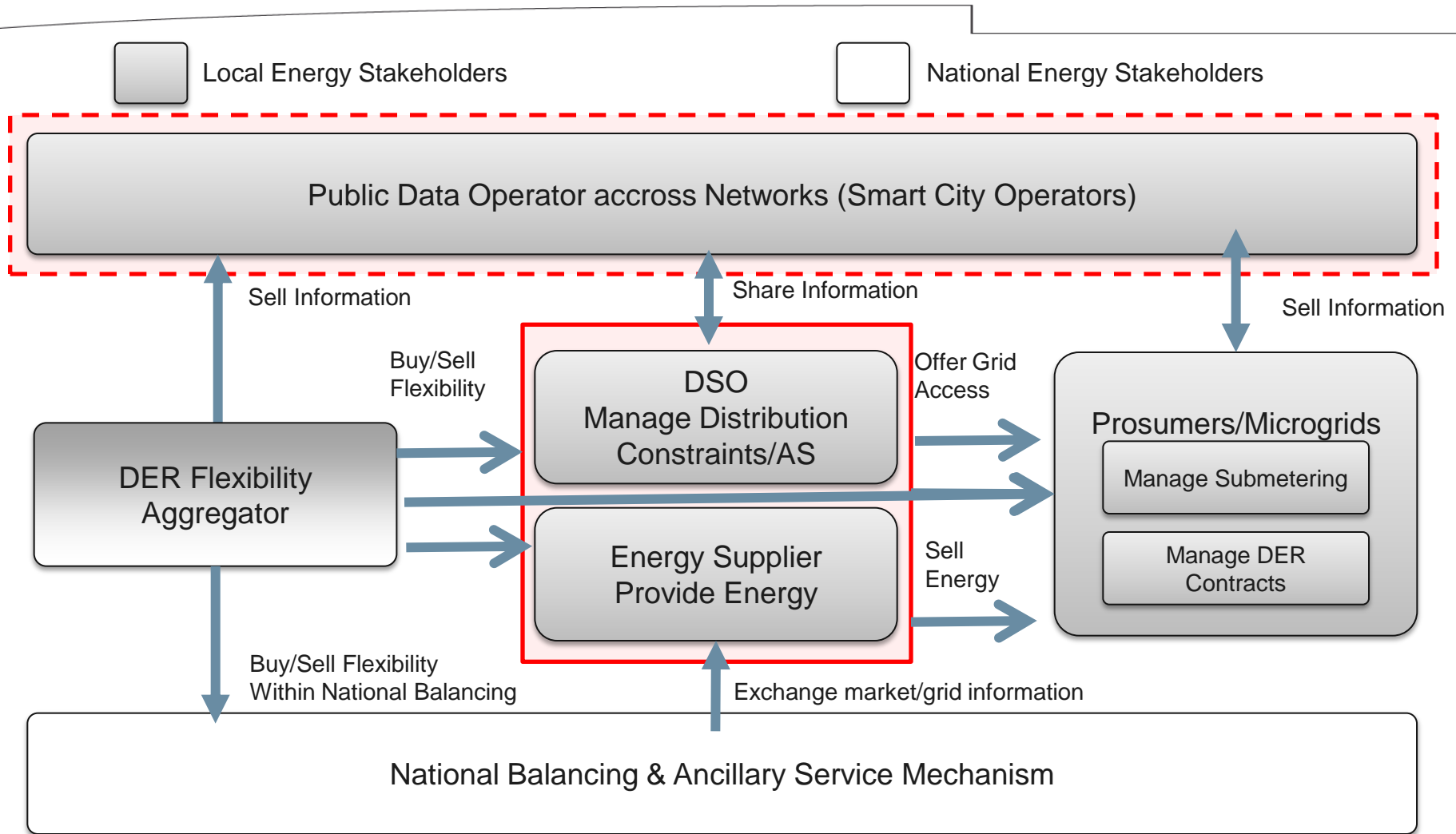




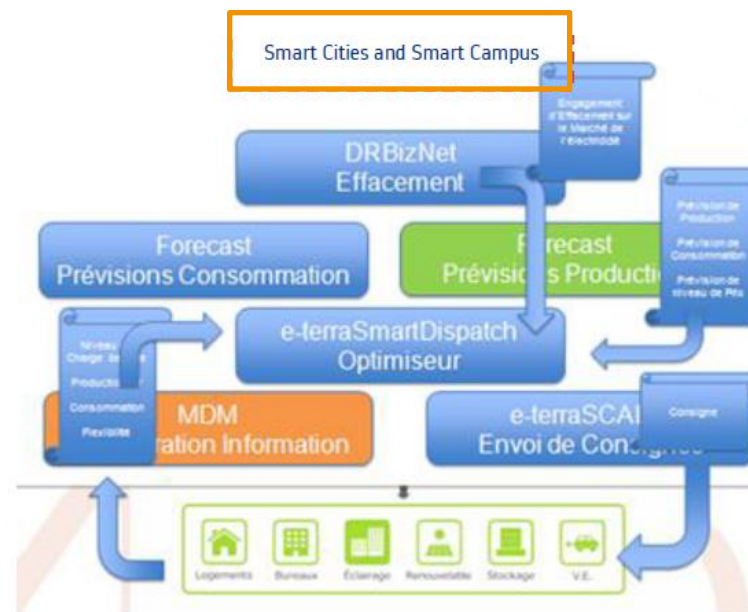
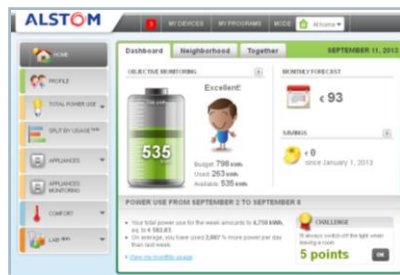
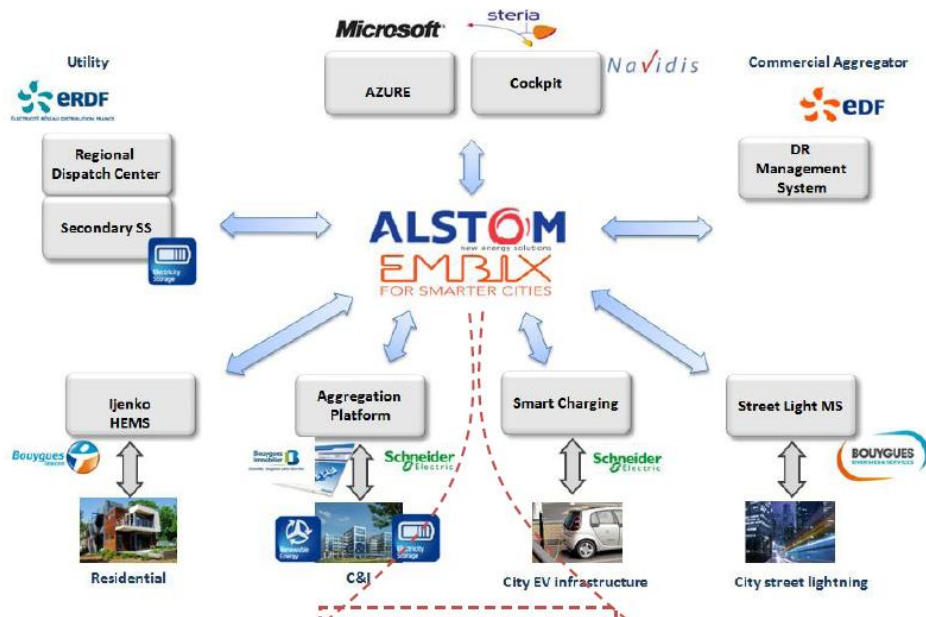
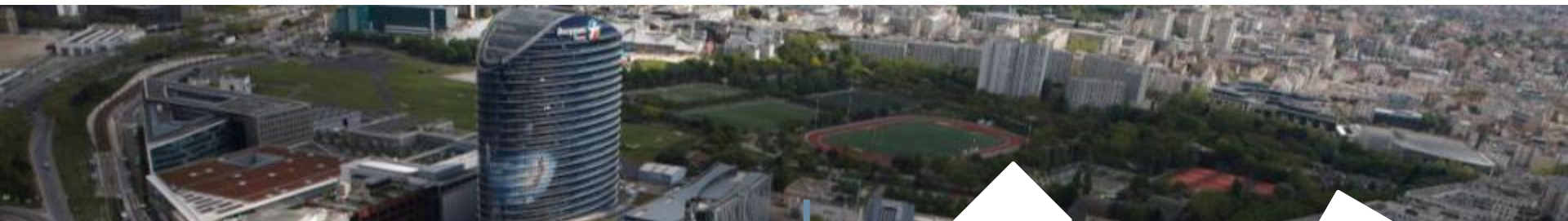
# New DER Situational Awareness in MV/LV



# New Distribution Market Place



# IssyGrid Smartcity concept







Welcome in Alstom Smart Grid connected world !

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