

**Supporting the deployment of safe Li-ion stationary  
batteries for large-scale grid applications**

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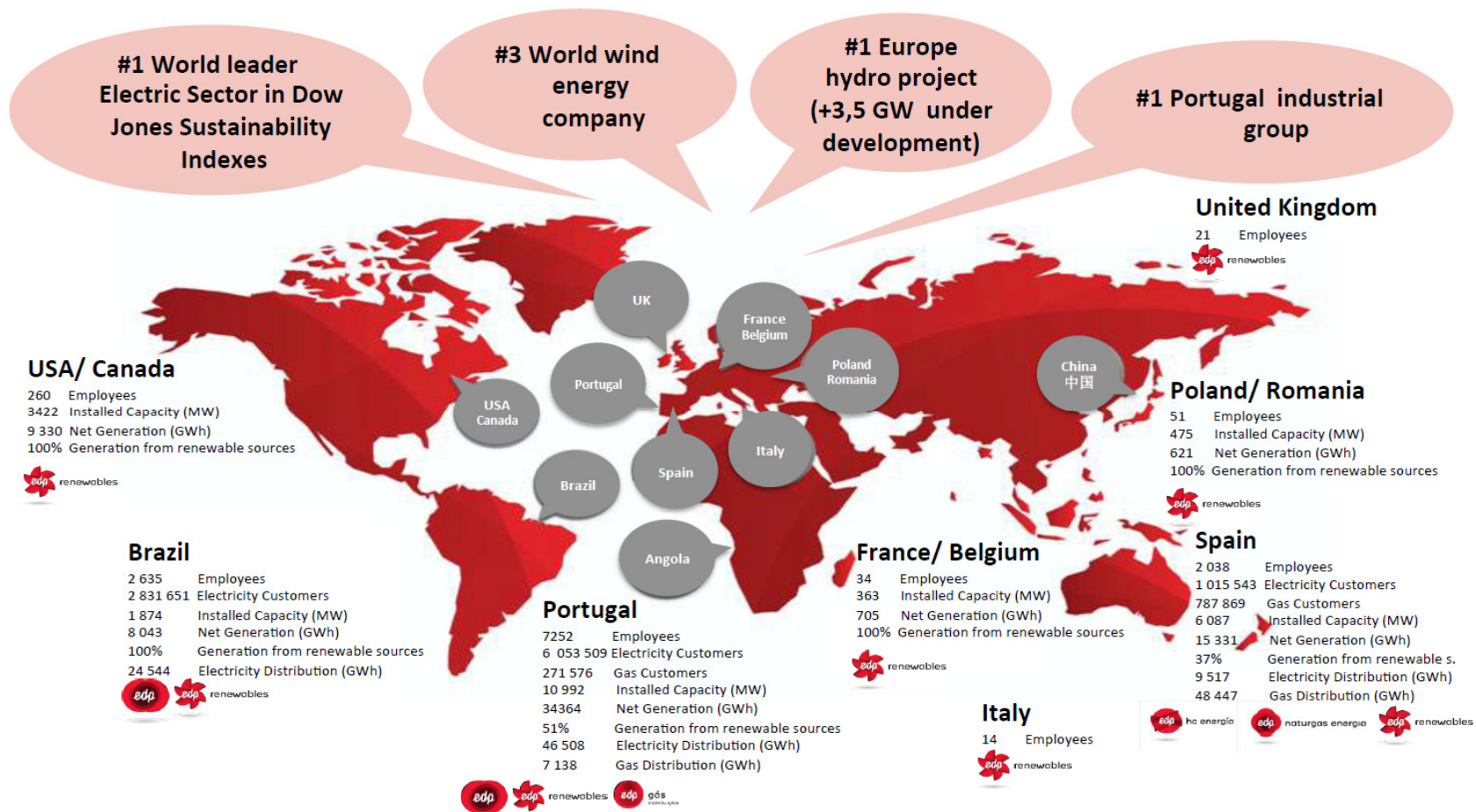
## DSO perspective

Susete Albuquerque, EDP Distribuição



Düsseldorf, 10 March 2015

# EDP Group.....



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# Organization....

## THE NATIONAL ELECTRICITY SYSTEM

### GENERATION

**(Ordinary and Special Regime Generation)**

*Competition by means of License attribution*



### NATIONAL TRANSMISSION NETWORK

*Public Service Concession assigned to REN*

### DISTRIBUTION

*Public Service Concession assigned to EDPD*



**Supplier of Last Resort** *Public license under universal service obligations assigned to EDP*  
**Serviço Universal**



**Non Regulated Suppliers**  
*Competition by means of License attribution*



**Customers in the Regulated Retail Market**

**Customers in the Liberalized Retail Market**



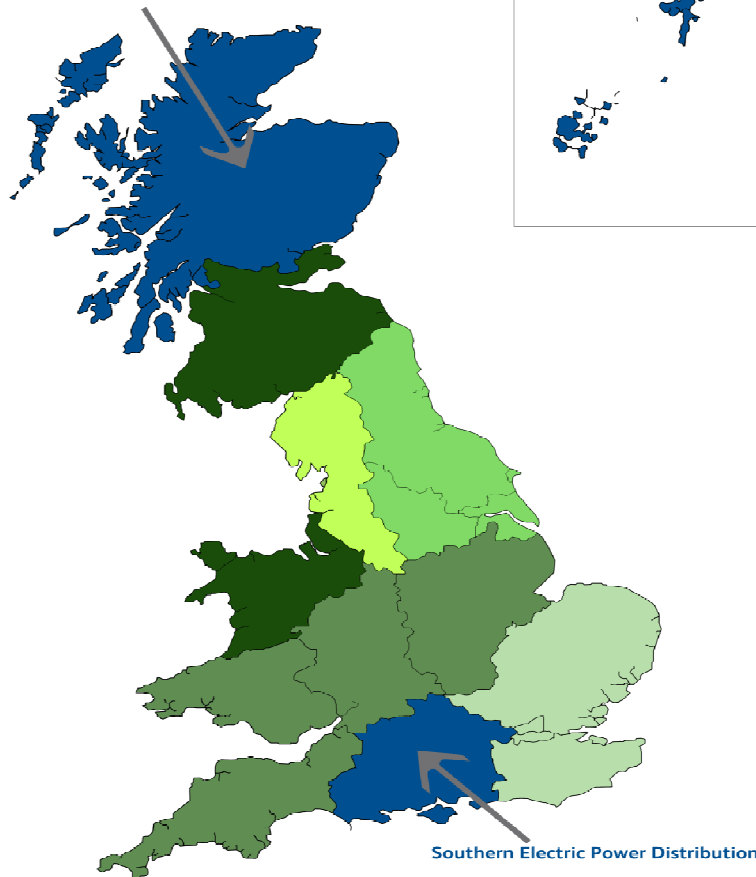
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# About SSEPD

Scottish Hydro Electric Transmission  
Scottish Hydro Electric Power Distribution



Scottish and Southern Energy Power Distribution owns:

- » One electricity transmission network
- » Two electricity distribution networks
- » 106,000 substations
- » 130,000 km of overhead lines and underground cables
- » 100+ submarine cable links

The company serves **3.5 million customers** across **one third of the UK's landmass**



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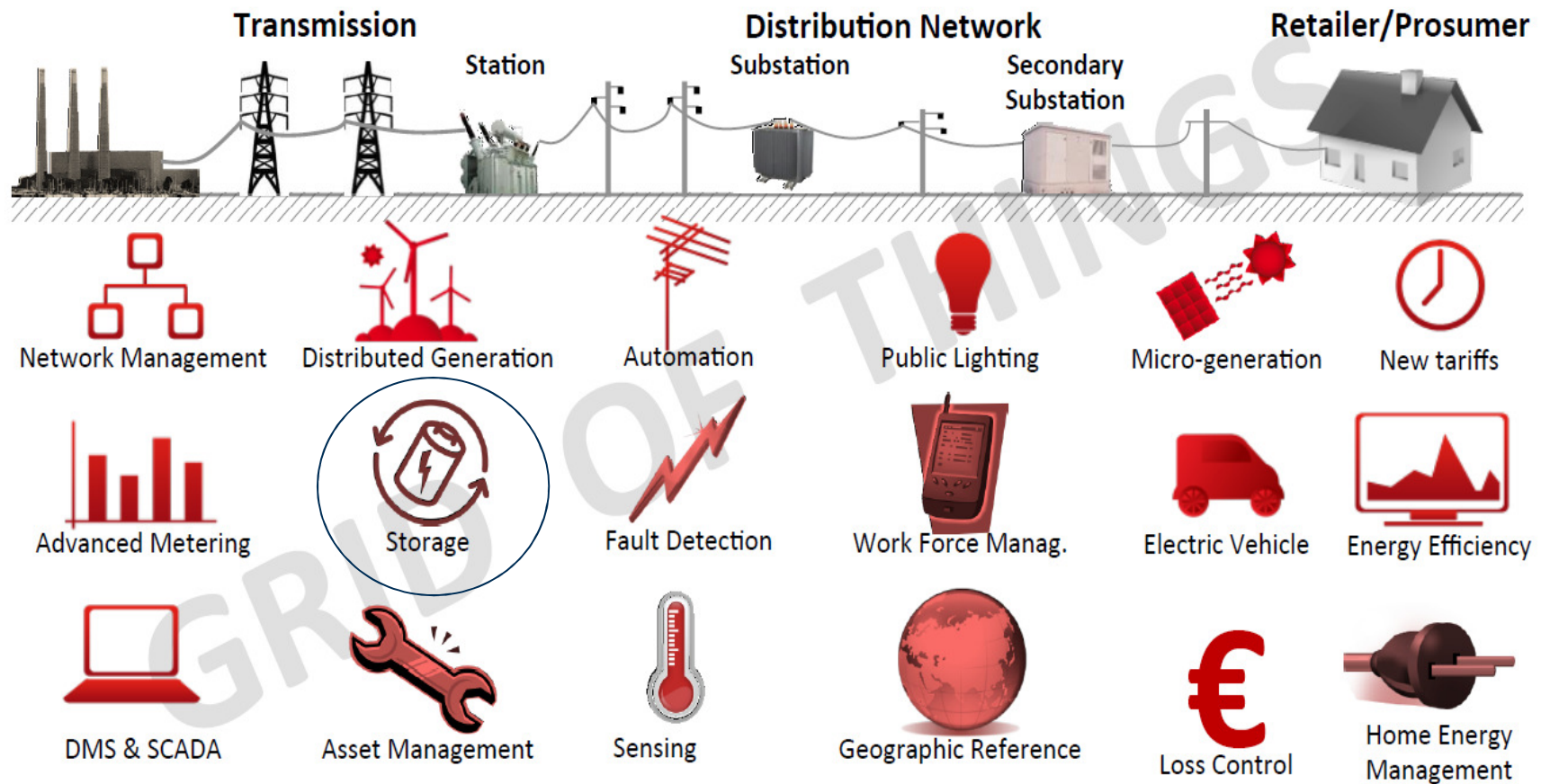


## Changes....

- » European Directives;
- » Distribution networks power flows unidirectional (HV → MV → LV)  
→ Bidirectional power flows ;
- » Increasing decentralised generation with high fluctuations (e.g. wind or PV);
- » Introduction of mobile loads (EVs) and less stable consumption patterns;
- » Increase of electricity consumption.

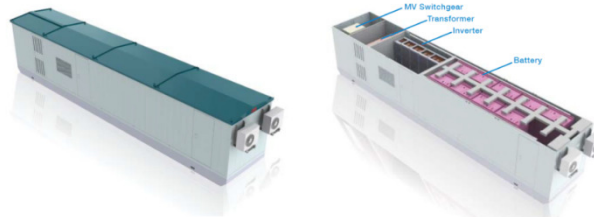
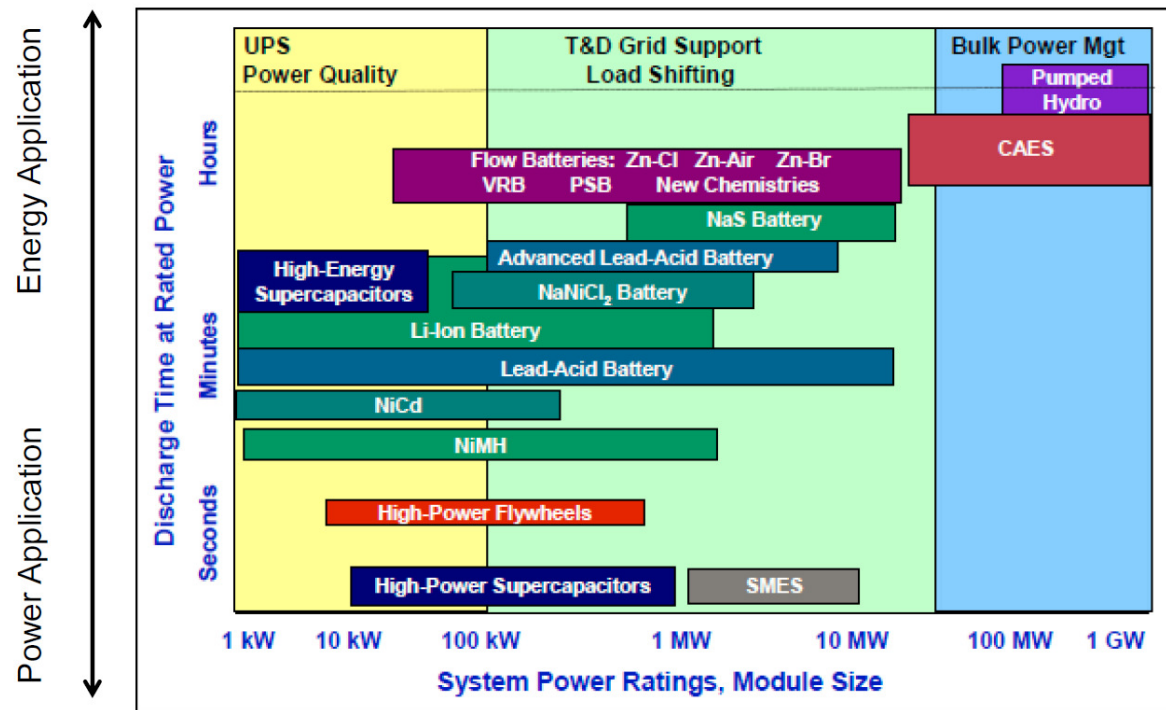


# The Distribution Grid is evolving to GofT.....





# Storage: Types and methods....



Agulheira	Alqueva	Alqueva II
Alto Lindoso	Alto Rabagão	Aregos
Baixo Sabor	Belver	Bemposta
Bemposta II	Bouça	Bruceira
Cabril	Caldeirão	Cançada
Canico	Carrapateiro	Castelo do Bode
Cefra	Crestuma-Lever	Desterro
Drizes	Ermal	Ermida
Figueiral	Foz Tua	Frades
France	Fratel	Freijil
Fridão	Guilhofoei	Labruja
Lagoa Comprida	Lindoso	Miranda
Paradela	Paradela II	Paleiro
Pedrogão	Penide	Picote
Picote II	Pisões	Pocinho
Ponte da Esperança	Ponte de Jugais	Póvoa
Pracana	Raiva	Régua
Rei de Moinhos	Riba Cõa	Ribafelga
Ribeirado - Ermida	Sabugueiro I	Sabugueiro II
Salamonde	Salamonde II	Santa Luzia
Senhora do Porto	Torrão	Touvedo
Valeira	Varosa	Velada
Venda Nova	Venda Nova III	Vila Cova
Vilar-Tabuaço	Vilarinho das Furnas	



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# Usual Storage applications....

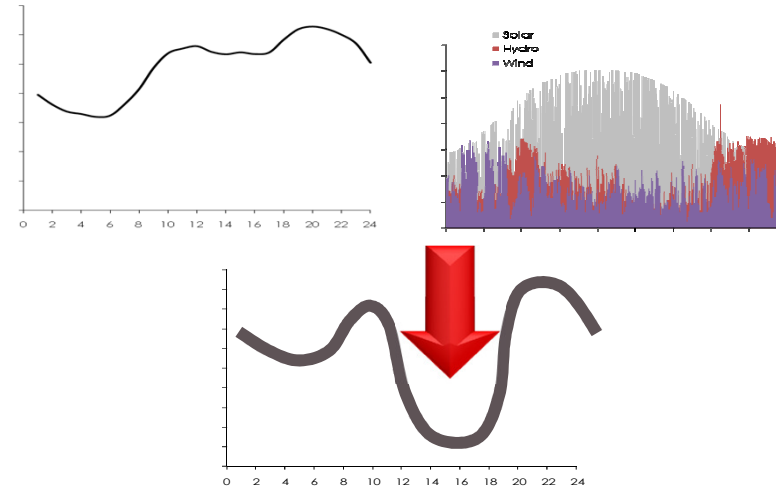
PRO	TSO	PRE	DSO	Retailer
Black start	Participation to the prim. frequency control	Renewable generation flexibility	Capacity support	End-user peak shaving
Arbitrage	Participation to the sec. frequency control	Capacity firming	Dynamic, local voltage support	Time-of-use Energy cost management
Support to conventional generation	Participation to the terc. frequency control	Limitation of upstream perturbations	Contingency grid support	Particular requirements in power quality
	Improve. of the freq. stability of weak grids	Curtailment minimization	Intentional islanding	Continuity of Energy supply
	Investment deferral		Reactive power compensation	Limitation of upstream disturbances
	Participation to angular stability		Distribution power quality	Compensation of the reactive power
	Limitation of upstream perturbations		Limitation of upstream perturbations	
			Investment deferral	



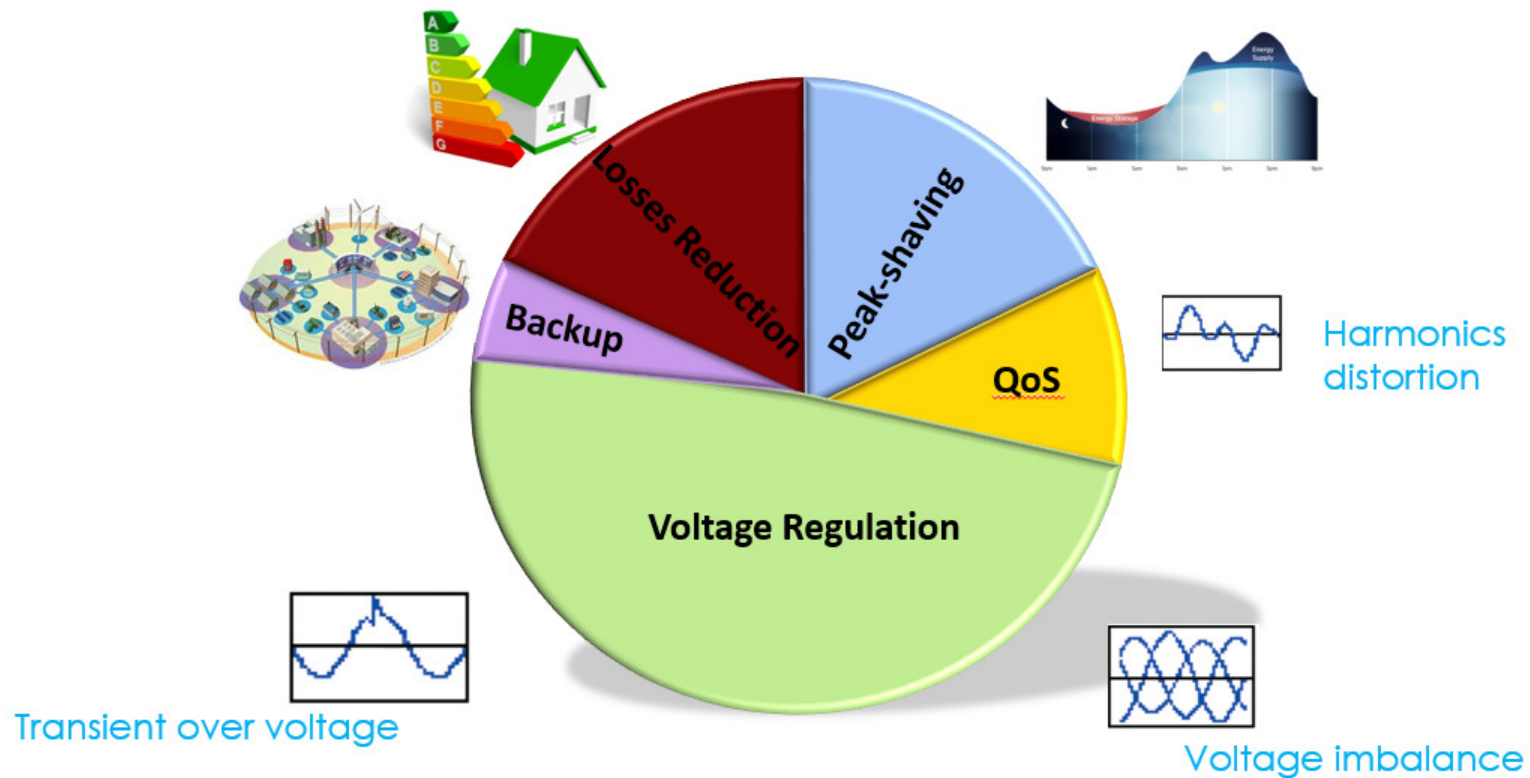
# Storage as a helpful tool for DSO....

## And also....

- » Actively Managing the grid;
- » Increase DER integration ;
- » Increase QoS;
- » But also as a Market facilitator.....

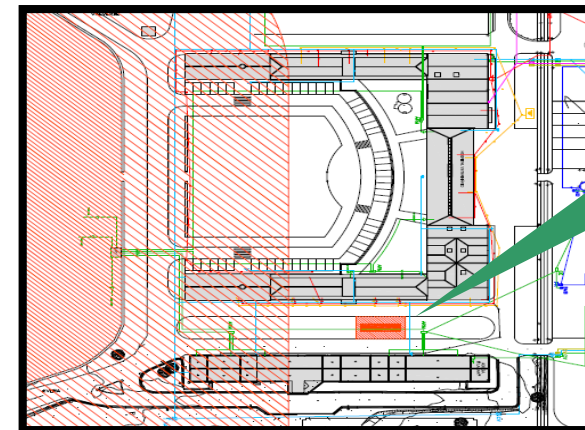
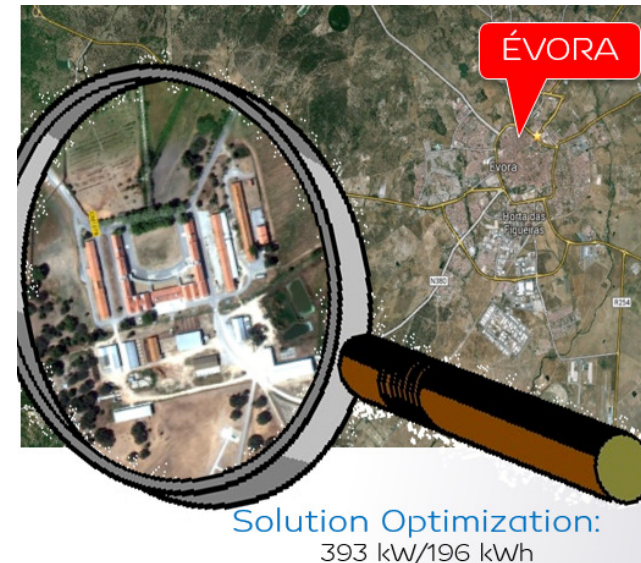


# SSS – Smart Storage System



# EDP D Deployment example...

- **Location in Évora (InovCity) a typical rural network**
  - University of Évora–  
Institutional Client MV
    - Max. 480 kVA
- **Chosen and Dimensioned:**
  - Quality of Service
  - Load Profile
  - CAPEX
- **Selected Technology: Li-Ion**



# SSEPD's energy storage projects

- » 100kW / 150kWh Zinc Bromine flow battery
- » 1MW / 6MWh Sodium Sulphur battery
- » 3x 25kW / 25kWh Li-ion batteries
- » 2MW / 500kWh Li-ion battery
- » 1MW / 3MWh Lead acid battery
- » 16kW / 16kWh – Li-iron battery



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# Slough Low Voltage Connected Battery Project

- » Project started in 2011
- » Technology L-Ion 3x 25 kW 25kWh
- » Connected at 230V
- » Main objectives:
  - to determine the operational issues and benefits the batteries can provide
  - gain experience of installation and operation of the battery
  - gain experience of integration with local Demand Side Response to remove station peaks providing additional Demand capacity
  - Full safety case completed to ensure units were safe to install / operate





# Low voltage connected battery project

Greenwatt Way, Chalvey, Slough



<http://www.ssezerocarbonhomes.com/>



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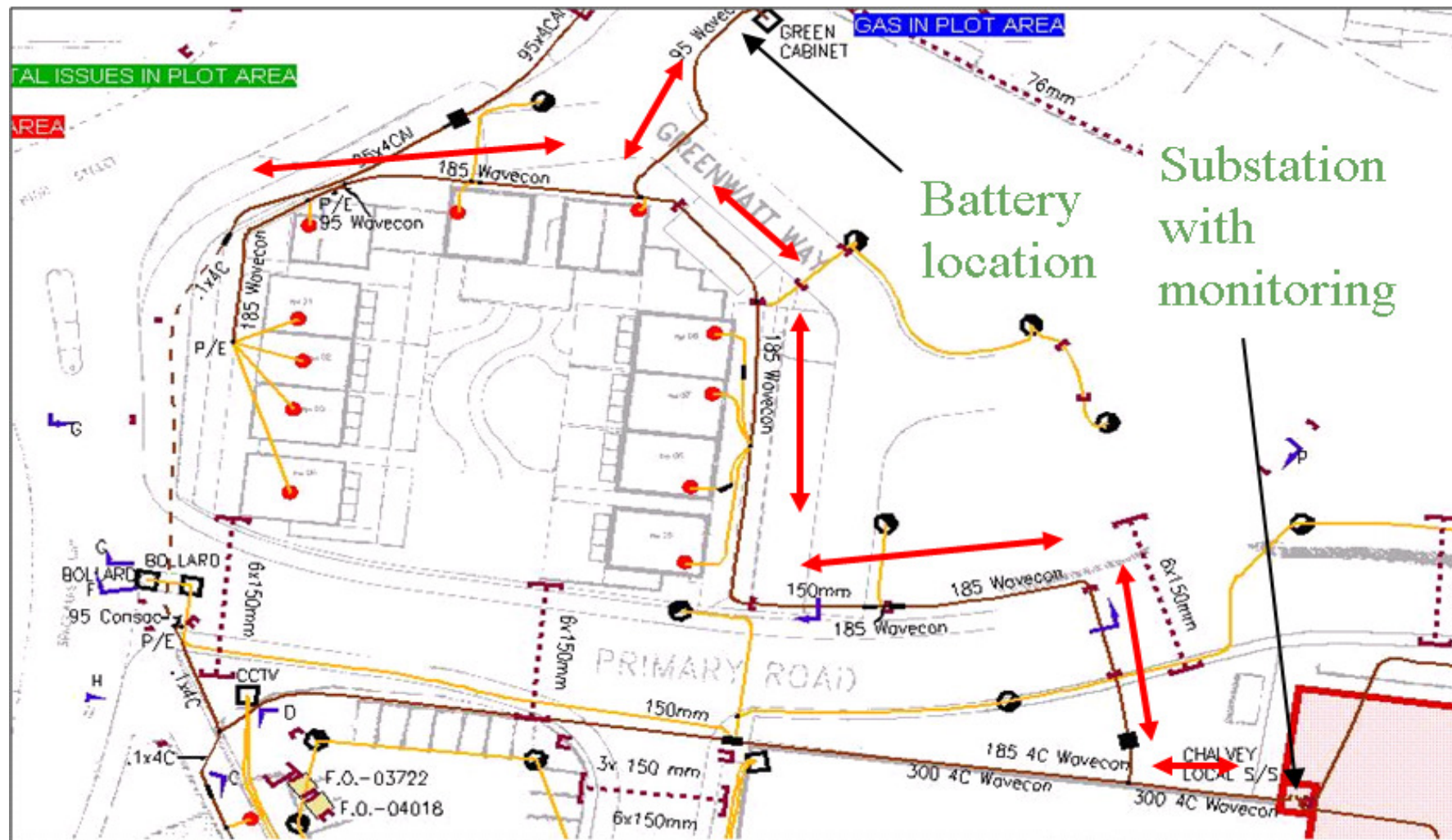
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# Low voltage connected battery, Slough

Network location of the batteries



# Low voltage connected battery project

## Installation photos



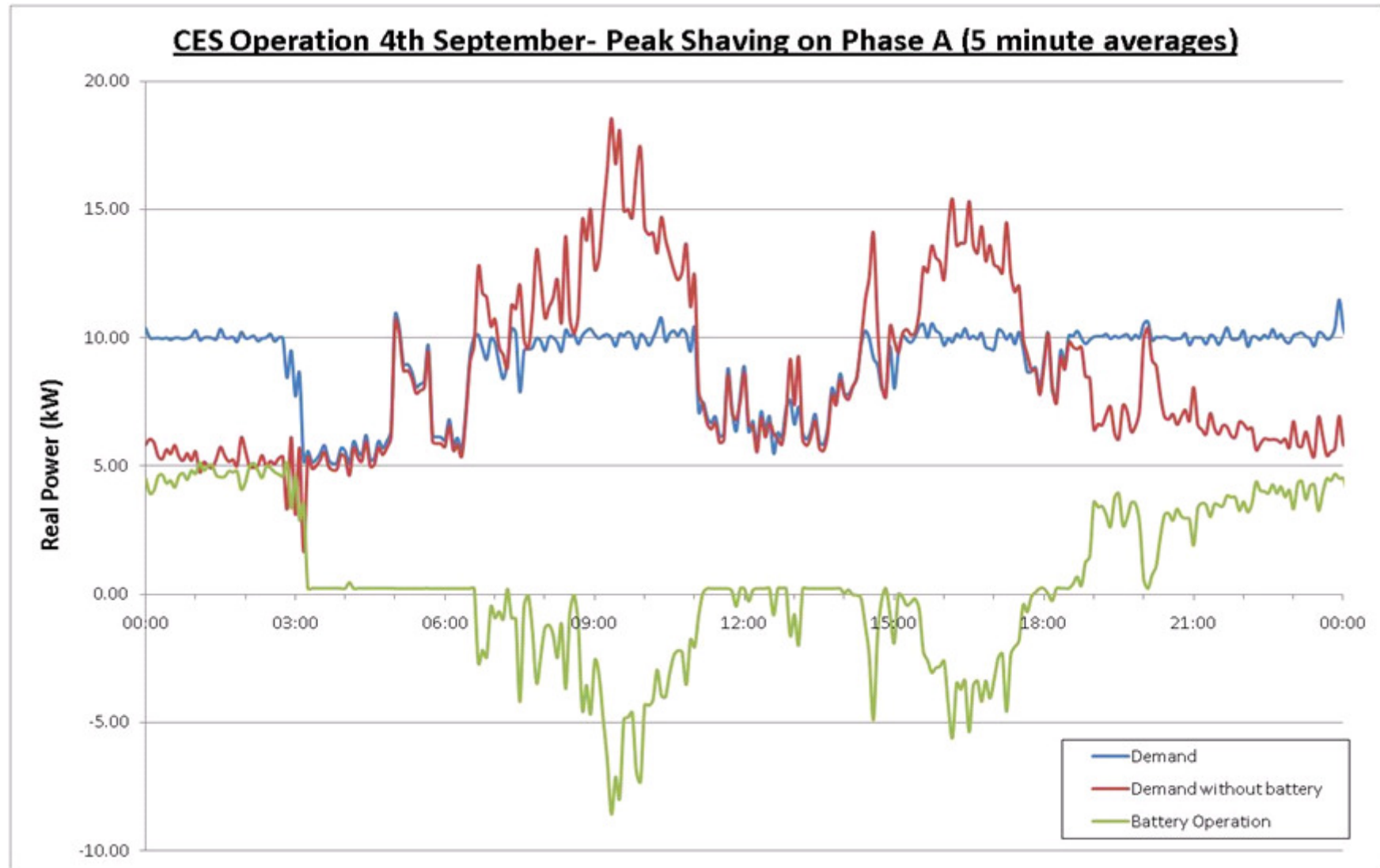
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# Low voltage connected battery project



# Orkney Energy Storage Park Project

- » Project started in 2011
- » Technology L-Ion 2MW 500MWh
- » Connected at 11kV
- » Main objective:
  - gain better understanding of the commercial markets that storage can operate in
  - gain experience of installation and operation of the battery
  - gain experience of integration with Active Network Management system
  - Full safety case completed to ensure units were safe to install / operate



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# Potential Revenues Streams

- » STOR
  - » Committed
  - » Flexible
- » TNUoS avoidance
- » DUoS avoidance
- » Capacity payments
- » Arbitrage

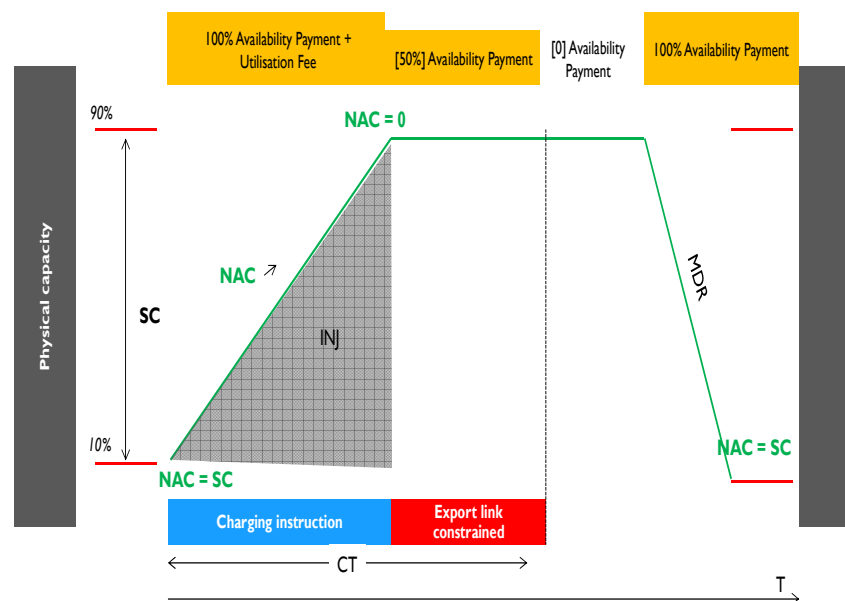


# Orkney Energy Storage Park



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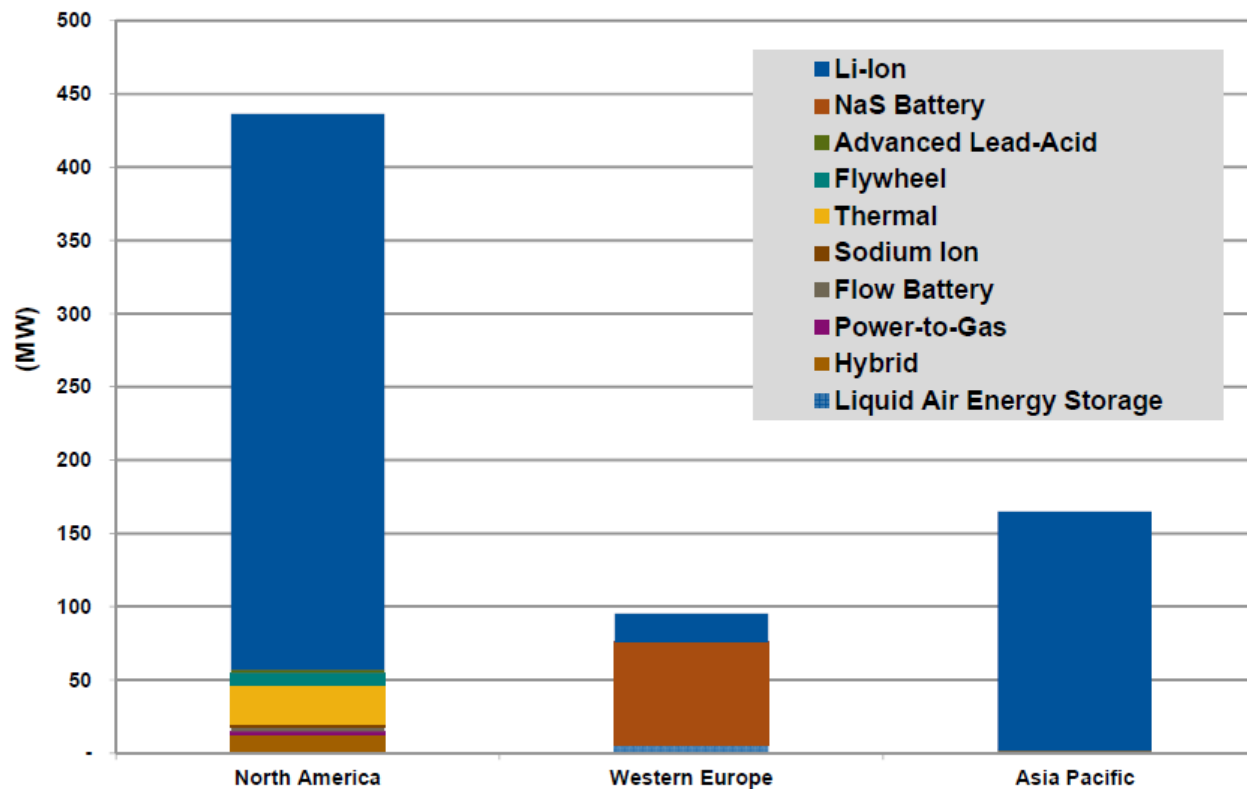




# We are in the right track

## Trends....

Chart 1.1 New Announced Projects by Technology and Region, Excluding Pumped Storage, World Markets: 3Q 2014-1Q 2015



(Source: Navigant Research)



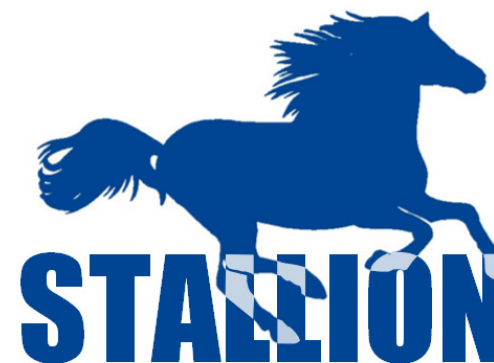
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# Importance/Interim conclusions Stabalid&Stalion projects....

- » Storage is indeed a helpful tool;
- » DSOs in Europe are becoming more aware and interested in this technology from business point of view but also as a market facilitator;
- » Safety standards not clearly defined, but needed;
- » Standards will help to mitigate certain uncertainties and facilitate deployment;
- » ...





**Supporting the deployment of safe Li-ion stationary  
batteries for large-scale grid applications**

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**Thank you!**  
**DSO perspective**

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