Energy storage and our electricity networks: policy requirements

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THE ELECTRICITY STORAGE NETWORK

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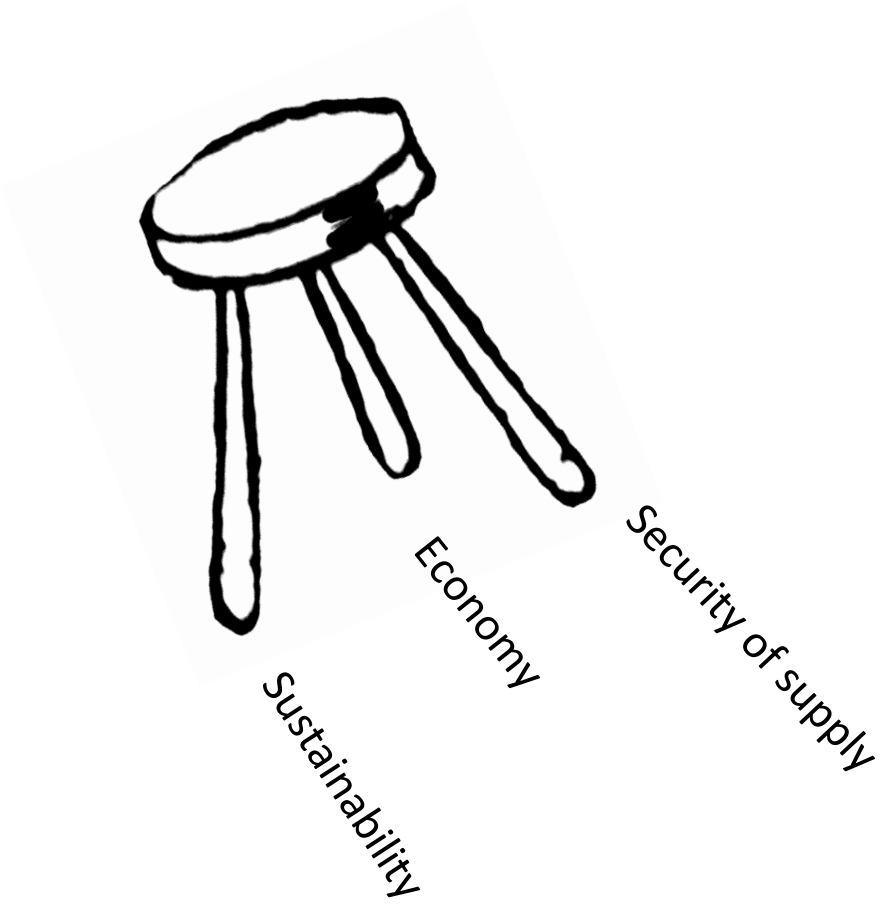
Synopsis

- UK energy policy and grid issues
- Requirements for storage
- Issues, barriers and incentives
- Policies

Energy policy



UK's Energy policy

Sustainability

- EU 20 / 20 /20 targets
- Climate Change Act 2008
- Increased renewables
- Decarbonisation of electricity
- Decarbonisation of other sectors
- Increased use of electricity as a clean energy vector
- Energy conservation
- Energy efficiency
- Sustainable generation
- Distributed generation
- Efficient generation
- Non sustainable resources as last resort

Economy

- Open markets deliver competitive prices
- Interconnections link markets
- Vertical industry separation increases market transparency
- Avoid price uncertainty for consumers
- Political intervention and regulation to protect consumers
- Community and domestic stakeholder participation in ownership, production and trading
- Asset optimisation

Security of supply

- Licence conditions provide requirements for supply
- SQSS to ensure adequacy
- T & D investment
- Ensure sufficient peak capacity
- Maintain margin with adequate reserves
- Increase renewables to reduce reliance on imported gas and other fuels
- Develop system flexibility and community level resilience
- Adopt smart grids

Power networks

Today's network

- Large scale generation, through transmission, distribution to users
- Limited embedded generation (at distribution level)
- Wholesale market supplies retail customers
- Limited number of self suppliers
- System planned to meet peak demand plus reserves – spare (or under utilised assets)
- Low level of interconnections to other systems
- Regulated wires businesses
- Facing substantial change

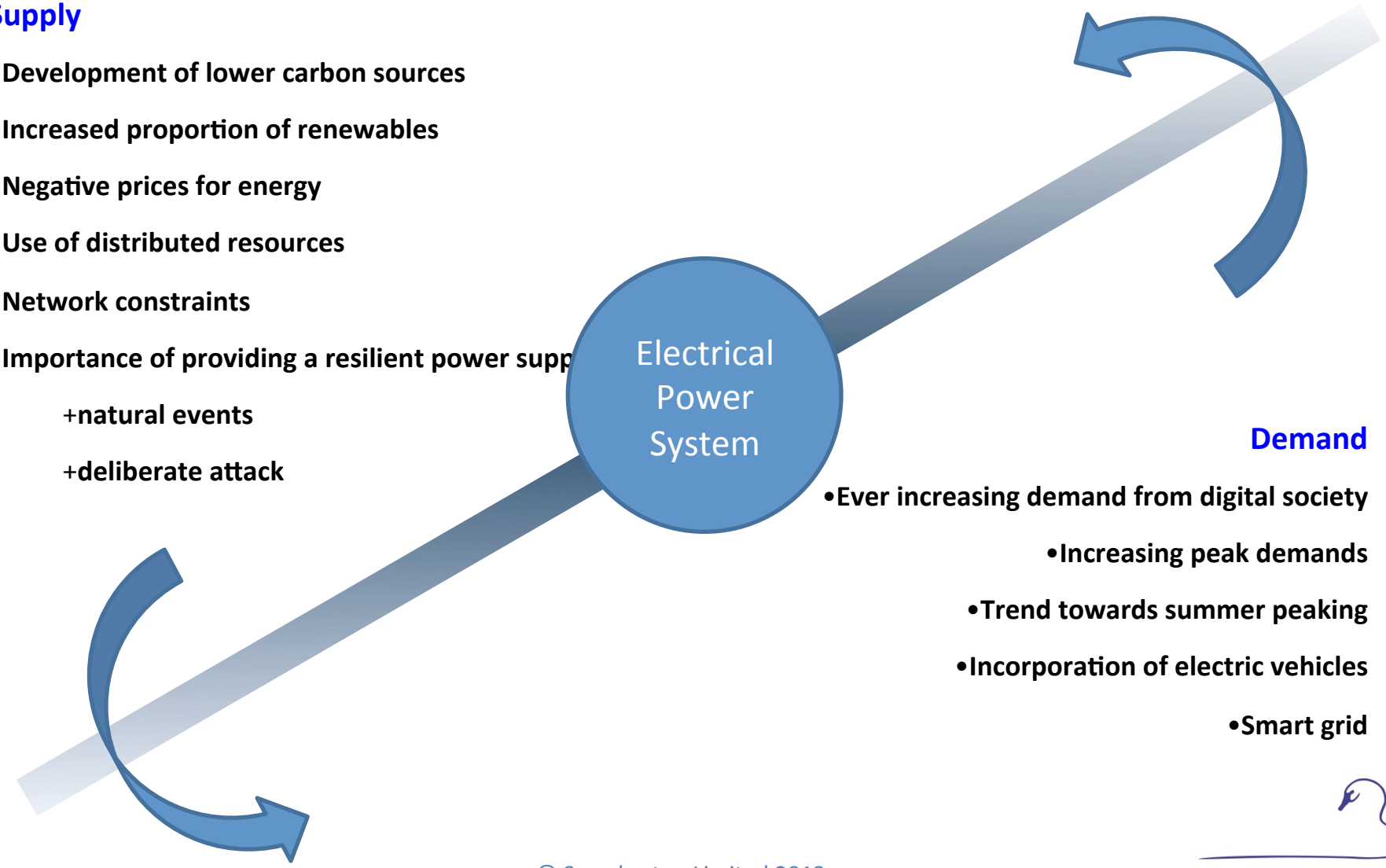
The future

- Significant shift from dispatchable generation to time variable generation
- More negative prices for electricity and increased market volatility
- Peaky demands from digital society, switch to heat pumps, uncertain effect of electric vehicles
- Distributed community and domestic level generation and trading
- Average and peak domestic demand likely to increase (double??)
- Balancing the system requires more flexibility
- *Even more government interference?*

Trends in the power system

Supply

- **Development of lower carbon sources**
- **Increased proportion of renewables**
- **Negative prices for energy**
- **Use of distributed resources**
- **Network constraints**
- **Importance of providing a resilient power supp**
  - **+natural events**
  - **+deliberate attack**



Demand

- **Ever increasing demand from digital society**
- **Increasing peak demands**
- **Trend towards summer peaking**
- **Incorporation of electric vehicles**
- **Smart grid**

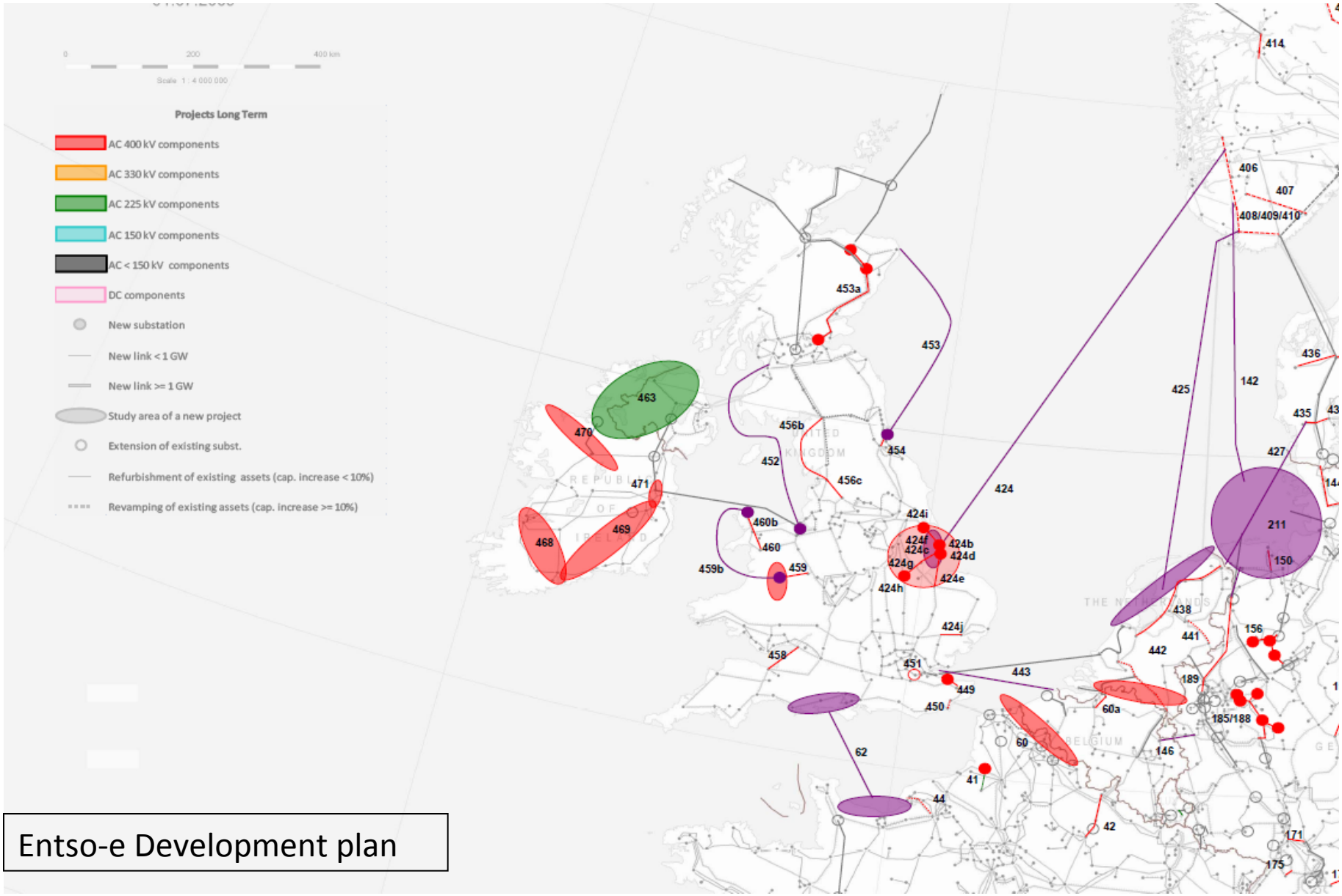
Grid issues in GB

Power flows

- Generation in Scotland and offshore
- New offshore HVDC links

Energy balancing

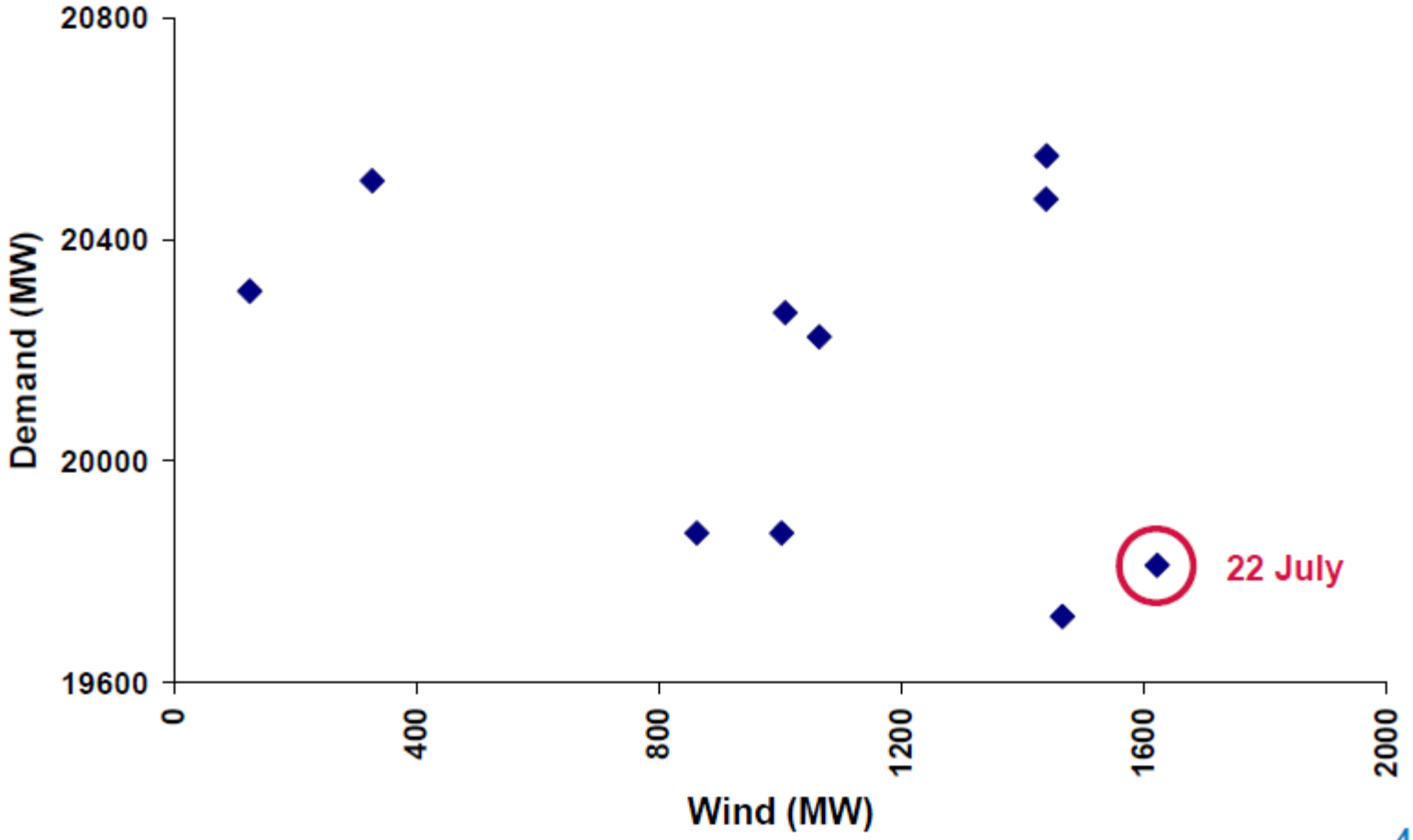
- Maintenance of minimum demand
- Adequacy of supply in low wind conditions
- Operational reserve
- Strategic reserve



Entso-e Development plan

nationalgrid

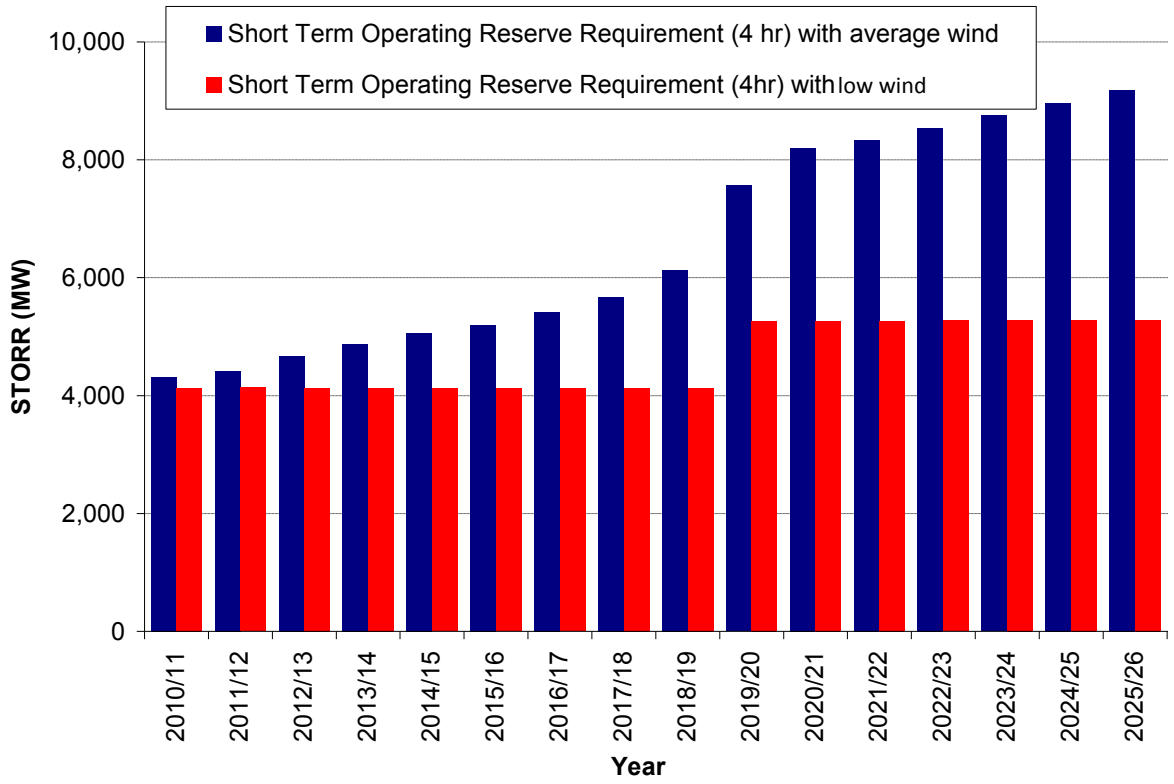
Ten Lowest Actual Demands in 2012



Reserve and Operating Margin

Reserve requirement under 'Gone Green'

Short Term Operating Reserve Requirement for average wind and low wind conditions



Source:
National Grid

Two major issues with renewable generation

Fast changes

- Changes in demand
  - 6.5 GW / h at present
- Changes in production
  - 4 GW / h
- Max rate of change
  - ~ 11 GW / h [1]

Lulls

- 5 days plus of low wind production
- 33 GW nameplate
  - Av 10 GW production
  - 5 day lull = 1200 GWh

[1] David Mackay "Energy Storage without the hot air"

Does storage offer a solution?

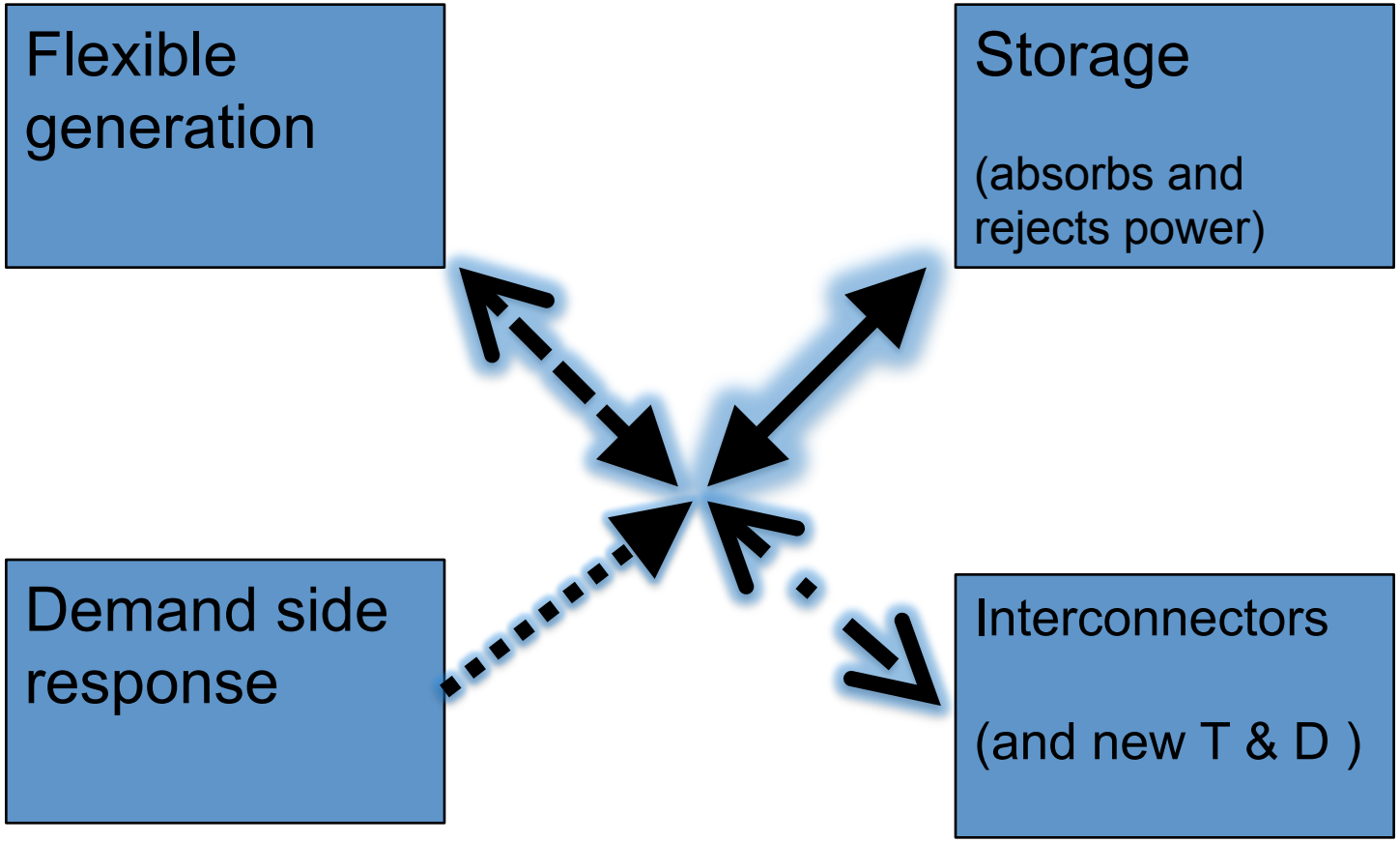
Storage

- Rapid response
- Absorbs and rejects power
- Many options for location
- Rapid construction time
- Possible to match power and energy to requirement
- Multi purpose – unlikely to become a stranded asset

Issues

- No clear business model
- Power industry separation disincentives investment
- Uncertain income projections increases project financing risk
- No clear regulatory or licensing policy
- No current government policy for widespread deployment / adoption of storage

The four tools for system balancing



Policy requirements

- Clarify position of storage: **New classification needed**
- Set target for storage requirement: **2 GW by 2020**
- Support storage: **parity with support for other new / green technologies + provide certainty of income**
- Support mechanism specifically for storage: **capacity mechanism class based on capability**
- Extend capital grants for deployment of storage: **Develop projects to encourage the sector**

A new classification for storage

- Storage is neither generation, nor demand.
- Existing licensing provisions are inconsistent and not necessarily relevant
- A new classification clarifies position of network operators who own storage
- Clarify connection charges
- Enable whole system to benefit from storage
- Consistent with EU Directives

2 GW by 2020

- 22 GW of renewables in the pipeline for 2020
- Allow 10% to be supported by storage = 2 GW
- Imperial College / Carbon trust proposes that 2 GW storage in 2020 has value:
  - £100 / kW / year for bulk storage
  - £160 / kW / year for distributed storage

2 GW target

- GB system current pumped storage = 3GW
- Dinorwig ~ 2GW
- Achievable: average 300 MW / year
- Beneficial

	Year	User led	Distributed	Centralised	annual total	cumulative total	
	2013	2	5		7	7	
	2014	8	10		18	25	
	2015	20	25	10	55	80	
	2016	30	60	50	140	220	
	2017	60	90	50	200	420	
	2018	120	150	100	370	790	
	2019	150	250	150	550	1340	
	2020	180	300	200	680	**2020**	

Summary of key points

- GB system current pumped storage = 3GW
- Insufficient peak capacity
- Reserve capacity needed
- Storage = suitable technology
- Current business model needs to be improved
- Policy changes needed
  - New classification for storage
  - Government policy to adopt storage