

Future Trading Arrangements

Role of markets in low carbon electricity systems

Goran Strbac

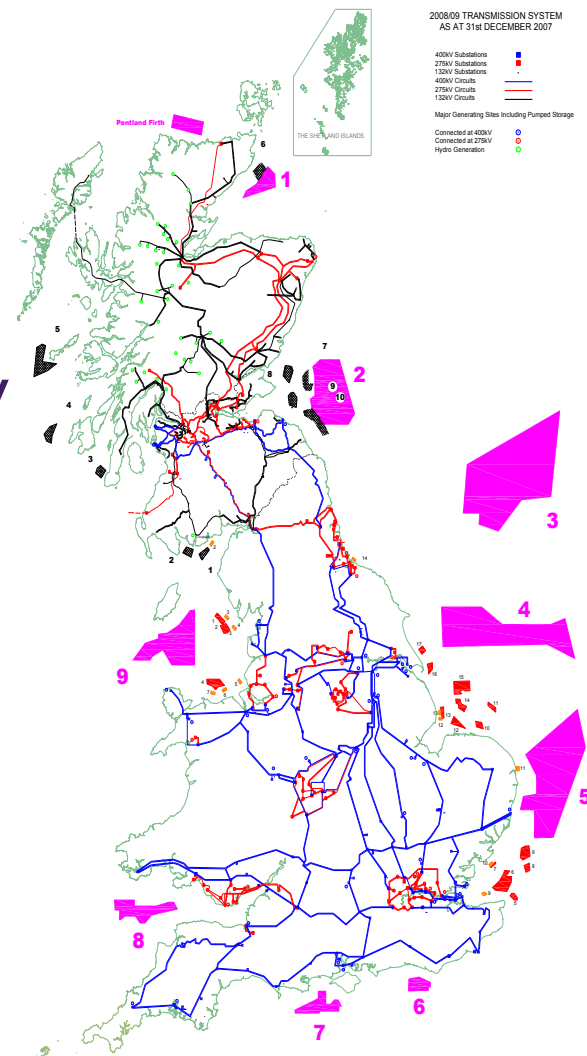
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Areas of interest

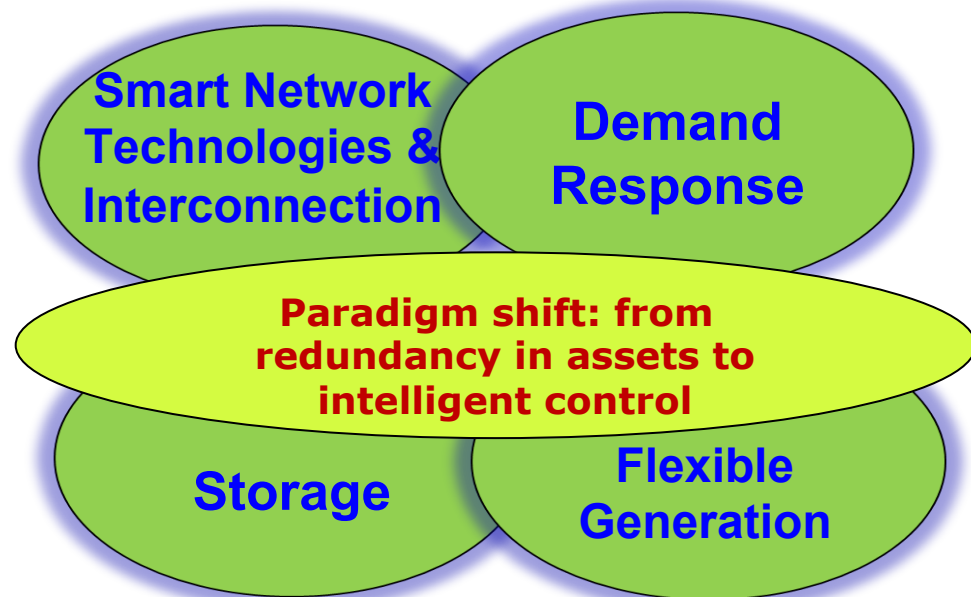
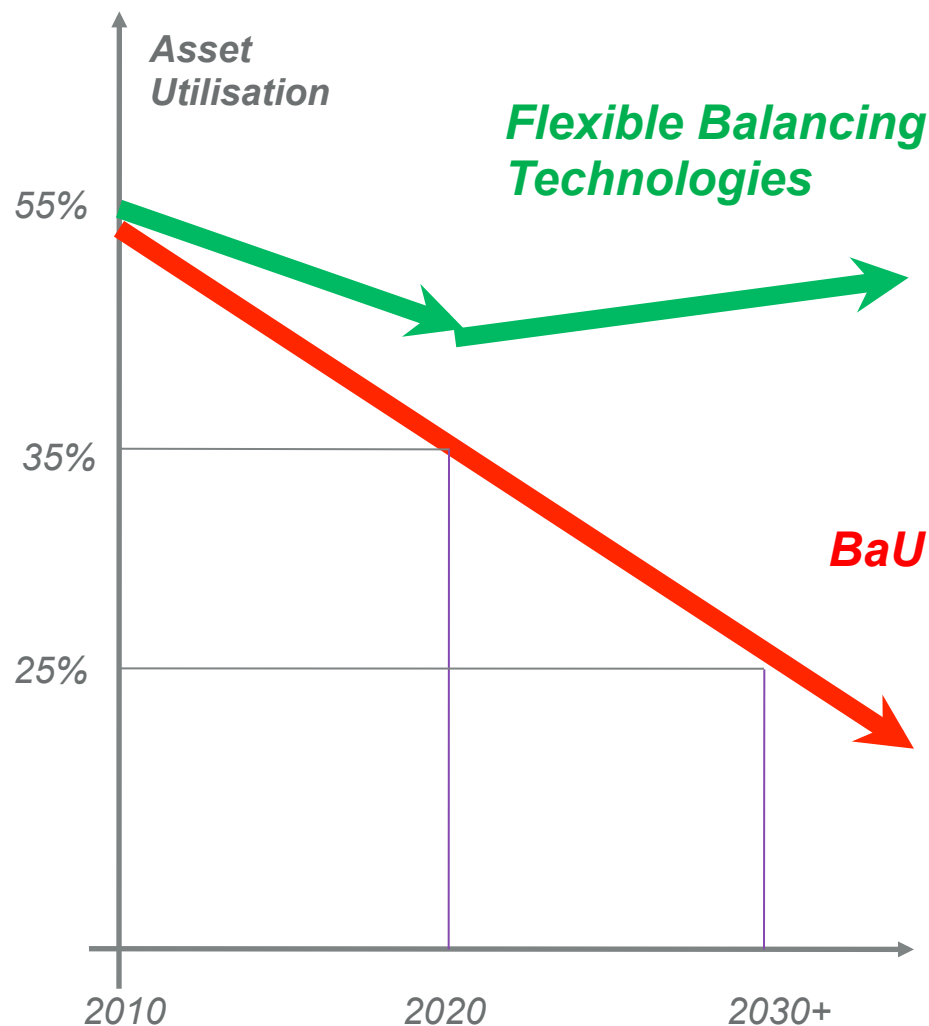
- Synergies and conflicts between market and subsidies driven investment in low carbon energy system
- Role of markets in supporting cost effective integration of low carbon generation and demand technologies
- Innovative solutions and industry business model
- Consumer interests
- Building evidence - case studies
 - Value of DSR and generation flexibility, role of networks, benefits of EU market integration

UK Response to Climate Change Challenge

- 2020: 25-30% of all electricity demand to be met by renewable generation
- 2030+ :
 - Largely decarbonised electricity generation, while.....
 - Electrifying segments of transport and heat sectors
- ...in order to reduce CO2 emissions by 80% by 2050



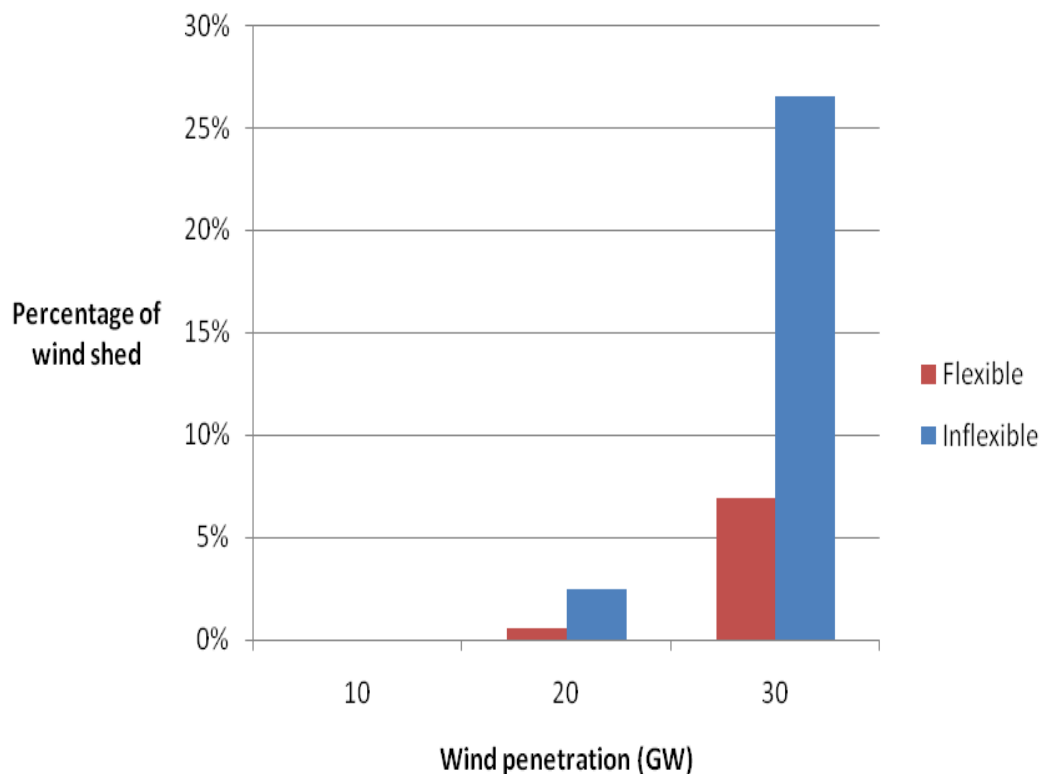
Low carbon system integration challenge: degradation in asset utilization



***Volume of the market
for flexible balancing
technologies >£60b***

System integration costs in low carbon European system may exceed €500b

Balancing and Need for Flexibility



Number of hours with zero or negative prices

High Generation Flexibility

200

Low Generation Flexibility

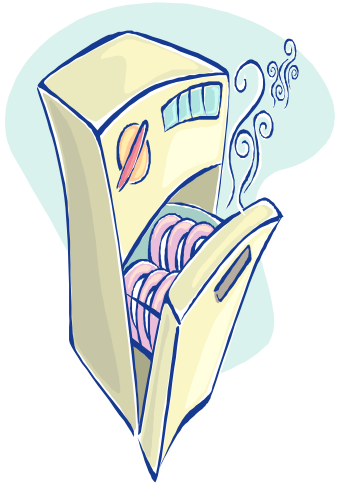
>1500

Unprecedented price volatility... value of energy frequently lower than value of flexibility

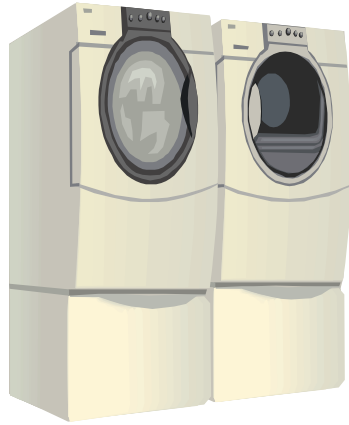
leading to increased base-load & peak generation investment risks...

...while providing significant opportunities for demand side response, storage, flexible generation and interconnection

Demand response in action: demand to follow wind...



Smart Dishwasher



*Washing Machine &
Tumble Drier*



Refrigerator



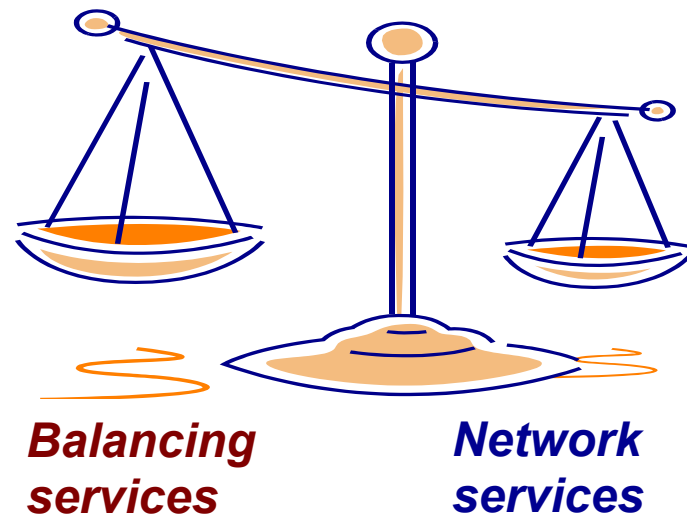
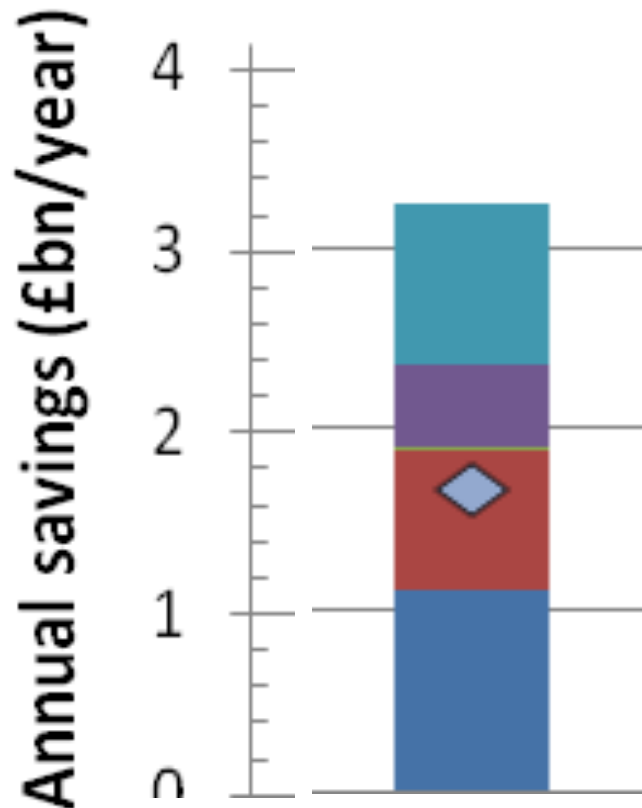
Air Conditioner



Water Heater

Generation Mix Flexibility	High	Low
Cost Savings £/SD	<10	>100
CO ₂ Savings kg/SD/year	<50	>250

Complexity of demand response and storage: *Split benefits*

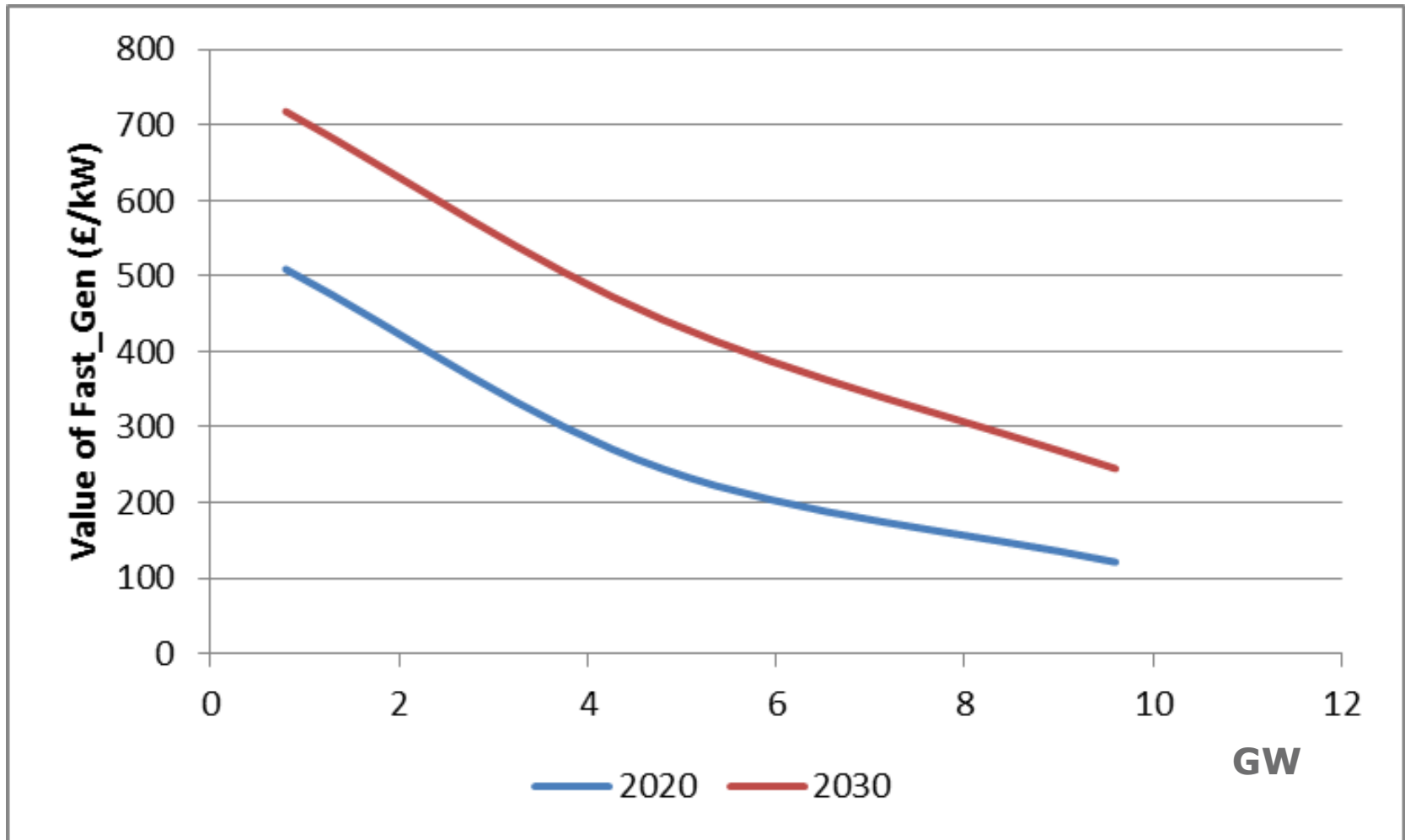


■ OPEX ■ G CAPEX ■ T CAPEX ■ IC CAPEX ■ D CAPEX

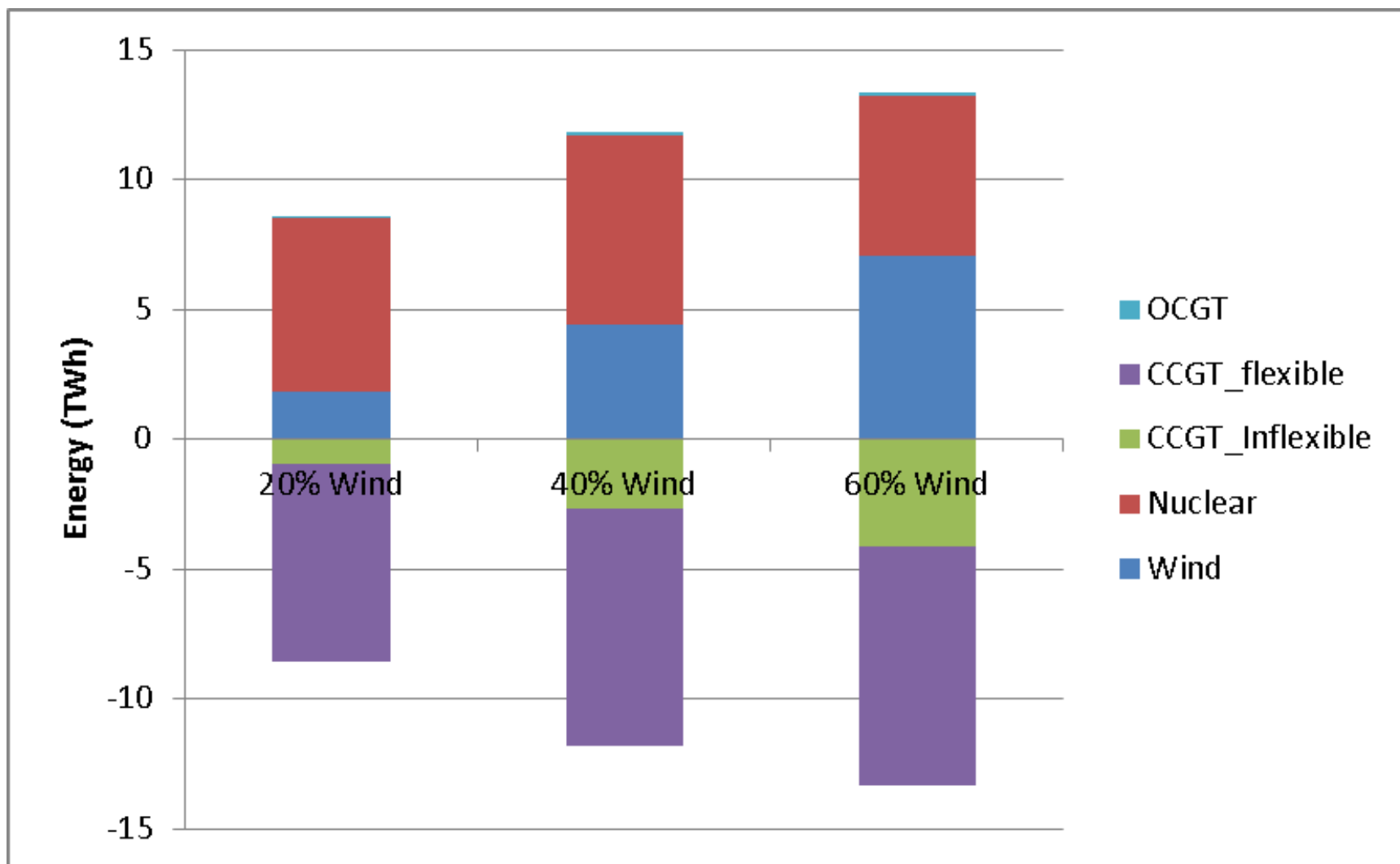
Can the market facilitate this?

How about DSR & industry business model?

Value of Flexible Peaking Plant – 2020+

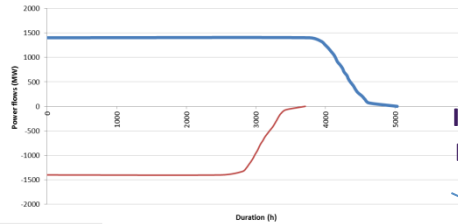


Impact of flexibility on plant energy production

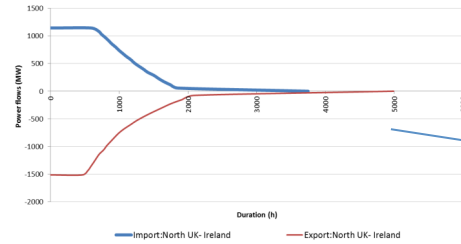


UK is not an island in low carbon future

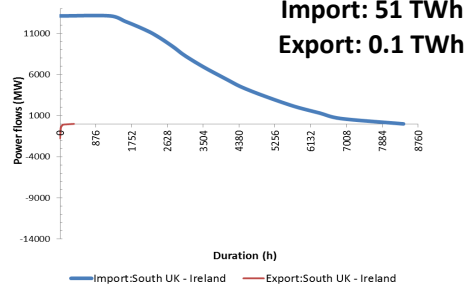
UK-NI 1.5GW
Import: 1.4 TWh
Export: 1.7 TWh



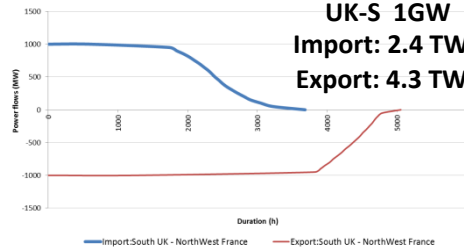
UK-N 1.5GW
Import: 6.0 TWh
Export: 4.4 TWh



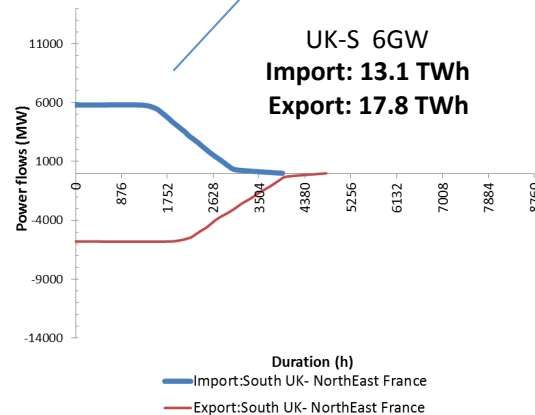
UK-S 13GW
Import: 51 TWh
Export: 0.1 TWh



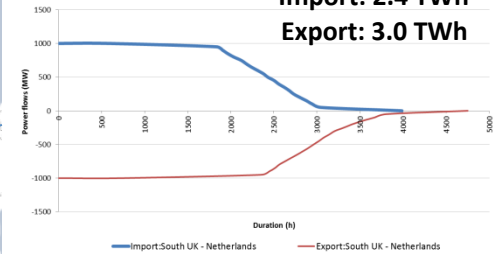
UK-S 1GW
Import: 2.4 TWh
Export: 4.3 TWh



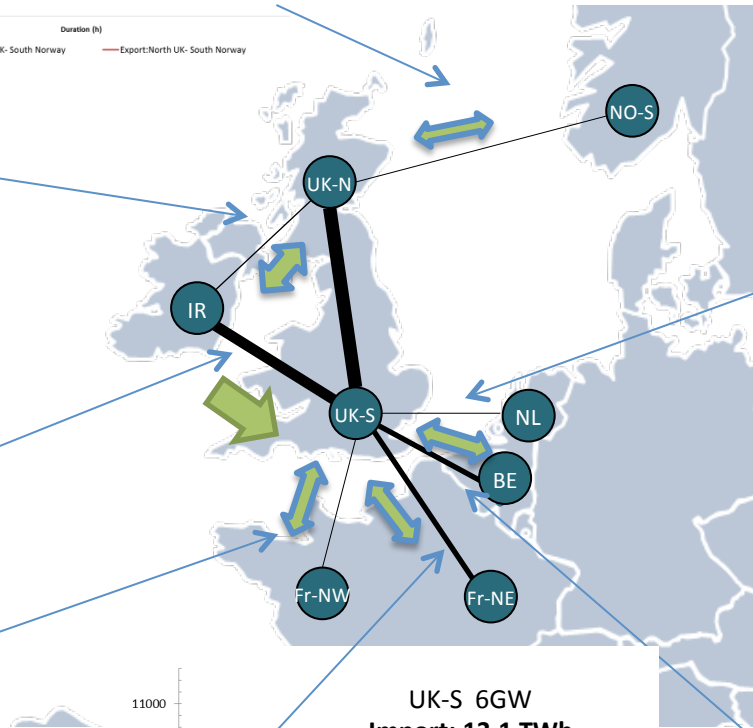
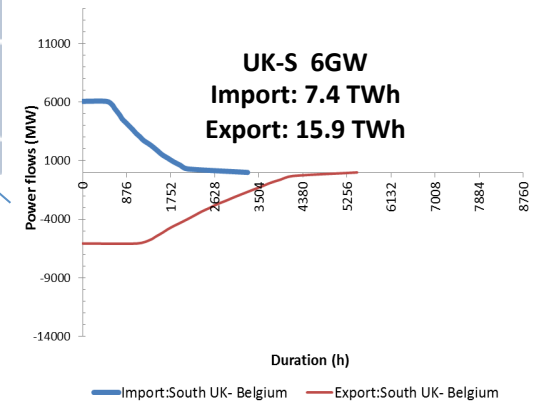
UK-S 6GW
Import: 13.1 TWh
Export: 17.8 TWh



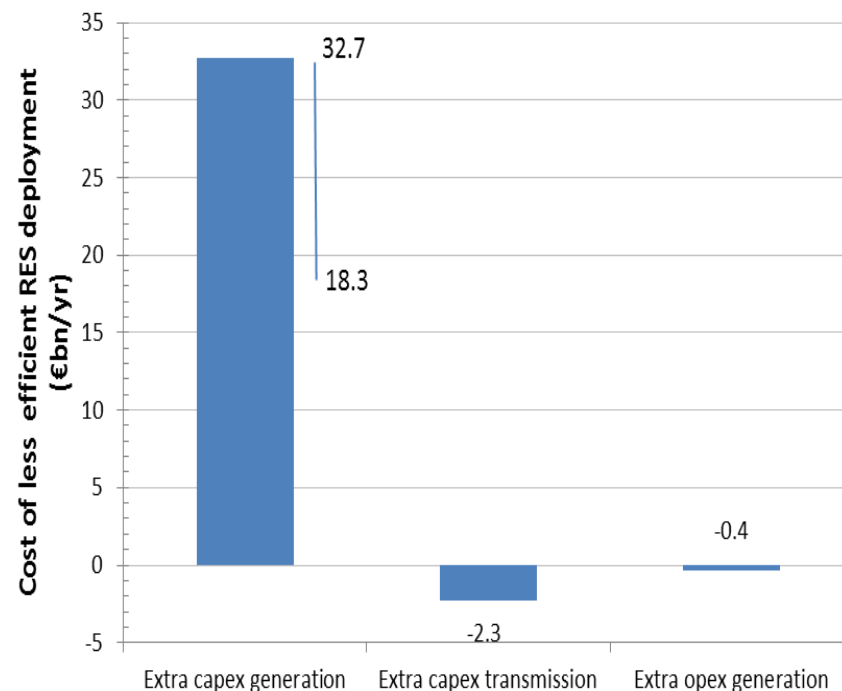
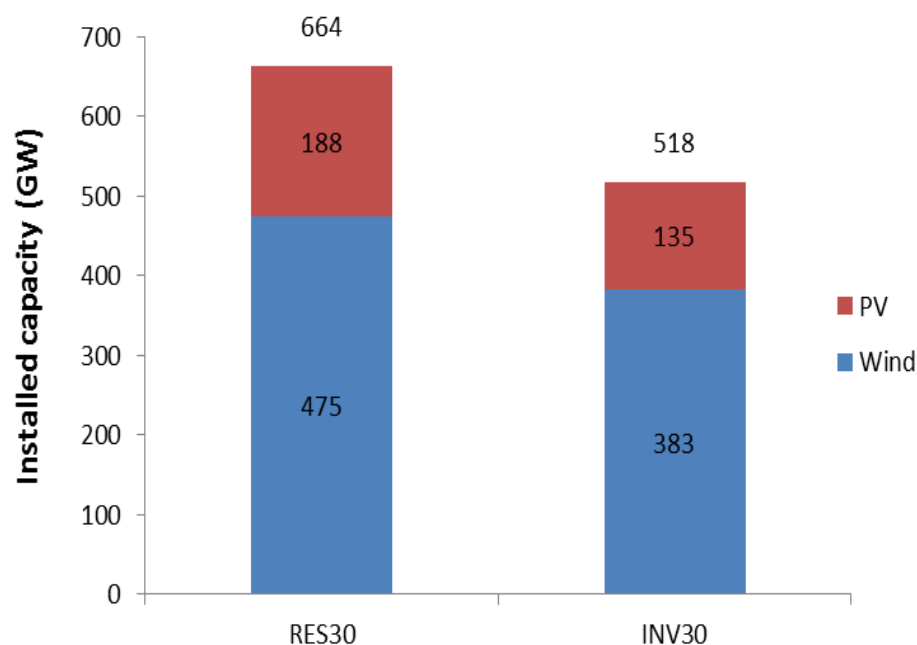
UK-S 1GW
Import: 2.4 TWh
Export: 3.0 TWh



UK-S 6GW
Import: 7.4 TWh
Export: 15.9 TWh



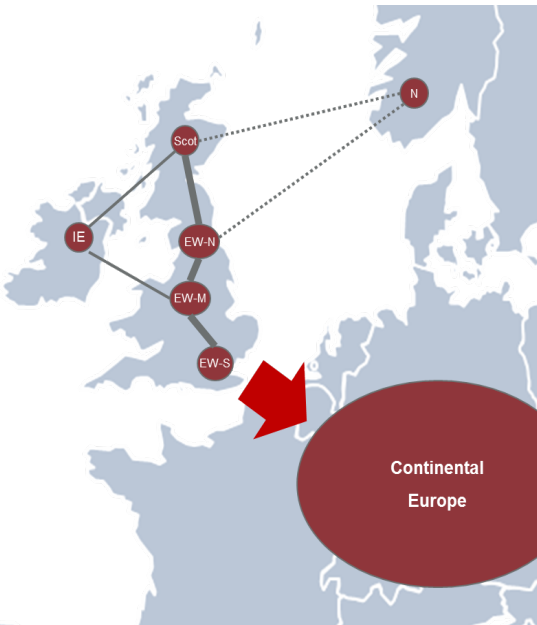
EU-wide versus member state centric RES deployment in Europe



Coordinated new wind and new PV deployment → saving 146 GW of new capacity

- Wind in the North
- PV in the South

EU-wide capacity mechanism can save 100-160 GW of peaking plant



Can you really trust when it comes to security ?

Market design and regulatory framework

Market design:

- Market to facilitate consumer choice
 - » Growing value of flexibility in future => energy bills of flexible consumers may be only 30% of these for inflexible consumers
- Enable competition between smart and asset solutions

Network design:

- Cost-benefit approach to network operation and design
- Recognition of smart technologies in network planning

Regulation:

- Incentivise application of flexible solutions against asset-based solutions
- Split Benefits and business model

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