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THE ECONOMICS OF DEMAND RESPONSE

June 2014

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INCREASING NEED FOR FLEXIBILITY IN THE FUTURE

A range of anticipated changes affect the need for and supply of flexibility

Drivers for future flexibility need

- Capacity mix and growth of technologies with uncertain or variable output
- Forecasting errors mitigated by improvements in forecasting techniques (demand, wind/solar output)
- Changes to the policy and regulatory landscape

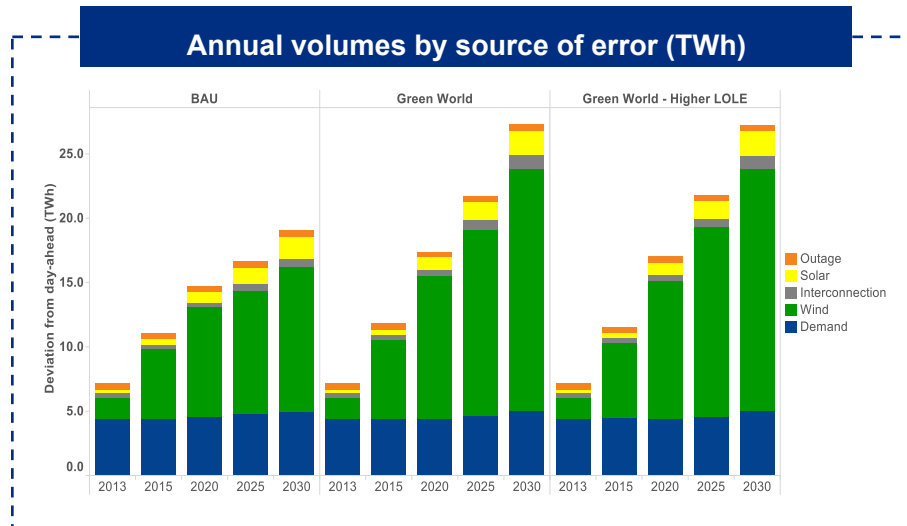
Drivers for future supply of flexibility

- Amount of existing older thermal plants that remain open (LCPD and IED closures)
- Level of cross-border coordination and efficient use of interconnectors
- Development of innovative technologies
- Improvements in flexibility parameters of thermal plants
- Technology and cost developments of demand side response

Demand Response is one of the pillars of flexibility in the future alongside storage, interconnection and flexible plants

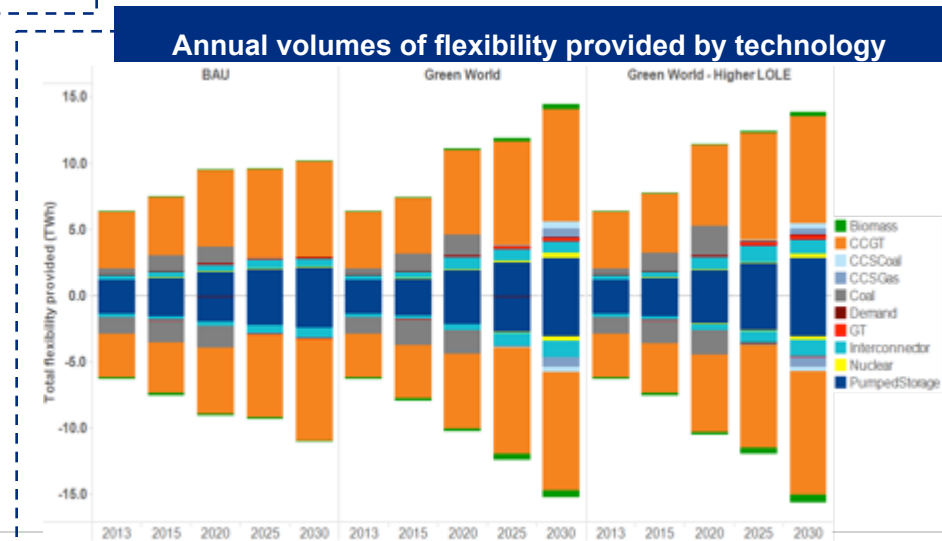
SIGNIFICANT CHANGES UNDERWAY...WIND, ELECTRIFICATION...

Increasing wind and demand forecast errors will create significant future demand for flexible capacity and for balancing services



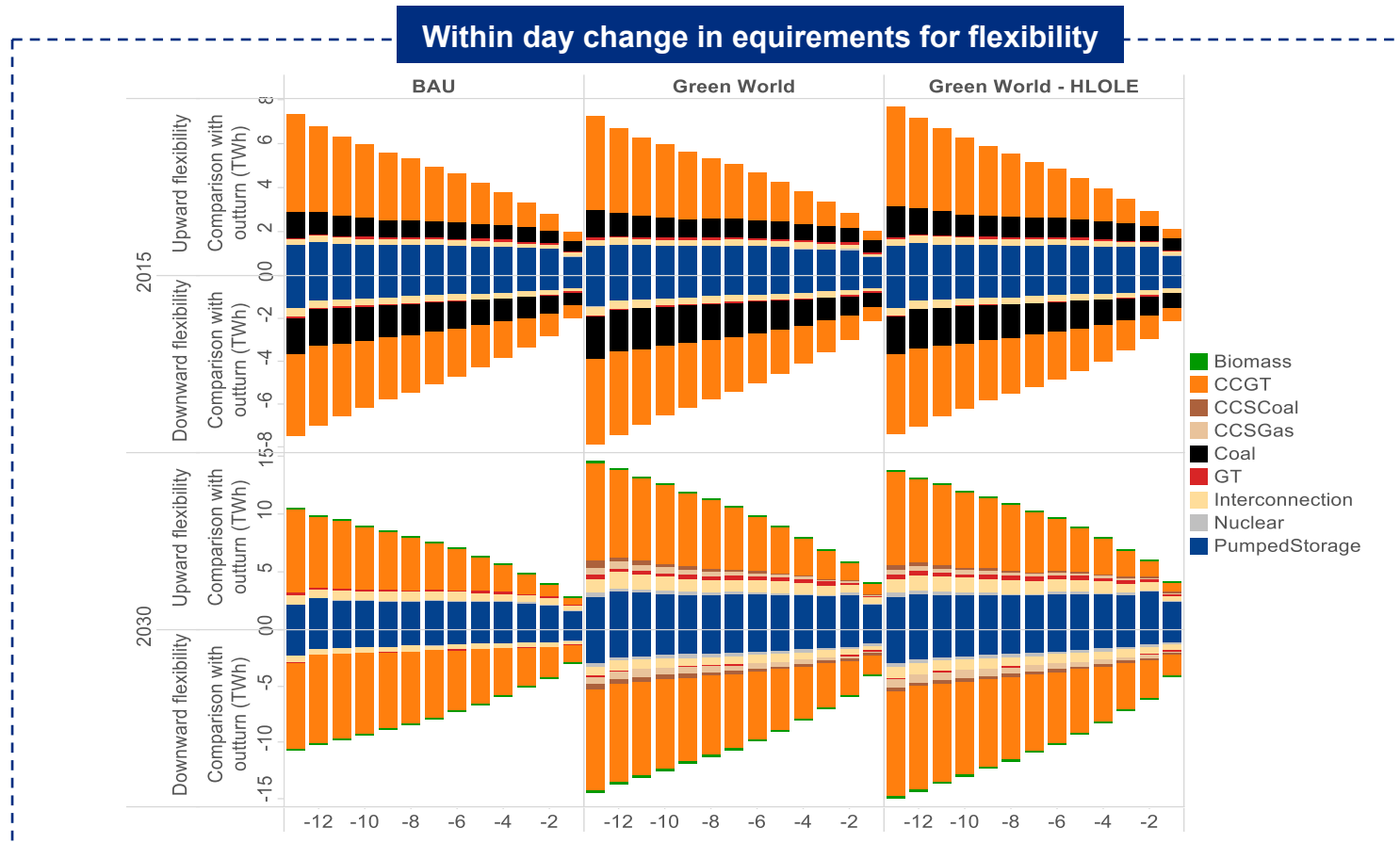
- Wind expected to become the dominant source of error within-day in GB
- This increase in error is anticipated as wind capacity grows at a faster rate than forecasting accuracy..
- ..but we expect this relationship to stabilise in the medium to long term

- CCGTs, Pumped Storage and DSR provide the greatest source of within-day flexibility in all scenarios
- The closer to real time, the more OCGTs and DSR are needed
- Coal plants provide flexibility with their output in 2015 and 2020 but this decreases in line with the coal phase out and the escalation of the carbon floor price



FLEXIBILITY REQUIREMENTS OF THE SYSTEM WILL CHANGE WITHIN DAY

Need for more rapidly dispatchable plants/demand response closer to real time

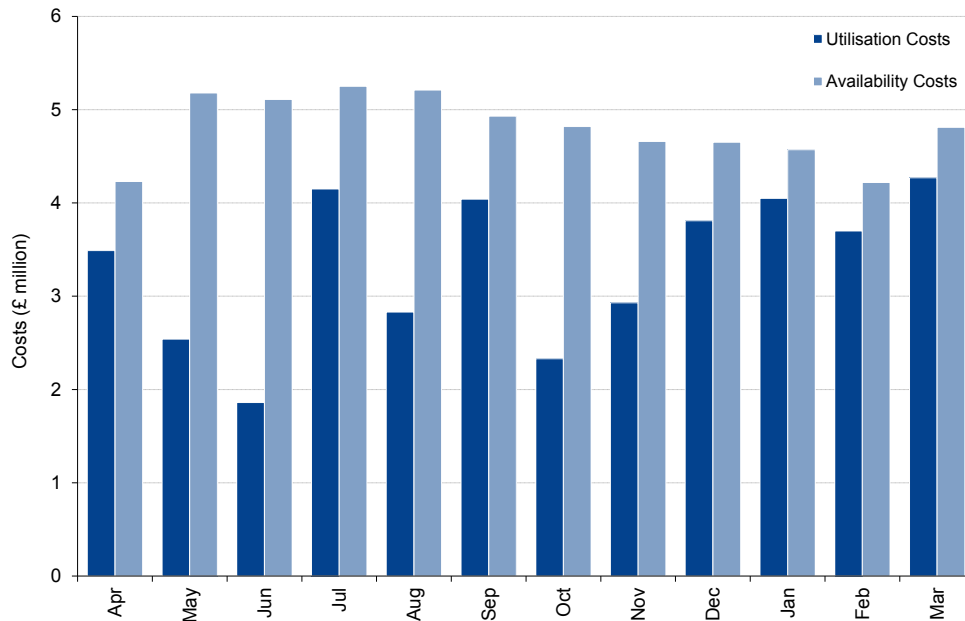


Demand response could contribute to the flexibility requirements

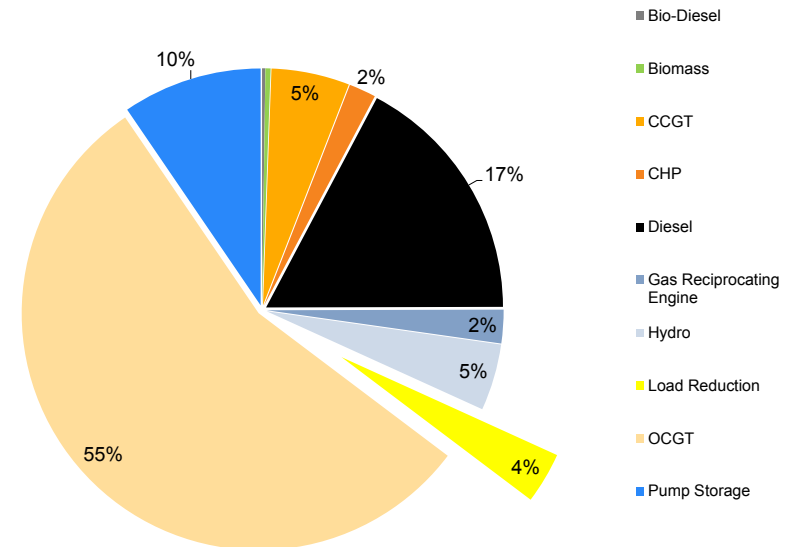
TSO USE DEMAND RESPONSE FOR RESERVE PURPOSES

Potential to use Demand Response to serve multiple purposes ...starting with the TSO

STOR Costs 2013-2014



STOR providers by type

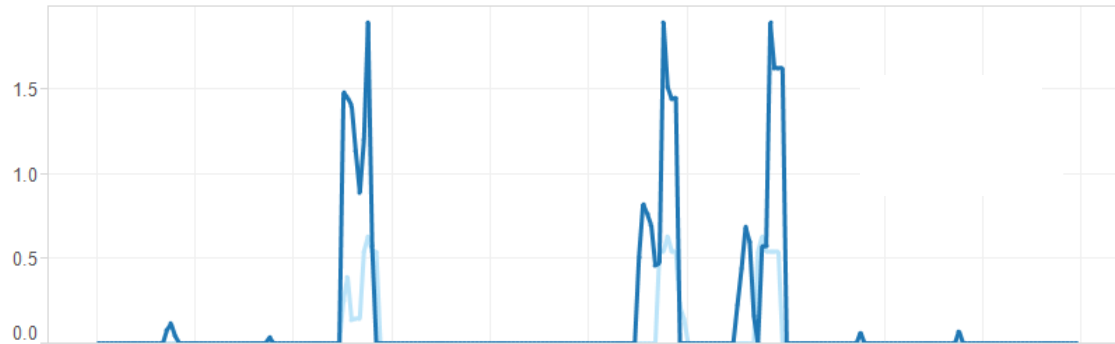


As need for flexibility and reserve increase due to variability and unpredictability of renewable generation, the use of demand response may increase

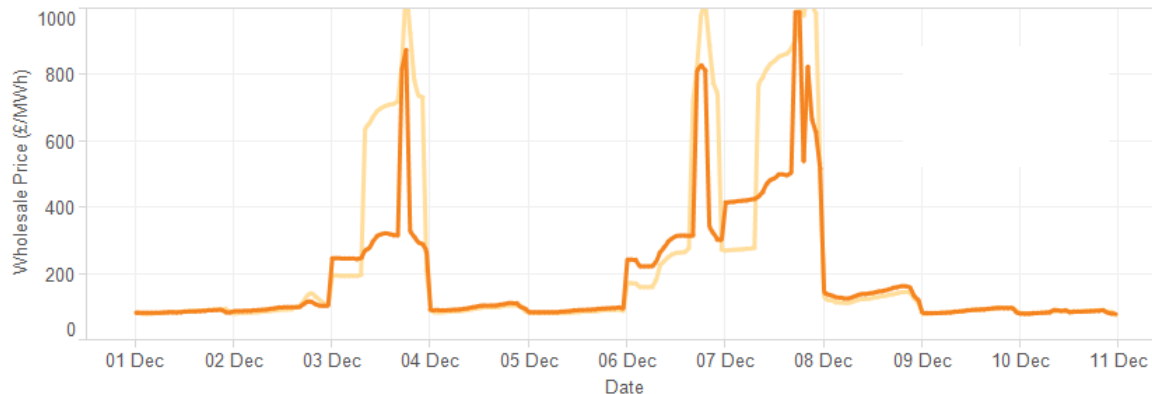
SUPPLIERS COULD USE DEMAND RESPONSE TO HEDGE THEIR WHOLESALE COSTS IN THE FUTURE

...reduce peak prices for customer, better manage their wholesale costs and generate more interesting propositions, e.g. dynamic (CPP) tariffs

National DSR Usage



Wholesale Prices

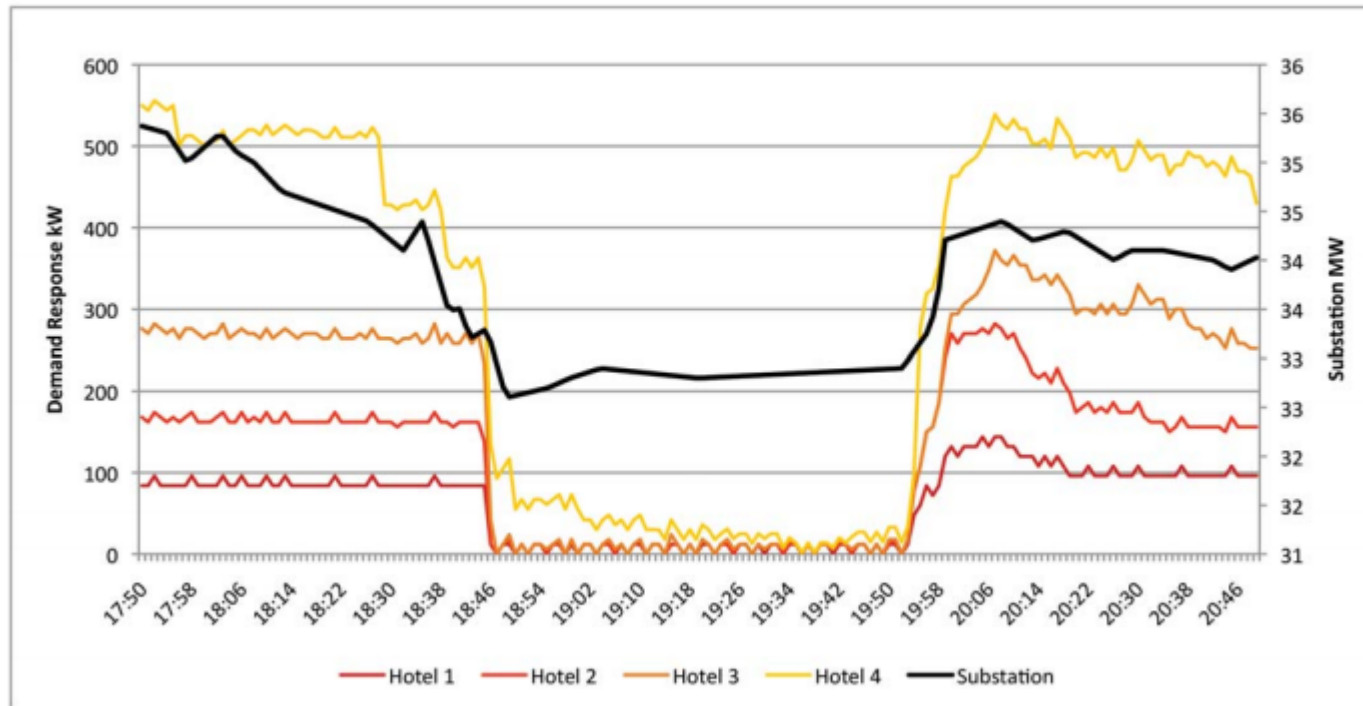


**Demand Response could also be a source of flexibility to wind portfolio players...
but destroy value for thermal plants**

DNOS COULD USE DEMAND RESPONSE TO MANAGE THEIR NETWORK INVESTMENTS, DEFERRING REINFORCEMENT

Use of I&C demand response by UKPN as part of their Low Carbon London Project

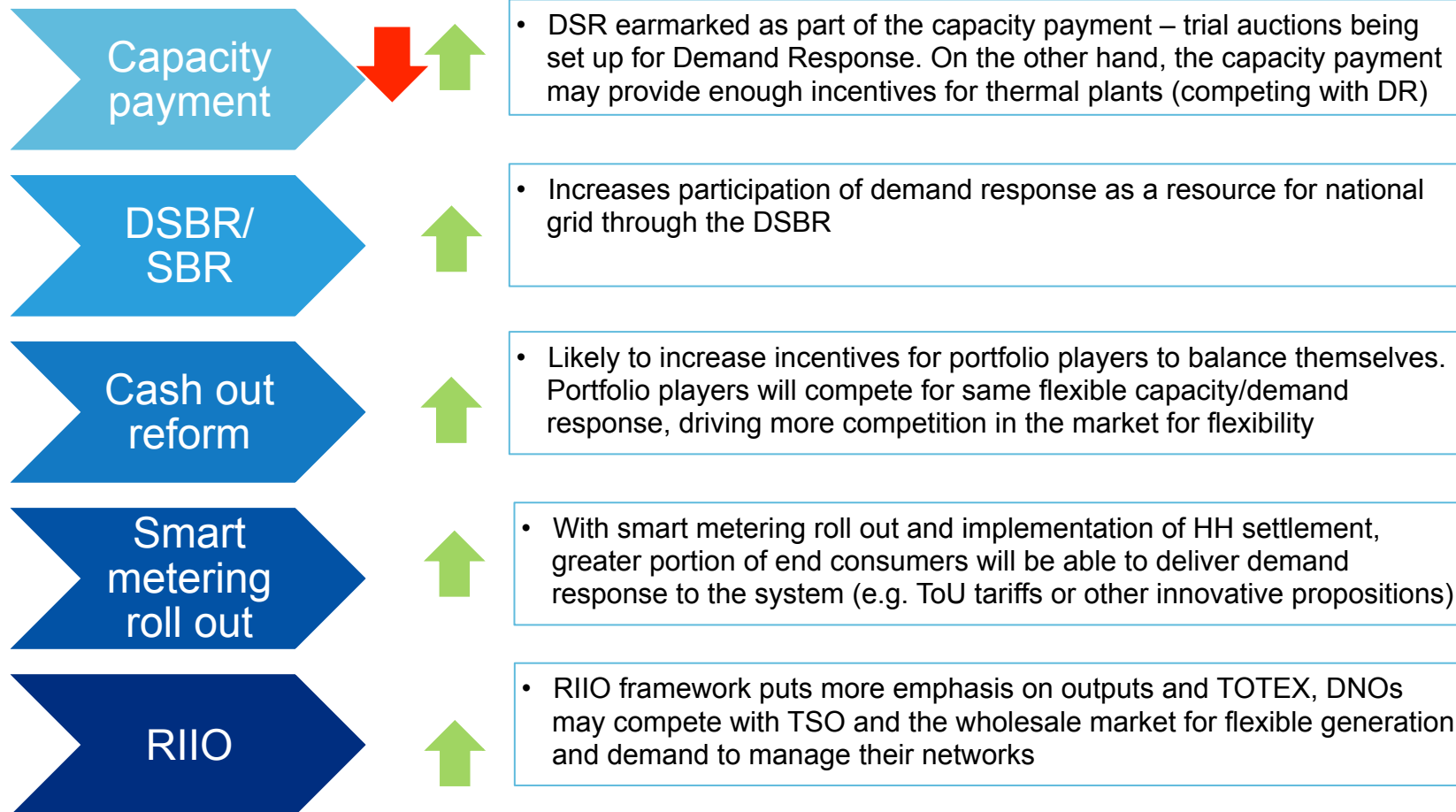
Fig 8. Example of a multiple site turndown event. Four-site Demand response Portfolio (Building Turndown)



1. Source: [http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Low-Carbon-London-\(LCL\)/Project-Documents/Overview-Low-Carbon-London.pdf](http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Low-Carbon-London-(LCL)/Project-Documents/Overview-Low-Carbon-London.pdf)

IN ADDITION TO FUNDAMENTALS CHANGES, A NUMBER OF POLICY DECISIONS WILL ALTER THE LANDSCAPE FOR DSR

Several policy changes likely to have some implications on the use of Demand Response as a flexibility resource



WHEN WILL DEMAND RESPONSE THEREFORE TAKE OFF?

Three ingredients needed...



Coordination
Business framework
Trust

COORDINATION NEEDED FOR DEMAND RESPONSE TO SERVE MULTIPLE PURPOSES

Three aspects of coordination required; competing demand for DSR, financial and data

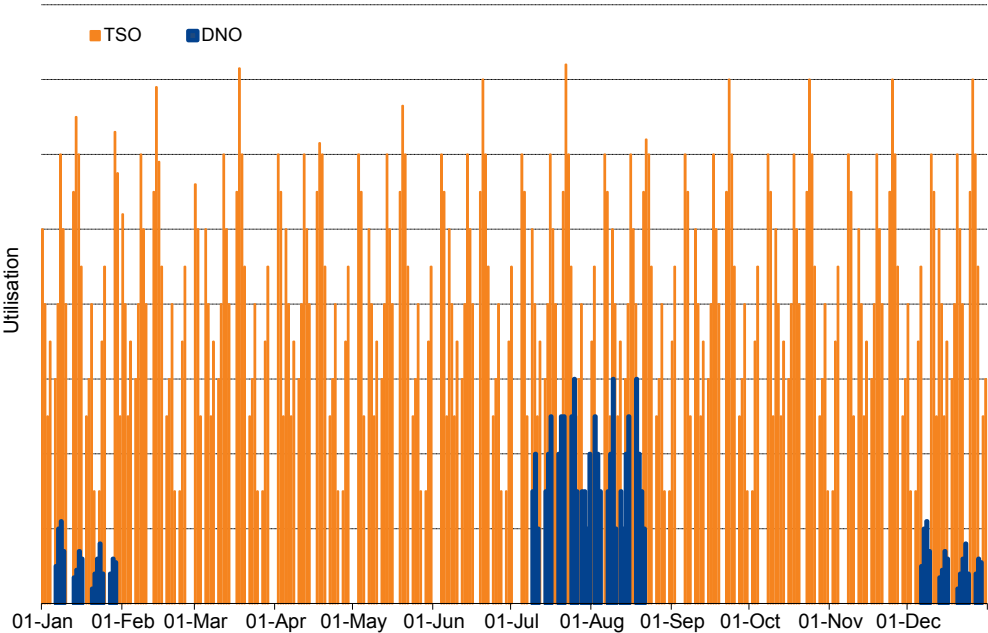
| | |
|--------------------------|--|
| Competing demand for DSR | <ul style="list-style-type: none">• The TSO will need DSR for reserve purposes; close to outturn• Suppliers will wish to use DSR to manage their wholesale costs and will therefore need to get to know their customers to provide appropriate signals• DNOs may use DSR for planned outages as well as for unplanned outages.• Wind portfolio players may use DSR to manage their imbalances• How will all these requirements be coordinated? |
| Financial coordination | <ul style="list-style-type: none">• What are appropriate price signals for the customer?• How is the customer paid for providing DSR and by whom?• Will aggregators be responsible for imbalances? |
| Data coordination | <ul style="list-style-type: none">• How will data flow from one party to the next especially if DSR resources are to be shared? |

The coordination requirement also depends on the extent of anticipated conflicts and synergies in the use of DSR by various parties in the future

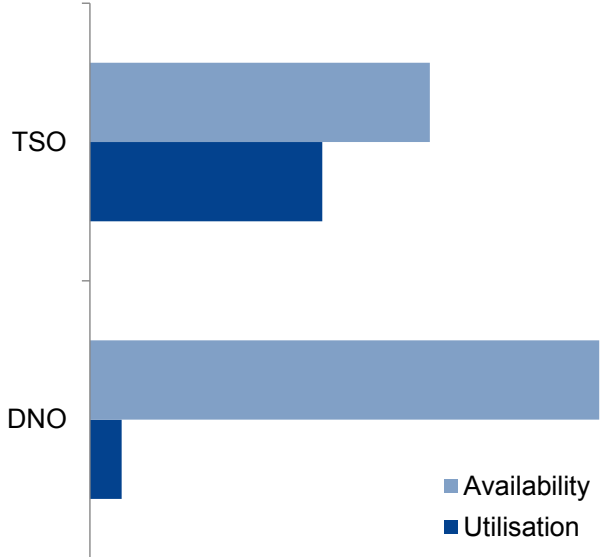
BUSINESS FRAMEWORK – WHO PROCURES WHAT, WHEN AND HOW?

The way in which various actors may contract for DSR will be significantly important

TSO and DSO utilisation (Illustrative)



Availability vs Utilisation Costs (Illustrative)



- DSR resources will be needed by various parties – right remuneration needed to ensure all parties have access to their required resource. For example: DNO payments need to be competitive enough to attract DSR resources but how does this impact on the TSO’s procurement and vice versa?

TRUST – A COMPONENT LACKING IN THE CURRENT GB MARKET

I&C and SMEs will likely provide a significant portion of DSR....trust in all institutions currently lacking

Trust in Government Plunges to Historic Low

Business Trust Stabilizes, Creating Largest Gap Ever Between Trust in Government and Business

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Gas and electricity prices are rising at up to eight times the rate of earnings, warns Citizens Advice

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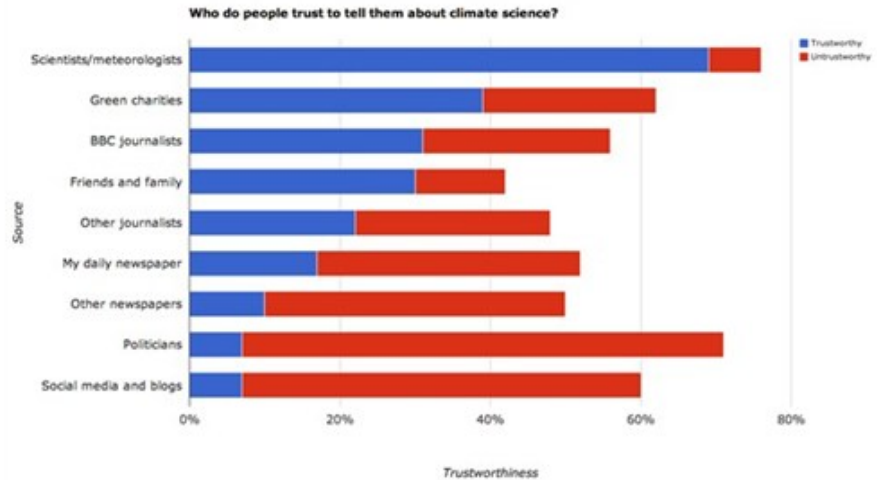
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12 November 2013 Last updated at 13:05

EDF Energy prices 'to rise 3.9%'

Consumer trust in both energy companies and in Governmental policies is critical to deployment of DSR

SUMMARY

DSR could provide flexibility to the system...implementation needs careful thought

1 Requirements for flexible generation/demand increase with rising penetration of renewable on the system; DSR is well placed to contribute to this flexibility requirement and serve multiple purposes

2 Policies being implemented seem favourable to DSR

3 Coordination in the use of DSR by various parties will be necessary to allow DSR to serve multiple purposes; synergies and conflicts need to be understood

4 Right remuneration signals needed to optimise the procurement of DSR; allowing all parties access to their required resources

5 Trust will be an important component of wider deployment of DSR resources



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