

Overview of the UK Demand Response Market

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Agenda

1. Brief historical overview: Demand Response (DR) in the UK
2. Review of the current DR market in the UK, focusing on:
 - Current market options
 - Market participation parameters
 - Market size and returns
 - Business models
 - Deployment examples and issues
3. Looking ahead: the future of DR for the UK

UK DR Market – Brief History

- Pre mid-2000s - limited DR usage in the UK
- From mid-2000s - increase in DR usage due to:
 - climate change
 - security of supply
 - efficiency concerns
- *Short Term Operating Reserve (STOR)*, managed by the UK National Grid system operator has comprised the main market method for DR
- STOR capacity is awarded by tenders, resulting in varying pricing:
 - Started in 2007 with yearly revenues of £40,000-£50,000 per MW
 - Pricing peaked in 2012 at £60,000-£70,000 per MW
 - Since the peak, pricing has steadily decreased: currently at £20,000-£30,000 per MW

UK DR Market - Overview

Currently 2 key markets for providing Demand Response in the UK

1. Short Term Operating Reserve (STOR)

- *“reserve power in the form of either generation or demand reduction to be able to deal with actual demand being greater than forecast demand and/or plant unavailability”*

2. Frequency Response

– Firm Frequency Response (FFR)

“provides firm provision of Dynamic (continually matching) or Non-Dynamic Response (set points) to changes in Frequency”

– Frequency Control by Demand Management (FCDM)

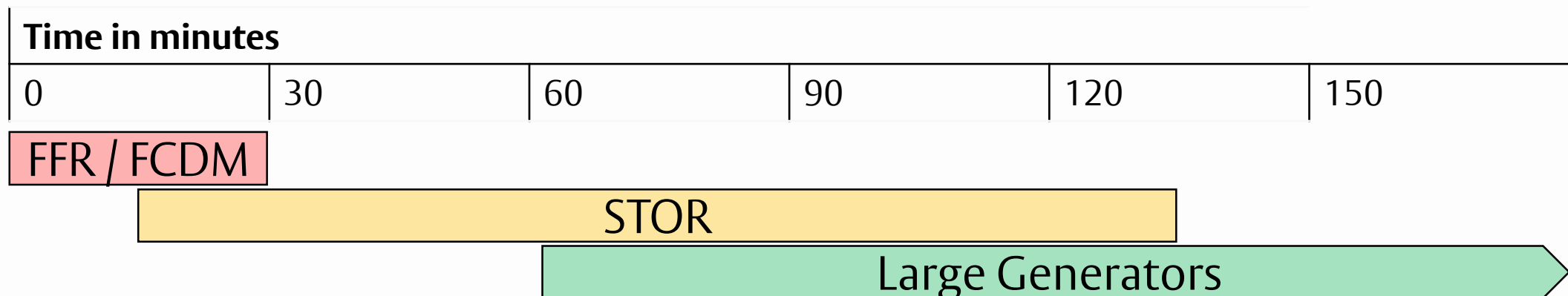
“provides frequency response through interruption of demand customers. The electricity demand is automatically interrupted when the system frequency transgresses the low frequency relay setting on site”

UK DR Market – Participation Parameters

- Market programme participation parameters summary

Programme	Response time	Duration (max)	Minimum MWs	Trigger
FFR - Primary	2 to 10 seconds	1 to 2 minutes	10	Static or Dynamic Frequency
FFR - Secondary	Up to 30 seconds	30 minutes	10	Static Frequency Point
FCDM	2 to 10 seconds	30 minutes	3	Static Frequency Point
STOR	Up to 20 minutes	2 hours	3	National Grid Request

- Programme usage timeline



UK DR Market - Market Size & Returns

- Market size and returns summary

Programme	Overall Capacity Per Year (MW)	DR Capacity Per Year (MW)	Procurement Method	Returns Per Year, Per MW
FFR - Primary	200-700	Unknown	Tender	£15,000 to £20,000
FFR - Secondary	700-1400	Unknown	Tender	£30,000 to £40,000
FCDM	150-200	150-200	Bilateral	£30,000 to £40,000
STOR	2500-3500	200-700	Tender	£20,000 to £30,000

- FFR and FCDM run 24/7; returns are based on an hourly availability payment
- STOR has two daily operational windows (~07:00-14:00 & ~16:00-22:00); returns are based on an availability payment and a utilisation payment
- STOR DR capacity is provided via 150-250MW of Load Reduction and 300-500MW from Load Replacement (using backup generators, CHP etc.)

UK DR Market – Business Models

- UK DR aggregator business model variables
 - **Tender pricing:** DR aggregator can decide on level of risk it's willing to accept – e.g. between winning high value capacity that is easier to sell vs. winning no capacity and having nothing to sell
 - **Returns sharing:** Programme payments are shared, normally 70% Client / 30% Aggregator
 - **Installation Costs:** The DR control/monitoring hardware installation is managed by aggregators – some will charge clients, while others will include this for 'free'
 - **Penalty Handling:** Most clients are part of an aggregated contract (e.g. one contract could include 3 clients each providing 1 MW to meet the 3MW STOR minimum). If one client does not meet the 1MW requirement for an event, then the whole STOR contract is penalised. Aggregators manage this in 3 different ways: (i) share the penalty; (ii) causing client must cover; (iii) absorb the penalty
- Example business models

Business model scenarios for client with 1MW STOR	Gross Yearly Returns	Installation Costs	Penalties	Net Client Returns	Net Aggregator Returns
1 - 70/30 Split, Aggregator covers costs	£30,000	£3,000	£0	£21,000	£6,000
2 - 70/30 Split, Aggregator covers costs / penalty	£30,000	£3,000	£5,000	£21,000	£1,000
3 - 70/30 Split, Client covers costs	£30,000	£3,000	£0	£18,000	£9,000
4 - 70/30 Split, Client covers costs / shared penalty	£30,000	£3,000	£6,000	£19,000	£9,000
5 - 70/30 Split, Client covers costs / penalty	£30,000	£3,000	£6,000	£12,000	£9,000

Deployment Examples & Issues

Example 1: STOR – using Generator Load Replacement

Overview: Uses client's backup generator to replace grid demand. Effectively appears as grid 'Demand Reduction' and is how the majority (>80%) of DR in the UK is currently provided

Benefits

- Creates revenue from an expensive non-revenue generating asset
- Can replace the need for monthly testing - and cover costs of testing
- Can meet the 2 hour duration requirement and 20 minute response time
- Easy to install control and monitoring equipment

Issues

- Reliability of the generator: backup generators are often not maintained (or not fuelled!)
- Client trust: the building manager is often not happy with allowing external control of a building's generator
- Running costs: no revenue from the STOR utilisation payment given running costs (~£150-200 per MWh)
- Meeting DR expectations: the STOR programme requires committed reduction, 7 days a week in operating windows (~07:00-14:00 & ~16:00-22:00), reducing site's potential to the lowest demand level at these times
- Carbon Emission Uncertainty: whole cycle assessments have shown lower emissions, then peaking plants

Deployment Examples & Issues

Example 2: STOR – Turndown

Overview: Temporarily turndown / off assets to reduce demand on the grid. This can be through turning off large HVAC systems, manufacturing lines, refrigeration etc.

Benefits

- Often can be implemented with no noticeable user impact - e.g. HVAC can be turned off for an hour without users knowing
- Creates a new revenue stream and also savings from a reduced electricity bill
- Promotes 'green' business credentials

Issues

- Hard to meet programme conditions: event durations can last up to 2 hours (normally less than an hour in practice) therefore risking non-delivery penalties or user impacts
- Installation costs: installation can often be expensive due to individual asset control and each asset will only provide a small amount of turndown
- Client trust and meeting DR expectations issues, as per *Example 1 (STOR – using Generator Load Replacement)*

Deployment Examples & Issues

Example 3: FFR – Battery or Turndown

Overview: Frequency response based programmes use an onsite frequency relay which triggers mains disconnection within seconds of meeting the trigger conditions – normally 49.7 Hz. Batteries are an obvious choice if available - or any asset that can respond within 30 seconds. Sometimes a combination is used, with short term response being handled by a battery while larger assets are turned down (e.g. as an HVAC system might take 5 minutes to meet reduction levels, a battery system is used for those first 5 minutes)

Benefits

- Greater flexibility for participation through allowing for variable DR targets, set a week ahead
- Fast response requires direct controls therefore drives fully automated solutions
- Short event duration minimises any potential impact

Issues

- Meeting response times: fast response times (within 30 seconds) can make it difficult to find suitable assets
- Client trust: can be hard to build trust in client's base given concerns about losing control of their assets
- Monitoring requirements: frequency DR requires second by second monitoring - hard to achieve, without specialised monitoring hardware

The Future of DR in the UK

- *STOR* and *Frequency DR* market options will continue, for the foreseeable future
- The new *Capacity Market* will start delivering in 2018 and directly includes provision for DR
- However, the first *Capacity Market* auction in 2014 (for 2018 delivery):
 - Awarded 49,258 MWs of capacity, but only 174 MWs (0.36%) for DR
 - Clearing price was £19,400 per MW per year: at the bottom of the current £20,000 - £30,000 *STOR* pricing range
 - Offers unfavourable DR conditions – e.g. DR contracts limited to 1 year, generators 15 years
- *National Grid* recently launched its own ‘Power Response’ campaign:
 - Aims to: ‘Identify the barriers that exist; bringing the industry and businesses together to deliver the actions and solutions to address these barriers.’
 - Result of feedback from the industry about current programmes and barriers
 - Time will tell if it helps!

Thank you

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Additional information

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