

SEM Review of Demand Side Management

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Demand Side Working Group
Ofgem, London.
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Agenda

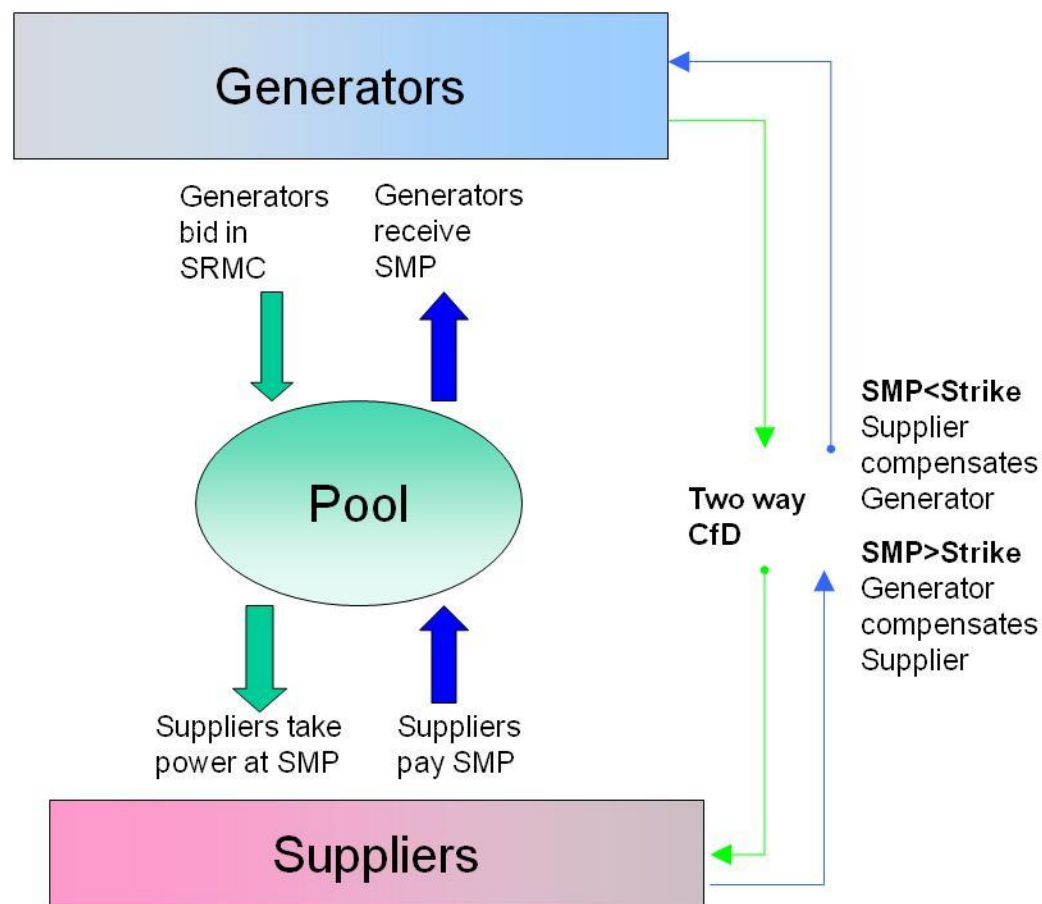
1. Irish market context
2. Overview of Irish Regulatory Authorities' 2020 DSM Vision project
3. Use of DSM to balance wind

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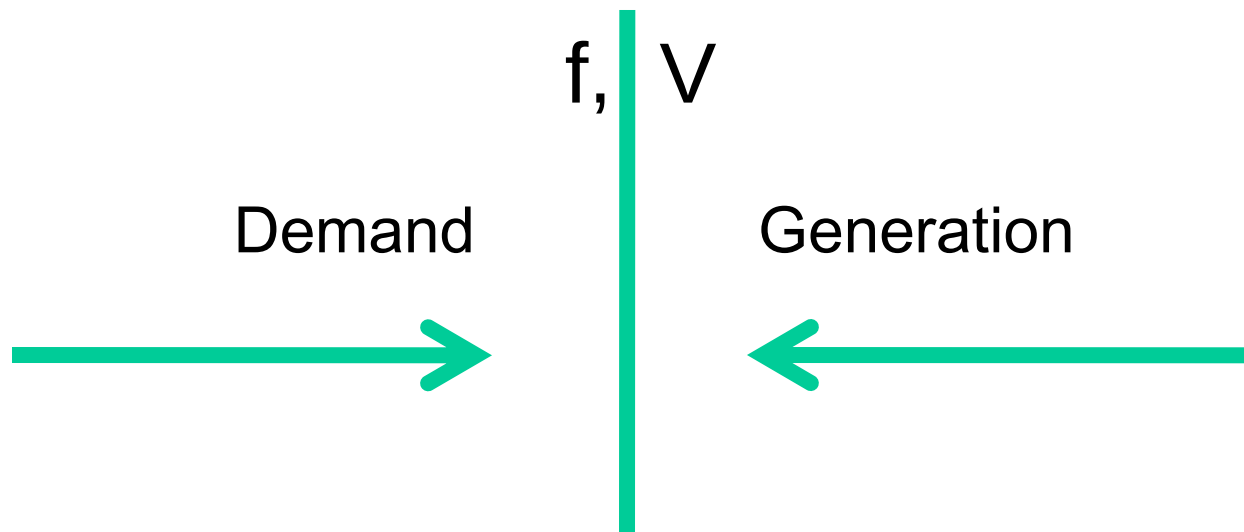
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Single Electricity Market (SEM)

- All Island wholesale electricity market 1st November 2007;
- Efficient, competitive market;
- Market power & dominance structures;
- SEM Committee oversees the market.



Equivalence of Generation and Demand?



System Operator aims to maintain the generation-demand balance within frequency and voltage limits by matching generation to demand at every point in time.

Demand Side Participation in the SEM

In Market – Explicit

- Single large demand unit offers demand reduction/shifting (DSU). Barriers – no firm day ahead price in the SEM; DSU at present has to be a supplier unit
- Aggregation of demand reduction by smaller units (already have aggregation of distributed generation)

Demand Side Participation in the SEM

In Market – Implicit

- Voluntary demand reduction/shifting in response to tariff signals – users require information upon which to base their consumption decision
- Demand reduction/shifting dispatched by TSO or initiated by automatic frequency response – what is the upside for consumers?

Demand Side Participation in the SEM

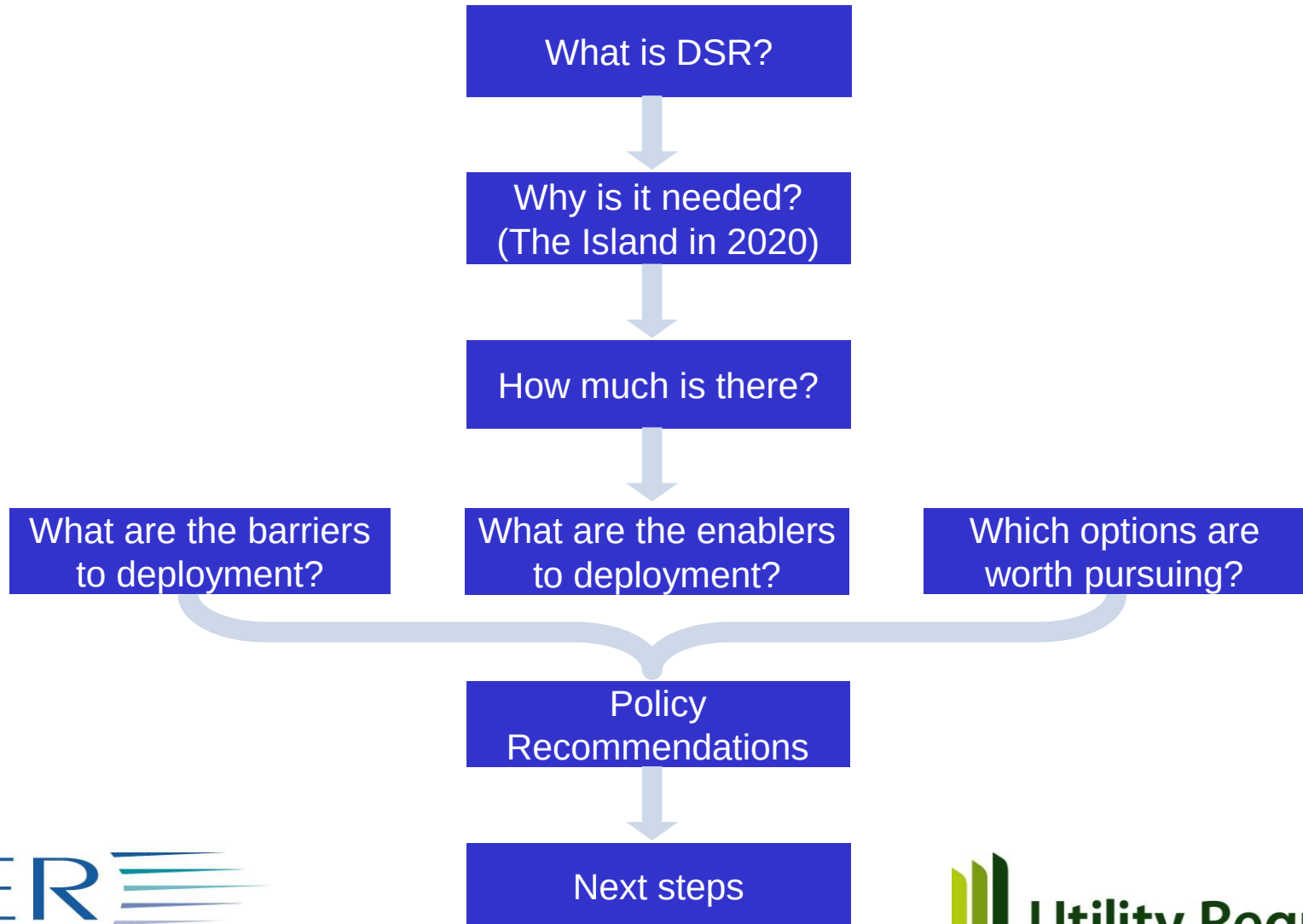
Out of Market

- Ancillary Service type purchase of reserve e.g. STAR, WPDRS, Powersave

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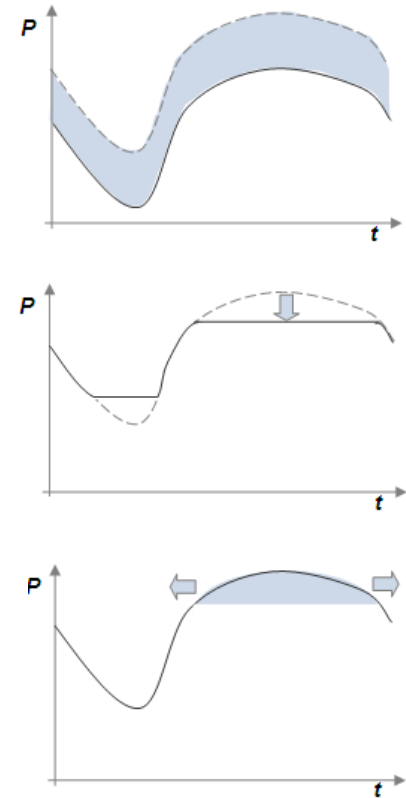
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Project Structure



Role & Benefits of DSR

- **Overall demand reduction**
 - refers to measures which reduce energy consumption, typically the target of efficiency programmes;
- **Static peak reduction**
 - encompasses measures which enable changes to be made to the profile of demand to alleviate system peaks
Examples include; static ToU tariffs & interruption contracts;
- **Flexible measures**
 - allow demand, or load, to be shifted in response to system condition on the day, such as dynamic time-of-use tariffs and system operator interruption contracts.
- **Ancillary Services**
 - New technologies – frequency responsive fridges
 - Not covered in detail in this consultation



International Experience - Key Findings

- **Energy Efficiency**
- **Enhanced Feedback**
- **Time of Use Tariffs**
- **Demand Side Flexibility and Home Automation**
- **Quantitative Benefits Realised**
 - improving energy efficiency or modifying electricity users' behaviour consistently reduces the relevant customers' total energy demand.
 - Reported savings in the range 5%-15% of those customer total demand
 - automation in the home and in commercial and industrial settings significantly increases the potential for peak reduction compared to other measures
 - distributed generation and microgeneration can offer significant flexibility as a percentage of their capacity (depending on their energy source).

Potential for DSR

Pöyry have examined the potential for DSR measures and reviewed the policy options available for delivering the DSV for 2020.

- Energy Efficiency
- Behavioural Demand
- Smart Meters
- Home & Office Automation Industrial & Commercial demand response
- New Demand – Electric Vehicle & Renewable Heat
- Microgeneration
- Aggregation of Distributed Generation
- Storage

Estimated flexible demand in 2020:

	Space heating	Water heating	Other flexible demand	Total
Industry	790-920		320-370	1100-2300
Commercial			0-1020	
Domestic	520-690	700	0-950	1200-2300
Electric vehicles	N/A	N/A	0-100	0-100
Heat pumps	80+		N/A	N/A
Storage	N/A	N/A	240+	240+
Distributed generation	N/A	N/A	>120	>120

2020 Demand Side Vision

What does the 2020 vision look like?

- Electricity consumers make informed choices about their use of electricity in the short & long term
 - Consumers recognise the consequences of their consumption and the level of consumer awareness will be high
 - Consumers make informed choices when purchasing appliances
- Prices reflect the cost of supply at those times
 - Providing appropriate rewards for reduced consumption & changes to profiles
- Consumers will face appropriate incentives to ‘invest’ in methods which will allow them to better manage their consumption.
 - Perhaps in terms of effort rather than financially

2020 Demand Side Vision

What does the 2020 vision look like?

- Demand plays an active part in the process of system balancing and market price formation
 - Autonomous response to expected market prices
 - Dynamic response to market prices over a range of timescales
 - Inclusion of some dispatchable demand (and distributed generation) in the centralised processes
 - Perhaps bulk electricity storage.
 - Flexibility of demand will play a key role
- Electrification of heat and transport plays a significant role in the decarbonisation of the entire energy system for the Island,
 - This facilitates high levels of production of electricity from renewable sources.

2020 Demand Side Vision

Pöyry Policy Recommendation Based On:

- Competitiveness
 - Furthering of competition and consumer choice in energy markets
 - Encourage/ maximise innovation, enterprise and job creation (green jobs)
- Security of Supply
 - Focus on ensuring that electricity supply can meet demand and
 - Consideration of the maintenance and upgrade of networks
 - Also includes increasing fuel diversity in electricity generation
- Sustainability
 - Acceleration of the growth of renewable energy resources
 - Enhancement the efficiency of electricity use and realise savings in electricity use.

2020 Demand Side Vision

Pöyry Policy Recommendation Based On:

- Benefits to Electricity Markets
 - effect on generation capacity costs (requirements for investment in new gen cap.)
 - impact on variable generation costs
 - effect on levels of CO2 emissions
 - provision of frequency response.
- Cost
 - Low cost: € 0 -10 million
 - T&SC modifications, enabling SM with smart display & allowing static ToU tariffs
 - Medium cost: € 10 - 50 million
 - Subsidies for adoption of smart devices, R&D funding for technology funding, such as distribution level storage, and the additional investment in back-up processes.
 - High cost: > €50 million.
 - Major Capital Investments - a new pumped storage site, roll out of SM and the associated communications infrastructure.

Energy efficiency - Industrial
 Energy efficiency - Commercial
 Energy efficiency - Domestic
 Behavioural change - Education
 Smart meters - Advanced displays
 Smart meters - Static ToU tariff
 Smart meters - Dynamic ToU tariff
 Home & office automation - Direct load control
 Home & office automation - Autonomous
 Home & office automation - Frequency-responsive relays
 Industrial & Commercial DSR - Interruption contracts
 Industrial & Commercial DSR - Direct load control
 Industrial & Commercial DSR - Demand-side bidding
 Industrial & Commercial DSR - Autonomous
 Heat pumps - Heat pumps are fitted with storage
 Electric vehicles - Night charge
 Electric vehicles - Hybrid vehicles
 Electric vehicles - Intelligent (price-responsive) charging
 Microgeneration - Controllable
 Aggregation of DG
 Storage

Competitiveness		Security of supply		Sustainability		Electricity market metrics			Cost of delivery	Overall ranking
Competition & consumer choice	Green job creation	Generation capacity margin	Transmission capacity	Energy efficiency	Accelerated growth of RES	Generation costs / CO ₂ emissions	Generation capacity costs	Frequency response		
Neutral	Medium	Medium	Medium	Medium	Medium	Medium	Medium	No	Medium	High
Neutral	Medium	Medium	Medium	Medium	Medium	Medium	Low	No	Medium	Medium
Neutral	Medium	High	High	Medium	Medium	High	High	No	Medium	High
Neutral	Medium	Medium	Medium	Medium	Medium	Medium	Low	No	Low	Low
Medium	Medium	High	High	Medium	Low	High	High	No	Low	Medium
Medium	Medium	High	High	Medium	Medium	High	High	No	Low	Low
Medium	Medium	High	High	Medium	High	High	High	No	Medium	High
Medium	Medium	High	High	Neutral	High	Medium	High	?	Medium	Medium
Medium	Medium	High	High	Neutral	High	Medium	High	No	Low	Medium
Medium	Medium	Neutral	Neutral	Medium	Neutral	Low	Low	Yes	Medium	Medium
Medium	Neutral	High	High	Neutral	High	Medium	High	No	Low	High
Medium	Neutral	High	High	Neutral	High	Medium	High	?	High	High
Medium	Neutral	High	High	Neutral	High	Medium	High	No	High	High
Medium	Neutral	High	High	Neutral	High	Medium	High	No	Medium	High
Neutral	Low	Medium	Medium	Neutral	High	Medium	Medium	No	High	Neutral
Neutral	Medium	Medium	Neutral	Neutral	Low	Low	Medium	No	Low	Neutral
Neutral	Medium	Medium	Medium	Neutral	Medium	Low	Medium	No	Medium	Neutral
Neutral	Medium	Medium	Medium	Neutral	Medium	Low	Medium	No	Medium	Medium
Neutral	Neutral	Medium	Medium	Neutral	Low	Low	Medium	?	Low	Neutral
Low	Neutral	Medium	Medium	Neutral	Medium	Medium	High	?	Low	Medium
Neutral	Neutral	Medium	Neutral	Negative	Medium	Low	Medium	Yes	High	Low

Policy Recommendations

High Value Recommendations

Measure	Immediate	Short to Mid Term	Long Term
Energy Efficiency		More ambitious role out of energy efficiency measures	
Smart Meters	SM - Allow advanced displays & dynamic ToU tariffs	Education Programmes	
		Measures to accelerate adoption	
I&C Demand Side Response	Create firm day ahead price & schedule for SEM	Study of volume & nature of flexible demand	
	Review TSC & Grid Code - ID barriers to participation of I&C demand	Engage with sector - increase awareness of potential for I&C DS participation	

Policy Recommendations

Low Value Recommendations

Measure	Immediate	Short to Mid Term	Long Term
Behavioural Change		Labelling scheme & education programme for smart appliances	
Storage	Review of SEM payments to pumped storage	Review support for R&D in Dist. Level storage	

Limited Value Recommendations

Measure	Immediate	Short to Mid Term	Long Term
New Demand - Heat Pumps			Incentivise storage technology for HP
Microgen.	SM interact with		

Project Next Steps

- Consultation Paper Published 17th August 2010
 - Consultation includes workshops in Dublin and Belfast – 16th & 17th Sept (TBC)
- Responses due 18th October
- Publish Decision Paper which will set out the next steps in developing a detailed Demand Side Vision for 2020 and the necessary actions to realise it. December 2010

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Intermittency will be a major challenge for the SEM in the future

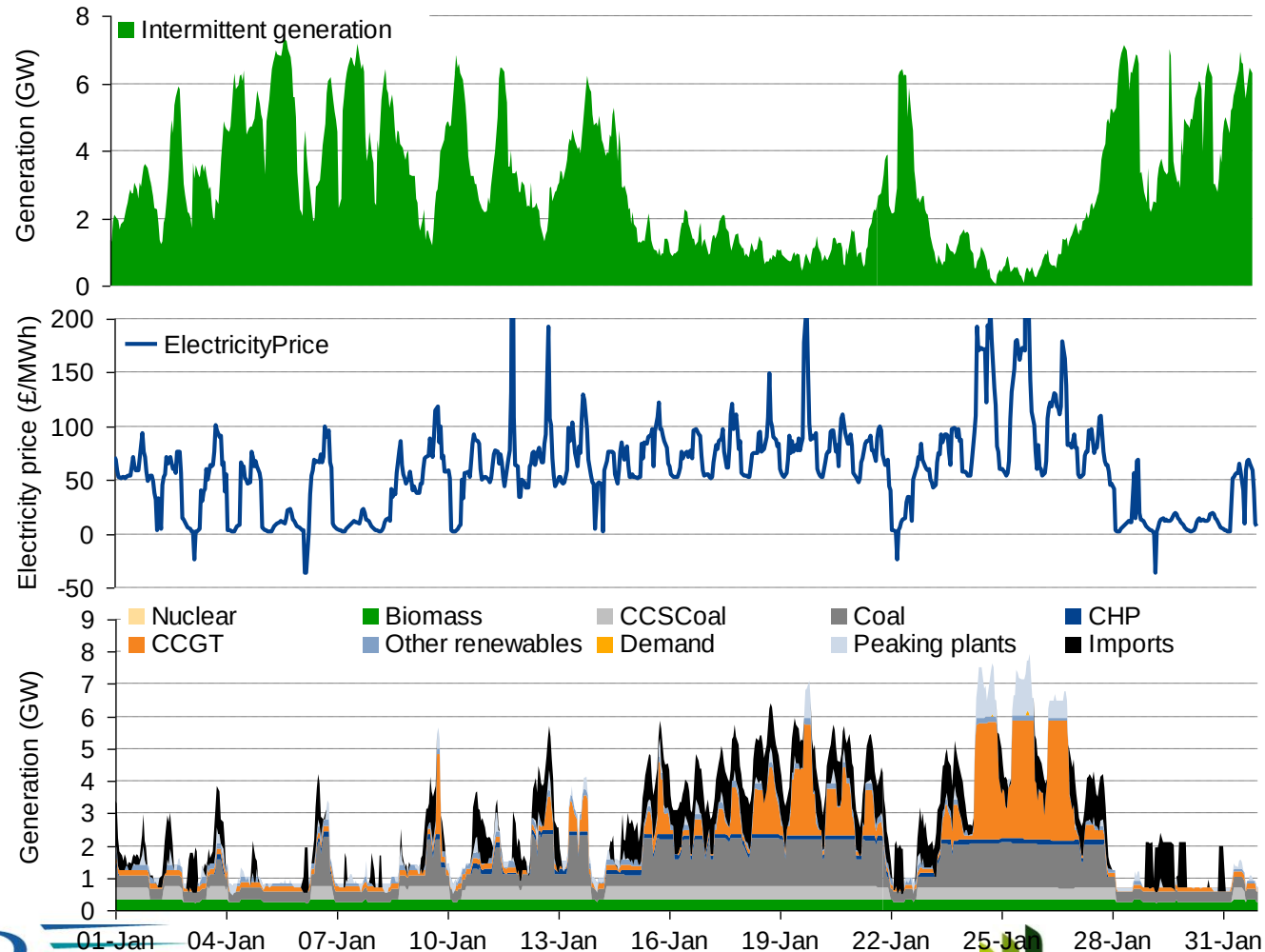
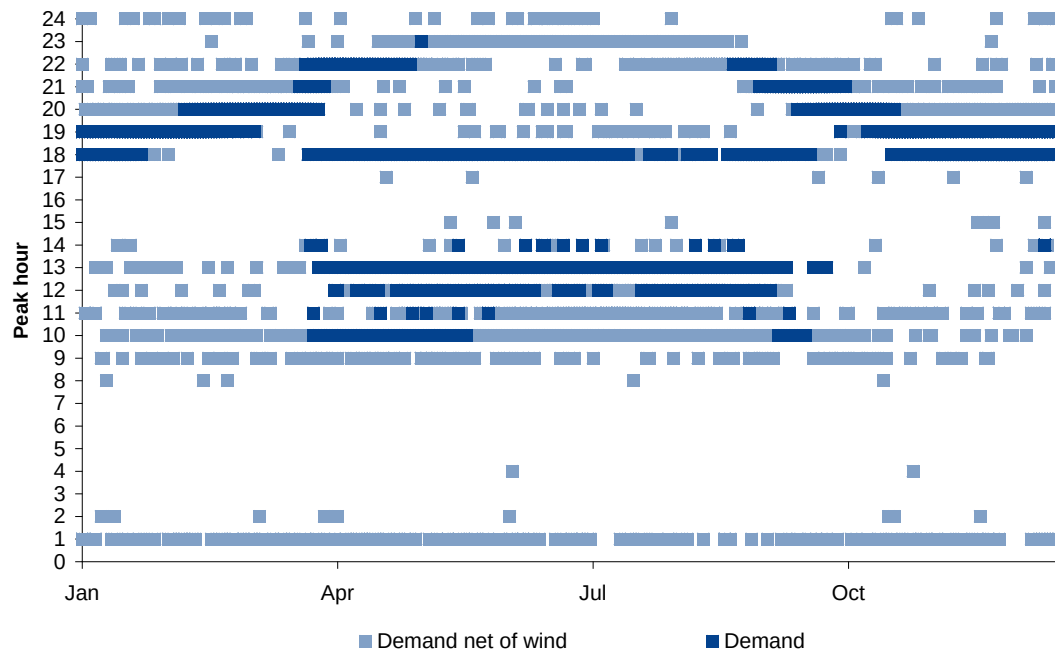


Chart shows January 2030
with 2000 wind patterns

Intermittency will change the timing of peak periods

Timing of the peak demand period and the peak 'demand net of wind' period for each day across eight wind years in 2020

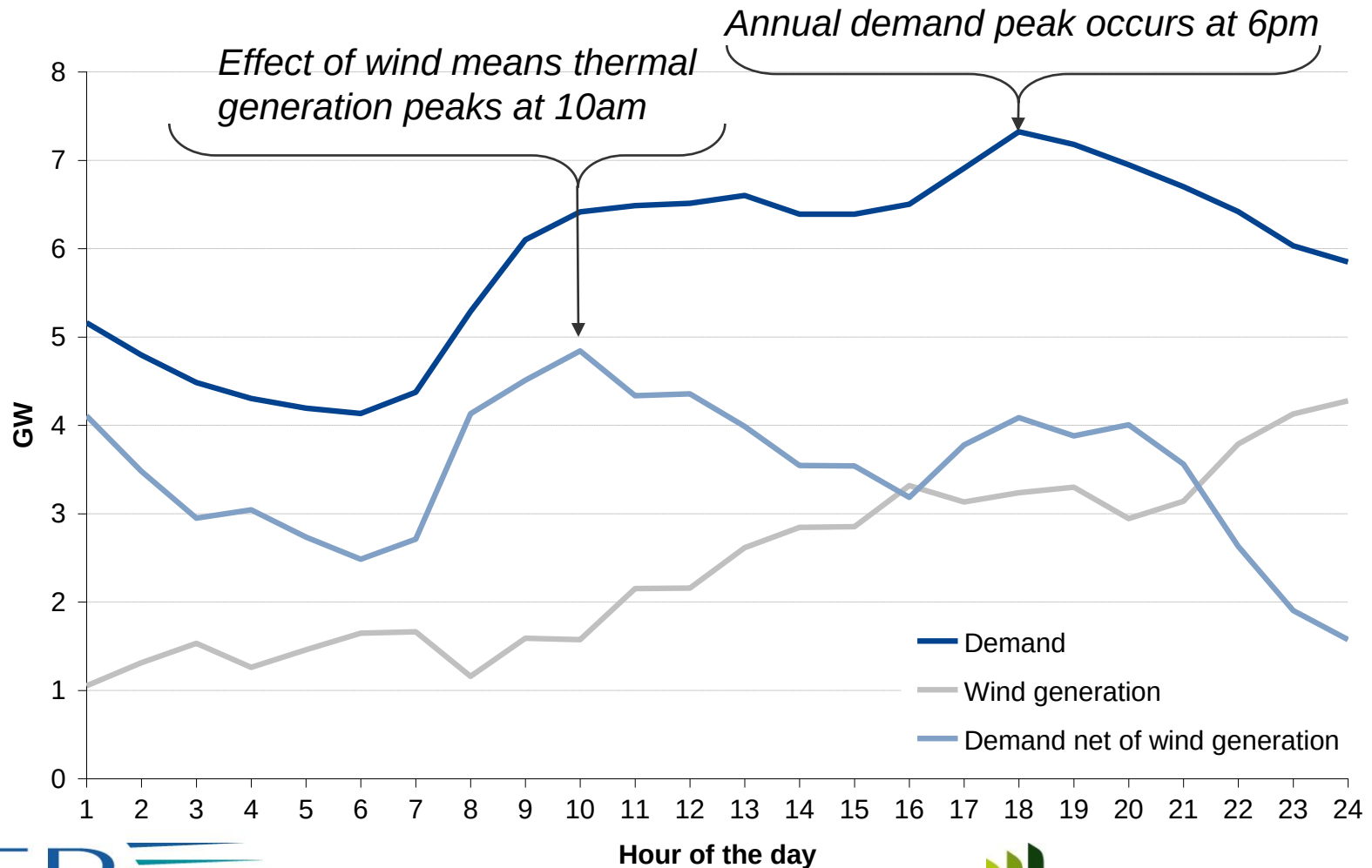


- Dark blue blocks show the timing of peak demand, which are clustered around the evening (18h – 21h) and midday (12h – 13h), and show a strong seasonal pattern
- Light blue blocks show the daily demand net of wind peak, which exhibits more within-day variance and less regular seasonal patterns

As wind intermittency grows, will static tariffs be good enough?

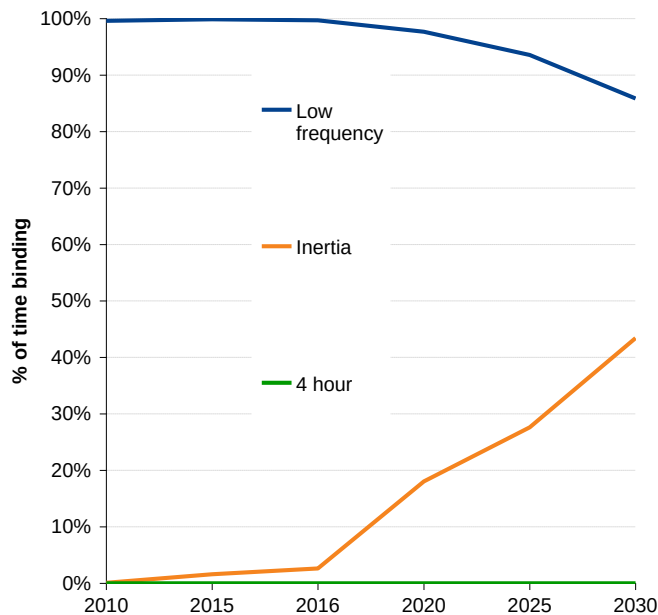
Will more automation and greater dynamism be required?

Peak thermal generation will no longer correspond to peak demand

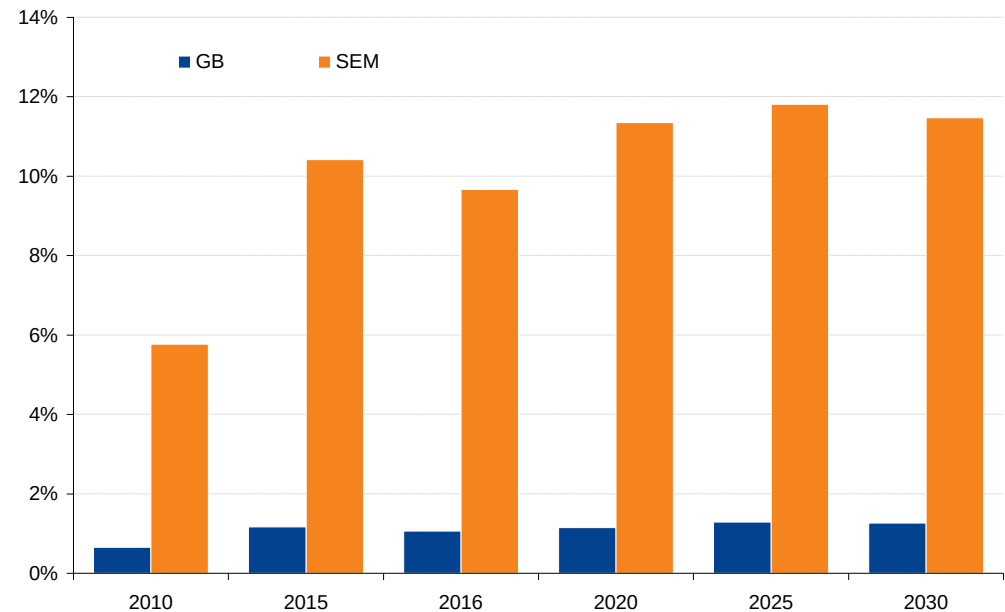


The unconstrained market is not the whole story

Binding constraints in the SEM



Redispatch in the SEM and GB



A range of options are available to address these challenges

- Solutions to meet increased reserve and response needs
 - Short term active demand management

- Lessen within-day wind volatility
 - Diversify wind location
 - Improve wind forecasting

- Increased interconnection

- Reshape demand
 - Increase off peak demand
 - Reduce peak demand

Demand-side response of different types can help deal with all these system issues

- Lower day to day volatility
- Longer range interconnection
- Other storage possibilities

- Network capacity

Real time

½ hr

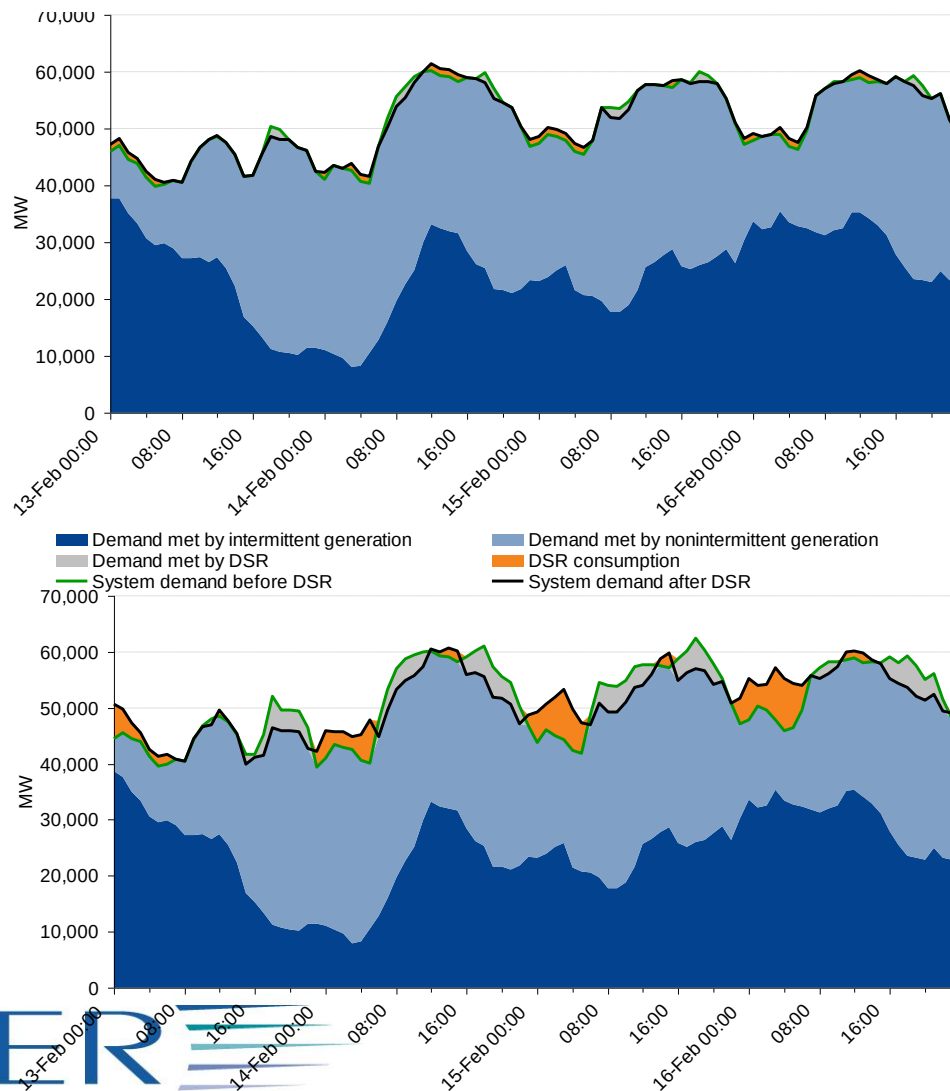
4 hrs

Within
day

3 days

New
investment

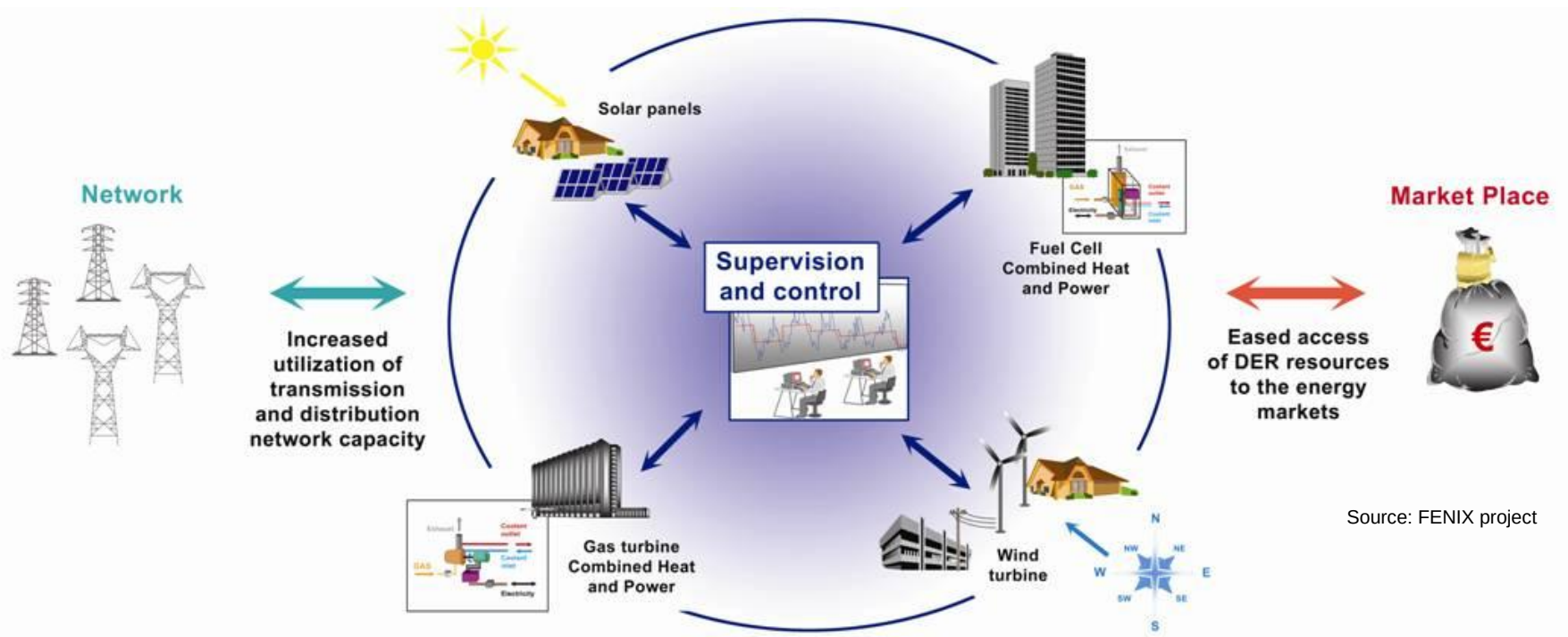
Active DSR can have a significant impact on wholesale markets



- Lower prices
- Less price volatility
- Less generator ramping
- Lower peaks may avoid network investments
- Lower CO2 emissions
- Increased competition in 'production' as well as retail

DSR can offer network benefits in addition to market benefits

However, it may not be possible to address both network and market problems at the same time



Source: FENIX project