







Solar, storage and UK Energy Future

March 2018



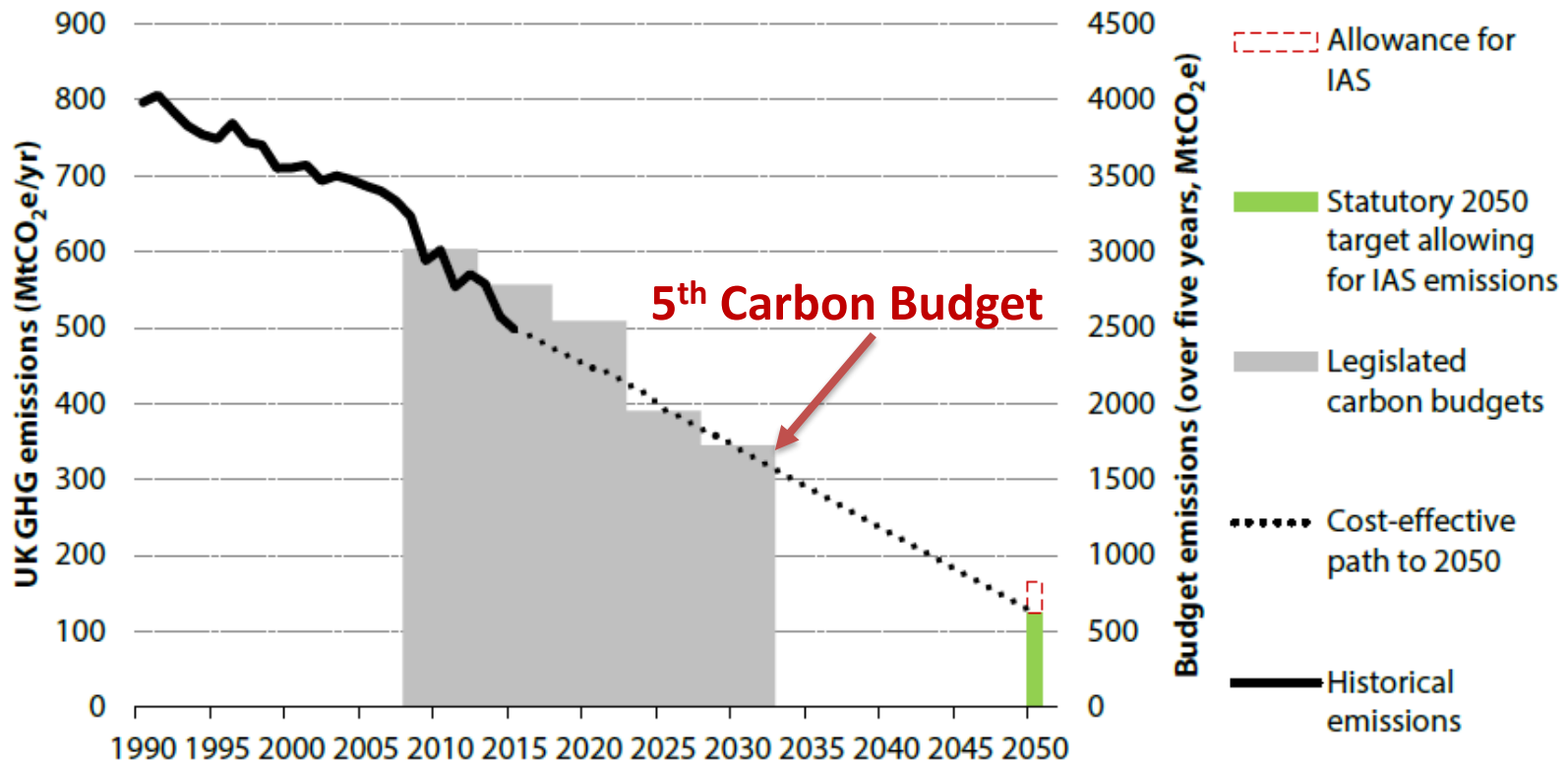
Changing GB electricity capacity

	Capacity 2010/11	Closed* since 2010	New Cap added	Current 2015/16	Closed by 2030 ???
 Coal 26 GW	13.3 GW			12.8GW	12.8 GW
 Gas 30.2 GW	4.5 GW	8.5GW		33.7 GW	16.5 GW
 Renewables 8.6 GW		24.8 GW		33.3 GW	3.5 GW
 Nuclear 10.7 GW	1.4 GW			8.9 GW	7.7.GW
	77.8 GW	22.9 GW	33.2 GW	90 GW	41.4 GW

* Closed, partially closed, converted to biomass or mothballed

UK's carbon reduction commitment

Figure 1.1. UK carbon budgets and the cost-effective path to the 2050 target



Source: CCC calculations.

To achieve the UK's target GHG emissions must drop from 800 MtCO₂e in 1990 to circa 120 MtCO₂e in 2050, and to near net zero if the Paris Agreement commitments are to be met

Decarbonisation of the power sector

2010

156 MtCO₂e
499 gCO₂e/kWh

2015 Progress

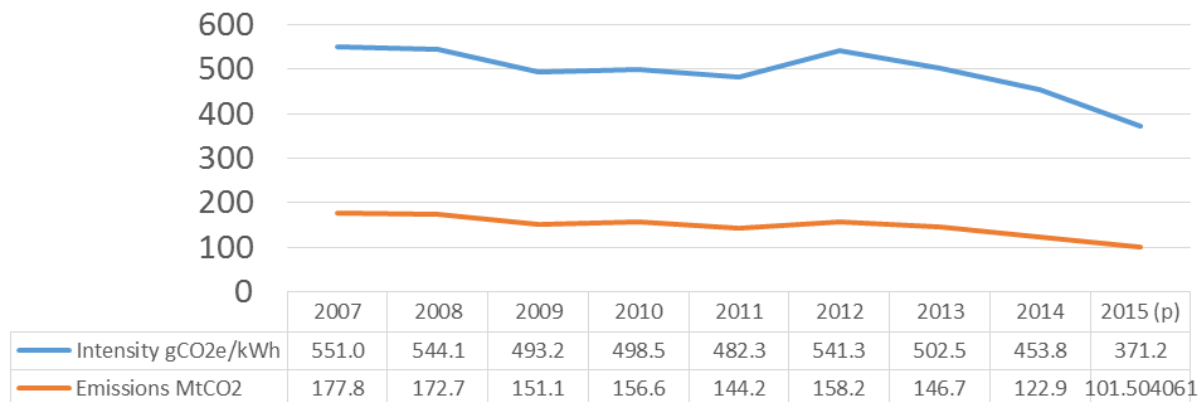
102 MtCO₂e
370 gCO₂e/kWh

2030 Target

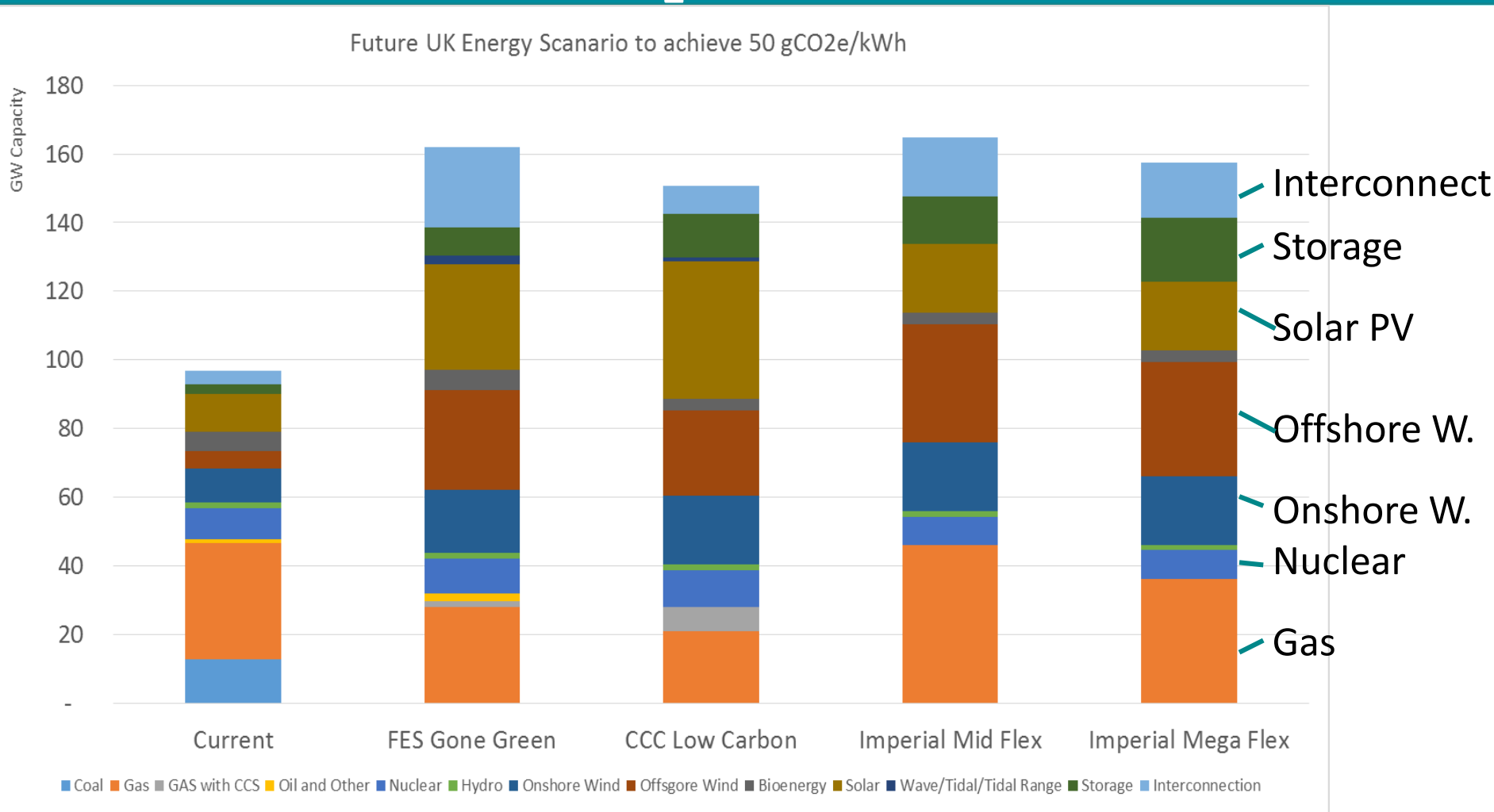
15-31 MtCO₂e
50-100 g CO₂e/kWh

DECC (March 2016) *Energy Trends*; DECC (March 2016) *Provisional 2015 results for UK greenhouse gas emissions and progress towards targets*; CCC calculations.

UK Power Sector Emission intensity MtCO₂e & gCO₂e/kWh







UK Electricity generation mix to achieve 50gCO₂e/kWh



Differences in mix, but most credible scenarios* suggest at least 120 GW of generating capacity and a total system, including storage and interconnection, of 150-160 GW

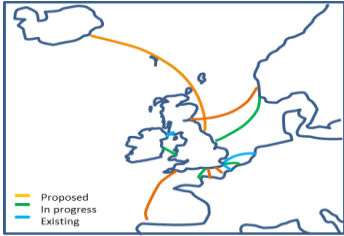
*e.g. National Grid, Committee on Climate Change, Imperial College

In practical terms this means new capacity needed by 2030

	New capacity needed	
Coal 	X	<u>Close all remaining coal plant by 2025 or earlier</u>
New Gas 	3-7 GW	Some new capacity will be needed to replace aging gas plant. Ideally this should include CCS. But CCS is unlikely to be ready at scale by 2030
New Nuclear 	6-8 GW?	It will be a challenge for new nuclear to replace the 7 GW of old nuclear that is expected to close. Hinkley C plus other plants may come on stream by 2030. This could maintain nuclear's current share.
Renewables 	50 GW	Onshore and Offshore wind 30-40 GW Solar – 5-10 GW Hydro and Bioenergy – 5 GW Marine – Wave and Tidal

Plus – sources of flexibility

Interconnection

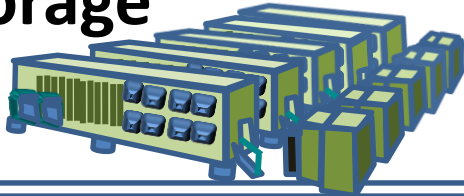


10-15 GW

New links planned to France, Norway, Ireland, Denmark and Belgium.

European Energy Market

Storage



10-12 GW

Large and small scale storage from pumped hydro, commercial and small scale battery storage

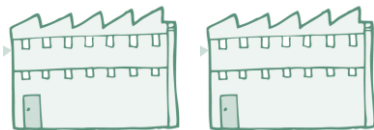
Peak demand shift



1-2 GW?

Smart meters and Time of Use Tariffs. Heat pump and EV charging off-peak. Smart appliances

Demand side Response (DSR)



2-4 GW

Contracted DSR – energy user peak demand reduction and demand turn up as needed

Potential Storage Market Scale

GB market scenario growth scenario by 2030

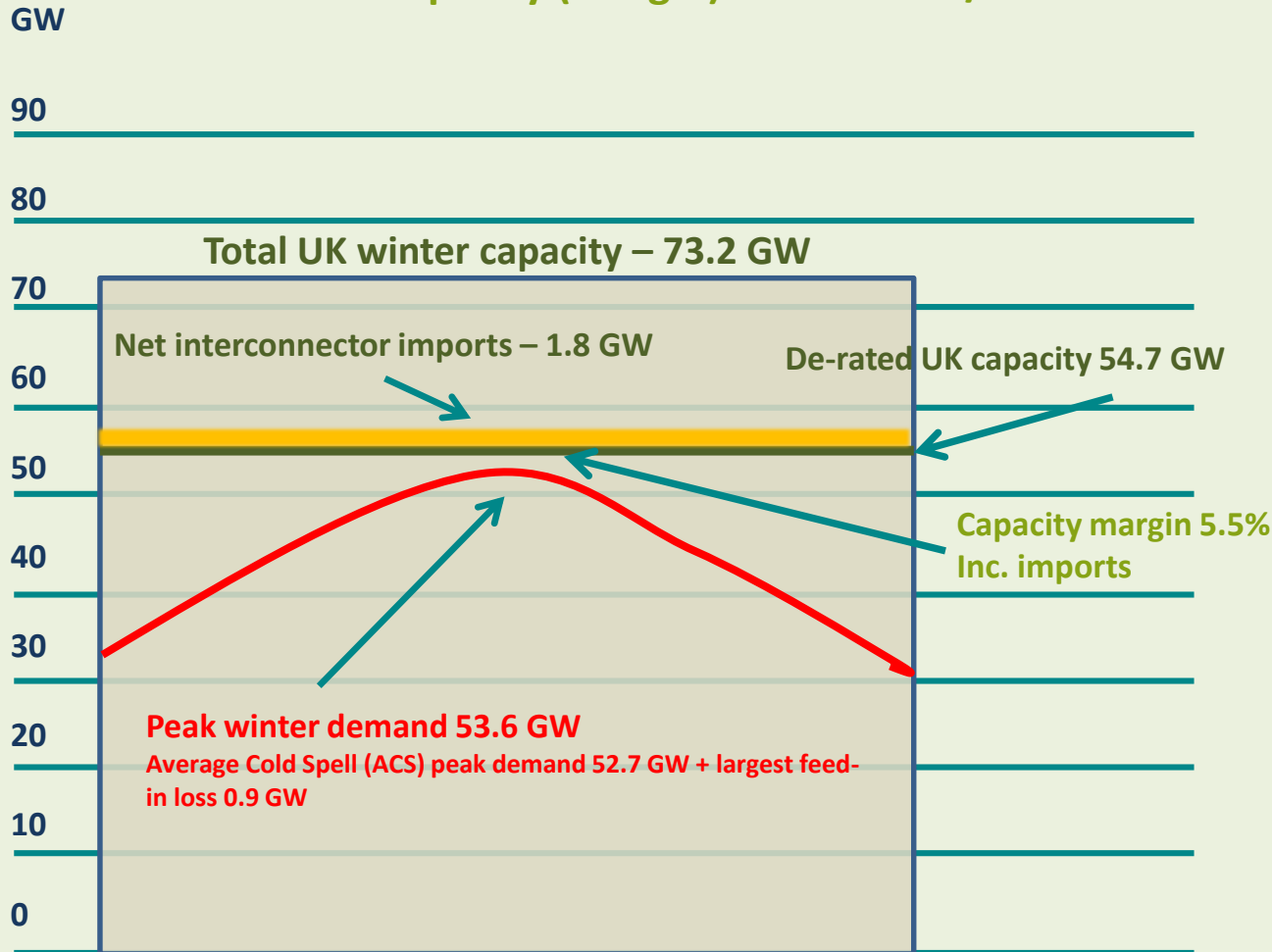
Business model	High Growth Scenario	Slower growth Scenario	Possible upside very high growth scenario
Response service	2 GW	0.5 - 1 GW	2 - 3 GW
	2 GWh	0.5 - 1 GWh	4 - 5 GWh
Reserve Services*	3-4 GW	2-3 GW	4-5 GW
	10-15 GWh	6-10 GWh	15-20 GWh
C&I high energy user & behind the meter	2.5 - 4 GW	0.6 - 1.2 GW	5 GW
	10 - 16 GWh	2.5 - 5 GWh	20 GWh
Domestic and community own use with PV***	1.5 - 2 GW	0.37 - 0.75 GW	3 GW
	6 - 8 GWh	1.2 - 3 GWh	12 GWh
Generation co-location	2 GW	0.5 - 1GW	4 GW
	6 - 8 GWh	2-4 GWh	16 GWh
Total GB market	10 - 14 GW	5 - 6 GW	15-18 GW**
	30 - 50 GWh	10 - 20 GWh	50- 70 GWh

* Larger scale specifically targeting capacity market, STOR and fast response services

** At very high growth levels the risk of revenue “cannibalisation” increases

National grid takes a risk based approach to calculate future winter capacity margins

Generation capacity (margin) winter 2016/17



Adapted from data from National Grid – Winter Consultation July 2016

Winter Outlook 2016/17

De-rated capacity factors:

- Coal – 87%
- Gas CCGT – 88%
- Gas OCGT – 94%
- Nuclear – 84%
- Hydro - 86%
- Wind EFC* - 21%
- Biomass Large – 87%
- Storage(pumped) – 96%

*If wind had a larger share it's Equivalent Firm Capacity would be reduced

No solar, also does not include small scale hydro, wind, microgen, biomass, AD, EfW etc



 **@RegenSW**

Regen SW, The Innovation Centre, Rennes Drive, Exeter, EX4 4RN
T +44 (0)1392 494399 **E** admin@regensw.co.uk **www.regensw.co.uk**

Registered in England No: 04554636

regen 
transforming energy