

Why Sustainable Severn?



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regen 
transforming energy

April 2017

2016 was a bit odd.....



While this was happening.....

401.01
parts per million (ppm)

Mauna Loa Observatory, Hawaii (Scripps Keeling Curve)

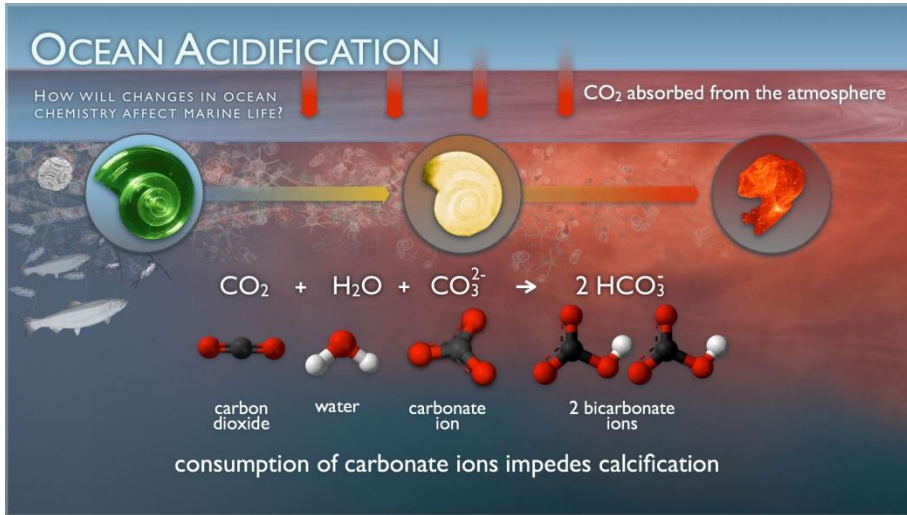
Preliminary data released [October 4, 2016](#)

Environment under threat.....

OCEAN ACIDIFICATION

HOW WILL CHANGES IN OCEAN CHEMISTRY AFFECT MARINE LIFE?

CO₂ absorbed from the atmosphere



The diagram illustrates the process of ocean acidification. It shows a cross-section of the ocean surface where CO₂ is absorbed from the atmosphere. Below the surface, a chemical reaction is shown: CO₂ + H₂O + CO₃²⁻ → 2 HCO₃⁻. Below the reaction, ball-and-stick models represent the molecules: carbon dioxide (CO₂), water (H₂O), carbonate ion (CO₃²⁻), and two bicarbonate ions (2 HCO₃⁻). The text 'consumption of carbonate ions impedes calcification' is written at the bottom. The diagram also features three circular icons: a green spiral shell, a yellow shell, and a red shell, representing the impact of acidification on marine life.

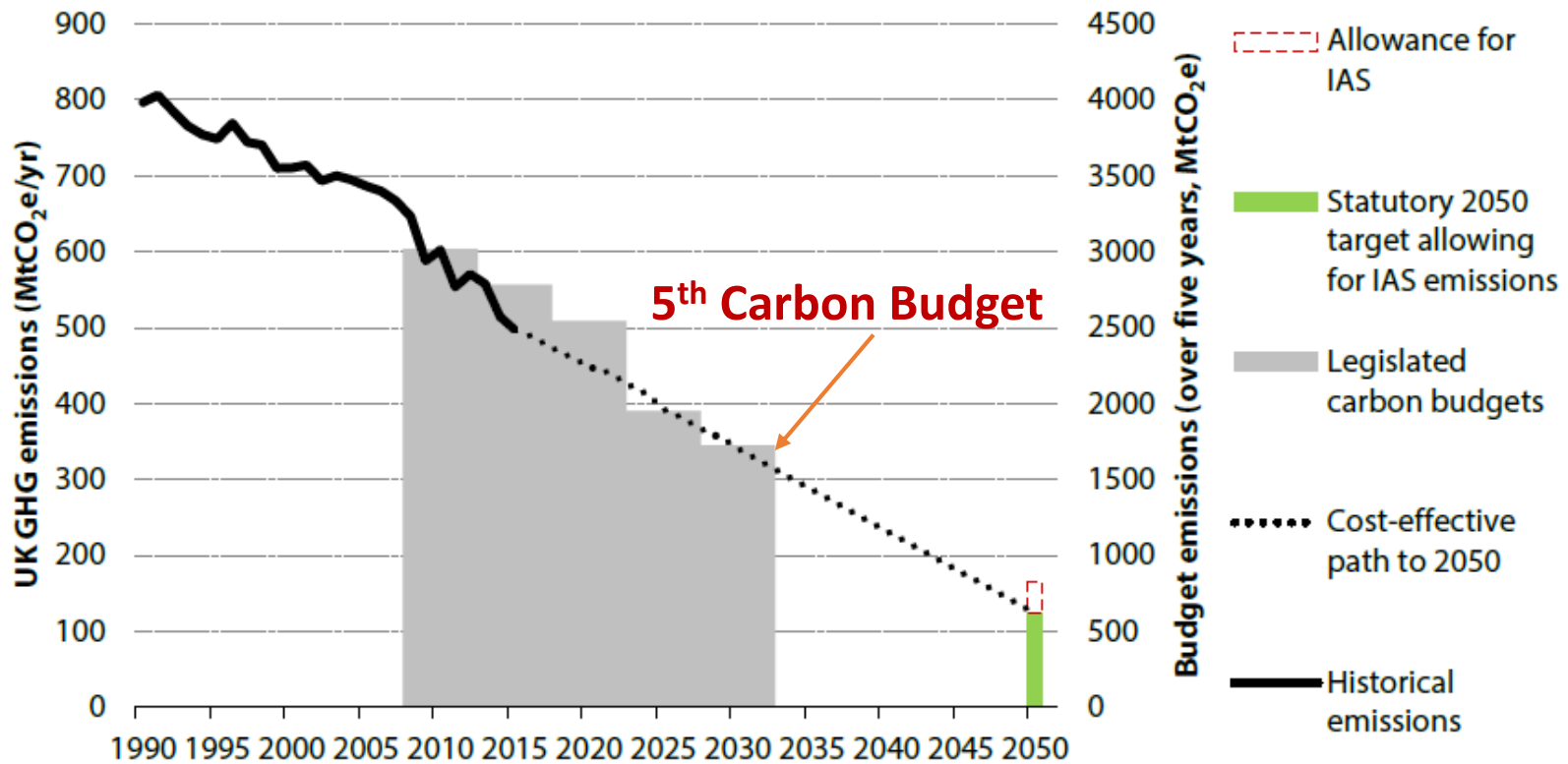
CO₂ + H₂O + CO₃²⁻ → 2 HCO₃⁻

carbon dioxide water carbonate ion 2 bicarbonate ions

consumption of carbonate ions impedes calcification



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

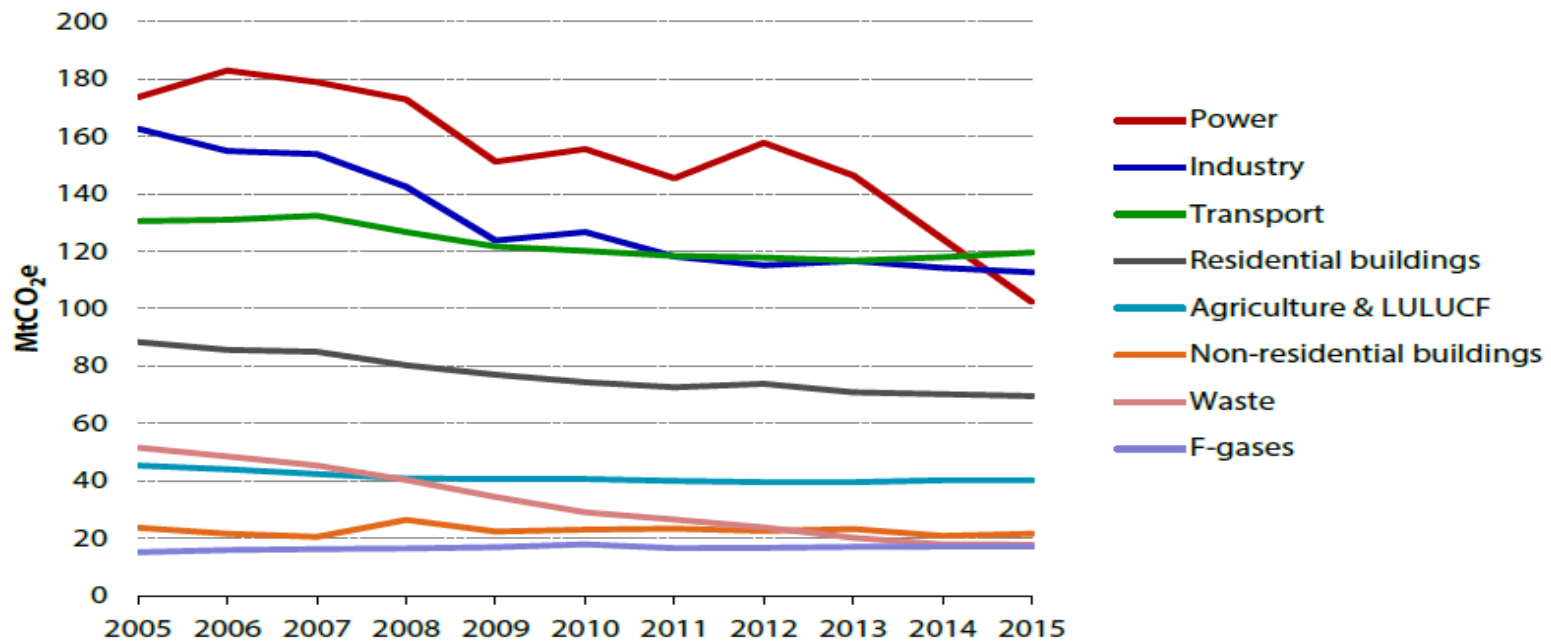


Source: CCC calculations.

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

UK emissions – good and bad news

Figure 1. Progress reducing emissions since 2012 has been almost entirely due to the power sector



Source: DECC (2016) *Provisional GHG statistics for 2015*; DECC (2016) *Final GHG statistics for 1990-2014*; CCC analysis.

Decarbonisation of the power sector

2010

156 MtCO₂e
499 gCO₂e/kWh

2015 Progress

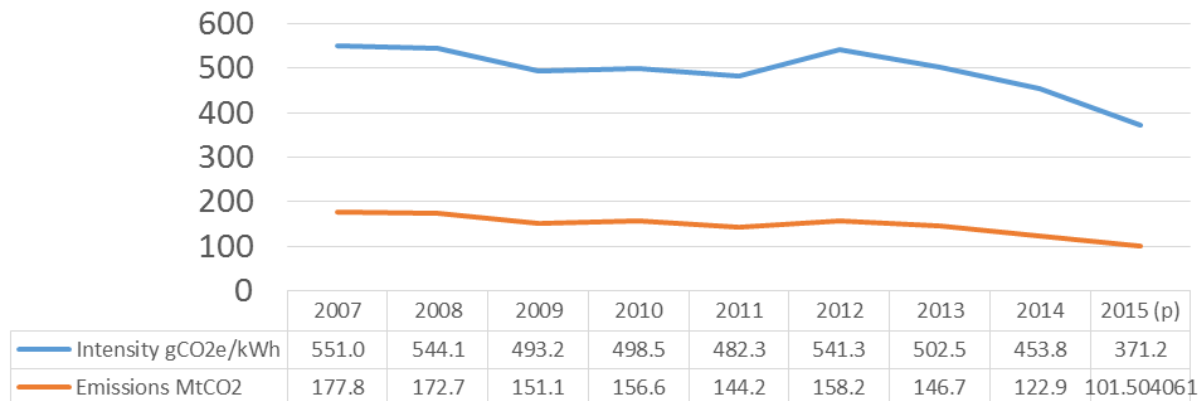
102 MtCO₂e
370 gCO₂e/kWh

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



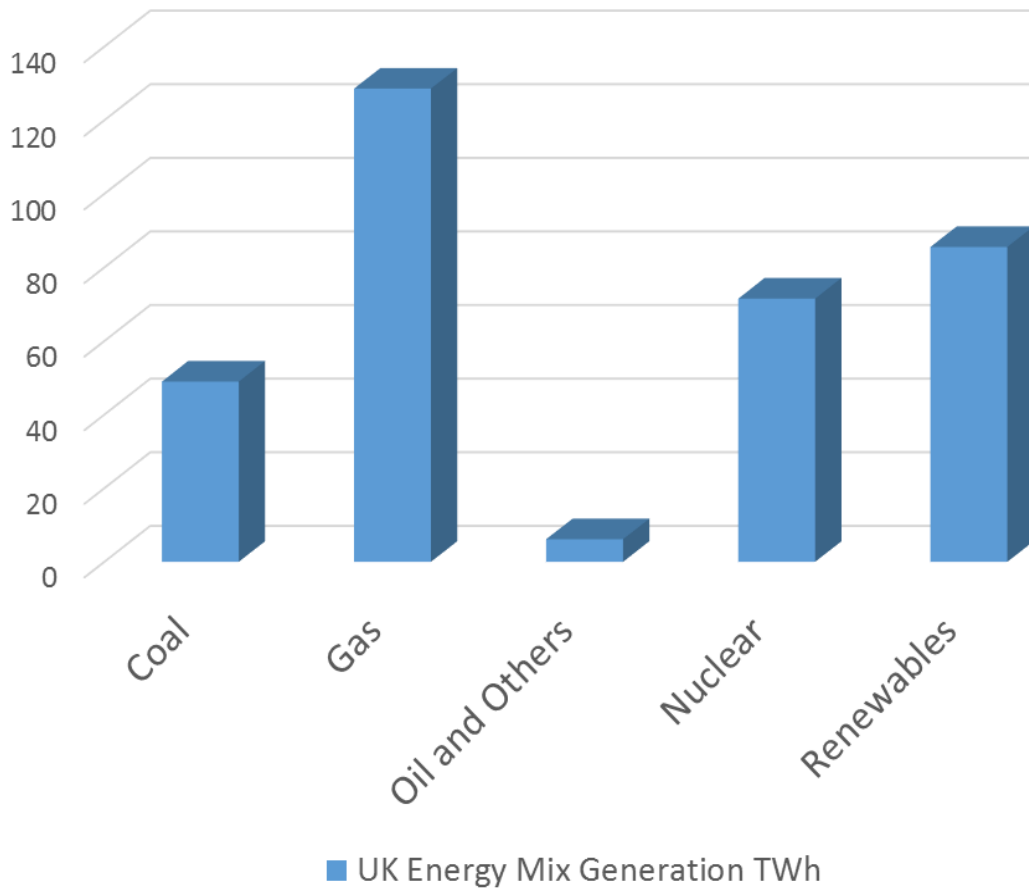
Changing GB electricity capacity

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

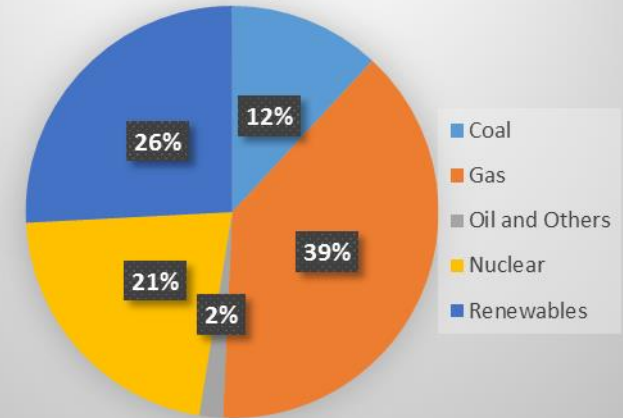
* Closed, partially closed, converted to biomass or mothballed

Low carbon electricity reaches 50%

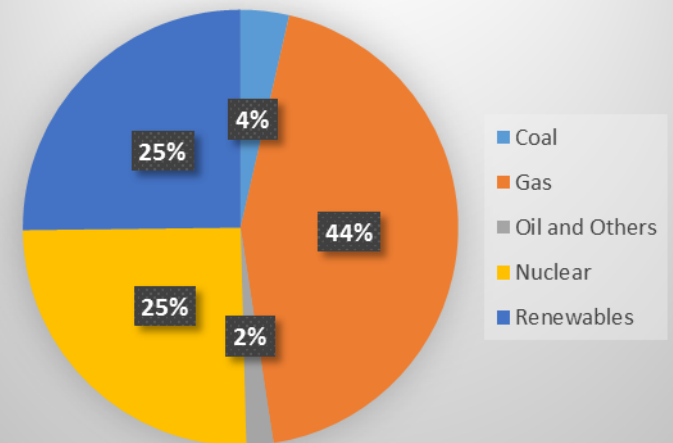
UK Energy Mix Generation TWh



GB Electricity Generation in 2015/16




Q3 2016 Low Carbon at 50%



Coal is the worst carbon emitter and is holding back Germany and other east European countries

Live CO2 emissions of the European electricity consumption

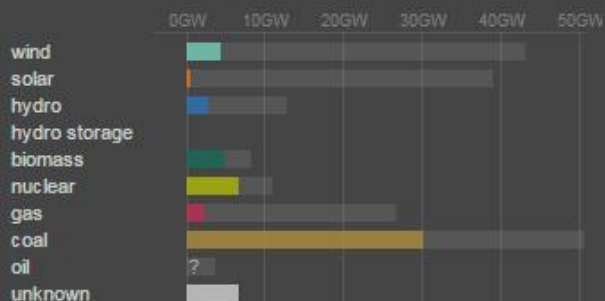
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


 DE (an hour ago) [\[source\]](#)

Carbon intensity:  524 gCO₂eq/kWh (53 % fossil fuels)

Electricity price (day-ahead): ? €/MWh

Electricity production (show emissions) by source:



-  AT
-  CH
-  CZ
-  DK
-  FR
-  NL
-  PL
-  SE

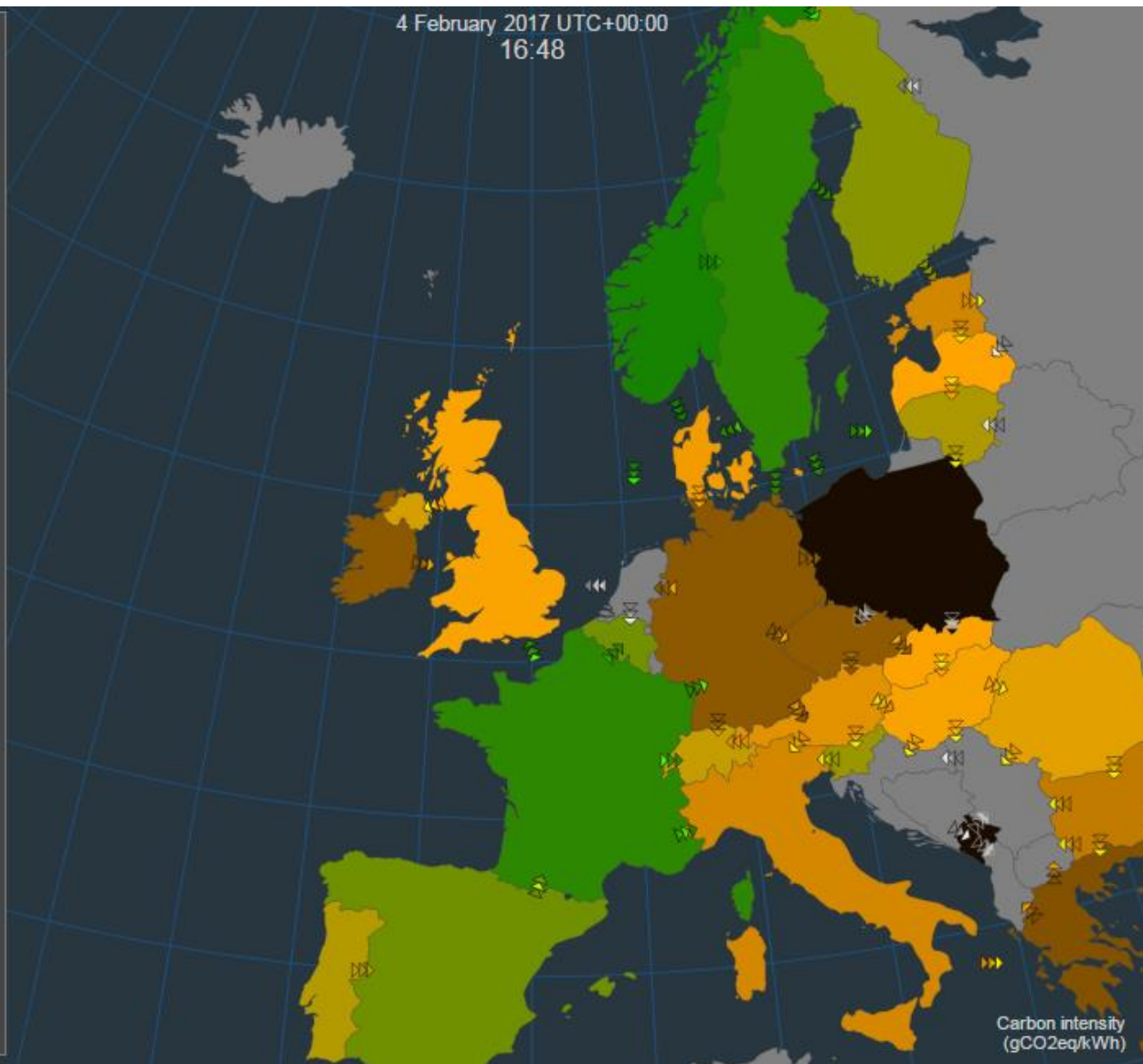
Like the visualization? We would love to hear your feedback!

Found bugs or have ideas? [Report them here.](#)

Check out how our CO₂ Signal can help your devices and electric vehicle consume electricity at the right time.

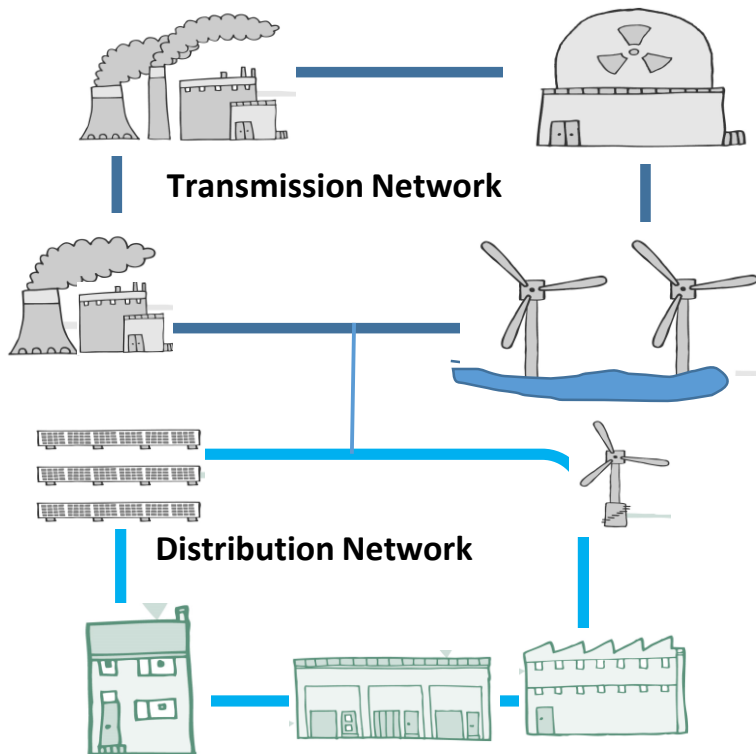
tomorrow

Share Like Follow Tweet Slack

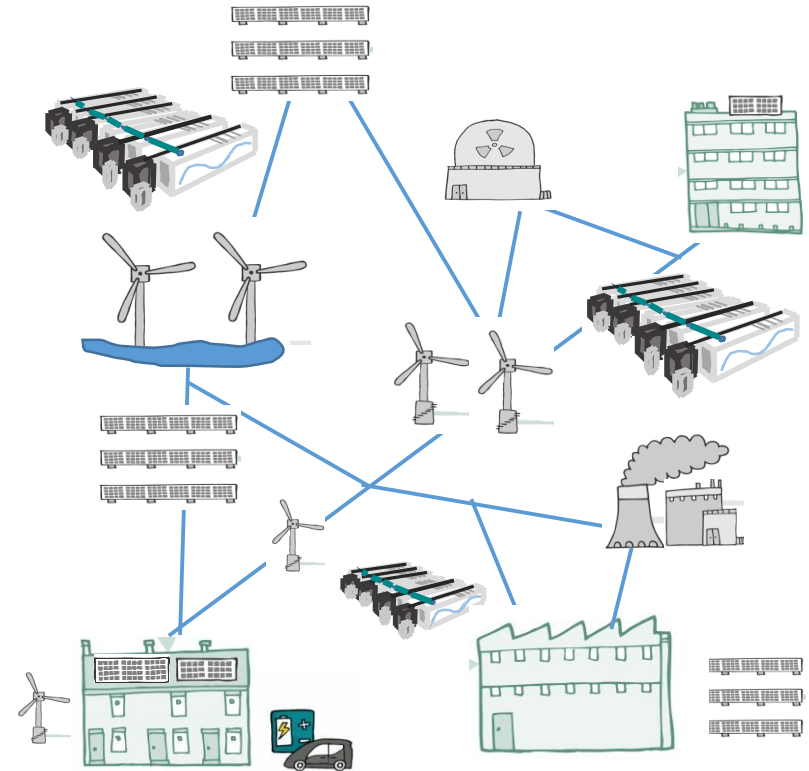


Structural change is happening

A centralised system

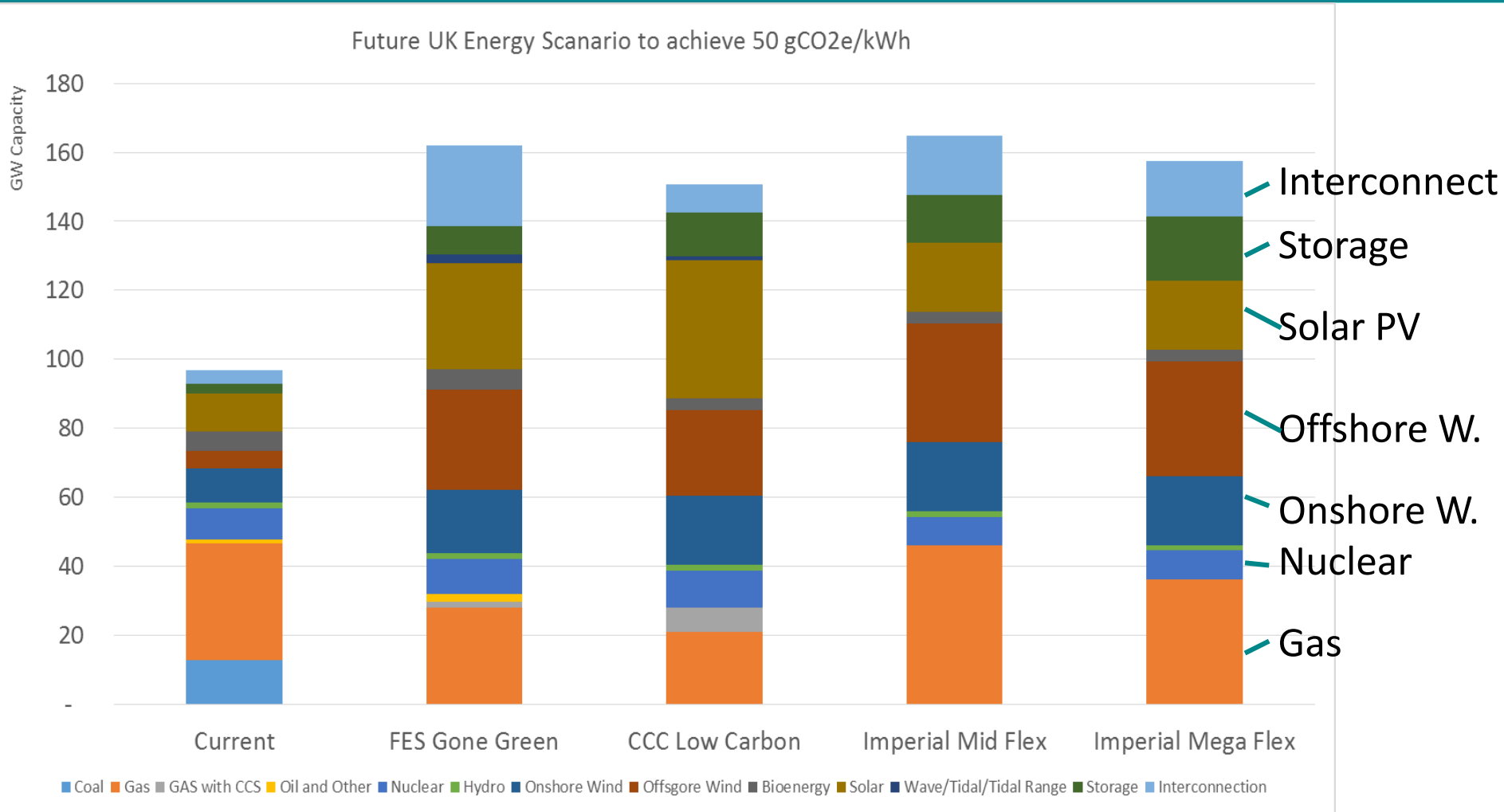


More decentralised system



“Our engineers say that 2015 was the last year we operated the system in the way it has operated for the past 50,” he says. “The way we are operating now is fundamentally different.” **John Pettigrew Chief Exec. National Grid**

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

Close all remaining coal plant by 2025 or earlier

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

Interconnection

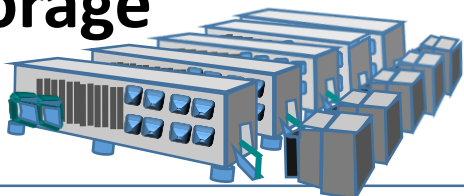


10-15 GW

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

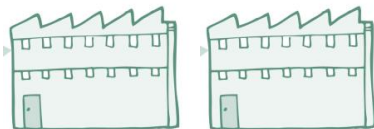
Peak demand shift



1-2 GW?

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

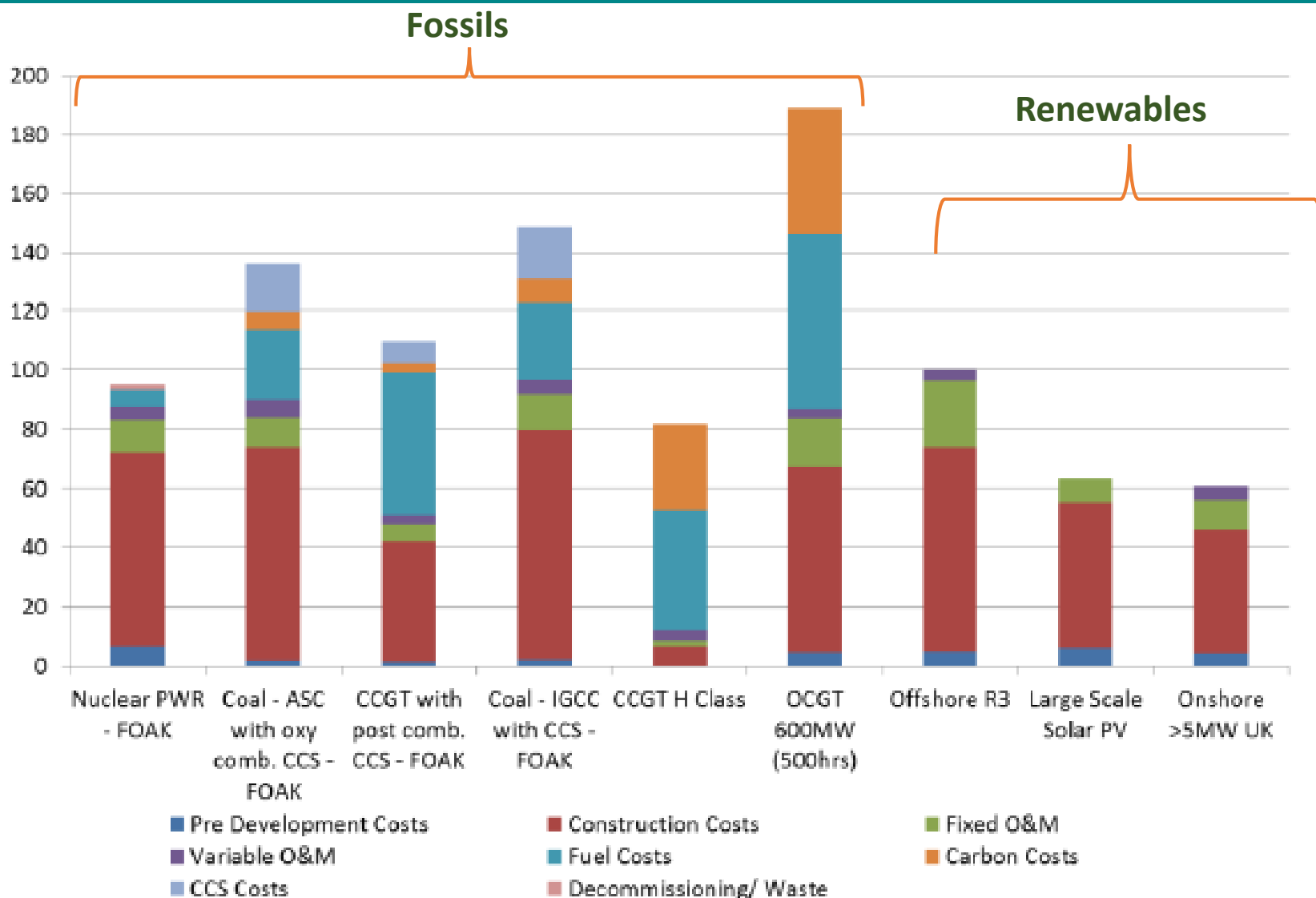
Demand side Response (DSR)



2-4 GW

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

A way forward ...falling costs



Levelised Cost Estimates for Projects Commissioning in 2025, Technology-specific Hurdle Rates, £/MWh



Over 45 GW originally in lease

12 GW withdrawn/reduced/refused

Current portfolio 32 GW

Just over 5 GW built

Further 5 GW in construction and expected by 2020

Government has budgeted (LCF) support for 4 GW 2021-26

Target 20 GW by 2030 if costs are acceptable and policy is in place to support

Bristol Channel - a fantastic opportunity

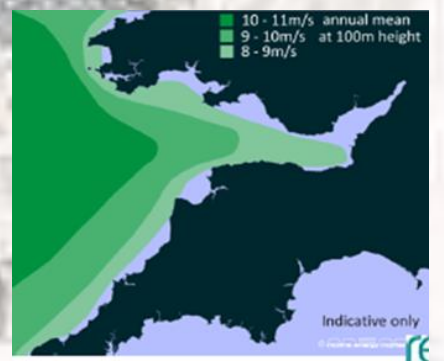
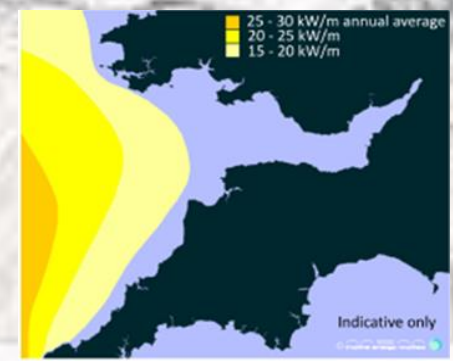
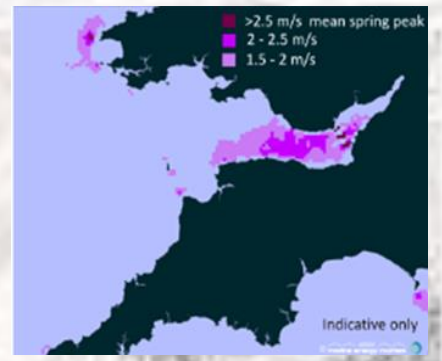
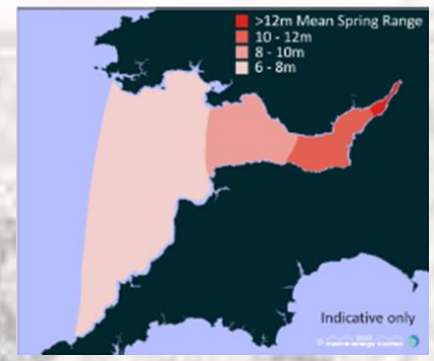
Resource potential

Clean energy

Investment and economic development

New technology and innovation

Skills and jobs



A Sustainable Severn

SUSTAINABLE SEVERN

For illustrative purposes only

ECONOMY

£14bn
critical infrastructure
in the Severn Estuary

3,293,000
people living in districts
and counties bordering
Bristol Channel

49.2m
visitors to
the region

17,450
jobs dependent
on Bristol and
South Wales ports

-  Ports
-  Tourism
-  Conventional Power Generation

MARINE ENERGY

5-14 GW
potential energy
capacity from offshore
renewable technologies
in the Bristol Channel

7 GW
potential capacity
from combination of
tidal range and tidal
stream projects

c. 3+ GW
potential offshore wind
capacity

1.2 GW
planned capacity
from Atlantic Array
windfarm

ENVIRONMENT

20,300
hectares of mudflats
cover the intertidal
area

Inner Bristol Channel
important for feeding
seabirds

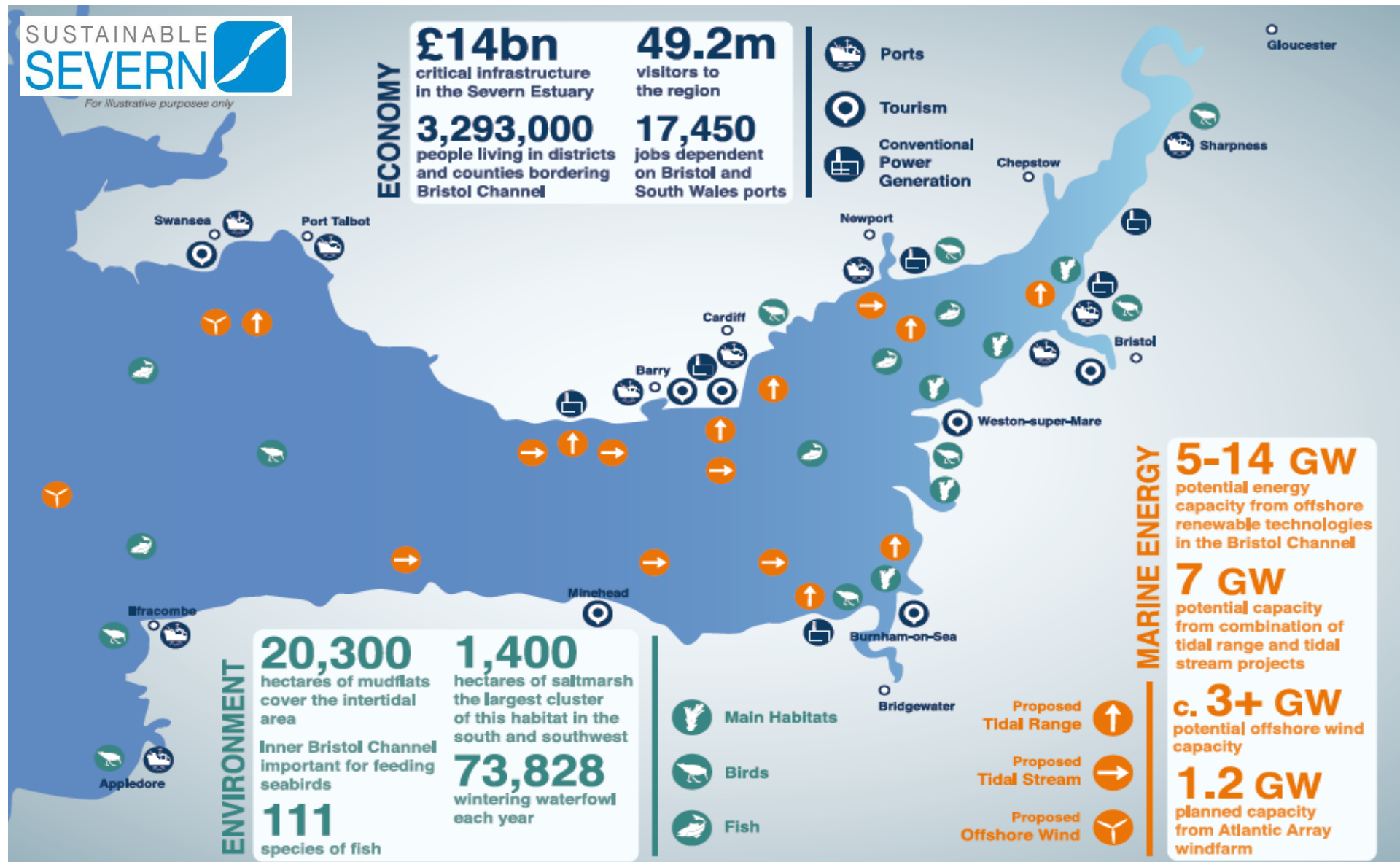
111
species of fish

1,400
hectares of saltmarsh
the largest cluster
of this habitat in the
south and southwest

73,828
wintering waterfowl
each year

-  Main Habitats
-  Birds
-  Fish

-  Proposed Tidal Range
-  Proposed Tidal Stream
-  Proposed Offshore Wind



But only if we do it right...



Energy, Economy and Jobs



Environment and society

A balanced approach underpinned by a long term strategy and proper governance

- Respecting and protecting the environment
- Working with existing marine users and economic stakeholders
- Providing real economic and social benefits
- Knowledge backed by science and research
- Holistic approach – cumulative impacts
- Proper engagement and genuine partnership
- Providing opportunities for shared ownership
- Maximising the opportunity for innovation

▶ Thank you for listening



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transforming energy

December 2015