

Scottish Energy Strategy:
The future of energy in Scotland



December 2017

 Scottish Government
Riaghaltas na h-Alba
gov.scot

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*Future Wind and Marine
University of Strathclyde:
Wind and marine in a net zero world*

5th March 2020



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3 years at the Scottish Government

- *Energy Strategy*
- *Vision for Scotland's Gas and Electricity Networks*
- *Black Start and Sustainable Security of Supply*
- *EV and Heat electrification*

10 years at the University of Strathclyde

- *Network innovation projects including NINES (Shetland) ARC (SE Scotland), Security of Supply (Scotland and GB)*
- *PhD and research work focused in integration of distributed generation, DSO operation, energy storage, flexibility*
- *Member of the first cohort of the wind CDT students, involved in the inaugural Future Wind.*

5 years as a high school physics teacher



There is a global climate emergency!

The Scottish Parliament has passed a
our Climate Change Act to set a **net-**
zero target for 2045



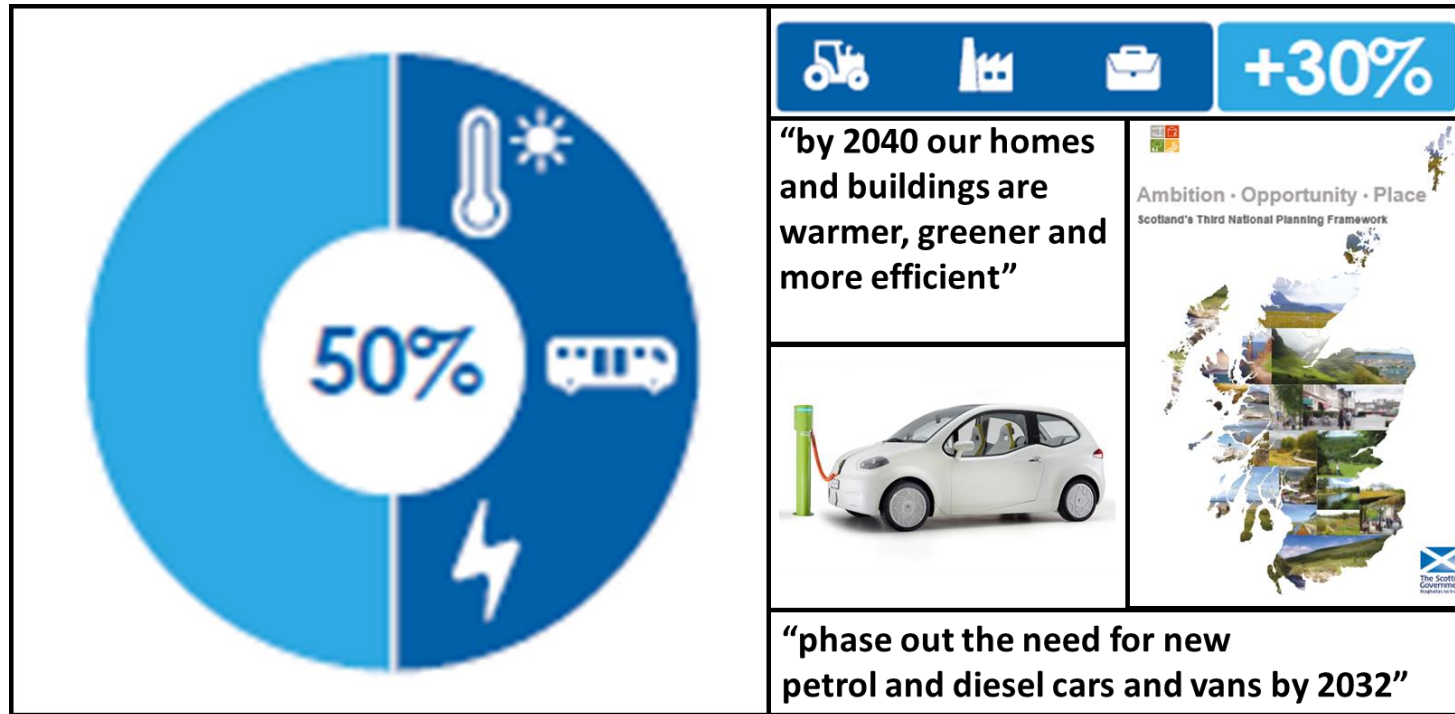
That is just **298** months from today!



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Scottish Government and the Energy System



How do we plan and deliver a distinctly Scottish energy system within a system where large parts of organised on a GB or UK basis?

The CCC
UK Government
National Grid ESO
Ofgem
National Grid Gas



The Climate Change Act and The Energy Strategy

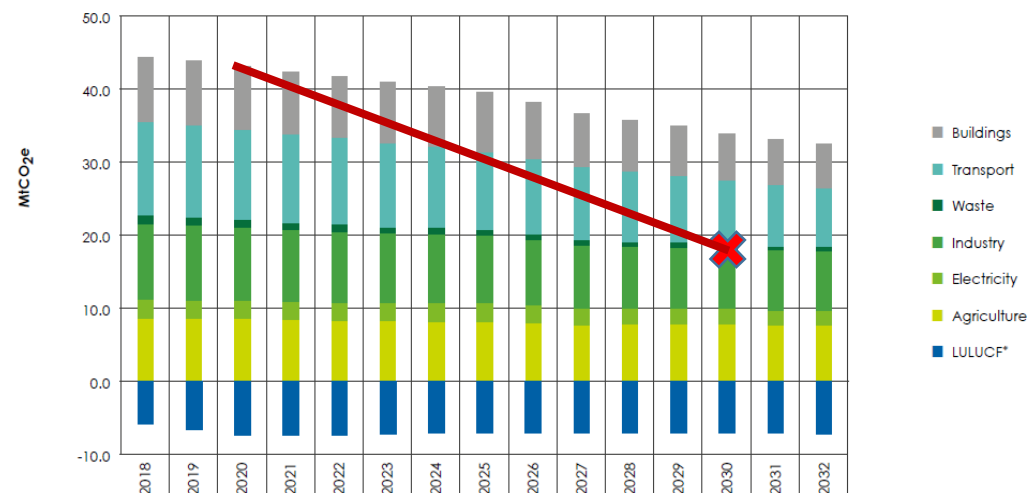
Scottish 2019 Climate Change Act

The Scottish Ministers must ensure that the net Scottish emissions account for the net-zero emissions target year is ... 2045.

The Scottish Ministers must ensure that the net Scottish emissions account for the year—

- (a) 2020 is at least 56% lower than the baseline,
- (b) 2030 is at least 75% lower than the baseline, and
- (c) 2040 is at least 90% lower than the baseline.

Figure 1: Pathway to 2032



This is our 2050 vision for energy in Scotland:



A WHOLE-SYSTEM
VIEW



AN INCLUSIVE
ENERGY TRANSITION



A SMARTER
LOCAL ENERGY MODEL



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What is the role of wind and marine in delivering net zero?

Decarbonise the
supply of electricity
energy

~80%*

Decarbonise the
operability and
security of the
electricity system

~20%*

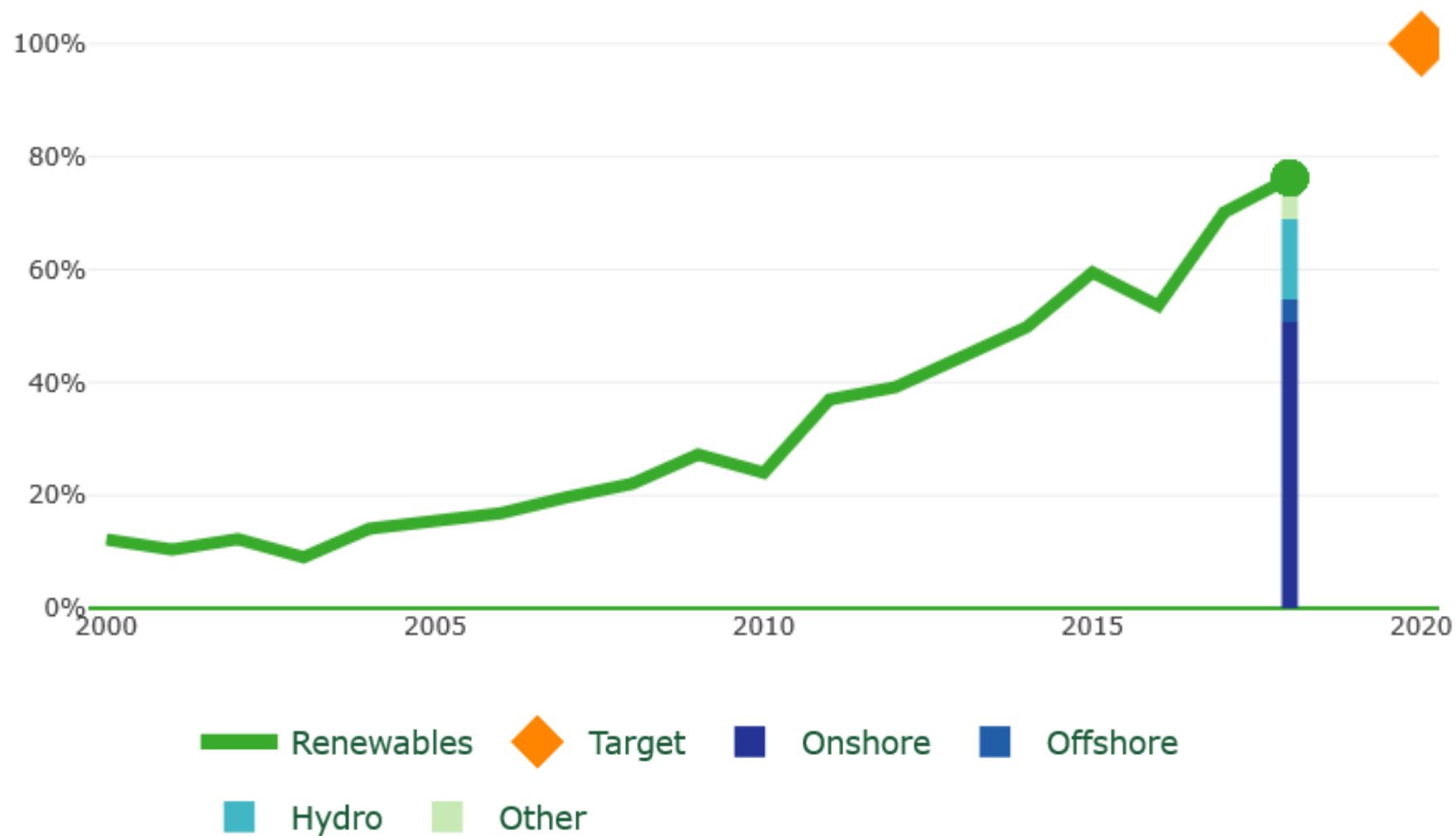
Support
decarbonisation of
the wider energy
system

~5%*

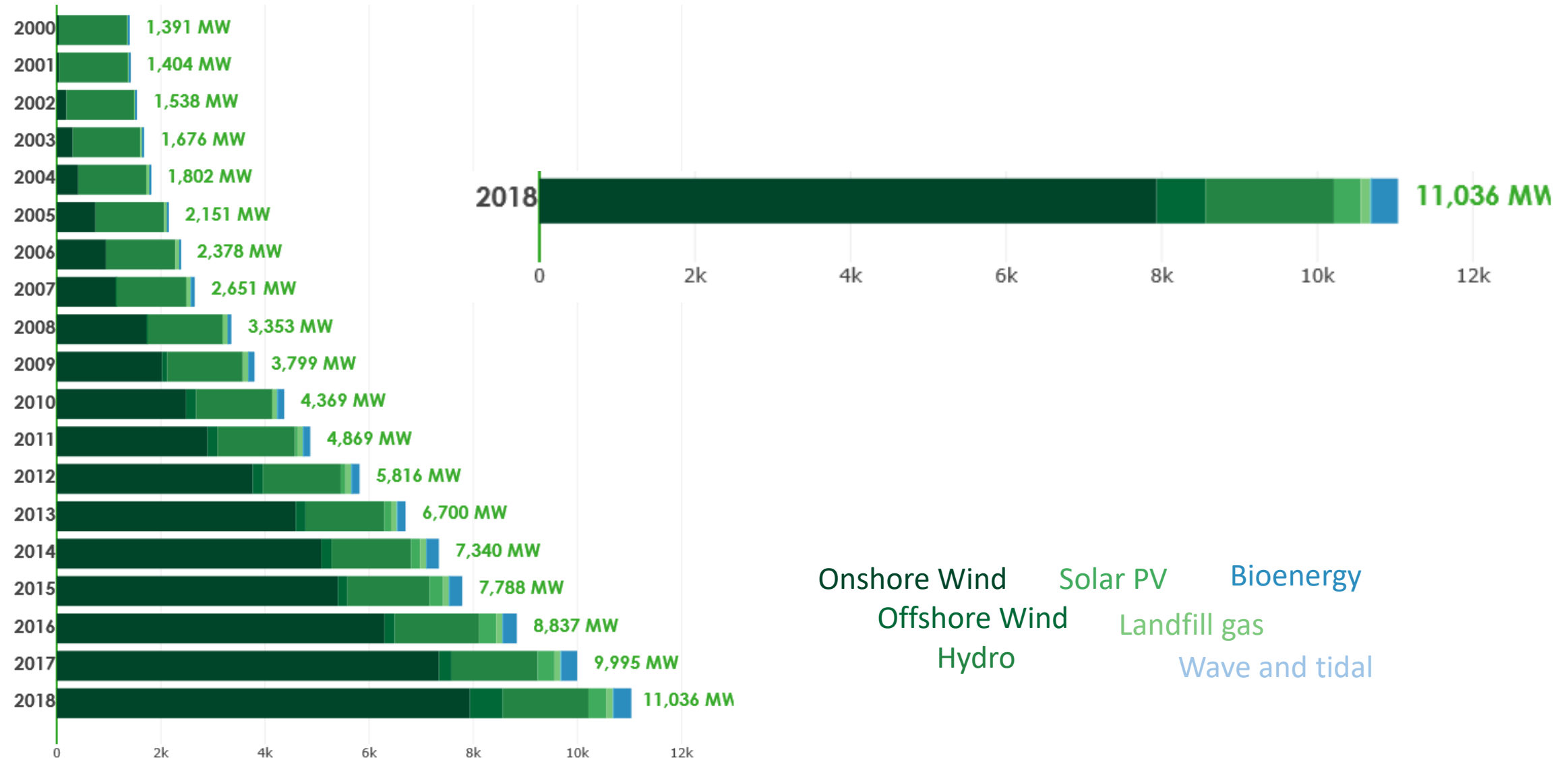
*My personal estimates of progress to date



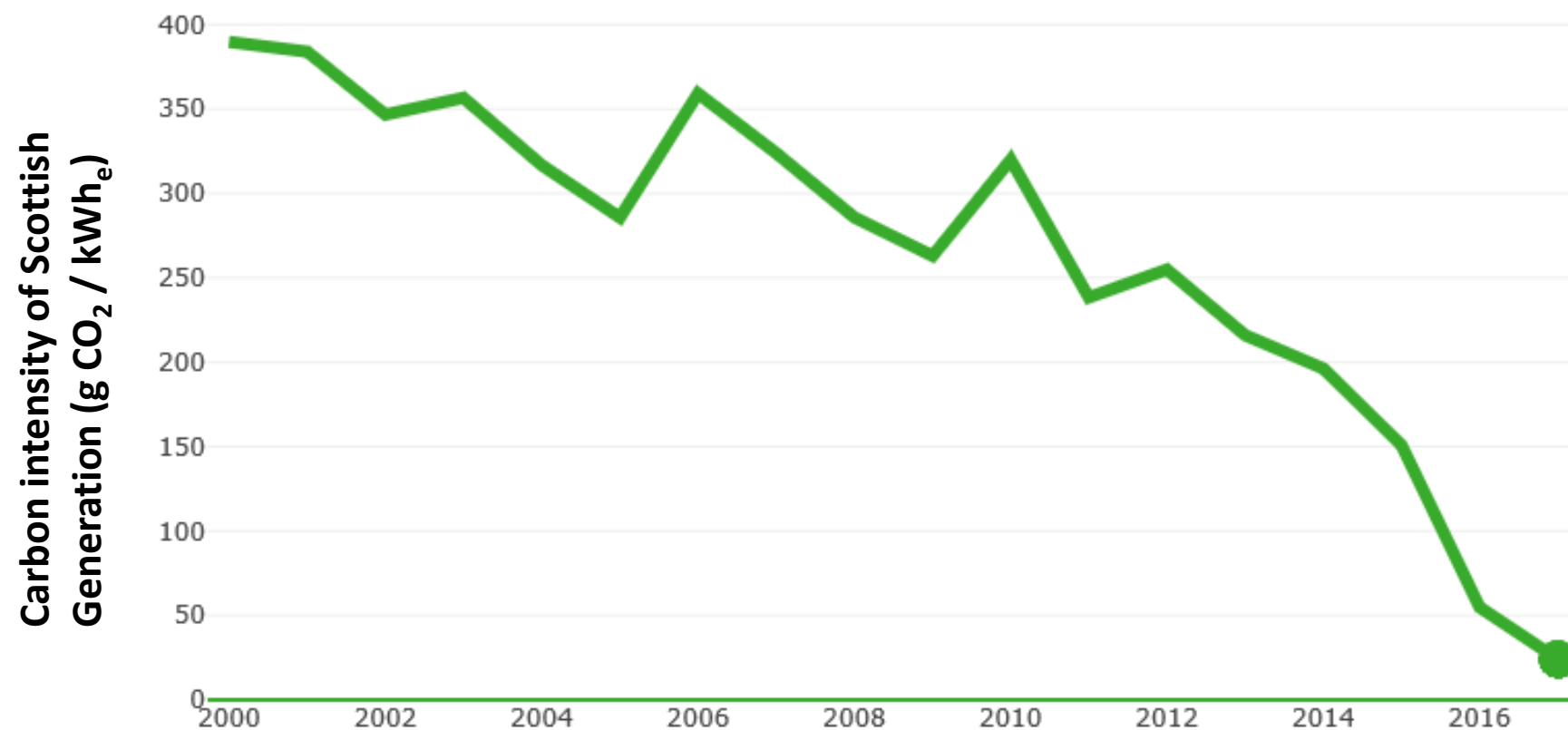
Decarbonising electrical energy (Scotland)



Decarbonising electrical energy (Scotland)



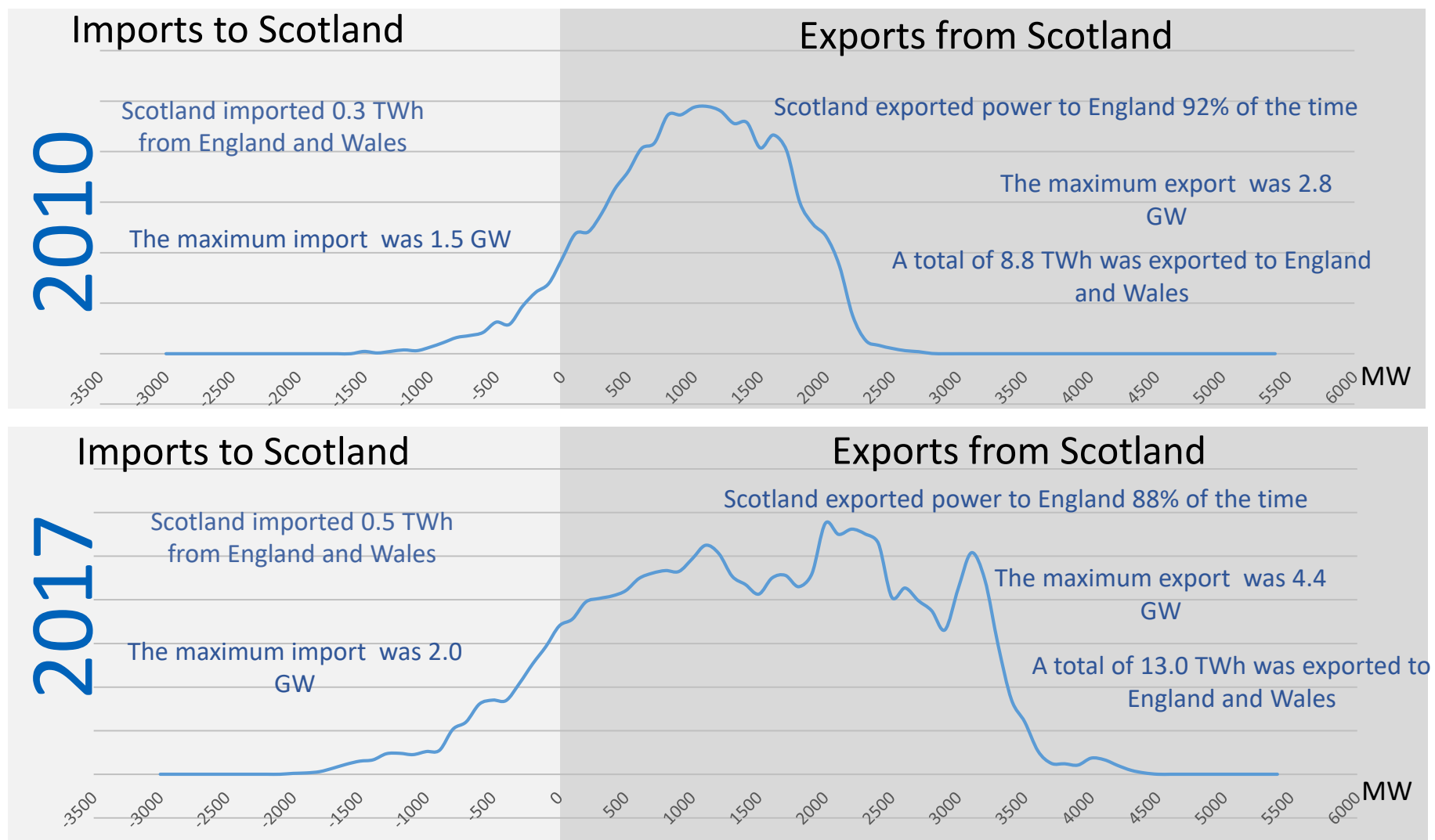
Decarbonising electrical energy (Scotland)



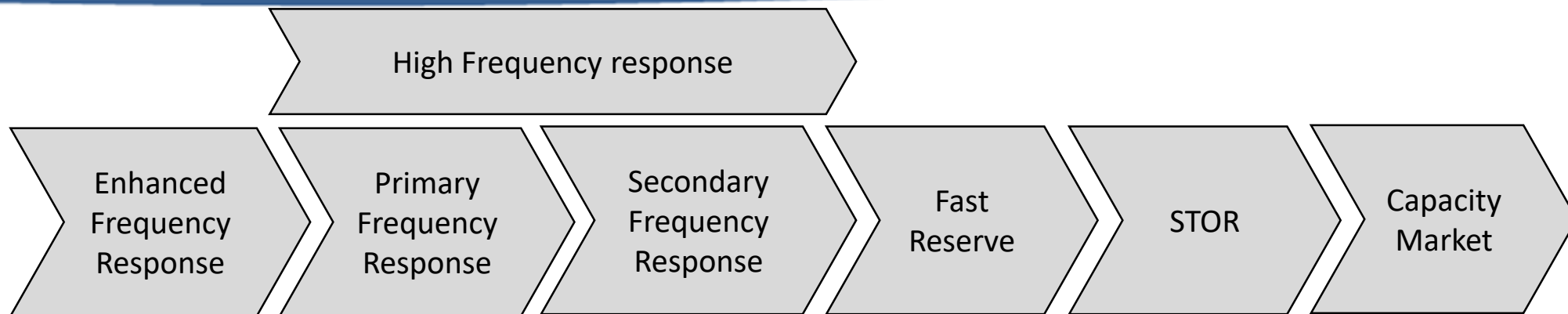
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Decarbonising electrical energy (GB)



Decarbonising electricity operability and security of supply



Ancillary services for the new world

Fault
Current

Voltage
Support
(Dynamic and
static)

Supporting a
low inertia
system

Black
Start

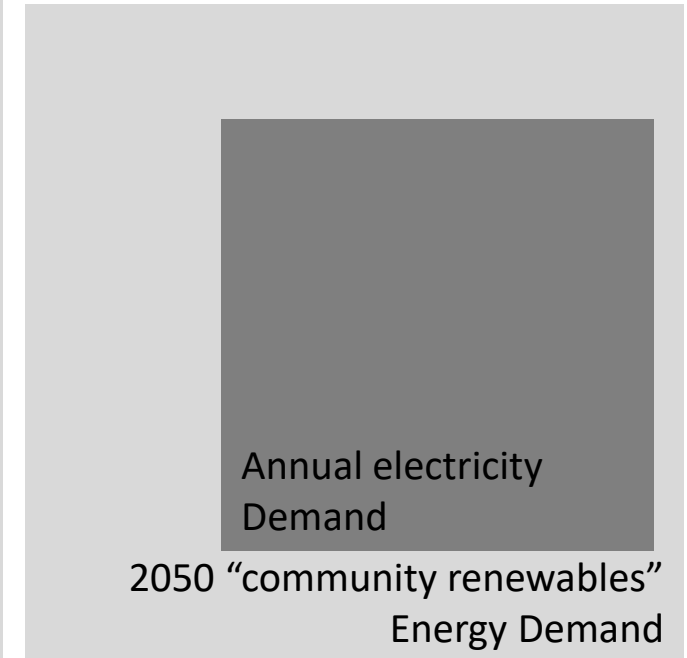
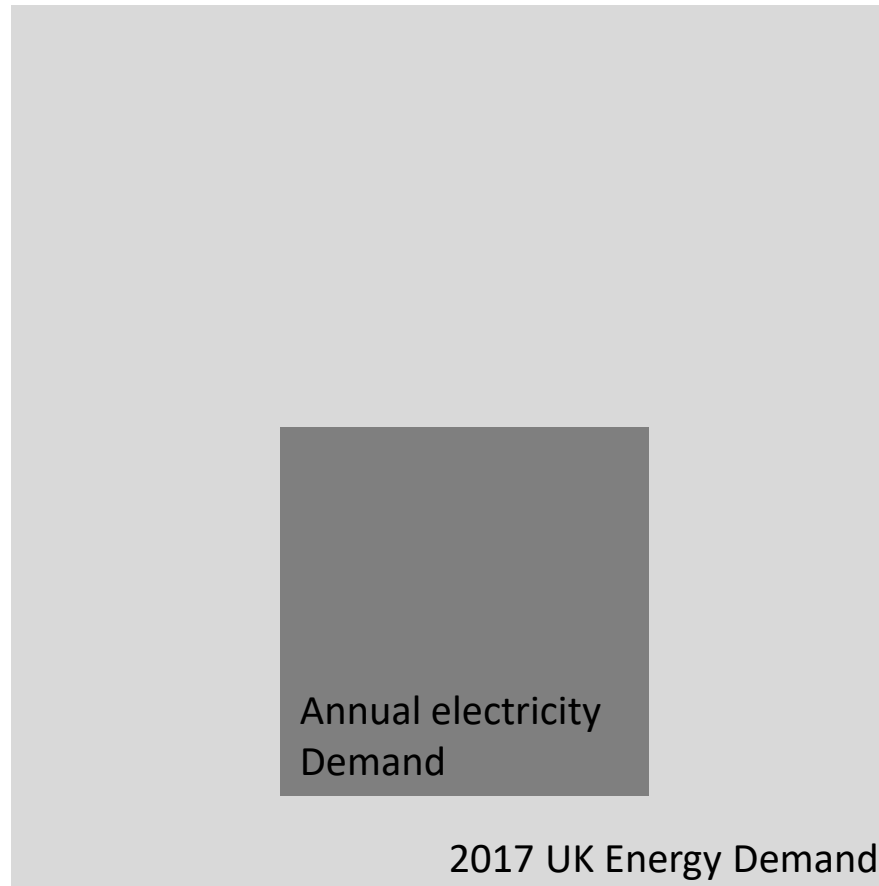
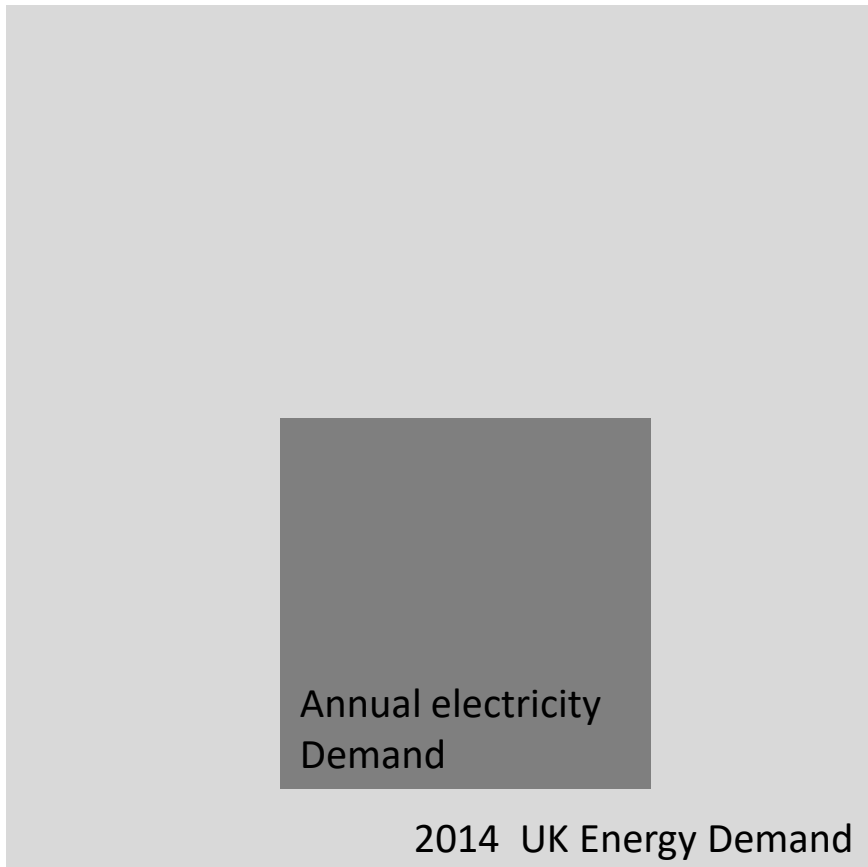
VSM

Integration with energy storage,
Flywheels' synchronous
compensators?

Black start development,
Distributed re-start

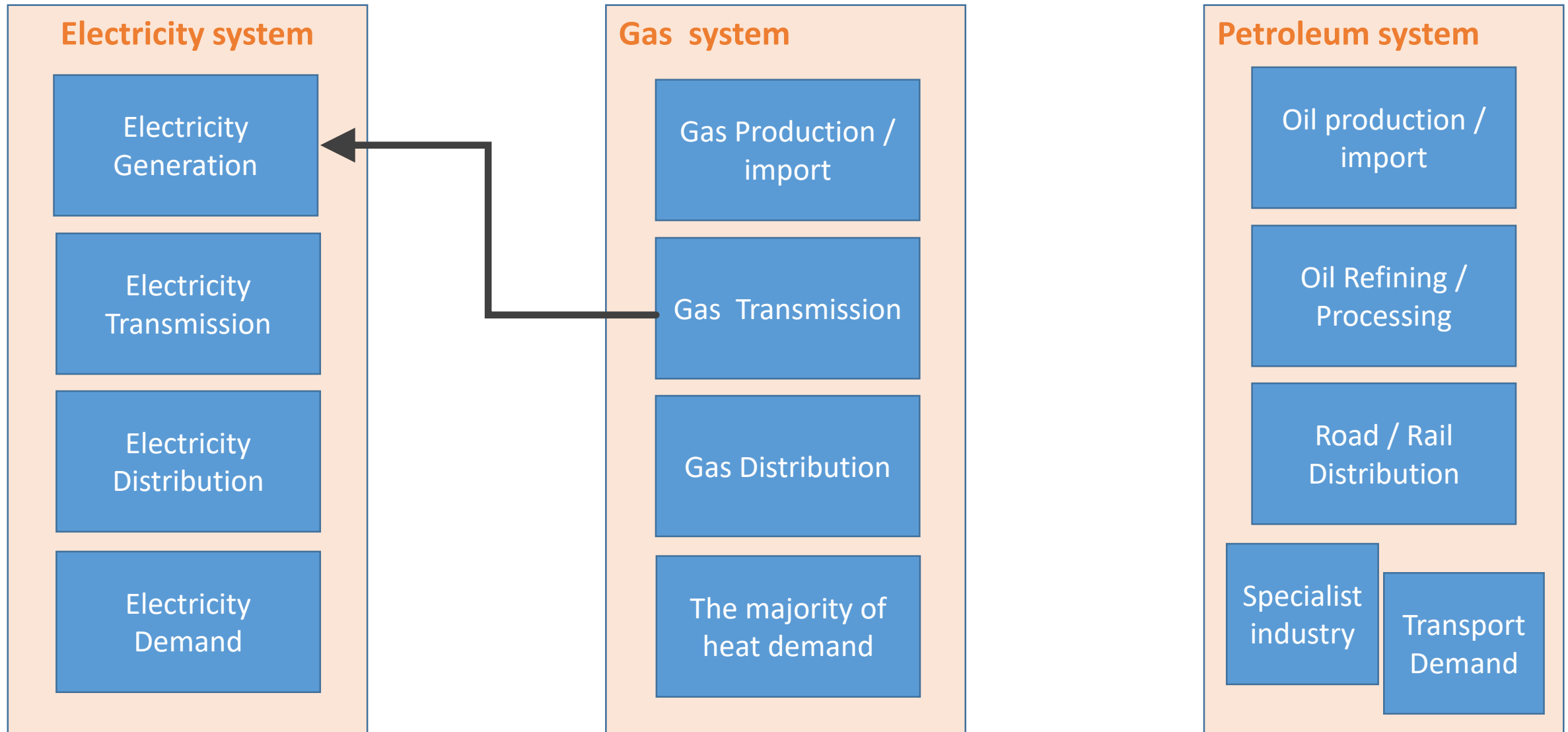


Decarbonising the wider energy system



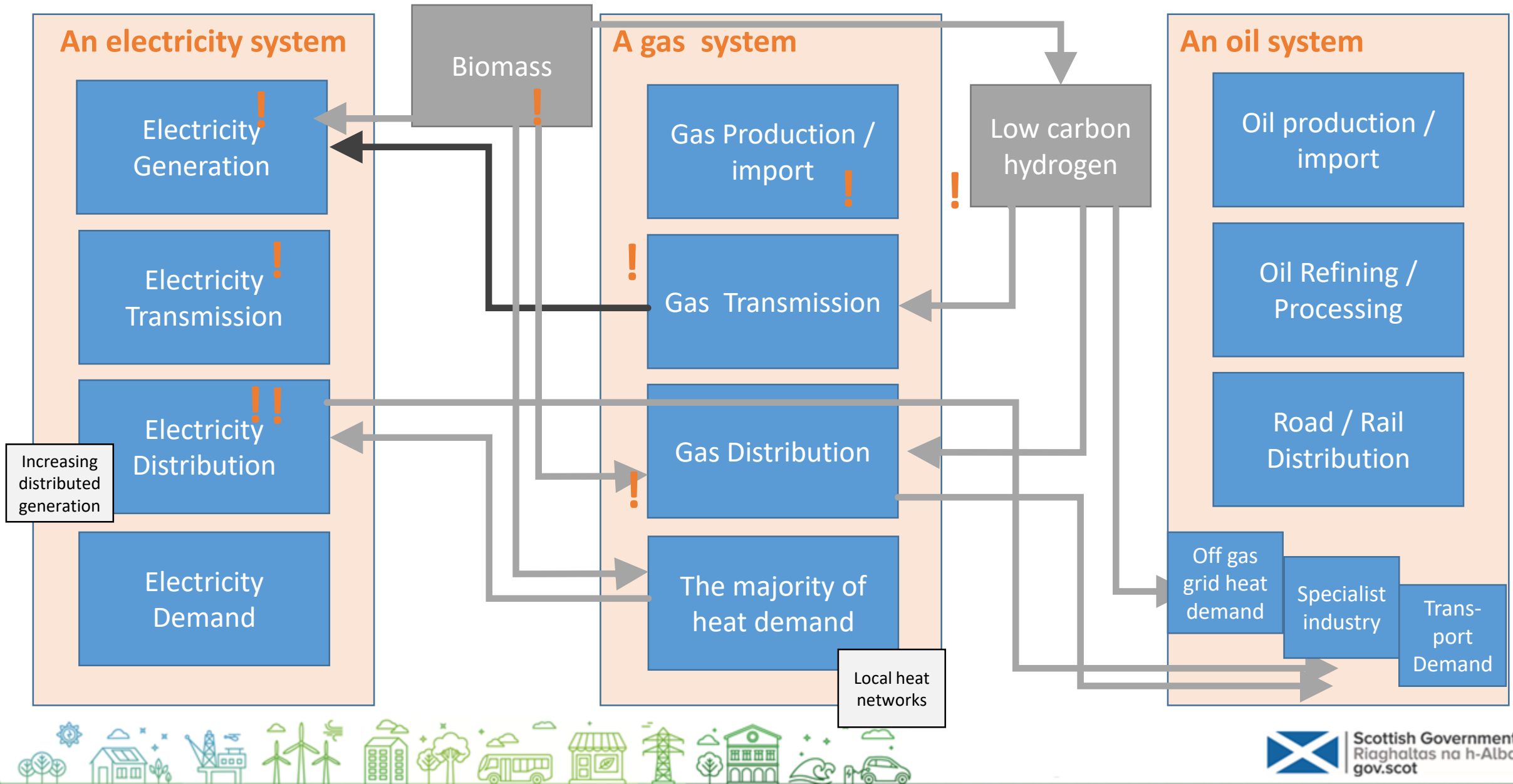
Today the **electricity system** is less than a fifth of the **energy system**, and the energy system is growing. In 2050, the **electricity system** could be more than 60% of an **energy system** that is less than half the size



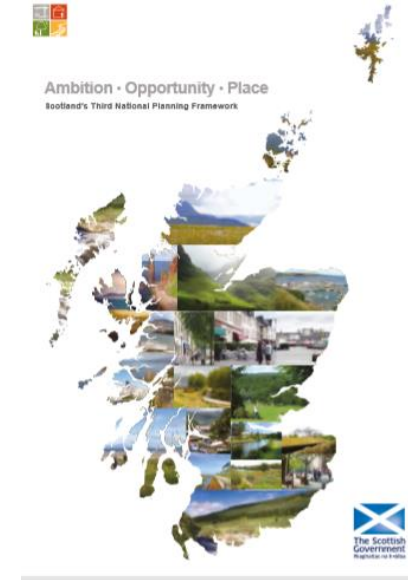
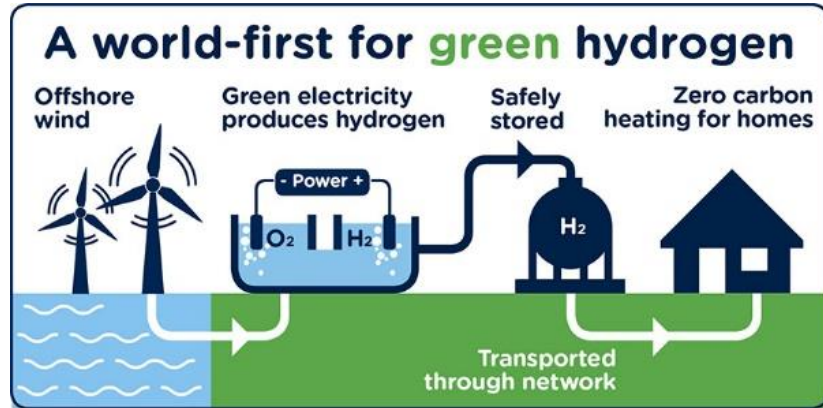


Decarbonising the wider energy system

Future Model



Decarbonising the wider energy system



How do we link wind and marine to other energy vectors?

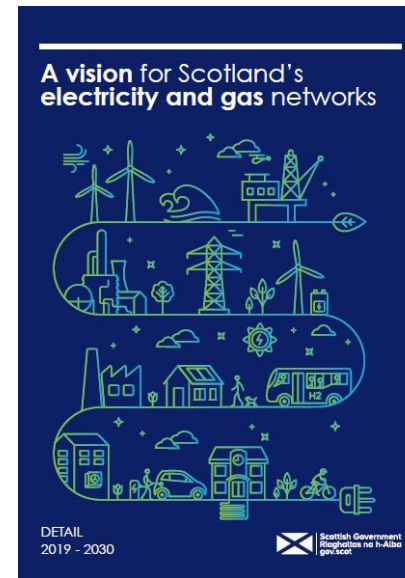
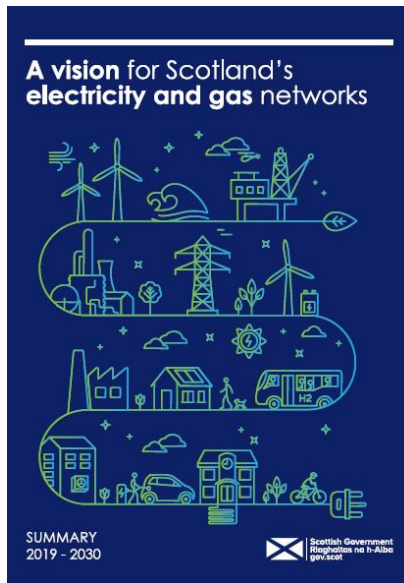
How do we use other system elements to make the best use of wind and marine for the energy system?

How do we plan our economy and society around renewable resources like wind and marine?



<https://www.gov.scot/publications/vision-scotlands-electricity-gas-networks-2030/>

<https://www2.gov.scot/Topics/Statistics/Browse/Business/Energy>



Thanks



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