

CLASP - Energy Challenge Areas

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The net-zero challenge

In 2019 the UK passed into law to bring its GHG emissions to net zero by 2050 – this means any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage

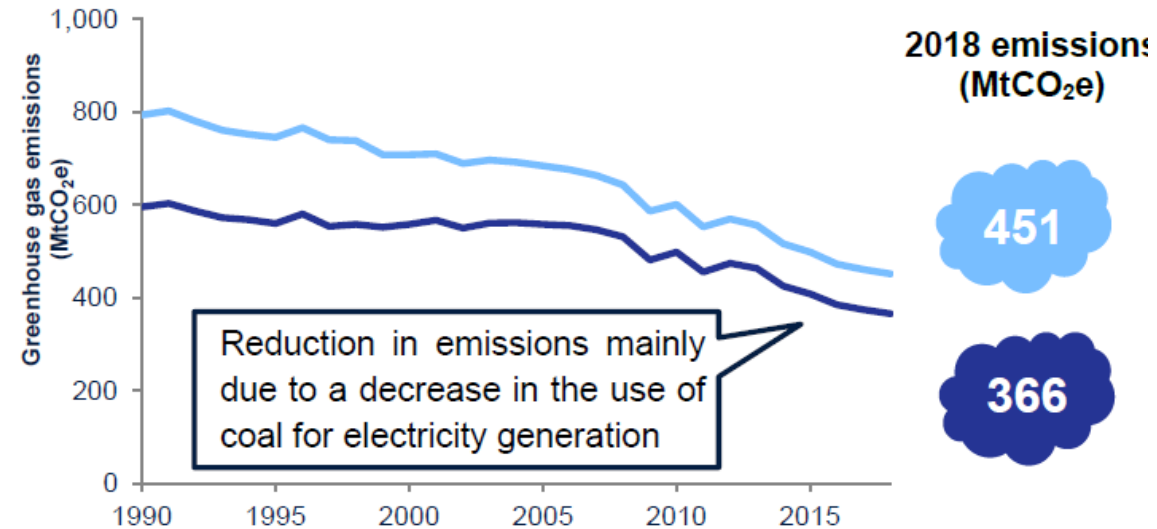
Transport was the largest emitting sector of UK greenhouse gas emissions in 2018



Other includes Public, Industrial Processes and the Land Use, Land Use Change and Forestry (LULUCF) sectors (note that LULUCF acts as a net sink of emissions). The percentages may not sum to 100% due to rounding.

Energy supply delivered the largest reduction in emissions from 2017 to 2018

	2017-2018 % change	1990-2018 % change
Transport	↓ 1%	↓ 3%
Energy supply	↓ 7%	↓ 62%
Business	↓ 3%	↓ 31%
Residential	↑ 4%	↓ 14%
Agriculture	↓ 1%	↓ 16%
Waste management	↑ 1%	↓ 69%
Other	↓ 8%	↓ 89%



Energy Challenge Priority Areas

BEIS provided a priority list of energy challenges that require R&D for the CLASP call.

- Advanced Modular Reactors (AMR) – development of key components
- Industry decarbonisation – new technologies and processes across the sector
- CCUS development – technologies that lower cost and lock away CO₂
- Smart Energy and Storage – technologies that enable more low carbon generation to be effectively used
- Hydrogen – development of technologies across the supply chain

Whilst these are BEIS priorities, innovation across the energy sectors is developing at a fast pace. CLASP is open to all challenges currently facing the energy sector.

AMR – Advanced modular reactors

AMRs could have a vital role to play in the UK's future energy mix, providing low carbon energy that is easier to finance and quicker to deploy than conventional large nuclear technology.

AMRs are a broad group of advanced nuclear reactors (including Gen IV) which differ from the technologies of conventional reactors that utilise pressurised or boiling water for primary cooling purposes. They maximise the use of off-site factory fabrication of modules and target applications that include:

- delivering low cost electricity
- increased flexibility (e.g. load following) in delivering electricity to the grid
- increased functionality (e.g. heat output for domestic and/or industrial use, facilitate the production of hydrogen)
- providing alternative applications that generate additional revenue or economic growth

Innovation Requirements - AMR

Technology	Development Opportunities (TRL 3-5)
High-temperature Gas Reactor	Turbine generators and fuel development
Very High Temperature gas-cooled Reactor	materials development, Brayton cycle
Sodium-cooled Fast Reactor	Reactor equipment, instrumentation and control
Lead-cooled fast reactor	Hydrogen production, reactor equipment, material development
Molten Salt-fuelled Reactors	Hydrogen production, reactor equipment, material development

R&D in modelling and simulation, and fuel cycle and waste management required for all reactor technologies

Industry and Carbon Capture, utilisation and storage (CCUS)

Industry has traditionally been seen to be hard to decarbonise, it is estimated that industrial emissions accounts for 16% of the UK's total emissions. Industry provides the building blocks which will enable us to meet net-zero

The main groups for decarbonising industry

- Resource efficiency - includes circular economy, material efficiency, energy efficiency and industrial symbiosis
- Fuel Switching – switching processes to using low carbon fuels such as hydrogen, biofuels and electrification, and the enabling technologies
- CCUS – developing technologies that can capture CO₂ from a range of industrial sources, but also enable negative emissions

We also need to consider how we can decarbonise industries off-road mobile machinery, and support the development of new industries that will help meet our net-zero ambition

Industry and Carbon Capture, utilisation and storage (CCUS)

Carbon Capture, Utilization, and Storage (CCUS) encompasses methods and technologies to remove CO₂ from flue gas and from the atmosphere, followed by recycling the CO₂ for utilisation or permanent storage options. It is a vital for achieving net-zero enabling many scalable negative emission technologies

The key options requiring development includes

- Re-use of our offshore infrastructure
- Improved solvents and chemical looping, including improving capture rates from air
- Improved adsorption processes
- Smaller scale technologies that can be deployed widely without huge cost penalties
- Advancements in materials/products which not only utilise but lock away CO₂.

Smart Energy and Energy Storage

There is increasingly more low carbon generation on the electricity system. There are also many more distributed and localised resources. Smart energy solutions and storage are required to enable us to effectively utilise this electricity ultimately bringing down the system costs

Flexibility technologies – enabling flexible trading platforms and improving demand side response

Network and data – distribution network load management

Energy Storage – Improvements in short, medium and long term storage

Hydrogen

“the difference [between existing targets and net zero] is striking. Low-carbon hydrogen moves from being a useful option to a key enabler.” – CCC. Hydrogen can extend electricity's reach across the entire energy system, however the safety case still is required for many end use applications

Production – innovation required for all “colours” of hydrogen

Transportation – improving access to hydrogen

End Use – proving safety case and bringing down the transition cost to end users

Further Information

<https://www.gov.uk/government/publications/energy-innovation-needs-assessments>

<https://www.gov.uk/government/publications/industrial-fuel-switching-to-low-carbon-alternatives>

<https://www.gov.uk/guidance/funding-for-innovative-smart-energy-systems>

<https://www.gov.uk/government/publications/advanced-modular-reactor-amr-feasibility-and-development-project>

<https://www.gov.uk/government/publications/call-for-ccus-innovation-literature-review-benchmarking-report-and-calculator>

<https://www.gov.uk/government/publications/hydrogen-supply-competition>