



Scotland's centre of expertise connecting  
climate change research and policy

## Monthly Report on Research and Policy Developments - Energy and Climate Change

December 2021 / January 2022

Purpose: This document provides a summary of recent key developments in policy and research relating to energy and climate change. It has been prepared by the [ClimateXChange](#) Secretariat and is intended to keep policymakers informed of issues relevant to the Scottish Government's Energy and Climate Change policy portfolio.

### International Climate and Energy Research and Policy

#### State of the Climate 2021

Last year was the warmest on record for ocean heat content, which increased markedly, while it was between the fifth and seventh warmest year for surface temperature, according to [Carbon Brief analysis of 2021 climate data](#). The summary - which examines datasets from NASA, NOAA and Copernicus - also finds that 2021 was the warmest northern hemisphere summer on land. Separately, the Met Office released a [review of UK weather in 2021](#); Carbon Brief published a guest [blog](#) on the findings.

#### 2022 climate trends

An African COP, two key IPCC reports and a long overdue biodiversity summit will shape the response to climate change this year, says a [Climate Home News article](#) looking ahead to key climate diplomacy issues. The outlet also published [nine must-read articles](#) from 2021 while the Thomson Reuters Foundation released a [preview of likely trends in 2022](#).

#### McKinsey on cost of achieving net zero

Reaching net zero by 2050 could require spending of \$9.2tn a year annually until 2050, more than expected, according to a report by McKinsey, [Reuters reported](#). To achieve stable planetary conditions, coal use would be virtually eliminated globally by 2050; oil and gas production would drop 55% and 70% respectively; and 200m new jobs would replace 185m positions the global economy no longer needs. [The Guardian notes](#) that McKinsey's calculations do not represent net costs, rather upfront costs without considering benefits

#### US government net-zero goal

US president Joe Biden signed an executive order that would make the US federal government carbon neutral by 2050, with a 65% reduction in emissions required by 2030, [AP reported](#). Federal agencies have been directed to buy only zero-emissions vehicles by

2035, to make their buildings zero emissions by 2045, and to buy only clean electricity by 2030.

### **Exxon pledge**

Exxon has pledged to cut emissions from its operations to net zero by 2050, a move the [FT described](#) (paywall) as a ‘big step for the oil major’. The move follows the replacement of three Exxon directors and the company’s pledge to invest \$15bn to cut emissions over six years. However, the goal does not cover scope 3 emissions from customers using the fossil fuels.

### **Hydrogen raw materials**

Key raw materials needed for most types of clean hydrogen production could become scarce and much more expensive, according to Germany’s Federal Institute for Geosciences and Natural Resources (BGR), [Euractiv reported](#). In a [report](#) (in German), BGR said the greatest risks related to iridium and scandium; by 2040, demand for scandium is set to increase more than two-fold and for iridium five-fold, compared to 2018 levels. The metals are used in proton-exchange membrane (PEM) electrolyzers which are a favoured technology for producing green hydrogen from renewable electricity.

### **Carbon border adjustment**

Harmonised carbon pricing across borders is hard to achieve as carbon leakage can reduce the cost-effectiveness of unilateral approaches to reduce global emissions. A new [paper](#), published in *Nature Climate Change*, reviews the potential environmental and economic impact of border carbon adjustments. It finds that the viability of border carbon adjustment schemes can be substantially reduced by legal and practical implementation constraints. However, a [report](#) from the Centre for Policy Studies, [covered in The Independent](#), said a UK carbon border tax would help reduce pollution and level up the economy.

### **Ocean carbon removal potential**

The National Academies of Sciences, Engineering and Medicine has urged the US government to step up its research into ocean carbon removal and capitalise on oceans’ size and carbon storage capacity, [Reuters reported](#). In a [report](#), the academies outline six options for enhancing ocean carbon uptake, such as making the seas less acidic with minerals or jolts of electricity; adding phosphorous or nitrogen to spur plankton growth; and creating massive seaweed farms. The report recommends a \$1bn research programme over the next decade since the costs and environmental risks remain uncertain.

## **UK Climate and Energy Research and Policy**

### **Windfarm developments**

The Scottish Government is in line for a windfall of almost £700m after the largest ever auction of the country’s seabed plots attracted high bids from developers of next-

generation windfarms, the [Guardian reported](#). [Crown Estate Scotland awarded](#) leases to 17 projects which could generate 25GW of capacity and power, the equivalent of 23m UK homes a year. The capacity of the windfarms, planned for development over the next 10 years, will be more than double the UK's existing 10GW of offshore wind, and equal Europe's current combined capacity. Separately, [EDF said](#) it had formed a joint venture with DP Energy to develop a 1GW windfarm - set to be the world's largest floating offshore wind facility - in English and Welsh waters of the Celtic Sea. The Conversation, meanwhile, published [an article](#) on the importance of understanding seabed geology for windfarm installation.

### **UK climate risk**

The UK Government's third five-yearly [climate change risk assessment](#) warns that, on current global heating trajectories, climate change will cost the UK economy up to £20bn a year by 2050. Damage to the UK's food production and to infrastructure, from extreme weather, and the risks of flooding, are all likely to cost more than £1bn a year each, [the Guardian noted](#). The Climate Change Committee ['strongly welcomed'](#) the assessment – which looks at 61 potential risks and opportunities - saying it aligned closely with its independent conclusions. The [i newspaper](#) covered the Met Office and University of Exeter [analysis](#), which informed the risk assessment.

### **UKERC energy models series**

UKERC has issued the fourth and final [policy brief](#) in its survey of UK energy models. The brief looks at: model inputs and outputs, the diversity of policy options that models aim to address, their application to policy issues, their use to support key policy and industrial decisions, the frequency of application, model 'customers', and academic outputs. The first brief explored the [UK energy modelling landscape](#); the second the [strengths and weaknesses of UK energy models](#); and the third the [construction, maintenance and transparency of energy models](#).

### **Electric cars**

Monthly sales of electric cars in the UK doubled late last year, bringing the total share accounted for by battery-powered electric vehicles to 19% in the UK, [the Guardian reported](#). Some 22,000 pure electric vehicles were registered in November, up from 10,345 in the same month in 2020. However, [research from the Society of Motor Manufacturers and Traders](#) (SMMT) found that only one charging point is being installed for every 52 cars sold. A north-south divide is also emerging with stronger sales in more affluent regions such as south-east England where 'early adopters' had driveways with their own chargers, [the FT noted](#).

### **Scottish Green Battery Complex**

Amp Energy, a Canadian energy developer, is to build Europe's two largest grid-connected battery storage facilities in Scotland. The [company said](#) the Scottish Green Battery Complex

would comprise two 400MW battery facilities in Hunterston and Kincardine. Due to come online in 2024, they will store and manage the dispatch of energy generated from wind farms, helping provide grid stability services across central Scotland, [Electrek reported](#).

### **Car battery production**

Start-up Britishvolt has raised around £1.7bn in funding to build its car battery factory in north-east England, [the FT reported](#). The investment was backed by a grant from the government, understood to be around £100m from the Automotive Transformation Fund, set up to attract battery developers and safeguard the future of the UK's car plants. The plant is set to employ about 3,000 workers when it reaches full capacity in around 2028, with the first batteries scheduled to start production in 2024, the [BBC reported](#).

### **Hot water cylinders**

The large number of homes in the UK without a hot water cylinder is set to hinder the move to net-zero emissions in the heat sector and increase the costs, the [Hot Water Association has warned](#), [Energy Live News reported](#). In a [report](#), the trade body says there has been a focus on heat sources, such as boilers and heat pumps, at the expense of hot water cylinders, which are required in most of the low-carbon heating solutions currently available. There is also currently untapped potential for cylinders to act as domestic batteries, it says. There are an estimated 9 million hot water cylinders installed in homes across England – less than 45% of the total, down from 77% in 2001, a fall attributed to the popularity of combi boilers.

### **UK heating options**

A new type of heat pump that may soon be rolled out in the UK could ease the shift for homes to low-carbon heating, [the Guardian reported](#). Sweden's Vattenfall and Dutch company Feenstra claim their new high-temperature heat pump could replace boilers without the need for added insulation or new radiators like other heat pumps. Separately, [research](#) from Imperial's Energy Futures Lab, [reported in The Independent](#), argues that deploying heat pumps and boosting energy efficiency should be the priority for home heating in the UK in the next decade, rather than hydrogen; using hydrogen as an energy source in the gas grid is unlikely to be feasible until the early to mid-2030s at the very soonest. Meanwhile, Britain's gas grid is being prepared to accept a blend of up to 20% hydrogen from next year, [Engineering & Technology reported](#). The Energy Networks Association (ENA) has [published a plan](#) which sets out Britain's five gas grid companies will meet the target and an [explainer on hydrogen blending](#).

### **UK electricity mix in 2021**

The UK's nuclear output fell to its lowest level since 1982 last year while wind generation dropped by 15%, according to a [Carbon Brief analysis](#) of the UK's energy mix. Nevertheless, with demand barely recovering from 2020's coronavirus lockdowns, low-carbon sources still generated more than half of UK electricity in 2021, including 19% from wind, 14% from

nuclear, 12% from biomass and 4% from solar. The Conversation published an article on the [increase in fossil fuel use](#) last year due to unusually calm and cloudy weather.

### **Sizewell nuclear funding**

The UK Government has given £100m in funding to the proposed Sizewell C new nuclear plant in Suffolk, the [BBC reported](#). The project, which has been strongly opposed locally, has not yet been approved; the funding aims to support its development and help attract other investors. [The FT said](#) the move meant the government had moved closer to taking a stake in nuclear power generation for the first time in more than a decade. The funding would work like a convertible loan, becoming a government stake in the scheme or being repaid.

### **Brexit and energy sector one year on**

The UK managed to set up its emissions trading system in record time while the impact of Brexit on new electricity interconnector capacity has not been as significant as some feared, according to a [UKERC paper](#) on Brexit and decarbonisation one year on. However, Brexit, in practical terms, is far from 'over', and energy and climate negotiations remain caught in the crossfire of friction between the UK and EU, it warns. Implementing Brexit has taken up civil service and political capacity, at a time when new climate policies are urgently required to get the UK back on track to meeting its legally binding emissions reduction targets, it says.

### **Power link to France rejected**

The UK Government rejected a proposed 2GW power cable to France, [the BBC reported](#). The interconnector, which its backers said could provide up to 5% of the UK's power, had met with strong local opposition in the Portsmouth area, where cables to Normandy would have been laid.

### **UK flash flooding**

UK towns and cities have been hit by flash flooding 51 times since 2007 according to a report [covered by the Guardian](#). The [in-depth report](#), from the Bright Blue think tank, finds that 15 hospitals, 68 schools and at least 12 electricity sub-stations were disrupted by flood waters. Using a form of artificial intelligence called Natural Language Processing (NLP), the data was drawn from thousands of local, regional and national newspapers. As well as funding research, the report calls on government to conduct a civil resilience exercise for an extreme rainfall event in a UK urban area, incorporating significant infrastructure failure.

## **Climate Science, Impacts and Adaptation**

### **Achieving net zero**

A [Perspectives piece](#) in *Nature Climate Change* discusses the concept of net-zero emissions; climate ambition is increasingly expressed as a specific target date for reaching net zero, typically linked to the goals of the Paris Agreement, it notes. While net zero is intrinsically a scientific concept, it is also a frame of reference for climate action. Achieving net zero

requires action in social, political and economic spheres while there are multiple ethical judgements, social concerns, political interests, fairness dimensions, economic considerations and technology transitions that need to be navigated, the piece says. It sets out the attributes needed to create a successful framework.

### **Climate modelling**

*Frontiers in Climate* has published a [series of 11 studies](#) examining new techniques for improving climate models. It notes that, while climate models are the main tools used to make predictions and projections, these models remain imperfect. Generations of models have shown persistent mean-state biases, such as the “double intertropical convergence zone”. The studies examine whether the new techniques are adequate or if substantial further work is needed. Separately, The Conversation published a [piece on the importance of climate models](#) and common misconceptions.

### **Plant-based diet dividends**

Adopting a more plant-based diet could give high-income countries a ‘double climate dividend’ of lower emissions and more land for capturing carbon, according to a [study](#) in *Nature Food*. Based on 54 countries, the results show that dietary change could reduce annual agricultural production emissions of high-income nations’ diets by 61% while sequestering as much as 98.3 GtCO<sub>2</sub> equivalent, if the agricultural land used was allowed to revert to its natural state. Moving away from animal-based foods could free up an area of land larger than the EU, it notes. Separately, The Conversation published an [article on agricultural subsidies](#) and the reforms needed to reduce their damage to both health and the climate. The article discusses a [paper](#) published in *Nature Communications*.

### **Afforestation and flooding mitigation**

Widespread afforestation may inadvertently reduce water availability in Britain, particularly in drier areas, whilst only providing a modest reduction in extreme flood flows, according to [research](#) published in *Nature Communications*. Ambitious afforestation proposals in the last decade target potential flood mitigation and carbon storage benefits but without sufficient evaluation of their impacts on streamflow, it says. The authors model the impact across twelve diverse catchments, finding no nationally-consistent reduction of extreme floods.

### **Urban design**

Urban greening methods, such as green roofs and parks, are unlikely to provide a single fix for reducing the risk of heatwaves and flooding in cities, according to a [study](#), published in *Nature Communications*. The researchers quantify how climate-driven trade-offs exist between hydrological retention and cooling potential of urban greening. Separately, The Conversation published two articles on buildings and climate change – the first looks at [design lessons from the past](#); the other discusses the need for [strategies to help cool buildings in the UK](#).