How to plan the future of sustainable energy

Written by

Richard Green

Published

29 October 2021

Category

Strategy & Leadership

Key topics

Climate Change, Economy, Sustainability

To meet sustainability goals, our future power systems will need to change dramatically over the next 50 years and the right solution is critical to shaping policy

Sustainable energy has been one of the defining concepts of the 21st century, so far, changing the way governments, businesses and individuals operate – possibly forever.

Most would agree that we still have a long way to go before humans are co-existing harmoniously with the planet. Nevertheless, many of the world's biggest economies are finally making major policy decisions around sustainable development goals and the future of energy use.

As countries move towards net zero emissions, this includes key decisions regarding the future of energy networks. Governments and businesses need fast, accurate predictions to help them understand and prepare for the next 30, 40 or even 50 years.

Alongside my colleague Dr Iain Staffell, I have been working to create economic and energy models that can quickly provide accurate information to help inform these decisions. And by making this information as accessible as possible, the benefits can be widely shared.

Long-term sustainable energy network solutions

Knowing the financial viability of a new electricity plant is crucial to deciding whether to build it. However, estimating this accurately requires a long-term perspective. If you want to know if a power plant is going to make money in 2060, you need to know what people are going to have built by 2050, and that depends on what they expect to happen in 2080.

Also, models have to be practical enough to quickly test and compare multiple scenarios, which is no small feat given the complexity of the situation. Our work was designed to strike a balance between speed and accuracy, while still capturing the intricacy of the modern electricity market as we move towards a sustainable energy future.

> Many of the world's biggest economies are finally making major policy decisions around sustainable development goals

This modelling played a significant role in the European Commission's decision to give State Aid Clearance for a 35-year, £70 billion contract with the Hinkley Point C nuclear power plant. Our modelling indicated that without government assistance new nuclear power stations would not be profitable until the 2050s, but with financial support, investment is attractive during the 2020s.

This was in 2013, and based in part on our research Hinkley Point C is today being built. It is expected to create up to 25,000 jobs during its construction and save around 600 million tonnes of CO_2 emissions over its lifetime.

Importantly, although the modelling was built for Britain, it could also be easily adapted to represent any other country with a similar power system.

Predicting the weather

There’s an extra challenge with wind and solar power generation. Unlike traditional power stations they can’t choose when they’ll generate, and we have to know how often the weather will be favourable if we want to predict their behaviour – which is very important now we have so many of them.

To allow others to benefit from the work we did on British wind farms, Dr Staffell, with PhD student Stefan Pfenninger, built the Renewables Ninja. Based on historic weather data from NASA, the system estimates the hour-by-hour generation of a solar or wind system at any location the users chooses. It’s freely available to anyone online, and is an incredibly useful resource for researchers in companies, business, government and academia. For a project developer, it won’t replace doing a test at a particular site, but it shows how a group of PV panels or wind turbines will affect the power system anywhere in the world.

Asking students to use the Ninja as part of a quick competition to build a turbine or a panel with the highest possible output is an excellent way to get them thinking about what makes a good site for renewable generators. They also have the chance to use simple versions of my research models in exercises to see how large-scale renewable generation changes the behaviour of electricity markets.

Public perceptions

As energy decisions get made, it has become clear there are a lot of misconceptions among the public about grid technology. Much like the Renewables Ninja, making information as freely available as possible can do a lot to improve public debate.

Using open-source data from the UK’s electricity system, Iain and I, with Imperial colleagues including Professor Tim Green, Co-director of the Energy Futures Lab, set up electricinsights.co.uk with UK energy generator Drax. The website provides free access to almost real-time data about the energy mix and price, with historical data available all the way back to 2009. The website, and our quarterly newsletter, are helping demystify the debate around decarbonisation and the future of power, particularly in the media, including international news organisations.

This has all been possible thanks to the availability of open-source data from the likes of NASA and National Grid. Very often people have data, but don’t have the knowledge or time to do many of the interesting things that it could be used for. If you make data available other people can do those things, and the sum of human knowledge increases. It’s far better than the alternative of keeping the information

private and never making important discoveries.

Written by

Richard Green

Published

29 October 2021

Category

Strategy & Leadership

Key topics

Climate Change, Economy, Sustainability

Share

About Richard Green

Head of Department of Economics & Public Policy, Professor of Sustainable Energy Business
Economist Richard Green is Professor of Sustainable Energy Business and Associate Dean of Education Quality at Imperial Business School. He is also Head of the School's Department of Economics & Public Policy.

He was previously Professor of Energy Economics and Director of the Institute for Energy Research and Policy at the University of Birmingham, and Professor of Economics at the University of Hull. He started his career at the Department of Applied Economics and Fitzwilliam College, Cambridge.

He has spent time on secondment to the Office of Electricity Regulation and has held visiting appointments at the World Bank, the University of California Energy Institute

and the Massachusetts Institute of Technology.

Read Richard's Imperial Profile for more information and publications.

Monthly newsletter

Receive the latest insights from Imperial Business School

Sign up now

Sustainability Leadership

This programme provides the methods and the mindset to help you create a sustainability plan with real impact for your business.

Read more

How can deep tech entrepreneurship solve the world's biggest problems?

With deep tech innovation struggling to obtain funding, we might be missing out on some of the best ideas of the future

Read more