Professor David Brayshaw

Dr Hannah Bloomfield

Meteorological Information to Support the Transition to Clean Energy

Professor David Brayshaw has led the University's **Energy Meteorology Group** since its formation in 2012. Sharing open data over a period of several years has enabled it to bridge the fields of meteorology and renewable energy research, leading to operational uses of their data and several research collaborations. Professor Brayshaw and Dr Hannah Bloomfield were **finalists in the University of Reading Open Research Award 2021**.

Energy systems around the world are rapidly changing to meet climate mitigation targets. A key aspect of this is the transition to renewable energy – much of which is highly sensitive to weather – and electrification of the heating and transport sectors. The impact of weather and climate upon the energy sector is therefore increasing rapidly.

Data to quantify and understand this impact have been historically sparse, with few researchers having expertise in both energy and meteorological science. Over the last decade, the **Energy Meteorology Group** has sought to directly address this challenge, publishing several open datasets which have been widely used by academia and industry. The first of these – a UK national wind-power history spanning over 30 years – was made available in 2015 (via the University's publications repository, CentAUR, as an institutional data repository was not then available).[1,2] Since then, five further 'historical weather for renewables' datasets have been published under open licences (Creative Commons Attribution) in the University's Research Data Archive, substantially expanding the original offering.[3] The most recent of these (2020) includes weather-dependent demand, wind power and solar power data spanning 28 European countries and a historic period of almost 40 years. These datasets enable the impacts of climate variability on present and future power systems to be investigated in a rigorous way.[4,5] The methods associated with the datasets are described in Open Access publications for those wishing to create their own variations.

We have further extended this collection to include historic **subseasonal weather forecasts (up to 6 weeks ahead) alongside historical observations**. These include output from two different weather forecasting centres (each over a period of approximately 20 years with some 20 forecasts launched each week for each of wind power, solar power and demand). The related Open Access data paper[6] describes the steps needed to convert weather forecast data into usable energy time series. The published datasets allow end users to
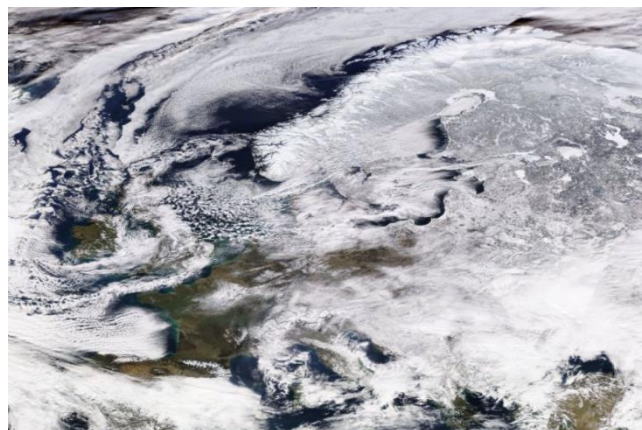
Satellite image from **Nasa Worldview** showing Europe, during the cold wave on 27 February 2018 ('The Beast from the East'). Multiple countries are experiencing very cold weather, and high electricity demand.

understand the potential for greater uptake of weather forecasts and to assess the feasibility of 'climate service' energy forecasting systems.

Understanding how to present and document datasets to best facilitate their re-use has been a learning experience for the Group, and has developed the data science skills of several early career researchers. **Dr Hannah Bloomfield** has discussed her own open data learning journey as a PhD student and postdoctoral researcher **in a blog post**.

The Group's published methods and datasets have been **used by the UK Met Office** to inform the National Infrastructure Committee, and in projects for UK National Grid and the UK Crown Estate. The datasets have proved an excellent resource for teaching, with student projects leading to publications in collaboration with the **National Grid** and **Imperial College London**. Making the data available under open licence has enabled wide academic engagement, and colleagues in Norway, Austria, Russia, Germany, the Netherlands and across the UK are working with the data to complement their own research. The datasets have also been **included in European inter-comparison projects**.

Our pioneering open data historical reconstructions and forecasts of national demand, wind power and solar power across Europe have generated wide engagement in the academic and industrial sectors, and will continue to support the creation of climate-robust power systems.

Open at a glance

- Research group has published several valuable open datasets bridging the fields of climate and renewable energy
- Making data open and re-usable has led to wider use in research and teaching, research collaborations, and partnerships with industry
- A peer-reviewed data paper can promote the value of data resources and attract new users
- Preparing data for sharing and re-use is a valuable learning experience for early career researchers

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References and further information

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