

ENERGY, WEATHER AND CLIMATE

Walker Institute Research



'Much research is still needed to understand the implications of climate change and extreme weather on the energy sector and to identify cost-effective adaptation options.'

Climate Change 2014:
Impacts, Adaptation,
and Vulnerability, IPCC 2014.

Climate scientists and engineers are working together to understand the impacts of weather and climate on energy systems.

WEATHER, CLIMATE AND ENERGY/POWER SYSTEMS

Weather and climate can affect many aspects of modern power systems. For example, intense storms can damage physical infrastructure through high winds or flooding and droughts may lead to cooling problems within thermal plants. In addition, human induced climate change is beginning to alter the frequency and intensity of such weather related events, changing supply and demand patterns and presenting new risks to the energy sector.

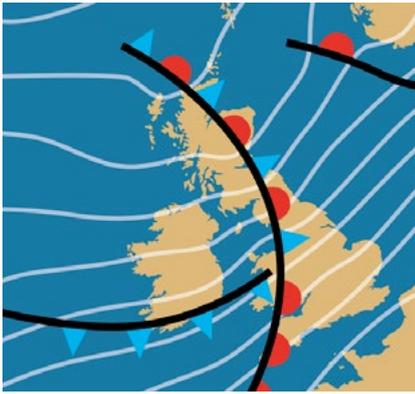
With the increasing deployment of variable, renewable energy generation (such as wind and solar), a diversity of new challenges are arising for energy markets and energy infrastructure. Modern power systems already provide for large short-term changes in energy demand and sporadic plant failures. However, the imperatives of carbon reduction and energy security mean that systems must increasingly adapt to varying supply.

OUR WEATHER/CLIMATE AND ENERGY EXPERTISE

Energy research crosses a number of disciplines at Reading with experts active within Meteorology, Construction Management and Engineering, Systems Engineering, Mathematics and beyond. There is close cooperation across departments, with Walker associates pursuing questions such as:

- How do weather and climate affect energy and power systems, particularly in terms of supply and demand?
- How will increased deployment of renewable/low carbon energy generation affect these weather/climate and energy links?
- How might climate change and an increase in extreme weather events affect energy generation/power systems?

The multi-disciplinary Energy Group brings together researchers from across these distinct fields: www.reading.ac.uk/energy



One area of our research is helping to understand how weather and climate affect the supply of energy from renewable resources and the demand patterns of consumers, both now and in the future.

FIND OUT MORE

Cross disciplinary energy research
www.reading.ac.uk/energy

Energy & meteorology
www.met.reading.ac.uk/~energymet/

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Technologies for Sustainable Built Environments
www.reading.ac.uk/tsbe

Sustainability in the built environment
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WEATHER AND CLIMATE RISK IN ENERGY SYSTEMS

Researchers in the Department of Meteorology are seeking to develop a better understanding of how large-scale weather drivers affect energy systems and markets, and to identify ways in which meteorological tools can be harnessed to manage this risk. Recent projects include: using multi-decadal meteorological records to assess extremes and aid forecast interpretation in national scale wind-power output (with **National Grid**); developing probabilistic month-ahead weather forecast tools for power-system risk management and trading in the UK and Europe (with **Centrica, Rubykon** and other partners); and identifying the impacts of climate variability and change on power systems and international energy markets (with the **UK Met Office** and others).

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WEATHER IMPACTS ON ENERGY TECHNOLOGIES

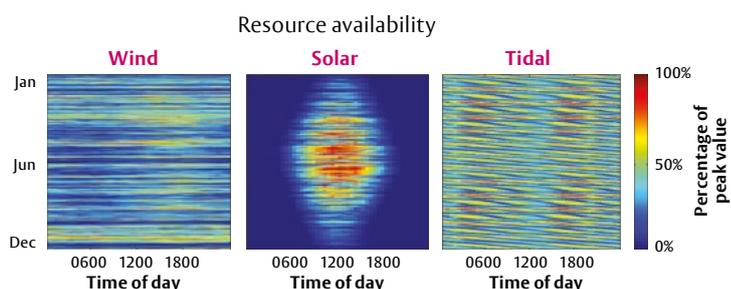
We are also researching the impacts of local weather on individual wind turbines and solar panels, or whole wind farms. Recent trends, such as towards larger single wind turbines and massive off-shore wind farms are bringing new concerns for power system operators. High concentration of generation in specific locations brings the potential for significant weather-related power swings that require improved microclimate forecasting capability. Recent projects include: improving short and long-term wind power predictions for off-shore wind farms through better representation of intra- and inter-wind farm wind resource patterns (with **National Grid**); modelling urban wind resource and assessing design criteria for building integrated wind turbines (with **Matilda's Planet**); field measurement and modelling studies of pollutant and cloud impact on solar photovoltaic system performance (with **SSE**).

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ENERGY SUPPLY/DEMAND – MANAGING VARIABILITY

Variability of supply from renewable energy sources and in the demand for energy has implications for secure and efficient operation of power systems. Researchers in Construction Management and Engineering are using system modelling and analytical techniques to identify the impacts on power systems, as well as to explore strategies to mitigate these impacts. Previous work, considering specific renewable resource characteristics has revealed distinct implications for integration of wind, solar and tidal energy. Work with **AES** identified opportunities to modify existing power station operation to aid the incorporation of new wind generation in Northern Ireland. Current work is considering active demand management at a variety of scales, including work with **Scottish and Southern Energy, Reading Borough Council and Marks & Spencer**, as well as exploring the potential of novel energy storage strategies and the role that hydrogen infrastructure could play.

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Wind, solar and tidal resources have distinct patterns of variability through the day and through the year.