Extending practical guidance for climate data in adaptation planning and policymaking for energy systems

Organisers: James Fallon, Martin Kittel, Jethro Browell, Paula Gonzalez, Michael Craig

Utilities, regulators, and policymakers across the world are grappling with how to maintain reliable, cost-effective, and accessible energy systems under climate change. During such climate adaptation planning, stakeholders must make critical decisions, including selection and/or creation of climate data to integration of climate data into existing planning and decision-making processes. These decisions can play a pivotal role in shaping adaptation choices and their long-term value. But guidance for these processes is still developing, so decisions vary utility to utility, potentially undermining the value of adaptation plans and our ability to compare and integrate plans across systems and geographies.

This breakout session will extend existing guidance for decision-makers on using climate data during adaptation planning. While our focus will be on the electric power system, we will consider other energy sectors, including compound hazards across sectors, if time permits.

Key outputs could include:

- Decision tree(s) with concrete recommendations mapping activities and goals to data decisions and datasets.
- Practical guidance on defining sets for stress testing, a common framework for adaptation planning amongst utilities in the wider policy context of climate stress testing.
- Practical guidance that illuminates trade-offs between approaches, with an eye towards identifying the “best” versus “good enough” approaches
- Options for ‘adding value’ to existing climate datasets via postprocessing, whether through climate/weather modeling or transformation of climate data into more useful variables via impact models

How can the energy sector maximise the value of weekly-to-decadal forecasts?

Organisers: Hazel Thornton, Paula Gonzalez, Marisol Osman, Ben Hutchins, Aheli Das

Climate forecasts have increasing potential to support decision-making across the energy sector, from energy security and network planning to system operations and trading. Realising that value, however, requires a clearer understanding of which decisions can realistically be informed by these forecasts, what levels of uncertainty users can tolerate, and what forecast quality is needed before they become useful in practice.

The session will open with short talks covering a range of energy-sector applications, followed by an interactive discussion supported by a whiteboard. Discussion will address the decisions that could be informed by forecasts, the challenges that currently limit their use, the levels of uncertainty and confidence that are acceptable to users, and the forecast evaluation approaches needed to ensure products are fit for purpose. The session will also consider what kinds of frameworks, accessibility, and user engagement are needed to build familiarity, trust, and confidence in weekly-to-decadal forecasts.

Future scenarios for energy & climate

Organisers: Daniel Kirk-Davidoff & Jan Wohland

We aim to discuss and potentially reach a consensus about which element of the climate-model-output to energy-system-decision pipeline should receive the most attention. Specifically, we will address the following question:

Where is energy-climate research lacking the most?

A. Good enough climate inputs (model suitability, appropriate resolution and variables, CMIP7 data request)

B. The right scenarios (including overshoot and tipping points??, volcanoes in future CMIP projections?)

C. Defensible conversion from climate to energy

D. Climate-dependent energy system modeling

E. Technology and cost uncertainty

F. All of the above

The idea is to have a poll at the start and end of the session (when participants are fresh vs. after all opinions where exchanged). In the session itself, we aim to have two presentations by advocates of individual parts (A-F).

What happens after the lights go out? Compound and Cascading hazards, and their impacts on highly renewable systems

Organisers: Hannah Bloomfield, Nathan Agarwal and invited speakers

Recent international review articles and national climate risk assessments have pushed for an increasing focus into research onto compound and cascading events. There is a growing body of work on the spatial and temporal compounding of meteorological hazards, but less work that links these *hazards* to specific compound *impacts*. In this session we will explore how compound meteorological events could be drivers of major energy system failures, and how this could trigger cascading failures across critical infrastructure sectors, and therefore impacts on society. We will start by exploring some of the typologies of multi-hazard risks from a climatological perspective, then we will consider how this could lead to cascading failures. The final two talks will consider the impacts of chosen mitigation pathways (e.g. electrification of energy grids, and green fuels) and potential adaptation solutions in the form of early warning systems for decision making.

Talk 1: Nathan Agarwal (Johns Hopkins University) Compound Meteorological Drivers of Major Energy System Failures. Defining the typology of compound events and some key 'high risk' compounds for the energy sector.

Talk 2: Chris White (University of Strathclyde) How can extreme weather events lead to cascading impacts across sectors?

Talk 3: Bryn Pickering (University of Cambridge & ARUP) How might our journey to net-zero lead to different impacts of compound/cascading extremes?

Talk 4: Dan Suri (UK Met Office) How can we prepare for cascading failures? An example from UK civil contingency planners.

The focus of these talks will be Europe, but in the followup discussion we will consider how the compounds and cascades of interest may be different in low and middle income countries, and how different groups of people may experience these events differently.

Hands-on training sessions: Using climate data in energy optimisation modelling

Organisers: Matteo De Felice, Ekaterina Fedotova, Ana Arama

These hands-on sessions focus on using state-of-the-art climate data for power system modelling. It will show examples (also accessible via Google Colab) that are built on open, Python-based solutions, such as PyPSA. The session will be divided into two blocks, each starting with a short presentation: the first one will provide an overview of PyPSA and the PyPSA-meets-Earth initiative, whilst the second presentation will explore energy modelling from a climate perspective.

The first session will demonstrate how to run a power system model using cloud-optimised data from ERA5, highlighting the use of EarthDataHub (or similar) initiatives. The aim is to provide an overview of the increasing availability of ARCO (analysis-ready cloud-optimised) datasets from an energy modelling perspective.

The second session revolves around using a microgrid model with multiple renewable sources as inputs. Leveraging the capabilities of the PyPSA modelling framework, this example shows how to run and explore the model outputs to answer some climate-driven research questions.

- Tutorial 1: Using cloud-optimised data formats to facilitate porting of climate data into energy modelling
- Tutorial 2: PyPSA-based modelling of a microgrid with hydro turbine