NextGenEC24 – Day 2
Friday 27th September

Day 2 of the workshop will be split into parallel sessions. Attendees are invited to join the workshop Zoom as normal for a brief plenary introduction. They will then be invited to select breakout rooms from the following options across two sessions. The meeting will conclude with a final brief plenary summary.

Session 1 (1200-1340 UTC)

A. Opportunities and Challenges of Large Climate Ensembles for Energy System Planning
B. Science for Stakeholders
C. Methods for climate effects in energy system models (interactive training, part 1)

Session 2 (1400-1600 UTC):

A. AI in energy and climate modelling
B. How can the climate and energy mitigation synergies in the IPCC AR7 cycle be enhanced?
C. Methods for climate effects in energy system models (interactive training, part 2)

Details for each option are provided below.

1A - Opportunities and Challenges of Large Climate Ensembles for Energy System Planning

Moderators: Michael Craig (University of Michigan), Ben Hutchins (University of Reading and RMetS), Alex Kies (Aarhus University & University of KwaZulu-Natal)

Extreme weather events can challenge the reliable operation of energy systems. Energy system planners globally must grapple with changing frequency, intensity, and distribution of extreme weather events driven by climate change. Planning for future extremes typically relies on incorporating future climate data into existing planning processes. The value of this approach hinges on the ability of the underlying climate data to accurately represent the range of future extremes a power system can face. Of particular concern are tail events or low probability, high impact events, that have either long return periods or compounding risks. Large climate ensembles – namely single model initial-condition large ensembles – provide unique insights into extremes, especially in the near-term when internal climate variability dominates projections. But these large ensembles are often only created at low spatial and temporal resolution, limiting their application to energy system planning. This session will examine the potential value of large ensembles for capturing extremes in power system planning. It will also begin to formulate a research agenda that could make these ensembles more valuable for energy system models. Our targeted outcome is a journal perspective summarizing this discussion.

1B - Science for Stakeholders

Moderators: Bryn Pickering (University of Cambridge & Arup), Laura Fischer (EPRI), Hannah Bloomfield (Newcastle University) , Paula Gonzalez (UK Met Office), Laurens Stoop (TENNET), Izzi Ariail (University of Reading)

This session will explore how state-of-the-art scientific research and best practices from the academic and research community can be made operational, whether that's through direct application by businesses, support from consultancies or adoption by other academic units. Academic publications and the data used to make them are now commonly required to be hosted open access, which increases potential access to methods, datasets and processing chains. However, even if the full workflow is open access, it can be (a) resource intensive to recreate results from publications (e.g. supercomputing power, or large storage space for climate data); (b) difficult or misguided to apply these workflows to different contexts without a deep understanding of the methods; and (c) inaccessible to most potential users if they are unaware of their existence. As the number of open access methods, tools, and data increases, potential users will also be faced with the possibility of too much choice, with little support available to filter that which is available.

This session will start with short talks presenting some recent high impact publications from the broader research community that have the potential to aid decision making in the transformation of our energy systems. It will be followed by presentations from industry representatives who will highlight their experiences in accessing and using research outputs. We will then discuss the challenges of operationalising the presented research work, and state-of-the-art science more generally. Breaking out into smaller groups, we will use this session to begin formulating best practices for operationalising research, which we plan to publish as a guide on which all session participants will be co-authors.

2A - AI in energy and climate modelling

Moderator: Alex Kies (Aarhus University & University of KwaZulu-Natal)

Accurate prediction and characterization of localized weather and climate impacts are essential for the reliable operation of energy systems. Energy system planners worldwide are increasingly challenged by changing climate patterns and extreme weather events, which can vary significantly in frequency, intensity, and distribution due to climate change. Traditional planning processes incorporate future climate and weather data, but their effectiveness hinges on the quality and resolution of the data used.

AI-driven downscaling techniques offer a groundbreaking solution to enhance the spatial and temporal resolution of data derived from global and regional climate models. By refining these projections to provide detailed and localized insights, AI methods enable precise energy system planning, crucial for managing and mitigating the impacts of extreme weather events that can disrupt energy supply and demand.

This session will introduce and explore the transformative potential of AI in downscaling climate models, focusing on capturing localized extremes and their implications for energy systems. Attendees will gain insights into the latest AI-driven methodologies, practical applications in energy system planning, and the integration of these advanced techniques within the broader context of the Destination Earth initiative.

2B - How can the climate and energy mitigation synergies in the IPCC AR7 cycle be enhanced?

Moderators: Andrea Hahmann (DTU Wind, Denmark), Paula Gonzalez (UK Met Office)

In the last IPCC Assessment Cycle (AR6), two separate reports contained material on the interface of climate and energy: Chapter 12 (Climate Change Information for Regional Impact and for Risk Assessment) in Working Group I and Chapter 6 (Energy Systems) in Working Group III. However, the NextGen community could participate more deeply in the next AR7 cycle. Particularly in enhancing the communication between the reports' climate science and climate mitigation parts.

After two initial presentations (maybe Robert Vautard and I representing the two previous reports) describing the reports' content, past experiences with the IPCC process and how to contribute, we suggest a conversation between everyone interested in how we can best contribute next time.

1C and 2C - Methods for climate effects in energy system models (interactive training)

Moderators: Leonard Goeke (ETH Zurich), Ekaterina Fedotova, Salim Poovadilyil (University of Reading), Matteo de Felice, Laura Fischer (EPRI)

Analyzing climate effects on the energy system requires more than accurate time-series data for capacity factors or demand - it also requires appropriate methods to apply to the data. Most commonly, the analysis applies energy system modeling based on linear programming. Most models rely on a single year of weather data and are deterministic, assuming perfect foresight, meaning weather conditions for the entire year are known in advance. Yet, weather effects actually vary widely across years, are stochastic, and are difficult to forecast in the long term. Against this background, the workshop offers a practical introduction to advanced methods and stochastic programming for energy modeling under climate uncertainty. We will showcase methods that simultaneously consider more of a single year of climate data and do not assume perfect foresight of weather conditions but remain computationally tractable.

In the workshop, we will use an exemplary small-scale energy model planning a renewable energy system. Participants will interactively follow the steps to implement an existing set of time-series data for capacity factors and demand into this model. As a first step, we will implement a single year of climate data, reflecting the status quo in energy system modeling. Afterward, we successively increase sophistication, first considering multiple years of data simultaneously and then relaxing the assumption of perfect foresight. After each step, we study the impact the changes had on the results of the planning model.

The workshop will use the latest version of the Julia framework AnyMOD.jl for energy system modeling. Participation does not require previous experience with the tool, but we recommend some familiarity with energy system modeling and linear programming.