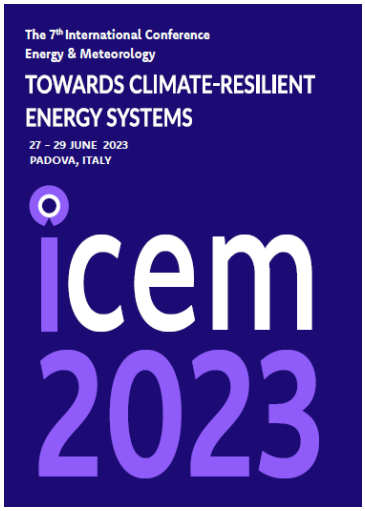

Summary of the ICEM 2023 Panel Session "Towards climate-resilient energy systems"

Being responsible for about 70% of greenhouse gases emissions, the energy sector has a pivotal role to play in the transition to a low-carbon future, to limit global and regional climate changes.

This energy transition is progressing in parallel with mitigation and adaptation strategies, but the pace of change is far too slow to meet the international agreements' targets. In addition, it is becoming clear that climate changes are probably faster and stronger than anticipated, with multi-hazards such as cold waves combined with wind droughts, or heat waves combined with droughts or even wildfires, increasing in many regions. Already challenging energy transition pathways are also disturbed by other major crisis (e.g. COVID-19, wars) that make the problem even more difficult. Approaches are still missing in most cases to address the issues posed by climate change to energy systems in its various aspects (infrastructures, supply, demand) in a systematic way.

This panel focused on major challenges from the weather and climate perspective that need to be addressed to improve knowledge and to facilitate action and decisions that will make energy systems climate-resilient.

After a short introduction by Laurent Dubus (RTE & WEMC), the panel consisted in 3 short presentations then a discussion moderated by Sue Ellen Haupt (NCAR & WEMC). The presentations as well as the audio recording of the session are available on the ICEM 2023 web page (https://www.wemcouncil.org/wp/icem2023).

Laura Di Bernardo (ENEL): *ENEL climate data for business adaptation strategy*
Adaptation is a global challenge, and collaboration between policymakers, companies and the scientific community is crucial to face climate change and to adapt effectively. ENEL's climate adaptation approach relies on three pillars:

- Resiliency Actions: Increase asset resiliency to reduce Climate Risk implementing adaptation measures on existing assets and ensuring resiliency by design
- Response Management: Be ready to response to adverse events leveraging on weather and climate analysis to prioritize efforts
- Opportunities: New business or product design to adapt to future changes in climate, so as to facilitate the adaptation of all stakeholders

The main gaps consist in improving site specific vulnerability assessments through an improvement of the specifications of asset characteristics and tracking the adverse events impacts and their causes, so that the relationships between hazards and impacts can be better modelled.

Modelling developed need to provide quantitative inputs necessary to assess adaptation measures ex post benefits, through dedicated cost-benefit analyses.

Giuliana Barbato (CMCC): *Understanding climate change to support adaptation*
Some tailored climate tools and services have been developed by CMCC in order to help study and tackle climate risks and hazards at the local level by using different type of data. Some service are present on the dataclime platform (https://www.dataclime.com) which has been used for several years by researchers, consulting firms, businesses, and policymakers. In particular, CMCC helps organization, local authorities and businesses in their adaptation strategies, notably by introducing climate proofing in investments and spatial planning. Several local pilot projects have been developed to support the introduction of climate proofing (process of mainstreaming climate change) in strategic planning and decision-making to cope with climate risk. One of these projects relates to electricity distribution. The approach consists in defining of a database of maps on expected local climate change conditions by considering a wide range of climate indicators defined on the basis of literature studies and users of the various economic sectors analysed. The goal is to provide a tailored hazard assessment to support risk analysis and decision making. It also includes the dataclime platform which provides decision-makers with customized climate info.

Jan Wohland (ETH Zurich): *The role of multidecadal climate variability and climate change in designing future highly renewable power systems*.
As electricity generation from weather-dependent renewables rises, we need to better understand climate risks for the energy sector. While this need appears generally acknowledged, current energy sector climate risk assessments are incomplete, oftentimes only partially addressing the roles of long-term climate variability as well as climate change. Drawing from peer-reviewed publications, Jan presented examples that quantify the impacts of climate variability and climate change on renewable energy potentials as well as complementarity. He emphasized that multidecadal climate variability is more important than climate change with respect to expected changes in mean wind and solar capacity factors in the decades to come and should be included in capacity expansion planning and adequacy assessments. Nevertheless, climate change might become a major concern for energy system planning in the long run and might also impact the energy system on shorter timescales, for example, via changes in extremes. We reference some of Jan's publications below.

Discussion points

- Multi-decadal climate variability and climate change. How will climate variability change with climate change? Is there an interest from companies in analysis and projections of multi-decadal fluctuations when making asset investments?
- Different climate datasets have different strengths and weaknesses and the choice of the dataset can substantially impact the results. For instance, EURO-CORDEX is higher resolution than CMIP6 but it assumes that land use does not change (all existing simulations) and that aerosols remain constant (most simulations). It is

therefore important to use projection simulations from the appropriate model (e.g. CMIP vs CORDEX), depending on the subject of the study.

- Industry-Academia relationship. Highlighted the importance of having experts within the company to translate academic contents for business stakeholders and to share data / knowledge / approaches with academics to help them conduct research in a way that is useful for applications. Need to improve the communication with industry from the academic side, learn to deliver key messages effectively to business stakeholders and policy-makers. Need to overcome “data mining” in the business world to make sure adaptation and mitigation planning can be based on the best available evidence.
- Modelling in industry. Two current trends have been noticed: use of black box models by consultants, providing customers no insight into the methodology used; many companies are developing their own internal modelling team instead of using climate services, and this leads to the risk of increasing the knowledge gap with academia.
- Extreme events: importance of studying not just extreme events on their own, but also compound events and their cross-sector impacts.
- Example: ENEL carried out an internal study on the probability of having extreme events like those observed in 2022 in Italy (drought and heatwaves) in the future.

Even if the collaboration between scientists and end-users have strongly improved in the last decade, the panellists emphasized that there are still gaps to fill and necessary improvements to help the industry better take into account the appropriate level of science for decision making and strategic planning. Among other things, increasing the access to, and the quality of energy sector data is key in further developing useful applications and impact models.

The meeting organizers thank Gianni Goretti for sharing his notes of the session.