Clim2Power
Fact Sheets
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Using climate data to plan our renewable energy future

Climate Change & the Energy System

Climate change may cause significant changes to weather patterns across Europe. Both negative *and* positive impacts of climate change will influence the generation of energy from renewable sources. Depending on the region, for example, it might be more or less windy, sunny, or rainy. These changing conditions will affect the supply of energy from renewable sources (including solar panels, hydroelectric dams, or wind turbines), and may be desirable in some cases and unfavourable in others.

Because renewable energy sources depend on certain climate conditions (e.g. cloudless days for optimum solar energy or robust winds for wind energy), informing power plant managers about likely future climate conditions can help them harness renewable sources – and the energy system as a whole – more efficiently. To provide them with that information, Clim2Power is considering different **climate scenarios** for the future and **modelling** their future impacts.

Modelling the Future

We use **climate models** to simulate how the climate system will respond to a possible future scenario under a specified concentration of greenhouse gases (GHGs) in the atmosphere. In 2014, the United Nations Intergovernmental Panel on Climate Change (IPCC) selected four possible **climate scenarios** for modelling and research. These Representative Concentration Pathways, or **RCPs**, represent different possible climate futures for our earth. Clim2Power uses two of these scenarios for our research: **RCP 4.5** and **RCP 8.5**.

Climate Scenarios

plausible and often simplified representations of the future climate used for research and serving as input for impact models

Climate Modelling

a simplified, numeric way to approximate reality, which we can use to make climate projections

Climate Projections

simulated responses of the climate system to a future climate scenario, obtained using climate models

Representative Concentration Pathways

pathways of plausible climate futures, based on greenhouse gas concentrations in the atmosphere

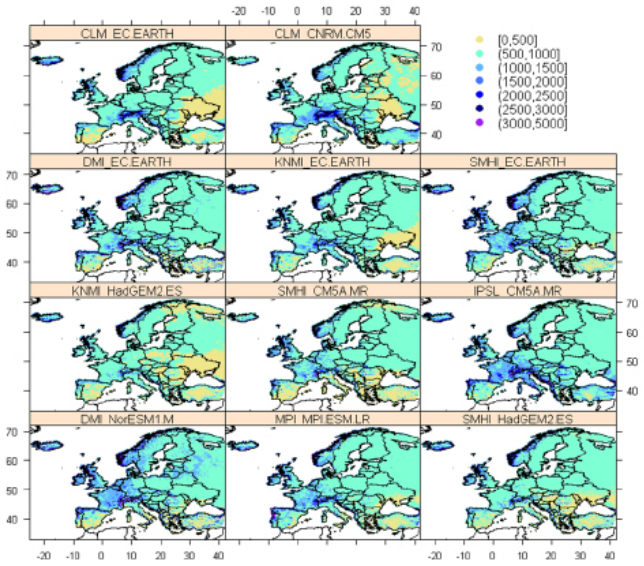
RCP 4.5 — Emissions in RCP 4.5 peak around 2040, then decline

RCP 8.5 — In RCP 8.5, emissions continue rising throughout the 21st century

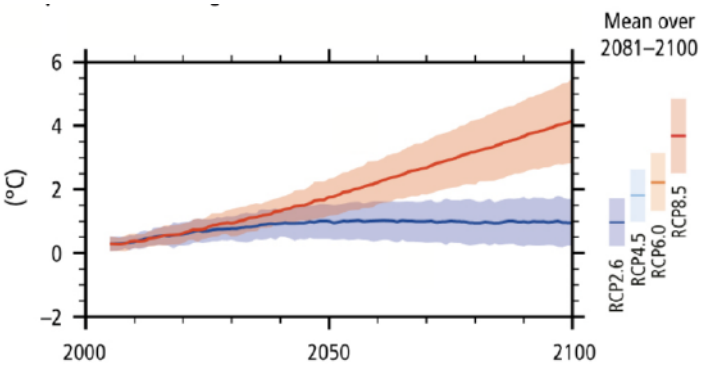
Across all RCPs, global mean temperature is projected to rise by 0.3 to 4.8 °C by the late 21st century due to an increase in atmospheric greenhouse gas emissions since the industrial era.

Selecting Models

Global Climate Models (GCMs) provide updated and detailed information on climate projections. These models describe interactions between parts of the global climate system, including the atmosphere, the oceans, and the earth's surface. Aspects of the biosphere (the area of Earth where life exists) and the lithosphere (the rigid shell of Earth formed by the crust and upper mantle), as well as their interaction with the atmosphere and oceans, together influence how much energy is available on Earth (also called the "surface-energy balance"). GCMs provide information at the global scale, but to make climate information relevant to energy managers, we use more detailed Regional Climate Models (RCMs) to study impacts and adaptation to climate change.



Comparing the output of models to historical data helps researchers choose which models best cover the full range of climate possibilities. Above are the mean annual precipitation data from 1979–2005, from the 11 model combinations chosen.



Global average surface temperature change (relative to 1986-2005). Source: IPCC.

Under the RCP 8.5 (red) pathway, global temperatures are projected to rise, with more extreme climate-related events.

But which RCM-GCM combinations should be used? The challenge for Clim2Power researchers was to select a small subset that will perform adequately and yield the most accurate results. To do this, researchers evaluated the performance of the models over Europe, and chose 11 RCM-GCM combinations for use in impact models.

To ensure that the models selected are valid, historical data from public European repositories was used. In practice, ensuring that the chosen models can describe historical climate conditions means that they are more likely to accurately estimate future scenarios. However, there will always be a measure of uncertainty when generating models of our future climate.

The resulting climate data is input into energy models that eventually provide an estimate of future energy availability, which can help renewable energy managers make smart decisions that are tailored to the climate. By making this research available to energy managers, Clim2Power will help them plan for energy efficiency for the long-term future.

What do you think?

RCP 8.5

Do you think we're likely to follow the pathway of RCP 4.5 or 8.5?

RCP 4.5

- *What type of renewable energy would a power operator want to prioritise, regarding long-term planning for the mid-21st century, under RCP 8.5, bearing in mind that increasingly hot and dry summers are projected?*

- *Which climate variables are relevant for the energy sector?*

- *What is the difference between weather forecasts and climate projections?*