EMP-E 2019

Modelling the implementation of A Clean Planet For All Strategy

Session 3B

LINKING CLIMATE AND ENERGY MODELS IN SCENARIO ANALYSIS

Sandrine Charousset, EDF R&D

Session Agenda

- *Introduction – Sandrine Charousset*
- *Talk 1 -* Dr. Laurent Dubus (EDF – Électricité de France/ WEMC – World Energy & Meteorology Council): *"The Copernicus Climate Change Service Sectoral Information System for the Energy Sector"*
- *Talk 2 –* Dr. Pedro Crespo del Granado (NTNU – Norwegian University of Science and Technology): *"Research needs and linking energy system models: experiences, challenges and opportunities"*
- *Questionnaire review – Sandrine Charousset*
- *Group discussion*

Introduction – Focus and Objective

- *Focus : How to include Climate (and Climate Change) in energy models?*
- *Objective of the session:*
  - *Identify lacks in current research*
  - *Propose new research activities*

Questionnaire

- *20 answers from 18 different institutions*
- *Most involved in energy modelling*

How climate is included in Energy Models

- *50% : not included or*
- *included through sensitivities*
  - *Eg. Parameters for the energy demand*
- *(past) Time series for different climatic years for hydro/thermal/wind/PV generation capacity and energy demand*
- *Include changes in capacity factors / availability in scenarios*
- *Prospective future time series for hydro/thermal/wind/PV generation capacity and energy demand (eg. plan4res)*
  - *Including different scenarios for climate change*
  - *Including impact on performances of technologies*
- *Feedback loop from the climate module that impacts e.g. economic growth, energy demand etc. => climate change may slow down economic growth (eg. MEDEAS)*

Main foreseen impacts of climate change on the energy system

- Impact on Energy Generation :
  - Power plant performances, especially Hydro, WindPower directly linked to precipitation / wind
  - Reduction in reliability
  - Forecasts may become more difficult
  - Increased variability
  - Impact of extreme events (draughts, water shortages, extreme cold long periods….)
  - Availability of power plants (linked to river temperature/cooling)
- Impact on energy demand
  - Change in the heat/cooling demand (linked to temperature)
  - energy demand (linked to temperature but also indirect impact on GDP/population)
  - Increased energy demand for water supply
- Impact on infrastructure (eg. Extreme weather events might increase transmission network failures)
- Impact on performances of Power-to-Heat technologies (eg. air-source Heat Pumps)

What to include in energy models

- Dynamic coupling between climate and energy system models
- Link with climatic/energy data
  - (PV, Wind, ….) timeseries with high spatial and temporal resolution), enabling to simulate eg renewable capacity timeseries consistant with climate patterns
  - Specific focus needed on hydro, in different climate scenarios.
  - Including correlations between variables, eg very cold/no wind/no PV during extreme cold periods
  - Including impacts of changing weather patterns on previous correlations (if any)
- Long-term tendancies AND short-term dynamics (including Changing dynamics)
- extreme weather events in climate scenarios
- high-level climate change impacts on GDP, population, total energy demand.
- Methods :
  - Account for robustness in regard to Climate change

New research areas

- Accurate spatial and temporal climate data to feed new-generation detailed energy system models, including high resolution, correlations, impacts of climate on performances, patterns, dynamics of climatic variables (cold waves, peaks….)
- Model and quantify impact of extreme weather events in energy models
- New market design :
  - Incentives, such as positive pricing of emission reductions
  - Value of flexibility linked to its capacity to balance climate impacts?
- More stochasticity
  - Representative set of ‘scenarios’
  - Robust investment decision models towards uncertain impact of Climate change
- Define model outputs related to the currents energy and mitigation policies

Barriers

- spatial & temporal dimension in energy system models => accounting for the impact of climate necessitates accurate temporal/special resolution (hourly, NUTS2) AND detailed data (climate impact dependent on technology)
- Numerous uncertainties
- Complexity of models
  - Computer power
  - Volume of data / resolution
  - Interpretation of results
- Climate / Energy modellers are different communities with different academic backgrounds
- reliability of scenarios?
- Availability and Findability of data

Parallel group discussions should produce :

3/5 ideas to be included in research agendas

Give them back to me (Sandrine), either on paper sheet or by email (sandrine.charousset@edf.fr)

The synthesis will be communicated to the EU representatives