

# Representation of Renewable Energy Sources in Integrated Assessment Modelling of Energy and Climate Change Policies

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## Relevance and aim

Integrated assessment modelling stands out as a promising approach for analysis of climate change mitigation policies. It considers energy technologies and energy systems development on either regional or global level in the framework of energy-economy interaction and taking into account natural resource use and international trade. However, the difficulty is that the approach is based on aggregation of energy economies and time scale. Most of renewable energy sources are very site-specific with regard to availability of resources and operation of technology, making their feasibility and costs vary not only among but also within states. The aim of the present project is to improve the way the intermittent renewable energy sources are represented within integrated assessment models.

## Research questions

The study aims at answering the following questions:

- Which geospatial and temporal characteristics of the renewable energy sources are vital for capturing their main properties?
- How can these detailed geospatial and temporal characteristics be best implemented into a more aggregated model?
- How can the system-related challenges of intermittent renewable energy integration in an energy system be dealt with appropriately in a more aggregated model?
- What are the technological, economic and social implications of large scale utilisation of renewable energy sources?

## Modelling tools

The project relies on several energy system models:

- 1) Balmorel – detailed energy system model with hourly resolution. It is used to provide insight into the way intermittent renewable energy sources operate, interact with and influence the rest of the energy system
- 2) TIAM – TIMES Integrated Assessment Model. Contains global energy system modelled from primarily energy extraction to provision of energy services. It is divided into 16 regions representing either individual or groups of countries.

## Expected results

One of the project outcomes is to develop an approach on how to better represent properties of intermittent renewable energy sources on an aggregated geographical and temporal scale. The approach is then implemented in the integrated assessment model.



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