Modelling and optimization of the North Sea region's energy system in the long term

A Data Management Plan created using DMPonline

Creator: Juan Gea Bermudez

Affiliation: Danmarks Tekniske Universitet / Technical University of Denmark

Template: EUDP (Danish energy Agency), Nordic Energy Research

ORCID iD: 0000-0002-9142-1139

Grant number: 64018-0032 (NSON-DK), 76084 (Flex4RES)

Project abstract:

Deep decarbonisation of the energy system is required to reduce the impacts of climate change. This implies replacing generation from polluting technologies with clean ones, such as variable renewables. Integrating a high share of variable renewables such as wind and solar energy sets new requirements to balance the energy system in accordance with the depletion of current flexible ramping capabilities of the energy system, such as gas turbines. Frameworks and market designs have to be reformulated in order to enable and promote new flexibility options that assure a high-quality security of supply in energy systems, including additional market couplings, storage and active participation of renewable energy sources at the different power markets. One crucial aspect is the transmission infrastructure, where significant investments are foreseen and where an offshore meshed grid seems to be a more cost-efficient option for the future than the traditional radial grid, although for it to become real there is need for great international cooperation efforts. Due to the complexity and the size of the energy system, the use of comprehensive mathematical tools is critical to optimize and analyse the role that each participant of the energy system has in a future energy system, as well as the market rules that would affect their behaviour and investment decisions.
The 3-year PhD project is part of two research projects: NSON-DK (North Sea Offshore Development) and Flex4RES (Flexibility for Variable Renewable Energy Integration in the Nordic Energy Systems). The objective of NSON-DK is to study how the future massive offshore wind power and the associated offshore grid development will affect the Danish power system on short term, medium term and long term towards a future sustainable energy system, whereas Flex4RES aims to assess how to integrate and consolidate different energy markets to make a solid base to anchor resilient, sustainable, cost-efficient and coherent Nordic energy systems in 2050. This PhD will contribute to achieving the objectives of both projects.

Last modified: 17-12-2018

Modelling and optimization of the North Sea region's energy system in the long term

Data Collection

Raw data

Energy system related quantitative digital data will be collected from the most suitable available sources. The source for the data that will be used in my PhD will come from existing online databases, reports and journal papers. Because of the numerous elements that are part of the energy system, the total size of these files can be very extensive.

Temporary data

The processing of the raw data will be performed with excel, phyton and matlab.

Results

Results will provided in reports, journal papers, and excel, gams, and matlab files.

Model

The existing version of the energy system model Balmorel will be further developed to serve the needs of my PhD.

Raw data

The input data regarding the detailed information of the power plant portfolio of Denmark can only be provided in aggregated terms, so the power plants can't be identified. The rest of the data used is fully available.

Temporary data

Fully available

Results

Fully available

Model

Fully available

Data Storage

Raw data

The data will be stored in the O: drive of DTU, the files.dtu.dk plattform, and DTU sharepoints.

Temporary data

The data will be stored in the O: drive of DTU, the files.dtu.dk plattform, and DTU sharepoints.

Results

The data will be stored in the O: drive of DTU, the files.dtu.dk plattform, and DTU sharepoints.

Model

Since the model is version control, it will be stored in github. Additionally, preliminary versions of the model will be stored in the O: drive of DTU.

Documentation

In order to make the results of my PhD reproducible, relevant metadata will be created to describe the content and sources of the data used. The standard to be used is not decided yet.

Json files will be created to establish source of the data used.

The development of the model will be tracked through log files in the version control platform.

Data Sharing

Most of the data and models used will be made available to the public. Confidential input data will not be shared. Simple tools like excel, gams, matlab and pythong might be required to access the information.

I will make supporting data available in a suitable data repository, where possible.

Long-term Preservation

Developing datasets for the analysis of the energy system consumes an extensive amount of time. For this reason, the data sets will be archived in DTU's repository, so they can be accessed in the future. The data itself might get outdated in the short term, since the energy system is chaning very quickly. However, the structure of the required data to make energy system analysis will most likely still be relevant.

The model will be preserved in open online repositories, like github.