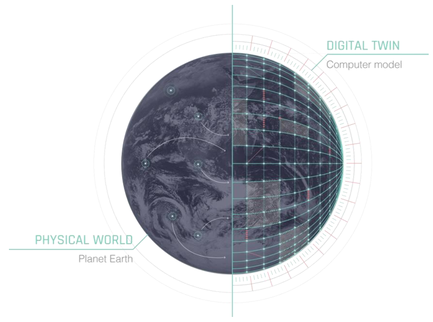
Adapting Energy Systems to a changing Climate

A Destination Earth Use Case

B. Schyska*[1], F. Witte[1], L. Hayez[2], A. Kies[3], A. Ceglarz[2], Marion Schroedter-Homscheidt[1], W. Medjroubi[1]

[1]German Aerospace Center (DLR), Institute of Networked Energy Systems, Oldenburg, Germany
[2]Renewables Grid Initiative (RGI), Berlin, Germany
[3]Aarhus University, Department of Electrical Engineering, Aarhus, Denmark
*bruno.schyska@dlr.de

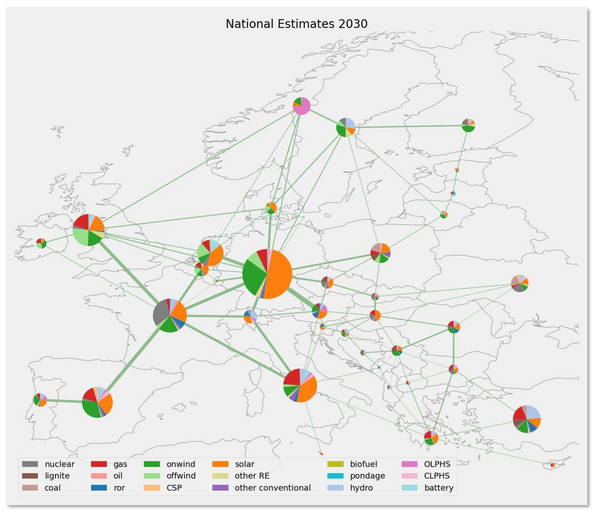


Introduction

As an interface between the ECMWF and the European grid operators and an advocate for their needs, DLR and its partners will contribute to bridging the knowledge gap between climate data and energy system modelers through:

1. The development of a representative demonstrator for the use of climate information in energy system planning applications
2. An observation-based validation of the DestinE data using DLR's unique cloud and radiation measurement network *eye2sky*
3. An inter-comparison of different meteorological data sets and the quantification of model sensitivities
4. The development of new tools and methods to integrate climate scenarios in energy system planning workflows
5. A close collaboration with the European grid operators, public authorities and further relevant stakeholders

Our Demonstrator: An open-source implementation of the European Resources Adequacy Assessment



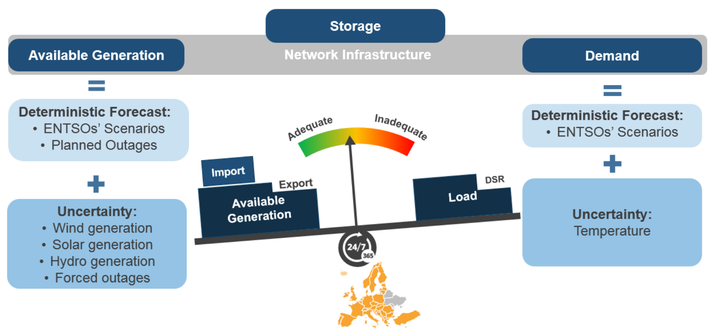


Figure 4: Top: How meteorology impacts the power system (credit: ENTSO-E); Left: Generation and storage capacities in Europe and the National Estimates 2030 scenario obtained from ENTSO-E'S Pan-European Market Modeling Database.

- The value of the DestinE capabilities will be assessed using representative demonstrator of an operational workflow in the energy sector: the European Resources Adequacy Assessment (ERAA) conducted annually by the European Network of Transmission System Operators for Electricity (ENTSO-E).
- ENTSO-E's data bases are used to compile a numerical model of the European power system with the open-source energy system modelling framework *REMix*.
- Using three different meteorological data sets, REMix can be used to simulate the adequacy of the generation, storage and transmission capacities to cover the demand for electricity in Europe, and for assessing the sensitivity to the meteorological parameters (see box on the right).

User Engagement and Co-Design

Can Destination Earth help energy systems management?

Observation-based data validation

Figure 1: Measuring clouds and radiation in very high resolution: DLR's measurement network eye2sky

Datasets inter-comparison

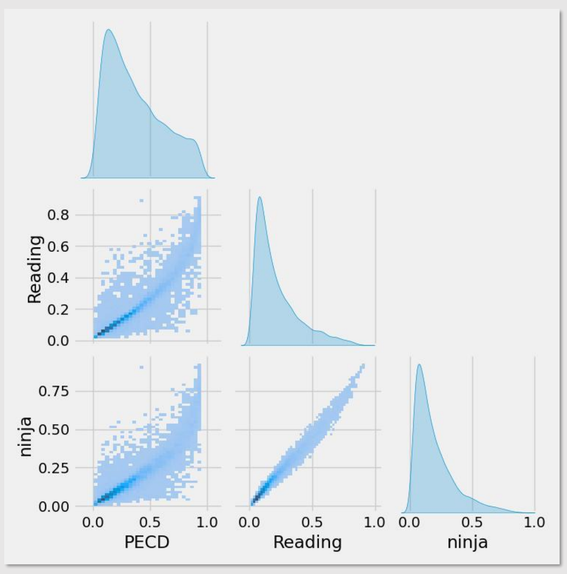


Figure 2: diagonal: Histograms of daily average onshore wind power capacity factors obtained from 3 different meteorological data sets; off-diagonal: scatter plots of the 3 data sets against each other.

Quantification of model sensitivities

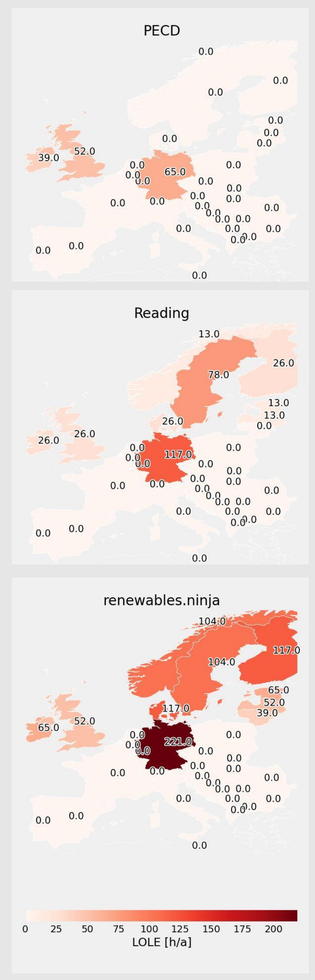


Figure 3: Resources adequacy obtained from the 3 data sets measured by the Loss of Load Expectation (LOLE) giving the number of hours per year during which the demand for electricity cannot be covered.

How will DestinE perform?!

Funded by the European Union
Destination Earth
implemented by ECMWF esa EUMETSAT

https://dlr.de/en/ve/
https://stories.ecmwf.int/energy-systems-use-case/index.html

The Destination Earth Use Case Energy Systems is a joint activity of DLR, Aarhus University and the Renewables Grid Initiative through a contract awarded by ECMWF within the Destination Earth Initiative funded by the European Union.

AARHUS UNIVERSITY
Renewables Grid Initiative
DLR