

DESTINATION EARTH

USE CASE ENERGY SYSTEMS FACTSHEET

JANUARY 2024



What is Destination Earth?

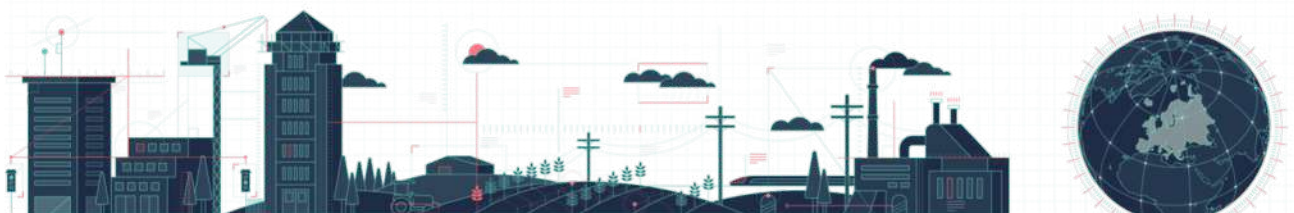
[Destination Earth](#) (DestinE) is a European Commission initiative that aims to develop a highly accurate digital model of the Earth to monitor and predict the interaction between natural phenomena and human activities until 2030. The DestinE initiative will contribute to achieving the objectives of the Green Deal and Digital Strategy.

What is the Digital Twin on Climate Adaptation?

The climate change adaptation digital twin will provide simulations of climate scenarios from global to regional and national levels at a multi-decadal timescale, including uncertainty quantification. Entering operation in 2024, the Climate Adaptation twin will deliver breakthroughs in accuracy, level of detail, interactivity and access to data speed.

Climate Adaptation Digital Twin Quick Facts

- Developed by **13 partners**, ranging from National Meteorological Services, supercomputing centers to some of Europe's top climate research institutions
- Builds upon a new generation of **storm-and-eddy resolving** Earth system models
- Performs **multi-decadal global climate simulations** at a horizontal **resolution of at least 5 kilometers**
- Run on two of the **most powerful European supercomputers** within the DestinE **Digital Twin Engine**
- Linked to DestinE's **Core Service Platform + Data Lake**



Funded by
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implemented by



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What is the Destination Earth Use Case Energy Systems?

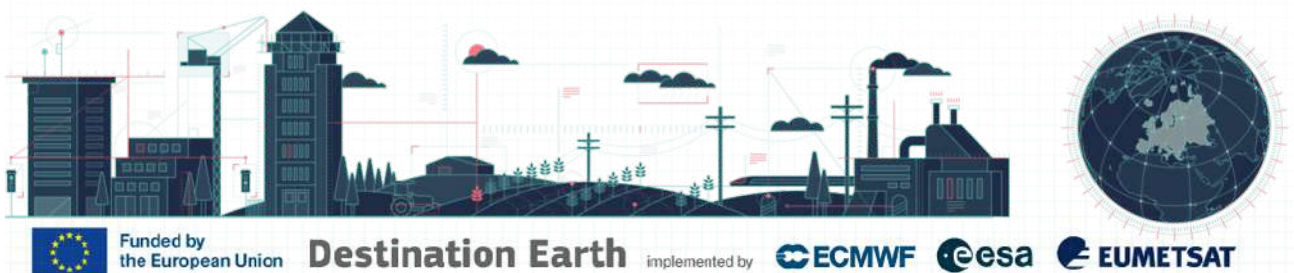
Building upon a thorough user engagement strategy, the DestinE Use Case Energy Systems will provide tools and guidance to support the European Transmission System Operators to fulfill their policy-mandates and to make a pro-active contribution to the energy transition. Core element is a Demonstrator, which exemplarily showcases the use of climate information in operational power system modelling workflows.

What is the Destination Earth Energy Systems Demonstrator?

The DestinE Use Case Energy Systems Demonstrator is a simplified adaptation of the European Resources Adequacy Assessment (ERAA) implemented in an open-source power system modeling framework. Using information provided by ENTSO-E, namely the PEMMDB and the PECD in their most recent versions, it simulates electricity markets for the European bidding zones for a great number of weather years and capacity scenarios. Main focus lays on assessing the impact of using different meteorological data sets for adequacy assessment and grid planning purposes.

Which tools will be developed?

Within the Use Case Energy Systems, tools will be developed for **the standardized assessment of the sensitivity of power system simulations on the meteorological information**. Starting point is the cross-comparison of several openly available data sets both from a meteorological view-point (e.g. through comparing statistics like extreme events or full load hours) and with respect to their impact on the results of the Demonstrator. Insights gained from this comparison will also be the basis for the development of **new methods for selecting weather scenarios for resource adequacy assessment and grid planning that consider scenario uncertainty while keeping complexity of the simulations low**.



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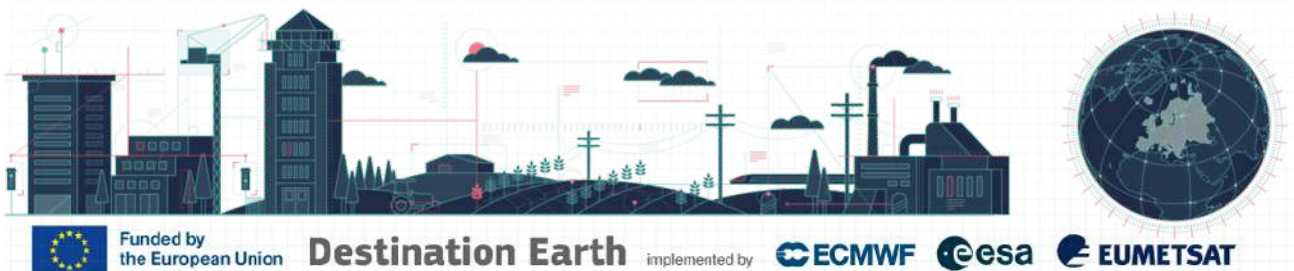


How will Destination Earth support energy system modelers?

Together with the unprecedented capabilities of the Destination Earth Digital Twins and infrastructure, the analysis performed and the tools developed will support system operators by several means: First, the sensitivity analysis will deepen knowledge about weather - power system interactions, paving the way for a sophisticated consideration of weather and climate uncertainty in power systems modeling, and **for increasing the transparency and reliability** of the workflows. Second, the scenario reduction techniques will allow to make appropriate scenario choices with uncertainty, keeping all relevant information - for instance on extreme events - while ensuring the feasibility of the workflows, and **freeing resources** for other important tasks.

Energy Systems Demonstrator Core Features

- Simplified European Resources Adequacy Assessment in an **open-source** energy system modeling framework
- Uses ENTSO-E'S **PEMMDB + PECD + 2 additional climatic data sources**
- All **European bidding zones** for electricity + **31 weather years**
- **Modular setup**: Easy additions of climatic data sources + update of data bases
- **Automated workflow** including data download, processing, simulation, evaluation and visualization
- Standardized **assessment of sensitivities** of the simulation results on climatic data sources using various indicators (e.g. residual load duration curves, Loss Of Load Expectations, Expected Energy Not Served, share of renewables)
- **Quantification of uncertainties** through ensemble simulations with different weather scenarios
- **Interactive visualization** of results in a user dashboard to communicate uncertainties, increase transparency and trustworthiness, and to support making appropriate scenario choices





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Energy Systems Demonstrator Core Information

- Overall, ERAA appears sensitive to the choice of the meteorological data set:
 - Compared to the PECD, using alternative meteorological data sets and scenarios leads to significantly higher LOLE in some European Countries.
 - This can be related to comparable high full load hours and fewer low-wind events in the PECD caused by a more prospective wind power fleet used to compute aggregated wind power capacity factors.
- Information on sensitivity helps estimating uncertainties and alters grouping of weather years to derive representative weather scenarios.
- Future R&D will focus on methodologies to improve the representation of uncertainty information in clustering approaches for selecting representative weather years.

Which operational services will be developed?

In the next phases of Destination Earth, the developments of the Use Case Energy Systems should be driven further. Based on users' feedback, the Demonstrator may be developed further to become an operational service.

How can I get involved?

Destination Earth offers several ways to get involved:

- Participate in the [DestinE Energy Systems User Perspective Survey](#)
- Take part in the DestinE Energy Systems **User Perspective Workshop in Brussels on February 6th, 2024** (limited availability, please get in touch!)
- Join the DestinE community on <https://destination-earth.eu/destine-community/>
- Get in touch: lea@renewable-grid.eu, bruno.schyska@dlr.de

The Destination Earth Use Case Energy Systems is an activity of the German Aerospace Center (DLR) together with Aarhus University and the Renewables Grid Initiative in support of ECMWF's role in Destination Earth funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union, the European Commission or ECMWF. Neither the European Union and the European Commission nor ECMWF can be held responsible for them.