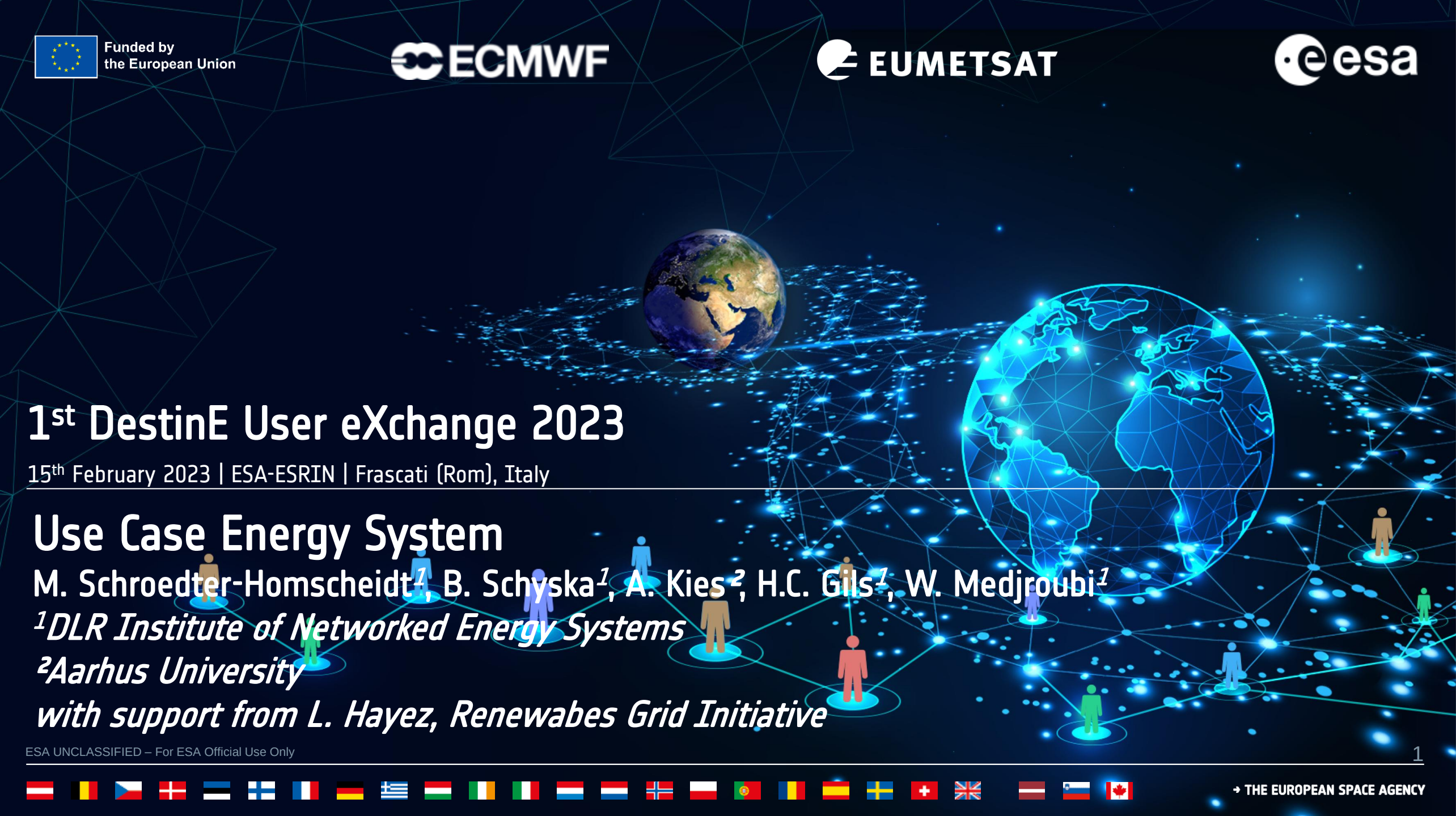


Funded by the European Union

ECMWF EUMETSAT esa

1st DestinE User eXchange 2023

15th February 2023 | ESA-ESRIN | Frascati (Rom), Italy

Use Case Energy System

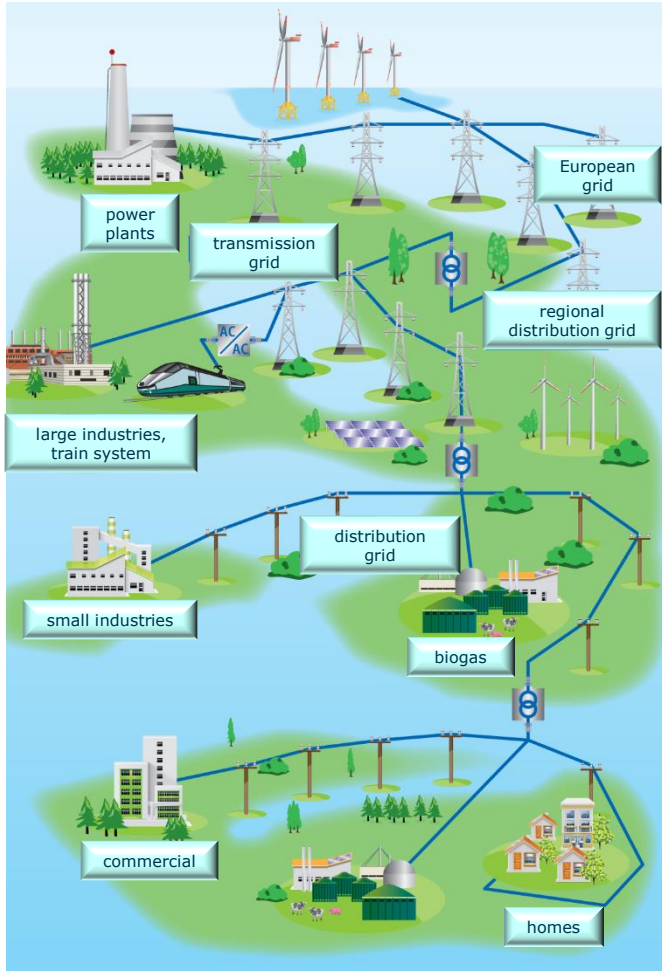
M. Schroedter-Homscheidt[1], B. Schyska[1], A. Kies[2], H.C. Gils[1], W. Medjroubi[1]

[1]DLR Institute of Networked Energy Systems

[2]Aarhus University

with support from L. Hayez, Renewabes Grid Initiative

Our energy system – electrification & de-fossilation



Source: RWE

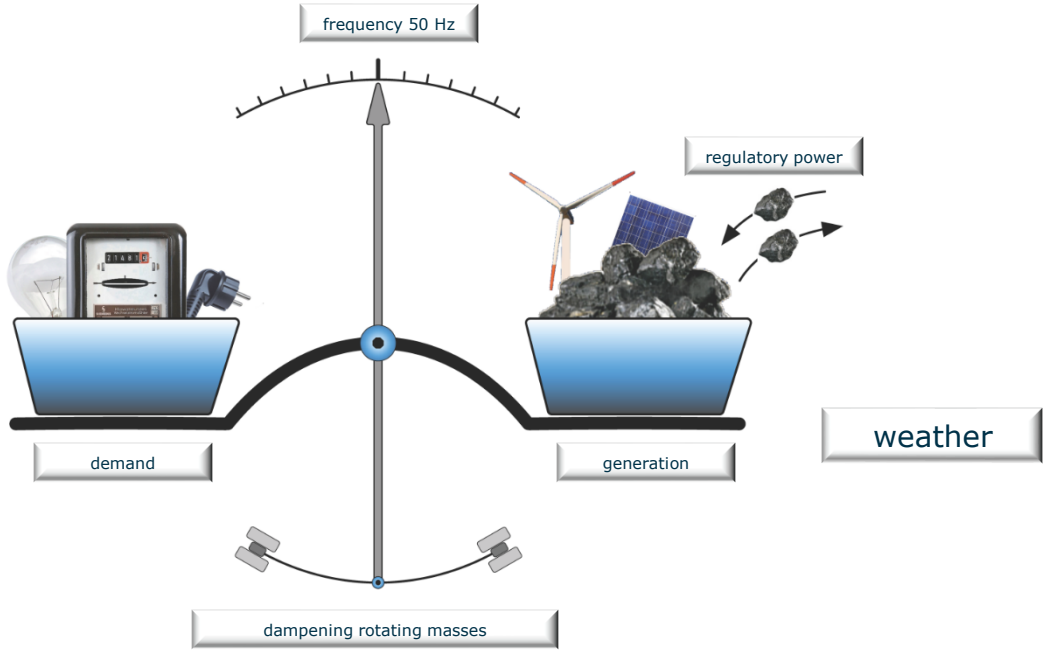
hydrogen economy

electric/fuel cell transportation

weather

heat pumps

electric cars



Source: D. Heinemann

This is the role of grid operators – transmission system operators (TSOs) and distribution system operators (DSOs).
Often private sector companies with publicly controlled monopoly role.

Users – TSO & DSO

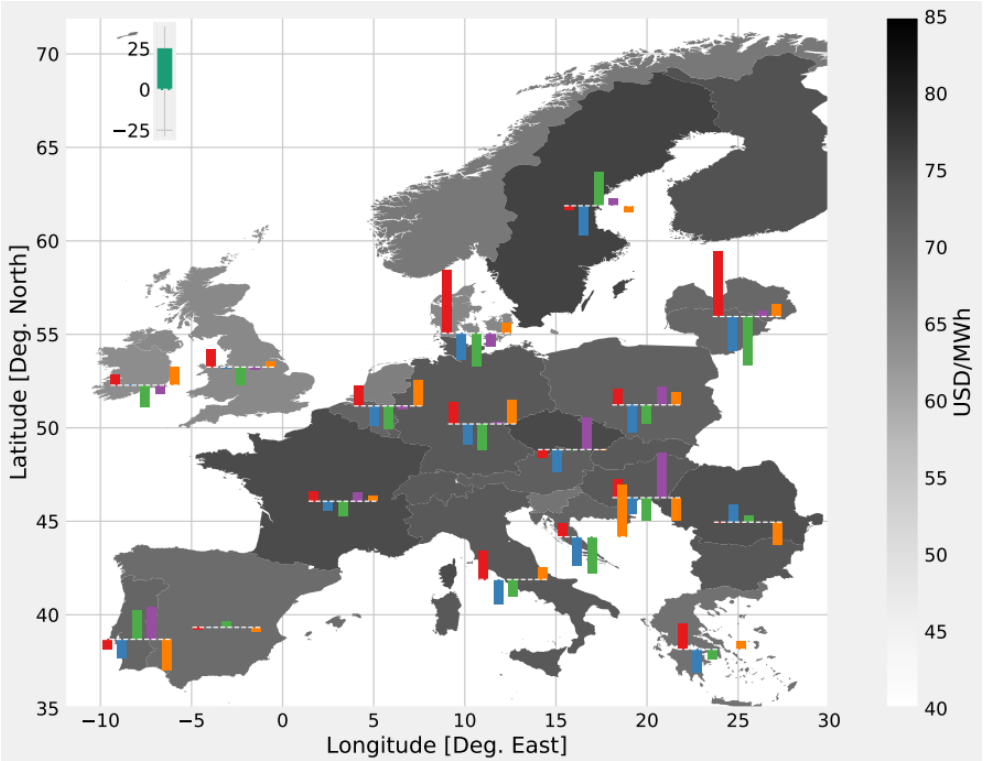
- Via DLR's contacts: Two German TSOs (TenneT + TransnetBW) and one DSO (Stadtwerke Ulm/Neu-Ulm Netze) involved already during the proposal preparation phase
- Now Extension to the network of RGI

- User tasks are e.g.
  - European Resource Adequacy Assessment (ERAA)
  - Joint Identification of System Needs (IoSN)
  - Ten Year Network Development Plan (TYNDP)

Source: RGI

RGI – a unique cooperation between industry and civil society

Dependency on meteorological information



[Kies et al., RSER, 2021]

Country-wise
levelized cost of electricity
LCOE [US$/MWh]
from
optimizing a simplified European power system

using five different meteorological data sets;

colour shading shows the mean, bars the data sets' deviation from that mean [%].

Take home message:
Spatial and temporal representation of weather patterns is highly relevant, simultaneous events & consecutive events need to be correct

Energy planning & investments are relevant for decades

Climate scenarios are needed

But they should cover all relevant meteorological conditions

Resolution and realistic representation of processes is the key

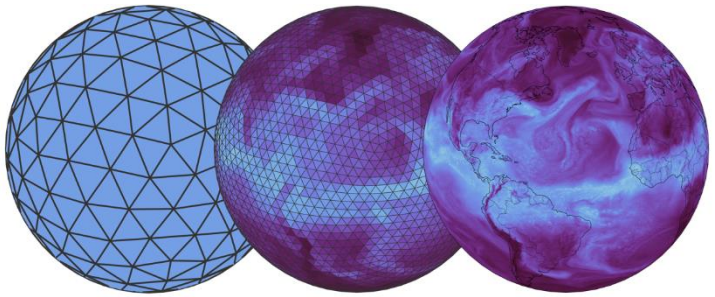


Image: DKRZ, https://easy.gems.dkrz.de/

Besides resolution – other barriers to overcome

Image from Dillon Winspear on Unsplash

- Lack of knowledge about available meteorological data sets
- Unknown implications of using different data sets and/or weather periods for energy system modelling
- Limited knowledge and resources to perform necessary downscaling and bias correction tasks
- Lack of standardized tools and methods to add the analysis of climate change and/or climate uncertainty to user workflows

(Craig et al., Joule, 2022)

We follow a co-design approach

- Showcase generation with DLR's own capabilities
- REMIX and ENDAT tools in use more than 20 years
- Increase transparency and thrustworthiness
- **Un-boxing climate scenario data for energy users**
- **Open the black box of energy system models for climate modelers**

REMIX – from energy production & demand to energy transition & answers

Input

- Model scope
  - Power
  - Heat
  - Transport
  - Gas
- Energy demand scenario
- Energy resources
- Infrastructure data
- Technology data

REMix energy system optimisation framework

Minimisation of system costs

$$\text{Min} \sum_{j \in n} c_j x_j \qquad \sum_{j \in n} a_{ij} x_j \geq b_i \qquad \forall i \in 1 \ldots m \qquad x_j \geq 0$$

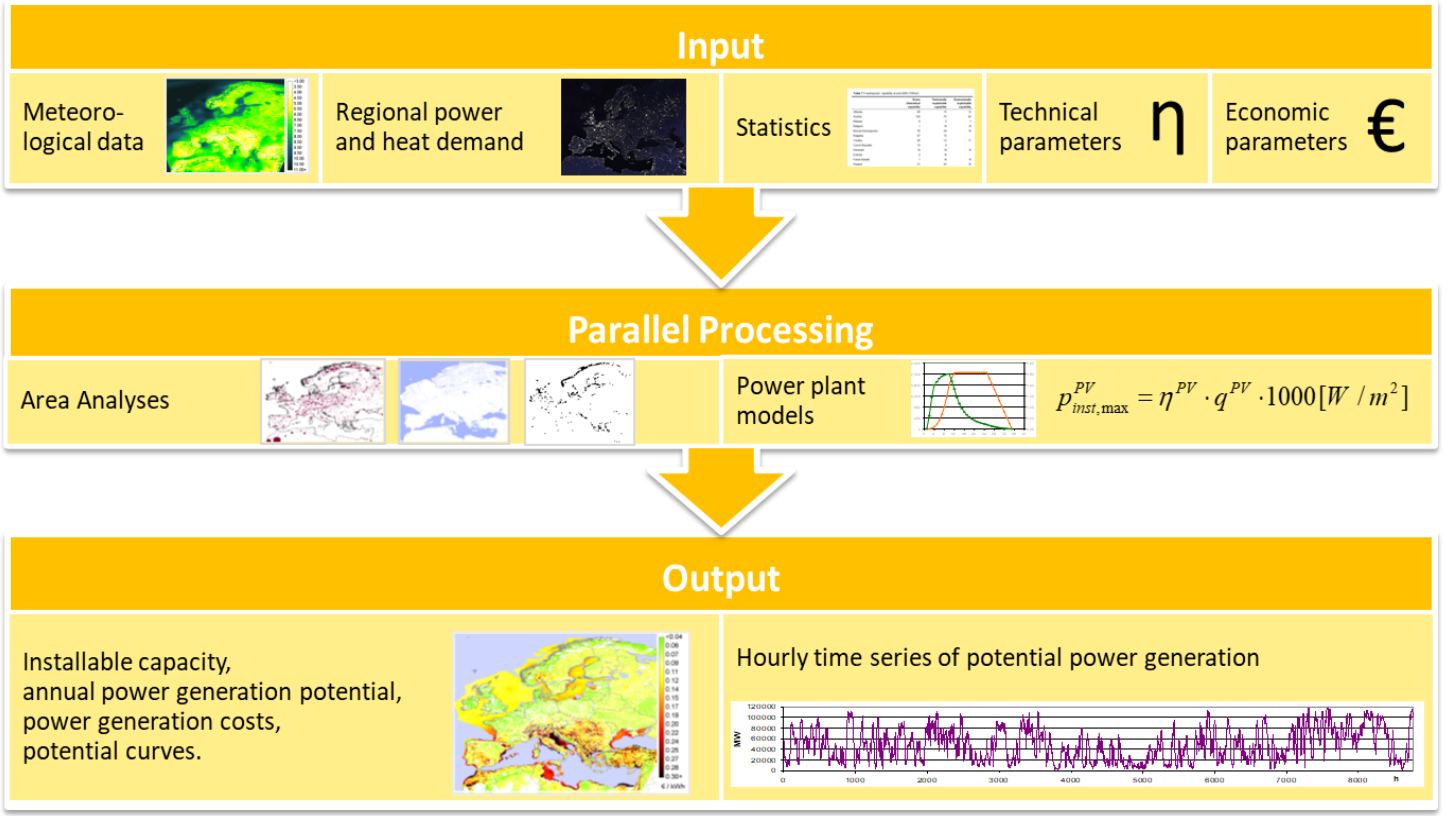
GAMS
python

CO_2 targets, domestic supply shares, …

Output

- Energy conversion
- Load balancing
- Infrastructures
- System operation
- Scenario variants

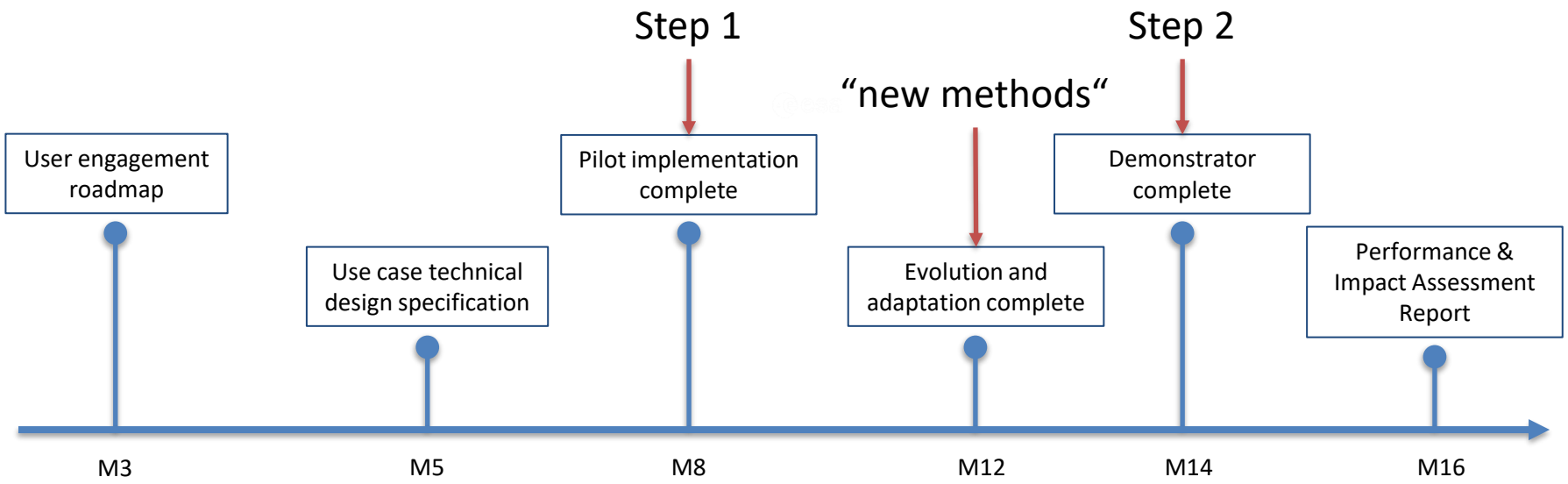
ENDAT – from meteorological data to power generation



Energy data analysis with DLR's Energy Data Analysis Tool EnDAT

Schedule – Jan 2023 to April 2024

Major deliverables & milestones



User workshop
28 Feb 2023 at
DLR in Bonn, Germany

Contact and further information

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www.dlr.de/ve/en

REMix

EnDAT

eye2sky