How the demonstrator data sets provide valuable and usable new information for the energy sector



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COPERNICUS European Commission



Summary of the data provided in the ECEM demonstrator

- Climate variables: temperature, precipitation, radiation (GHI), wind speed at 10m and 100m, relative humidity, sea level pressure
- Energy variables: capacity factor, energy and power
 - Electricity demand
 - Generation: Hydro, Solar and Wind
- Country and (in most cases) cluster spatial scale
- Daily, monthly, seasonal, annual time resolutions
- Historical: 1979-2016
- Seasonal forecasts (skill): for two seasons (DJF and JJA) and one month lead time
- Projections: 1979 to 2065/2100
- Absolute values, anomalies, long-term means
- For projections ensemble means and smoothed max/min range (7 regional climate models)





Some key characteristics of the ECEM data sets

- Consistent in terms of spatial and temporal scale and coverage, format, underlying assumptions etc, between:
 - Countries/clusters
 - Variables
 - Energy and climate
 - Time period (Historical, Seasonal forecasting, Projections)
 - Scenarios
 - Two greenhouse gas emissions scenarios RCP4.5 and RCP8.5
 - Five energy mix scenarios from eHighway2050
- High quality (e.g. based on the most reliable input data available, further checking and processing such as bias adjustment of climate data used to calculate energy variables)
- Can be **explored and downloaded** through a flexible and user-friendly platform, including standard plots (e.g. for climate projections, and evaluation of seasonal forecasting skill)
- Developed by subject **experts**
- Data and demonstrator developed in close collaboration with users
 - Range of **documentation and guidance** (e.g. technical metadata, FAQs, case studies)



Maps – allow exploration of spatial patterns across Europe

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e.g., Radiation, Spring, Ensemble mean, present day (left) and future (right)



Climate Projections Global Horizontal Irradiance | Long term mean(s) | Ensemble Mean | RCP8.5 [MAM only]

MAM 1981-2010

Legend 118Wm-2

Produced by the ECEM Demonstrator Vn2.2(http://ecem.climate.copernicus.eu/demo)

258Wm-2 Data

Climate Projections Global Horizontal Irradiance | Long term mean(s) | Ensemble Mean | RCP8.5 [MAM only]



Produced by the ECEM Demonstrator Vn2.2(http://ecem.climate.copernicus.eu/demo)

Countries can also be compared using time series plots

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e.g. Historic winter wind capacity factor for UK (top line), Croatia (lower line) and Norway, Germany, France, Spain, Italy, Greece (central lines)

ECEM Timeseries: Wind (WIN) Capacity Factor (CFR) | DJF only

- NO WIN CFR PhM03 DJF UK WIN CFR PhM03 DJF DE WIN CFR PhM03 DJF
- FR WIN CFR PhM03 DJF ES WIN CFR PhM03 DJF IT WIN CFR PhM03 DJF
- HR WIN CFR PhM03 DJF GR WIN CFR PhM03 DJF



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A large country can be explored in more detail using clusters

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e.g. Time series for 6 UK clusters, historical winter wind capacity factor as before. The map shows 1989 – where there is a strong north vs south contrast





Relationships between energy and climate variables

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e.g. Capacity Factor highlights the effects of climate variability – here for solar generation at the seasonal scale

ECEM Timeseries: Solar (PV only) (SOL) Capacity Factor (CFR) | JJA only and Global Horizontal Irradiance (GHI) Anomaly



• Spain

• Summer (JJA)

- Solar generation (red left axis)
- Radiation % anomaly from 1981-2010 long-term average (blue – right axis)





Focus on the climate effects -e.g. long-term projections



Increasing temperature (top) \rightarrow reduction in winter electricity demand (left) and increase in summer (right) – here for Greece Climate Projection | Greece

Can also explore effect of different climate scenarios – orange 'business as usual' vs blue (some reduction of greenhouse gas emissions)

Trend removed [MW]

mand Power 5200

5400













Socio-economic influences can be included/excluded

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e.g. Historical demand with (blue) and without (red) the long-term trend related to socio-economic factors – here, winter power demand for France



In the next presentation Laurent will show how different energy mix scenarios can be explored





Concluding remarks

- The Demonstrator data allow exploration of relationships between climate and energy over the last 40 years and the effect of climate change over coming decades, as well as assessment of the skill of seasonal forecasts
- Time-series plots and graphs can be downloaded to include in your own reports and presentations
- Data can be downloaded (.csv from Demonstrator, gridded netCDF files from ftp site) for more detailed analysis using your own software, models and additional data inputs

