European Climatic Energy Mixes (ECEM)

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Increasing share of power supply from variable renewable energy (RE) sources. Demand variability is also increasing. The transformation is taking place against a **variable and changing climate**.
Uniqueness

Integration of energy & climate information for energy mixes assessment

★ Is climate important for energy planning?
★ What can climate R&D learn from interaction with energy sector and make output more easily adopted by the industry/policy makers?

European Climatic Energy Mixes (ECEM) is developing a demonstrator to assess how well different energy supply mixes in Europe will meet demand, over different time horizons, focusing on the role climate has on the mixes.
Give more emphasis to data access and download

Provide information at the eHighway-2050 cluster scale (96 clusters) as well as at the country scale (33 countries)

Possibly include more climate variables (snow cover, snow water equivalent, relative humidity), offshore wind and biofuels

Ensure that access to information about underlying methods and assumptions is a prominent feature of the demonstrator
For this proof of concept service, we cannot:
- Provide information at very high temporal (sub-hourly) or spatial (e.g., a single wind farm/turbine) resolutions
- Include wind direction
- Incorporate economic information (e.g. investment costs, energy prices) – but some of the case studies may do so
- Consider short-term forecasts (not part of Copernicus)
“Planning for European Electricity Highways to ensure the reliable delivery of renewable electricity and Pan-European market integration”

The Energy Roadmap 2050 is the basis for developing a long-term European framework.

40 month project, from September 2012 to December 2015
Common reinforcements
Number of appearances in scenarios

- Displayed are all lines reinforced throughout all five scenarios
- Colors according to number of appearances in scenarios
- Need to transport energy from renewable sources from “European periphery” to central Europe
Issues considered by e-Highway 2050

- Technical
- Economic/financial
- Political/socio-political and environmental
- Research, development and deployment (RD&D)

However, climate not very prominent in eHW2050 even though ...
Global changes in streamflow projections

Change in streamflow for RCP8.5, 2040–2069 (2050s) vs 1971–2000

Reductions in usable capacity for 61–74% of the hydropower plants

van Vliet et al. (2016)
Global changes in water temperature projections

Change in water temperature for RCP8.5, 2040–2069 (2050s) vs 1971–2000

Reductions in usable capacity for 81–86% of the thermoelectric power plants

van Vliet et al. (2016)
Solar Radiation Inter-annual Variability

Percentage difference in monthly solar radiation in El Niño relative to La Niña

Winter (JJAS)  Summer (DJFM)

Davy and Troccoli (2012)
ECEM - A Copernicus Climate Change Service
Quick Facts

- A 27-month EU Copernicus Climate Service project
  - Started in November 2015

- Led by the University of East Anglia (UEA, UK), with:
  - Electricité De France (EDF, France)
  - The Met Office (UK)
  - ARMINES (France)
  - The University of Reading (UK)
  - The Agency for new technologies, energy and sustainable development (ENEA, Italy)

- Five work-packages
  - Clear focus on stakeholder engagement – one workshop every six month, so as to create strong engagement
Target

★ Energy Mix assessment for:
★ Present day
★ Seasonal Forecasts
★ Climate Change
From Climate variables to Energy systems

Calibrated Climate Variables
- Temperature
- Rainfall
- Wind Speed
- Cloud Cover
- Solar Radiation
- River Discharge
- Others?

Define models & transfer functions
Select / Gather relevant datasets

Energy Variables
- Hydro Power
- Solar Power
- Thermal Power
- Demand
- Wind Power

• Skill & Reliability
• Assessment of Seasonal Forecasts of Energy Variables

+ Extreme Events Case Studies
Impacts of Climate Variability & Change on Energy Variables

- Sub-Country Scale
- Historical Period
- Seas. Fcst

Ancillary

+ Others?
Climate Variables: Wind Speed Assessment

Fit of 10 m observations to Weibull distribution

Jan (Obs Weibull AIC GOF) [Map showing distribution with color scale]

Jul (Obs Weibull AIC GOF) [Map showing distribution with color scale]

Low number (blue) good fit; high number (red) poor fit
Climate Variables: Wind Speed Assessment

ERA-I Re-analysis versus 10 m obs

Scale diffs ratio ERA/obs

Jan

Jul
Demand modelling

Challenge: remove non-climatic factors
Risk climatologies - examples

**Investor/owner/planner: Volumetric generation risk**

- **Ideas:**
  - p5-p95 of production volume for RE
  - p5-p95 of annual hours at a specified load level for conventional plant
  - “best” and “worst” case years
  - Curtailment
  - Spatial correlations maps for neighbouring zones

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**Figures:**
- Cannon et al (2015, RE)
- Bloomfield et al (submit, Nat. Energy)
The ECEM Demonstrator

The purpose of the ECEM demonstrator is to enable the energy industry and policymakers to assess how well different energy supply mixes in Europe will meet demand, over different time horizons (from seasonal to long-term decadal planning), focusing on the role climate has on the mixes.
How will the demonstrator look like?

An online interactive tool to test energy mixes
Integration of energy & climate information for energy mixes assessment

★ Is climate important for energy planning?

★ What can climate R&D learn from interaction with energy sector and make output more easily adopted by the industry/policy makers?
Stakeholder Engagement

Co-development with prospective users is key to a successful implementation of ECEM

★ We welcome feedback at any time, including offers for co-development and/or to be a champion for the ECEM demonstrator
Feedback form, Twitter, Presentations

★ Feedback form:  http://tiny.cc/ECEM_WS2
★ Twitter:  #USER_ECEM
★ ECEM presentations:
  ★ http://tiny.cc/ECEM_USER2_a
  ★ http://tiny.cc/ECEM_USER2_b
  ★ http://tiny.cc/ECEM_USER2_c
  ★ http://tiny.cc/ECEM_USER2_d
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  ★ http://www.wemcouncil.org/wp/projects/ecem/
Thank you