Climate Service and Technology: a Key Tool of Climate Change Adaptation for the Energy Sector

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Climate Change Adaptation for the Energy and Industrial Sectors, Taiwan, 13 Oct 2016

Outline

- The evolving relationship between Energy and Climate
- How Weather/Climate impacts Energy
- Climate Services for Energy

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WEMC: Who are we?

Alberto Troccoli

Founder &
Managing Director

Sue Ellen Haupt

Founder &
Education Director

Laurent Dubus

Founder

Steve Dorling

Communication &
Services Director

Mohammed Sadeck Boulahya

Founder & Stakeholder
Engagement Director

Marta Catalano

Communications
Officer

Together we work with a wide range of scientists, organizations and experts in the energy, weather and climate sectors

WEMC: Our primary goal is to enable improved

Sustainable energy

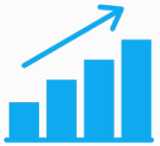
For a low carbon economy

Resilience

Of energy infrastructures

Efficiency

Of energy systems



Under ever changing weather and climate

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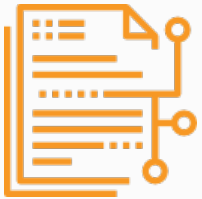
WEMC work focuses on

Enhancing productivity and policy formulation for the energy industry



Achieving improved adoption of weather, climate and other environmental information by the energy industry

Maximizing the exchange of relevant information between developed and developing countries

Icons designed by Smartline and Gregor Cresnar on flaticon.com

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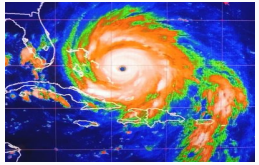
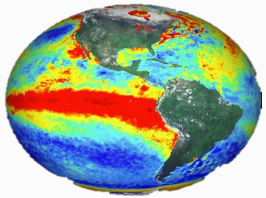
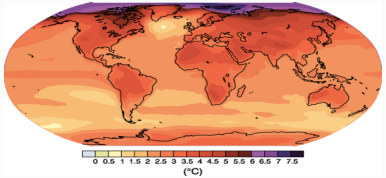
Energy and meteorology go hand in hand







Passing clouds	Hurricanes	El-Niño	Long term changes
Drop in solar power	Disruptions to oil rig operations	Changes in Demand Patterns	Renewable Resource Assessment

Seconds — Minutes — Days — Months — Seasons — Years — Decades

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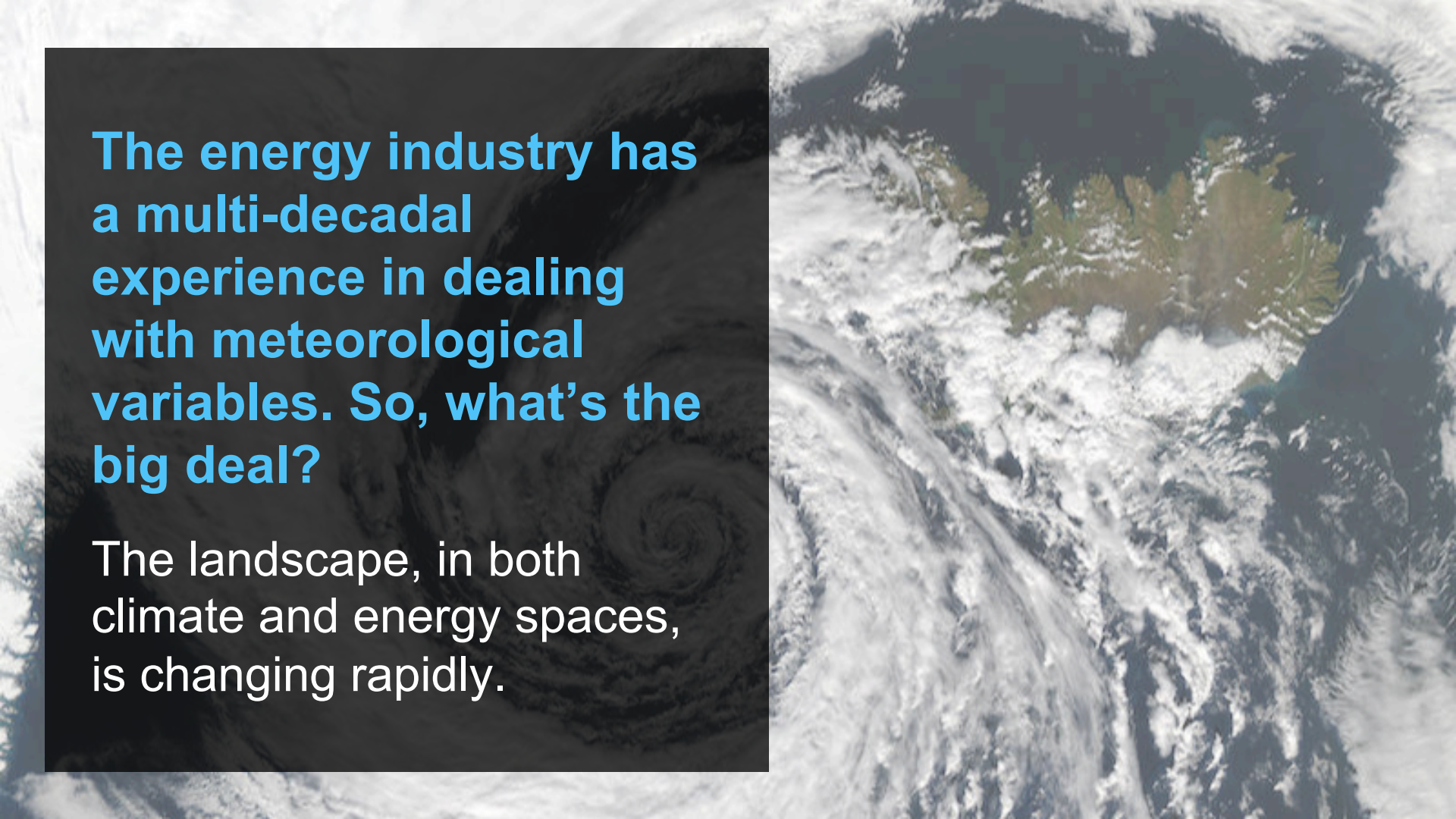
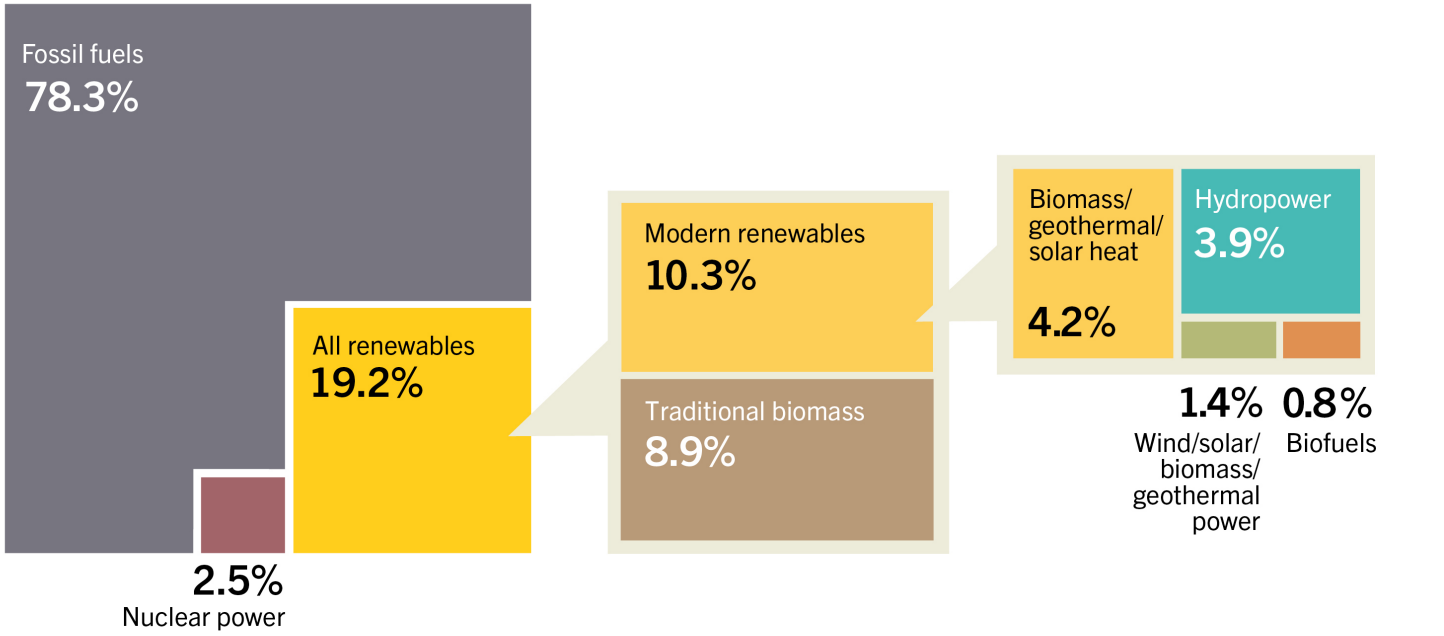


The energy industry has a multi-decadal experience in dealing with meteorological variables. So, what's the big deal?

The landscape, in both climate and energy spaces, is changing rapidly.

Global Final Energy Consumption



REN21 *Renewables 2016 Global Status Report*

REN21 Renewable Energy Policy Network for the 21st Century

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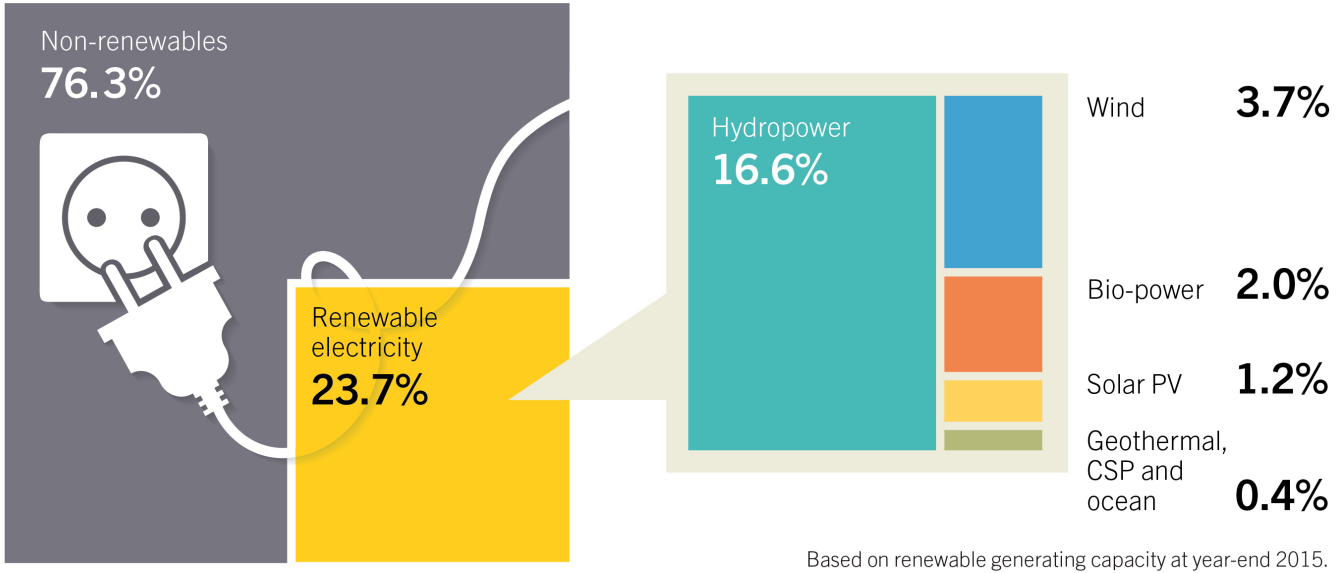
RE Share of Global Electricity Production



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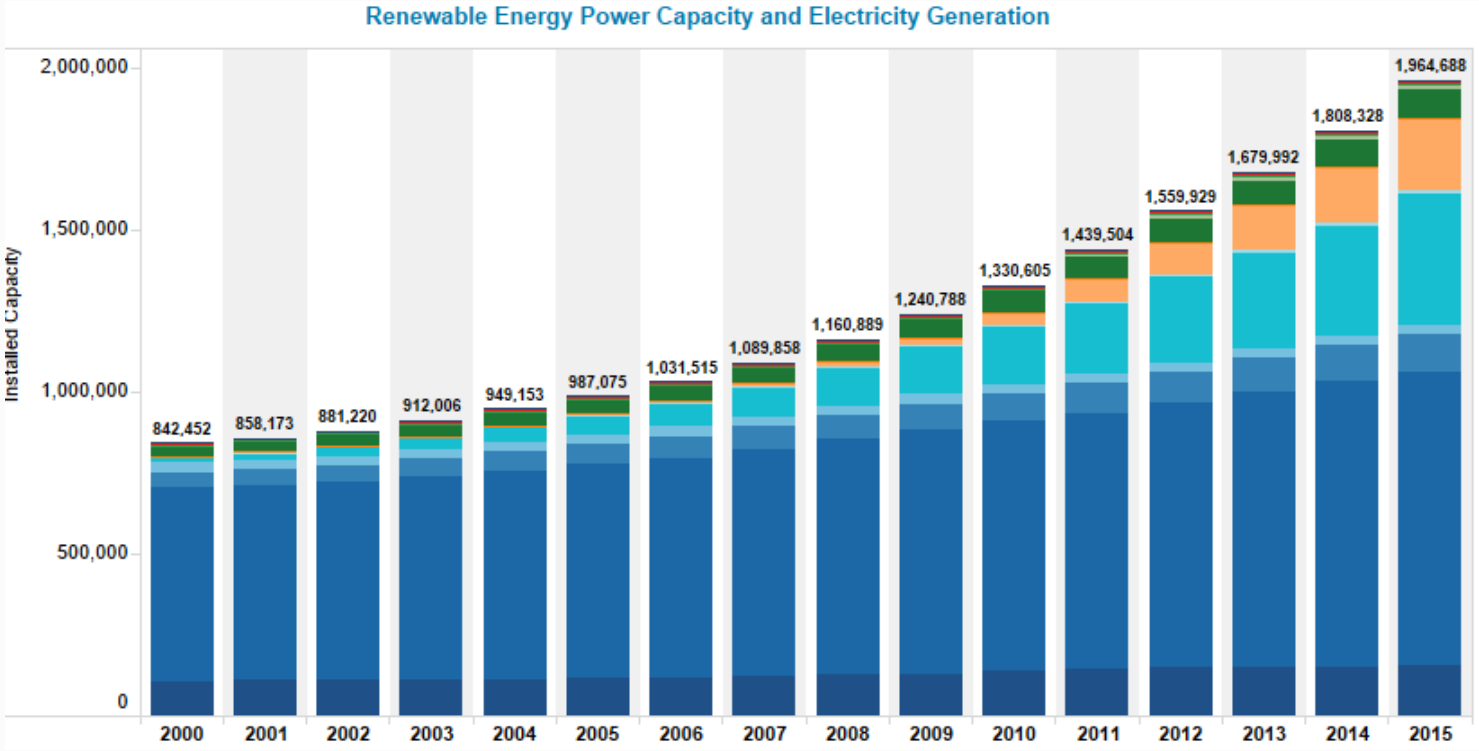
Strong growth in renewables



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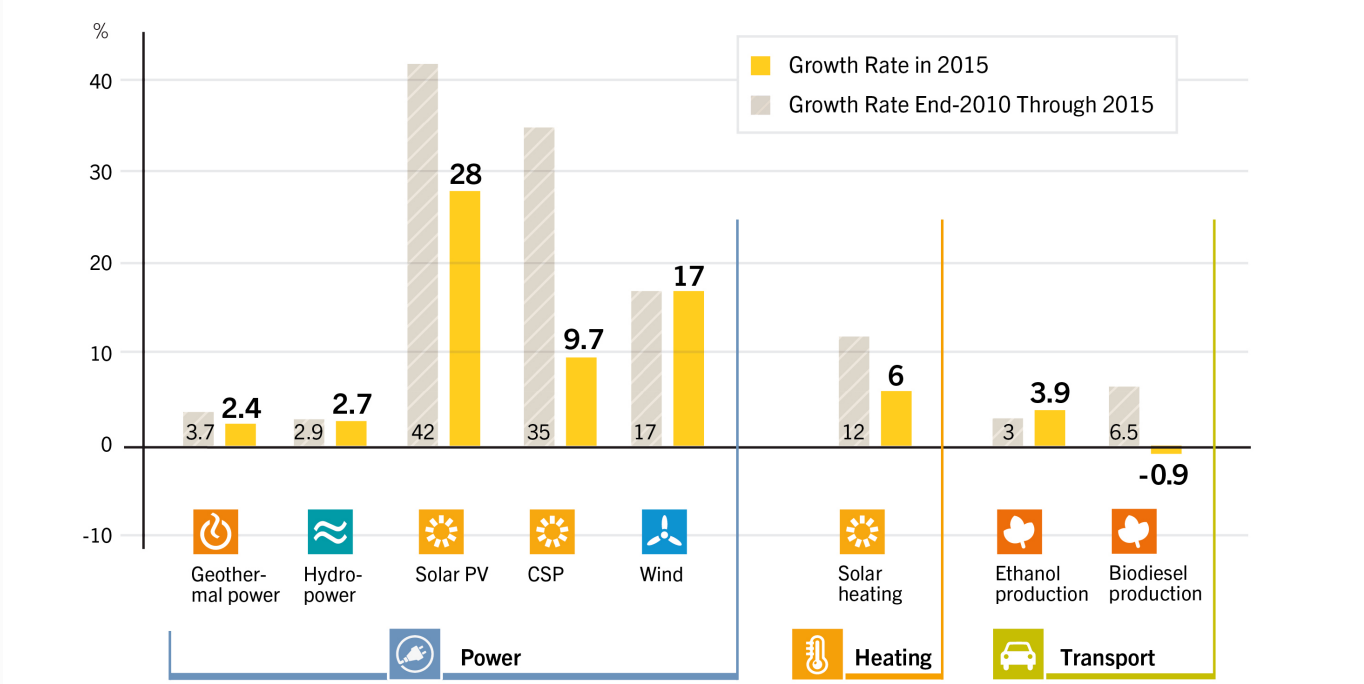
IRENA (2016)

Average Annual Growth Rate of RE (2010-2015)



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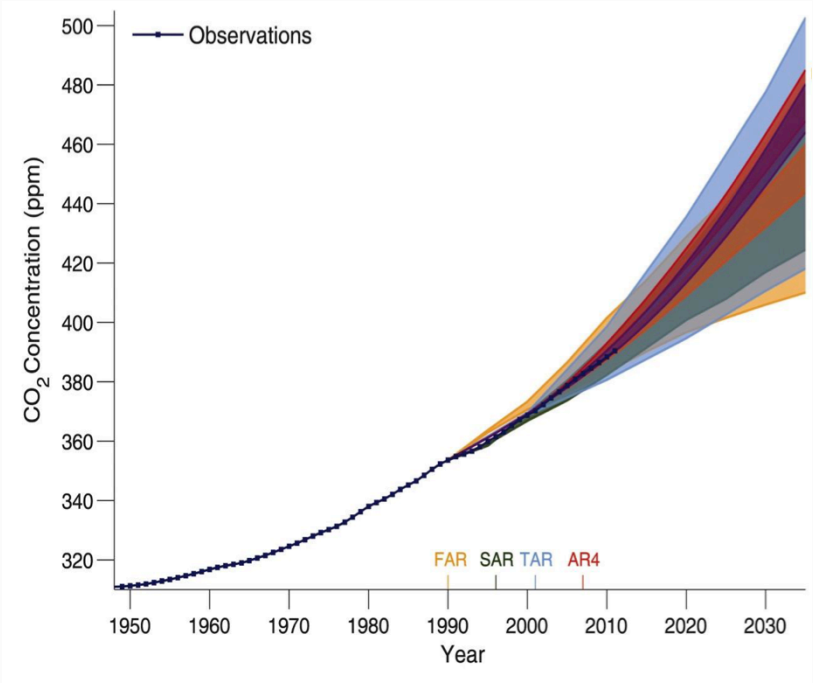
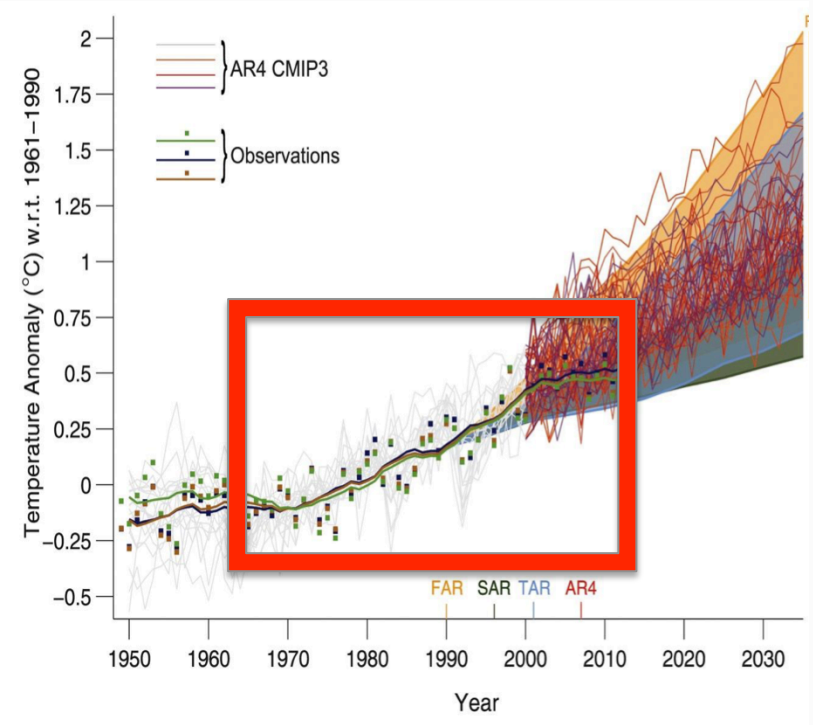
C02 emissions and temperature





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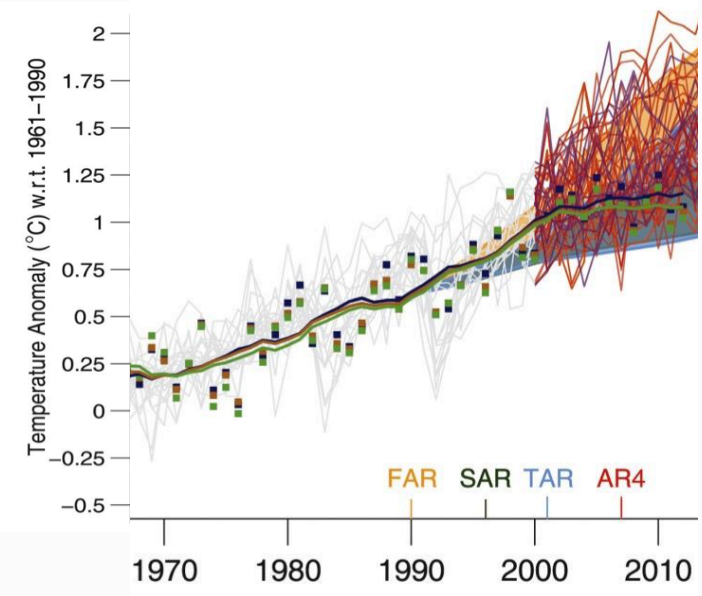
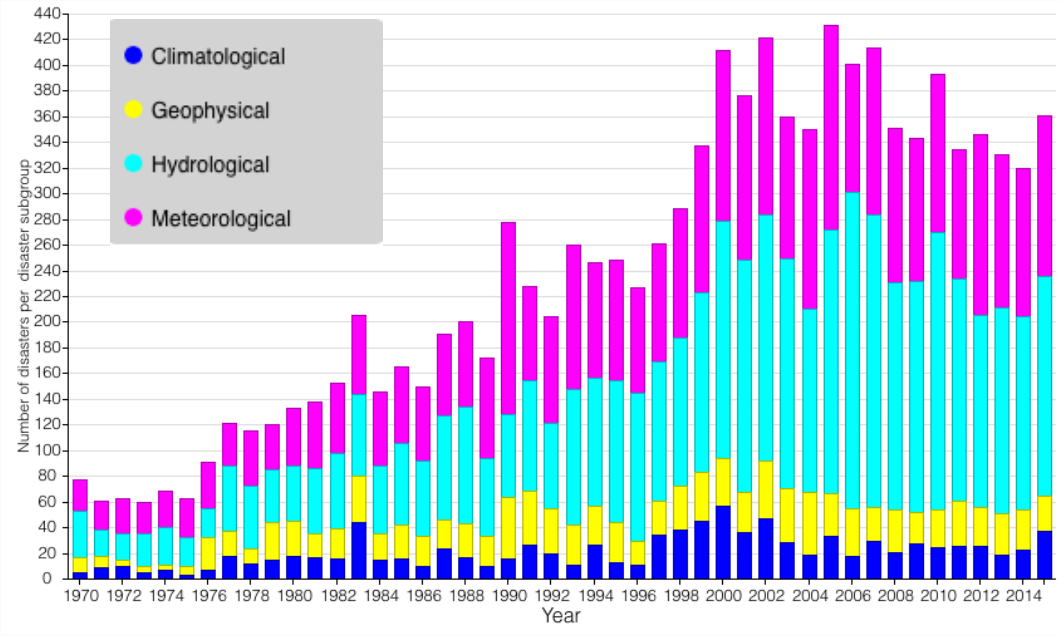
IPCC AR5
(2013)

Disasters due to natural events





EM-DAT (2016)

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Simplified Energy & Climate feedback

Emissions

Energy

Meteorology
Weather, Climate & Water

Impacts

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Energy industry is multi-faceted – a selection

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Climate impact on coal mines

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Love et al. (2014)

Climate impacts on hydro-power

Masinga Dam Water levels in different Years

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From Christopher Oludhe (2015)

Climate impact on nuclear power

The 2003 heatwave in France had serious consequences on the cooling of nuclear reactors. The overall cost of the heat wave for EDF was around €330 million

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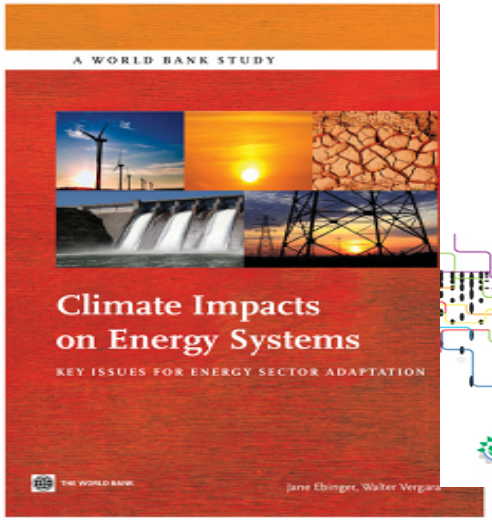
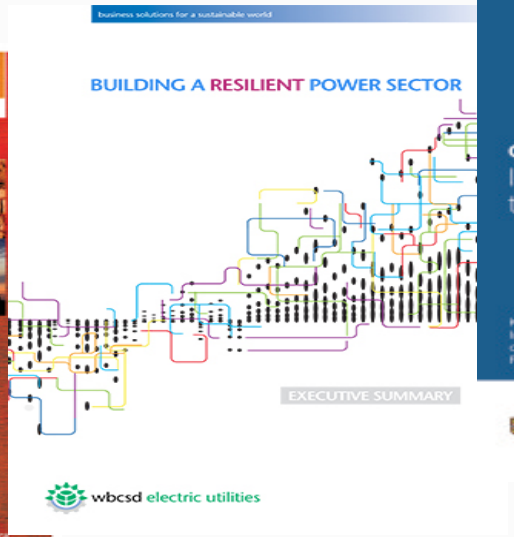
Dubus (2009)

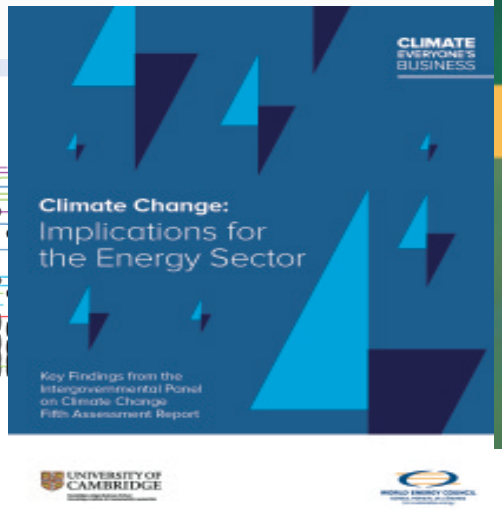
A selection of publications



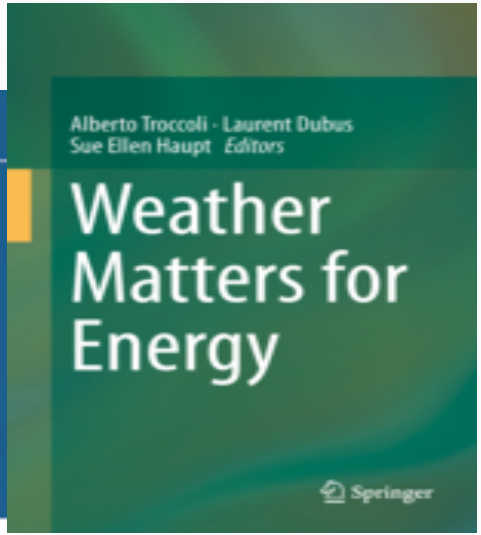
World Bank (2010)



WBCSD (2014)



WEC (2014)



ICEM (2014)

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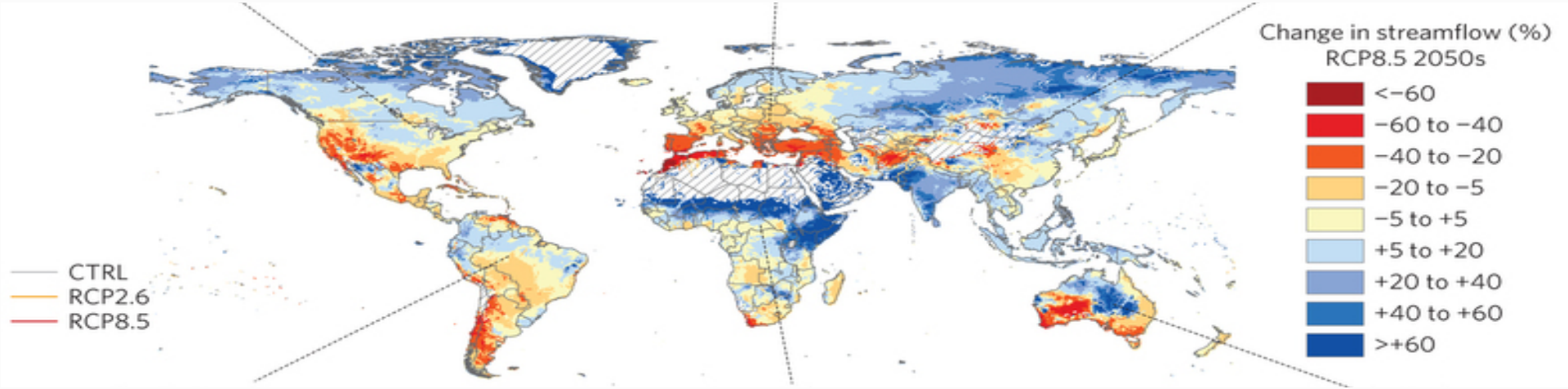
Global changes in streamflow projections



Change in streamflow for RCP8.5, 2040–2069 (2050s) vs1971–2000

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

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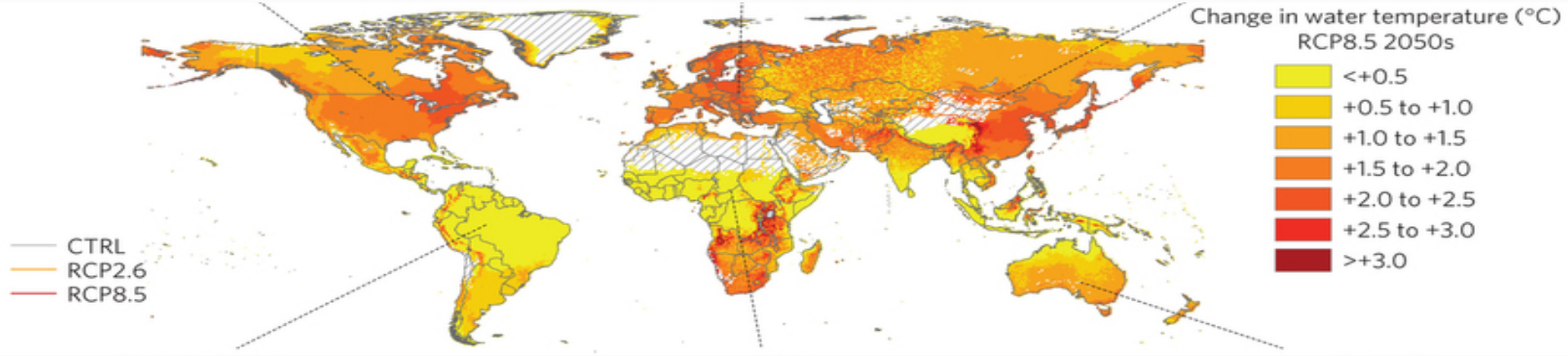
van Vliet et al. (2016)

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

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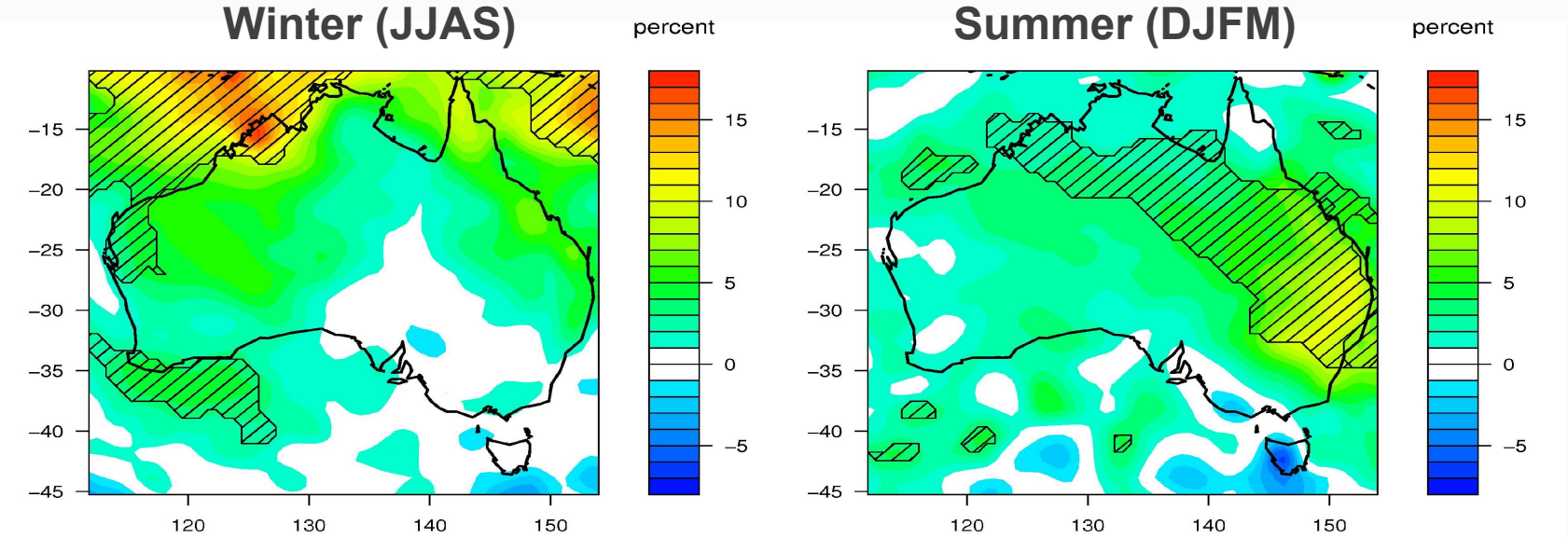
van Vliet et al. (2016)

Solar Radiation Inter-annual Variability



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

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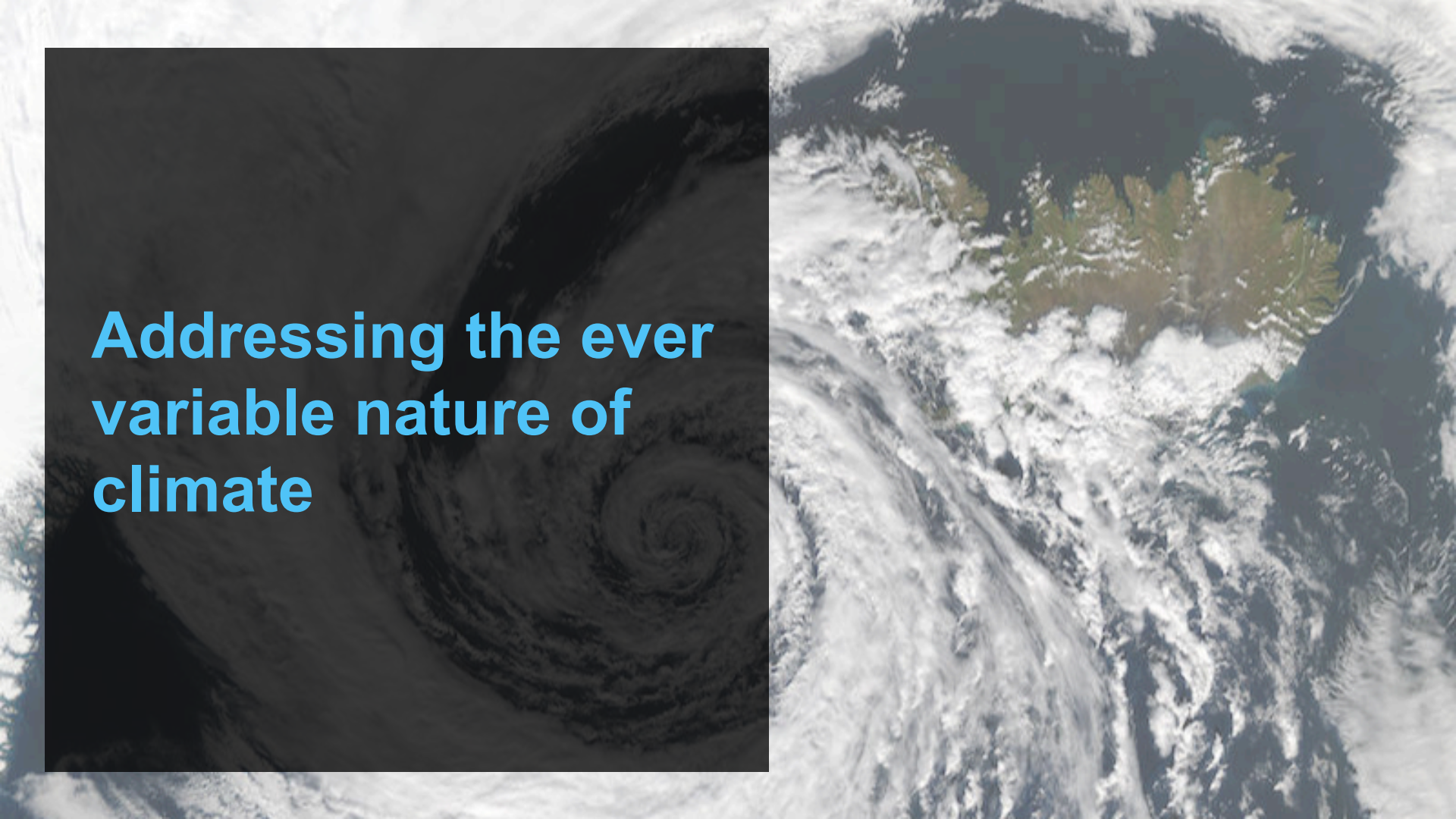
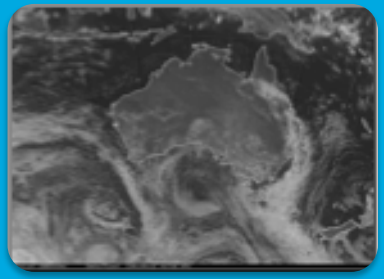
Davy and Troccoli (2012)

Addressing the ever variable nature of climate

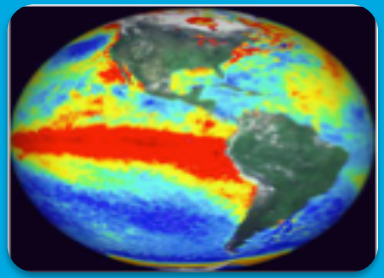


Meteorological Services



Weather

- National Meteorological & Hydrological Services
- E.g. Wind and Solar Energy Forecasting Systems



Climate

- E.g. Global Framework for Climate Services (GFCS)
- E.g. EU Copernicus Climate Change Services (C3S)

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Weather Services

- Very mature: 30+ years of experience
  - Also financial products since late 1990's
- Products well understood by many users
  - Relatively easy to identify needs
  - Users wish to be updated about latest developments in weather products but otherwise develop their own services
  - Regular (e.g. annual) users meetings and/or specific training normally offered by weather service providers

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Climate Services

- Relatively recent: ca. 10 years
  - First products from International Research Institute (IRI)
- Services still under developments
  - Large uncertainties in climate forecast/projections makes it more difficult for users to ascertain real value of climate information
  - Need to provide concrete examples of how to use climate information in practice

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But...

What is a Climate Service?

A set of actions/tools aimed at helping ‘people’ make the best use of climate information so as to improve their ‘business’

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A UN-led Initiative

GFCS provides a worldwide mechanism for coordinated actions to enhance the quality, quantity and application of climate services.

Energy has been recently adopted as a priority area

See Energy exemplar at: http://tiny.cc/GFCS_Energy_Exemplar

More info at: http://gfcs.wmo.int/

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Global Framework for Climate Services

- Established during the 3rd World Climate Conference in 2009
  - Endorsed by 13 heads state or government, 81 ministers and 2,500 scientists
- Partners Advisory Committee
  - European Commission, FAO, IFRC, UNDP, UNEP, UNISDR, WFP, WMO, World Bank, World Business Council for Sustainable Development and others
- 10-year initial implementation plan designed over three years by dozens of experts, backed by initial financing

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GFCS
GLOBAL FRAMEWORK FOR CLIMATE SERVICES

Areas of focus for energy

1. Identification & Resource Assessment
2. Impact assessments (incl. infrastructure and environment)
3. Site Selection & Financing
4. Operations & Maintenance
5. Energy Integration
   - ✓Market trading (incl. supply and demand forecasts) & Insurance
   - ✓Energy efficiency

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A major EU programme

Copernicus is harnessing world leading science and technology to equip society to understand and adapt to our changing environment.

Six Information Services: Land, Marine, Atmosphere, Climate, Security and Emergency

Make use of satellite, reanalysis and forecast data via data stores

Funding: €4.3 billions for 2014-2020

Data is full, free and open to all

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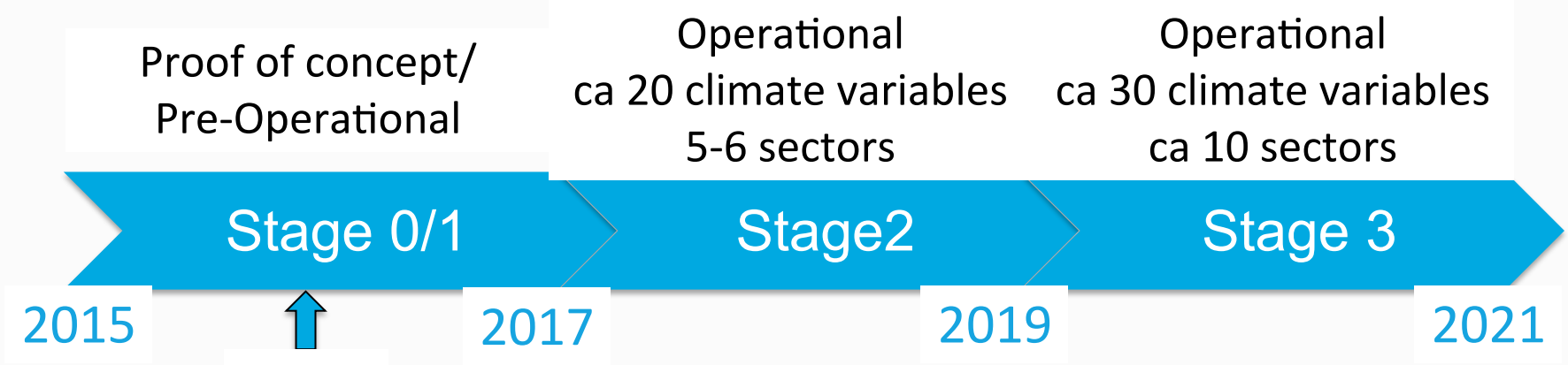
- **Seven services: 2x Energy, 2x Water, 1x Agriculture, 1x Cities, 1x Insurance**
- **Aim: to achieve operational climate services co-designed and co-developed with final users**



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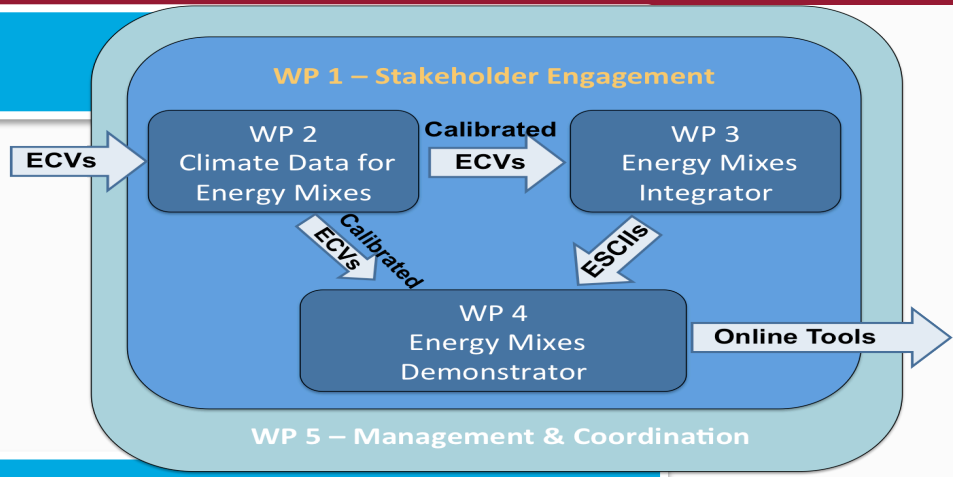
European Climatic Energy Mixes (ECEM)

Copernicus Europe's eyes on Earth

Climate Change Service
climate.copernicus.eu

C3S ECEM in brief

- Budget: €1.6 m
- Length: 27 mth (from Nov 2015)
- Six partners: UEA (lead) EDF, U Reading, Met Office, ARMINES and ENEA



Target: proof-of-concept or demonstrator

Stakeholder engagement central to ECEM

- Five stakeholder workshops, one every 6 months
- A tailored engagement plan

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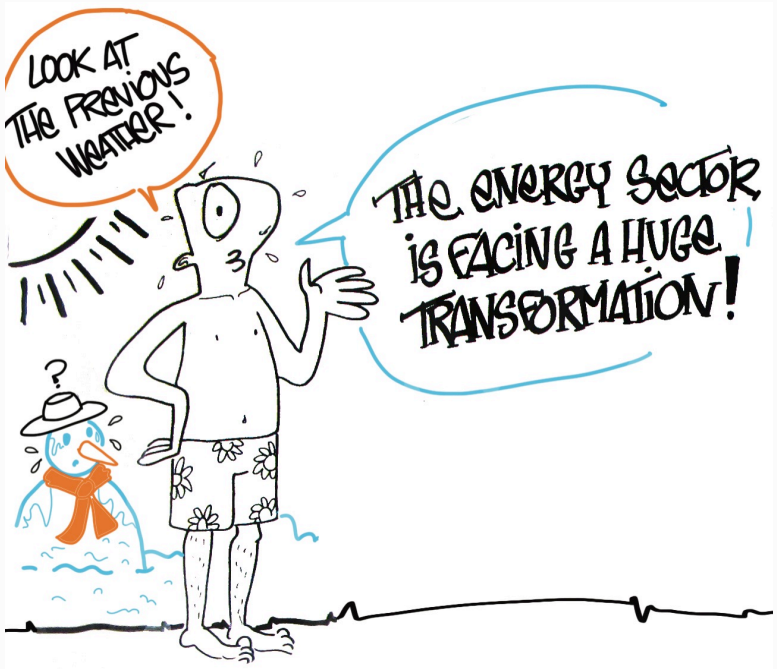
UEA University of East Anglia · EDF · University of Reading · Met Office · ARMINES · ENEA

ECMWF · European Commission

European Climatic Energy Mixes (ECEM)



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**.

European Climatic Energy Mixes (ECEM)

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.

European Climatic Energy Mixes (ECEM)

Climate Change Service
climate.copernicus.eu

- **Energy Mix assessment for:**
  - **Present day**
  - **Seasonal Forecasts**
  - **Climate Projections**

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ECMWF · European Commission

European Climatic Energy Mixes (ECEM)

Copernicus
Europe's eyes on Earth

Climate Change Service
climate.copernicus.eu

Calibrated Climate Variables

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

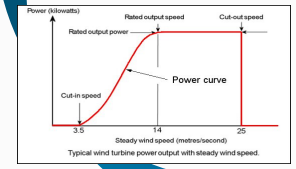
+Ancillary

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

+ Extreme Events Case Studies

Impacts of Climate Variability & Change on Energy Variables

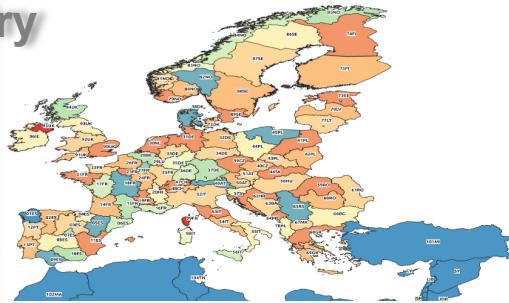
Define models & transfer functions
Select / Gather relevant datasets



Energy Variables

- Demand
- Hydro Power
- Wind Power
- Solar Power
- Thermal Power

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



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European Climatic Energy Mixes (ECEM)

Copernicus
Europe's eyes on Earth

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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.

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ECMWF

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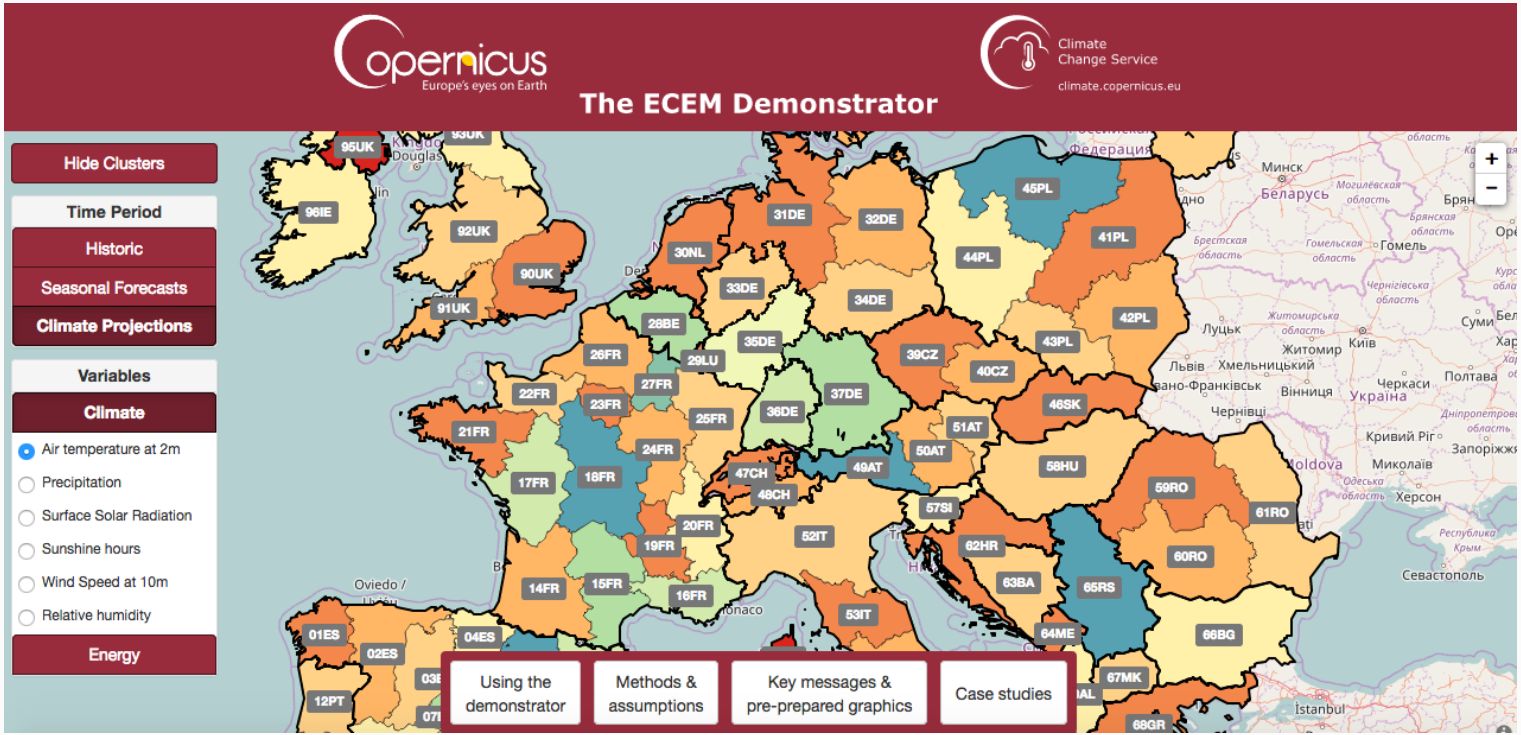
An online interactive tool to test energy mixes



ECEM: http://ecem.climate.copernicus.eu/

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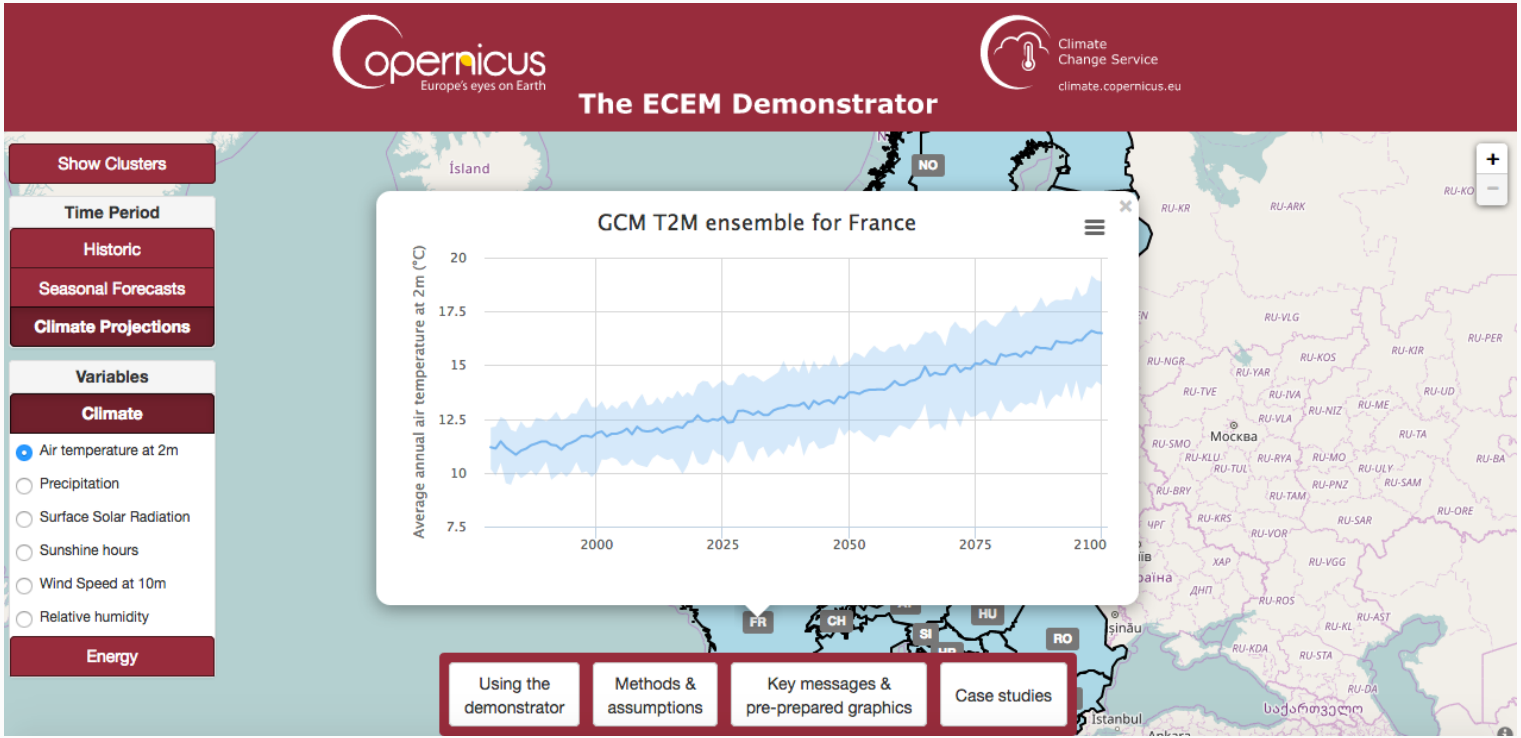
European Commission

An online interactive tool to test energy mixes



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ECMWF

European Commission

Summary

- Energy and Meteorology are closely connected
- Energy systems are already experiencing sizeable impacts, which are likely to become more severe
- Climate services are emerging as robust useful tools for Energy planning, and operations/maintenance
- There is a strong need:
  - to improve knowledge of meteorological data and processes
  - to improve access to meteorological and energy data for improved products

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Get in touch!

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