

# Engagement Models for the Earth Science Community

The background of the slide is a photograph of three wind turbines. The turbines are dark silhouettes against a vibrant sunset sky with shades of orange, red, and purple. The sun is low on the horizon, creating a strong glow. The turbines are positioned in a row, with the one on the left being the closest and the one on the right being the furthest.

Alberto Troccoli

World Energy & Meteorology Council & University of East Anglia  
with input from Copernicus, ECEM and GFCS colleagues

NASA Energy Workshop, Arlington VA (USA), 27 April 2016

# My main message



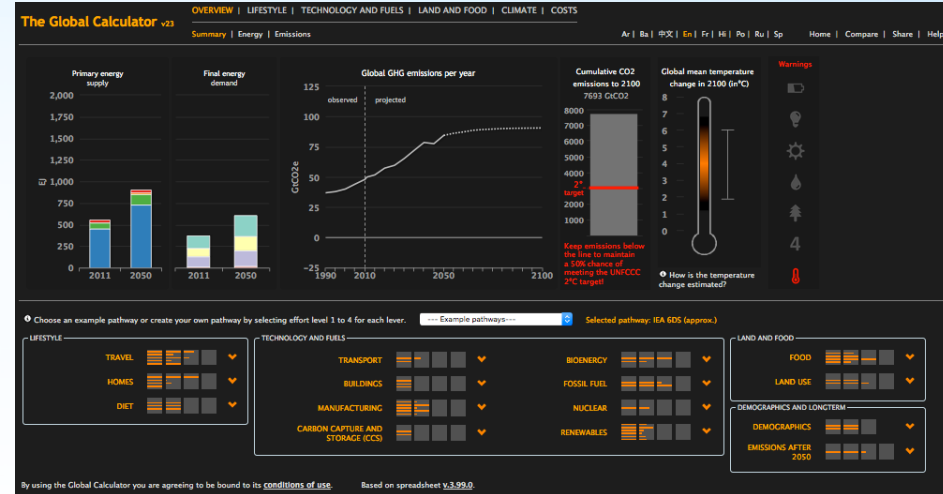
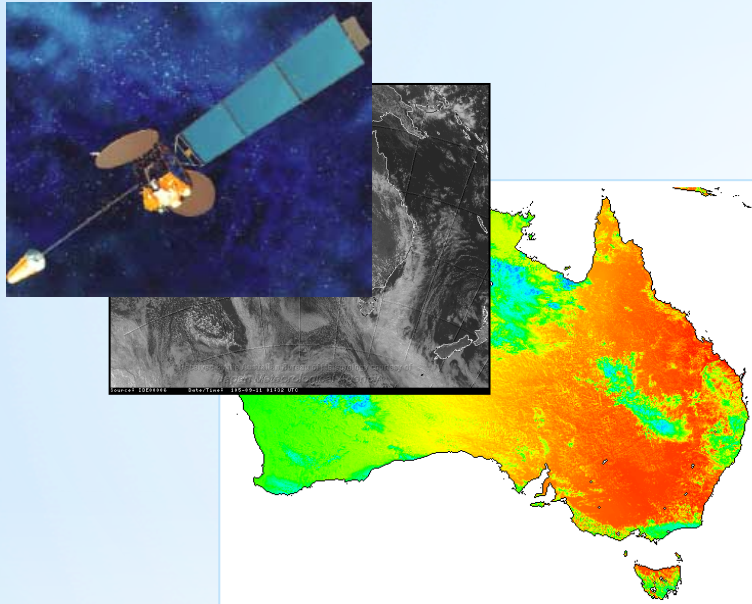
**Product or Service?**



World Energy &  
Meteorology Council



# My main message



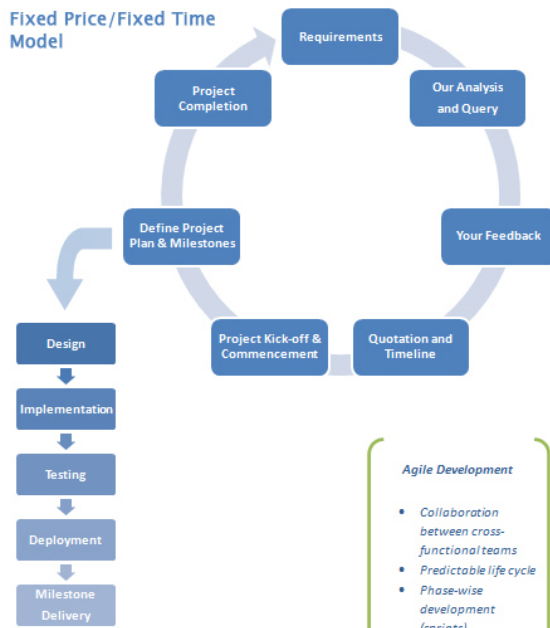
# Product or Service?



World Energy &  
Meteorology Council

# Engagement models

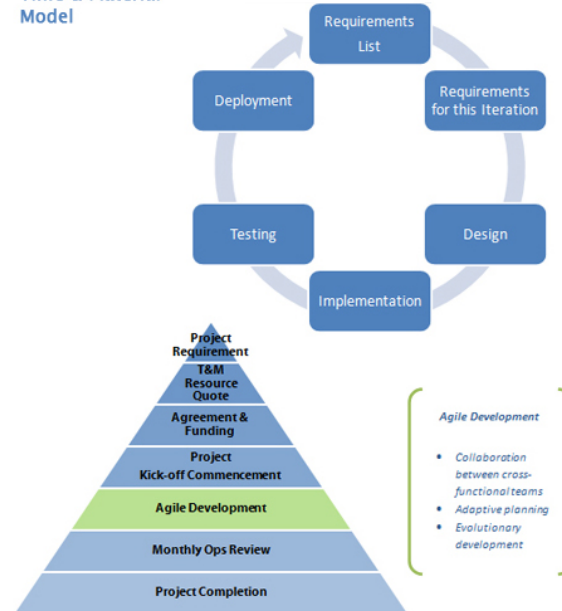
Fixed Price/Fixed Time Model



## Agile Development

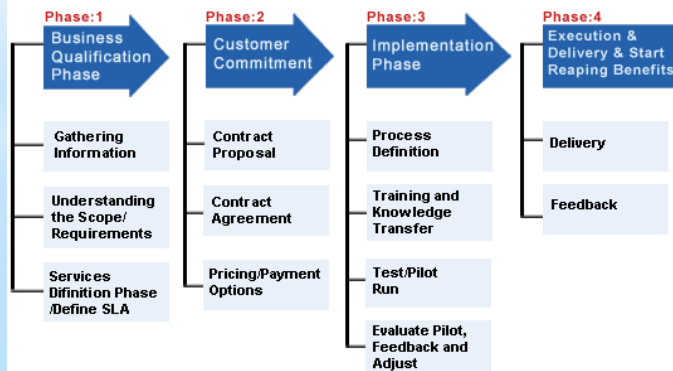
- Collaboration between cross-functional teams
- Predictable life cycle
- Phase-wise development (sprints)

Time & Material Model



- Agile Development
- Collaboration between cross-functional teams
  - Adaptive planning
  - Evolutionary development

Engagement Models



Our engagement model

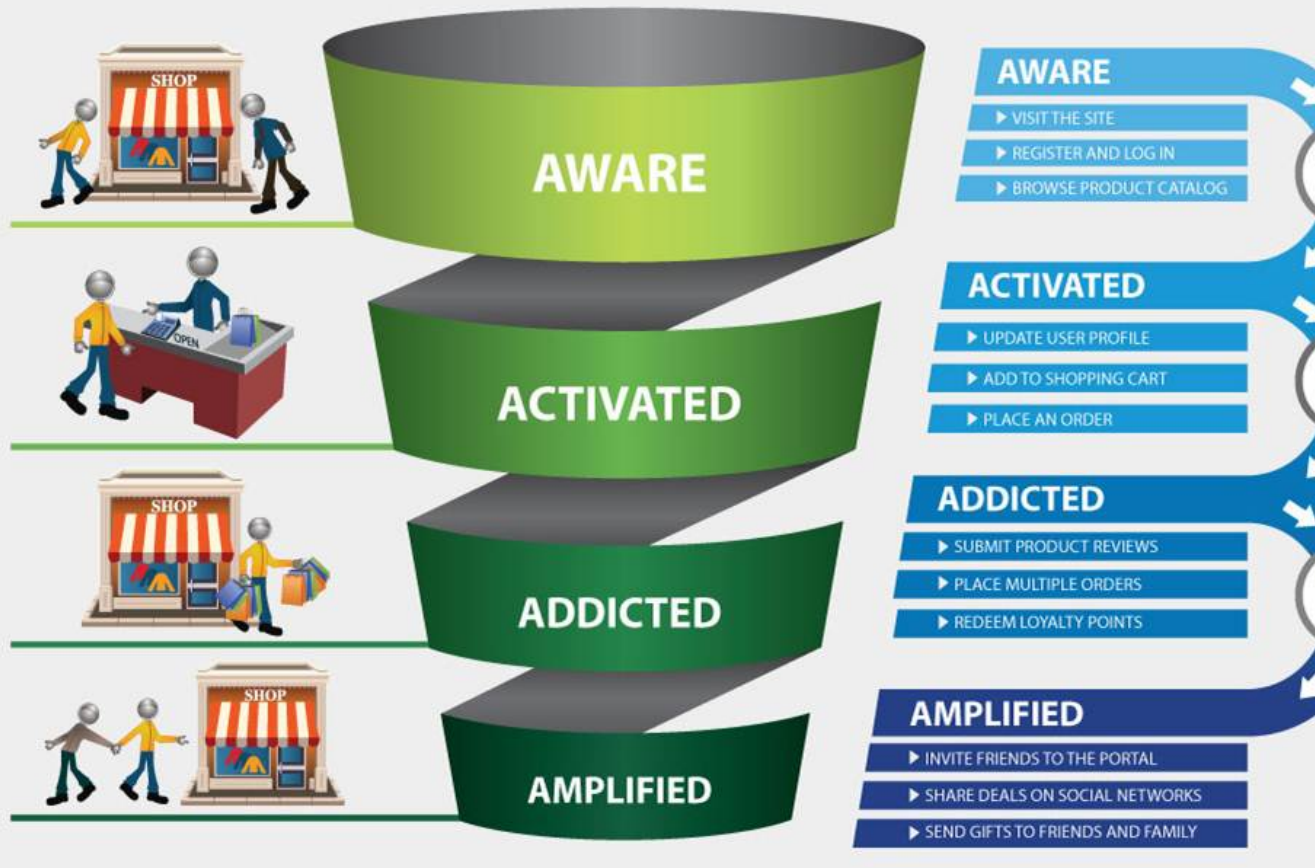


World Energy & Meteorology Council



# Engagement models

## 4 As of User Engagement



# Key considerations

Earth Science field is broad

- Focus on Weather and Climate

Maturity of the field

Push versus pull

- Development level of user requirements

Strength of relationship

Data Policy

Differentiation develop-ing/ed worlds



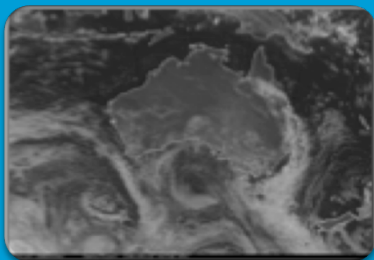
World Energy &  
Meteorology Council

# A Selection of Services



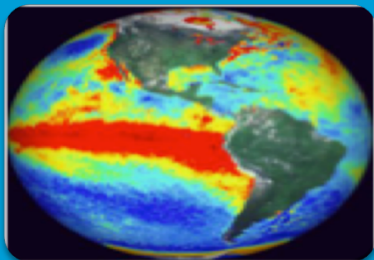
## Observations

- Ground station
- Satellite
- [Re-analyses]



## Weather

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



## Climate

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

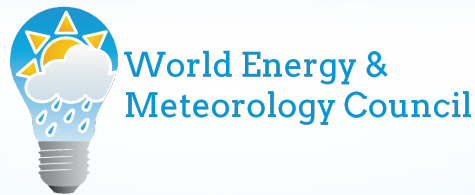


World Energy &  
Meteorology Council

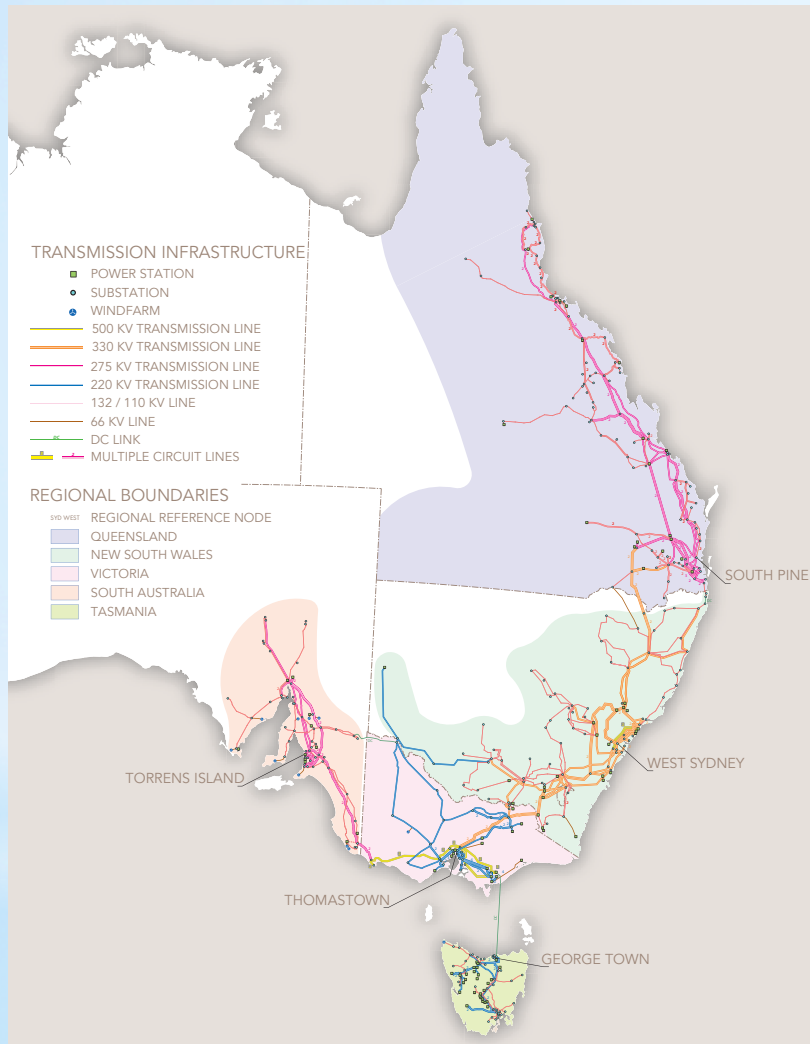


# Weather Services

- 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



# Australian National Energy Market



Run by Australian Energy Market Operator (AEMO)

- ~**50GW** installed capacity
- Market coupled to physical operation at 5 min intervals

Installed Wind & Solar:

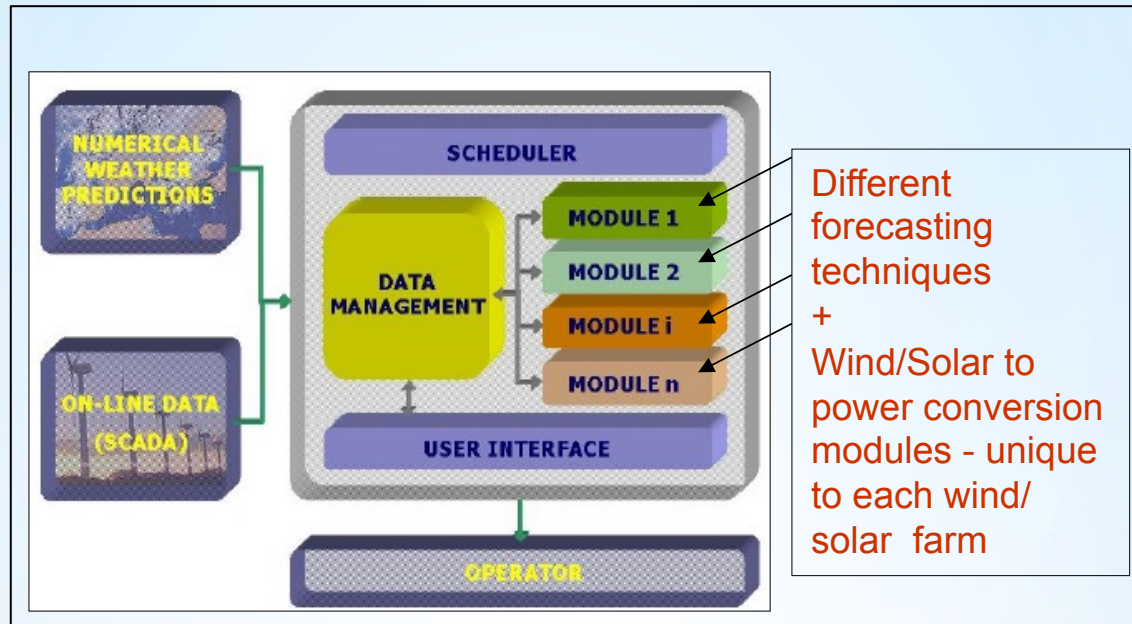
- Wind ca. **5 GW** → ~**10 GW** by 2030
- Solar PV ca. **5 GW** → ~**13 GW** by 2030

**A forecasting system was required**  
(compulsory for power stations > 30 MW)



World Energy &  
Meteorology Council

# Wind/Solar Energy Forecasting Systems



AEMO in consultation with the Department of 'Energy' and Research Institutions developed the Australian Wind Energy Forecasting System (**AWEFS**) first (operational since 2008) and the corresponding for Solar Energy (**ASEFS**, 'operational' since 2014). These projects cost each around A\$ 7 million for ca. 2 years.



World Energy &  
Meteorology Council



# Climate Services

- Relatively recent: ca. 10 years
  - Early products from International Res. 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



# A major EU programme

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

**Funding: €4.3 billions for 2014-2020**

**Six Information Services: Land, Marine, Atmosphere\*, Climate\*, Security and Emergency**  
(\* managed by ECMWF)

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



# A major EU programme

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

**Funding: €8 billion for 2014-2020**

**Six Information Services: Land, Marine, Atmosphere\*, Climate Change, Security and Emergency**  
(\* provided by ECMWF)

**Data is full, free and open to all**

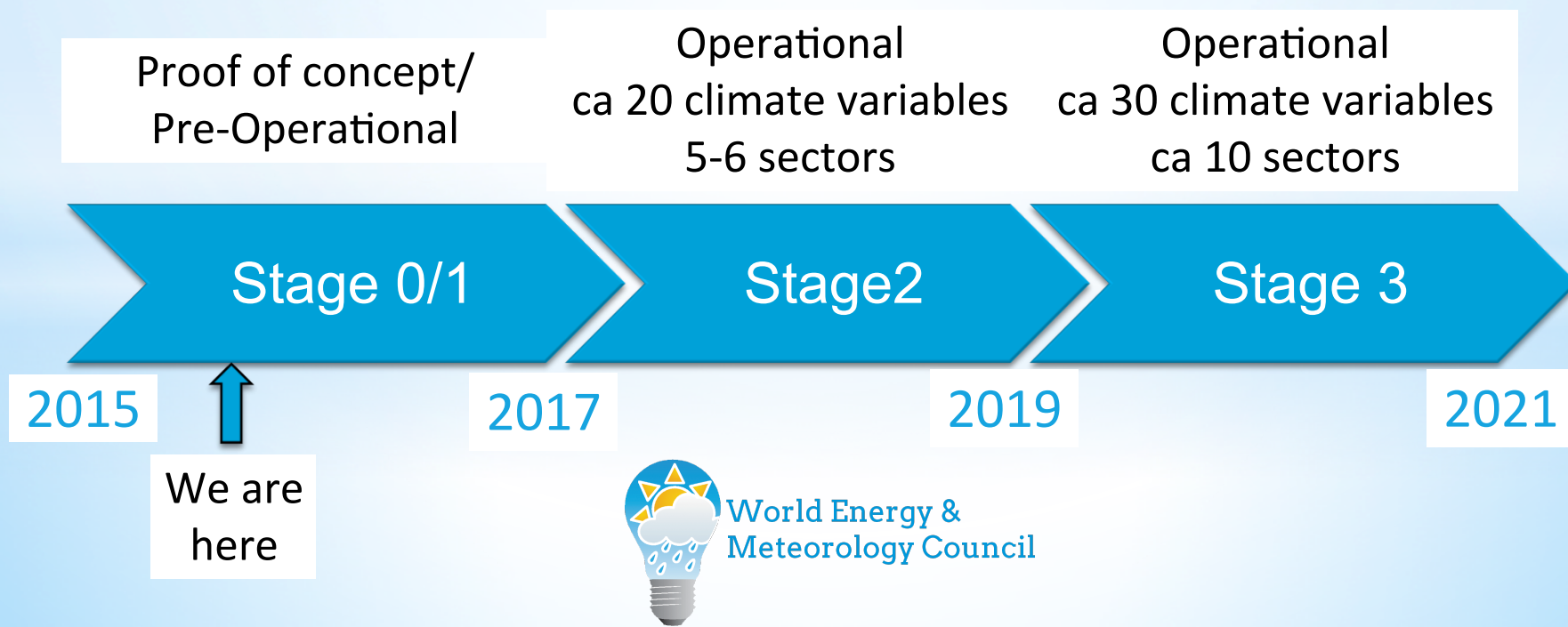
Make use of satellite, reanalysis and forecast data via data stores



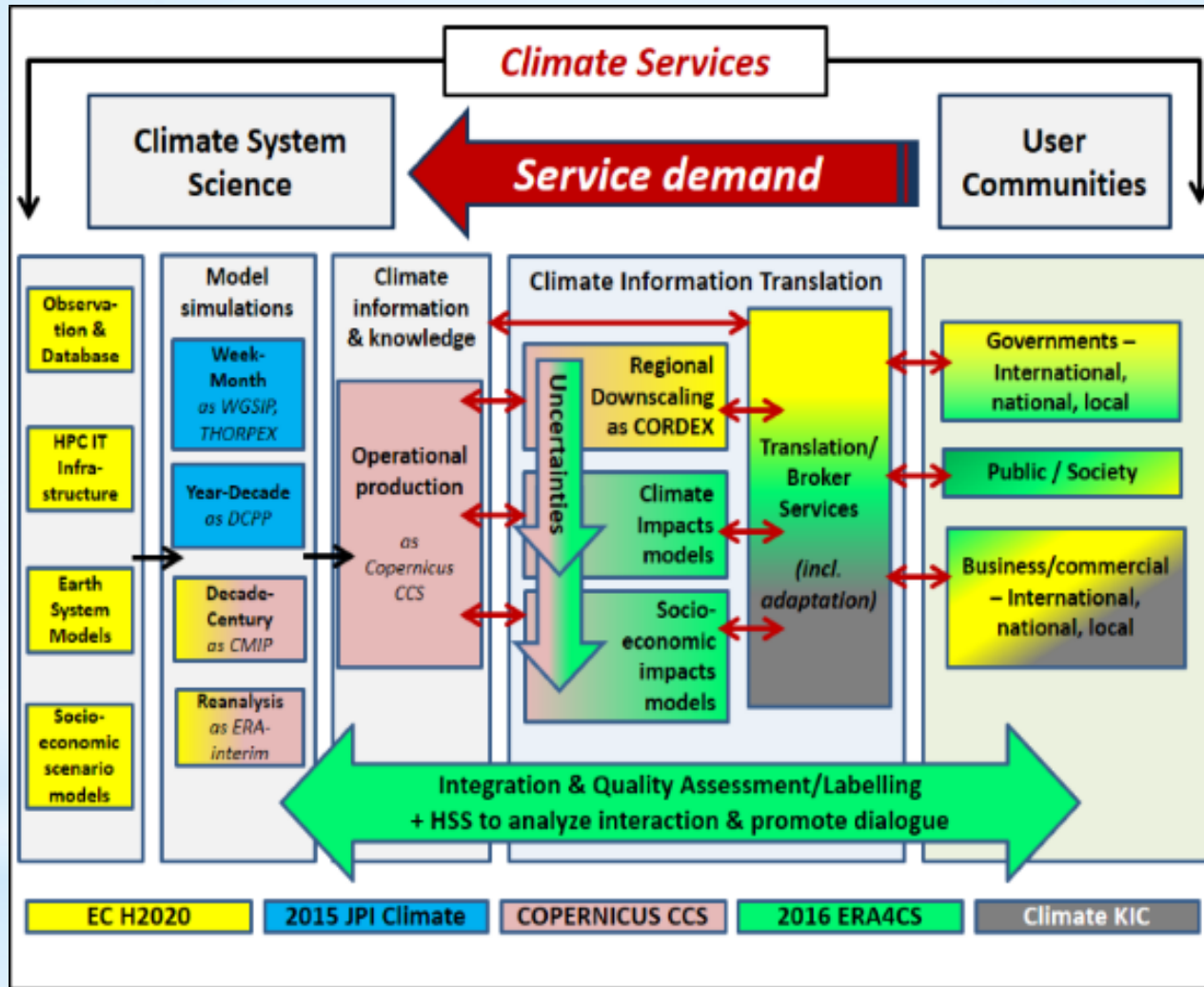


## Copernicus Climate Change Service (C3S)

- 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



# Role of C3S in European landscape



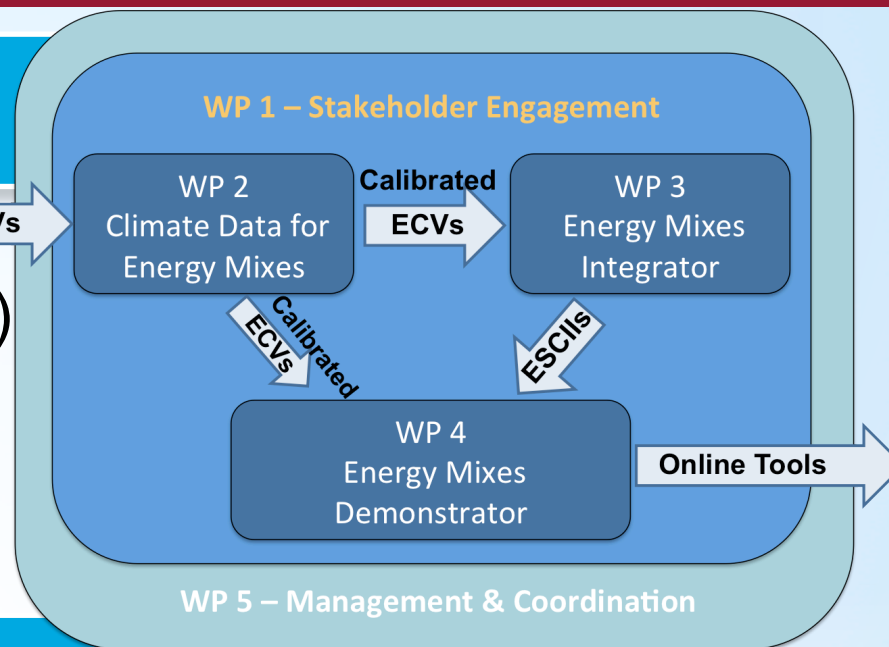
World Energy &  
Meteorology Council

P. Monfray (JPI Climate) & André Jol (EEA)

## 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

ECVs



Target: proof-of-concept or demonstrator

Stakeholder engagement central to ECEM

- Five stakeholder workshops, one every 6 months
- Tailored engagement plan



# How did ECEM come about?

E-Highway 2050, a 4-year EU project led by transmission operators, looked at European system adequacy using five scenarios ... however no account of climatic changes

## Five scenarios

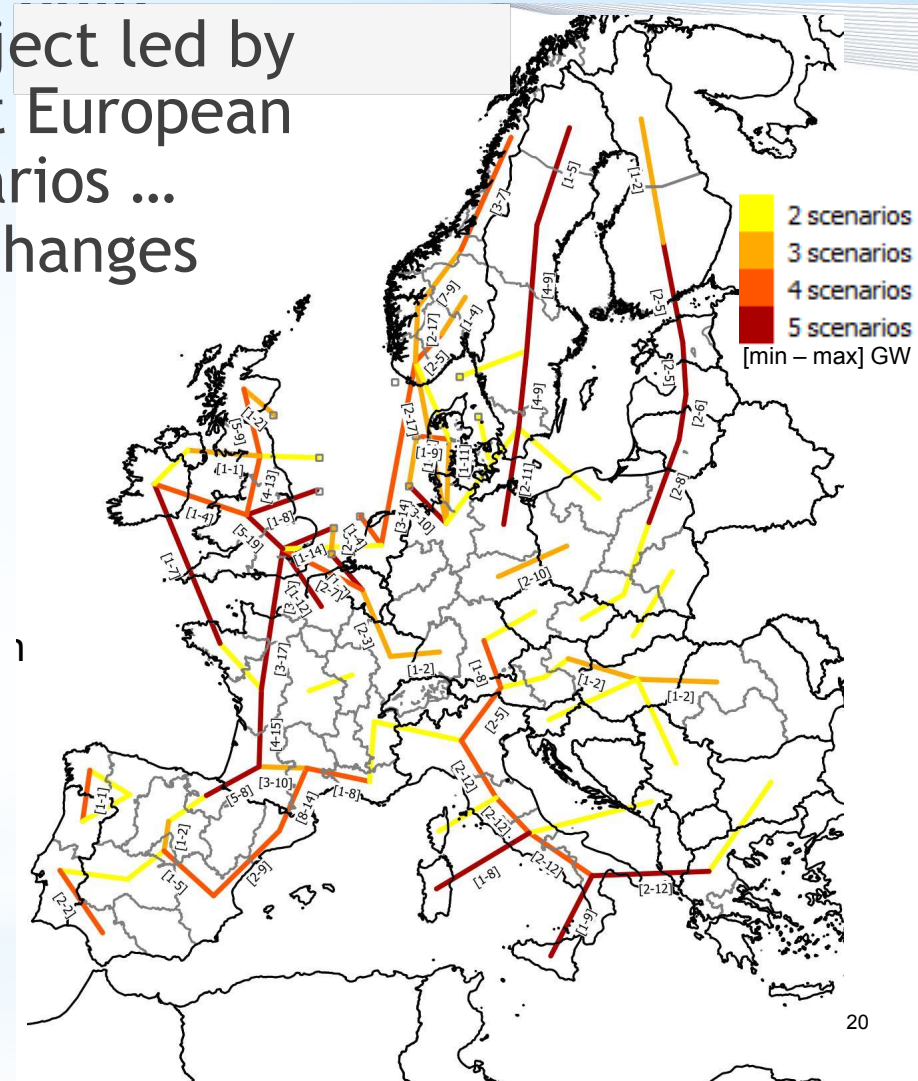
100%  
RES

Large  
scale  
RES

Big &  
market

Fossil &  
nuclear

Small &  
local



20

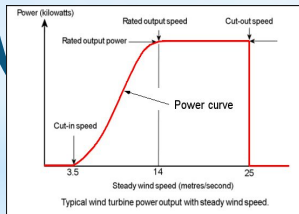
# From Climate variables to Energy systems

## Calibrated ECVs (WP2)

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

+Ancillary

Define Models / Transfer Functions  
Select / Gather relevant Datasets



## Energy Variables

Hydro Power

Demand

Wind Power

Solar Power

Thermal Power

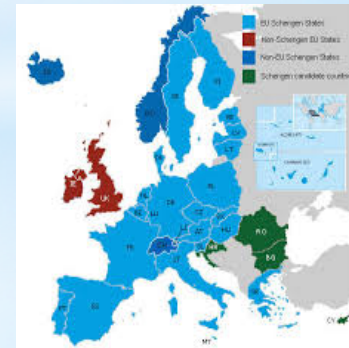
- Skill & Reliability
- Assessment of Seasonal Forecasts of Energy Variables

+ Extreme Events Case Studies

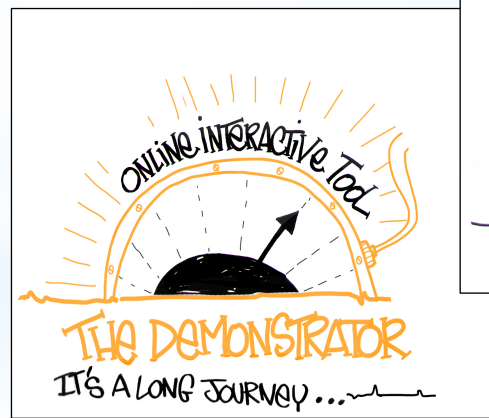
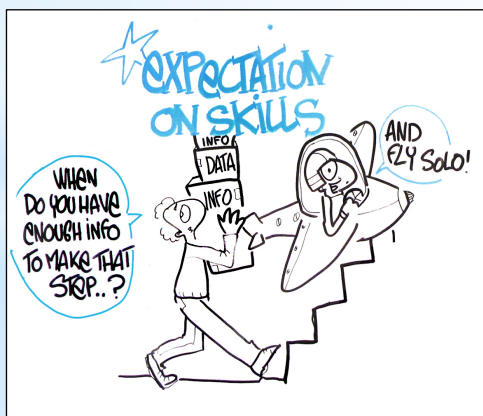
Impacts of Climate Variability & Change on Energy Variables

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

WP4



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.



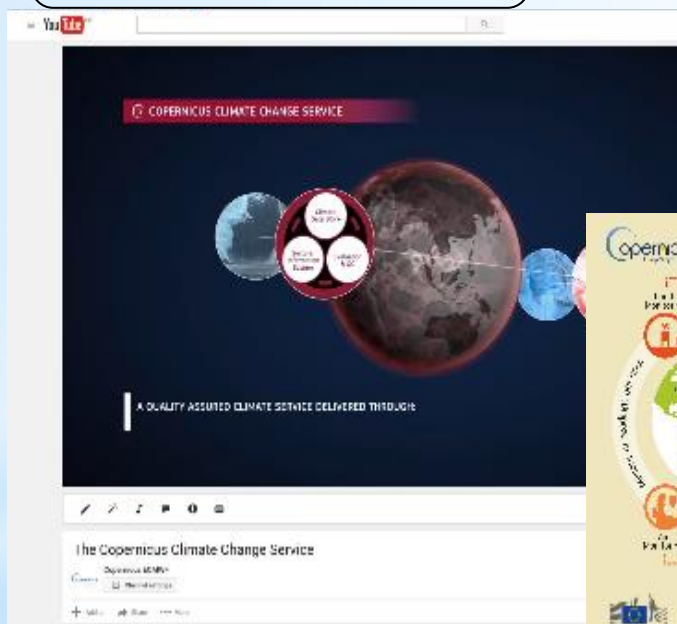






## Developing material

### Video & animations



### Brochures & postcards



### Infographics



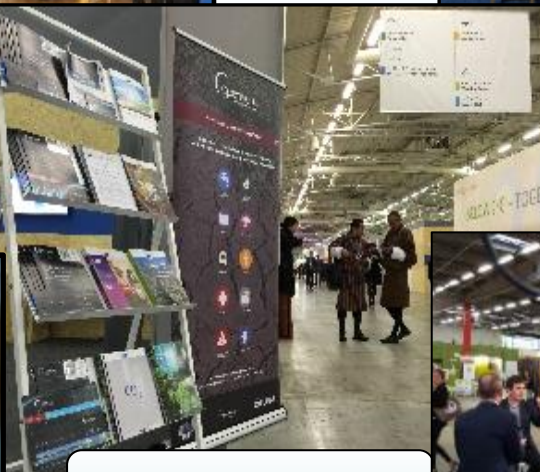
World Energy &  
Meteorology Council

## Attending conferences & interacting with the media



**GEOXII**

**Energy Live  
News  
Conference**



**COP21**



World Energy &  
Meteorology Council

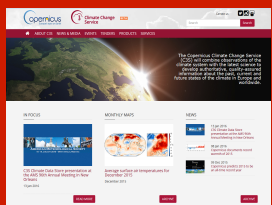




More Material –bringing the services to life –  
An interactive globe, modular exhibition stand, 3D sensor models



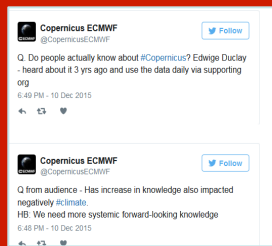
Pan-Europe Roadshow – Parliaments, Gov't Offices, Universities  
National & International Conferences – GEO, EGU, COP22, LPS,  
ESOF



Research – Website usability testing; audience awareness research



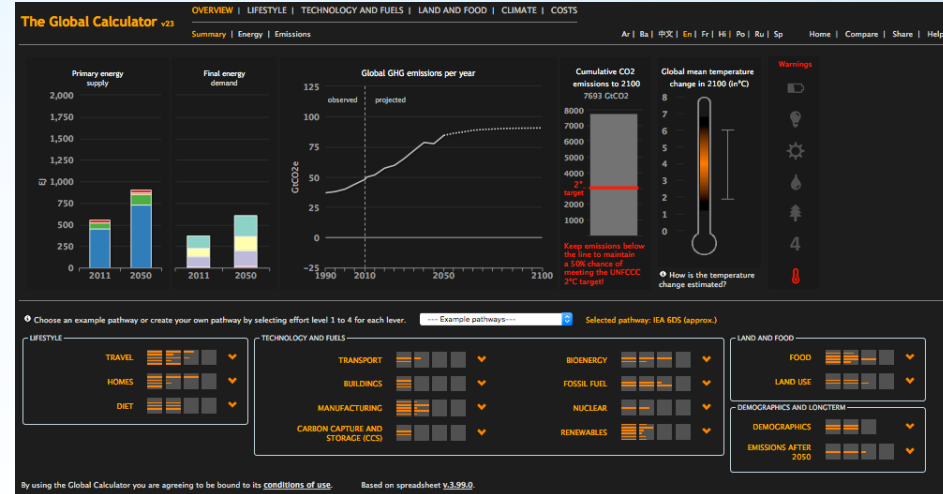
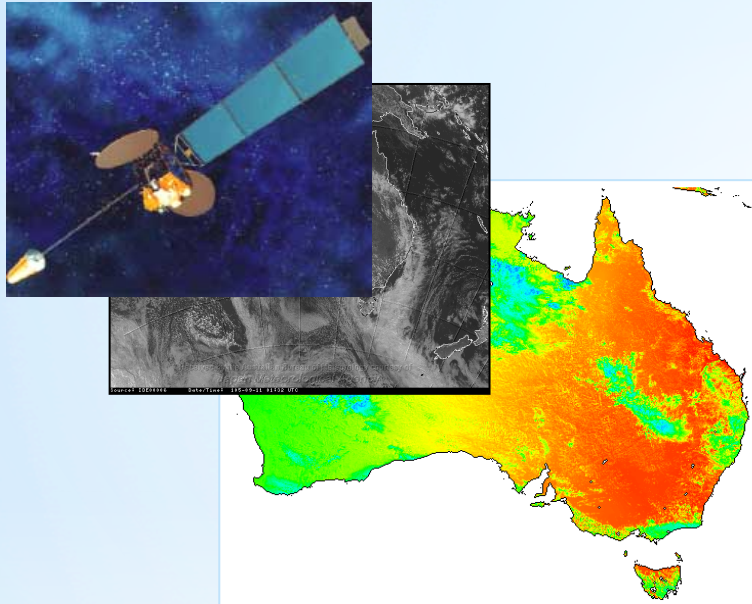
Training – How to videos, e-learning, Information days, workshops



Events – Third party conferences and expositions  
+ ECMWF originated – Hack days, Web chats, Twitter Q&As



# My main message



# Product or Service?



World Energy &  
Meteorology Council



Thank you

