



Climate Change

# C3S Energy Stakeholder Workshop

## Consultation on data and indicators



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# C3S Energy – Enhanced operational service for the Energy Sector

Lot 1 (Oct 2022—Sep 2025): Enhanced Energy Service, to produce operational high-quality global climate and energy indicators for the energy sector.

The **objectives** are:

- To deliver an enhanced operational energy service at the **global scale** extending the current operational service at the European scale and covering three streams: past climate, multi-model seasonal and projections
- To implement service fully based and running on the C3S Climate Data Store (CDS) infrastructure

**Activities** include:

- An increased temporal resolution of climate and/or energy indicator
- The development of enhanced toolbox applications, including for seasonal forecast
- The development of specific tools and continuous engagement with user communities through updated gap analysis and the development of case studies



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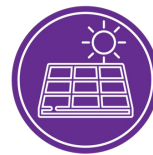
# C3S Energy Indicators and Streams

## Indicators



Conversion models  
from climate variables  
to energy indicators  
(statistical & dynamical  
models)

PV Solar power  
generation



Wind power generation  
(onshore and offshore)



Electricity Demand



Hydropower generation  
(run-of-river and reservoir)

## Streams

Historical

Seasonal Forecasts

Projections

2100

1979

Present +6 months



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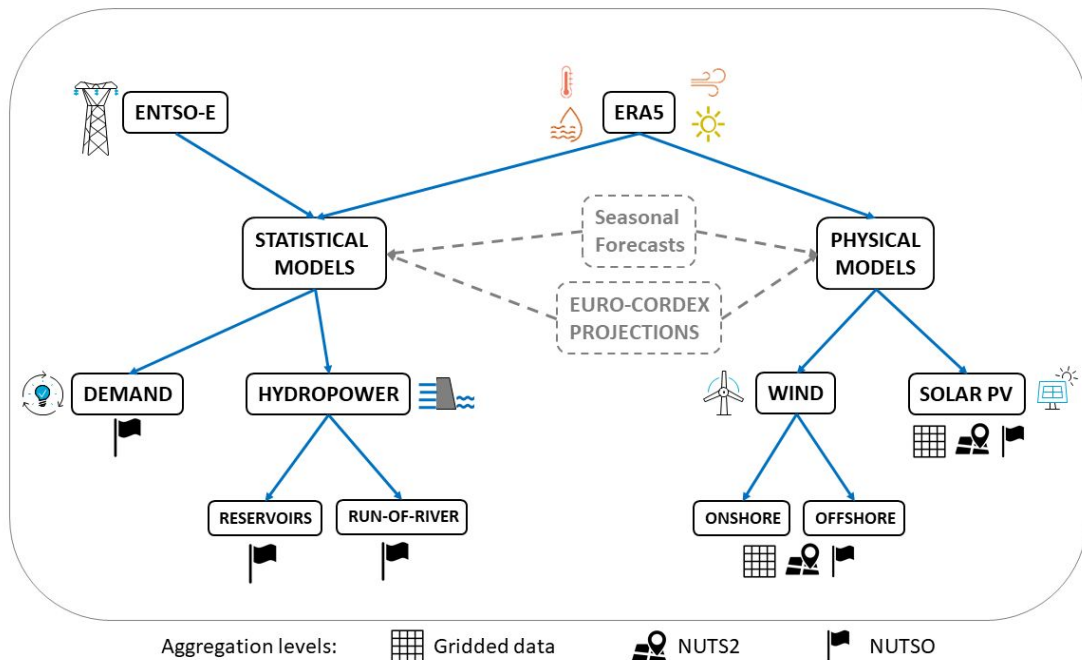


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# C3S Energy Modelling Strategy

The energy conversion models are:

- Trained over the historical period, using measured data, esp. from ENTSO-E Transparency portal
- Applied to the seasonal forecast and projection streams, as well as back in time for historical
- Applied to any location in Europe even if no specific information is available (installed systems or time series of generation)



Dubus et al. (2023, to appear)

→ The flexibility of the conversion models is favoured over accuracy



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## C3S Energy – Climate Indicators by Stream

**Table 3:** Summary of products to be delivered by C3S Energy. Note on abbreviations used in the Table: EC stands for ECMWF, MF for Météo-France, MO for Met Office, E-Cordex: Euro-Cordex, BA: Bias-Adjusted, C&C: Country and Cluster (the latter are sub-country regions/areas), B.o.: Based on.

Variable	Timescale	Source	Highest Temporal Resolution	Highest Spatial Resolution	Spatial Aggregation
CLIMATE INDICATORS					
Temperature	Historical	ERA5	1 hour	0.25 deg	C&C
	Seasonal	EC, MF, MO	1 day	1 deg	Country
	Projection	E-Cordex (BA)	3 hour	0.25 deg	C&C
Precipitation	Historical	ERA5	1 hour	0.25 deg	C&C
	Seasonal	EC, MF, MO	1 day	1 deg	Country
	Projection	E-Cordex (BA)	1 day	0.25 deg	C&C
Wind (10 m and 100 m)	Historical	ERA5	1 hour	0.25 deg	C&C
	Seasonal	EC, MF, MO	6 hours	1 deg	Country
	Projection	E-Cordex (BA)	3 hour	0.25 deg	C&C
Solar Radiation at surface	Historical	ERA5 (BA)	1 hour	0.25 deg	C&C
	Seasonal	EC, MF, MO	1 day	1 deg	Country
	Projection	E-Cordex (BA)	3 hour	0.25 deg	C&C
Mean Sea Level Pressure	Historical	ERA5	1 hour	0.25 deg	Country
	Projection	Euro-Cordex	1 day	0.25 deg	Country



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## C3S Energy – Energy Indicators by Stream

ENERGY INDICATORS					
Electricity Demand	Historical	B.o. ERA5	1 day	Country	Country
	Seasonal	B.o. EC, MF, MO	1 day	Country	Country
	Projection	B.o. E-Cordex	1 day	Country	Country
Wind Power (onshore and offshore)	Historical	B.o. ERA5	1 hour	0.25 deg	C&C
	Seasonal	B.o. EC, MF, MO	6 hours	1 deg	Country
	Projection	B.o. E-Cordex	3 hour	0.25 deg	C&C
Solar Power (PV)	Historical	B.o. ERA5	1 hour	0.25 deg	C&C
	Seasonal	B.o. EC, MF, MO	1 day	1 deg	Country
	Projection	B.o. E-Cordex	3 hour	0.25 deg	C&C
Hydro Power (Run-of-River and Reservoir)	Historical	B.o. ERA5	1 day	Country	Country
	Seasonal	B.o. EC, MF, MO	1 day	Country	Country
	Projection	B.o. E-Cordex	1 day	Country	Country



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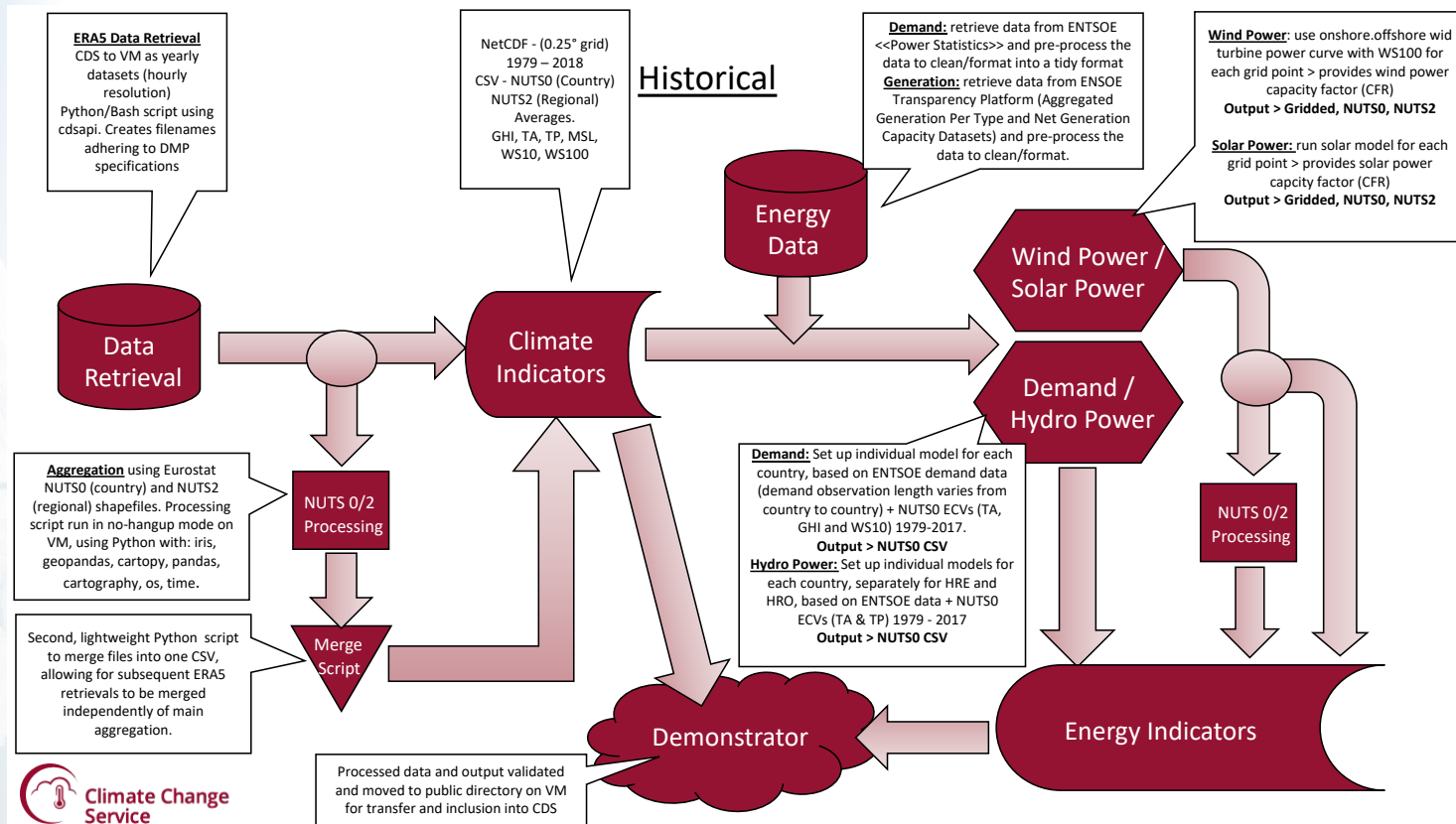






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# C3S Energy – Historical Stream Workflow



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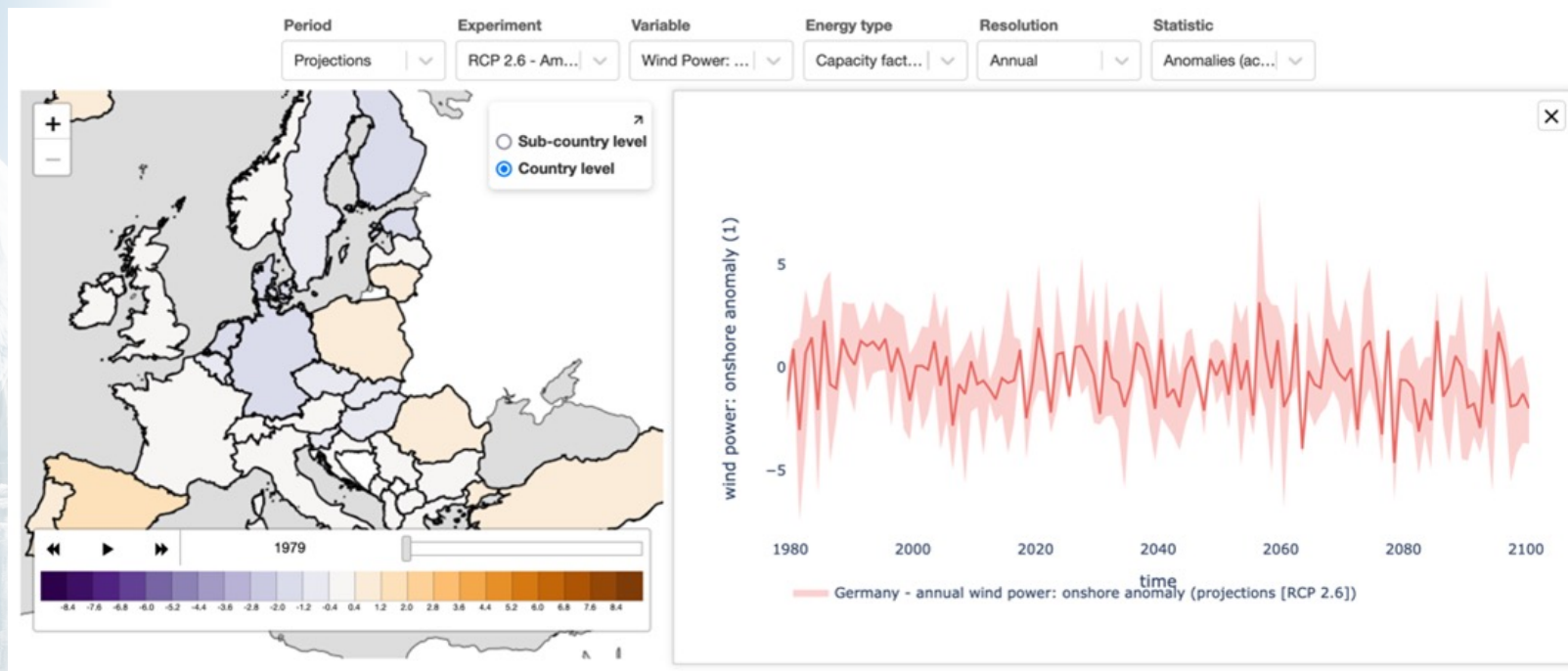
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# C3S Energy – European Energy and Climate Data Explorer



Current operational C3S Energy CDS toolbox

<https://cds.climate.copernicus.eu/cdsapp#!/software/app-energy-explorer-europe?tab=app>



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## C3S Energy – Stakeholder Workshop: Consultation on data and indicators

The **objectives** of the Workshop are:

1. To collect additional information about **global energy data availability** (specifically for wind, solar, hydropower, and electricity demand) and how to best use them
2. To gather suggestions for **potential additional energy indicators** to be developed as part of the C3S Enhanced Energy operational system

AGENDA		
9:00 - 9:15 (All in UTC)	<b>Welcome</b> <i>Copernicus Climate Change Service (C3S) – Intro</i>	Alberto Troccoli (ICS & WEMC) Chiara Cagnazzo (ECMWF & C3S)
9:15 - 9:25	<b>Introduction</b> <i>The C3S Enhanced Energy Service</i>	Alberto Troccoli (ICS & WEMC)
9:25 - 10:05	<b>Discussion Topic 1</b> <i>Global Energy Data</i>	Chair: Mattia Zaramella (ICS & UniPD)
10:05 - 10:10	<b>Break</b>	
10:10 - 10:45	<b>Discussion Topic 2</b> <i>Ideas for new energy indicators</i>	Chair: Laurent Dubus (RTE & WEMC)
10:45 - 11:00	<b>Wrap up and next steps</b>	Alberto Troccoli (ICS & WEMC)



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## C3S Energy Workshop next steps

Post-Workshop:

1. We will summarise the workshop discussion
2. Continue to reach out to additional stakeholders to continue collect information about available data
3. In person C3S Energy Workshop **26 June 2023**, 13:30-17:30 CEST, just before the

The banner is divided into two main sections by a central vertical line. The left section has a dark blue background with the text 'icem 2023' in white and purple, followed by '27 - 29 JUNE 2023' and 'PADOVA, ITALY'. The right section has a purple background with the text '7<sup>th</sup> International Conference Energy & Meteorology' and 'TOWARDS CLIMATE-RESILIENT ENERGY SYSTEMS' in white. A pink box at the bottom right of the right section contains the text 'IN PERSON CONFERENCE'.

**icem**  
**2023**  
27 - 29 JUNE 2023  
PADOVA, ITALY

7<sup>th</sup> International Conference  
Energy & Meteorology

**TOWARDS CLIMATE-RESILIENT  
ENERGY SYSTEMS**

IN PERSON CONFERENCE

<https://www.wemcouncil.org/wp/icem-2023>



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