Weather, Water and Climate Data to Boost the Renewable Energy Uptake

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• Climate Change: Facing Reality
• Vulnerability of the Energy Sector to Climate Change Impacts
• Renewable Energy Transition: Key to Climate Change Solutions
• Integrated Weather and Climate Services in Support of Net Zero Energy Transition
• Case studies
This visualization (one year, one bar) represents the evolution of the Earth’s surface temperature. We are at +1.15°C and this is the result of human activities, with an increase in the impacts in the world (IPCC).

Source: IPCC AR6 WG1
Climate Change: Facing Reality (2022 Climate Indicators)

Temperature and Accumulated Heat

Surface Temperature

Global mean temperature compared to 1850-1900 average

Ocean Heat

Atmospheric Composition

CO2

Global mean CO2 (ppm)

Acidification

Ocean and Water

Global mean ocean pH (pH)

Sea level

Cryosphere

Glaciers

Arctic and Antarctic Sea Ice Extent

Global State of the Climate 2022
Climate Change: Facing Reality (2022 Climate Indicators)

Around 90% of the energy trapped in the climate system by greenhouse gases goes into the ocean.

In East Africa, rainfall has been below average in five consecutive wet seasons, the longest such sequence in 40 years.

Record-breaking heatwaves affected China and Europe during the summer.

Record-breaking rain in July and August led to extensive flooding in Pakistan.

Despite continuing La Niña conditions, 58% of the ocean surface experienced at least one marine heatwave during 2022.

Global mean sea level continued to rise in 2022, reaching a new record high for the satellite altimeter record (1993–2022).

The annual increase in methane concentration from 2020 to 2021 was the highest on record.

In the hydrological year 2021/2022, a set of reference glaciers with long-term observations experienced an average mass balance of −1.18 metres water equivalent (m w.e.).

The years 2015 to 2022 were the eight warmest in the 173-year instrumental record.
Climate Change Impacts on the Energy sector

- In 2020, 87% of global electricity generated from thermal, nuclear and hydroelectric systems directly depended on water availability;

- Meanwhile, 33% of the thermal power plants that rely on freshwater availability for cooling are already located in high water stress areas;

- 15% of existing nuclear power plants are located in high water stress areas. The share expected to increase to 25% in the next 20 years;

Figure 2: Location of selected energy-related infrastructure and water stress levels, 2020

Source: WMO 2022 State of climate services for energy
Nuclear power plants depend on water, and are often located in low-lying coastal areas.
Renewable Energy Transition
Key to Climate Change Solutions

Source: IEA Net Zero by 2050
As Renewable Energy Grows, So Does Its Dependence on Weather and Climate Conditions
Historical Data: Characterization of past weather/climate events
Nowcasting: load balancing
Sub-seasonal to seasonal (S2S) climate forecasting: maintenance of infrastructures/ resource and risk management
Decadal climate forecasting: multi-year resource risk management
Multidecadal climate projection: Energy infrastructures risk assessment, planning and design purposes

Source: WMO Integrated Weather and Climate Services in Support of Net Zero Energy Transition
Early warning system for the Beijing branch of the State Grid

- **Challenge**: More than 50% of electricity supply failures in Beijing were caused by weather

- **Objectives**:
  a) Ensure safety and increase energy security,
  b) Reduce costs,
  c) Relieve pressure from the supply system,
  d) Improve efficiency

- **Characteristics**:
  a) Developed based on Real time event identification - different sources of data,
  b) Ensemble probabilistic forecasting
  c) Impact based risk forecasting

- **Developed by**:
  a) China Meteorological Administration
  b) Beijing branch of the State Grid

Source: WMO Integrated Weather and Climate Services in Support of Net Zero Energy Transition
A solar atlas to guide energy management and planning in Egypt

- **Challenge:** Egypt’s economic development is heavily reliant on the energy sector, posing a challenge in meeting energy demand
- **Objectives:**
  - Continuous provision of accurate climate information, through coordinated and sustained Earth observation activities for informed decision making;
  - Development of national solar atlas based on comprehensive measurement campaigns at areas with a high potential
- **Developed by:**
  - Egypt’s Integrated Sustainable Energy Strategy (ISES)
  - Copernicus Atmosphere Monitoring Service (CAMS)
  - IRENA, WMO, GEO CRADLE, EuroGEO, other entities
- **Result:** Excellent addition, complementing the Government’s efforts in finding (Mohamed Shaker El-Markabi, Minister of Electricity and Renewable Energy)

Source: WMO 2022 state of climate services for Energy