



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

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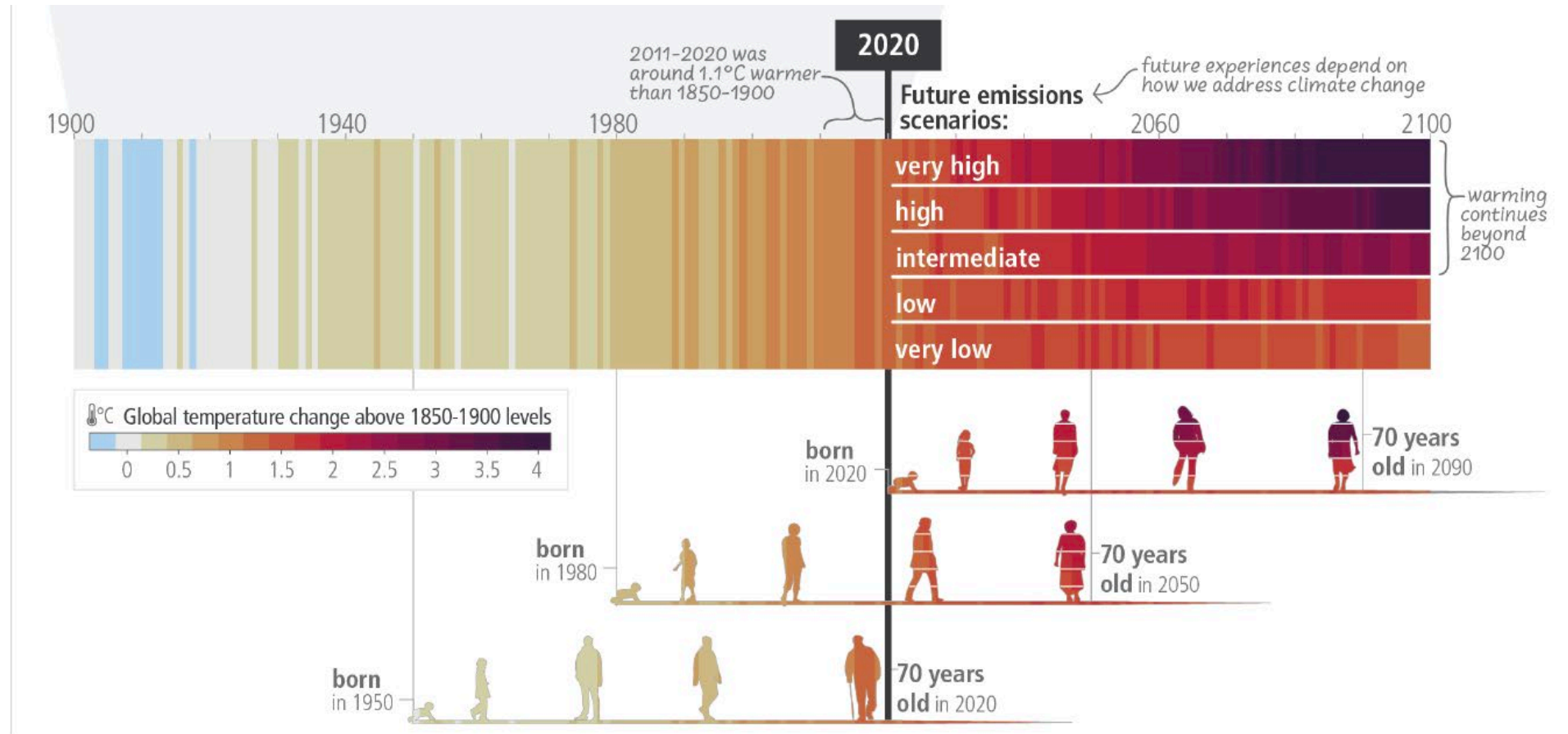


# Content

- **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**



# Climate Change: Facing Reality



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).

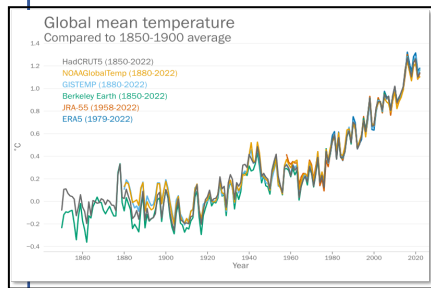
Source: IPCC AR6 WG1

Characteristics: Relevance; Representativeness; Traceability; Timeliness; Data adequacy

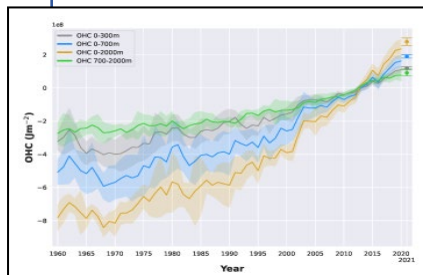
# Climate Change: Facing Reality (2022 Climate Indicators)

## Temperature and Accumulated Heat

### Surface Temperature

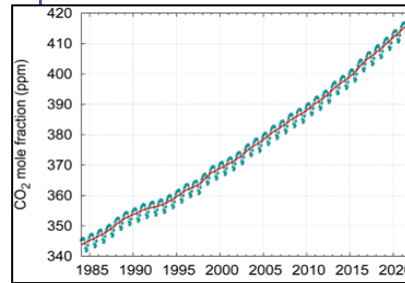


### Ocean Heat



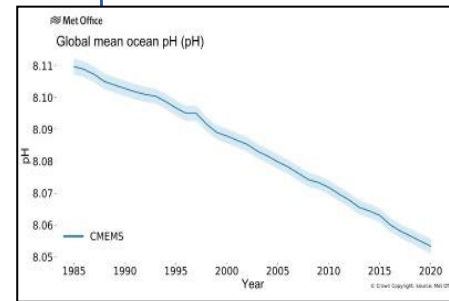
## Atmospheric Composition

### CO<sub>2</sub>

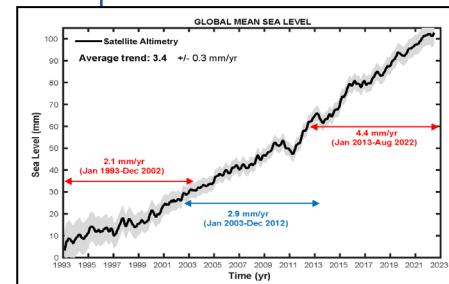


## Ocean and Water

### Acidification

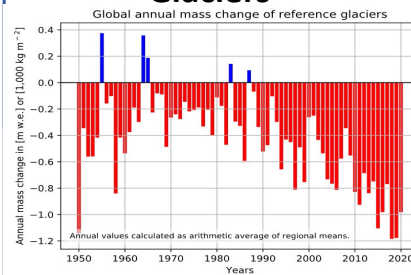


### Sea level

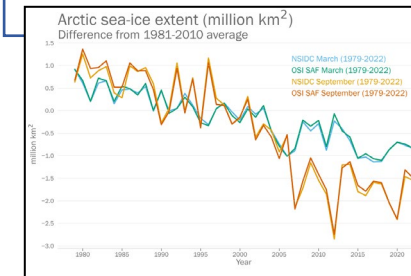


## Cryosphere

### Glaciers



### Arctic and Antarctic Sea Ice Extent



# Global State of the Climate 2022

# Climate Change: Facing Reality (2022 Climate Indicators)



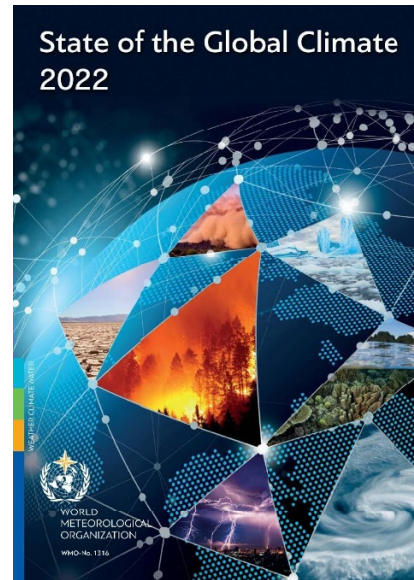
Record-breaking **heatwaves** affected China and Europe during the summer.

The years 2015 to 2022 were the eight **warmest** in the 173-year instrumental record.

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

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

State of the Global Climate  
2022



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

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

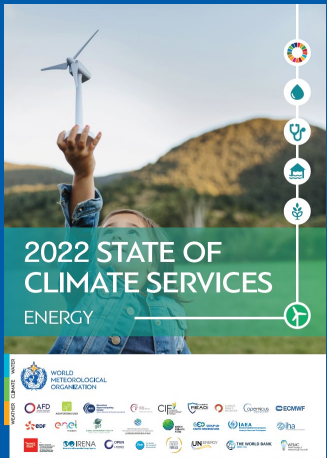
In the hydrological year 2021/2022, a set of reference glaciers with long-term observations experienced an average **mass balance of -1.18 metres water equivalent (m w.e.)**.

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.



# 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;

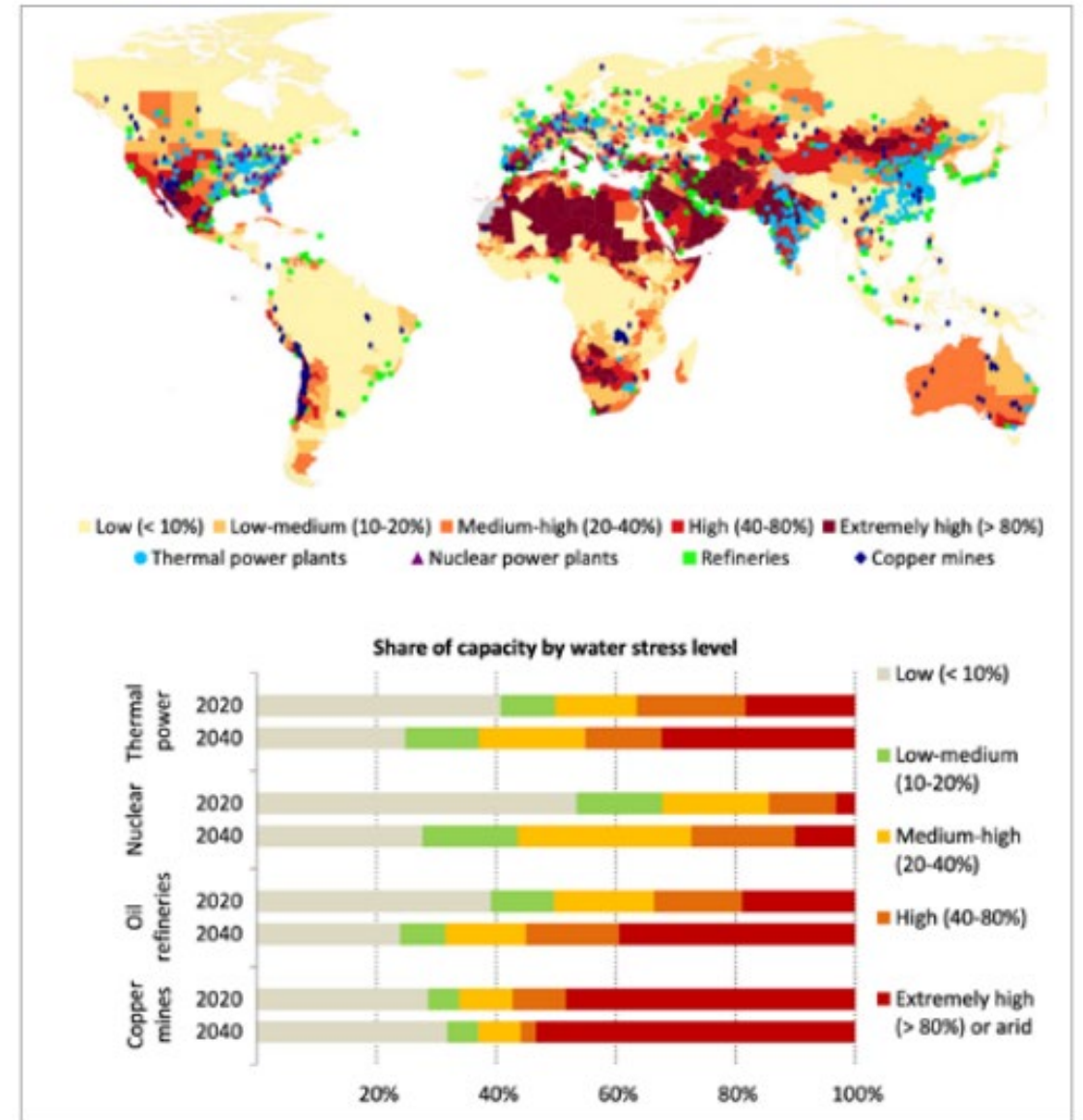
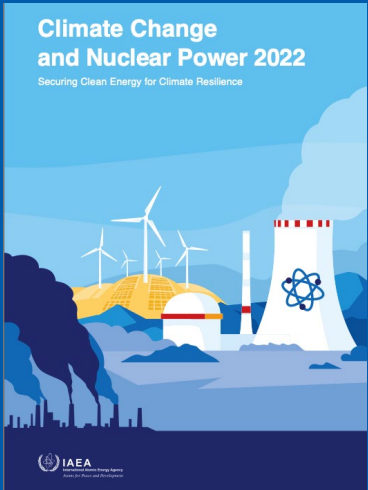


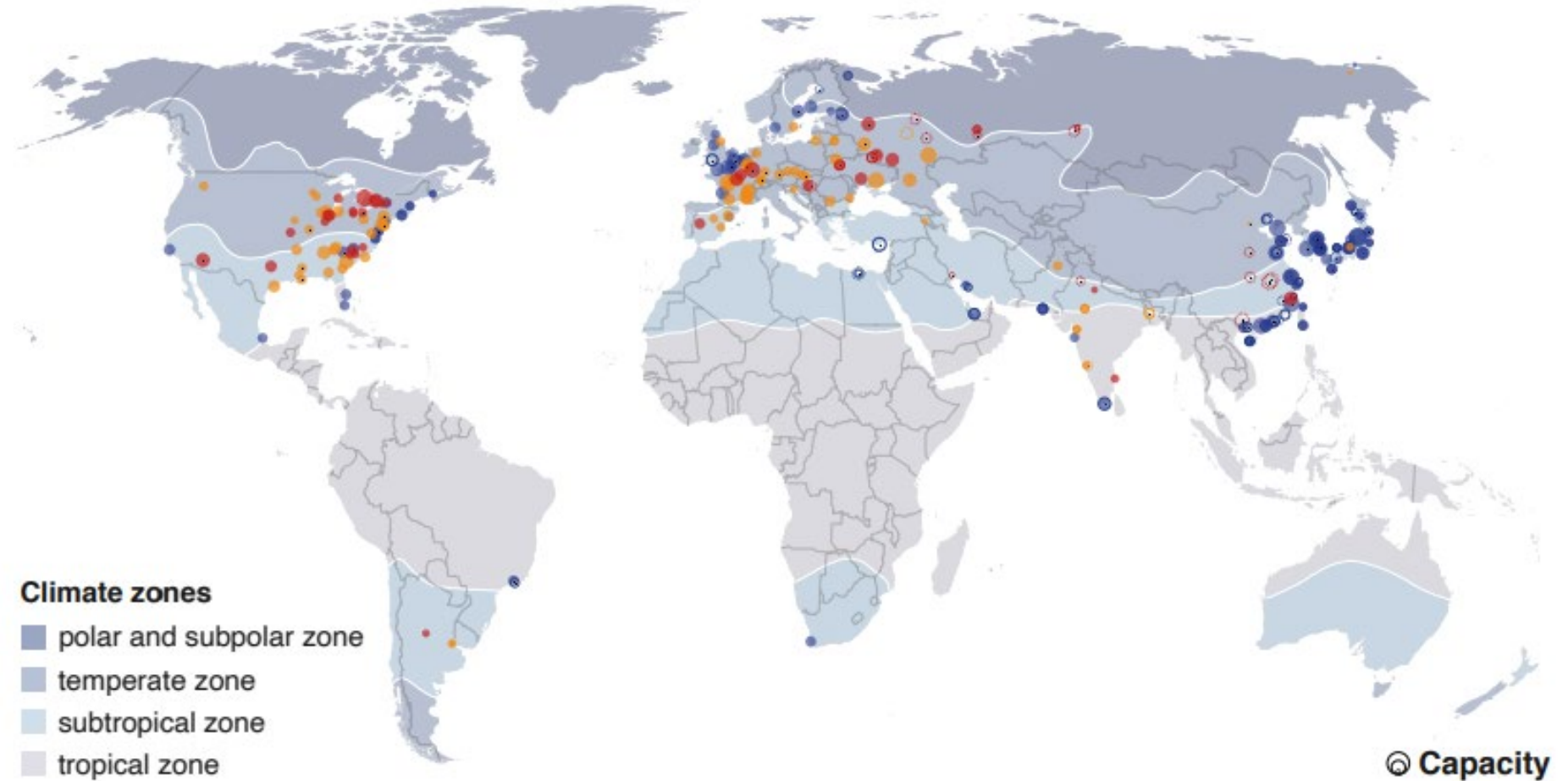
Figure 2: Location of selected energy-related infrastructure and water stress levels, 2020  
 Source: World Energy Outlook 2021; IEA analysis based on WRI Aqueduct 3.0 (2019) and S&P Global (2

Source: WMO 2022 State of climate services for energy

# Climate Change Impacts on the Energy sector



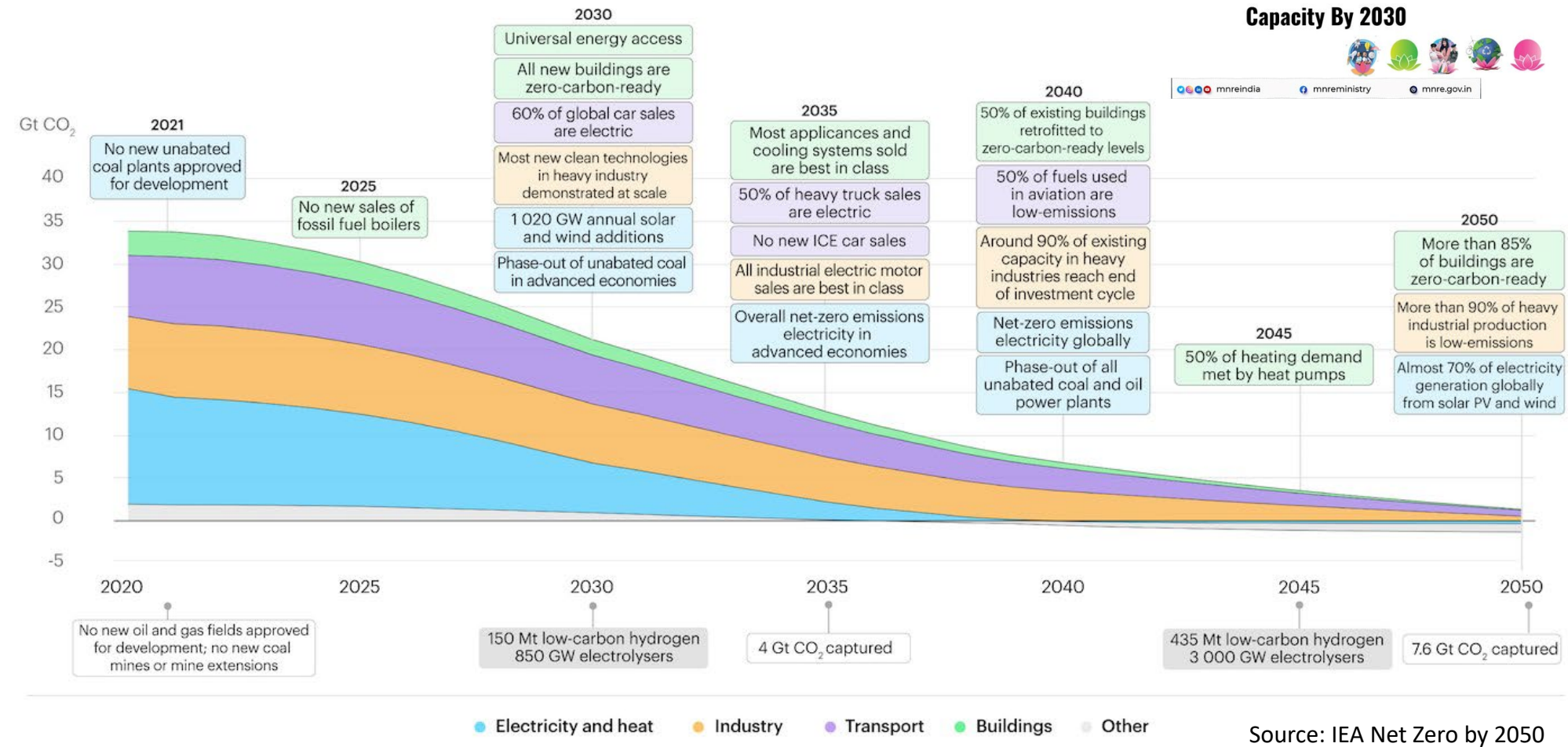
Nuclear power plants depend on **water**, and are often located in **low lying coastal areas**



**179** operational nuclear power plant sites  
73 ● at the sea coast 71 ● inland near a lake 35 ● inland near a river

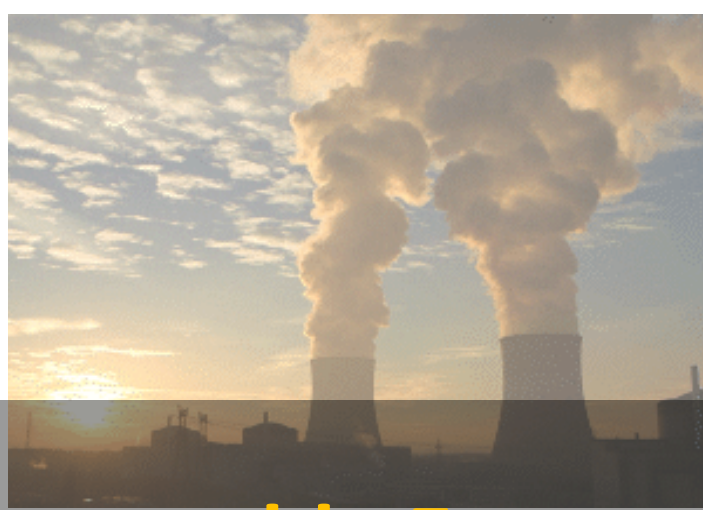
# Renewable Energy Transition Key to Climate Change Solutions

# EFFORTS To TRIPLE RENEWABLE ENERGY Capacity By 2030

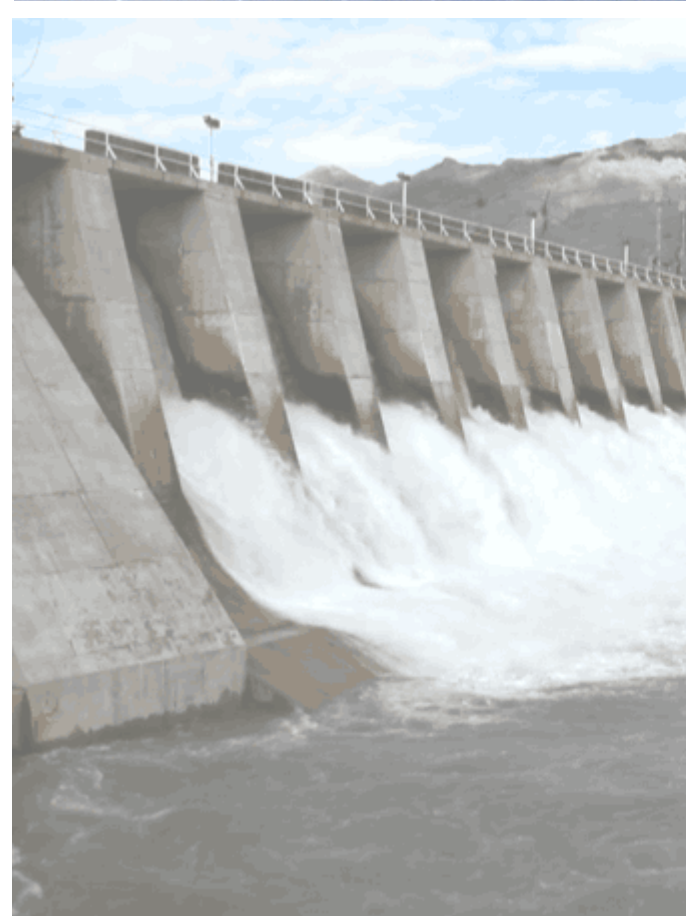


Source: IEA Net Zero by 2050



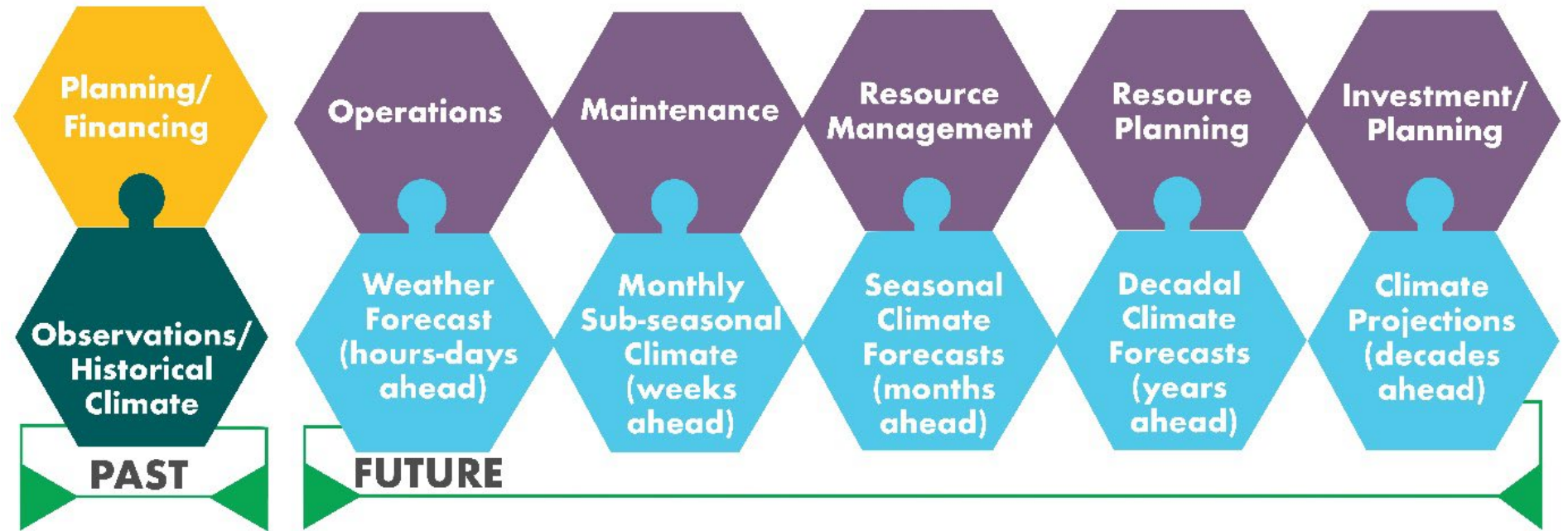


**As Renewable Energy Grows,  
So Does Its Dependence on  
Weather and Climate  
Conditions**





## Integrated Weather and Climate Services in Support of Net Zero Energy Transition

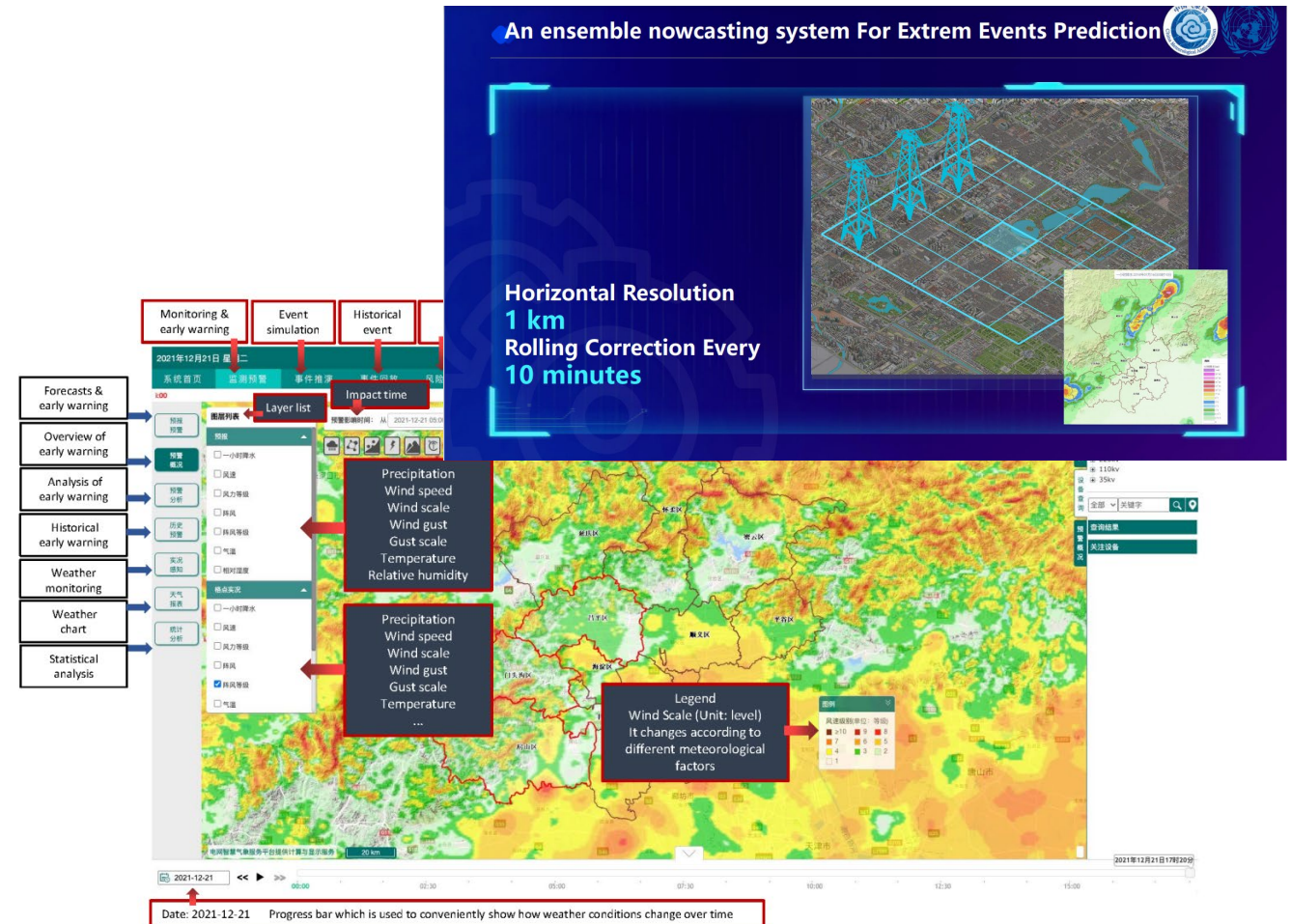


- **Historical Data:** Characterization of past weather/climate events
- **Nowcasting:** load balancing
- **Sub-seasonal to seasonal (S2S) climate forecasting:** maintenance of infrastructures/ resource and risk management
- **Decadal climate forecasting:** multi-year resource risk management
- **Multidecadal climate projection:** Energy infrastructures risk assessment, planning and design purposes

# Case Study: Weather and Climate Services for **Energy Security**

## 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:**
  - Ensure safety and increase energy security,
  - Reduce costs,
  - Relieve pressure from the supply system,
  - Improve efficiency
- **Characteristics:**
  - Developed based on Real time event identification - different sources of data,
  - Ensemble probabilistic forecasting
  - Impact based risk forecasting
- **Developed by:**
  - China Meteorological Administration
  - Beijing branch of the State Grid



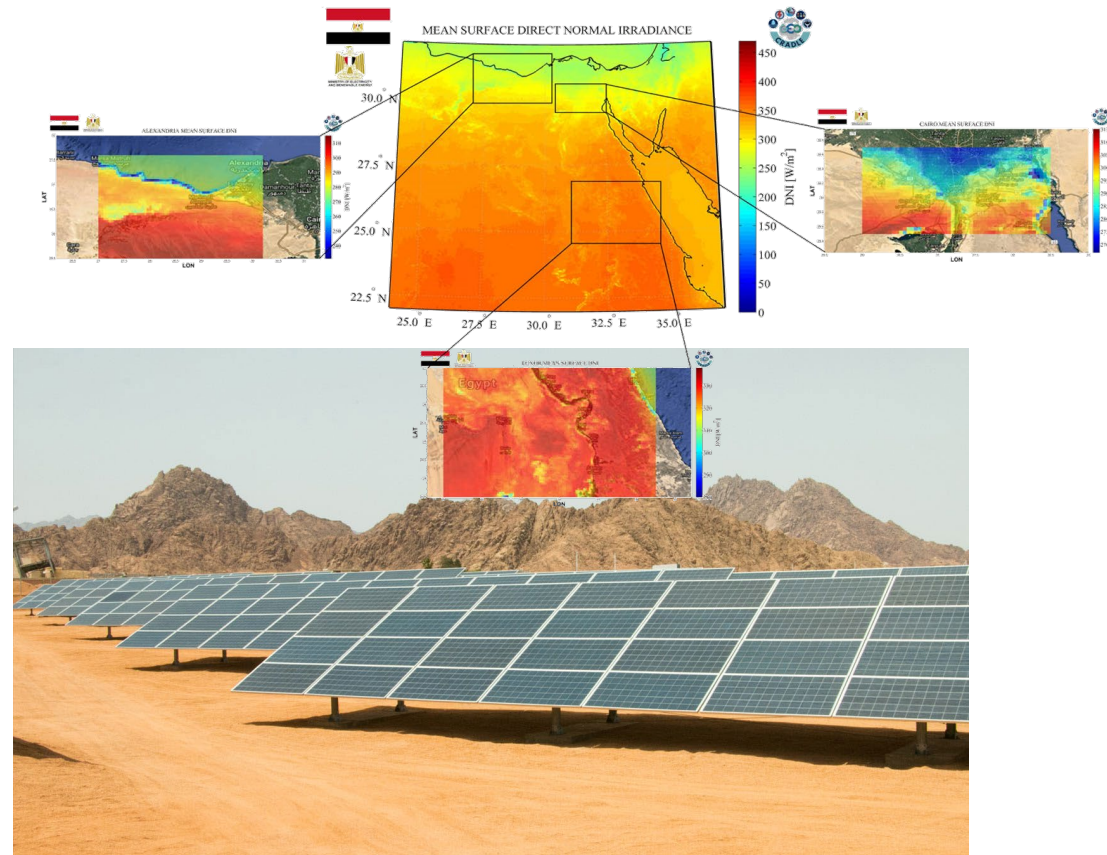
Source: WMO Integrated Weather and Climate Services in Support of Net Zero Energy Transition



# Case Study: Weather and Climate Services for Renewable Energy

## 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:**
  - a) Egypt's Integrated Sustainable Energy Strategy (ISES)
  - b) Copernicus Atmosphere Monitoring Service (CAMS)
  - c) 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



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THANK YOU!



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