



Energy Sector Resilience to Extreme Weather and Natural Hazards

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Enhancing adaptation and resilience indicators in the TYNDP CBA framework, RGI / ENTSO-E

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- **Natural hazards** and **severe weather events** are perennial risks to energy systems, exacerbated by climate change pose an increasing threat to secure, reliable and affordable electricity.
 - Rising demand for cooling placing strains on power supplies.
 - Reduced performance of energy facilities during severe weather.
 - Increased risk of disruptions to electricity supply.
 - Increased electricity costs due to outages and price spikes.
 - Rising cost to insure infrastructure and cover liability risks from disasters caused by energy infrastructure.
- IEA provides analysis on exposure of the energy sector and assesses [climate resilience for selected countries](#)
- Participants at the IEA's **Future of Energy Security Summit** in April and at the IEA's **High-Level Roundtable on Energy Infrastructure Resilience** called on the IEA to assess risks as a first step toward building stronger resilience.

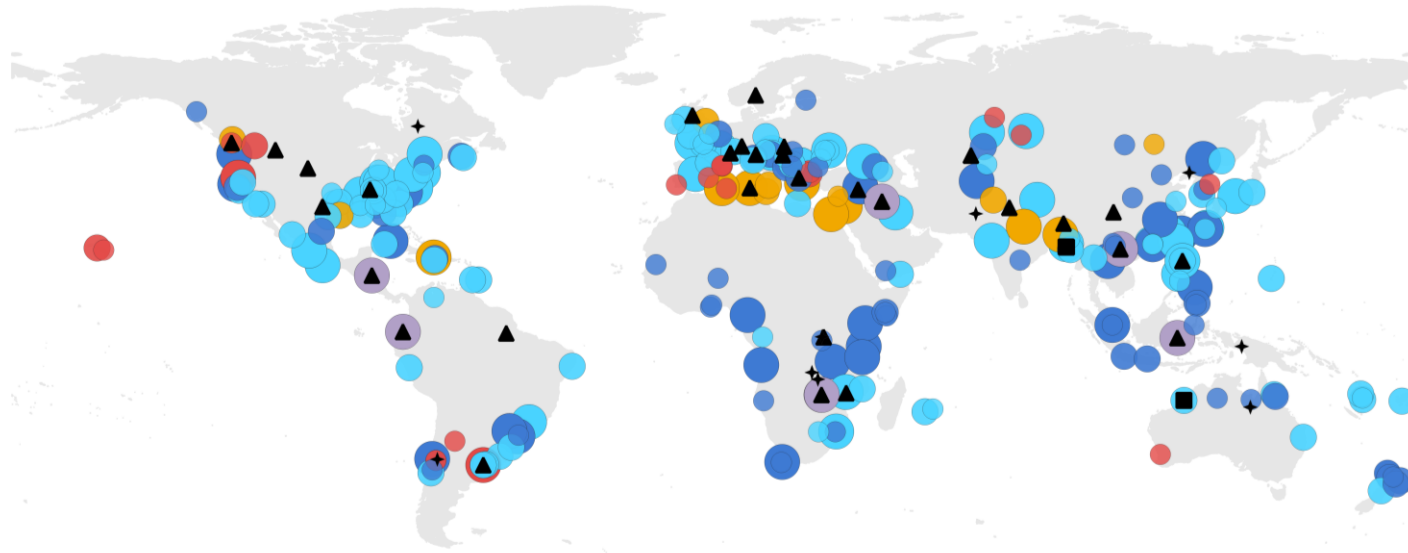


- Gathered about 90 delegations from 30+ countries, incl. government, industry, finance, civil society.
- Focus on **natural hazards but also geopolitical and cyber risks**
- Found **power sector most vulnerable**, with high consequences in an increasingly electrified and digitalized economy
- Discussed **resilience measures** in three key dimensions:
 - **Planning**: diversify and de-risk energy sources, emergency protocols
 - **Preparedness**: harden infrastructure with flood barriers, flexible grids
 - **Response & Recovery**: stockpiling components, coordinate response
- Identified need to **determine no-regrets measures** that are cost-effective and support broader energy security objectives
- Stressed the **role of governments, regulators**, and standards-setting bodies for incentives and additional support or public funds
- Highlighted a **role for cross-sector and international coordination** to align on standards and to prioritise actions.



IEA is tracking impacts of extreme weather on energy infrastructure

Power outages and operational disruption of energy infrastructure caused by extreme weather events in 2023

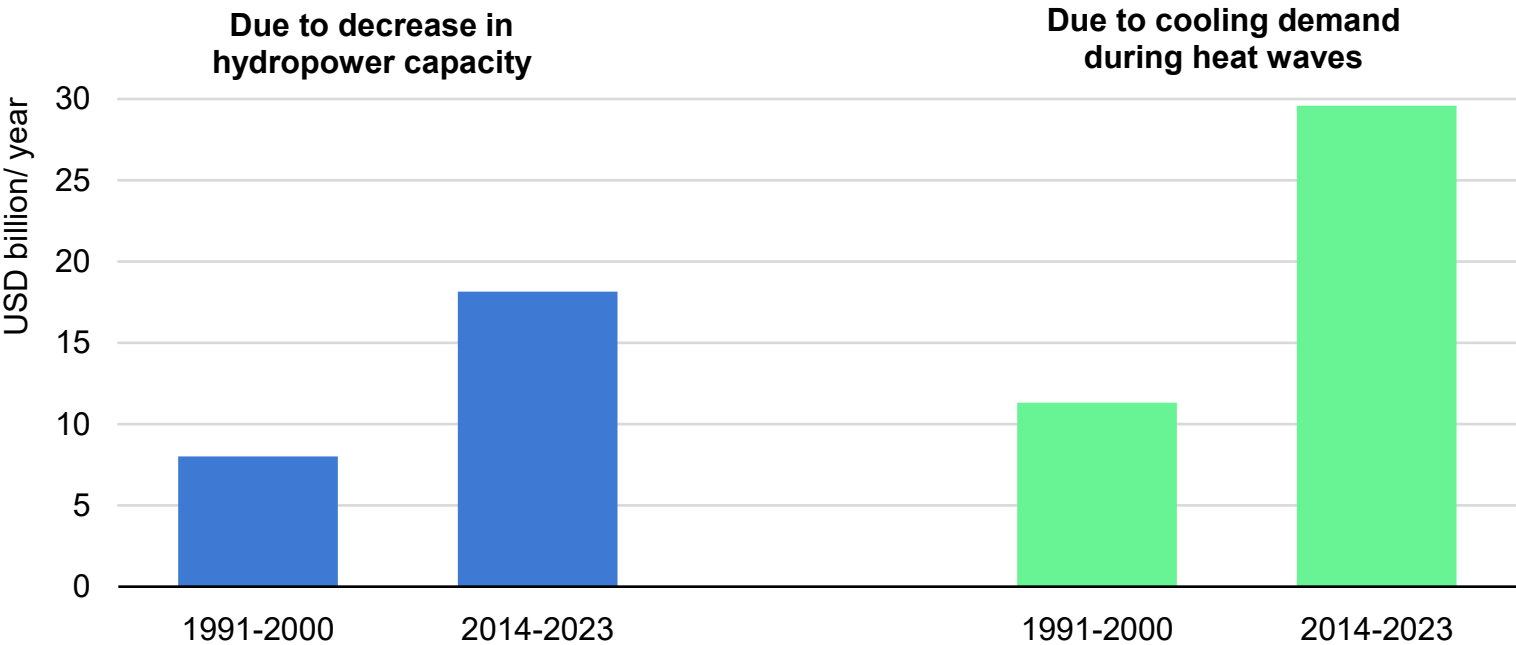


Disruption due to extreme weather of: ▲ Power plant ★ Coal or critical mineral mine ■ Fuel supply chain
Power outage due to: ● Drought ● Extreme Temperature ● Storm ● Flood ● Wildfire

In 2023, extreme weather caused nearly 300 energy disruptions, 85% in the power sector. Extreme weather was responsible for reported power cuts for more than 200 million households in nearly 100 countries.

Impacts of extreme weather events are driving up electricity costs

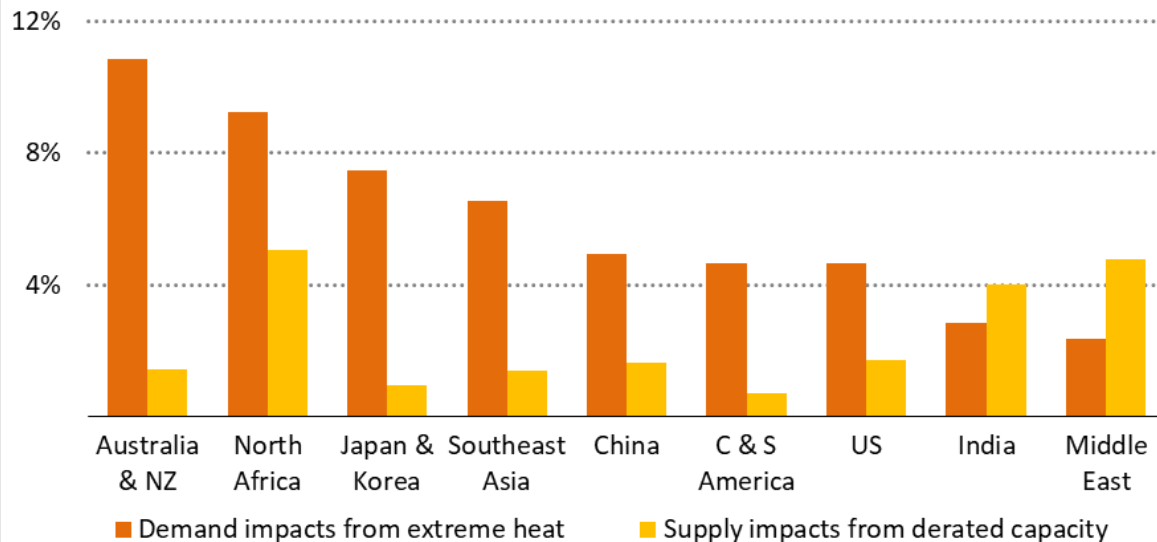
Average annual costs of climate impacts for 1991-2000 and 2014-2023



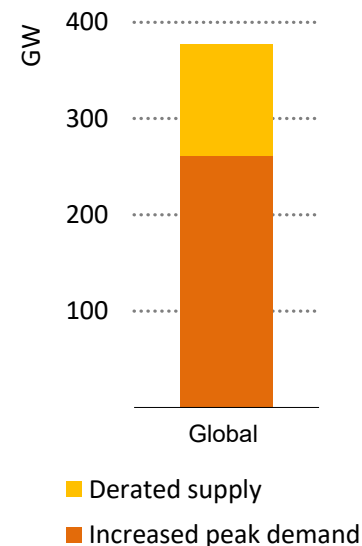
Since the 1990s, annual climate-related costs from lower hydropower output and higher cooling demand have already risen by nearly USD 10 billion and USD 20 billion, respectively.

Extreme heat drives up peak demand and strains power systems

Impact of extreme heat on peak demand and derated power supply by region in the STEPS, 2035



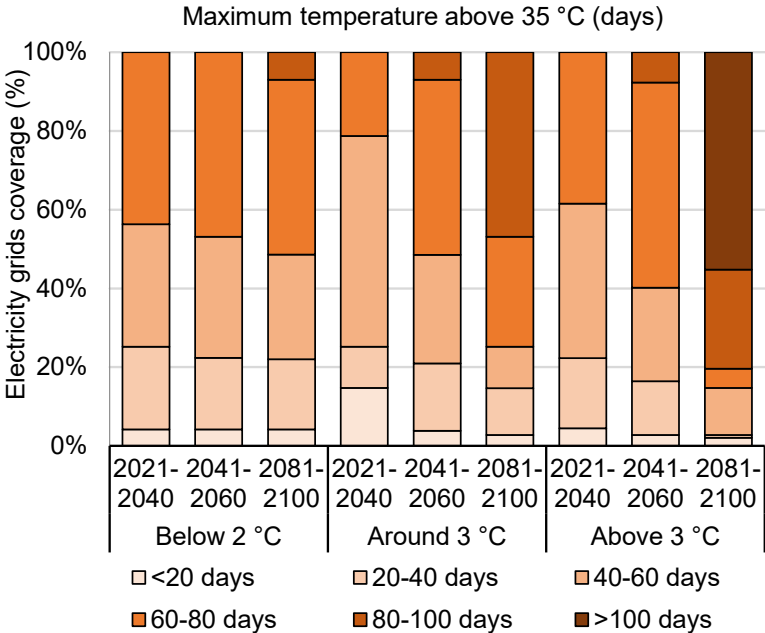
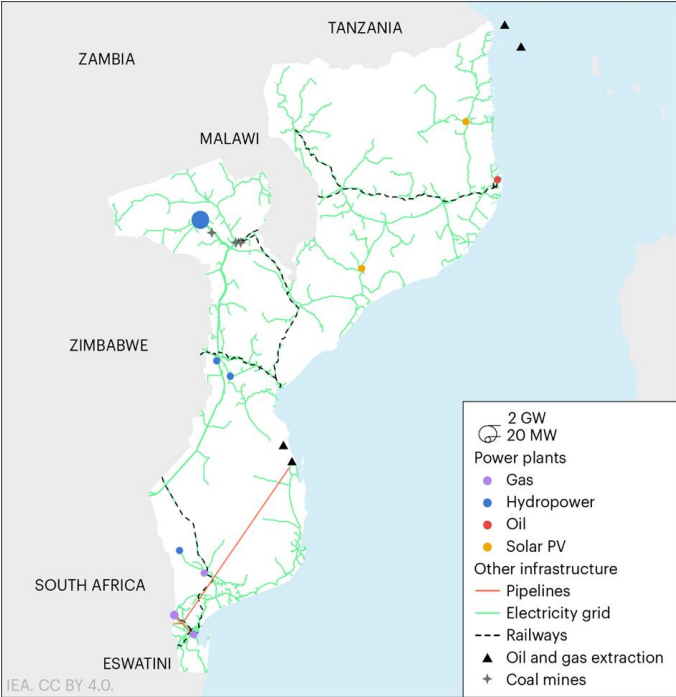
Additional capacity needed due to extreme heat in STEPS, 2035



System operators may have to consider additional capacity margins equivalent to around 6% of projected peak demand by 2035 due to extreme heat – equivalent to half to a third of typical reserve margins.

Climate change may increase challenges for electricity networks

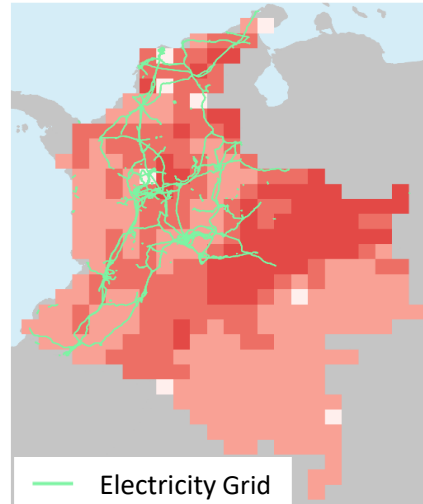
Electricity grid exposed to projected percentage increases in mean temperature above 35°C (days) by climate scenario



If climate change is not mitigated, over 80% of the existing electricity network is projected to face a significant increase in hot days.

Electricity grid exposure to wildfire risk in 2025

Colombia



Average time between fires (years)

10-50

2-10

< 2

Considering wildfire risk exposure of electricity networks helps to take targeted measures to enhance resilience of existing grids in high-risk zones and allows to lower risks when constructing new power lines.

Current and forthcoming areas of IEA tracking and analysis:

- Tracking disruptions to energy infrastructure by cause, country, affected energy infrastructure / households
- Mapping risk exposure of energy infrastructure to heat, storms, floods, and wildfires for projected asset locations
- Estimating impacts on energy systems, including
 - Output reductions for hydropower and thermal generation
 - Increases in peak demand due to extreme heat
 - Damage to energy assets from extreme weather
- Surveying insurance claims and coverage for energy infrastructure
- Compiling cost and benefits of specific measures and identifying “no-regret” actions
- Best practice sharing and collaboration across multiple stakeholders



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