



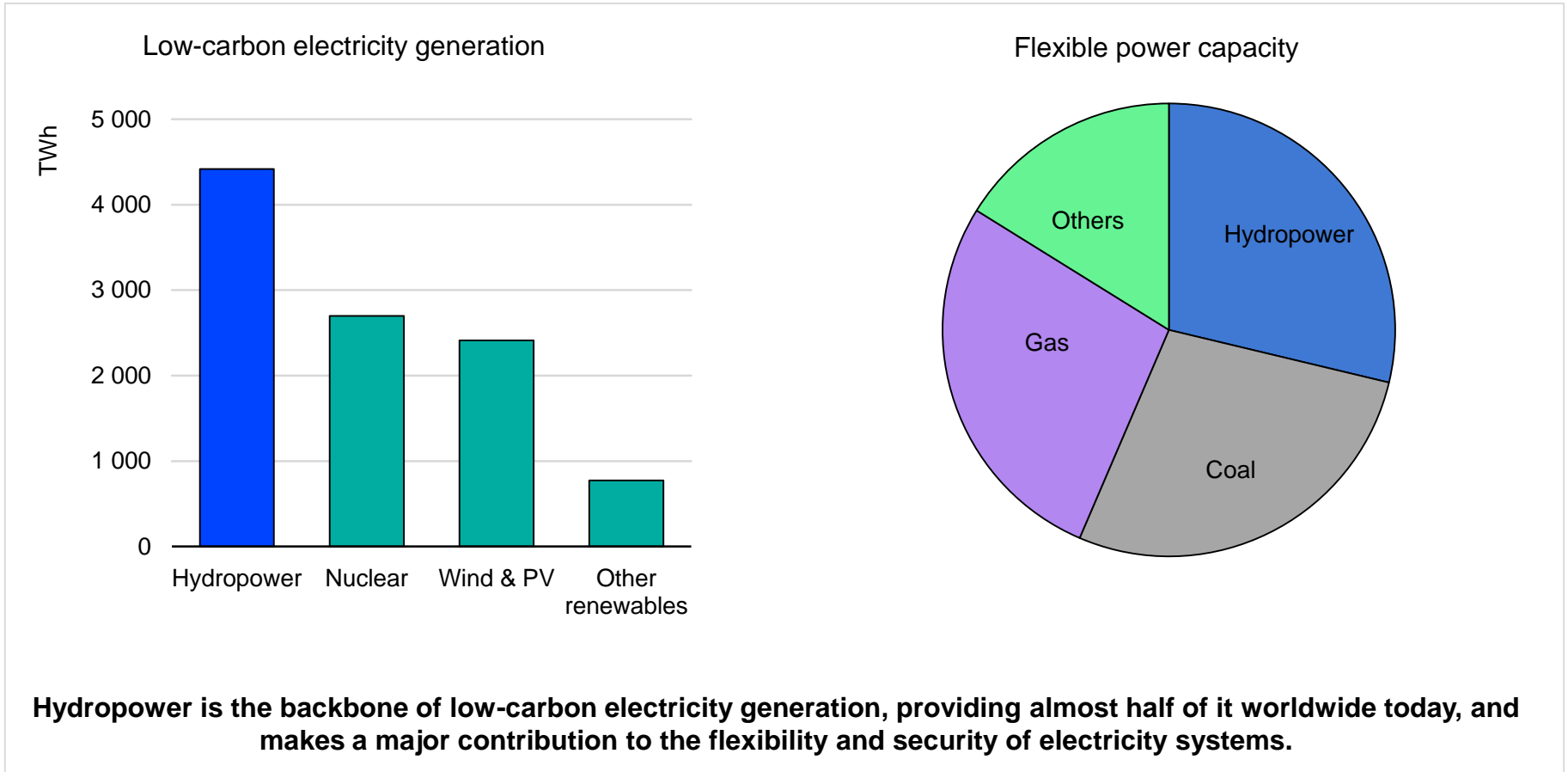
Hydropower Special Market Report

Global outlook to 2030 with a focus on India

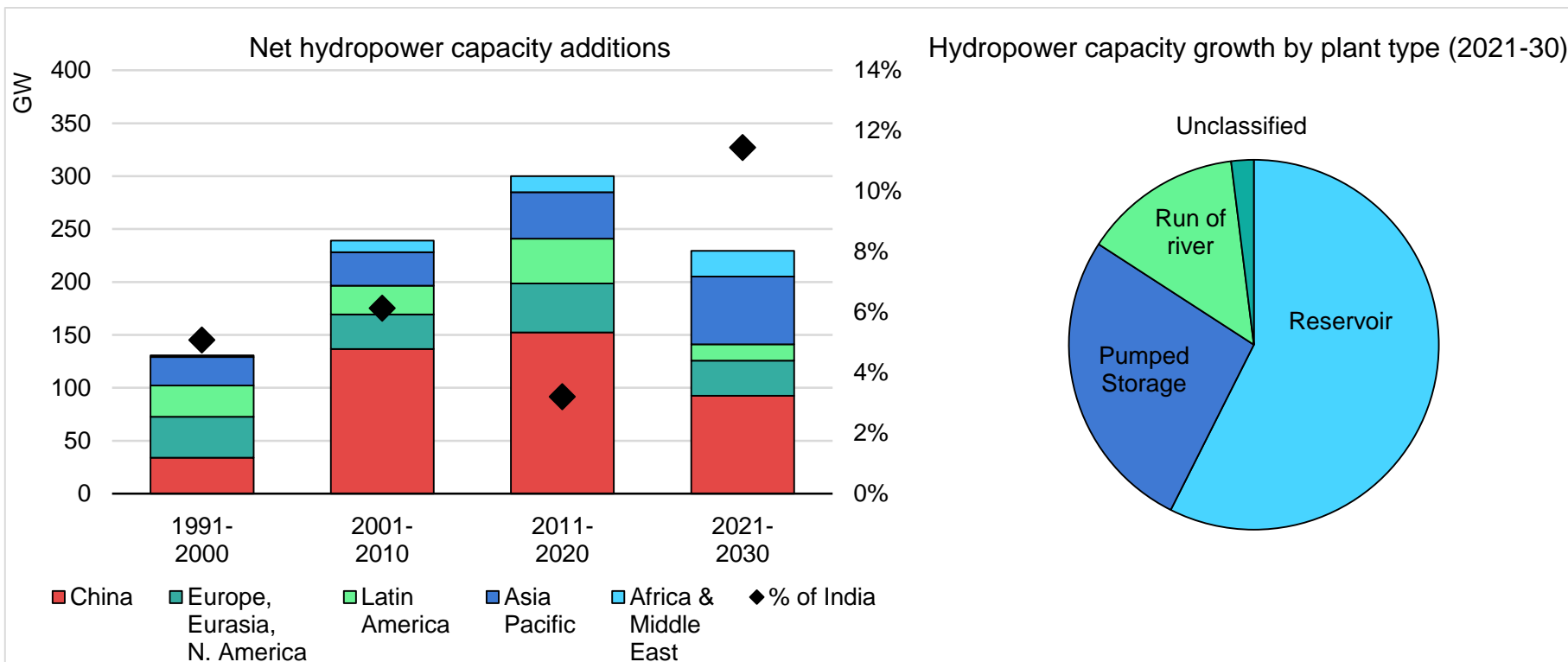
12 October 2021

IEA-CSTEP Webinar

Hydropower is the forgotten giant of the electricity sector

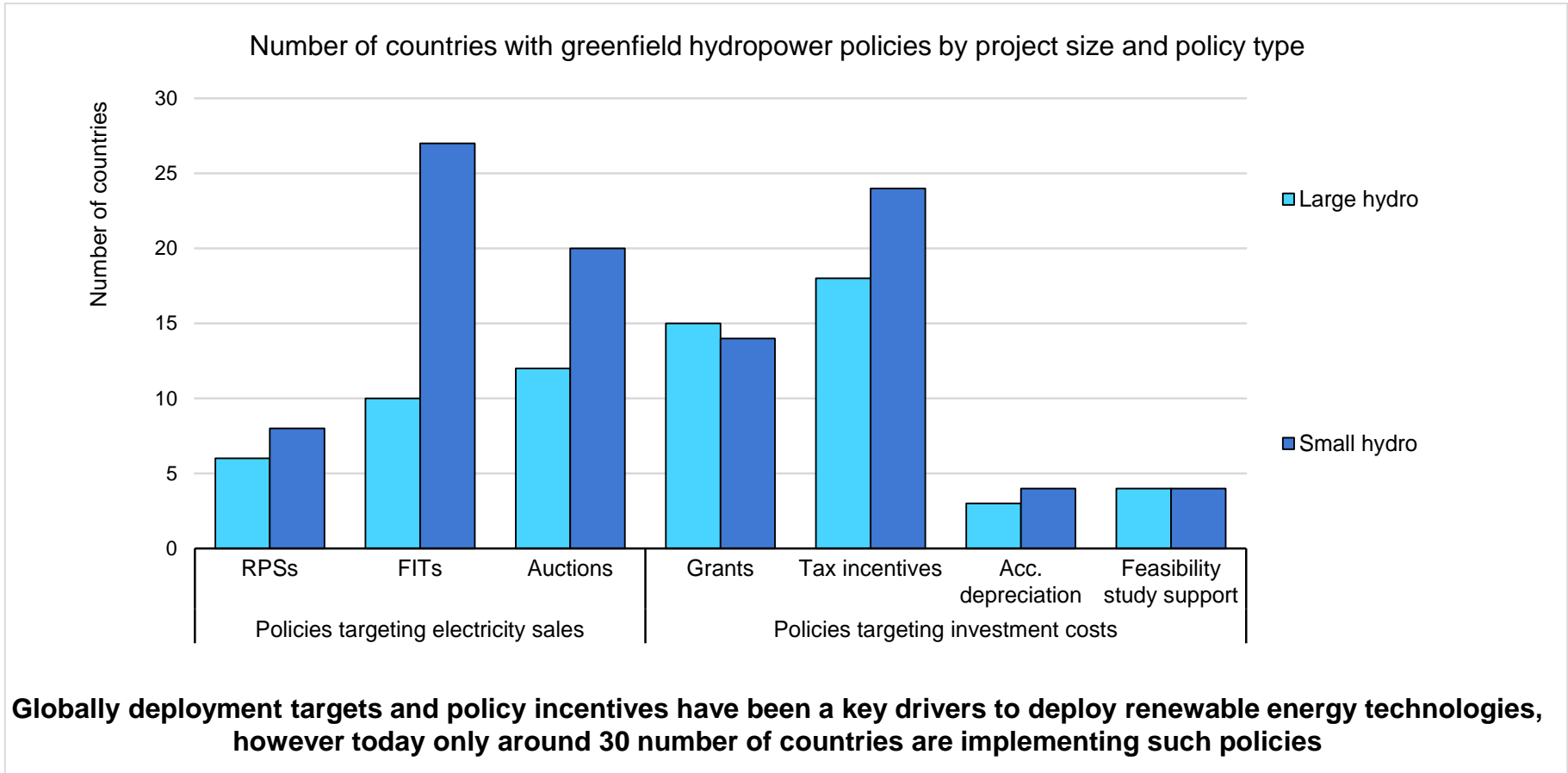


Growth in India & ASEAN partly offsets declines in China



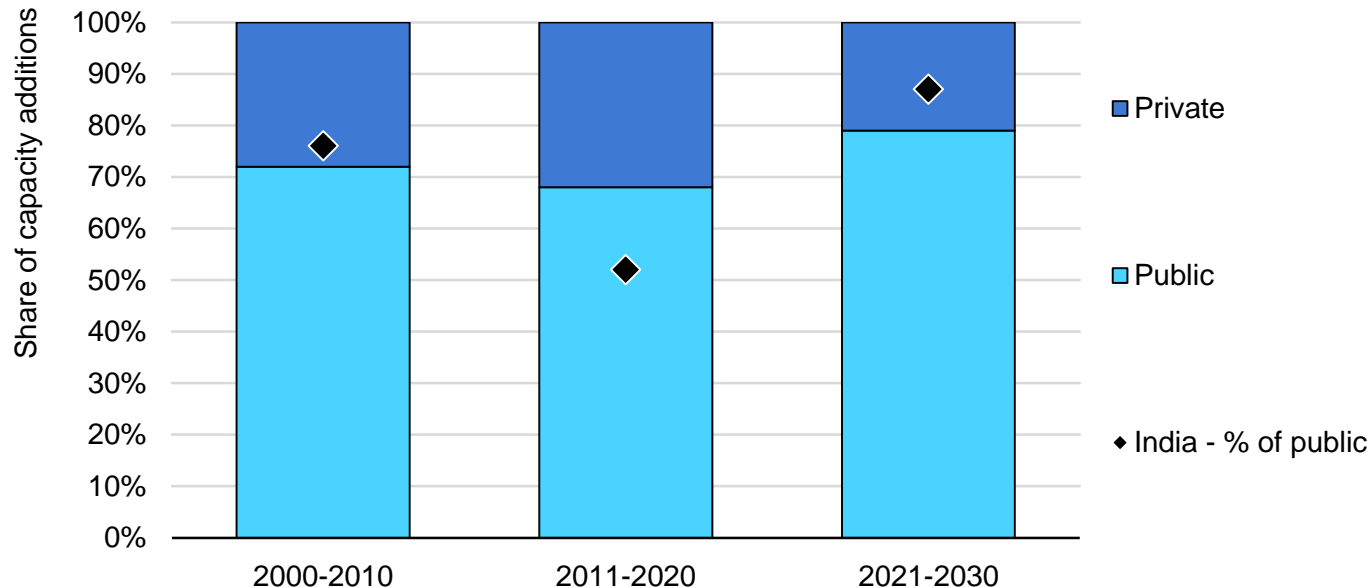
Hydropower expansion over 2021-30 slows down compared with last two decades. Reservoir plants lead greenfield expansion driven by growing power demand, followed by pumped storage needed to increase system flexibility.

Policy support for hydropower remains limited



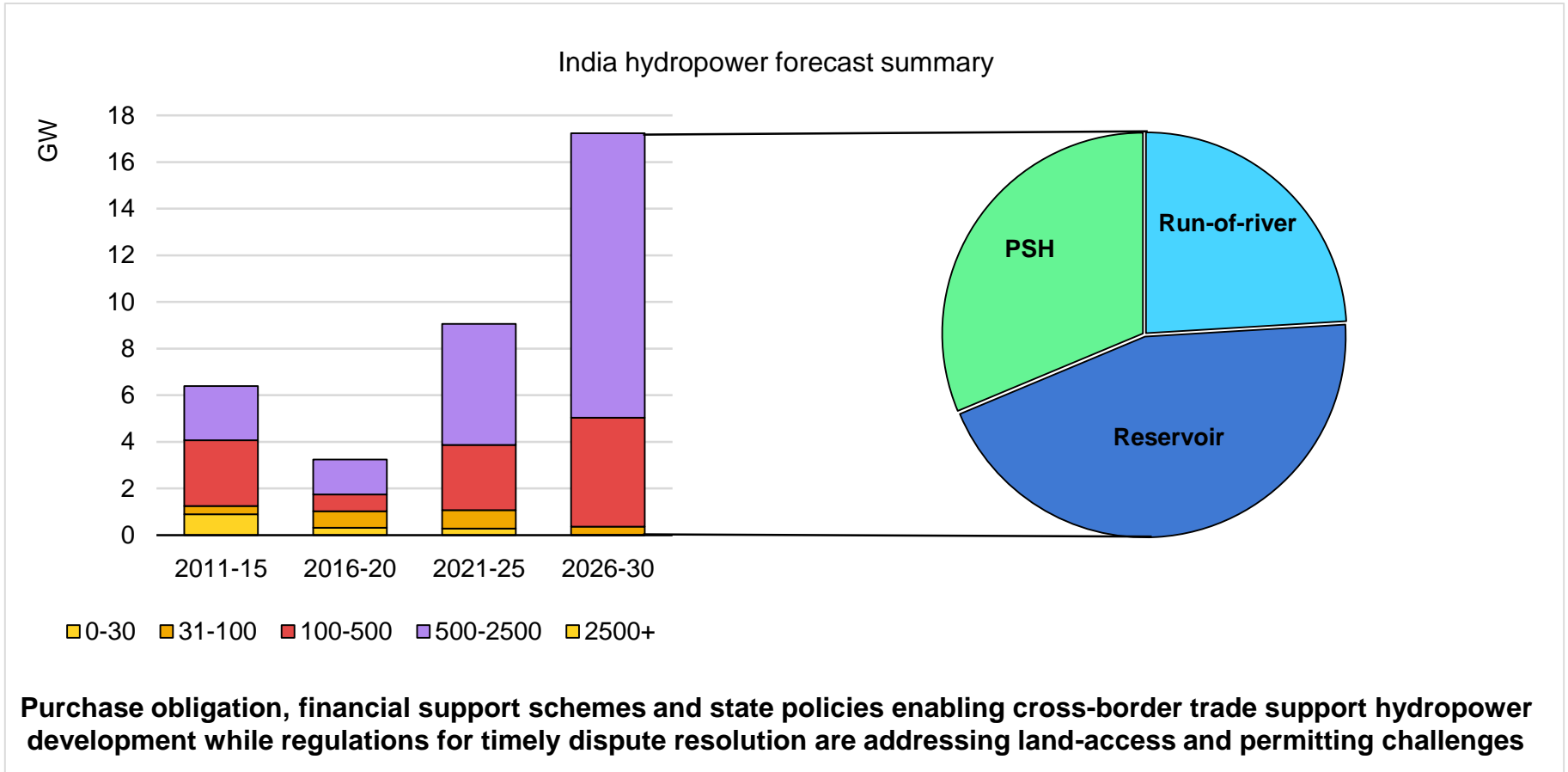
Public sector role in hydropower remains key

Hydropower capacity additions by ownership profile and size

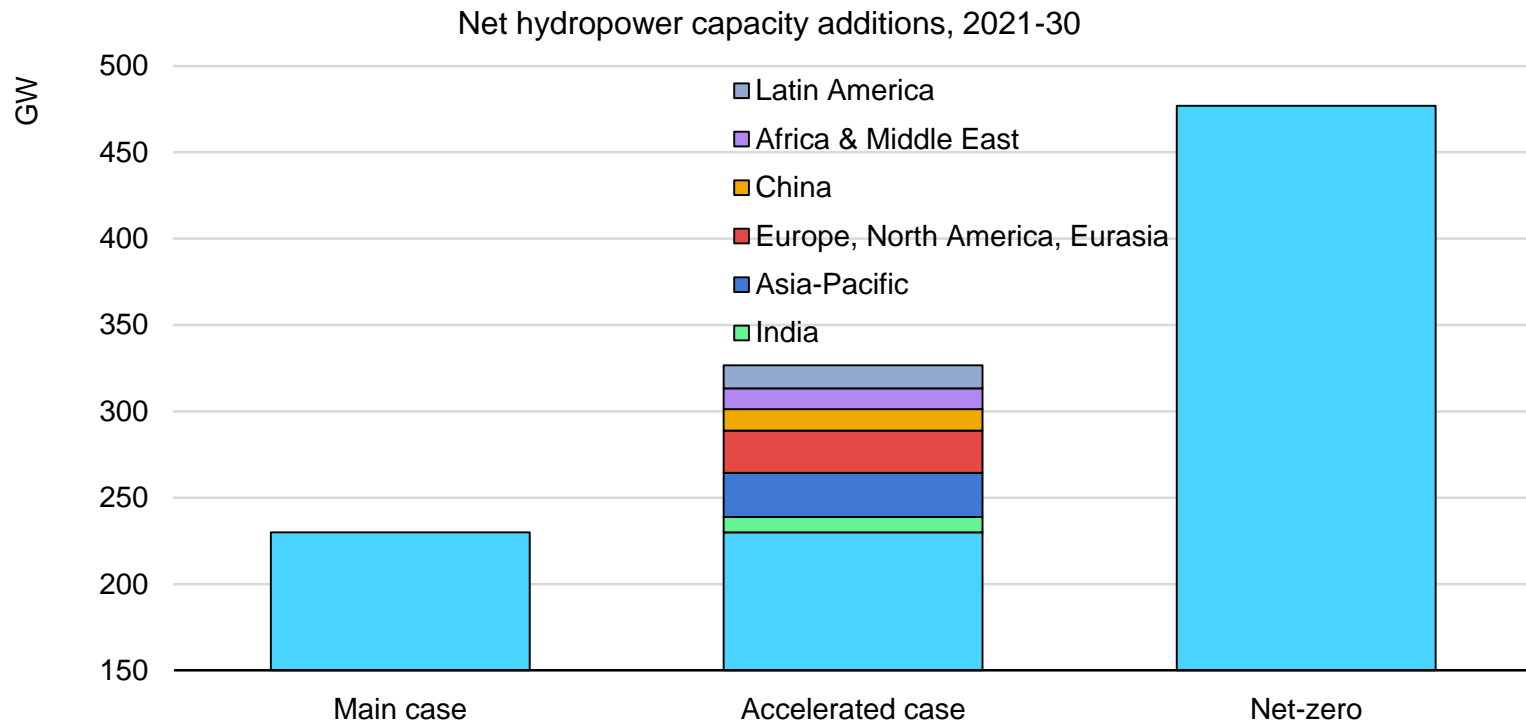


The involvement of the public sector in large plants helps mitigate investment risks on permitting, social acceptance and long construction times including in India, while the private sector deploys smaller plants with low risks.

Large reservoir and PSH projects lead India's accelerated growth



Faster hydro growth is possible but net zero requires higher ambition



In our accelerated case, growth is 40% higher thanks to improvements in policy & market design, such as streamlining of permitting, increasing affordable financing, and providing better visibility on revenues for projects under development.

7 policy considerations

- Move hydropower up the energy and climate policy agenda
- Enforce robust sustainability standards for all hydropower development with streamlined rules and regulations
- Recognise the critical role of hydropower for electricity security and reflect its value through remuneration mechanisms
- Maximise the flexibility capabilities of existing hydropower plants through measures to incentivise their modernisation
- Support the expansion of pumped storage hydropower
- Mobilise affordable financing for sustainable hydropower development in developing economies
- Take steps to ensure that the value of the multiple public benefits provided by hydropower plants is priced in



Hydropower Special Market Report

Flexibility and storage

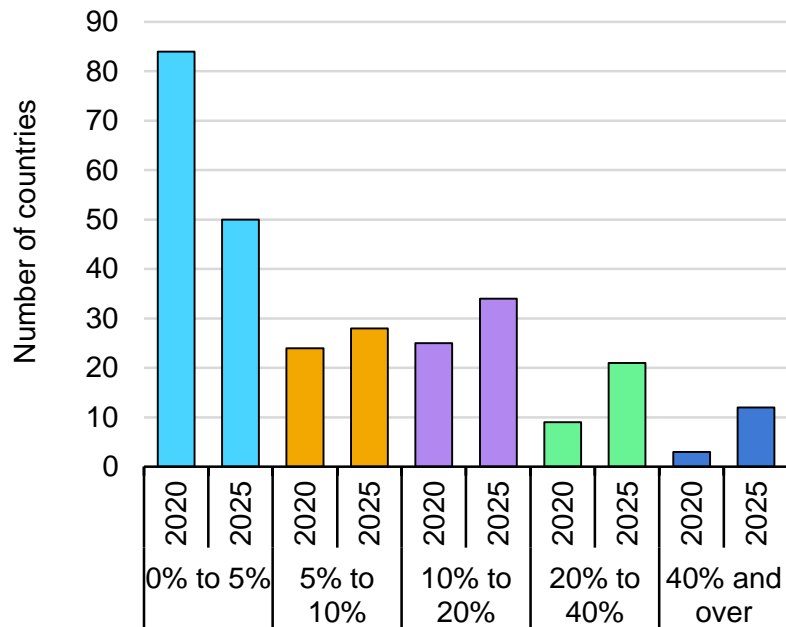
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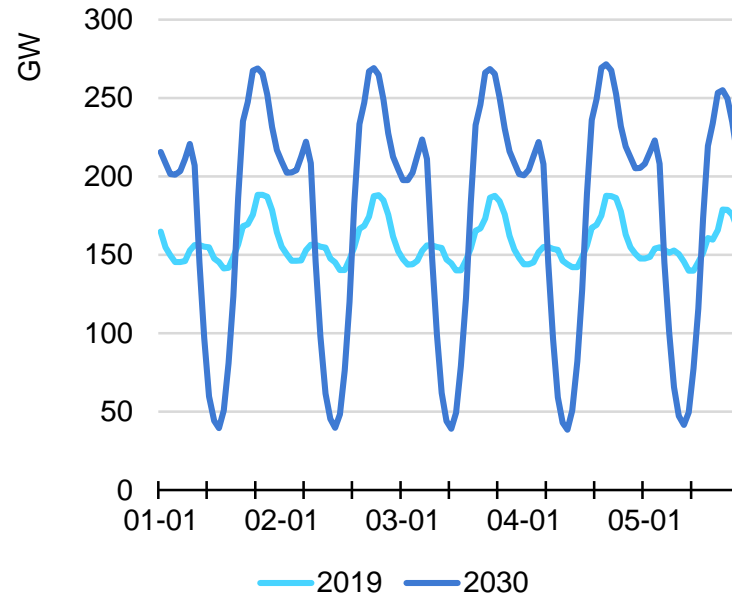
International
Energy Agency

Higher VRE shares increase flexibility needs

Countries per percentage VRE share

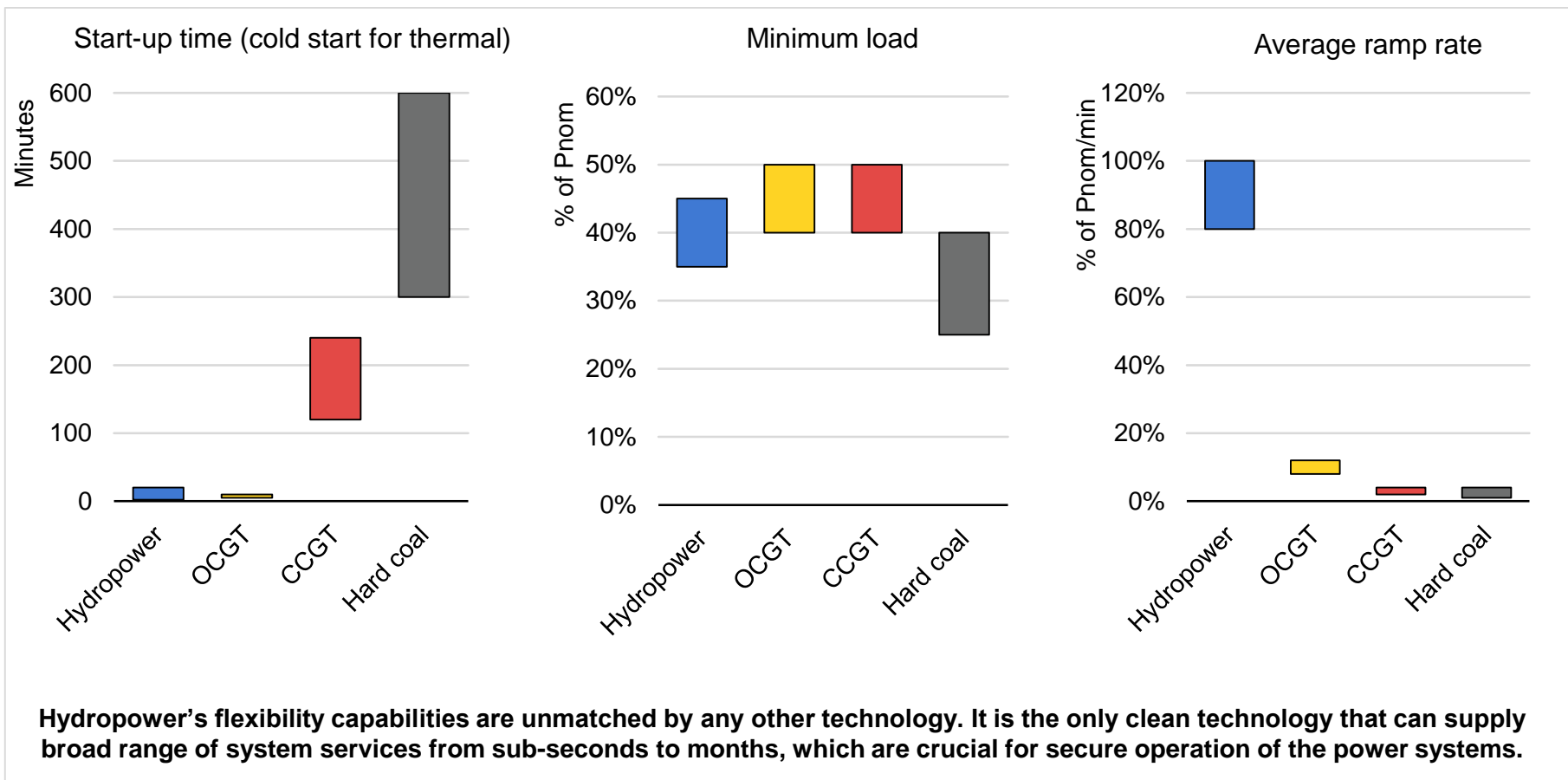


India daily peak and off-peak load swings



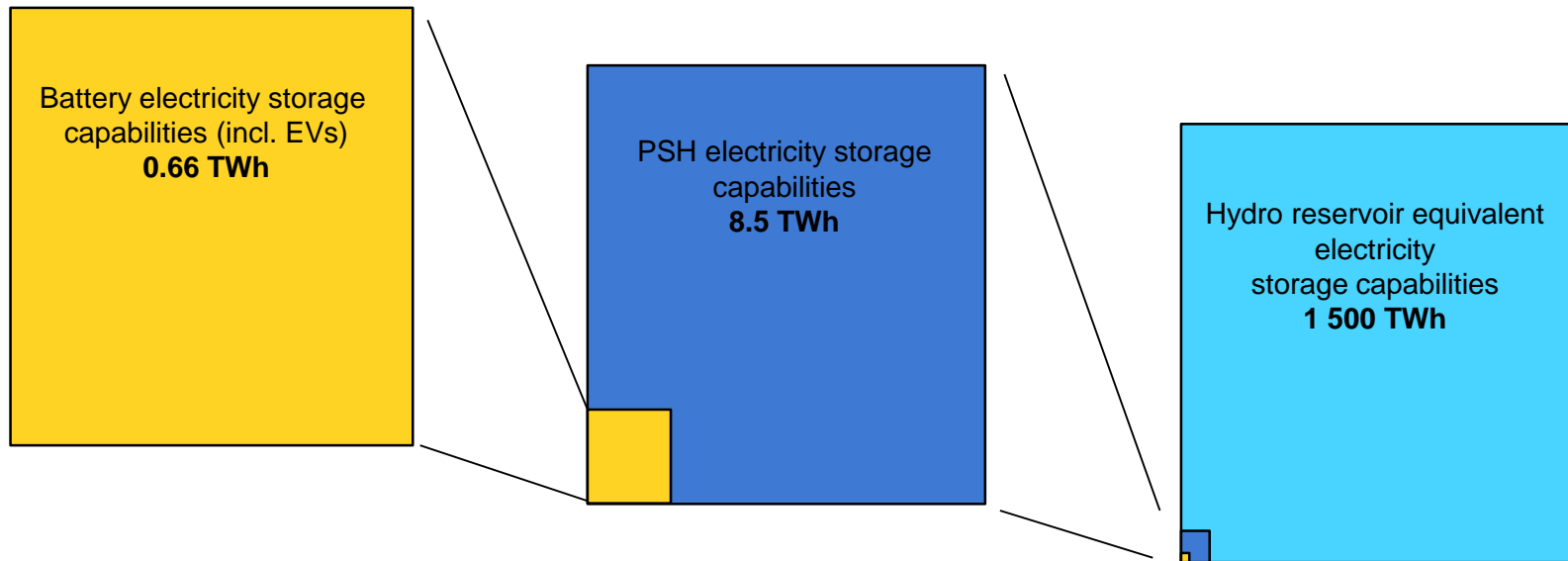
As VRE shares expand, integration challenges increase and policy priorities must be revised to ensure secure and cost-effective system integration of VRE.

Hydropower is the most flexible low-carbon power technology



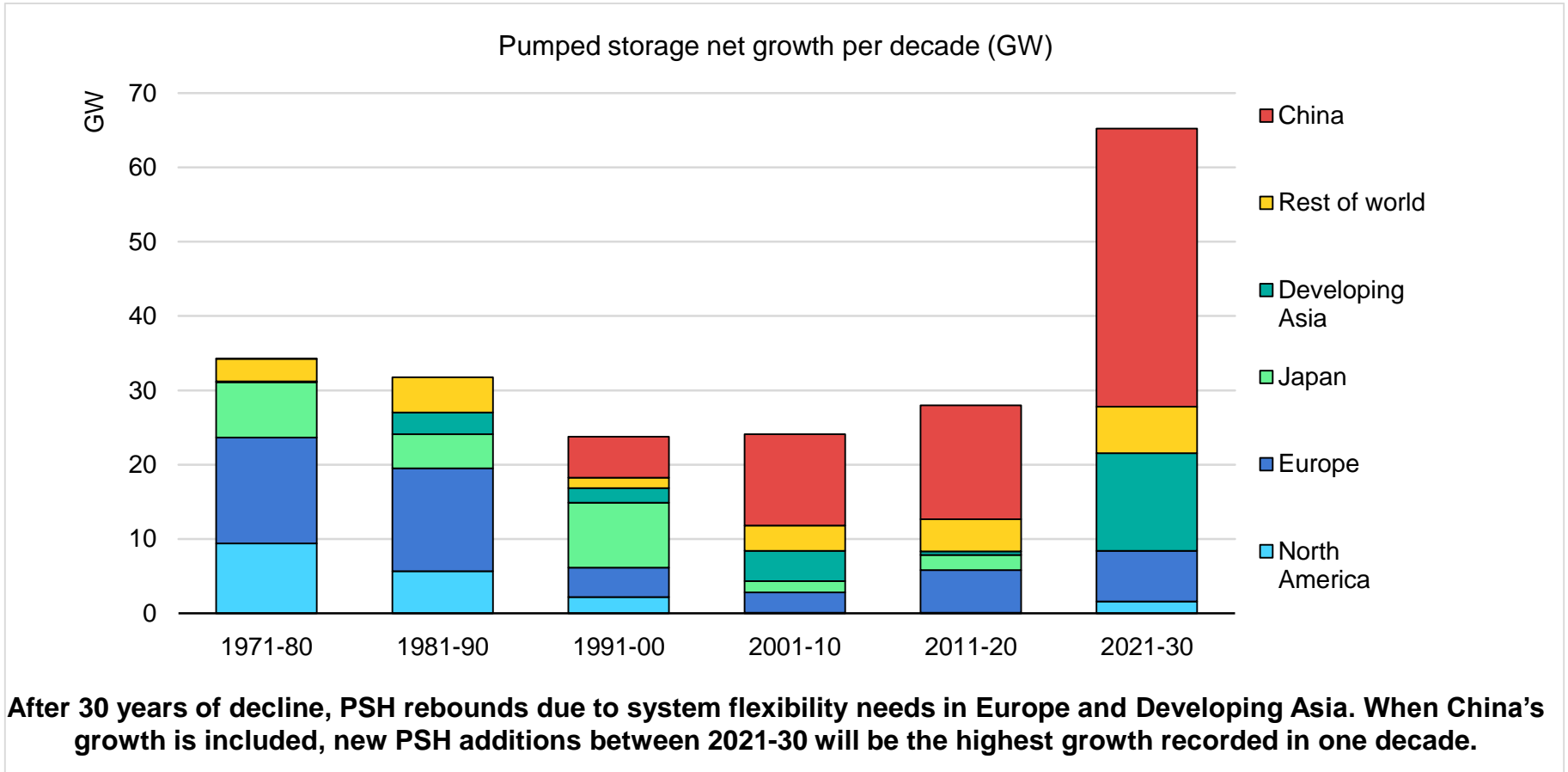
Hydropower has unmatched low-carbon energy storage capabilities

Storage capabilities of hydropower plants and batteries (1 full cycle)



Reservoir hydropower is the only low-carbon power technology capable of providing up to seasonal bulk electricity storage. Such capabilities will be essential for cost-effective and secure operation of VRE dominated power systems of the future.

A revival of pumped storage over the next decade



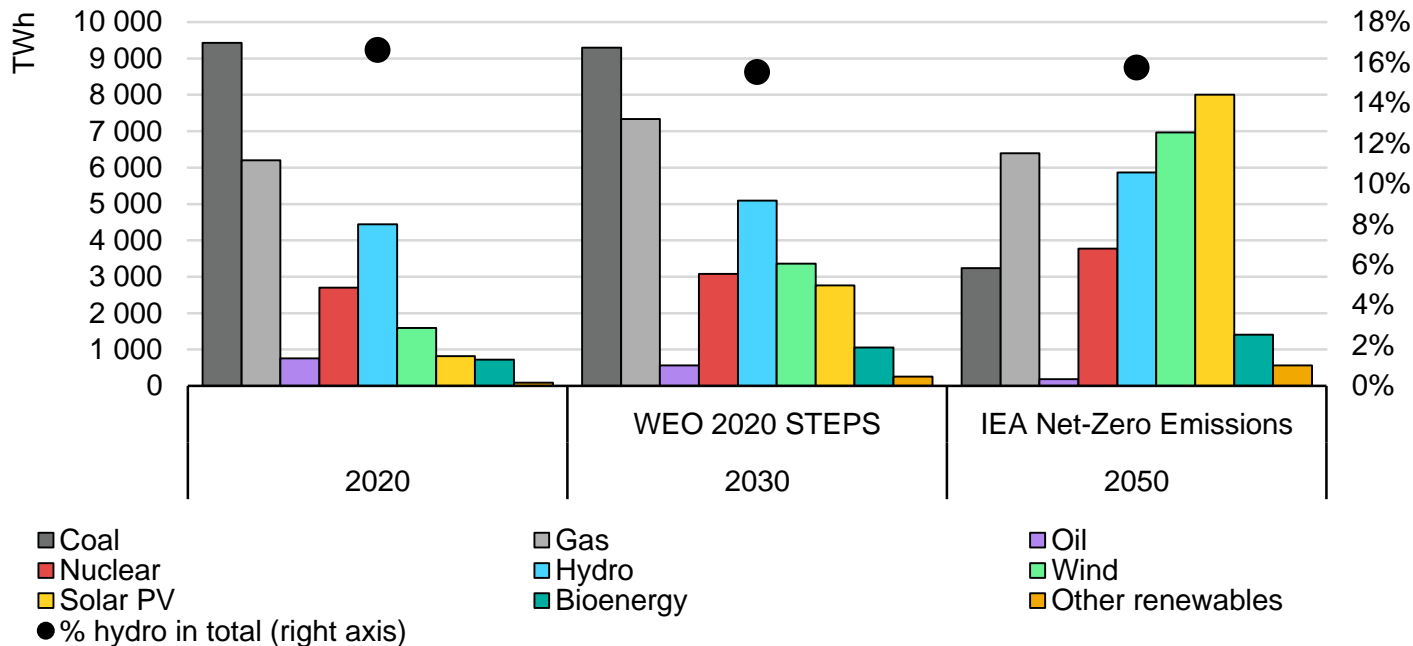


Report: <https://www.iea.org/reports/hydropower-special-market-report>

Data explorer: <https://www.iea.org/articles/hydropower-data-explorer>

Hydropower remains the largest low-carbon source of electricity by 2030

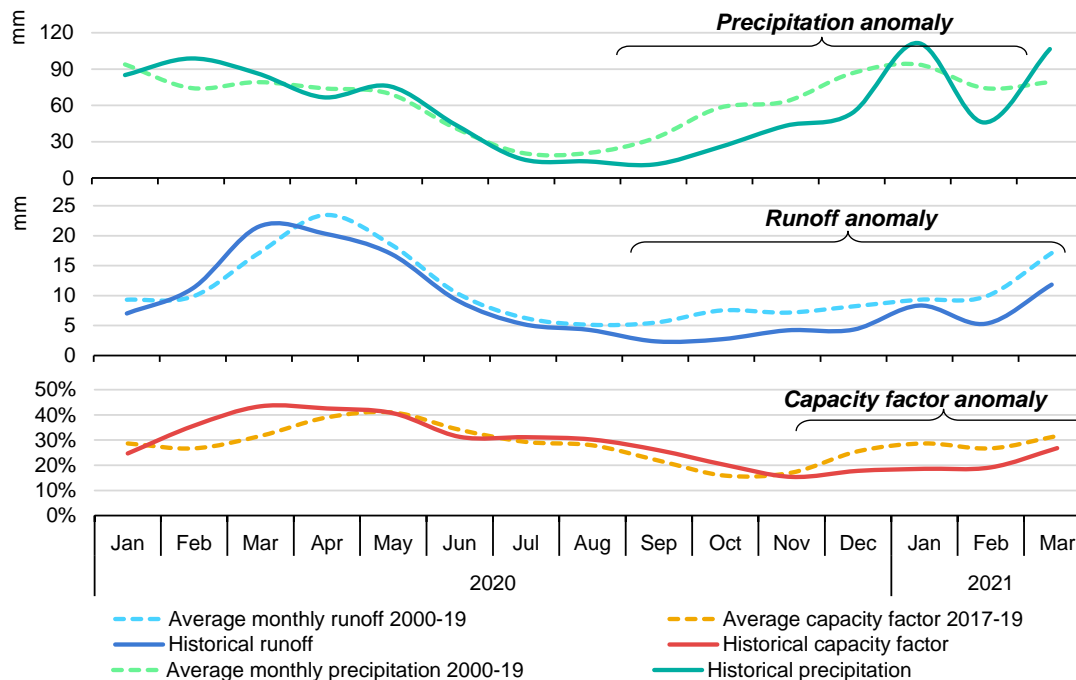
Global electricity generation by source in STEPS and Net Zero Emissions scenarios, 2020-50



While the share of hydro in total electricity generation is expected to see a slight decline, gross hydropower generation is expected to grow 19% globally by 2030. In the NZE scenario, hydropower generation increases by a third between 2020 and 2050, making it the fourth-largest electricity source in 2050.

Hydropower generation is sensitive to extreme hydrological events

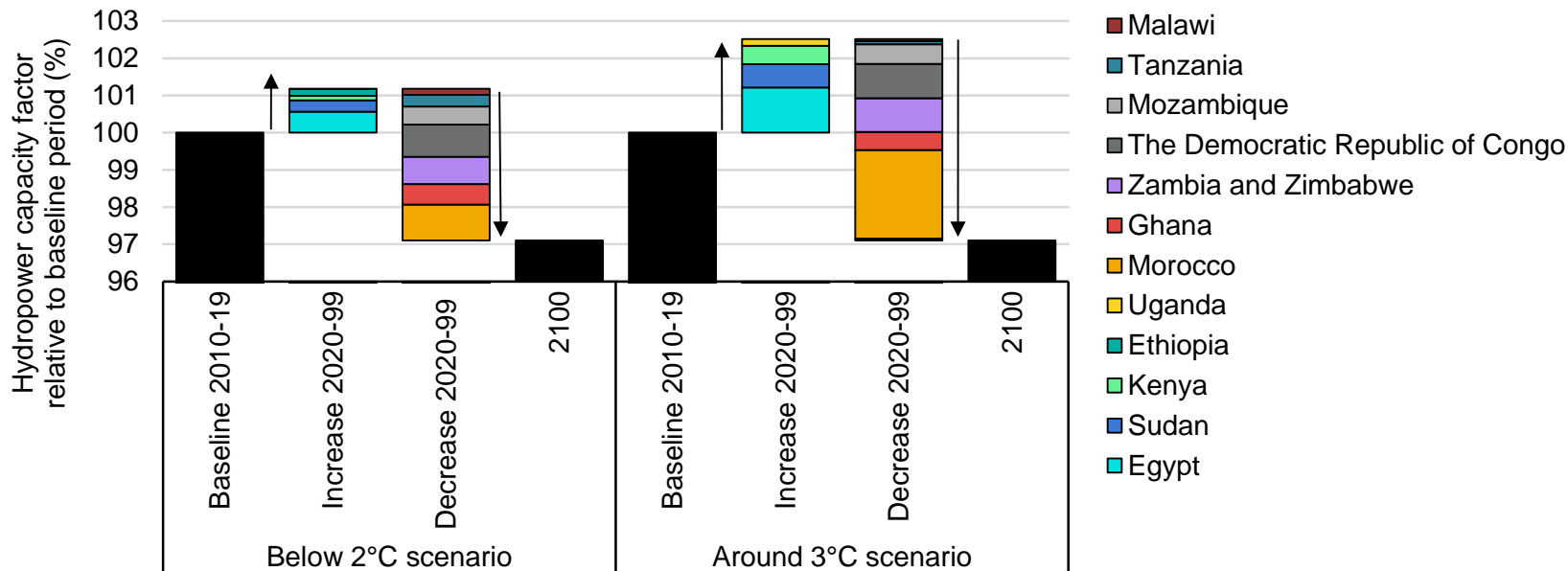
Impact of drought on average hydropower capacity factor, Turkey, 2020-21



While hydropower generation is vulnerable to extreme climate events, dams can also help mitigate their impacts through drought management and flood control, provided harmonized protocols are in place to ensure coordination of water uses located in the same river basin.

Climate change will impact hydropower generation in the long term

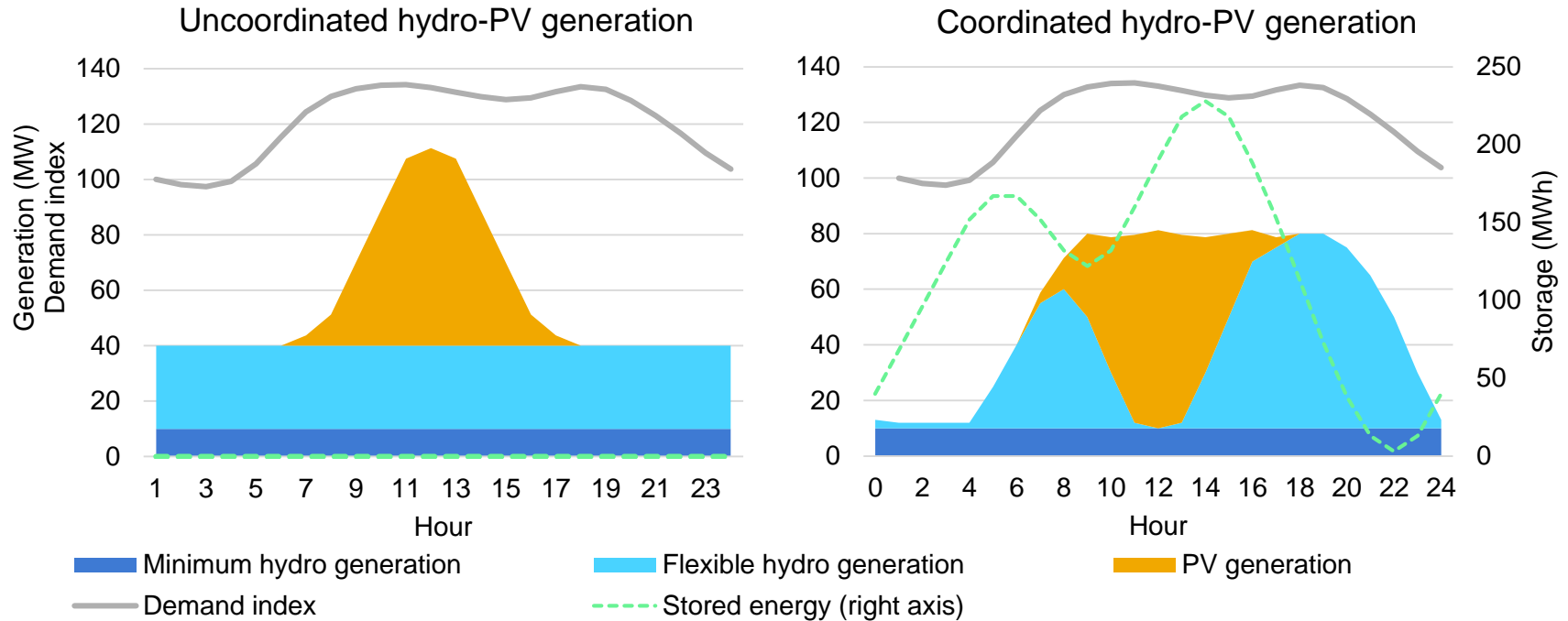
Impact of climate change on hydropower capacity factors in Africa, 2020-2100



Impact varies across regions, with drops expected in most regions but also small increases in others, as well as changes in seasonal patterns.

Hydropower's capabilities alleviate many VRE integration challenges

Theoretical uncoordinated and coordinated intraday generation profiles of 100 MW reservoir hydro and PV power plants



Hydropower's flexibility and storage capabilities allow it to serve as an important facilitator of VRE system integration, even after taking into account constraints resulting from changing hydrological conditions and environment protection rules.