

Theme Presentation: Power System Flexibility

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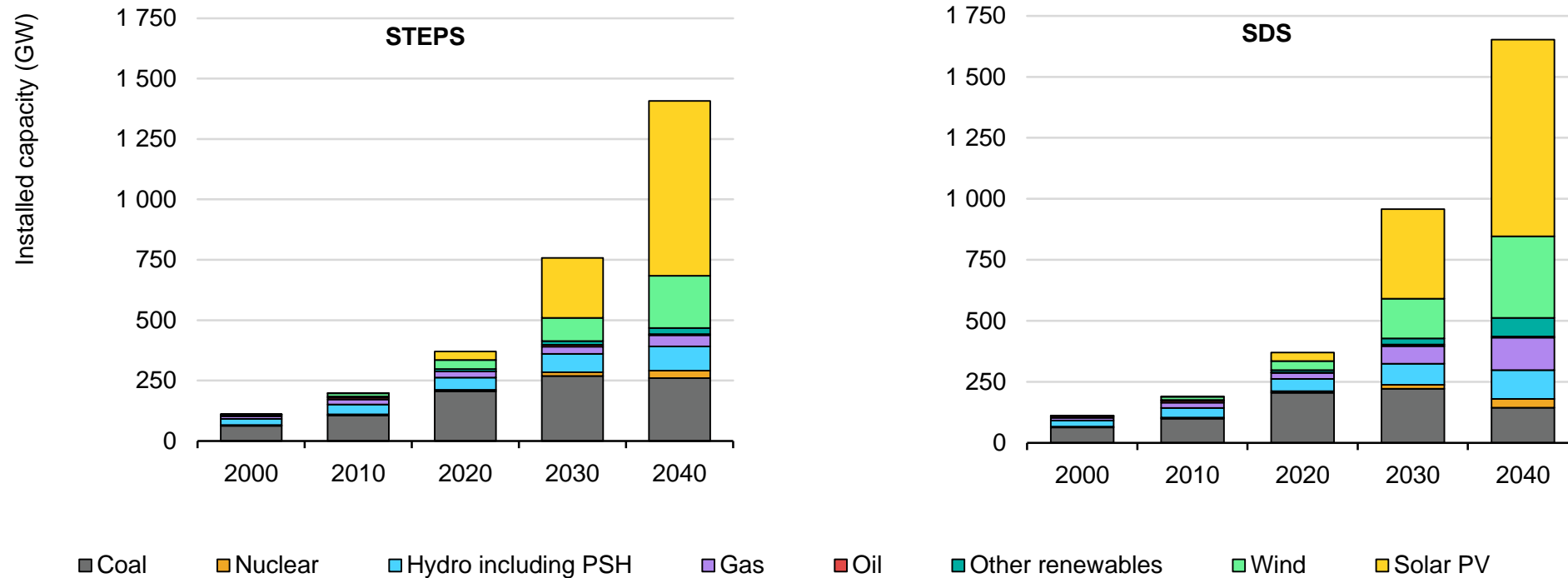
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India targets 450 GW of Renewables by 2030

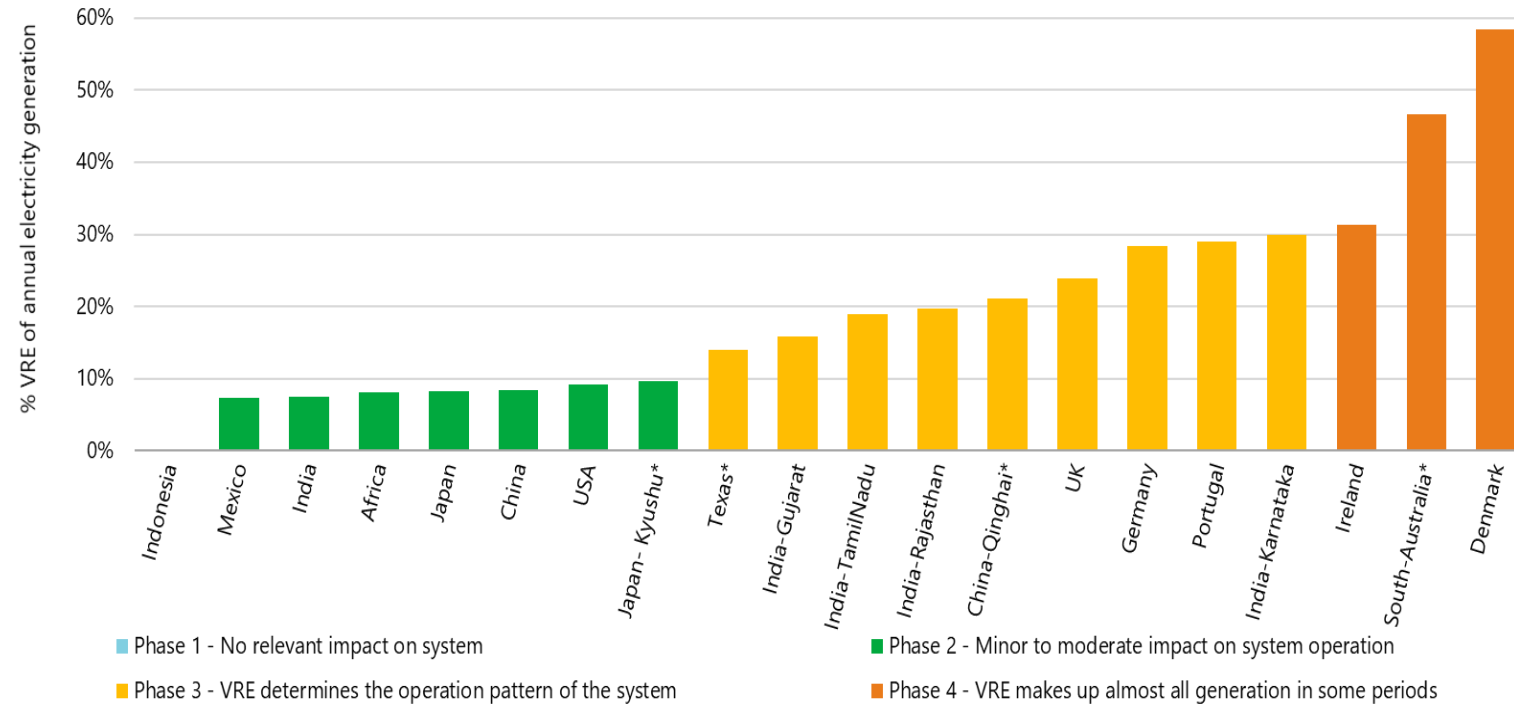
The evolution of India's electricity capacity mix in the Stated Policies Scenario and the Sustainable Development Scenario



Variable renewables (solar and wind) become dominant across all major pathways in India.

High renewables increasingly challenge power systems

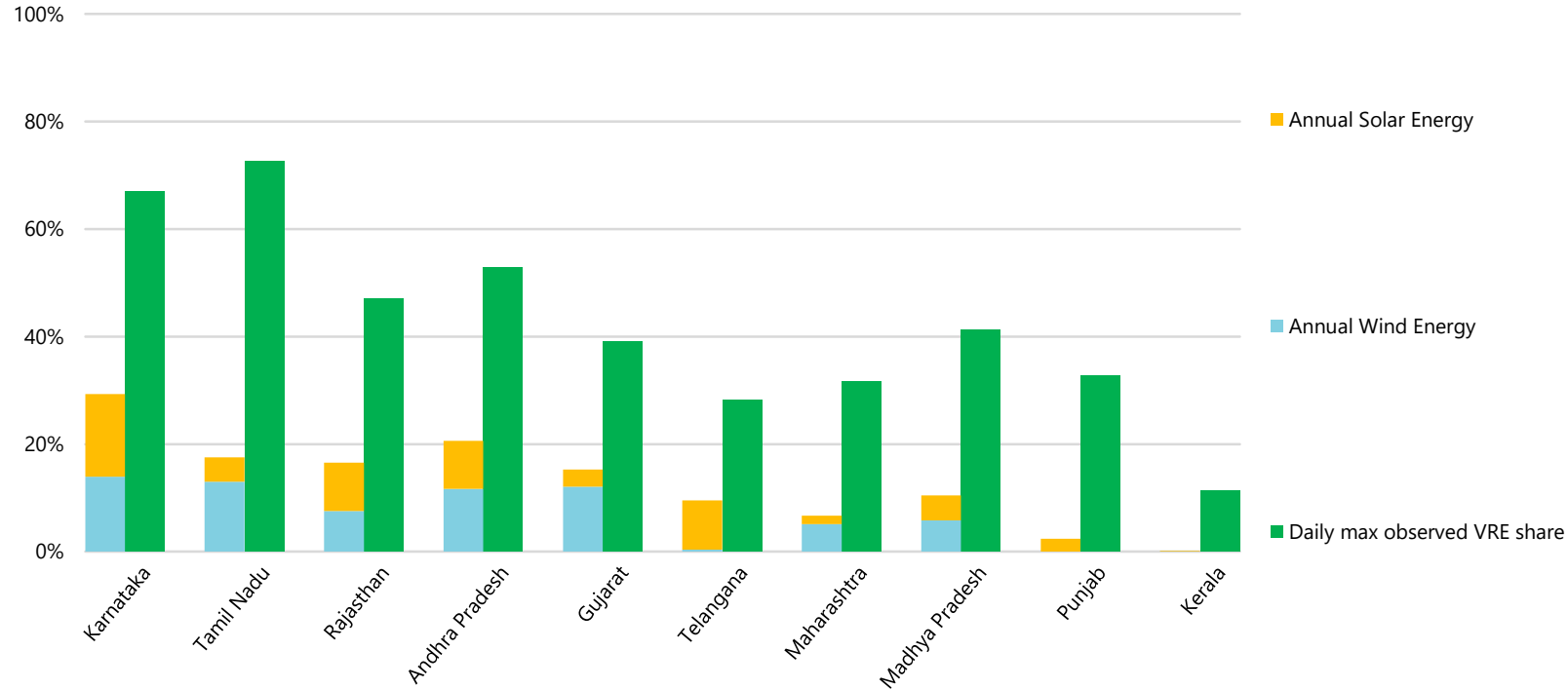
India and global status of solar and wind in the power sector



India's rapid energy transition already places parts of the country at the forefront of renewables integration internationally. The State of Karnataka for instance had more solar and wind generation (30 %) than Germany, UK or Texas in 2019.

High renewables increasingly challenge power systems

Electricity generation from VRE as a percentage of all generation in VRE-rich Indian states, 2020

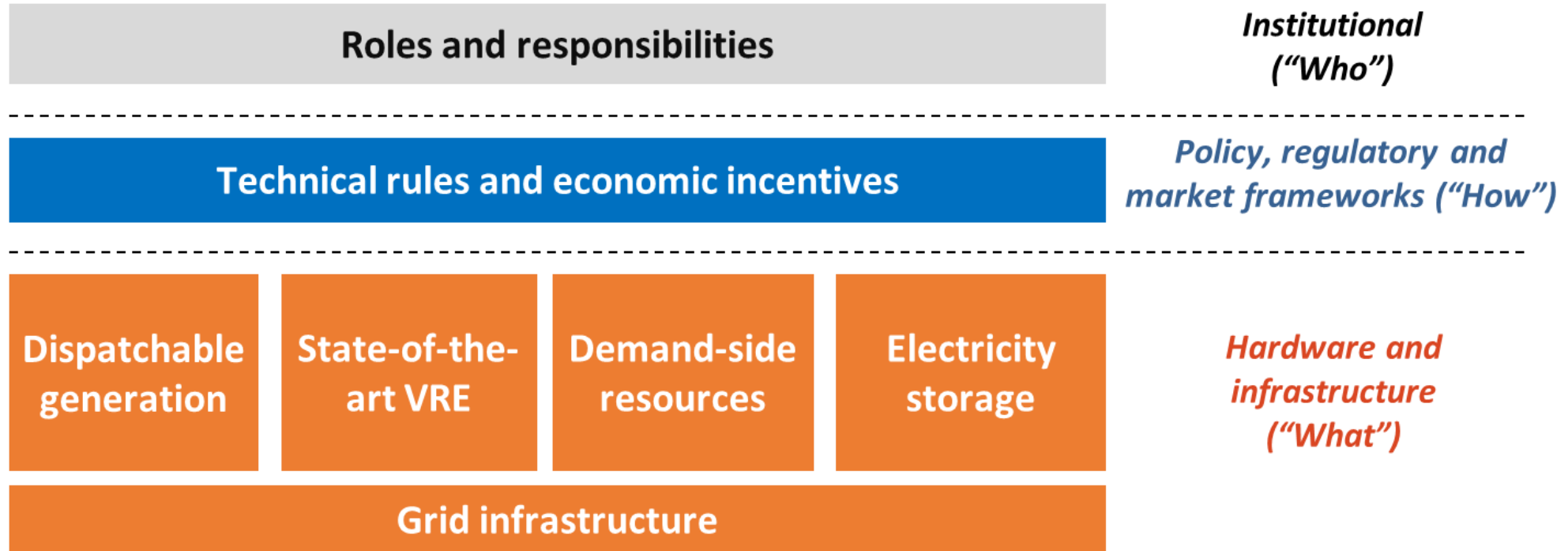


The highest daily share of solar and wind in year 2020 was already close to 70% in both Tamil Nadu (73%) and Karnataka (69%).



Key RE integration opportunities in Indian states

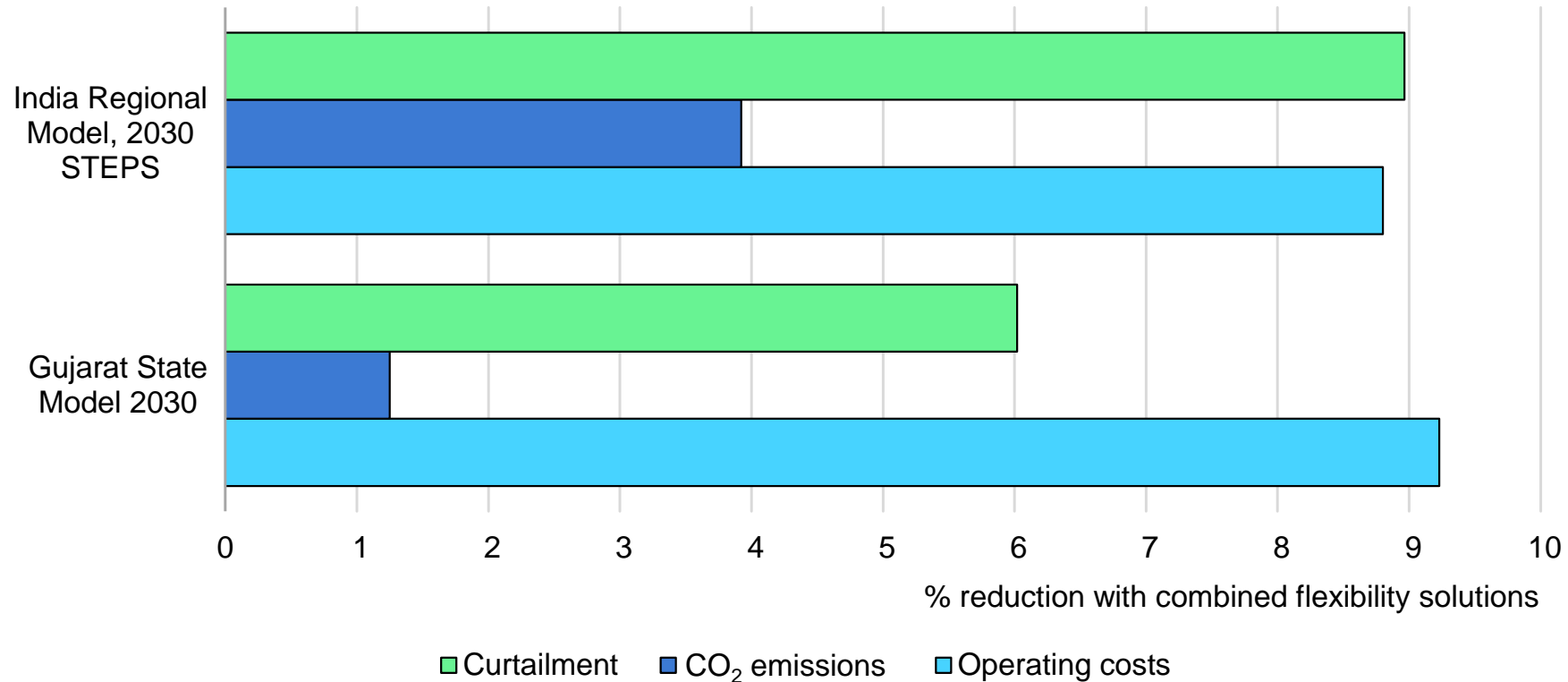
States have multiple options to increase the flexibility of their power systems



The specific flexibility measures developed should depend on the particular conditions of each state

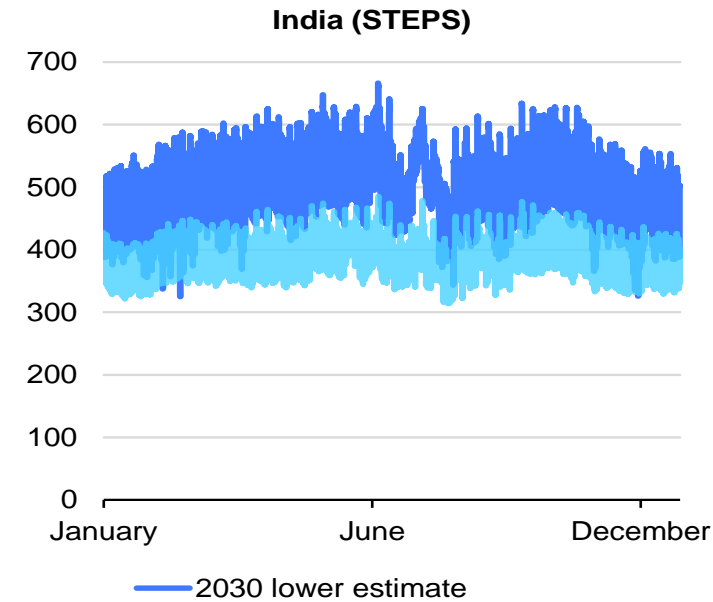
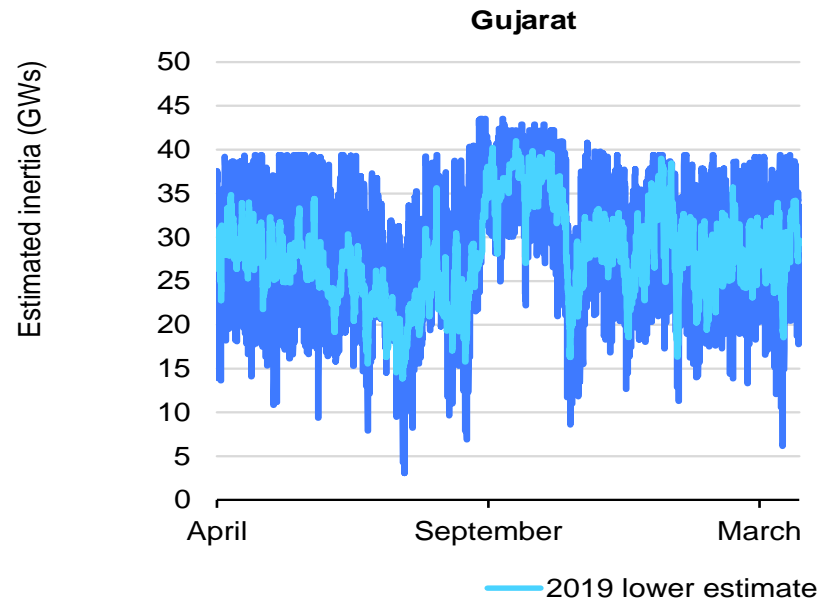
Benefits of flexibility go beyond RE integration

Power system flexibility reduces curtailment, and lower curtailment means reduced system operating costs and lower CO₂ emissions for India



Local system strength may need attention in some states before 2030

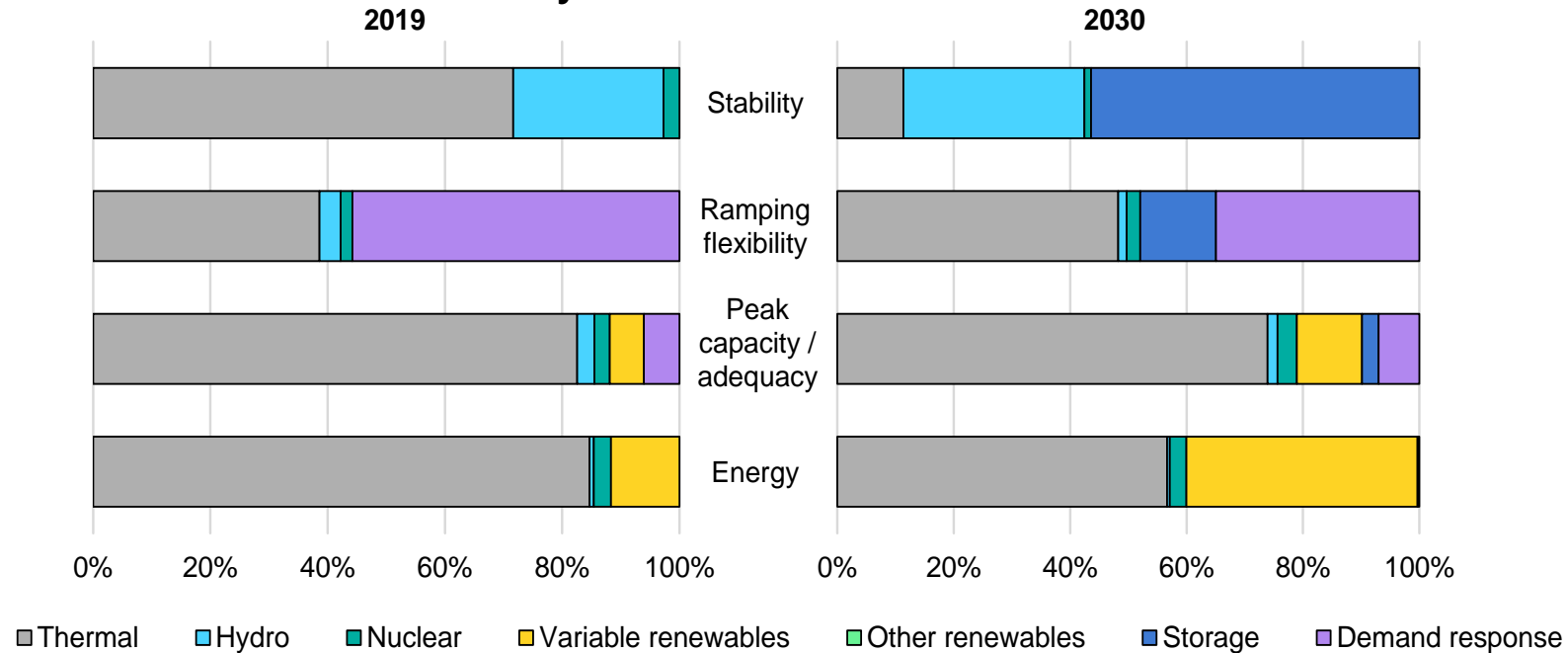
Inertia estimate for Gujarat contracted capacity (left) and whole India (right), 2019 and 2030



According to POSOCO, between 2014 and 2018 system-level inertia dropped slightly at certain moments, when renewable output was high. Going forward on the national level, inertia is not expected to decline significantly as the increase of solar and wind comes with an increase of thermal generation in STEPS.

Electricity security will depend on different technologies and services

Contributions of different technologies in energy and services needed to maintain electricity security in Gujarat, India, 2019 vs 2030.



Technologies providing system security will change in the next 10 years. The optimal combination will be different for each state, accounting for regional and national context. The report highlights key missing policy frameworks for each flexibility option.

Thank You