

## INDIA AND THE 21<sup>ST</sup> CENTURY POWER PARTNERSHIP

Paving the Way to a Cleaner, Smarter, and More Resilient Power System

### Mission and Objectives

The 21<sup>st</sup> Century Power Partnership (21CPP) aims to accelerate the global transformation of power systems. The Power Partnership is a multilateral effort of the Clean Energy Ministerial (CEM) and serves as a platform for public-private collaboration to advance integrated policy, regulatory, financial, and technical solutions for the large-scale deployment of renewable energy in combination with deep energy efficiency and smart grid solutions.

Indian leadership is crucial in both the establishment of the foundational capabilities of 21CPP and the realization of opportunities for applied policy implementation.

Understanding policy regimes that support and accelerate the transition to clean, smart, efficient, affordable, and reliable electricity will help inform decisions that enable innovative solutions, or even disruptive innovations. India has already demonstrated a wide variety of business model innovations across a range of industries. Its potential to do the same in the power sector is an enormous opportunity.

As a member of the Power Partnership Steering Group (PPSG), India provides high-level guidance to 21CPP, and Indian contributions to international knowledge about the legal, regulatory and business environment are an integral component of the Power Partnership.

### Advanced Modeling to Explore India's Renewable Energy Targets

A recent focus of 21CPP's work in India, in collaboration with USAID's Greening the Grid program and with support from the World Bank, has been to provide power system modeling support and training in tools that address critical needs in India as identified by Power System Operation Corporation, Ltd. (POSOCO).

To investigate system operations in each of the states with the potential for significant growth in renewable energy capacity, the team has also used a higher-resolution regional model that provides more robust views of localized operations and can offer more relevant insights to support state-level planning. Key findings of these modeling activities are outlined on the next page.

### About the 21<sup>st</sup> Century Power Partnership

The 21<sup>st</sup> Century Power Partnership is a multilateral effort of the Clean Energy Ministerial and serves as a platform for public-private collaboration to advance integrated policy, regulatory, financial, and technical solutions for the large-scale deployment of clean energy generation in combination with deep energy efficiency and smart grid solutions.

## Key Recent Modeling Findings: Exploring How India's Power System Could Operate with Visionary Targets of Solar and Wind

The use of renewable energy sources, primarily wind and solar generation, is poised to grow significantly within the Indian power system. The Government of India has created a visionary target of 175 gigawatts (GW) of installed renewable energy capacity by 2022, including 60 GW of wind and 100 GW of solar, up from 29 GW wind and 9 GW solar at the beginning of 2017. Thanks to advanced weather and power system modeling developed for this project, the study team is able to explore operational impacts of meeting India's renewable energy targets and identify actions that may be favorable for integration. Recent findings of this work include the following.

### **Balancing Load and Generation at 15-minute Intervals**

Based on the fulfillment of current efforts to provide better access to the physical flexibility of the power system, power system balancing with 100 GW of solar and 60 GW of wind is achievable at 15-minute operational timescales with minimal renewable energy curtailment.

### **Reducing Operating Costs and Curtailment of Renewables**

Changes to operational practice are not essential for 160 GW of renewable energy integration; however, introducing some new changes can reduce the cost of operating the power system and reduce renewable energy curtailment.

### **Coal Flexibility is the Biggest Driver of Reduced Curtailment**

Reducing minimum generation levels of large thermal plants (from 70% to 55%) is the biggest driver to reducing renewable energy curtailment.

### **Meeting Increased Ramp Rates**

The peak system-wide ramp increases 27% compared to a system with no new renewables, to almost 32 GW per hour. This ramp rate can be met if all generating stations exploit their inherent ramping capability.

### **System Flexibility and Retiring Coal Capacity**

Retiring 20% of installed coal capacity (46 GW) does not adversely affect system flexibility, with adequate intrastate transmission.

### **Enabling Efficient and Reliable Power System Operation**

Reducing coal minimum generation levels, enlarging geographic and electrical balancing areas, expanding specific transmission infrastructure, and planning for future flexibility can enable efficient and reliable operation of the power system now and in the future.

For more information, read [Greening the Grid: Pathways To Integrate 175 Gigawatts of Renewable Energy into India's Electric Grid](https://www.nrel.gov/analysis/india-renewable-integration-study.html) at: <https://www.nrel.gov/analysis/india-renewable-integration-study.html>.

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[www.21stcenturypower.org](http://www.21stcenturypower.org)

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