

INDIA AND THE 21ST CENTURY POWER PARTNERSHIP

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

Mission and Objectives

The 21st Century Power Partnership (21CPP) aims to accelerate the global transformation of power systems. 21CPP 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 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, 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 21CPP.

Advanced Modeling to Explore India's Renewable Energy Targets

A recent focus of 21CPP's work in India, in collaboration with the U.S. Agency for International Development'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.

To investigate system operations in each of the Indian 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 21st Century Power Partnership

The 21st 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 in combination with deep energy efficiency and smart grid solutions.

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

The use of renewable energy, primarily wind and solar generation, is poised to grow significantly within the Indian power system. The Government of India has 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 can explore operational impacts of meeting India's renewable energy targets and identify actions that support integration. The findings include:

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.

Improving Coal Flexibility to Reduce Renewables Curtailment

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

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.¹

Next Steps

Expanding Beyond India's Border

Modeling India's power system with a detailed operations model opened the door to higher-resolution regional analysis. NREL, in collaboration with the U.S. State Department and regional partners, linked the operation models of Nepal and Sri Lanka to India to analyze opportunities for electricity trade in the South Asia region.^{2,3,4}

Focusing on India's States

NREL, with sponsorship from the Children's Investment Fund Foundation, is supporting the development of state-of-the-art modeling for power system planners in India's states. Meeting the 175 GW renewables target will require that India's states play a large role in resource procurement and grid management and have access to robust tools and planning practices.

¹ For more information, read *Greening the Grid: Pathways To Integrate 175 Gigawatts of Renewable Energy into India's Electric Grid* at <https://www.nrel.gov/docs/fy17osti/68720.pdf>

² For more information, read *Cross-Border Electricity Trade between India and Sri Lanka: Impact on Power System Operations* at <https://www.nrel.gov/docs/fy19osti/71983.pdf>

³ For more information, read *Cross-Border Energy Trade between Nepal and India: Trends in Supply and Demand* at <https://www.nrel.gov/docs/fy19osti/72345.pdf>

⁴ For more information, read *Cross-Border Energy Trade between Nepal and India: Assessment of Trading Opportunities* at <https://www.nrel.gov/docs/fy19osti/72066.pdf>

WWW.21STCENTURYPOWER.ORG



The 21st 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 in combination with deep energy efficiency and smart grid solutions.

www.21stcenturypower.org

15013 Denver West Parkway
Golden, CO 80401
303-275-3000 | www.nrel.gov

NREL/TP-6A20-73782 | May 2019
NREL prints on paper that contains recycled content.

Front page photo: iStock 927867804