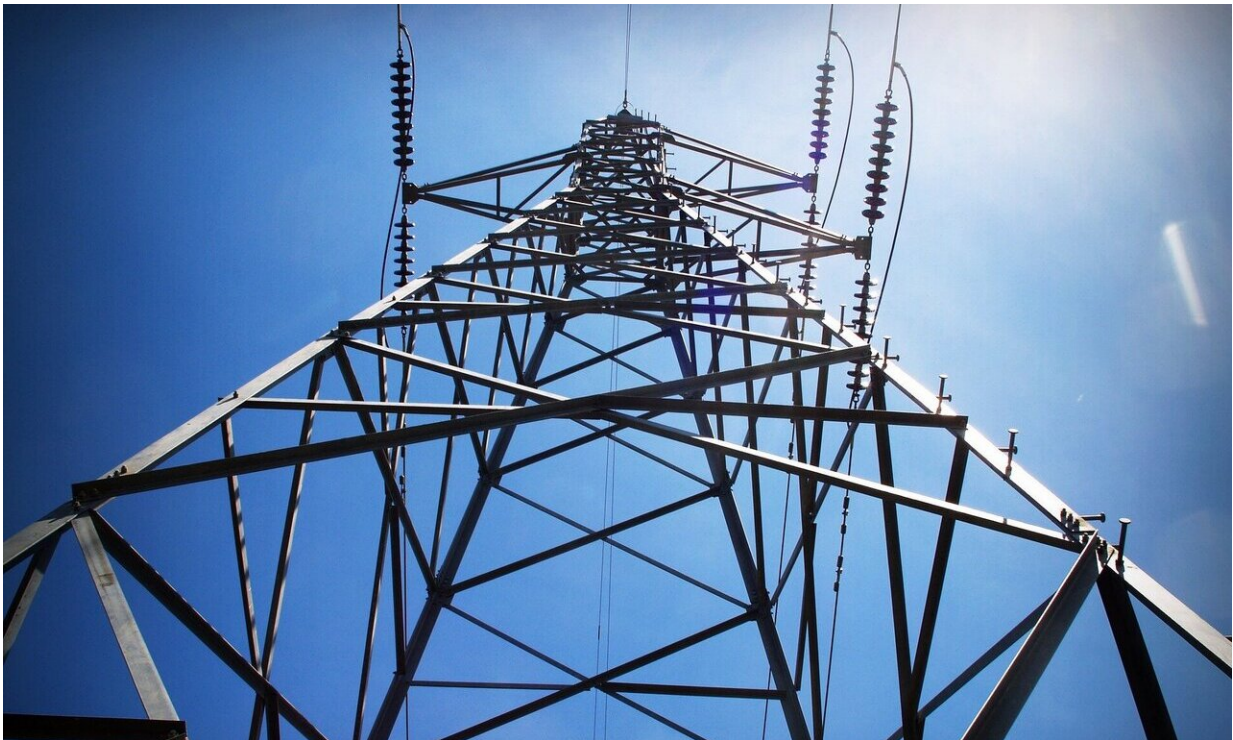


New guidebook informs next generation of grid integration studies

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When the government of India set a goal of deploying 175 gigawatts of renewable power by 2022, they understood changes to their power system's operations were needed to achieve that level of renewable power on the grid. India decided to work with the United States Agency for International Development (USAID) and the United States

Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) to develop a comprehensive grid integration study identifying operational pathways that would enable India to efficiently meet its renewable energy target.

Now NREL's [grid](#) integration experts are making the processes and best practices from India and other grid integration studies accessible in the form of a new [guidebook](#), produced through the USAID-NREL Partnership's Greening the Grid platform, that can be used by power system planners and decision makers across the globe. The guidebook, "Variable Renewable Energy Grid Integration Studies: A Guidebook for Practitioners," synthesizes the past decade of lessons learned and approaches for conducting high-quality grid integration studies.

"This guidebook will inform the next generation of grid integration studies," said Ilya Chernyakhovskiy, NREL researcher and one of the guidebook's authors. "It will help teams and project leaders to build on NREL's experience delivering high-quality analysis and insights, and to build consensus among in-country stakeholders around ambitious renewable energy targets."

Grid Integration Studies Bridge Clean Energy Transitions

Whether the aim is to lower emissions, stimulate their economy, or better utilize resources within their own borders, countries around the world are establishing ambitious targets for grid-connected renewable energy. However, the variable and uncertain nature of wind and solar generation presents novel challenges for power systems.

Grid integration studies focus on system-level issues that affect delivering variable renewable energy sources to a power grid and

identify the least-cost methods to do so. Studies may involve several types of technical analyses, including:

- Identifying future generation and transmission portfolios
- Simulating power system operations under different scenarios and timescales
- Identifying system reliability constraints
- Determining the relative costs and benefits of different actions

Depending on the scope of questions being asked, studies can take months or even years to complete and require coordination across many different actors and entities. To even initiate a grid integration study, elements such as access to high-quality data, staff with modeling capability, and the right set of modeling tools are required. The complexity of these studies is precisely why NREL's Greening the Grid team decided to develop a guidebook that demonstrates how to navigate the process. The guidebook also provides examples of related analyses that can help inform policymakers, without the full commitment of the time and resources needed to undertake a comprehensive grid integration study.

Guidebook Highlights Shared Components of System-Specific Analyses

In the guidebook, lead author Jessica Katz and the NREL Greening the Grid team condense the sum of their shared history facilitating grid integration studies into an anatomy of strategies, terminology, and proven methods for leading successful grid integration studies. While any one grid integration study is inherently system-specific, the guidebook demonstrates how all studies involve similar tools, obstacles, and coordination efforts. Additionally, the guidebook devotes special attention to the process of translating a study into actionable results,

policies, and operational upgrades.

Chernyakhovskiy further underscored the impact of this guidebook's release by emphasizing the breadth of experience it draws from. "This publication is a major milestone in the Greening the Grid platform," he said. "It is the culmination of several years of effort, and the resources provided will be useful to a wide swath of stakeholders internationally."

Cultivating Technical Ability Through Tools and Training

Understanding the philosophy behind Greening the Grid's platform is key to fully comprehending why the new guidebook will be one of the platform's centerpieces.

Greening the Grid stemmed from initial USAID-NREL grid integration efforts in Asia and has since grown into a holistic resource for addressing the technical challenges developing countries encounter when modernizing their grid. Since its inception, Greening the Grid has supported grid integration studies in the Philippines and wind resource assessments in Bangladesh, and the team has brought the expertise of the DOE's national laboratory system to other grid modernization projects around the world.

Greening the Grid is operated by NREL and is funded through USAID via the USAID-NREL Partnership, a joint initiative formed to assist countries with policy, planning, and deployment support for advanced energy technologies. Like all work performed under the USAID-NREL Partnership, Greening the Grid's approach to technical assistance is to promote self-reliance within host countries—researchers do not join projects to execute analyses themselves, but rather advise and help local actors perform the technical analyses independently. Greening the Grid

does this by hosting workshops and trainings, conducting side-by-side technical analyses, and developing accessible and applicable knowledge products, such as the new guidebook.

Chernyakhovskiy sees this guidebook as one means of helping kick-start a necessary and valuable, but often daunting and complicated, process. He hopes that by making the comprehensive resource available to anyone, grid [integration](#) studies like India's can be replicated in any country seeking to scale up their renewable energy power sources.

More information: The guidebook is available online:
www.nrel.gov/docs/fy20osti/72143.pdf

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