



Distributed Solar in Tamil Nadu

Advanced framework for enabling distribution sector transformation

With India's ambitious renewable energy targets and decreasing rooftop solar prices, customer adoption of rooftop solar on Tamil Nadu's distribution network is set to increase in the coming years. With that comes the challenge of how to assess the impact of these emerging distributed energy resources (DERs).

In an effort to help with such an assessment, the National Renewable Energy Laboratory (NREL) has created a holistic analysis framework for Tamil Nadu Generation and Distribution Company (TANGEDCO). The Emerging technologies Management and Risk evaluation on distribution Grids Evolution (EMeRGE) analysis framework and tool will help TANGEDCO and other distribution companies (DISCOMs) in India analyze new interconnection applications and evaluate the system risk impact over time with new emerging DERs.

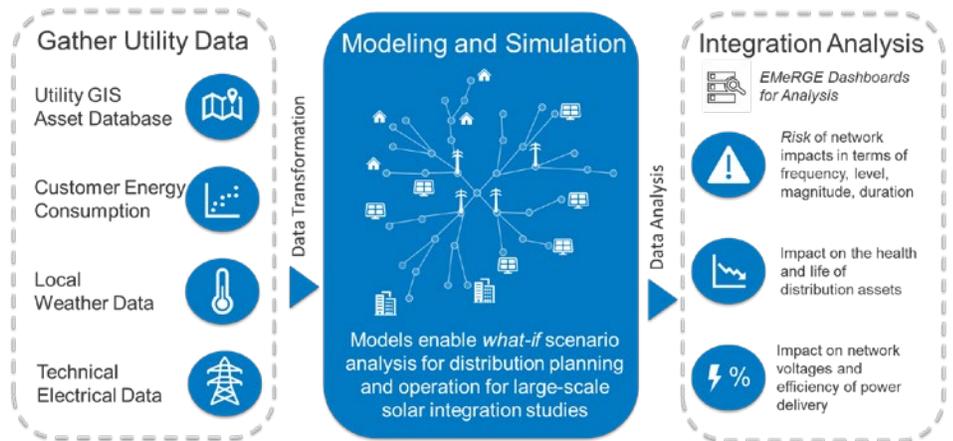


Figure 1. EMeRGE takes key distribution data sets to create holistic models for analysis of the risk to power quality and asset lifetime from the integration of emerging DERs.

EMeRGE Distribution Analysis Tool

Conversion of Geographic Information System (GIS) to Network Models: The tool takes utility GIS data and converts that data to electrical distribution models for power-flow analysis.

Load Profile Analysis: EMeRGE has used TANGEDCO advanced metering infrastructure and supervisory control and data acquisition (SCADA) data to create load profiles for the key load classes (e.g., residential, commercial, industrial, and agricultural).

Power Quality and Asset Risk Metrics: EMeRGE assesses the impact of DERs on power quality (e.g., voltages, asset loading) and the impact on asset lifetime (e.g., transformer degradation).

Analysis Dashboards: The tool comes with an easy-to-run, detailed visualization dashboard, allowing the user to visualize physical location, severity, and time-of-year network assets experiencing changes to risk.



Figure 2. EMeRGE allows distribution engineers to examine and visualize the risk of emerging DERs on utility distribution assets.

Key Outcomes

Distributed photovoltaic (PV) systems improve TANGEDCO network conditions: The integration of PV helps TANGEDCO improve customer voltages, and, at adoption levels up to 50% also helps reduce asset loading. Only at very high PV adoption and capacity installation levels, where generation is much greater than the load, are system assets at risk of being overloaded.

EMeRGE will help TANGEDCO remove barriers to improve solar interconnection: EMeRGE will allow TANGEDCO to model the impact of new interconnection applications as they arrive at the utility, allowing quick assessment of any technical barriers to the integration of new solar PV systems. The tool will evaluate new interconnections and their impact on power quality and update the framework with accepted devices.

Advanced inverter functions are not needed to alleviate technical problems introduced by solar but can provide valuable enhanced voltage control: Advanced inverter functions (such as volt-VAR control) are not required to help alleviate any technical problems introduced by solar PV. However, their introduction could benefit TANGEDCO by improving low system voltages, and benefits may exist for this capability even when solar is not generated as a form of end-of-line voltage control, improving power quality for all customers.

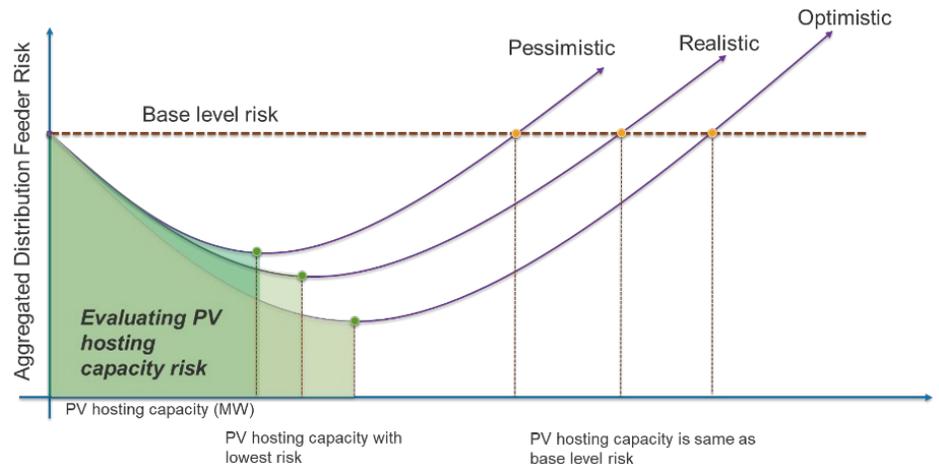


Figure 3. EMeRGE looks at the risk of emerging DERs, such as solar PV, on utility distribution feeders, allowing planning engineers to make informed planning decisions on DER integration.



Figure 4. EMeRGE enables distribution engineers to assess the technical impacts and accelerate approval of incoming PV applications.

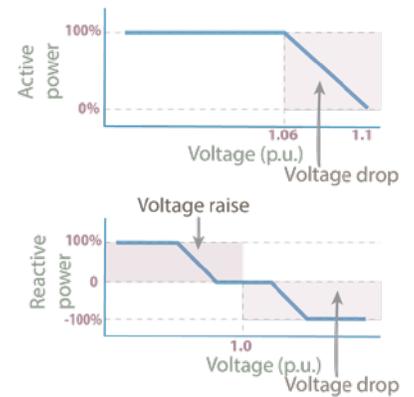


Figure 5. EMeRGE enables distribution planners to examine the potential benefits of advanced inverter functions to provide voltage support.

For more information:

Visit our webpage: [Supporting India's States with Renewable Energy Integration](#)

Email us: SouthAsiaSupport@nrel.gov

About the model:

EMeRGE is an open-source Python distribution analysis tool available online at: <https://github.com/NREL/EMeRGE>.

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