Value of Solar Analysis for Jharkhand: VoS Lite, a Simplified Approach

Presentation for the Jharkhand State Electricity Regulatory Commission

June 2020

Overview

- Meeting in Ranchi to present preliminary Value of Solar analysis results in February 2020
  - The energy value of solar analysis based on PLEXOS, a proprietary software
- Outcome of the meeting was for the NREL/LBNL team to produce a simplified analysis: VoS Lite
  - Allow JSERC staff to follow principles behind value of solar
  - Excel based, transparent methods
- NREL/LBNL with USAID team developed two methods which would approximate the energy value of solar
  - IEX method: Using India Energy Exchange data to estimate today's marginal energy value of solar
  - Generation stack: Using data on available generation to estimate marginal energy value of solar

Review: Value of Solar

- The VoS analysis seeks to calculate the net benefits and costs distributed PV (DPV) provides to the power system
  - Changes based on where the system is located, power system conditions and at what times the system exports into the grid
- Providing DPV customers with more granular and cost-reflective compensation can incentivize deployments in areas where DPV can be most beneficial as well as promoting more 'grid-friendly' operation of these systems

- Values estimated include:
  - Energy (offset fuel costs due to reduced conventional generation)
  - Generating Capacity (offset generation capacity investments)
  - Transmission Capacity (reduce the need for new transmission investments)
  - Environmental (reduce air pollution from conventional generation)
  - Avoided Losses (reduce system losses by meeting demand closer to customer load)

PLEXOS vs. Simplified Analyses

- PLEXOS enables a value of solar analysis based on long-term modeling
  - Considers future changes in electricity generation mix
  - Considers Jharkhand as node within the Indian grid
  - Considers transmission constraints
- VoS Lite
  - Excel-based analyses
  - Based on available empirical data for Jharkhand (for 2019-2020)
  - Can be updated regularly without access to specialized software
  - Does not take into account future changes in the electricity generation mix, specifically as it is related to conventional generation and non-solar renewables
  - Considers Jharkhand as a single node and doesn't allow for transmission or distribution value of solar calculations

VoS Lite Method #1: IEX method

- IEX provides 15-min and hourly prices for bid areas over several years

- Price represents cost of purchasing volumes of energy DISCOMS may need to buy/purchase on the margin

  – Due to outages, higher-than-expected demand, transmission constraints, ramping limitations

- Injections from rooftop solar can be assumes to either **reduce the need to purchase from the IEX** or to **increase energy available to sell on the IEX**

  – IEX prices represent marginal energy value from rooftop systems

- Hourly data from IEX used with solar generation data to determine average energy value for solar generation

- Energy value of solar cannot be determined with much higher levels of solar generation

  – IEX prices are likely to drop from their current levels during the hours when PV generates, but this method cannot account for this

VoS Lite Method #2: Generation Stack

- Data on the generations fleet's variable costs and hourly demand data can be used to estimate the marginal generator each hour
  - Assuming DISCOMs dispatch generators to meet load according to their merit order
  - Need data on in-state and out-of-state generation available for Jharkhand to meet load requirements
- Costs associated with the marginal generator during hours of solar production represent energy value
- Allows energy value estimate at higher levels of solar on grid
  - Can determine cost savings with all generators displaced by solar as one moves down generation supply stack

Review process and comments received

- Review with Ann Josey and Ashwin Gambhir from Prayas
  - Developing capacity expansion and dispatch model with Prof. Ranjit Deshmuk from University of California – SB
- Comments:
  - Agree with approach of using IEX data (E1 bid area)
  - Important to consider imports for Jharkhand
  - Best sources of data from SLDC (inter-state procurement and variable cost estimates for each generator)
  - Could consider transmission constraints
  - Historical focus for IEX

Other value elements

Generating Capacity

~~Transmission Capacity~~

Environmental

Avoided costs when utilities do not procure for demand that is met with DPV energy

Avoided costs when DISCOMs do not need to procure capacity to meet *peak* demand that can be *reliably* met with DPV exports

~~Benefits from reduced congestion due to DPV exports *or* the ability of DPV to reduce the need for new transmission capacity~~
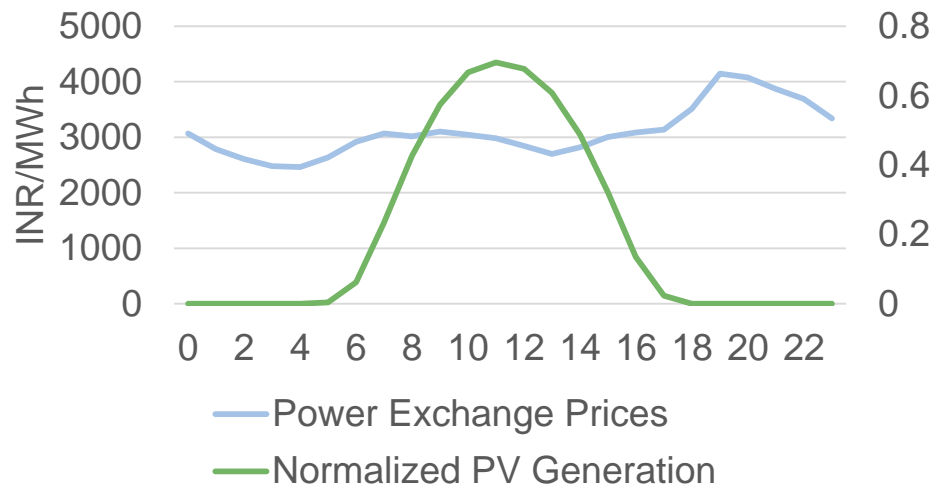
Societal, health or environmental benefits due to DPV exports offsetting generation from more polluting energy sources

All values scaled up by appropriate average distribution and transmission losses

IEX Results: Energy value

- Average IEX prices during PV generation

- Excel based – simple to download data and calculate energy value
- 2019 energy value = 2,949 INR/MWh

IEX method: What can results be used for?

- Determining energy value (and total value) using IEX prices provides estimate for **current value of existing fleet of rooftop solar**
  - Does not consider higher solar levels
  - Not accurate for future projections as historical data is used
- How can JSERC use IEX method?
  - Capacity building tool
  - Net metering impact evaluation and understanding financial impacts of net metering on utility or ratepayers as of 2020
  - Used to determine whether net metering policies should be continued in near term

Generation stack methodology

- Excel-based spreadsheet calculation has been developed
- Though the required data was not located, the methods have been implemented in the spreadsheet
  - Specifically, data on in-state and out-of-state generators available for electricity production in Jharkhand (heat rates and capacity each hour)

Discussion and next steps

- Sharing methods and analysis
  - IEX method
  - Created framework in Excel for "generation stack" method
  - Capacity value of solar Excel modeling
- Discussing how this analysis can be used to evaluate financial impacts of current net metering program
- Scoping further engagements
  - Potentially with on-site partners

Thank you

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