Virginia Solar Pathways Project – Consolidated Studies Report

Studies completed in 2016

Acknowledgment: "The information, data, or work presented herein was funded in part by the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Department of Energy, under Award Number DE-EE0006914."

Key Takeaways - Navigant Distribution Study

- DVP application process for DG interconnection, particularly NEM, will need to be automated in the near future.
- Best practices vary significantly across major utilities for solar integration
    - Large solar interconnections require telecommunications and transfer-trip schemes
    - Many utilities expressed the need for automating interconnection procedures as solar installations grow
- Small distributed generation installations (<1 MW) are likely to be clustered in areas with high income and high rooftop concentration
- Feeders with the following characteristics tend to have higher upgrade costs:
    - Large percentage of line is single phase
    - Long, with a high proportion of the line rated at less than 34.5 kV
- Feeders have different integration cost curve shapes—some require system upgrades immediately, while others need exponentially more upgrades as penetration increases past 50%. A vast majority of the 34.5 kV feeder lines can accept about 25% solar penetration with no additional upgrades.
- Hosting capacity of circuits decreased when dynamic effects were considered
- Emerging technologies can increase circuits' solar hosting capacity
- Further analysis, continuing into next year, will be necessary to better assess the dynamic impacts of solar penetration

Key Takeaways - Navigant Transmission & Generation Study

- Utility scale solar (USS) is likely to be sited in areas with large plots of less expensive land, while smaller distributed generation will be located in areas with high population density. In addition, unlike DG, USS can be installed at a potential optimal site.
- Few voltage or thermal violations occur at low levels of solar penetration, especially at levels presented in Dominion's 2015 Integrated Resource Plan
- Steady-state violations begin occurring when solar penetration exceeds 2,000 MW (approximately 10% of Dominion's current capacity).

- Excluding capital costs, energy cost savings average $75/MWh for up to 2,000 MW of solar installed on the system
    - These savings come mostly from reductions in fuel costs
    - These cost savings decrease as solar penetration increases past 2,000 MW
- The cost savings declines to $54/MWh when the generation system is analyzed from a zonal perspective, which would more closely align with a future scenario with increased solar penetration across all of PJM

Conclusions

Navigant created an iterative process for evaluating solar penetration on the distribution, transmission, and generation systems as solar penetration levels increase. This process can be repeated as solar installations grow, and can be further refined as solar sites are selected and developed in Virginia.

These reports provide an estimate of the expected areas of growth for small-scale residential solar as high income areas in densely populated neighborhoods. This includes areas in Fairfax, Alexandria, Richmond, Charlottesville, and Norfolk. As net metering installations rise, the majority of system upgrades are likely to concentrate in this area and on the very long, rural circuits where solar integration is more difficult.

The main takeaways from these studies also show that the system is fairly resilient at absorbing low amounts of solar penetration, but additional system upgrades might be necessary as solar capacity increases across the system. As technologies evolve and become more cost-effective, energy storage devices or smart inverters may prove to be an integral piece to ensuring the operation and reliability of the grid. This might necessitate more advanced communication and grid control as residential installations grow.

Key Takeaways - NREL Solar Economic Study

- Of the three major components of soft costs, the permitting, inspection and interconnection (PII) fees are lagging the current-year targets to reach SunShot 2020 targets.
- Partnerships between third-party solar developers and electric utilities may provide opportunities for reducing the soft costs of solar deployment
    - Structuring a partnership to allow each entity to execute on its strengths could enable lower cost development
        - Utilities may provide lower-cost customer acquisition and insurance fees
        - Third-party solar developers may provide lower cost installation or system design

    - Utility financing may prove to be an area for soft cost reduction, but is largely dependent on the location of the solar facility and the relevant regulatory structures in place

- In addition to partnering on residential or commercial solar projects, community solar has become an increasingly popular way for utilities to create solar programs for their customers
    - Tax-exempt electric cooperatives may not be able to take full advantage of creating these programs, as they cannot claim investment tax credit on the solar installations

- Tax normalization, which requires utilities to spread the benefit of a solar installation's investment tax credit over the life of the asset, presents a challenge to the economics of utility-administered programs
    - Utilities may still be able to fully participate in the solar markets by structuring solar initiatives to affect only certain customers, or by investing in projects for non-jurisdictional customers
    - The financing of many solar projects may be contingent on the regulatory approval of the state's public utility commission

Conclusions

Clear synergies exist between solar developers and utilities. NREL conducted a survey of several utilities with current solar programs to assess their approach to the soft costs of their programs, and identified areas where significant cost reductions can be achieved. Among other categories, NREL identified customer acquisition and insurance costs as areas with potential for significant cost savings. These findings can apply to the development of community solar programs, as well. These programs can provide additional cost savings for the consumer by applying economies of scale to individual consumers, but approval of these programs can face regulatory hurdles.

An additional challenge to utility-administered programs comes from the unique tax issues surrounding solar installations, investment tax credits, and tax normalization policies. Although in certain cases, these challenges can be mitigated, they present a challenge for solar installations in a utility's service territory.

Key Takeaways – SEPA Community Solar Study

- Community solar programs are complex. Internal and external stakeholders should collaboratively participate in the design process
    - Collaboration between parties can improve design, lessen the marketing challenge, and garner the necessary buy-in.

- Community solar customers respond to simplicity and flexibility.

    - Financial and environmental motivations are main reasons why customers participate.
- Utility billing systems face integration challenges.
    - Involving IT teams early in the design process can lessen the integration challenges.
- Economies of scale must be leveraged in order to keep programs affordable and accessible to the widest variety of customers.
    - However in some states like Washington, the renewable production incentive for community solar partnership can only be used if the solar arrays are below a specified kWh. This is likely to limit the scale of projects.
- Offer other services in accordance with the Community solar program.
    - Other services could include EV charging rates, energy efficiency, and community storage.
- Don't over promise rewards.
    - Negative experiences were had when customers received less of a financial gain than was expected.
    - Focus on the wide variety of benefits including GHG emission reductions and keeping energy dollars local, not just cost savings.
- Provide a feedback mechanism so consumers can see their share of system production and how much it offsets their consumption.
    - As close to real-time as possible.

Conclusions

SEPA conducted their Community Solar Study to determine best practices for implementing community solar programs across the country. The study also performed customer and utility surveys to gain better views into the programs and to garner any successes, failures, and feedback.

The study's findings suggest that implementation of Community Solar programs can be complex to design. Programs benefit from stakeholder collaboration, especially early in the design process. IT integration, especially the billing process, is a costly task. Also, customers respond to simplicity and flexibility in program design. Customers also like to see benefits earlier in the process rather than later. Over-promising and under-delivering for the Community Solar programs were the main customer complaint.