The Governor's Conference on Local Renewable Energy Resources

California's Path To Local Renewables

Grid Planning Panel

Discussion Paper

ISSUE OVERVIEW

For the purposes of grid planning, it is instructive to consider two types of local renewable: customer-based renewable (such as very small rooftop solar), and wholesales renewable (larger facilities from which most or all of the power is sold to the local utility). In order to meet the Governor's 12,000 megawatt (mw) goal, it is going to be necessary to rely heavily on wholesale renewable. The introduction of a massive amount of wholesale renewables would be both a challenge and an opportunity for planning and development of the distribution grid.

Customer-based renewable are located on a fixed customer site, and thus grid planning mostly reacts to the connection of new generation. The addition of such facilities looks to the grid operator more like energy and demand changes rather than new energy and capacity supply. However, wholesale renewables should be treated like new energy and capacity supply, since the location can be more flexible and the energy can be more visible to the grid operator and potentially more controllable. Thus, grid planning for wholesale renewable can involve consideration of where the energy should and will be generated.

An important issue for policy makers is then how to define and identify the "best" places for new local renewables. The determination of "best" depends on the range and prioritization of policy principles and objectives underlying the drive towards local renewables. Currently, technical and physical factors continue to be the primary considerations in locating local renewables: resource quality, grid capacity, reliability / intermittency, etc. However, in taking a more complete view of the impact of large amounts of new local renewables, policymakers must consider other factors such as economic development, full ratepayer impact (e.g. integration costs), site availability and appropriateness, and environmental justice.

Once a policy definition of "best" locations emerges, policymakers then should consider whether to revise distribution grid objectives and change procedures to attract wholesale renewables market to the best locations. Distribution grid development can be critical to the policies that define the market.

SUMMARY

Current grid planning is primarily reactive, with planners responding to predicted demand changes and new generation projects, large and small, in the context of certain principles:

- Reaction to demand changes / anticipated load growth
  - Principle: customers receive service where they are, in the amount they are willing to pay for
  - Grid Objective: meet demand safely, reliably and cost-effectively
- Reaction to a customer adding retail DG.
  - Principle: customers have a right to generate to serve their own load.
  - Grid Objective: serve customer-generator's new load profile and ensure new DG is interconnected appropriately
- Reaction to a new wholesale DG facility
  - Principle: generators can locate where they want and sell energy given that the generator is responsible for incurred distribution grid costs
  - Grid Objective: Ensure that the new facility is interconnected appropriately and modify the system as necessary to serve customers safely and reliably.

For wholesale renewables, grid planning could be more proactive in identifying the locations where the generation of energy has higher value to stakeholders. Then, such additional value could be reflected in the market. Instead of reacting to the locational decisions of wholesale renewables developers, policy makers could ensure that the market is encouraged to go to the places where the generation has the most value.

In addition, such a proactive approach could be additionally useful because the studies needed to assess impacts on the distribution and transmission grid are usually lengthy.

Any shortening of those timeframes would require advance work, as described further below.

The following are some suggested elements that could be used to determine location-based value. These elements are defined by policy objectives.

Policy Objective	**Value Factors**
Capturing the best renewable resources	Resource quality (i.e. production potential)
Lowest Cost Energy	Full cost accounting of T&D, permitting, construction, congestion, line losses, site availability/appropriateness
Schedule / Speed of deployment	Easiest, low-cost interconnection, Environmental impact
Grid Reliability / Balancing / Resilience	Resource Adequacy, islanding, inverter functions
Matching demand growth/changes	Generation profile (e.g. match to anticipated electric vehicle adoption)
Economic Development	Local job creation, economic multiplier, attracting business, tax revenues
Environmental Justice / Public Health	Reduced pollution, fair access to clean energy, right to self-generation

Significant procedural changes would be necessary to determine location-based values. Here are some potential requirements:

- Conduct comprehensive studies before receiving interconnection requests
- Establish systems for ongoing evaluation of locations as conditions change.
- Integrate distribution planning with transmission planning to determine value for avoiding additional network costs, congestion and line losses, and with smart grid planning to understand grid conditions and consider where smart grid functionality is necessary/beneficial to local renewables
- Coordinate with the California Independent System Operator (CAISO) to calculate resource adequacy value

With location-based value information in hand, the following represent potential policy changes that could encourage development in preferred locations:

- Utility- published grid information so that wholesale renewables developers can be aware of the preferred locations as early as possible Standardized pricing of interconnection in preferred locations
- Streamlined interconnection processes for renewable generation in preferred locations, e.g., by studying "bulk" resources in high-potential areas in the regular interconnection-study process instead of requiring each project to be studied separately
- Location-based value reflected in the pricing of Power Purchase Agreements: Utilities could pay wholesale local renewable developers more for their energy based on the pre-identified location-based value
- Socialized network costs: Where it is shown to benefit ratepayers, interconnection and the distribution grid network, upgrade costs could be rate based, as they are for the transmission system

BACKGROUND

Customer-based renewables, also referred to as "behind the meter" generation, is mostly invisible to grid operators. While the operators know when new generation is installed behind the meter, they don't know when and how much energy will be generated on an ongoing basis or how much of the generated energy will be used on-site. Thus, customer-based renewables offer grid operators a different kind of load profile plus occasional small exports to the grid. This requires grid planning to be reactive and new generation doesn't directly aid in resource adequacy requirements.

In contrast, wholesale renewables not necessarily associated with any specific load and are more visible to grid operators, making the net impact on the distribution grid more predictable and potentially more controllable. This could enable grids planners to have a more direct impact on the siting of new generation

Wholesale renewables is a very young market, with very few online projects in California. The utilities developed and own several of the projects that are online, hence grid planners have had minimal experience in completing interconnections and grid upgrades for independent wholesale local renewables projects. However, the utilities are now faced with a large number of interconnection requests for new wholesale local renewable energy projects.

This flood of requests makes it difficult for the utilities to dedicate resources to proactive grid planning. For example, Sacramento Municipal Utility District (SMUD) conducted a detailed study of its electrical grid, prior to the launch of its feed-in tariff (FIT) program to produce a map of broad areas where new interconnections might be less costly. The investor-owned utilities have been able to publish similar, but all of these maps use only one major factor, available grid capacity / low cost interconnection, to evaluate potential wholesale local renewable energy locations.

The cost of interconnection is one of the most important factors in determining good locations along the distribution grid because developers must pay all related costs for interconnection and distribution network modifications. As a result, interconnection costs have become a major barrier for such projects. In contrast, ratepayers often absorb the initial cost for transmission upgrades needed to serve large, central-station renewables . With proper grid planning, the utilities could help local renewables developers overcome this disadvantage.

In addition there are no incentives to locate local projects where they can help avoid network modifications, improve grid resilience or provide energy close to load. In addition, the prices paid for output from such projects do not fully consider the location-based value of the local renewables, such as the additional Resource Adequacy value in load centers or the reduction in energy loss by avoiding long-distance transmission lines.

CHALLENGES

Some of the key challenges in making the necessary changes to accommodate large amounts of new DG include:

- Sheer volume of current interconnection requests and limited experience in studying/processing this young market
- Jurisdictional / physical overlap and friction: Projects that electrically affect each other may handled by different entities / processes
- Data availability: Some information about the distribution grid is currently not collected / available for central analysis (e.g. minimum load statistics)
- Modeling sophistication: In California, the systems may not be in place to accurately model/predict the intermittent output of local renewable energy facilities
- Policy constraints: The inertia of existing regulations can prevent beneficial paradigm shifts e.g. rate basing, resource adequacy, confidentiality rules

POSSIBLE SOLUTIONS

Resource Adequacy consideration:

The savings calculations should include avoided Resource Adequacy (RA) costs, especially in transmission-constrained Local Capacity Areas (LCAs). Resources locating in these areas not only count toward meeting utility RA targets, they also cover the specific RA Location-Constrained Resource (LCR) credit toward the portion of the RA capacity that must be located in transmission-constrained local areas – in other words, they provide additional RA value to ratepayers.

German-style cost allocation:

In Germany, DG developers are only responsible for the costs to interconnect their facilities to the nearest point on the grid. Further grid modifications are socialized across all ratepayers. Such a policy shift could remove a major complicating factor in grid planning, but may also result in inappropriate cost allocation to ratepayers. The CAISO is considering some version of this in its transmission-level planning, and it should be considered as well for the distribution grid.

Grid Modeling Software

Recent CPUC and CEC events showcased software that can characterize the technical specifications of the grid and model the impacts of new DG facilities. Such software could be included in smart grid investment plans

Predictive Models

In a recent California Energy Commission workshop, it was shown that the German grid operators are significantly more accurate in real-time predictions of generation from local energy facilities. If California could adopt similar systems and methodologies, it should be easier to plan the grid for local renewables and determine location-based value.

Multi-Stakeholder Collaboration

The Renewable Energy Transmission Initiative (RETI) was a multi-stakeholder collaboration that resulted in identifying the preferred zones for large-scale renewable generation as well as the needed transmission lines to reach those zones. Could a similar collaboration model be used for identifying and planning for preferred local renewables locations? Because the distribution grid has an order of magnitude more circuits, substations, etc. than the transmission grid, this could be a much more difficult and lengthy process.

Cluster Studies of Interconnection

One of the most complex problems with a large volume of interconnection requests is the cumulative effect of projects in a concentrated location. In this case, the combined impact on the distribution and transmission grid is not attributable to a single project. The CAISO and the investor-owned utilities use what is referred to as a cluster approach to assess related interconnections. However, developers have objected to the way this approach has been implemented in the interconnection tariffs.

IMPORTANT QUESTIONS TO PURSUE

- What is the complete set of objectives that need to be considered when determining location-based value of wholesale local renewables? (starting list suggested above)
- How should policymakers prioritize these objectives? Ultimately, one would want to prioritize based on total benefit to California citizens (not just ratepayers). To the extent that each type of benefit can be monetized, would the benefits be ranked, or could some kind of blended priority score be created?
- How best can the location-based value for each objective be determined?
- What are the near term procedure and policy changes needed to encourage development in the highest location-based value?
- How can smart grid development help in grid planning efforts and location-based renewables policies?
- What new requirements would be placed on the smart grid by large volumes of new local renewables?