Distribution System Planning & Use of The Grid

Advancing Transparency & Collaboration
Ensuring Reliability & Affordability

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EXECUTIVE SUMMARY

The distribution grid is evolving from a one-directional delivery channel for electricity to a resilient platform that allows for not only the optimal planning, dispatch and valuation for distributed resources but also the facilitation of a wide variety of customer engagements. This modern distribution system requires upgraded infrastructure, new planning methods and revised operating and maintenance procedures. Allowing the utility to serve as the platform operator facilitates and incents greater participation by distributed resources and customers, while ensuring electric service remains reliable and affordable. Evolving the tools and practices applied to identifying and addressing distribution system needs is an integral step utilities should take to achieve this 'utility as platform' end state that will advance the interests of customers, third parties and communities.

The capabilities of distributed energy resources ("DERs") have expanded and their costs have declined over the past several years. While the increased penetration of DERs increases grid complexity, the role these assets can and should play as grid solutions has significant potential. As these new technologies evolve and mature, and utilities gain experience and confidence in the application of DERs to meet grid needs, non-wire alternatives ("NWAs") that present reliable, cost-effective means for addressing grid needs should receive consideration in the planning process. To this end, a variety of stakeholders are engaging in dialogues regarding how to further modernize utility distribution system planning ("DSP") to make these processes more transparent and the resulting NWAs more collaborative.

Due to the nascency of the DSP issue, this paper addresses process advancement only as a vehicle for identifying and developing cost-effective and reliable solutions to system capacity and reliability needs. Ultimately, however, a more transparent and collaborative DSP process could further aid stakeholders and utilities in identifying economic and equitable means to increase locational hosting capacity, improve interconnection ease and aid in DER locational and temporal valuation.

The utility, as a public service company and as the distribution system operator, can and should be making investments in the grid to maintain and advance reliability, affordability and equity of access. Many utilities are working to evolve grid planning and establish new regulatory and business models as they seek to engage stakeholders to facilitate the integration of a rapidly growing number and range of decentralized resources that may both drive and serve system needs. However, the resulting planning process must be streamlined, predictable and rational so it does not compromise the integrity of the grid. Thus far, no "one-size-fits-all" solution to DSP reform has presented itself. Nonetheless, foundational policy parameters have emerged.

Authority for Planning

As the regulated entity charged with serving all reliably and affordably, the utility must maintain its ability and authority to plan for the needs of the distribution grid. It is also important, however, that the utility planning process allow for transparency, credibility,

and for the evaluation of all options to determine which can best serve grid needs while cost-effectively addressing public policy objectives.

Compensation Mechanisms

If appropriate regulatory constructs are not created, NWAs could present a sub-optimal solution and/or a threat to utility financial health. Direct utility ownership of NWA assets must be available if that approach is the most cost-effective or necessary to ensure grid reliability. Alternatively, if third party ownership is more cost-effective and would not impair reliability, mechanisms must allow the utility to treat a contract for access to a third party asset as it would one it directly holds.

Risk Mitigation to Protect Grid Reliability

There is reliability risk inherent in reliance for grid needs on parties not subject to regulation and on programs or assets that depend on voluntary action, third party maintenance, or uncontrollable factors such as weather. Some of these risks can be ameliorated by having a common technical understanding of the criteria that will be used for selecting NWA solutions. NWA selection criteria can include:

- Ability to meet system needs;
- Level of complexity;
- Cost-effectiveness (may include avoided cost and/or value of service);
- Alignment of timing of system need and NWA availability; and,
- Synergistic ability to address multiple needs.

In addition, contracted DERs will likely need to be subject to utility operational control and to performance assurances. These requirements can be addressed through regulatory, contractual, operational, or infrastructure means.

Regulatory Review

To the extent there is need for a regulatory process to review utility planning criteria and decisions, that process should be defined in advance, streamlined, transparent, and under the jurisdiction of the state utility commission. As these regulatory processes evolve, stakeholders -- including regulators -- should work together to establish appropriately streamlined mechanisms for evaluating and selecting these resource alternatives. In its role as the DSP process regulator, a commission can either review a utility's system plan to determine if it was developed under the agreed upon process and criteria or choose to approve the utility plan and limit any subsequent review of utility decisions thereunder to a determination of prudent implementation.

In sum, optimal DSP process characteristics include the following:

- Timelines are clear and consistently applied;
- Planning criteria are agreed upon and conform with the technical requirements utilities face in grid operation;
- Stakeholders are afforded visibility and opportunity for input based on clear criteria;
- The utility is given an opportunity to incorporate, as appropriate, stakeholder input;

- Compensation and risk mitigation mechanisms remove financial and system reliability concerns that may drive a utility to discount third party solutions;
- Regulation of the process, if needed, is by the same agency that regulates utility rates; and,
- Plans thus prepared can be relied on by the utility to make long-term capital investments.

DSP process reform should be seen as subject to evolution. Implemented properly, DSP reform presents a critical opportunity for utilities and stakeholders to develop plans that allow for alignment with public policy goals; ensure the identification of best possible, least cost solutions to grid needs; facilitate discussion of proposed investments and mutual understanding of value derived from those investments; and, engender greater stakeholder trust in the ultimate outcome.

INTRODUCTION

Over the last several years, interest in utility investment decisions has steadily grown and has expanded from a focus on major capital investments (e.g., new transmission lines and peaker plants) to include interest in distribution system decisions. This paper opens with a brief discussion of past and current utility Distribution System Planning ("DSP") approaches and the leading factors driving stakeholder interest in this increasingly complex and technical process.

Over-Arching Trends

NWAs are increasingly viewed by regulators and stakeholders as potential solutions for addressing capacity constrained locations on the grid.

Utilities are proposing increased planning transparency and NWA consideration through processes that reflect the continued responsibility of the utility to ensure that decisions regarding when to employ NWAs are predicated on ensuring the sufficiency of these alternatives in maintaining or enhancing system reliability and affordability.

Utilities continuously evolve the consideration of tools, technologies and design practices they apply to distribution system needs. As the capabilities of DERs have expanded and their costs declined, so too has the role these assets could play as system solutions. While DERs can provide system capacity solutions, they may also create system challenges associated with voltage and power quality that could negatively impact reliability. Non-Wires Alternatives ("NWA")[1] are conventionally understood to represent non-traditional investments and operating practices that may be deployed to meet specific grid needs, while minimizing or avoiding these unwanted potential impacts. It is widely acknowledged amongst policy makers and in practice with utilities that, as these technologies evolve and mature and as utilities gain operating experience, NWAs should be considered if they present reliable, cost-effective means for addressing grid needs. In addition to discussing the policy implications associated with DSP process reform, this paper addresses foundational policy constructs that can be established to allow for the robust consideration of NWAs in a DSP process.

Underpinning the foundational policy parameters that should be considered when crafting new utility distribution system planning and NWA deployment approaches is the assumption that the goal is to increase consumer benefits through system planning transparency and collaboration on solution execution while maintaining grid reliability. It should be noted that, due to the nascency of the DSP issue, this paper addresses process advancement from the perspective of the utility – as a vehicle for identifying and developing cost-effective and reliable solutions to capacity challenges. DSP process change

[1] The definition of what may constitute an NWA, how it is deployed on the grid (including who makes such decisions), who may own and operate such tools, are issues still under debate; however, NWAs are understood to include DERs such as photovoltaics, energy efficiency initiatives, demand response, energy storage, controlled electric chargers, or other grid edge energy devices. Some of the technologies contemplated for incorporation in NWAs are nascent and their costs are still high; however, others, such as energy efficiency and demand response, are more established, with costs that may potentially be competitive with traditional grid solutions

may have additional benefits associated with greater transparency and wider engagement in crafting solutions that enable greater consumer control and more consumer choices.

DISTRIBUTION SYSTEM PLANNING YESTERDAY AND TODAY

Simply stated, system planning from the utility perspective involves determining the investments that must be made to operate and maintain the grid in a way that ensures sufficient capacity to address demand while also maintaining voltage and reactive power within required limits. For many years following the first electric illumination of our streets and homes, demand for electricity and the infrastructure to deliver it grew along a rather predictable path. The inability to effectively store energy at the distribution level meant that capacity expansions were calibrated to meet peak demand and utility system planning at the distribution level focused on these peak needs and on extending the existing system to serve new communities. With time, however, utility distribution system planning shifted from grid expansion to improved grid reliability as well as grid solutions to address consumer interest in greater choice and control and a variety of public policy needs. As part of this effort, there has been an interest in exploring new and emerging technologies to address these system needs.

The growth of Distributed Energy Resources ("DERs") and consumer demand for greater energy market engagement requires that utilities evolve system planning approaches. Today, utilities engage in a complex and iterative process of load forecasting, assessing current equipment conditions and capabilities and -- based on these forecasts and assessments -- planning for equipment maintenance, replacement, and upgrades. At times, distribution system planning may need to involve more granular level assessments and forecasts at the feeder level— so as to address specific locational system needs. Within this complex process, load forecasts are regularly updated and plans recalibrated to reflect changing realities or new information. Utilities are continuously expanding the tools to apply and assets to deploy in maintaining, expanding and modernizing the grid. All this is done by the utility as the distribution system operator to ensure it is able meet its regulatory compact -- to safely, reliably and affordably distribute electricity to everyone. This compact hasn't changed; the utility still holds the responsibility for serving all customers and managing risk associated with ensuring system reliability.

WHY THE INTEREST IN DSP NOW?

The current interest in evolving distribution system planning processes is being driven by a diverse set of stakeholders including the utilities themselves, customers, regulators, environmental and social justice advocates, and new market entrants seeking opportunities for business development. The reasons for this new interest in DSP are as diverse as the stakeholders, but they can be distilled into four thematic areas.

Grid Quality vs. Electricity Quantity

In most cases, flat or declining demand for a product is associated with flat or declining investment in the mechanisms for delivering that product. In the case of electricity, however, while load is flat or declining due to increased energy efficiency and DER integration, investment in the grid has been steady or on the rise. This new paradigm is appropriate given the shift in grid investment drivers from quantity-based factors (volume) to quality-based factors such as a growing dependence on electricity, rising grid complexity, new natural and man-made threats to the grid, and new consumer demands for cleanliness, choice, resiliency and flexibility. In fact, investments are required for many reasons, including replacement of aging infrastructure and the enablement of specific public policy goals such as transportation electrification However, this perceived disconnect between flattening load and continued investment in the grid is the first influence driving interest in DSP.

Equity and Affordability

Though electricity bills remain a relatively small share of the average American household's monthly expenditures, studies show that underserved groups, such as moderate to low-income renters, spend up to three times more than the average household on home energy costs[2]. Diligence in ensuring that current infrastructure costs and proposed system investments are prudently incurred and result in value to all customers, including these often-underserved communities, is a second factor driving interest in the planning process underpinning utility system investment decisions.

Societal Imperatives and Policy Goals

The grid can and must play an integral role in addressing societal imperatives such as improving community resilience, achieving decarbonization targets, and enabling greater and more equitable customer choices. It follows that those charged with implementing policies to achieve these societal goals will seek transparency and coordination in planning for the platform that will enable the solutions, namely the grid. This public policy lens is the third major driver of interest in DSP.

NWAs as Potential DER Value Streams

Finally, given the rapidly growing interest in solar, storage and more advanced demand side management tools -- the DER developer community and individual consumers interested in DERs for their homes or businesses are eager to understand both how the costs of installing these technologies could be reduced and how the value of these technologies could be increased if they are leveraged to meet grid needs. The potential for using the utility distribution planning process to increase hosting capacity, reduce

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[2] Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities, APRIL 20, 2016, Research Report u1602, Ariel Drehobl and Lauren Ross, ACEEE.

interconnection costs and participate with DERs as NWAs and in other value streams is the fourth and final major driver of DSP interest.

These four broad drivers of interest in DSP are not equally distributed across the nation. The relative weight of each driver in a jurisdiction as well as current regulatory and reporting constructs differ. As a result, one can find current and proposed DSP processes and NWA consideration approaches along a continuum that ranges from utility insular (the utility conducts its planning process with little or no external participation or review) through stakeholder-informed to collaboratively delivered.

Although we are just beginning to observe the emergence of DSP initiatives, the overall objectives of DSP reform are in fact very similar to those in Integrated Resource Planning ("IRP") processes. The objective of an IRP is to identify -- often via a stakeholder-informed process -- a preferred mix of resource options, considering factors such as, but not limited to, demand for energy/electricity, public policy objectives, new technology resources, and cost-efficiency. IRP processes are iterative, often addressing long term needs over a 10-20-year planning horizon. Proponents of DSP reform seek similar consideration of public policy objectives, cost-efficiency, and the integration of DERs. A number of states with IRP processes in place are extending these processes to include distribution system decisions of a certain scope and nature. In most of these jurisdictions, the resulting NWA opportunities may benefit from the ability to serve both bulk power and distribution system needs, allowing for multiple value streams to be tapped.[3] California is one such state.

Notwithstanding significant interest in modifying utility planning, the evolution of DSP is in its nascent stages. Stakeholder desire for increased transparency varies from jurisdiction to jurisdiction and manifests itself in different ways. As a result, DSP is being tested and tried in various ways, including through grid modernization plan requirements, legislative mandates for NWA consideration and state-level public utility commission ("Commission") review of DSPs. Thus far, no "one-size-fits-all" solution has presented itself.

[3] At the time of this writing, we are unaware of any purely distribution system NWAs that have resulted from a reformed DSP process in a restructured or non-vertically integrated state outside of a pilot construct where certain cost performance measures may be waived.

EPRI's Advanced Distribution Planning Research Priorities

The requirements for distribution planning tools are changing along with the rapidly changing characteristics of distribution systems themselves. This changing landscape is driven by the need to accommodate and integrate distributed energy resources (DER), changing load patterns, increased stakeholder engagement in the development and application of planning processes, and increased automation and control of the distribution system. Traditional planning tools and processes typically address only a narrow piece of these emerging planning needs.

Important research topics around meeting these needs are being addressed at EPRI. They include:

- Holistic evaluation of traditional and non-wires alternatives, including assessment of the locational value of distributed energy resources
- Investment optimization considering multiple time horizons
- Hosting capacity approaches and automation for PV, storage, electric transportation, etc.
- Including the operational aspects of distribution systems (automation approaches, smart inverter integration, energy storage controls integration, microgrids, etc.) in the planning process
- Advanced customer models that can support assessment of demand management, response to price signals, adoption of new technology, electrification, etc.
- System-wide benefit-cost assessments
- G/T/D Integrated resource planning
- Model management and integration with GIS and other enterprise applications
- Automation of complex assessments across circuits and timeframes
- Scenario planning and sensitivity assessments
- Stochastic assessment approaches

Find more details on these research topics in the recent EPRI journal article - Distribution System Planning Gets a Makeover http://eprijournal.com/distribution-system-planning-gets-a-makeover/

KEY CONSIDERATIONS FOR DSP REFORM AND REGULATION

The grid is evolving from a one-directional delivery channel for electricity to a resilient platform that allows for both the optimization of distributed resources and the facilitation of a wide variety of customer options and engagements. Adding to the challenge presented by this significant shift in grid functionality is the imperative that this shift be achieved while maintaining reliability, affordability and equity of access. The utility, as a public service company and as the distribution system operator, can and should be making investments in the grid to further these outcomes.

Utilities should seek to reform grid planning processes to engage stakeholders and to facilitate the integration of a rapidly growing number and range of decentralized resources that may both drive and serve system needs. Planning process transparency and collaboration must be balanced with a need for process efficiency, grid security and recognition that the reliability of the distribution network must be preserved. The

objectives and approach to adoption of new planning practices should also take into consideration jurisdictional utility regulatory structures as these differ from region to region.

Common understanding and clear framework for determining when NWA solutions should be considered

Utilities should actively identify opportunities for NWAs in the ordinary course of planning for the system because NWA solutions may potentially offer the most cost-effective means of addressing a grid need. This is consistent with the utility's obligation to identify and implement prudent investments. NWAs may, in fact, present utilities with an important tool in addressing affordability as more investment is required in the grid to support public policy goals such as decarbonization and resilience. In order to establish a framework for NWA deployment, certain data collected by the utility may need to be made confidentially available to NWA-bidders and regulators, including information regarding the timing, location, and size of system challenges. The parameters and mechanisms for this type of information disclosure must always recognize the primacy of the utility's obligation to maintain system security and customer privacy.

Authority for Planning

The utility must maintain its ability and authority to plan for the needs of the distribution grid, including determining where NWAs will deliver solutions that assure continued reliability while delivering cost benefits to customers. As part of the normal course of planning for grid needs, the utility should evaluate all options—including NWAs—considering where and when they can technologically and economically serve grid needs and address public policy objectives, including transparency of the process.

Compensation mechanism(s) for NWAs is critical

As the costs for NWA technologies continue to decline, there may be more opportunities for utilities to incorporate these assets into the grid. In order to further support the development of the NWA market, the industry should adopt a business model structure that makes the utility agnostic to the choice between traditional and non-traditional investments and even encourages it to consider non-traditional investments. Cost recovery mechanisms should overcome the disincentives associated with the traditional rate-based cost recovery model. Compensation mechanisms should, in fact, incentivize utilities to explore and adopt NWAs to the benefit of customers, thereby better aligning utility incentives with public policy goals. This concept is no different than what has been employed to support the growth of energy efficiency programs, in which compensation structures have been established that align utility actions with public policy goals.

In the case of utility-owned NWAs, the utility should have the ability to rate base these type of investments in a manner that is no different from traditional grid assets. If the NWA is owned by a third party or the utility contracts for grid-related functions and services, several potential compensation mechanisms merit consideration. Additionally, NWA compensation should be aligned with the methodology used to value/compensate other DERs in that particular market.

Current 3rd Party NWA Compensation Approaches

Con-Ed BQDM --Regulatory Asset for all NWA Expenses

Recovery of both utility operating expenses and third party contract costs is deferred and amortized over a fixed period with a return for the utility

California – NWA Incentive Adder

The utility receives a revenue adder equal to a percentage of annual operating expenses and third party contract costs as an incentive to compensate for lost earnings

Central Hudson – Sharing of NWA Cost Savings

The difference between the cost of the NWA solution and the cost of the traditional rate-based utility investment is split between the utility and customers in an agreed-upon manner

Protections to ensure that grid reliability is not impaired

Third party NWA providers typically would not be subject to traditional utility regulation and may operate under a commercial contract as opposed to a utility's more fundamental statutory obligation to serve. Consequently, there may be less recourse in the event of non-performance. Similarly, DERs that depend on voluntary action (e.g. demand response), on third party maintenance, or on uncontrollable factors such as weather, may not consistently perform as expected. To ensure continued grid safety, reliability, and operations, there should be appropriate mechanisms in place, commensurate with the risk profile of the NWA in question, to address potential situations in which the NWA does not in fact present the solution for which it was selected.

Risk Mitigation

The extent of utility control and risk mitigation options for contracted third party grid solutions should be dependent on the assessed risk (likelihood and consequence for failure) of a specific technology type. Contracted DERs may need to be subject to utility operational control and to long-term performance assurances. These requirements can be reflected in regulation and assured through regulatory, contractual, operational, or infrastructure means—such that the system is not impaired if the NWA either fails to perform as expected or is unavailable.

It should also be recognized that there are many different types of NWA technologies and configurations, and deployment of theses resource will likely create significant new complexities to maintain stable and reliable operation of the grid. The design requirements and cost associated with integration and control of these new resources will evolve over time and need to be addressed in the selection decisions.

Regulatory Review

To the extent there is a regulatory process to review utility planning criteria and decisions, that process should be:

Defined in advance. Procedural uncertainty does not benefit the utility, customers or competitive developers.

Be streamlined. The timeline in which the planning process is conducted should be well-structured and defined. Lengthy dispute resolution cycles could cause gridlock, impairing the implementation of needed investments and potentially comprising reliability.

Transparent. The process should allow for stakeholder input and utility consideration of such input.

Under the jurisdiction of the state utility commission. Authority to accept/approve utility plans and decide disputes about their application to specific projects should rest solely in the state commission/agency that also reviews utility expenditures for prudency and approves utility construction projects requiring such approval.

More Transparent & Collaborative… How?

DSP transparency and collaboration are advanced by:

- Timely and accurate data to the utility regarding projects and programs that could impact load forecasts
- Regular hosting capacity map updates
- Clearly articulated interconnection procedures and costs
- Jointly-developed criteria used to identify NWA opportunities
- As system security allows, public release of data defining the general location, timing and size of system needs to inform solution ideation
- Secured sharing of more granular system data with qualified parties to inform specific NWA solutions
- BCA handbooks that define how solutions will judged and selected
- Public workshops to offer clarifying information, solicit input, and allow for the development of partnership opportunities
- To the degree possible, standardized contracting for solutions
- Creative business and regulatory models that allow for a variety of parties to engage in providing solutions

CONCLUSION

The grid is evolving from a one-directional delivery channel for electricity to a resilient platform that allows for both the optimization of distributed resources and the facilitation of a wide variety of consumer options and engagements. Adding to the challenge presented by this significant shift in grid functionality is the imperative that this shift be achieved while maintaining reliability, affordability and equity of access. The utility, as a public service company and as the distribution system operator, can and should be making investments in the grid to further these new outcomes in a reliable and affordable manner. Utilities should seek to reform grid planning processes to engage stakeholders and to facilitate the integration of a rapidly growing number and range of decentralized resources that may both drive and serve system needs. However, the resulting more transparent and collaborative process must be streamlined, predictable, and utility-executed, so that it does not compromise the overall integrity of the grid.

Collaboration is Key

Implemented properly, DSP reform presents a critical opportunity for utilities and stakeholders to develop plans in a collaborative manner that:

- Ensures alignment with public policy goals;
- Allows for the identification of best possible, least cost solutions to a grid need;
- Facilitates a discussion of proposed investments that allows for mutual understanding of value derived from those investments; and,
- Engenders greater stakeholder trust in the ultimate outcome.

The planning, ownership, and operation of the grid is inextricably intertwined with the utility's obligation to maintain safe, reliable, and affordable service; and to stand ready to offer that service to all at regulated, non-discriminatory rates. The utility's ability to support this principle is contingent upon regulatory clarity regarding planning authority, utility compensation, and risk mitigation.

DSP process reform is a nascent area of utility, stakeholder and regulatory engagement. The tools available for assisting in planning and the resources and services that must be considered in the resulting DPS process are rapidly evolving. DSP process reform too should be seen as subject to evolution as all the parties gain experience and insights with each iteration. At any given point along this planning evolution, the form a

Optimal DSP Process Characteristics

Timelines are clear and consistently applied

Planning criteria used by the utility to identify solutions to grid needs are agreed upon

Stakeholders are afforded visibility and opportunity for input to utility investment decisions

Utilities incorporate this input if it is based on a clear set of criteria

Regulation of the process, if needed, is by the same agency that regulates utility rates

Plans prepared with stakeholder participation can be relied on by the utility to make long-term capital investments

DSP process may take in a given jurisdiction will be informed by a variety of factors including but not limited to regulatory construct, stakeholder expectations, utility capabilities and policy goals. Nonetheless, this paper has attempted to outline the foundational principles that will ensure that the evolving DSP process advances transparency and collaboration while ensuring the grid remains reliable and affordable.

State Commissions and Energy Offices Form Planning Taskforce

Realizing the convergence of technology, new business models, and increased customer engagement will spur the need for innovative policy and regulatory solutions, the National Association of Regulatory Utility Commissioners (NARUC) and the National Association of State Energy Officials (NASEO) have organized a Task Force on Comprehensive Electricity Planning.

The Task Force, comprised of officials from 16 states, is providing a forum for the broader energy stakeholder community to share best practices and support the task force goal to develop state -led pathways toward a more resilient, efficient, and affordable grid. The Task Force is aiming to align state visions in order to:

- Improve grid reliability and resilience
- Optimize use of new and existing distributed and centralized energy resources
- Avoid unnecessary costs to ratepayers
- Support state policy priorities
- Increase the transparency of grid-related investment decisions

Workshops throughout 2019 and scheduled in 2020 are aimed at increasing states alignment of distribution, resource and transmission planning visions, while working towards developing roadmaps for states as they solve planning challenges. Find more resources and status of the Task Force on Comprehensive Electricity Planning at https://www.naruc.org/taskforce.