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Distribution System Planning – State Examples by Topic

May 2018

Funded by the U.S. Department of Energy Solar Energy Technologies Office

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Executive Summary

The purpose of this report is to summarize approaches or elements of electric distribution system planning (DSP) that some states have adopted in the context of grid modernization and higher levels of distributed energy resources (DERs). Other states can consider adapting these to help achieve the specific aims set for their own DSP process. Table ES.1 lists state approaches to DSP that are described in this report.

Table ES.1. State Approaches to Electric Distribution System Planning

Planning Approaches	States With Advanced Practices					Other States' Approaches										
	California	Hawaii	Massachusetts	Minnesota	New York	D.C.	Florida	Illinois	Indiana	Maryland	Michigan	Ohio	Oregon	Pennsylvania	Rhode Island	Washington
Distribution system plan requirement ¹	√	√	√	*	√					√	√					
Grid modernization plan requirement	√	√	√	√	√											
Incentives reflecting locational value	√				√											
Hosting capacity analysis requirement	√	√		√	√											
Non-wires alternatives requirements	√				√										√	
Standardized calculations / processes	√				√											
Storm hardening requirements							√			√						
No planning requirement but proceeding underway ²						√		√				√	√		√	√
Requirement to summarize current practice				√	√					√						
Voluntary distribution or grid modernization plans supporting surcharge/rider cost recovery								√	√			√		√		
Improved alignment / linking processes	√			*											*	*
Required reporting on poor-performing circuits and improvement plans							√	√				√		√	√	

√ is used to indicate the planning approach is applicable under the present regulatory or statutory requirements.
 * is used to indicate that the planning approach would apply under pending proposals or proposed decisions.
¹ Requirements for one or more utilities.
² States noted in this row have processes underway which may result in adoption of one or multiple planning approaches listed in this table.

The report contains descriptions of and links to:

- Vision statements, goals, objectives, and definitions set by states to guide their distribution planning processes
- Materials that can potentially be adapted and used — for example, utility surveys and non-wires alternatives (NWA) screening criteria
- Advanced tools, such as hosting capacity and locational net benefits methodologies, that can be adapted and used

- Processes such as utility filing requirements — for example, distribution investment plans — that can shine light on DSP-related needs
- Cost recovery mechanisms that can incentivize grid improvements to improve reliability and resilience and modernize the grid
- Examples of how states are aligning distribution system planning with other types of planning.

The first step for any state that wants to move forward with an integrated DSP process¹ is to clearly define its vision, goals, and objectives. Clear goals and objectives will help guide the process and avoid wasted effort. Goals and objectives should take into account immediate needs and opportunities and those that are likely to emerge in the future.

¹ ICF 2016

Acknowledgments

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Acronyms and Abbreviations

BGE	Baltimore Gas & Electric
CPUC	California Public Utilities Commission
DER	distributed energy resources
DOE	U.S. Department of Energy
DPU	Department of Public Utilities
DRP	distribution resource planning
DSIP	Distributed System Implementation Plan
DSP	distribution system planning
GMLC	Grid Modernization Laboratory Consortium
GMP	Grid Modernization Plan
GNA	Grid Needs Assessment
GRC	General rate case
HECO	Hawaiian Electric Companies
ICC	Illinois Commerce Commission
IOU	investor-owned utilities
IREC	Interstate Renewable Energy Council
IRP	integrated resource planning
IURC	Indiana Utility Regulatory Commission
LNBA	locational net benefits analysis
MDPSC	Maryland Public Service Commission
MIPSC	Michigan Public Service Commission
NYPSC	New York Public Service Commission
NWA	non-wires alternative
PUC	Public Utilities Commission
PUCO	Public Utilities Commission of Ohio
PV	photovoltaic
RFP	request for proposal
TDSIC	transmission, distribution, and storage system improvement charge
WUTC	Washington Utilities and Transportation Commission

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1.0 Introduction

In December 2017, the U.S. Department of Energy’s (DOE) Grid Modernization Laboratory Consortium completed a study on how utility regulators in 16 states have addressed distribution system planning (DSP) in the context of grid modernization and higher levels of distributed energy resources (DERs).⁶ The study catalogued extensive information on state-level activities related to DSP and grid modernization plans, including tools for integrating DERs, such as hosting capacity and locational value analyses, and linkages to related processes, such as cost recovery through general rate cases or rate surcharges.

Oregon is among the states included in the report, with several proceedings completed, underway and under consideration related to DSP. To advance this work, the Oregon Public Utility Commission (Commission) requested assistance from DOE’s Solar Energy Technologies Office on DSP. In response to this request, the Pacific Northwest National Laboratory (PNNL) and Lawrence Berkeley National Laboratory (Berkeley Lab) identified 1) specific topics from the original study of particular interest to states such as Oregon and other states moving toward comprehensive DSP and 2) states that could provide potential examples to draw from. Toward that end, this report summarizes and reorganizes the pertinent original material by subject. We developed a table that points to specific states for each topic. The “Approaches” section calls attention to a few immediately useful documents. The body of this report includes summaries of each state example by topic area with web links to the source documents. Some states have taken significant steps since information was collected for the original Grid Modernization Laboratory Consortium study. In these cases, we have supplemented the original information.

Depending on context, needs and opportunities within a state, potential benefits of a more integrated and transparent DSP process include:

- Comprehensive utility plans for distribution-level investments that signal intended acquisitions over a longer time horizon, before they show up individually in cost recovery proceedings.
- Strong links between DSP and other planning activities to establish distribution system resources as options to meet bulk system needs.
- Improved forecasting and representation of DER in distribution plans and other utility plans.
- Valuation of DERs to inform more granular compensation by type and location.
- A roadmap for optimized locational planning for DERs, including implementation of hosting capacity and locational value analysis.
- Opportunities for meaningful public utility commission (PUC) and stakeholder engagement, which can improve outcomes.

This report identifies how some states have addressed these issues. It provides examples that other states may find useful.

⁶ Grid Modernization Laboratory Consortium. 2017. *State Engagement in Electric Distribution System Planning*. PNNL-27066. Prepared by Homer, J. and A. Cooke (Pacific Northwest National Laboratory), L. Schwartz and G. Leventis (Lawrence Berkeley National Laboratory), and F. Flores-Espino and M. Coddington (National Renewable Energy Laboratory), prepared for the U.S. Department of Energy.
https://epe.pnnl.gov/pdfs/State_Engagement_in_Electric_Distribution_System_Planning_PNNL_27066.pdf

2.0 Context Matters

Utility regulators in many states are grappling with questions related to electric DSP in the context of grid modernization and increasing levels of DERs. [*State Engagement in Electric Distribution System Planning*](#) reviews DSP and related activities in 16 states. States adopt different requirements for planning distribution systems based on the context in which the regulator is working. For example, states with low penetrations of rooftop solar are less likely to require utilities to pursue hosting capacity analyses than states with high penetrations. Thus, the context in which the regulator is working is an important factor in implementation of planning activities.

Context-specific factors that should be considered in DSP include (GMLC 2017a):

- Statutory requirements and regulatory requirements;
- Priorities, phasing and related proceedings; and
- Differences across utilities.

3.0 Approaches

Table 1 summarizes approaches or elements of DSP that some states have adopted and that other states might consider.¹ Five of the states in Table 1, “States with Advanced Practices,” are among the first to establish a systematic and comprehensive approach to DSP or grid modernization, and also have developed advanced practices for addressing higher levels of DERs. Another 11 states are included to represent a broader array of approaches to DSP.

Table 1. State Approaches to Electric Distribution System Planning

Planning Approaches	States With Advanced Practices					Other States' Approaches										
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Distribution system plan requirement ¹	√	√	√	*	√					√	√					
Grid modernization plan requirement	√	√	√	√	√											
Incentives reflecting locational value	√				√											
Hosting capacity analysis requirement	√	√		√	√											
Non-wires alternatives requirements	√				√										√	
Standardized calculations / processes	√				√											
Storm hardening requirements							√			√						
No planning requirement but proceeding underway ²						√		√				√	√		√	√
Requirement to summarize current practice				√	√					√						
Voluntary distribution or grid modernization plans supporting surcharge/rider cost recovery								√	√			√		√		
Improved alignment / linking processes	√			*											*	*
Required reporting on poor-performing circuits and improvement plans							√	√				√		√	√	

√ is used to indicate the planning approach is applicable under the present regulatory or statutory requirements.
 * is used to indicate that the planning approach would apply under pending proposals or proposed decisions.
¹ Requirements for one or more utilities.
² States noted in this row have processes underway which may result in adoption of one or multiple planning approaches listed in this table.

Some highlights of these approaches are listed below.

- California is rolling out a series of processes and requirements that fit together into an integrated distribution resource planning (DRP) process. The DRP process includes an assessment of DERs (including load and hosting capacity calculations, locational value assessments, and DER growth scenarios), an assessment of grid needs, frameworks for grid modernization investments and

¹ The report *State Engagement in Electric Distribution System Planning* (December 2017) contains a table (Table S-1) that is similar in format. Table 1 here is not intended to replace the original; rather, it is intended to help identify where utility regulators might look for examples to consider as they move forward.

investment deferrals and a solicitation process for DERs. The California PUC's latest order on grid modernization is located [here](#) (CPUC 2018a).

- Maryland Public Service Commission required utilities (see item 90 in the case file located [here](#)) to submit five-year distribution plans describing how the utilities will prioritize distribution resources over the five-year period (MDPSC 2016b, page 58). Baltimore Gas & Electric's (BGE) 2017 filing (BGE 2017) is an example (item 116 located [here](#)).
- The Minnesota Public Utilities Commission issued a questionnaire (located [here](#)) to collect information a) from utilities about their distribution planning processes and current plans and b) from both utilities and stakeholders on ways to improve or augment the utilities' DSP processes (MNPUC 2017).
- The New York Public Service Commission (NYPSC) directed utilities in their initial Distribution Service Platform Provider filings to present information about the state of their distribution systems, planning processes, and specific system needs to build and maintain distribution service provider functions. Subsequent filings are geared toward common approaches to completing the process of defining how the utilities will transform their systems to become Distribution Service Platform Providers as envisioned by the Commission. The Commission order (NYPSC 2016b) can be found [here](#).
- Two states, Hawaii and Massachusetts, required utilities to submit Grid Modernization Plans (GMP). In contrast to modernization plans that simply look at including smart grid assets, the required plans also must include modern planning methods, such as identifying how DERs can be used to strengthen and add to the reliability of the grid, and advanced systems for controlling distribution systems.
 - *Hawaii* – For Hawaii's order with guidance on plan contents, see Hawaii Public Utility Commission 2017a, pp. 50–66, located [here](#).
 - *Massachusetts* – For Massachusetts' order with guidance on plan contents, see Massachusetts Department of Public Utilities (DPU) 2014, pages 2–6 located [here](#).
- Four states (Illinois, Indiana, Ohio, and Pennsylvania) have statutes allowing utilities to request rate surcharges to recover distribution investments if they file distribution plans (voluntary plans).
- Five states (Florida, Illinois, Ohio, Pennsylvania, and Rhode Island) have requirements for reporting on poorly performing circuits and filing improvement plans. Florida and Ohio are discussed later in this report.
- Three states (Washington, Minnesota, and Rhode Island) are examining the alignment of planning processes, such as IRP and DSP, or synchronizing multiple separate planning processes. DOE sponsored a report for the Minnesota Public Utilities Commission commissioned, located [here](#), that is informative in this regard (ICF 2016).

4.0 Vision Statements and Goals for Distribution System and Grid Modernization Planning

Clear vision statements, goals, objectives, and definitions are important for distribution system and grid modernization planning. Borrowing loosely from the impetus for action in Minnesota (GMLC 2017b, page 4.1), common reasons for engaging in these processes as articulated by many states include that the distribution grid is at an inflection point because of DER; with rapid changes in the types of DER and declining costs, utilities and states should enable customer choices; and the processes of the past will not work going forward, and now is the time to invest in the 21st century grid.

- *California* – The California Public Utilities Commission defined grid modernization in a recent decision:¹ “A modern grid allows for the integration of DERs while maintaining and improving safety and reliability. A modern grid facilitates the efficient integration of DERs into all stages of DSP and operations to fully utilize the capabilities that the resources offer, without undue cost or delay, allowing markets and customers to more fully realize the value of the resources, to the extent cost effective to ratepayers, while ensuring equitable access to the benefits of DERs. A modern grid achieves safety and reliability of the grid through technology innovation to the extent that is cost effective to ratepayers relative to other legacy investments of a less modern character.” (CPUC 2018a, page 7).
- *Maryland* – In September 2016, the Maryland Public Service Commission (MDPSC or Commission) initiated Public Conference 44 (PC44) “... to ensure that electric distribution systems in Maryland are customer-centered, affordable, reliable and environmentally sustainable.” The MDPSC adopted a vision statement in 2017 and identified several topic areas to be addressed by workgroups led by a Commission Advisor (MDPSC 2017, pages 12–14). The vision statement is an early step in the process. (GMLC 2017b, page 10.1).
- *Minnesota* – The Minnesota Legislature required Xcel Energy to file grid modernization plans every two years. The Commission provided early guidance through its decision on the initial plan (GMLC 2017b, page 4.3) as well as a Staff report that teed up three questions:
 - “Are we planning for and investing in the distribution system that we will need in the future?”
 - “Are the planning processes aligned to ensure future reliability, efficient use of resources, maximize customer benefits, and successful implementation of public policy?”
 - “What Commission actions would support improved alignment of planning for and investment in the distribution system?” (MNPUC 2015, page 12)?
- *New York* – The NYPSC is redefining what it means to be a distribution service provider. As envisioned by the NYPSC, it is “... an intelligent network platform that will provide safe, reliable and efficient electric services by integrating diverse resources to meet customers and society’s evolving needs. The distribution service provider fosters broad market activity that monetizes system and social values by enabling active customer and third-party engagement that is aligned with the wholesale market and bulk power system.” (NY PSC 2015a, page 31). The Commission’s Track I

¹ The CPUC decision was issued in 2018, after the December 2017 publication of DOE’s report upon which much of this report based.

Order described the goals of the Distributed System Implementation Plan (DSIP) (GMLC 2017b, page 5.1):

- Serve as a source of public information regarding distribution service provider plans and objectives, including specific system needs allowing market participants to identify opportunities
- Serve as the template for utilities to develop and articulate an integrated approach to planning, investment, and operations
- Enable the Commission to supervise the implementation of Reforming the Energy Vision in the context of system operations (NY PSC 2015a, page 129; GMLC 2017b, page 5.1).
- *Rhode Island* – Known as the Power Sector Transformation Initiative, Rhode Island’s grid modernization initiative has three objectives: 1) control long-term costs of the system, 2) provide more energy choices for customers, and 3) build a flexible grid to integrate more clean energy generation (R.I. DPUC, OER, & PUC. 2017. 2017, pages 8–9). DSP is one of four work streams.² This work stream is considering what outcomes should be promoted by DSP, what aspects of utility operations it should address, and how accessible planning should be to third parties (GMLC 2017b, page 15.1).

² The other three work streams are utility business models, grid connectivity functionality, and electrification of transportation and heating.

5.0 Distribution Investment Plans

California and New York require utilities to routinely file distribution investment plans. These plans make transparent the methods used and generally provide visibility into the existing state of the systems and planning process. Additionally, some states have taken phased approaches where they have ordered either initial distribution system plans to be filed (Maryland, Michigan) or descriptions of the utilities' current distribution system planning process (Minnesota).

- *California* – To implement legislation requiring utilities to consider nonutility-owned DERs in their DSP, the California Public Utility Commission (CPUC) required investor-owned utilities (IOUs) to file Distributed Resource Plans (DRPs). The CPUC order required utilities to consider locational benefits and costs of DERs on the distribution system, and to identify tariffs and other mechanisms to deploy cost effective DERs, ways to coordinate with other state DER incentive programs, additional utility spending needed to integrate cost effective DERs, and barriers to deployment of DERs (DOE, 2017, pages 1.1–1.2).

In February 2018, the CPUC issued a decision giving greater direction to utilities. The IOUs are to file annual Distributed Resource Plans and Grid Needs Assessments (GNAs) that identify specific deficiencies on the distribution system. The GNAs are to form the basis for annual project lists for utility distribution work and shall document deficiencies quite specifically (e.g., identifying the circuit, the deficiency the underlying cause of the deficiency such as meeting customer growth, etc.). The GNA is also the basis for a list of potential candidates for non-wires alternatives (NWAs) discussed in the NWA section of this report. The GNAs will also provide input to the utility's GMP (as discussed in the next section of this report) and provide additional information to inform GRCs (CPUC 2018b).

- *New York* – As part of the New York Reforming the Energy Vision process, the NYPSC in Docket/Case 14-M-0101 ordered IOUs within the state to file DSIPs. The NYPSC specified filing to involve two or more phases:
 - In the first phase, each utility addressed its own system and identified immediate changes that could be made to effectuate state energy goals and objectives (filed June 2016). This filing also required utilities to provide information regarding their current 5-year capital investment plans as a first step toward providing customers and other parties with the information needed to identify and characterize near-term opportunities for DER development in each utility's electric distribution system (NYPSC 2016, page 24 and Attachment 1 to the order that specifies detailed information to be included).
 - In the second phase, utilities filed a joint—and as necessary, individual—Supplemental DSIPs (filed November 2016) that addressed the tools, processes, and protocols that would be developed jointly or under shared standards, and that would be used to plan and operate a modern grid capable of dynamically managing distribution resources and supporting retail markets (NYPSC 2016, pages 24–25).
 - In subsequent filings (on a biennial basis), utilities are expected to include more details (GMLC 2017b, page 5.2).

- *Maryland* – The MDPSC wanted to ensure that the Potomac Electric Company (Pepco) and BGE fully used the smart grid technology they were installing and that ratepayers realize a demonstrable return on the investment—in particular the investment in advanced metering infrastructure. For this reason, the MDPSC required Pepco (MDPSC 2016a, page 22) and BGE (MDPSC 2016b, page 58) to submit distribution investment plans (DOE, 2017, page 10.2).
 - In June 2017, BGE filed a distribution investment plan (BGE 2017).
 - In November 2017, Pepco filed an investment plan (Pepco 2017).
 - Both plans are relatively short, high-level summaries stemming from Commission orders in general rate cases.
- *Michigan* – The Michigan Public Service Commission (MIPSC) ordered DTE Electric Company and Consumers Energy Company to develop and submit 5-year distribution plans in response to general rate case proceedings. While authorizing the utilities to revise their rates, the MIPSC stated that it lacked the appropriate level of information to properly evaluate the investments in the utilities’ distribution systems (GMLC 2017b, page 11.1).
 - The order issued by MIPSC stated they did not intend distribution plans to be formally approved. Rather, plans were to provide Staff, MIPSC, and other interested parties with “... a more thorough understanding of anticipated needs, priorities, and spending outside of the contested rate case process.” (MIPSC 2017, page 2)
 - After reviewing the utilities’ draft filings, MIPSC clarified its expectations that in their final filings, utilities would focus on addressing aging infrastructure, identifying and addressing known safety concerns, identifying how to prioritize maintenance and investments to improve reliability and resilience, and defining objectives and metrics for meeting reliability goals (MIPSC 2017, pages 16–17).
- *Minnesota* – The Minnesota PUC used a questionnaire to assess the status of distribution planning in the state and to improve the process moving forward. In April 2017, the Commission issued a Notice of Comment Period and a questionnaire¹ to inform the Commission and Staff on distribution planning (MNPUC 2017). PUC staff proposed draft rules in April 2018, in Docket 15-556, accessible [here](#). A decision on distribution planning requirements is expected in 2018 (GMLC 2017b, pages 4.3–4.4).

¹ The Distributed Resource Plans mentioned in Section 4 of this report cover specific mechanisms for utilizing and guiding the locational development of DERs, while the Grid Modernization plans are seen as long-term planning visions.

6.0 Grid Modernization Plans

Several states have either passed legislation calling for or enabling grid modernization planning, or utility regulators have ordered utilities to develop plans. In Hawaii and Massachusetts, regulators ordered jurisdictional utilities to develop comprehensive GMPs including metrics and methodologies for valuing DER and comparing NWA solutions to traditional solutions.

- *Hawaii* – Hawaii set a 100% renewable energy portfolio standard for 2045. Between high electric rates and policies encouraging the installation of solar PV, approximately 16% of customers in Hawaii had rooftop solar systems in 2016 (GMLC 2017b, page 2.1). As a result, the Hawaii Public Utilities Commission supports development of modern grids to support renewable energy and DERs in general. In Order No. 34281 (HPUC 2017a, pages 50–66), the Commission provided guidance for developing a detailed, scenario-based grid modernization strategy that provides a comprehensive and holistic vision and context to inform subsequent review of discrete grid modernization project applications submitted by the utility (GMLC 2017b, pages 2.2, 2.5).
 - Hawaiian Electric Companies, or HECO (i.e., Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., Maui Electric Company, Limited), filed a final Grid Modernization Strategy on August 29, 2017 (HECO 2017).
 - HECO proposed a new planning process to integrate the customer, distribution, transmission and bulk power resource levels of the system. The process which HECO calls Integrated Grid Planning was filed with the PUC on March 1, 2018 (HECO 2018). Primary features of HECO’s proposal include: 1) extensive customer and stakeholder involvement; 2) holistic, optimized solutions for resource adequacy and grid services, based on procurement processes which include NWA solutions; and 3) incremental deployment of grid modernization technology. The current planning processes are not integrated, meaning that resource adequacy, transmission and distribution are optimized separately, and as a result the solutions don’t converge. Integrated Grid Planning is an attempt to not only integrate the planning processes but also to integrate the market-based solutions into the planning process, rather than having solutions come sequentially after the completion of the planning process. By integrating the market-based solutions into a unified analysis, HECO will be better able to capture the full value of service by evaluating the ability of the available alternatives to address all system needs.

HECO proposes a multi-step process:

- using production simulation models, identify resource needs
- initiate market-based solution sourcing/procurement
- using information from the sourcing/procurement process, identify transmission and distribution needs to integrate the resources
- using aggregated transmission and distribution needs, improve the sourcing/procurement information to develop a request for proposal (RFP) for resource/grid services, including NWAs
- evaluate alternatives and develop a 5-year action plan

A long-term plan would then be completed, informed by the near-term plan. Finally, the action plan would be submitted to the Commission with related applications for approval (HECO 2018, pp 14 –15).

- *Massachusetts* – To support a renewable energy standard of 25% by 2030 and to reduce outages, optimize demand and integrate DER, the Massachusetts DPU issued Order 12-76-B to begin a grid modernization process. The order requires each electric utility in the state to submit a 10-year grid modernization plan (DPU 2014, pages 2–6). Massachusetts’ regulated utilities filed 10-year plans with the DPU in August 2015 (GMLC 2017b, pages 3.1–3.2).
- *Ohio* – Legislation in 2012, promulgated in Ohio Revised Code 4928.02, addresses distribution system enhancements such as advanced metering infrastructure and smart grid-related programs (State of Ohio 2012). In 2016, the Public Utility Commission of Ohio (PUCO) approved a modernization rate rider for Ohio Edison, Cleveland Illuminating, and Toledo Edison, in which the Commission ordered the companies to file a grid modernization plan (PUCO 2016, Fact Sheet). The PUCO has approved plans for Ohio Power’s gridSMART project (GMLC 2017b, page 12.1).
- *California* – As part of a broad process (Rulemaking 14-08-013), California is in the midst of developing Grid Modernization Investment Guidance.¹ In May 2017 (CPUC 2017a), the CPUC proposed a Grid Modernization white paper that outlined a framework for evaluating investments needed to increase DER penetration and integration and value maximization. In March 2018, a decision (CPUC 2018a) was issued adopting with modification the process proposed in that paper.
 - The grid modernization process would integrate the utilities’ planning for general rate cases with their existing distribution planning processes, but would provide additional information through the Grid Needs Assessment (GNA) and GMP.
 - The GNA is envisioned as an annual assessment of needs to be addressed through grid modernization, arising out of the utilities’ DSP process, and would include distribution system deficiencies related to capacity, voltage support, reliability, or resiliency. In the GNA, utilities will identify locations with deficiencies, the forecasted overload of existing equipment, the timeline by which the deficiency must be addressed, and the primary driver of the deficiency (CPUC 2018a, pages 17–19).
 - The GMP is a 10-year planning vision for investments the utility anticipates will be necessary. The GMP would be reviewed by the CPUC and stakeholders as part of the utilities’ triennial general rate case proceeding (CPUC 2018a, page 20).

¹ The Distributed Resource Plans mentioned in Section 4 of this report cover specific mechanisms for utilizing and guiding the locational development of DERs, while the Grid Modernization plans are seen as long-term planning visions.

7.0 Incentives Reflecting Locational Benefits

As states and utilities move forward with assessing the value of DER, a key element of the value is where on the system the DER is located. If distribution capacity into a geographic space is limited, solar PV would have far greater potential value to the grid than solar PV in geographic spaces with no such constraints. California and New York have undertaken processes to quantify such values. A forthcoming report by ICF International for DOE addresses in detail locational value assessment use cases (ICF 2018).

- *California* – California has a work group process underway to develop tools for locational net benefits analysis (LNBA). The process includes demonstration projects to test and identify location-specific values in the LNBA models. In particular, the CPUC directed that value components in an existing DER Avoided Cost Model that were not location-specific should be modified to reflect more location-specific information, particularly (GMLC 2017b, page 1.4):
 - Avoided sub-transmission, substation, and feeder capital and operating expenditures
 - Avoided distribution voltage and power quality capital and operating expenditures
 - Avoided distribution reliability and resiliency capital and operating expenditures
 - Avoided transmission capital and operating expenditures.

The LNBA working group and utilities have submitted multiple reports to the CPUC and received further guidance for refining the LNBA models, with completion expected in mid-2018 (GMLC 2017b, pages 1.4–1.5).

- *New York* – In the Value of DER proceeding, the NYPSC is attempting to promote the growth of DER by implementing successors to Net Energy Metering tariffs that provide incentives reflecting the locational value of DER. New York’s value of DER tariffs, also referred to as value stack tariffs, are intended to replace net metering for larger-scale community solar PV projects in the short term, and will eventually be applied to all DERs across the grid. The NYPSC is looking at accomplishing this by identifying, quantifying, and compensating for locational system relief value zones (GMLC 2017b, pages 5.6–5.7).

8.0 Hosting Capacity Analysis

Several states (Minnesota, California, New York, and Hawaii) are working on identifying how much generation can be installed on line sections without distribution system upgrades, referred to as hosting capacity, and how to increase the ability of the grid to integrate additional levels of DER. A forthcoming report by ICF International for DOE addresses in detail use cases for hosting capacity analysis including distribution system planning (ICF 2018).

While it is not discussed in detail herein or in GMLC 2017b, a December 2017 document produced by the Interstate Renewable Energy Council (IREC) is available to readers interested in additional information about hosting capacity analysis. The IREC document, which can be found [here](#), is targeted toward regulators that are overseeing utilities developing hosting capacity analyses (IREC 2017).

- *Minnesota* – State law requires Xcel Energy to conduct a study identifying interconnection points on its distribution system for small-scale distributed generation and necessary upgrades to support continued distributed generation development. The Minnesota Public Utilities Commission required Xcel Energy to file its initial hosting capacity analysis by December 1, 2016, with analysis of each feeder for distributed generation up to 1 MW and potential distribution upgrades necessary to support expected distributed generation, based on the utility’s integrated resource plans and the Community Solar Gardens process. The Commission decision on the filing requires hosting capacity analyses by November 1 of each year and provided direction for the utility’s next hosting capacity analysis. (GMLC 2017b, page 4.3). Xcel Energy filed the second analysis on November 1, 2017. Parties have filed comments, and Staff filed a technical review by Lawrence Berkeley National Laboratory (Docket No. 17-777).
- *California* – California is developing models and processes for calculating hosting capacity (called “integration capacity analysis”) and for displaying the information graphically online for stakeholders to access. The California process includes a working group to develop the processes and demonstration projects (“Demo A”). The working group and utilities have submitted multiple reports to the CPUC, responding to guidance on developing the integration capacity analysis process and tools. A proposed CPUC decision in 2017 provided guidance for further refinements. The utilities were directed to work toward a standardized mapping structure and functionality while using what they developed for Demo A for initial system-wide rollouts. The CPUC listed the attributes each map should display and set an implementation schedule giving the utilities nine months for the initial system-wide rollout (GMLC 2017b, pages 1.3–1.4).
- *New York* – The Supplemental DSIP filing provides an initial view of enhanced planning tools and methodologies (GMLC 2017b, page 5.2), including:
 - A load and DER forecasting stakeholder engagement process
 - A process for coordinating with the New York Independent System Operator on short- and long-term forecasting
 - An NWA suitability framework and forthcoming implementation matrices
 - A detailed roadmap for hosting capacity
 - An interconnection data platform and process roadmap.

While hosting capacity is a key element of DER development, the progress thus far has been slow and has not supported industry needs according to the NYPSC (GMLC 2017b, page 5.3).

- *Hawaii* – In the order establishing a process for developing DER markets, the Hawaii Public Utilities Commission established a “technical track issue” to answer the question of how utilities’ DER integration analyses can be improved to accurately characterize grid capacity for various forms of DER and other renewable resources (GMLC 2017b, page 2.3).

9.0 Non-Wires Alternatives

California, New York, and Rhode Island are leading states with respect to requirements for using NWAs—energy efficiency, demand response, distributed generation and storage—to address distribution system needs.

- *California* – In December 2016, the CPUC approved an interim regulatory process to pilot the competitive solicitation process and the effect of incentives on utility sourcing of DERs as NWAs. Parties developing the pilot recommended the incentive be set at the high end of the range of the estimated value of the utility’s return on equity minus the cost of equity. In the framework for the pilot approved December 15, 2016, the CPUC established a 4% pre-tax incentive on annual payments made to third-party DER providers (customers or vendors) to cost-effectively displace or defer traditional distribution system investments that were planned and authorized previously. To test the competitive solicitation process, utilities are required to pursue at least one project. To test the incentive mechanism, utilities are encouraged to select up to three additional projects (CPUC 2016k). Utilities were required to issue solicitations for projects by mid-2017. Solicitations were to be crafted with input from a newly formed Distribution Planning Advisory Group (CEM 2016).

In February 2018, the CPUC directed IOUs to identify in Distribution Deferral Opportunity Reports prospects for DERs to cost-effectively defer or avoid traditional IOU investments that are planned to mitigate forecasted deficiencies of distribution systems. The CPUC direct utilities to identify these opportunities for NWAs using proposed “technical and timing” screening criteria. The IOUs must determine that a candidate investment could technically be addressed using DERs, and that sufficient time exists to issue RFPs, select bidders and get DER in place in a timely fashion. The Commission determined that other potential screening criteria such as economic and/or financial might be better used as metrics for selecting between bidders. The Commission’s decision also requires utilities to provide these reports in a transparent manner, including mapping information online in the same web page used to map hosting capacity and locational net benefit analysis data for use by customers and third parties. Existing working groups will help prioritize NWA opportunities (CPUC 2018b).

- *New York* – The Supplemental DSIP filing discussed earlier in this report includes NWAs. The Joint Utilities filed a Suitability Criteria framework to indicate whether a distribution project should be considered for an NWA solution that might be more cost effective than a traditional solution. Each of the utilities performs annual transmission and distribution planning to identify system needs. Beginning in May 2017, each utility began posting on websites the list of potential NWA opportunities along with preliminary descriptions and expected timing for solicitations (GMLC 2017b, pages 5.4–5.5). Con Edison and National Grid processes are summarized in Appendix B of GMLC 2017b. Con Edison, National Grid, New York State Electric and Gas, and Central Hudson have all issued RFPs. The Joint Utilities website provides hotlinks to individual utilities’ NWA RFPs ([here](#)) as well as additional information pertaining to NWA opportunities.
- *Rhode Island* – Chapter 2 of the Rhode Island Public Utility Commission’s Least Cost Procurement Standards (R.I. PUC 2017, Docket No. 4684) covers System Reliability Procurement (SRP) standards, which set forth guidelines to incorporate NWAs in utility SRP plans. NWA implementation costs are recovered through SRPs. (SRPs also includes other types of expenditures.) The standards also set forth criteria for identifying the situations in which NWAs might be applicable and should be considered. (R.I. PUC 2017, pages 14–15). In August 2017, National Grid filed its [Efficiency and System Reliability Procurement Plan](#). The plan highlighted the use of NWAs for

highly utilized distribution systems, areas where construction is physically constrained, and areas where the utility anticipates demand growth.

10.0 Standardization of Methodologies

Two states have developed standardized processes and tools to facilitate stakeholder engagement and speed the development of distribution system and grid modernization planning. Specifically, stakeholder knowledge is transferrable from utility to utility, so a solar vendor, for example, needs to learn one system for the state rather than one system for each of the state's utilities. Standardizing methodologies also makes it easier for regulators to review filings.

In New York, regulated utilities filed jointly for the Phase 2 DSIP filing (discussed elsewhere in this document) and have also produced other joint filings with relatively standardized tools. For example, in the Benefit-Cost Analysis filings of the utilities, the majority of the documentation is a standard methodology developed jointly.

In California, the IOUs have hosted or participated in ongoing workshop processes to develop tools related to hosting capacity analysis and locational benefit analysis. There also has been standardization in the state for developing DER growth scenarios and load forecasts (see GMLC 2017b, page 1.6).

11.0 Storm Hardening

Because distribution grids in Florida must withstand the impact of hurricanes and tropical storms, the state and utilities have specifically focused on storm hardening. As discussed earlier in this report, Maryland also has focused on the resilience of distribution systems in the face of extreme weather events.

Grid hardening can include improving the current strength of feeder lines to conform to the National Electrical Safety Code's Extreme Wind Loading guidelines; following Extreme Wind Loading design standards for new construction of feeders, pole lines, and other planned work; replacing wooden transmission structures with steel and concrete structures; and "undergrounding" (i.e., burying power lines instead of putting them on poles) where it is cost effective. Under Florida Administrative Code and Public Service Commission requirements, each Florida investor-owned electric utility must file an updated, detailed storm hardening plan every three years. The report must include a description of the deployment plan and standards and procedures for joint and third-party uses (to ensure that they do not interfere with the utility's storm hardening activities). Utilities must seek input from joint and third-party users when developing their plans. Plans also involve maintaining written safety, reliability, pole-loading capacity, and engineering standards and procedures for third parties to attach to utility transmission and distribution poles (GMLC 2017b, page 7.1).

12.0 Voluntary Planning and Surcharges to Accelerate Investment

Several states have passed legislation to accelerate investments in grid modernization (“smart infrastructure”) or replacement of aging facilities to improve resilience and reliability. Generally, such legislation provides vehicles for utilities to accelerate investment if the utility meets prescriptive filing approaches, and prescriptive requirements for regulatory review. In addition, in Maryland, two utilities and the state regulatory commission utilized surcharges in response to the need to improve resiliency in the face of severe weather events.

- *Illinois* – The Energy Infrastructure Modernization Act (Senate Bill 1652) allows utilities of a certain size to voluntarily undertake investments in distribution infrastructure improvements, including smart meters, distribution automation, associated cyber-secure data communication networks, substation microprocessor relay upgrades, and grid hardening (Illinois General Assembly 2011).¹ The Act requires utilities in Illinois to file annual Grid Modernization Action Plans requesting formula rates for Illinois Commerce Commission (ICC) approval (GMLC 2017b, page 8.2).²
- *Indiana* – In Indiana, utilities were legislatively given an option of funding distribution improvements through a transmission, distribution, and storage system improvement charge (TDSIC). To take advantage of this option, utilities must file a 7-year TDSIC plan that meets several minimum requirements. The Indiana Utility Regulatory Commission (IURC) must determine that the TDSIC plan meets the definition of “a plan,” and that the projects included are in fact eligible projects under the law. The Commission also must determine whether the cost estimates provided are the best estimates of the cost of the projects, whether the proposed plan provides incremental benefits justifying the cost of the projects, and whether the plan is reasonable. Utilities may recover costs for eligible transmission, distribution, and storage improvements that meet these requirements using the improvement charge (GMLC 2017b, pages 9.1–9.2). The TDSIC plans target replacement and upgrades to aging infrastructure (IURC 2016, page 24). Utilities and Indiana regulators and stakeholders are using the process to incorporate modern smart assets into the distribution system (DEI 2016).
- *Maryland* – Pepco and BGE used rate surcharges to recover costs related to accelerated upgrades to the distribution system that are designed to increase grid resilience. The surcharges/riders were responses to weather events that caused widespread outages. The MDPSC approved Pepco’s Grid Resiliency Surcharge in 2013 to accelerate replacement of feeders, with the provision that unless reauthorized, it would sunset when Pepco completed the qualifying projects, and any uncollected and prudent costs would be rolled into Pepco base rates at that time (MDPSC 2013a, pages 133–164). In the 2016 rate case order, the MDPSC determined that Pepco’s surcharge had achieved the intended improvements and rejected renewal of the surcharge (MDPSC 2016a, pages 74–75). The MDPSC

¹ Utility grid modernization investment plans are posted at <https://www.icc.illinois.gov/electricity/utilityreporting/InfrastructureInvestmentPlans.aspx>.

² An example of Ameren’s 2016 Grid Modernization Action Plans can be found at <https://www.icc.illinois.gov/docket/files.aspx?no=16-0262&docId=248656>.

approved BGE's Electric Reliability Investment Initiative Surcharge in 2013 to authorize several grid resilience programs. The BGE surcharge will sunset in 2018 unless it is reauthorized (MDPSC 2013b). The surcharges were an outgrowth of inquiries beginning in 2011 into widespread outages caused by weather events (GMLC 2017b, pages 10.2–10.3).

- *Pennsylvania* – Since 2013, Pennsylvania's System Improvement Charges Act 11 of 2012 has enabled electric distribution companies to seek Pennsylvania Public Utility Commission approval to implement a Distribution System Improvement Charge (PAPUC 2012). The charge is intended to provide for timely recovery of costs incurred to repair, improve, or replace eligible property to ensure "... adequate, efficient, safe, reliable and reasonable service" (State of Pennsylvania 2012). The Act requires utilities that wish to implement an Improvement Charge to submit a Long-Term Infrastructure Improvement Plan that includes investment needs and justification of proposed investments. The plans are subject to Commission review at least once every 5 years. Utilities also must submit asset optimization plans annually describing investment made in the last year and facilities to be improved in the next 12 months (GMLC 2017b, page 14.1).

13.0 Aligning Distribution System Planning With Other Types of Planning

Several states have made strides in aligning distribution system planning with other planning processes. For example, California is aiming for consistent DER forecasts across multiple planning processes. Minnesota and Washington are proposing greater linkage between IRP, grid modernization and DSP. Rhode Island’s latest proposal calls for the synchronization of two planning processes that previously operated under separate schedules and to make the processes more open to stakeholders.

- California** – The CPUC distribution planning proceeding (R.14-10-003) includes a series of processes and requirements that fit together into an integrated DRP process. The DRP process includes an assessment of DERs (including load and hosting capacity calculations, locational value assessments, and DER growth scenarios), an assessment of grid needs, frameworks for grid modernization investments and investment deferrals, and a solicitation process for DERs. See Figure 1 for the proposed process of how different elements fit together into California’s distribution resource planning process. Direction was given to California IOUs to develop approaches to developing DER growth scenarios through a stakeholder process. For the near-term, the IOUs DER forecasts will be linked to another ongoing process, the California Energy Commission’s Integrated Energy Policy Report. The Commission provided guidance for developing future assumptions, including guidance for producing projections in “off-years,” or between years when IOUs make submissions to the California Energy Commission process, and high and low DER cases. Next steps will be determined in a CPUC proposed decision that will address longer-term issues (GMLC 2017b, pages 1.6–1.7)

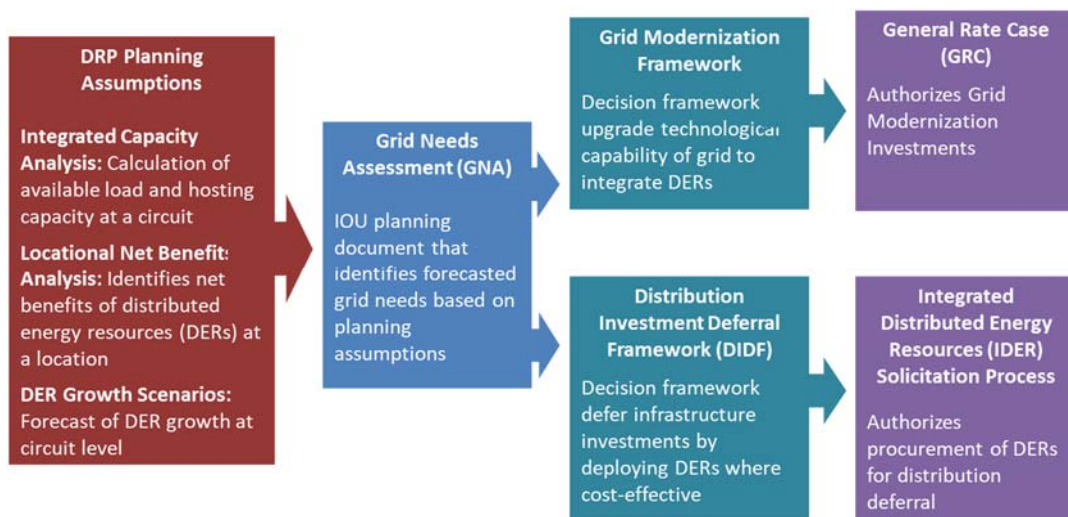


Figure 1. Elements of California’s Distribution Resource Planning Process (Source: CPUC 2017b)

- Minnesota** – The Minnesota Public Utilities Commission identified Integrated Distribution Planning as a key component of a grid modernization program. DOE commissioned a report on Integrated Distribution Planning to assist the Commission in defining the process, to identify the components, and to identify implementation considerations (ICF 2016). A key question to be answered is how distribution planning, IRP, and other planning processes (e.g., transmission planning), can be coordinated to protect and promote the public interest (GMLC 2017b, page 4.2). Figure 2 shows the Integrated Distribution Planning framework developed for the report.

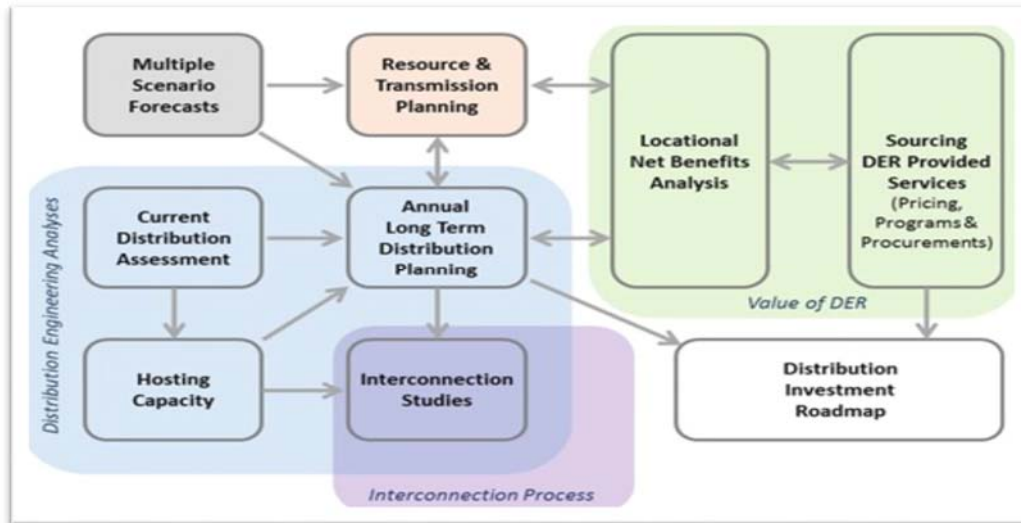


Figure 2. Integrated Distribution Planning Framework. (Source: ICF 2016)

- *Rhode Island* – In a recent filing, state agencies propose to link and synchronize two planning processes to increase transparency, codify mechanisms for stakeholder and regulatory input, and allow parties to consider proposed investments in a comprehensive and holistic manner (Rhode Island DPUC, OER, and Public Utility Commission. 2017b, page 8). Today, the utility National Grid supplies information in two distinct processes, each with a distinct planning cycle. The Infrastructure, Safety, and Reliability Plan provides information about costs of infrastructure projects used for cost recovery. The System Reliability Procurement Plan covers the costs of NWA (Rhode Island DPUC, OER, and Public Utility Commission. 2017a, page 44). The latest proposal would synchronize these processes. (Rhode Island DPUC, OER, Public Utility Commission. 2017b, page 7).
- *Washington* – On October 11, 2017, the Washington Utilities and Transportation Commission (WUTC) issued a final policy on analyzing energy storage. The policy statement recommended that a stacked benefits approach be considered for analyzing storage. While the policy statement dealt with energy storage at the system planning level, the WUTC intends to develop rules guiding the treatment of energy storage and other DERs in its ongoing IRP rulemaking (WUTC 2017a). The rulemaking (U-161024) is considering revisions to IRP and resource acquisition rules. Among other things, WUTC is exploring whether IRP modeling can be improved to better account for distribution system impacts of electric vehicles and distributed generation (GMLC 2017b, page 16.1).

WUTC submitted a report to the Washington Legislature in December 2017 on the state of distributed resource planning. The report summarized the following overarching principles for distribution planning as (WUTC 2017b, page 2):

- Transparency (fairly consider both traditional distribution solutions and NWA solutions)
- Coordination (between planning processes)
- Flexibility
- Reliability and security
- Inclusion (customers and stakeholders participate).

WUTC staff recently proposed draft rules to integrate DSP into the IRP process, available at this [link](#).

14.0 Reporting on Reliability and Poor Performing Feeders

Many, if not most, states require utilities to report on distribution system reliability measures such as system average interruption duration index (SAIDI), customer average interruption duration index (CAIDI), and system average interruption frequency index (SAIFI). Florida, Illinois, Ohio, Pennsylvania, and Rhode Island take this a step farther and require utilities to report on the worst-performing feeders according to typical reliability measures. Illinois and Ohio requirements are summarized below. The other states are discussed in GMLC 2017b.

- *Illinois* – Illinois State Administrative Code Title 83, Section 411.120, requires annual reporting, including the utility’s performance on distribution system reliability, a 3-year plan for future investments in distribution system reliability, and identification of future distribution system reliability challenges (Illinois General Assembly, not dated). The ICC assesses the reports at least every 3 years.
- *Ohio* – Ohio Administrative Code 4901:1-10-26 requires electric utilities to annually file a report with PUCO on performance and reliability of distribution systems. The report must include plans for system investments and improvements looking out at least 3 years into the future. Reports must cover the entire service territory, characterize the condition of the system, provide a timetable for improvements, and give details of distribution system budgets and expenditures. Ohio Administrative Code 4901:1-10-10 sets rules for reliability measurement, reliability performance standards, and reliability performance reporting,¹ while Ohio Administrative Code 4901:1-10-11 prescribes methods for determining distribution circuit performance, including provisions for reporting on the utilities worst-performing circuits.²

¹ Ohio Administrative Code 4901:1-10-10 is at <http://codes.ohio.gov/oac/4901:1-10-10>.

² Ohio Administrative Code 4901:1-10-11 is at <http://codes.ohio.gov/oac/4901:1-10-11>.

15.0 Conclusion

The first step for any state that wants to move forward with an integrated DSP process is to clearly define its vision, goals, and objectives. States can consider adapting some of the actions others are undertaking to help achieve the specific aims set for their own DSP process. Clear goals and objectives will help guide the process and avoid wasted effort. Goals and objectives should take into account immediate needs and opportunities and those that are likely to emerge in the future.

This document summarizes some of the ongoing planning processes among U.S. states that are undertaking similar efforts. Contained herein are descriptions of and links to:

- Vision statements, goals and objectives set by states to guide their distribution planning processes
- Materials that can potentially be adapted and used — for example, surveys, NWA screening criteria and Commission orders
- Advanced tools, such as hosting capacity and locational net benefits methodologies, that can be adapted and used
- Processes, such as utility filing requirements and cost recovery mechanisms that can shine light on DSP-related needs and incentivize grid improvements to improve reliability and resilience and modernize the grid.

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