Energy Markets & Planning
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Guide
Distribution System Plan Template for Electric Utilities

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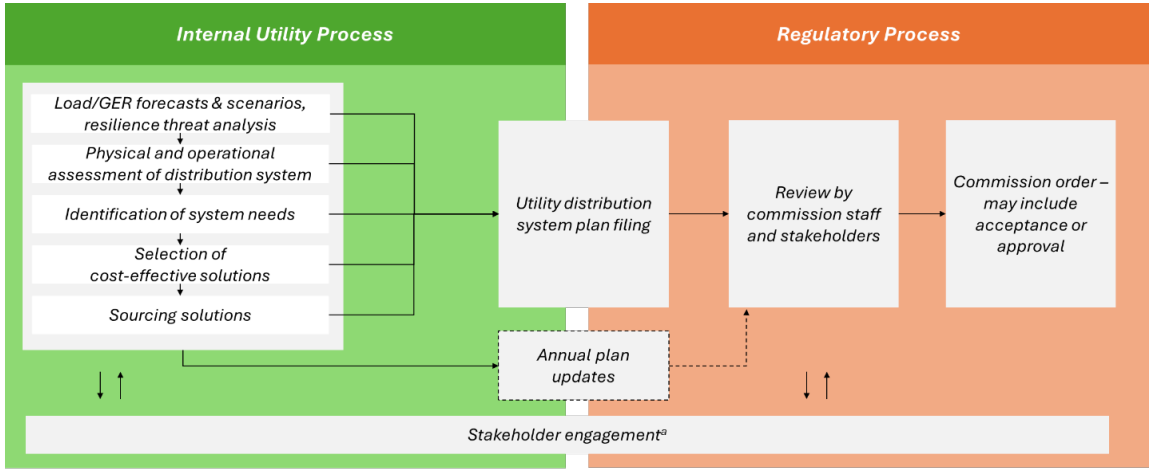
Acronyms and Abbreviations

BCA	Benefit-Cost Analysis
CAIDI	Customer Average Interruption Duration Index
DSIP	Distribution System Implementation Plan
GER	Grid-Edge Resources
HCA	Hosting Capacity Analysis
LRC	Lowest Reasonable Cost
NWS	Non-Wires Solutions
O&M	Operations and Maintenance
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index

Introduction (1)

Electric utilities conduct distribution system planning internally each year to assess physical and operational changes needed to deliver safe and reliable electricity service to customers. The process includes assessing asset condition, system reliability, estimating demand impacts, and identifying grid needs and solutions. A growing number of states require regulated utilities to make such information publicly available in distribution system planning filings to facilitate regulatory oversight and stakeholder engagement.

This document serves as a guide for a companion template for structuring distribution system plans, with the aim of focusing the information that utilities submit for regulatory decision-making. Distribution system plans filed in 16 jurisdictions (Appendix A) and subject-matter experts informed these documents. Even if state regulations specify minimum contents and format of plan filings, commissions and stakeholders can use the guide and template to consider potential improvements.



Notes

[a] Stakeholder engagement often occurs during forecasts and scenario development, and during development of resilience threat assessment, as well as sourcing of solutions before plan filing, in the filing (e.g., reporting on outcomes of stakeholder engagement), after plan filing, when considering changes for future IDSP filings.

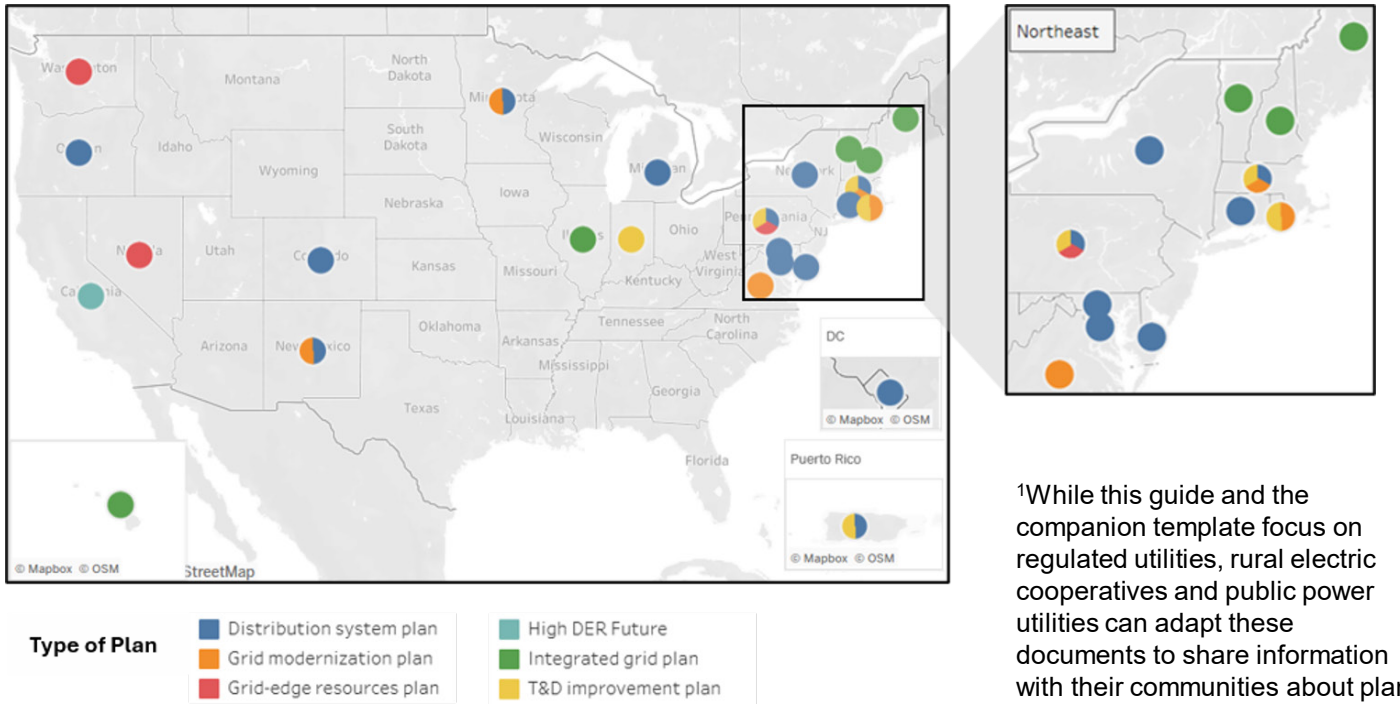
Typical U.S. distribution system plan processes (LBNL)

Introduction (2)

Information to support regulatory oversight

Distribution system planning requirements in 22 states, Puerto Rico, and the District of Columbia are reshaping long-established utility practices. In these jurisdictions, regulated utilities file some type of distribution system plan with the public utility commission to describe near- and long-term strategies, investments, and other expenditures to meet distribution system needs at the lowest reasonable cost. A long-term plan component, typically 10 years into the future, establishes the utility's strategy and a roadmap of capital and maintenance expenditures. For the near-term, the utility identifies anticipated expenditures more specifically to address priority grid needs in the next three to five years.

State planning requirements have evolved over time, vary across jurisdictions, and cover a wide range of topics. Resulting utility filings provide greater transparency into the utility planning process, with detailed information to inform regulatory decisions and facilitate stakeholder engagement. Regulators rely on this information to help oversee distribution system expenditures ultimately recovered from utility ratepayers.[1]



Types of distribution system plans required in the U.S.
Source: LBNL, 2026, State Distribution Planning Requirements

[1]While this guide and the companion template focus on regulated utilities, rural electric cooperatives and public power utilities can adapt these documents to share information with their communities about plans to improve local grids.

Introduction (3)

Utility template to inform the planning processes

While detailed information on distribution system planning data, analysis, and results is important, the massive amount of information associated with utility filings can overload regulators and stakeholders, potentially impeding effective plan assessment and reducing oversight effectiveness. At the same time, even voluminous plans may omit critical information.

The template characterizes information for utility filings as *essential* or *supplemental.* ***Essential information*** is the minimum threshold required for the commission and stakeholders to evaluate the utility's plan. ***Supplemental information*** expands on the essential information to provide greater transparency and enable a better understanding of the utility's plan, proposed near-term actions, and long-term vision.[2]

Some items in the companion template are flagged (with an asterisk) to indicate that they may be included in an appendix or that a link to information already filed may suffice.

Jurisdictions can adapt the template to meet their own needs as they establish and update filing requirements or provide guidance on plan content. Utilities also can consider the LBNL template when developing their filings.

The template covers 11 key sections in utility distribution system plans and underlying topics (described in the next two slides). For each section, this guide provides:

- A description of the topic and its importance
- The type of content included
- An example utility approach
- References to other utility plans that also serve as models for providing information on the topic

Distribution system plans may include topics not covered in this guide and template. See examples in Appendix B.

[2] Unless noted as "*Supplemental*," each item listed in the guide is considered to be essential for effective regulatory oversight and stakeholder engagement.

Outline for Distribution System Plan Template

1 **Executive Summary**

2 **Planning Objectives**

- Grid vision and strategy
- Compliance with state requirements and priorities

3 **Current Distribution System**

- Current distribution system operations
- Grid-edge resources (GER) interconnection and utilization

4 **Planning Approach**

- Planning processes
- System analysis methodology and tools
- Stakeholder engagement
- Utility data access provisions

5 **Reliability and Resilience**

- Performance/statistics
- Priorities and planned expenditures

6 **Asset Management**

- Strategy and practices
- Methodology
- Results

7

Operation & Maintenance (O&M) Expenses

- Vegetation management
- Asset O&M

8

Capacity Expansion Planning

- Load and GER forecasting
- Scenario analysis
- Hosting capacity analysis

9

Solution Identification

- Grid needs assessment and solution selection
- Capital investments
- Non-wires solutions

10

Cost-effectiveness

- Evaluation objectives
- Methodologies
- Estimated costs and benefits
- Prioritization process

11

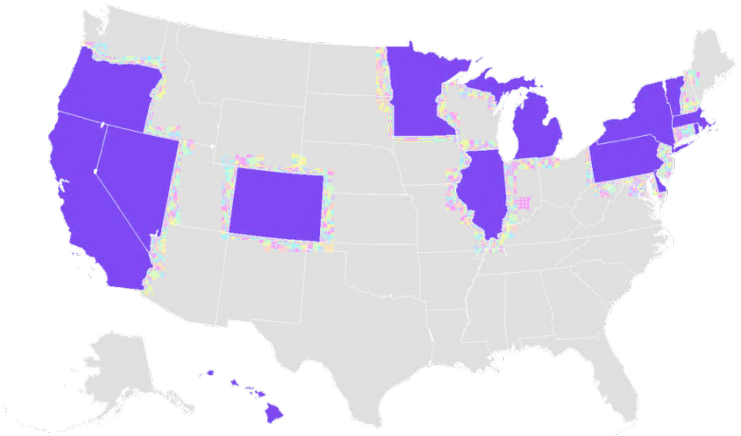
Implementation

- Roadmap
- Forecast costs
- Risks and mitigation strategies
- Performance assessment

Methodology

To inform the template and this companion guide and identify leading practices, LBNL researchers selected 26 geographically diverse distribution system plans recently filed by utilities (see Appendix A) in 16 jurisdictions using the following criteria.

- **Date of plan filing:** Plans filed in 2022 or later
- **Type of plan:**
  - *Transmission and distribution improvement plan* - Some states enacted laws that provide regulated utilities the opportunity for expedited cost recovery for certain types of grid improvements included in an approved plan.
  - *Grid modernization plan* - These plans provide a technology roadmap for capital investments and other expenditures that meet state objectives. Ideally, the plan is filed as part of the distribution plan.
  - *Grid-edge resources (GERs) plan* - In a few states, regulated utilities file plans to consider ways to improve deployment and integration of GERs, including investments in distribution system infrastructure and interconnection processes.
  - *Integrated resource plan (IRP)* - In some states, utility plans for bulk power systems (generation and transmission) include elements of distribution system planning.



Jurisdictions represented in LBNL sample of utility plans reviewed

  - *Integrated distribution system plan* - An increasing number of states require regulated utilities to take a systematic and objectives-based approach to long-term investment strategies, ideally coordinated with bulk power system planning where relevant.
- **Planning horizon:** Plans that include, at a minimum, a medium-term (e.g., five-year) planning horizon
- **Regional representation:** At least one distribution system plan from each jurisdiction - For jurisdictions with more than one utility filing a plan fitting the selection criteria, researchers selected plans from the largest two utilities, based on number of customers served.

1

Template for Executive Summary

Executive summary (1)

This section of the distribution plan synthesizes the utility's planning outcomes, emphasizing proposed capital and operations and maintenance (O&M) expenditures and their alignment with the utility's planning objectives, including statutory and regulatory requirements.

The executive summary of the distribution plan provides an overview of the content and topics that are presented in greater detail in later sections. The information can help decision-makers identify initial areas of focus for their review and assessment.

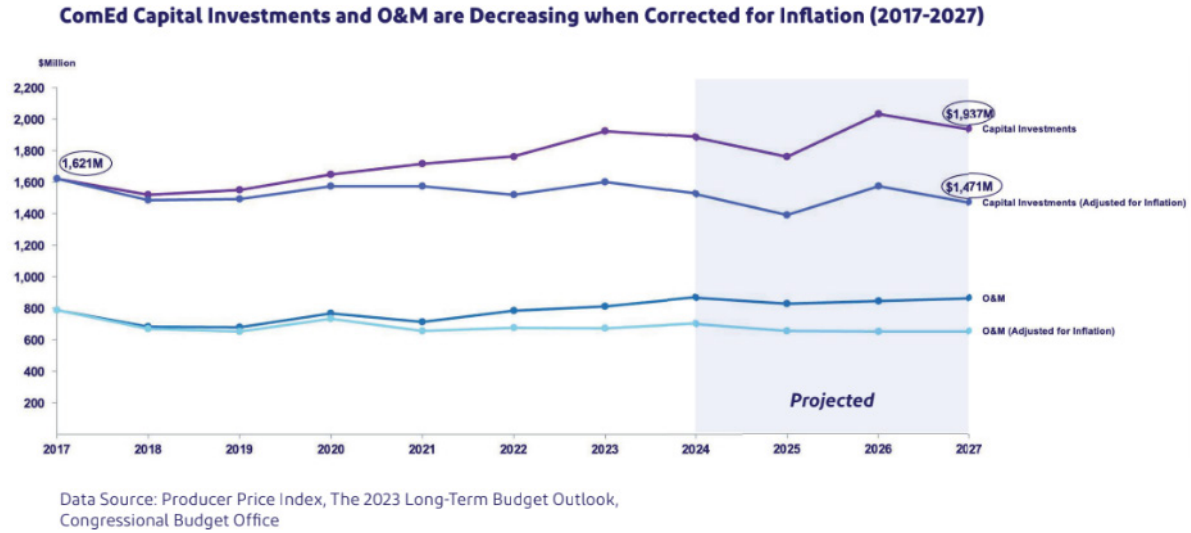
Template

- Overview of plan structure and content
- Synopsis of past and planned actions to achieve the long-term vision, including key differences between the utility's previous plan and the current filing, rationale, and impacts on planning outcomes
  - Links to previous plans and implementation progress reports, if applicable
- List of planning objectives (e.g., reliability, safety, resilience, affordability) with a brief description of their relevance for the utility's service territory
- Summary of anticipated system evolution through the planning horizon
- Summary of proposed capital and O&M expenditures by year for the planning period, including identification of major cost drivers

Executive summary (2)

Utility practice example

Commonwealth Edison (ComEd) - The executive summary for the 2024 Multi-Year Integrated Grid Plan provides an overview of the utility's service territory, distribution planning process, and drivers of change affecting planning and operations, such as load growth, GERs, severe weather, cybersecurity risks, and evolving state objectives. The utility also summarizes proposed investments, including alignment with state requirements, outlines differences from its previous plan, and highlights budget changes and customer affordability impacts associated with proposed investment levels. In addition, the summary includes projected costs and budget allocations for the 2024-2027 period, comparing them to historical levels for capital investments and O&M expenses.



ComEd's Historical and Projected Capital and Operational Spending

Source: ComEd (IL), 2024 Multi-Year Integrated Grid Plan, "Setting the Stage for the Refiled Grid Plan," (p. 11)

Additional references for utility practices

- Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Executive Summary" (p. 5)
- DTE (MI), 2023 Distribution Grid Plan, "Executive Summary" (p. 6)
- Eversource (MA), 2024 Electric Sector Modernization Plan, "Executive Summary" (p. 6)

2

Template for Planning Objectives

- Grid vision and strategy
- Compliance with state requirements and priorities

Planning Objectives (1)

This section of the distribution plan provides information on the utility's grid vision and strategy, as well as compliance with state requirements and priorities. Regulators and stakeholders use this information to assess the utility's vision and supporting strategies.

Grid vision and strategy
The utility provides information to support regulatory review and stakeholder engagement of expenditures proposed for cost recovery in the near term, in a rate case or other proceeding, and how they relate to long-term grid needs and planned expenditures in the future.

The vision describes the long-term evolution of the distribution system, including the rationale for changes and how it will adapt to future challenges and opportunities. The strategy outlines an actionable framework for achieving the long-term vision.

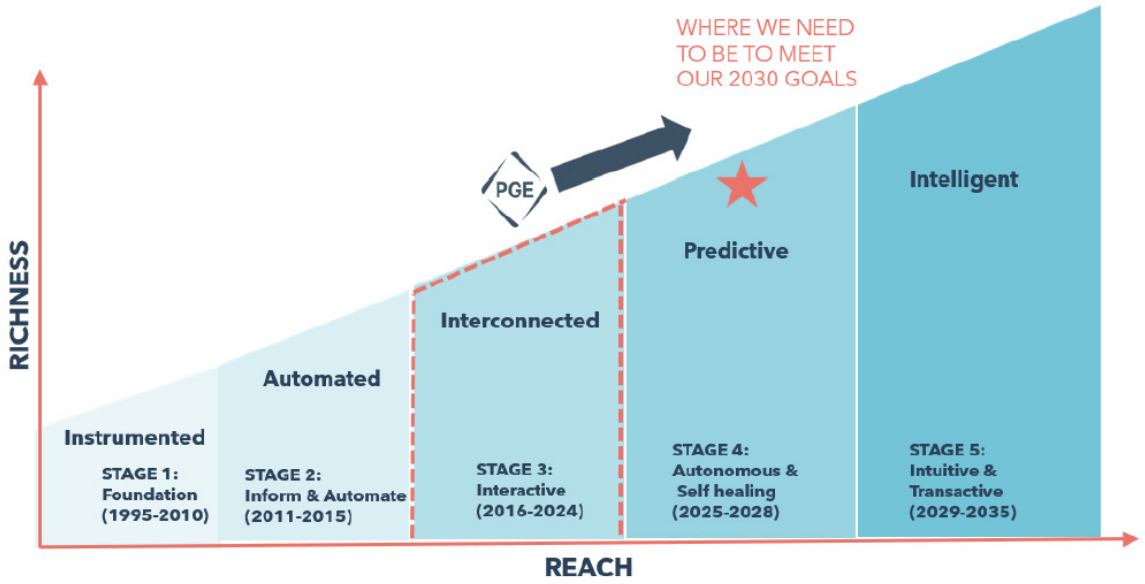
Template

- Utility's long-term vision for the distribution system (e.g., guiding principles and key considerations), emphasizing capabilities, functionalities, and technologies
- Regulatory, technology, and market drivers and impacts on grid vision and strategy
- Planned evolution from the current state of the distribution system to achieve the long-term desired state, including key milestones, and measurable progress indicators

Planning Objectives (2)

Utility practice example

Portland General Electric (PGE) - The utility's 2024 Distribution System Plan provides its vision for the distribution system, including modernizing the grid to better serve customers, leveraging GERs to meet peak demand, exploring alternatives to traditional infrastructure investments, and ensuring long-term affordability. PGE also discusses the continuing need to develop operational capabilities to support evolution from the current "Interconnected" stage to a "Predictive" system with autonomous and self-healing capabilities to meet the utility's goals.



PGE system evolution from interconnected to predictive state

Source: PGE (OR), 2024 Distribution System Plan, "Distribution system vision" (p. 29)

Additional references for utility practices

- Consolidated Edison (NY), 2023 Distributed System Implementation Plan, "Progressing the DSP" (p. 7)
- PGE (OR), 2024 Distribution System Plan, "Distribution System Vision" (p. 23) and "Distribution System Strategy" (p. 30)
- Northern States Power Company-Minnesota (NSPM), 2024 Integrated Distribution Plan, "Distribution Strategy and Plan" (p. 13)

Planning Objectives (3)

Compliance with state requirements and priorities

This section of the distribution plan provides regulators and stakeholders with information to assess how the plan's content addresses state requirements.

State requirements define long-term, high-level outcomes for grid planning, including core utility functions such as maintaining a safe and reliable distribution system at affordable rates. Goals and objectives also may address specific state priorities such as economic development and GER integration and utilization.

Requirements and priorities for regulated utilities can emerge from the state legislature or regulatory commission and include guidance for both procedural and substantive planning elements.

Template

- Summary of applicable state objectives, statutory and requirements, and priorities
- Description of how the plan addresses the objectives, requirements, and priorities and identification of any areas that may benefit from future regulatory clarification or guidance
- Identification of any aspects where the filed plan is not compliant, including rationale

Planning Objectives (4)

Utility practice example

Eversource - The 2024 Electric Sector Modernization Plan discusses state requirements and regulatory priorities related to distribution system planning, including plan compliance. Eversource distinguishes between state requirements, which are fully addressed in the plan, and the utility's recommendations for future regulatory proceedings to address unresolved issues. The utility maps each statutory requirement to specific plan sections or pre-filed testimonies (see table) and discusses information and methods used during the planning process to fulfill requirements.

Information Required in ESMPs	Citation to Plan and/or Testimony
Alternatives to proposed investments, including changes in rate design, load management and other methods for reducing demand, enabling flexible demand, and supporting dispatchable demand response.	ES-ESMP-1, at Sec. 6.0, 6.3.2.1, 6.5.2, 6.7.2, 7.1.1, 9.0, 9.3, and 9.6; ES-Policy/Solutions-1, at Sec. XI.

Sample section of Eversource's mapping of state requirements to plan or testimony
Source: Eversource (MA), 2024 Electric Sector Modernization Plan, "2.0 EDC Compliance" (p. 33)

Additional references for utility practices

- ComEd (IL), 2024 Multi-Year Integrated Grid Plan, "Statutory Objectives and Requirements" (p. 1)
- FirstEnergy (PA), 2024 Long-Term Infrastructure Improvement Plan, "Requirements of the LTIIP" (p. 21)
- NSPM (MN), 2024 Integrated Distribution Plan, "Integrated Distribution Plan Background, Requirements, and Landscape" (p. 5)

3

Template for Current Distribution System

- Current distribution system operations
- GER interconnection and utilization

Current Distribution System (1)

Regulators and stakeholders can use information in this section of the plan to understand the current state of the distribution system. The information provides a baseline to assess how the proposed plan addresses system strengths, weaknesses, opportunities, and threats to delivering safe, reliable, and affordable electricity service.

Template

- **Summary of current distribution system operations**
  - Characteristics of utility's service territory and each planning area, including maps, assets in service, and customers served
  - Information on distribution system assets in operation
    - Maximum rated capacity of each substation transformer
    - Capacity margin of each substation transformer
    - Number of feeders served by each substation and transformer
    - Maximum rated capacity of each feeder
    - Miles of underground and overground feeders by voltage class
    - Existing monitoring and control capabilities, limitations, and planned enhancements for interconnection of GERs such as distributed generation and energy storage systems
    - Non-wires solutions (NWS) in operation
    - Existing capacity (MW) of energy efficiency and other demand-side programs addressing distribution grid needs, including MW reduction goals per feeder and substation
    - Primary voltage violations by resource type for the past three years
    - Power quality complaints by customer class for the past three years
- **Summary of GER interconnection and utilization**
  - Interconnection queue size and queue duration from application to permission to operate — by project type and size range (*Supplemental*)
  - Information describing how connected GERs provide grid services (e.g., participation in utility demand flexibility programs, enrollment in wholesale market) and characteristics of grid services provided (e.g., capacity, number of events called, duration)

Current Distribution System (2)

PROJECT DESCRIPTION	PROJECTED IN-SERVICE DATE	AREAS SERVED
Mt. Vernon Square Sub. – Build new substation to relieve predicted network overloads.	In Service June 2024	NoMa, Mt. Vernon Triangle, Shaw
Harvard Sub. – Upgrade Harvard as a new 230/13 kV substation to retire existing Harvard and Champlain substations.	In Service December 2023	Columbia Heights, Adams Morgan
Champlain Sub. – Upgrade Champlain to a new 230/69 kV substation to resupply downtown distribution substations.	2029	Downtown

PEPCO substation additions and enhancements

Source: Adapted from PEPCO (DC), 2025 Annual Consolidated Report (p. 25)

Utility practice example

PEPCO – The 2025 Annual Consolidated Report provides information on current characteristics of the distribution system, including substations in service and customers served per substation, as well as information on substation additions and enhancements since the last report. The utility also provides a description of existing monitoring and control capabilities, including information on SCADA systems, substation automation, and distribution automation.

Additional references for utility practices

- Delmarva Power & Light (DE), 2023-2032 Long-Range Distribution Plan, "Introduction" (p. 8)
- Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Distribution System Overview" (p. 11)
- National Grid (MA), 2024 Electric Sector Modernization Plan, "Current State of The Distribution System" (p. 60)
- NV Energy (NV), 2023 Distributed Resources Plan, "Barriers to Deployment of GER" (p. 89)

4

Template for Planning Approach

- Planning processes
- System analysis methodology and tools
- Stakeholder engagement
- Utility data access provisions

Planning Approach (1)

This section of the distribution plan provides information on planning processes, system analysis methodologies and tools, stakeholder engagement, and utility planning data access provisions. Regulators and stakeholders can use this information to understand the utility's planning framework and how the plan addresses grid needs.

Planning processes
The utility describes the framework it uses to identify grid needs and select cost-effective solutions. The approach includes information on the types of inputs required and analyses that the utility conducts throughout the planning cycle. The utility also can discuss the degree to which it coordinates distribution system planning with its other planning processes as well as relevant utility and state and local government plans.

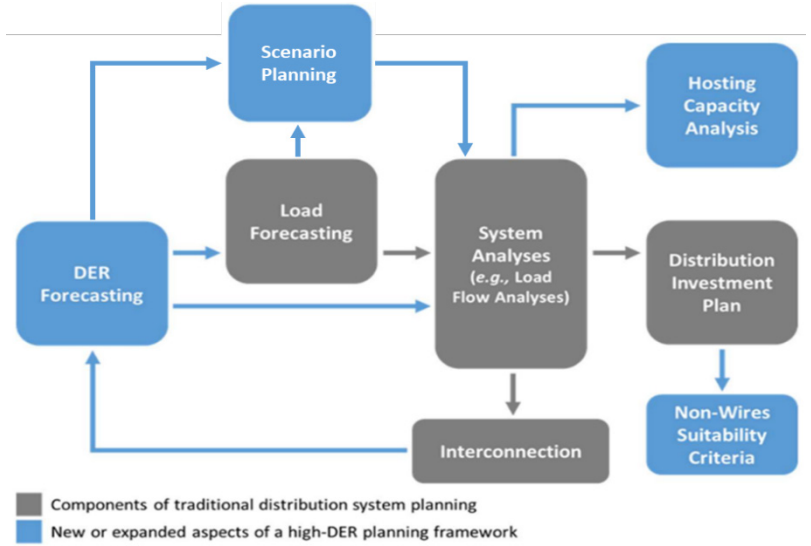
Template

- Summary of utility's planning process, including any changes since the previously filed plan
- Types of inputs and key assumptions used in planning and where to find them in the plan, including assumptions that materially impact planning outcomes
- Summary of coordination with other regulatory processes (e.g., integrated resource planning, bulk power system planning, coordination between electric and gas planning for dual-fuel utilities, rate cases), including coordination approach and identification of dependencies and potential conflicts between processes

Planning Approach (2)

Utility practice example

Consolidated Edison - The 2023 Distributed System Implementation Plan outlines its purpose and how the plan's structure reflects Commission staff guidance. The utility provides information on recent improvements and future enhancements to distribution system planning processes, schedule, and investments and other expenditures in current and future initiatives, including a detailed discussion of the advancement of key planning functions, such as coordinated grid planning with other state utilities, market services, GER integration, and information sharing. The utility also addresses risks, mitigation strategies, and stakeholder engagement and describes methods used to conduct integrated distribution system planning.



ConEd's integrated distribution system planning framework
Source: Adapted from Consolidated Edison (NY), 2023 Distributed System Implementation Plan (p. 14)

Additional references for utility practices

- Xcel Energy (CO), 2024 Distribution System Plan, "The Nuts and Bolts of Distribution System Planning" (p. 34)
- Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Planning Process" (p. 38)
- PGE (OR), 2024 Distribution System Plan, "Appendix B. Distribution Planning Process" (p. 161)
- PacifiCorp (OR), 2022 Distribution System Plan, "Distribution System Planning" (p. 17)

Planning Approach (3)

System analysis methodology and tools
Distribution system analysis methodologies and tools support utilities throughout the planning process. The methodologies outline the utility's processes and key steps for identifying near-term investment needs and informing the utility's long-term vision. Analytical tools support the utility's methodologies and typically encompass software, models, algorithms, and relevant datasets. Tools ensure that engineering, economic, and other technical analyses yield robust results to inform long-term strategy and near-term solution decisions.

This part of the distribution plan provides regulators and stakeholders with information on planning methods and tools the utility used in the planning process. The utility also can flag challenges related to tool capabilities, share lessons learned, and discuss the need for additional tools for future planning cycles.

Template

- Summary of distribution system analysis and planning methods
- Summary of tools used in the planning cycle, including name, vendor, version, known limitations, and any material embedded assumptions
  - Steps in the planning cycle that use these tools and types of information provided
  - Inputs and outputs for each tool
- New tools used in the planning process since the previously filed plan, including capabilities provided and cost
- Additional tools needed to support the next distribution system plan, including purpose and rationale

Planning Approach (4)

Utility practice example

DTE - The 2023 Distribution Grid Plan provides information on each tool used and how it supports the planning process. The plan also discusses objectives guiding adoption of new tools. The utility maps proposed investments to associated benefits and specific objectives, as described in the framework for the U.S. DOE Distribution System Platform Initiative (DSPx).

Additional references for utility practice

- Xcel Energy (CO), 2024 Distribution System Plan, "The Nuts and Bolts of Distribution System Planning" (p. 34)
- Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Planning Process" (p. 38)
- PGE (OR), 2024 Distribution System Plan, "Appendix B. Distribution Planning Process" (p. 161)
- PacifiCorp (OR), 2022 Distribution System Plan, "Distribution System Planning" (p. 17)

Key Investment	Use Case Description	Implementation highlight and Customer Benefit	DSPx Objective
Network Management System (NMS) Phase 2	Management of GIS, asset and system model data for use by the ADMS and System Planning tools	Improved cohesion of utility data systems; enhanced accuracy of distribution model improves all functions that are essential to safe and effective planning, monitoring, and operation of the electrical grid	Operational Data Management, Distribution Network model
Load Allocation Analytics	Data consolidation and analytics platform that integrates hourly SCADA loading information, AMI loading and load forecast data into a single analytics and reporting engine that can be used by other operational and planning tools and distribution system programs	Improved accuracy of system loading models improves results of distribution planning analysis leading to better project designs and more efficient investment of capital system improvements.	DER & Load Forecasting, Operational and Data Management, Locational Value Analysis
CYME Enhancements Program	Distribution planning tool enhancements to incorporate power runner data to perform hourly multi scenario analysis for DER and system improvements	More accurate distribution system planning leading to optimized distribution system capital investments, more integration of DER, Storage, Non-Wire Alternatives and being prepared for electrification.	Power Quality Analysis, Fault Analysis, Power Flow analysis, Probabilistic Planning, Locational Value Analysis

DTE's description of investments in planning tools

Source: DTE (MI), 2023 Distribution Grid Plan, "Information Technology Investments" (p. 152)

Planning Approach (5)

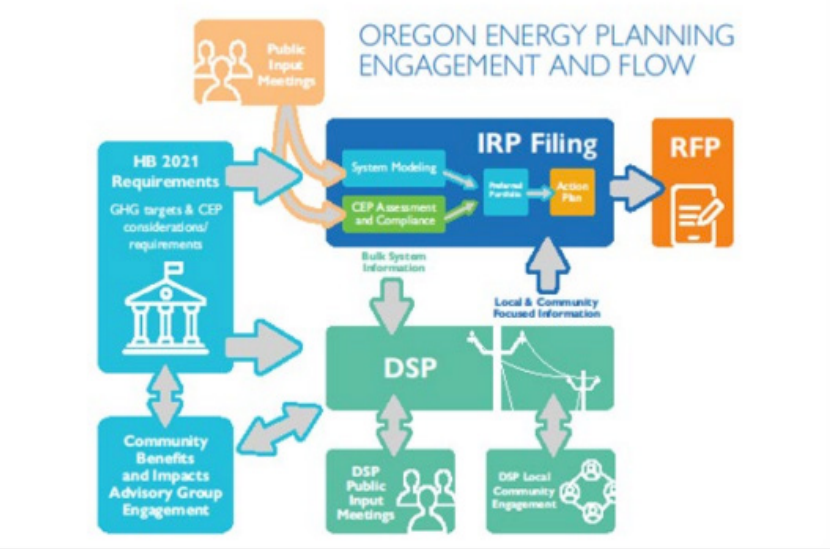
Stakeholder engagement
Utilities engage stakeholders who are affected by, or have expertise relevant to, distribution system planning to provide feedback on planning objectives, inputs, methods, scenarios, and expenditure priorities. Stakeholders may include utility consumer advocates, state energy offices, local governments, organizations representing a particular customer class, and GER project developers. Engagement activities range from information sharing (e.g., public meetings, data portals) to consultation and collaboration (e.g., workshops, technical working groups).

This part of the distribution plan provides regulators and stakeholders with information to assess the utility's efforts to foster greater stakeholder coordination and transparency and the impacts these efforts have on the planning process.

Template

- Description of the stakeholder engagement process, how it informed the distribution plan, and list of stakeholders engaged
- Summary of stakeholder input, section of plan relevant to the input received, utility actions taken and rationale
- Planned improvements to stakeholder engagement for next planning cycle

Planning Approach (6)



PacifiCorp's Stakeholder Engagement Framework
Source: PacifiCorp (OR), 2022 Distribution System Plan, "Community Outreach and Engagement Update" (p. 144)

Utility practice example

PacifiCorp - The 2022 Distribution System Plan for Oregon summarizes stakeholder engagement efforts, including updates on outreach initiatives, tools, and tactics (e.g., customer materials, surveys, focus groups, workshops, and community engagement) and the utility's framework for integrating the results of outreach efforts into the planning process.

Additional references for utility practices

- Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Stakeholder Engagement" (p. 22)
- National Grid (MA), 2024 Electric Sector Modernization Plan, "Stakeholder Engagement" (p. 38)
- Xcel Energy (CO), 2024 Distribution System Plan, "Stakeholder and Community Engagement and Outreach" (p. 194)

Planning Approach (7)

Utility data access provisions
These policies specify the utility's internal processes, including data-sharing standards and platforms, for making information about its distribution system available to state regulators, other state agencies, GER project developers and additional stakeholders.

Regulators and stakeholders can use this information to inform their assessment of the utility's approach to sharing distribution system planning data, including whether the approach facilitates effective regulatory review and stakeholder engagement while ensuring data security and privacy.

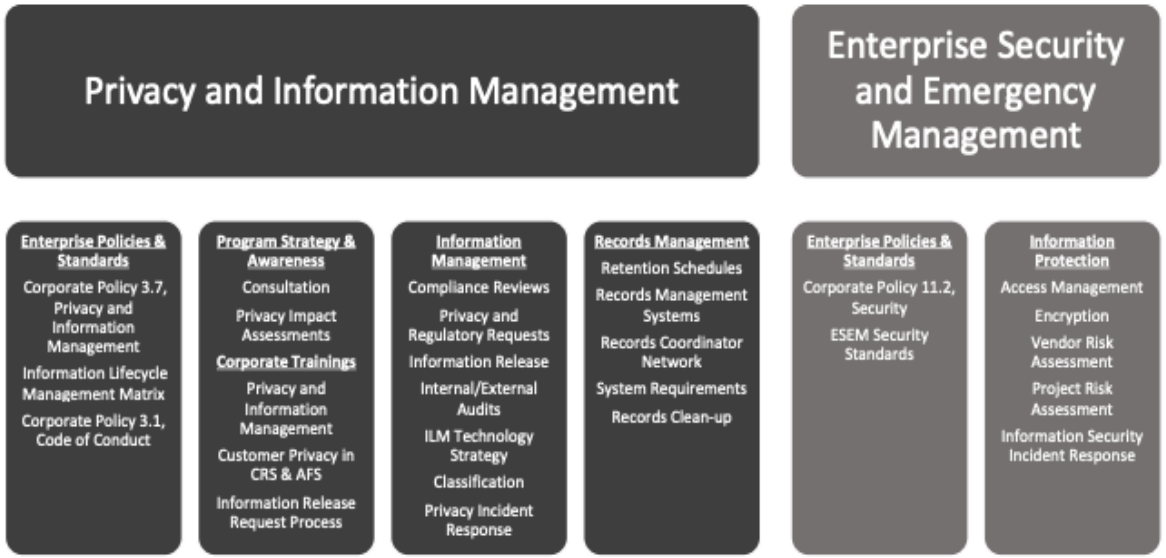
Template

- Planning-related data-sharing processes and standards, including how they meet regulatory requirements, data formats, accessibility (e.g., portals, downloadable datasets), and update frequency
- Improvements implemented during the planning cycle and resulting benefits *(Supplemental)*

Planning Approach (8)

Utility practice example

NSPM - The utility's 2024 Integrated Distribution Plan for Minnesota provides information on data management practices, including strategies, data access provisions, privacy considerations, and governance framework. NSPM highlights the roles and functions of different internal groups overseeing data access provisions, standards, and compliance. The utility explains that data is a business asset, which affects data management. The plan also provides information on data protection, including data creation, collection, use, release, and disposition. The utility classifies data into four categories — confidential and restricted, confidential, internal, and unsecured — each with specific protections and handling rules.



NSPM's Information Management and Protection Framework

Source: NSPM (MN), 2024 Integrated Distribution Plan, "Customer, Operational, and Planning Data Management, Security, and Information Access Plans and Policies" (Appendix B2, p. 12)

Additional references for utility practices

- Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Customer and System Data Management" (p. 112)
- Green Mountain Power (VT), 2024 Integrated Resource Plan, "Communicating With Our Customers" (Appendix A, p. 1)
- Rhode Island Energy (RI), 2022 Grid Modernization Plan, "Cybersecurity, Data Privacy, and Data Governance Plan" (Attachment J, p. 1)

5

Template for Reliability and Resilience

- Performance/statistics
- Priorities and planned expenditures

Reliability and Resilience (1)

Each jurisdiction may develop its own definitions for reliability and resilience to indicate the range of normal operating conditions as well as the degrees of severity and hazards in scope for resilience events. Following are example definitions:

- *Reliability* – "The ability to maintain the delivery of electric power to customers in the face of routine uncertainty in operating conditions. For utility distribution systems, measuring reliability focuses on interruption in the delivery of electricity in sufficient quantities and of sufficient quality to meet electricity users' needs for (or applications of) electricity."[3]
- *Resilience* – "The ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event."[4]
- *Resilience event* – "[A]n event involving extreme weather conditions, wildfires, cybersecurity threats, or physical security threats that poses a material risk to the safe and reliable operation of an electric utility's transmission and distribution systems. A resiliency event is not primarily associated with resource adequacy or an electric utility's ability to deliver power to load under normal operating conditions."[5]

This section of the distribution plan provides information and analysis to enable regulators and stakeholders to understand utility efforts to maintain or improve reliability and resilience. It also helps identify drivers of reliability and resilience concerns and assesses whether utility priorities and proposed expenditures are adequate to mitigate those concerns cost-effectively. It includes a comprehensive overview of distribution system reliability and resilience.

[3] Eto et al. (2020). Grid Modernization: Metrics Analysis (GMLC1.1) – Reliability. https://gmlc.doe.gov/sites/default/files/2021-08/GMLC1.1_Vol2_Reliability.pdf.
[4] IEEE (2018). Technical Report PES-TR65.
[5] This illustrative definition is from Texas, based on hazards in scope in that state. The electricity industry does not have a standard definition for "resilience event." Each jurisdiction develops its own definition based on hazards in scope. The definition may indicate the range of normal operating conditions as well as the degrees of severity for resilience events.

Reliability and Resilience (2)

Template

- Summary of utility's reliability and resilience performance in the past five years, including key drivers, impact of previous activities and expenditures (e.g., those in prior distribution system plans and related utility planning and initiatives), and benchmarking results compared to industry and peers
- Description of the process and analytical approach for assessing past reliability and resilience performance including, if applicable, with respect to target levels
- Summary of approach for projecting the frequency and severity of resilience events

- Reliability statistics
  - System Average Interruption Duration Index (SAIDI), excluding major events
  - System Average Interruption Frequency Index (SAIFI), excluding major events
  - Customer Average Interruption Duration Index (CAIDI), excluding major events
  - Customers Experiencing Long Interruption Durations (CELID), by customer class
  - Customers Experiencing Multiple Interruptions (CEMI), by customer class
  - Customers Experiencing Multiple Sustained Interruptions and Momentary Interruptions Events (CEMSMI), by customer class (*Supplemental*)
  - Momentary Average Interruption Frequency Index (MAIFI) (*Supplemental*)
  - Worst performing circuits, including criteria used
  - Benchmark of reliability performance with industry peers (*Supplemental*)

- Resilience statistics
  - Overview of resilience events in the utility's service territory in the past 10 years (e.g., storms, wildfires, floods, freezes, seismic events), including restoration costs and times
  - Major event only SAIDI
  - Major event only SAIFI
  - Major event only Customer Minutes of Interruption
  - Outage causes

- Summary of priorities and planned expenditures to maintain or improve distribution system reliability and resilience, including criteria to prioritize expenditures; medium- and long-term strategies; and near-term and ongoing expenditures and programs (e.g., technology and automation, equipment standards, storm readiness)
  - Utility infrastructure and processes (e.g., substations, distribution poles, key company facilities) affected and vulnerabilities mitigated for each priority and action (e.g., storms, wildfires, floods, freezes, seismic events)
  - How the priority or action impacts the prevention of, response to, and recovery from resilience events
  - Expected benefits (e.g., reduced restoration costs, shorter outage duration, avoided customer interruption costs)
  - Timeline, including actual or estimated start and completion dates
  - Cost estimate

Section 6 of the distribution plan template provides information on asset management related to capital expenditures. Section 7 addresses related O&M expenditures, including vegetation management and equipment maintenance. Regulators and stakeholders can use information in these subsequent sections to help assess the utility's identification of grid needs, potential solutions, and planned capital investments and expenditures.

Reliability and Resilience (3)

Utility practice example

FirstEnergy - The 2024 Long-Term Infrastructure Improvement Plan provides information on reliability performance, key drivers of reliability trends, and completed and proposed investments. The utility reports historical 5-year trends in reliability and resilience. The reported reliability metrics include SAIFI, SAIDI, and CAIDI. The reported resilience metrics include blue-sky,[6] major, and minor weather event day SAIFI, SAIDI, and CAIDI. The utility also discusses proposed capital investments and their expected impact on reliability metrics for each investment.

[6] FirstEnergy uses blue sky days for days that do not meet minor or major weather event criteria.

Additional references for utility practices

- Xcel Energy (CO), 2024 Distribution System Plan, "Climate Resilience" (p. 128)
- Eversource (MA), 2024 Electric Sector Modernization Plan, "Reliable and Resilient Distribution System" (p. 606)
- ComEd (IL), 2024 Multi-Year Integrated Grid Plan, "System Reliability Investments" (p. 1)

Initiative	Planned Capital Investment (In Millions)					
	2025	2026	2027	2028	2029	Total
CEMI	$3.77	$3.84	$3.90	$4.00	$4.09	$19.60
Circuit Improvement	$77.40	$79.62	$75.90	$84.39	$80.68	$397.99
Network and Underground Ducted Systems	$9.63	$8.97	$8.38	$8.80	$9.23	$45.01
Overhead Circuit Replacement/Rehab	$59.70	$81.77	$85.83	$87.60	$84.18	$399.08
Pole Replacement	$4.48	$4.48	$4.48	$4.48	$2.19	$20.11
Substation Equipment Replacement	$6.00	$5.10	$6.90	$6.00	$6.00	$30.00
Underground Cable and Equipment Replacement	$8.95	$14.23	$12.33	$12.33	$10.92	$58.76
Distribution Circuit Protection and Sectionalizing	$30.99	$20.89	$13.27	$11.64	$0.00	$76.79
New Sources	$12.62	$12.83	$14.12	$17.12	$16.31	$73.00
Remote Sectionalizing (Distribution Automation Prep)	$42.80	$47.64	$42.40	$41.16	$34.60	$208.60
Voltage Conversion*	$15.75	$9.00	$6.00	$7.00	$6.00	$43.75
Unreimbursed Highway Relocation	$6.20	$6.34	$6.49	$6.69	$6.89	$32.61
Battery Storage*	$0.00	$3.00	$8.50	$5.50	$0.00	$17.00
Total	**$278.29**	**$297.71**	**$288.50**	**$296.71**	**$261.09**	**$1,422.30**

** These projects are new beginning in 2025.*

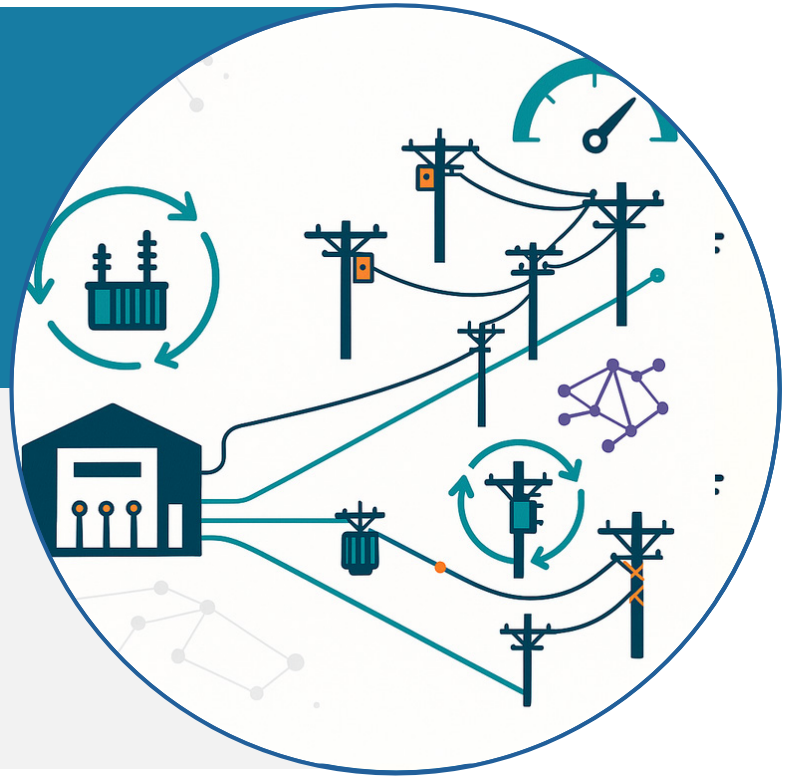
FirstEnergy proposed reliability investments and estimated impact

Source: FirstEnergy (PA), 2024 Long-Term Infrastructure Improvement Plan, "LTIIP III Development" (p. 40)

6

Template for Asset Management

- Strategy and practices
- Methodology
- Results



Asset Management (1)

Asset management is the process of managing infrastructure required to deliver electricity service. It includes a systematic analysis of asset condition and performance according to regulatory and technical standards, state objectives, and utility priorities. Utilities inventory existing distribution system assets, analyze condition and performance, and make capital and maintenance spending decisions for system safety and reliability.

Programmatic investments address repeating system needs, remediating widespread issues over time, or scaling up deployment of new technologies. Discrete investments address specific system needs based on asset health, safety, or reliability. Asset management encompasses the entire asset life cycle, from initial equipment selection and design and construction practices to inspection, maintenance, and ultimately replacement.

This section of the distribution plan describes asset management practices and provides information to enable regulators and stakeholders to assess proposed capital and O&M expenditures, taking into account asset health and associated risks.

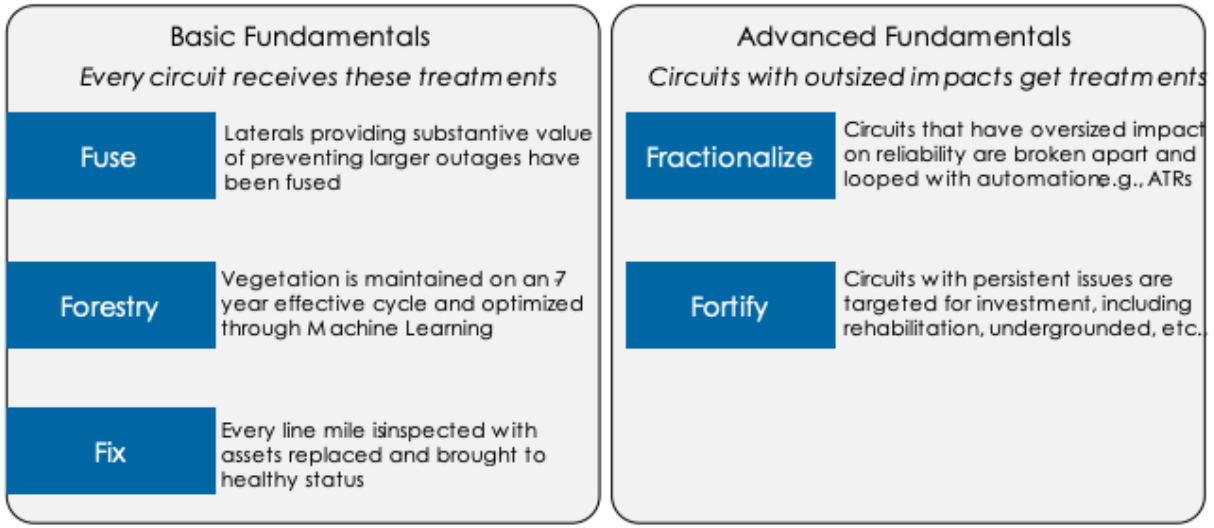
Template

- Description of asset management strategy and practices for inspections, maintenance, and replacements (e.g., risk-based analysis, predictive maintenance)
- Description of assessment methodology, including any changes to applicable standards for each asset category (e.g., poles, conductors, transformers, circuit breakers) and asset health scoring framework
- Assessment results, including prioritization of asset classes based on predictive failure risk and performance
    - Asset life cycle data *(Supplemental)*
    - Asset failure rates *(Supplemental)*
    - Identification of existing and expected risks related to asset health and impacts on system operations
    - Actions taken and planned to manage asset health risks

Asset Management (2)

Utility practice example

Consumers Energy - The 2023 Electric Distribution Infrastructure Investment Plan outlines the utility's asset management practices, including descriptions of distribution asset classes and approach to asset risk assessment and prioritization. The plan describes the utility's overall strategy, linking asset planning to grid safety, reliability, and resilience, and identifies primary asset categories. The utility also describes its framework for determining circuit treatments based on distribution system impacts. For each asset subclass, the utility describes risks, countermeasures, reliability-based prioritization, a corresponding 5-year work plan, and capital investment and O&M needs.



Consumers Energy's approach for selecting measures for each asset class

Source: Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Asset Management Approaches" (p. 54)

Additional references for utility practices

- PEPCO (DC), 2025 Annual Consolidated Report, "Productivity Improvement Plan" (p. 62)
- PPL Electric (PA), 2022 Long-Term Infrastructure Improvement Plan, "Response to Aging Equipment" (p. 4)
- Delmarva Power & Light (DE), 2023-2032 Long-Range Distribution Plan, "System Performance" (p. 23)

7

Template for Operation & Maintenance (O&M) Expenses

- Vegetation management
- Asset O&M

O&M Expenses (1)

This section of the distribution plan provides information on vegetation management and asset O&M. Regulators and stakeholders can use this information to assess the utility's vegetation management strategy and proposed programs, as well as expenditures to maintain asset reliability and sustain IT infrastructure.

Vegetation management

Vegetation management is the process of overseeing the interaction between vegetation and utility infrastructure to ensure the safe and reliable delivery of electric service. It includes assessing vegetation conditions around utility assets, determining associated asset risks and implications for utility service, and planning actions such as trimming, removal, and long-term maintenance strategies.

Regulators and stakeholders can use this information to understand how current vegetation management efforts have affected historical reliability performance and the impact of proposed vegetation management expenses on vegetation-related risks to system reliability and public safety.

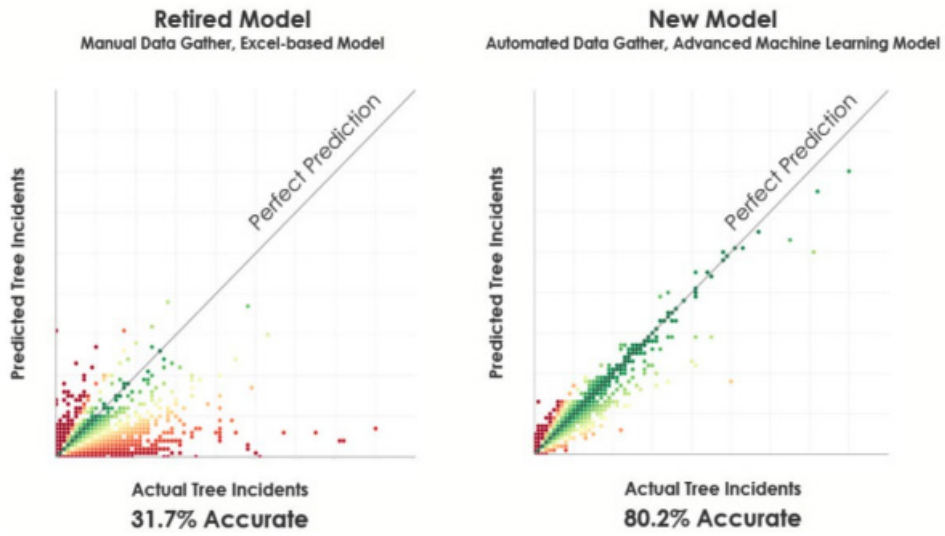
Template

- Vegetation management strategy
  - Overview of the utility's vegetation management planning process, programs (e.g., trimming, hazard tree identification), objectives, priorities, challenges, and changes since the previously filed plan
  - Summary of relevant distribution system information (e.g., distribution system total circuit miles, miles needing trimming, frequency of trimming)
  - Actions taken and planned to effectively manage vegetation risks
- Vegetation management programs
  - Program scope (e.g., planting trees, scheduled and unscheduled vegetation maintenance, herbicide application) and objectives
  - Program cost drivers (e.g., miles trimmed, frequency of trimming)
  - Description of optimization strategies and tools (e.g., use of advanced analytics)
  - Summary of historical and proposed expenses and associated impact on distribution system objectives

O&M Expenses (2)

Utility practice example

Consumers Energy - The 2023 Electric Distribution Infrastructure Investment Plan provides information on the company's vegetation management strategy, describing the scope of programs, budgets, cost drivers, and expected reliability impacts (e.g., SAIDI and SAIFI). The utility also describes its process for developing its vegetation management workplan, informed by a tree incident predictive model. The granularity of the model enables the utility to prioritize areas with the highest expected grid reliability and safety benefits, including poor-performing circuit segments within otherwise well-performing circuits.



Consumers Energy's model improvement for predicting tree incidents in circuits
Source: Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "LVD System" (p. 85)

Additional references for utility practices

- Green Mountain Power (VT). 2024 Integrated Resource Plan, "Vegetation" (p. 3-13)
- PEPCO (DC), 2025 Annual Consolidated Report, "Vegetation Management Program Detail" (p. 46)
- Village of Morrisville Water & Light Department (VT), 2023 Integrated Resource Plan, "Vegetation Management/Tree Trimming" (p. 96)

O&M Expenses (3)

Asset O&M

Asset O&M encompasses the expenditures required to conduct planned maintenance and repairs to ensure safe and reliable system operations and sustain the utility's IT infrastructure. Information provided in the distribution system plan includes the utility's rationale for planned asset O&M expenditures and cost estimates.

This part of the plan provides regulators and stakeholders with information they can use to evaluate proposed expenditures and analyze future trends in asset O&M costs, including emerging asset needs that may increase costs. It also provides information to help assess whether proposed expenditures adequately address priority needs while supporting the utility's distribution system strategy and state objectives.

Template

- Description and rationale of planned distribution O&M expenditures and related IT (e.g., asset maintenance and repair, software licenses)
- Cost estimate for each proposed O&M program, project, or activity for each year of the planning period

O&M Expenses (4)

Utility practice example

Eversource - The 2024 Electric Sector Modernization Plan provides detailed information on asset O&M to maintain and operate the system for 2025-2029. The utility breaks down expenditures by category (e.g., electric operations, IT platform investments) and describes activities included, the applicable cost recovery mechanism, and total expenditures for the period.

O&M Category	Summary	Recovery	O&M $ Millions 2025 – 2029
Electric Operations	Programs to support safe and reliable service, including equipment repair, new customer connections, peak load growth, maintaining reliability in line with SQ	Base rate recovery	$829M
Storm	Estimates of storm costs for response during critical events	Base rate recovery	$114M
Business Support	Costs for support of operations including Finance, Human Resources, Legal, Communications, and IT	Base rate recovery	$1,025M
Customer	Costs to support customer experience including communications, billing, and other programs	Base rate recovery	$407M
EV Program	Deployment of EV make-ready and charging infrastructure	EV Mechanism (through 2026/2027)	$78M
AMI	Deployment of meters, supporting technology, customer data sharing, outreach to customers	Grid Mod Mechanism (through 2028)	$91M
Platform Investments	Investments identified to leverage data, digitalization, and other platforms to optimize infrastructure and meet evolving customer needs	**INCREMENTAL ESMP**	$10M

Eversource O&M Categories and Planned Cost Recovery (2025-2029)
Source: *Excerpts* from Eversource, 2024 Electric Sector Modernization Plan (p. 438)

Additional references for utility practices

- Xcel Energy (MN), 2023 Integrated Distribution Plan, "O&M Budget and Forecast" (p. 40)
- DTE (MI), 2023 Distribution Grid Plan, "Summary of Investment Plan" (p. 163)
- ComEd (IL), 2024 Multi-Year Integrated Grid Plan, "Overview of ComEd Information Technology Investments" (p. 628)

8

Template for Capacity Expansion Planning

- Load and GER forecasting
- Scenario analysis
- Hosting capacity analysis

Capacity Expansion Planning (1)

This section of the distribution plan provides information on load and GER forecasting, scenario analysis, and hosting capacity analysis. Regulators and stakeholders use this information to assess the utility's process to estimate peak demands and understand the implications of available system capacity to meet customer needs.

Load and GER forecasting

Load and GER forecasting informs the timing, need, and type of distribution system investments required to meet estimated peak demand at specific grid locations and times. Forecasts can be developed for multiple time horizons, geographic aggregation levels, and economic development scenarios.

Regulators and stakeholders can use this information to assess the utility's forecasting methodology and results and discuss potential right sizing of assets to meet projected growth.

Template

- Load and GER forecasting methodology
  - Overview of forecasting framework for load and GERs, including model specification, types of GERs and load forecasted, and geographic granularity of the analysis (e.g., substation-level, feeder-level, or feeder-segments)
  - Changes to the forecasting framework implemented since the previously filed distribution system plan
  - Summary of load and GER modeling inputs (e.g., economic data, historical load and GER data, weather data, and assumptions), including historical and projected data for each parameter, and identification of sensitivities and ranges for key assumptions
  - Planned enhancements to the forecast methodology (e.g., deploying new tools, partnering with local stakeholders)
- GER forecast hourly results, including base cases and scenarios
- Load forecasts (e.g., peak demand, energy, and losses), including comparison to historical data
- Assessment of the accuracy of previous load and GER forecasts and discussion of variances

Capacity Expansion Planning (2)

Utility practice example

National Grid - The 2023 Distributed System Implementation Plan describes the long-term load and GER forecasting process, including current capabilities, methodological enhancements, investment roadmap, risks and mitigation strategies, alignment with state objectives, and stakeholder engagement. For instance, the utility describes methodological updates to forecasting methods (e.g., adding new GER profiles that better reflect impacts of temperature and resource use) and refinements to the overall forecasting process (e.g., aligning system, regional, and feeder-level forecasting processes).

Additional references for utility practices

- Delmarva Power & Light (DE), 2023-2032 Long-Range Distribution Plan, "Capacity and Load Forecasting" (p. 14)
- Green Mountain Power (VT), 2024 Integrated Resource Plan, "Demand & Distributed Energy Forecast" (p. 43)
- PGE (OR), 2024 Distribution System Plan, "DER Forecasting" (p. 42)
- NSPM (MN), 2024 Integrated Distribution Plan, "DER Snapshot and Forecasts" (p. 29)

Category	Enhancement Description	System	Feeder
Electric Heat Pumps	Introduce base case scenario	✓	✓
Electric Heat Pumps	Introduce full and partial use-cases	✓	✓
Electric Heat Pumps	Using census data for adoption analysis		✓
Electric Vehicles	Introduce medium- and heavy-duty EVs and electric buses	✓	
Electric Vehicles	Introduce impacts on charging load from temperature, EV types, at-home vs. public charging for light-duty EVs	✓	✓
Electric Vehicles	Introduce managed charging scenario	✓	✓
Solar PV	Use multiple-level GIS information for land parcel analysis		✓
DER Scenario	Develop DER scenarios reflecting up-to-date State policies and market studies	✓	✓
DER Scenario	Introduce likelihood for DER cases and scenarios	✓	
Climate Scenario	Introduce climate change weather scenarios	✓	
Forecasting Process	Bring in alignments among forecasts at different levels to provide holistic view	✓	✓

National Grid's summary of enhancements to long-term load and GER forecasts

Source: National Grid (NY), 2023 Distributed System Implementation Plan, "Advanced Forecasting" (p. 34)

Capacity Expansion Planning (3)

Scenario analysis

Scenario analysis is a well-established approach for assessing the potential impact of plausible future events. Its use to date in distribution system planning is limited. Scenarios can identify challenges and risks that the distribution system may face in the future and help manage uncertainty by analyzing a range of conditions. Scenarios are not predictions; instead, they inform the flexibility needed and test the plan's robustness under different potential conditions.

This part of the distribution plan provides regulators and stakeholders with information on how the utility incorporates long-term uncertainties into its planning priorities and expenditure strategies.

Template

- Summary of sources of uncertainty impacting distribution system needs and solution selection
- Scenario analysis methodology and data sources, including consistency with scenarios used in other planning processes
- Improvements to scenario analysis since the previously filed plan
- Summary of scenarios developed, including rationale for scenario selection
- Discussion of how scenario analysis informed the planning process and expenditure priorities

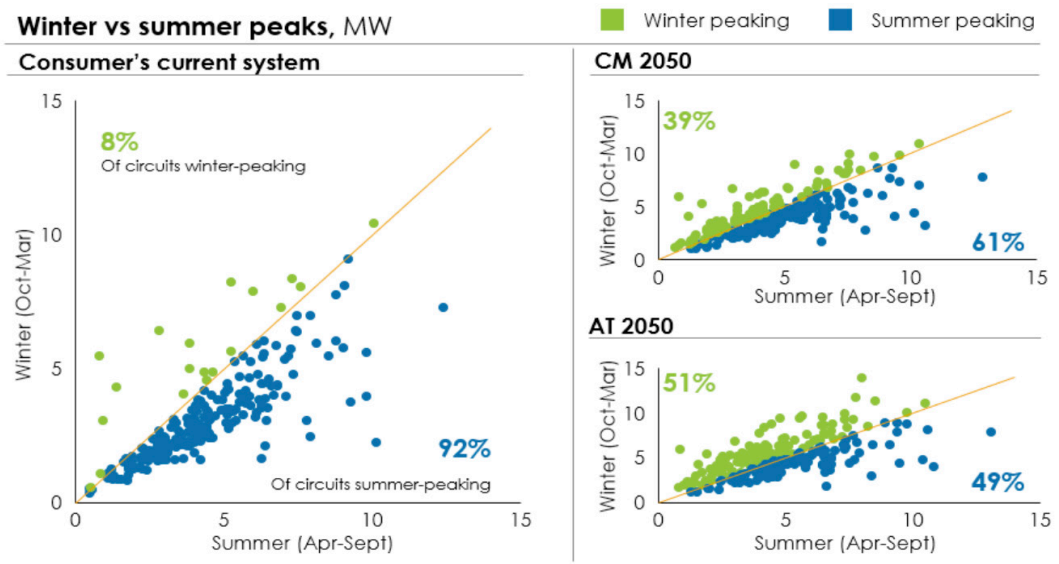
Capacity Expansion Planning (4)

Utility practice example

Consumers Energy - The 2023 Electric Distribution Infrastructure Investment Plan describes the utility's scenario analysis approach, including identifying key drivers of change (e.g., severe weather and customer adoption of new technologies) and evaluating projected load and other impacts on the distribution system under various scenarios. The utility also provides information on how scenario analysis supports solution selection.

The plan presents results for each scenario at the circuit level, quantifying and describing risks and impacts, such as increased outage events, peak load exceedances, seasonal peak shifts, and other challenges (e.g., power quality, GER interconnection, and bidirectional flows). The utility presents results for each scenario and a combination of potential future drivers, including new state requirements and customer technology adoption. The figure illustrates the utility's projected seasonal peak shifts in 2050 under two scenarios, compared to the baseline.

CIRCUIT PEAK LOADS BY 2050



Consumer Energy's projected peak loads for different scenarios

Source: Consumers Energy (MI), 2023 Electric Distribution Infrastructure Investment Plan, "Scenario and Investment Planning" (p. 34)

Additional references for utility practices

- DTE (MI), 2023 Distribution Grid Plan: "Future Drivers of Change" (p. 19)
- Eversource (MA), 2024 Electric Sector Modernization Plan, "2035 - 2050 Policy Drivers: Electric Demand Assessment" (p. 48)
- Xcel Energy (CO), 2024 Distribution System Plan, "Distribution System Load Forecasting" (p. 46)

Capacity Expansion Planning (5)

Hosting capacity analysis

Hosting capacity analysis (HCA) determines the amount of distributed generation (e.g., gas turbines, PV systems) and new load that can be interconnected at specific points on the distribution system without adversely affecting power quality or reliability under existing control and protection systems and without grid upgrades. The utility simulates power flows across different levels of distributed generation and load penetration based on existing grid conditions to determine circuit-level hosting capacity. In addition to producing maps and associated data for customers and project developers, utilities use HCA information in the distribution system planning process — for example, to develop mitigation strategies based on projected constraints for distribution system capacity and to estimate the locational value of GERs for NWSs and utility customer programs.

Hosting capacity results provide regulators and stakeholders with an understanding of how much capacity exists throughout the distribution system to interconnect GERs and EVs, as well near-term grid upgrades that may be needed to meet anticipated needs. The information also enables utility customers to estimate GER installation costs more accurately, project developers to target specific locations with sufficient hosting capacity, and utilities to determine whether detailed studies are necessary for interconnection requests.

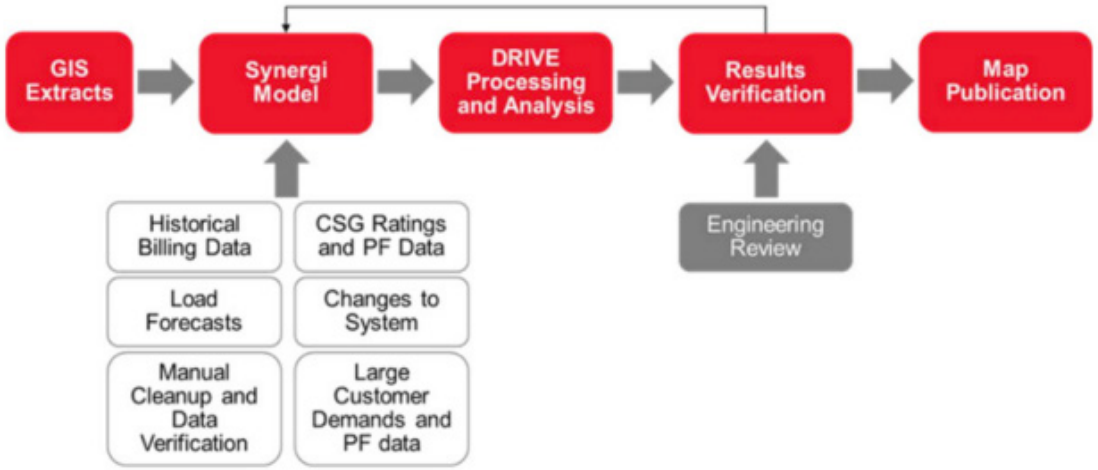
Template

- HCA process, including scope, frequency, methods, inputs, and tools
- Summary of HCA results, including how results are used in other planning and interconnection processes, and identification of constrained areas and implications for future system upgrades
- Planned future improvements, including timeline
- Description of any mitigation analyses
- Description of publicly available results for HCA, including interactive maps, associated granular data in downloadable tables, and file formats for publicly available data

Capacity Expansion Planning (6)

Utility practice example

Xcel Energy - The utility's 2024 Distribution System Plan for its Colorado service area provides information on the role of HCA in the GER interconnection process, methodology, analytical tools, and results. The utility describes the capabilities and applications of its HCA tools (e.g., EPRI DRIVE, and Synergi Electric) and highlights the trade-offs between analytical speed and accuracy. The plan also describes the quality assurance process and how the results inform publicly available HCA maps. Additionally, the utility characterizes the role of HCA within the distribution system planning process and as an early screening activity in the interconnection process, compared to more accurate and costly detailed studies associated with specific interconnection applications.



Xcel Energy's HCA tools and process
Source: Xcel Energy (CO), 2024 Distribution System Plan, "The Nuts and Bolts of Distribution System Planning" (p. 39)

Additional references for utility practices

- Black Hills (CO), 2025 Distribution System Plan, "Hosting Capacity Analysis Report" (Appendix N, p. 167)
- Green Mountain Power (VT), 2024 Integrated Resource Plan, "System Resiliency and Grid Transformation" (p. 30)
- NV Energy (NV), 2023 Distributed Resources Plan, "Distributed Resources Plan Analyses" (p. 27)
- Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Hosting Capacity and GER Interconnection" (p. 227)

9

Template for Solution Identification

- Grid needs assessment and solution selection
- Capital investments
- Non-wires solutions

Solution Identification (1)

Utilities identify potential solutions to address each deficiency identified in the grid needs assessment, including investments in distribution infrastructure (e.g., asset renewal, capacity expansion, reliability and resilience, grid modernization, and metering) and NWSs (e.g., procurements, programs, and pricing).

Grid needs assessment and solution selection

The grid needs assessment is the output of distribution system analysis. It identifies specific grid deficiencies over a set period (e.g., 10 years), based on distribution analyses such as load forecasting and scenario analysis, to perform hourly analyses on transformers and circuits. Using data from the grid needs assessment, utilities analyze potential solutions to address grid needs and identify solutions that best address grid deficiencies. Solutions may encompass operational modifications (e.g., rebalancing load between different feeders or substations), capital investments (e.g., building a new substation), and NWSs.

This part of the distribution plan provides regulators and stakeholders with detailed information on grid deficiencies and affected system assets. It also provides information on grid needs the utility prioritizes in the near-term, as well as information on the process the utility uses to select suitable solutions from a portfolio of alternatives. Regulators and stakeholders can use this information to assess the robustness of the utility's analytical process, vet the alternatives considered, and select solutions.

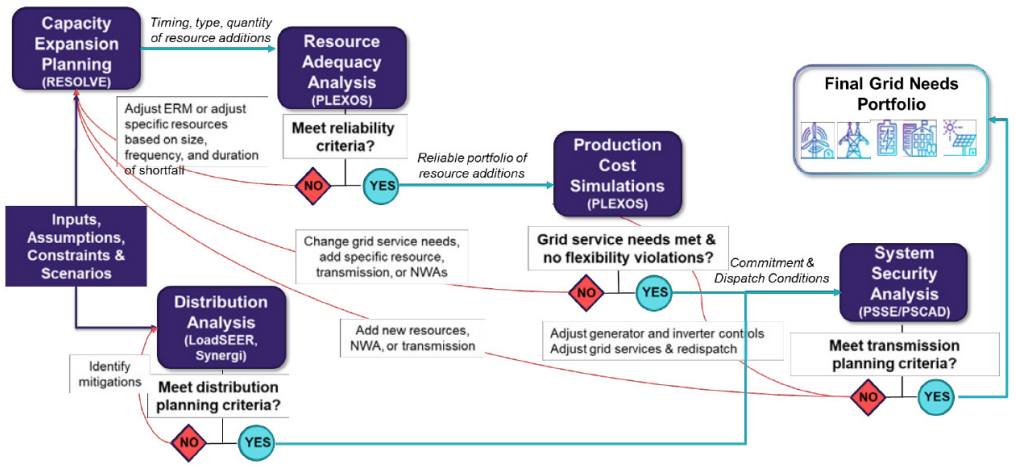
Template

- Description of methodology to identify grid needs, including justification of the utility's planning criteria and asset ratings to assess grid needs (e.g., engineering standards applied, manufacturers' recommendations, percentage loading, frequency and duration of breaches in ratings)
- Description of grid needs
  - Summary of grid needs identified
  - Number of feeders and substations forecast to exceed planning ratings in the near-term (1–5 years) and longer-term (6–10 years)
- Detailed information of each grid need
  - Asset type (e.g., transformer, feeder), identifier, and equipment rating
  - Description of the grid need, including type of grid deficiency, year grid need is observed, and hours grid need is expected to occur (peak day or season)
  - Number of customers by class within the grid need area
  - Typical wires solution
  - Cost estimate of wires solution
  - Impact on reliability standards if no improvements are made
- Description of methodology to identify, assess, and select solutions (traditional utility solutions and utility and third-party NWSs), including the study tool, assumptions, and results under normal and N-1 operating conditions (e.g., equipment loading, number of customers affected)
- Identification of the portfolio of available alternatives, including operational and capital solutions, and criteria used to evaluate alternatives
- Summary of solutions selected to address grid needs (pending identification of any suitable NWSs), rationale for the selections, and reasons for rejecting other options

Solution Identification (2)

Utility practice example

Hawaiian Electric (HECO) - The 2023 Integrated Grid Plan describes the modeling framework and methodology supporting the grid needs assessment, including grid needs identified and stakeholder engagement. The plan categorizes grid needs as hosting capacity needs and load-driven needs and provides information for each planning area (by island). Information provided for each area includes grid needs identified for a range of scenarios and a cost summary for deploying traditional utility solutions.



HECO's grid needs assessment modeling framework
Source: HECO, 2023 Integrated Grid Plan, Overview of Grid Needs (p. 114)

Additional references for utility practices

- PacifiCorp (OR), 2022 Distribution System Plan, "Grid Needs Analysis" (p. 74)
- Back Hills (CO), 2025 Distribution System Plan, "Grid Needs Assessment" (p. 25)
- DTE (MI), 2023 Distribution Grid Plan, "Work Prioritization" (p. 164)
- PGE (OR), 2024 Distribution System Plan, "Traditional infrastructure needs and solutions" (p. 110)

Solution Identification (3)

Capital investments
The utility uses results from detailed distribution system analyses, guided by utility strategy and state objectives, to prepare the near-term implementation plan. The plan provides detailed information on capital investments, including a summary of progress for ongoing projects.

This part of the distribution plan provides information for regulators and stakeholders to assess the utility's ability to effectively select and deploy distribution system investments. It also provides information to help assess whether the near-term implementation plan appropriately addresses priority grid needs while supporting the utility's long-term distribution system strategy and state objectives.

Template

- Progress on capital investments since the previously filed distribution system plan, focusing on projects and programs over a material ($) threshold
  - Investment category
  - Investment description, including project ID, project category, objective, project scope, planned in-service date, estimated costs by year, and percentage completion
  - Any material schedule variances to capital investment plan and reasons
  - Any material capital variances to capital investment plan and reasons
- Summary of proposed capital investments, including grid needs addressed
  - Estimated costs
  - Planned schedule

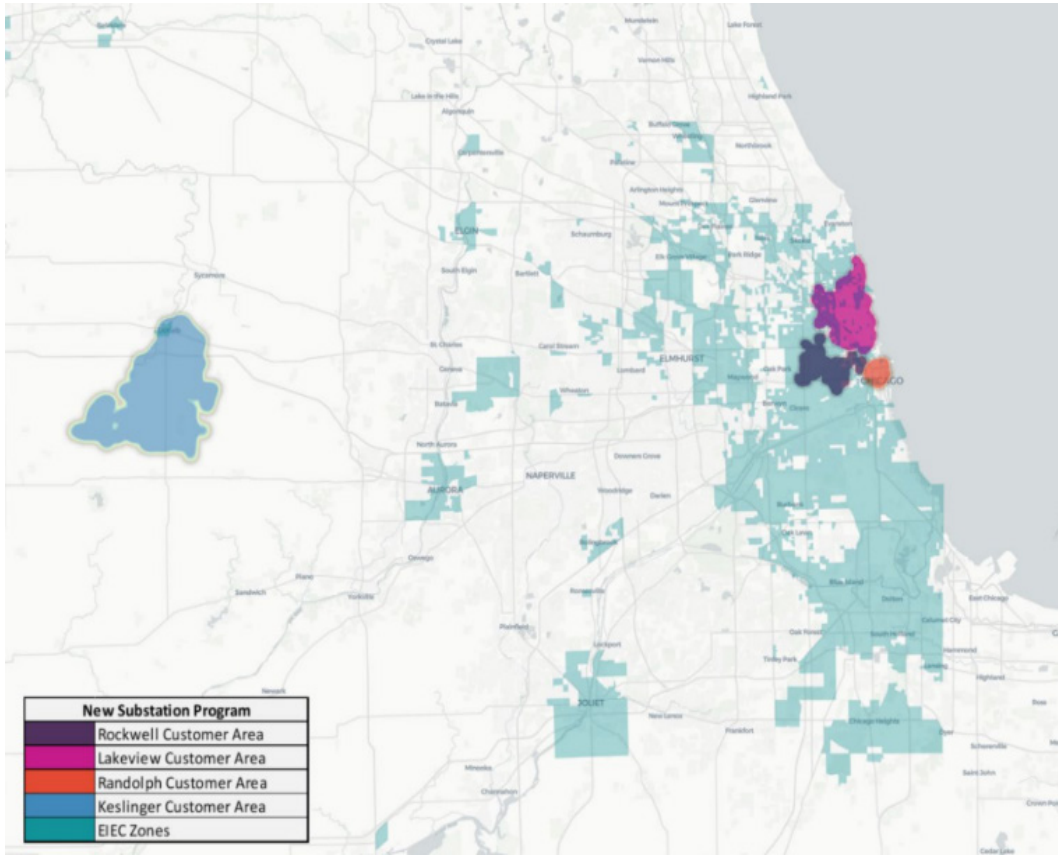
Solution Identification (4)

Utility practice example

ComEd – The 2024 Multi-Year Integrated Grid Plan provides information on the utility's historical and proposed capacity expansion investments. ComEd describes why these investments are needed to meet customer load requirements. The utility provides information describing the need and resulting benefits for each investment, as well as an implementation schedule.

Additional references for utility practices

- Minnesota Power (MN), 2023 Integrated Distribution Plan, "Current GER and Foundational Investments" (p. 23)
- Eversource (MA), 2024 Electric Sector Modernization Plan, "Five- and Ten-Year Planning Solutions: Building for the Future" (p. 289)
- PPL Electric (PA), 2022 Long-Term Infrastructure Improvement Plan, "Poles" (p. 13)



ComEd overview of proposed new substations and areas served by each investment
Source: ComEd (IL), 2024 Multi-Year Integrated Grid Plan, "Capacity Expansion Investments" (p. 216)

Solution Identification (5)

Non-wires solutions

These are technologies or operating practices that reduce grid congestion and manage peak demand to offset the need to make additional utility investments in conventional assets like substations and feeders. Examples include batteries, gas generators, microgrids, time-varying rates, geotargeted load management programs, and dynamic phase balancing. Utilities leverage data from the grid needs assessment to identify infrastructure projects that are candidates for potential NWSs. The plan includes any utility expenditures to implement and operate NWSs, such as GER management systems and field control technology for flexible service connections. The utility may acquire NWS through procurements, programs, and pricing (e.g., time-varying rates).

This part of the distribution plan provides regulators and stakeholders with detailed information on NWS selection methodology, technical and economic analyses of solutions considered, and, when applicable, planned NWS projects. Regulators and stakeholders can use this information to assess the utility's process for considering lower-cost alternatives to meet identified grid needs.

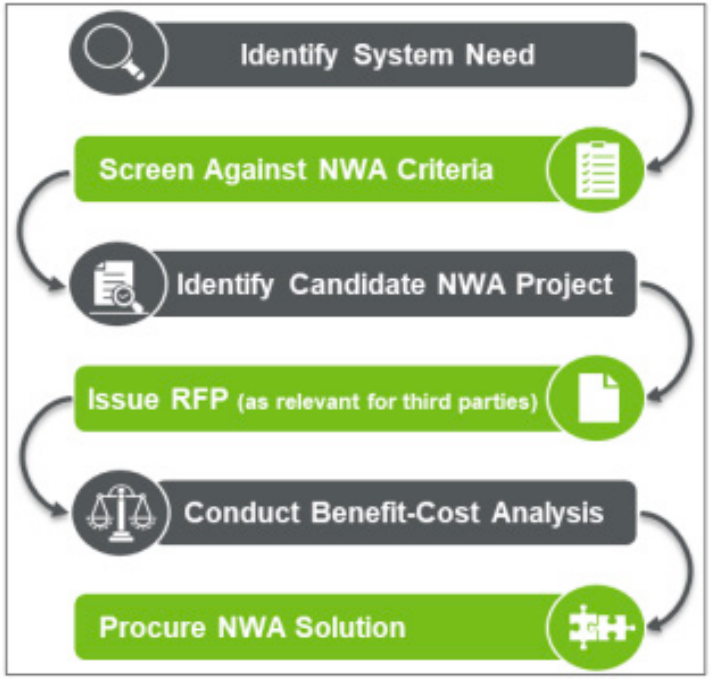
Template

- Summary of NWS sourcing outcomes based on previously filed distribution system plan, including solutions sourced and methods used (procurements, programs, and pricing), challenges and lessons learned, and implications for current plan and future planning cycles
- Changes to NWS process since previously filed plan, including drivers (e.g., lessons learned, regulatory compliance, and alignment with leading industry practices)
- Methodology used to assess the viability of NWSs to reliably and cost-effectively address the grid need
- List of grid needs that will be considered for NWSs, including asset type and identifier
- Summary of proposed NWSs and implementation timeline
    - Cost comparison between the traditional solution and NWS, including assumptions used
    - Contingency plan for NWS non-performance

Solution Identification (6)

Utility practice example

Ameren - The 2024 Multi-Year Integrated Grid Plan provides information on the utility's NWS evaluation framework, methods for solution acquisition, bid evaluation, and procurement, as well as details on each NWS process step, including suitability criteria and NWS screening tools. Selection criteria for NWS procurement include project cost, timeline, and eligible grid needs related to reliability, resilience, and capacity expansion. Ameren also provides information on current and potential NWS projects, including project names, grid needs addressed, implementation timelines, and a map illustrating potential NWS locations.



Ameren's simplified NWS process framework
Source: Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Non-Wires Alternatives Analysis" (p. 191)

Additional references for utility practices

- NV Energy (NV), 2023 Distributed Resources Plan, "Distributed Resources Plan Analyses" (p. 48)
- PacifiCorp (OR), 2022 Distribution System Plan, "Identification of Solutions" (p. 92)
- NSPM (MN), 2024 Integrated Distribution Plan, "Non-Wires Alternative Analysis" (Appendix F, p. 1)

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Template for Cost-effectiveness

- Evaluation objectives
- Methodologies
- Estimated costs and benefits
- Prioritization process

Cost-effectiveness (1)

This section of the distribution plan provides information on the utility's cost-effectiveness evaluation — costs, benefits, and qualitative impacts of grid solutions — to inform their prioritization to meet planning objectives.

Regulators and stakeholders can use this information to help understand and assess the rationale for solution selection. Regulators also use this information to guide decisions on the distribution system plan, requests for further utility analysis, and ultimately cost recovery in rate cases or other proceedings.

Template

- Cost-effectiveness evaluation objectives, including how results inform planned expenditures
- Methodologies for evaluating cost-effectiveness of potential grid solutions (e.g., Lowest Reasonable Cost and Benefit-Cost Analysis — BCA), including application of multiple planning objectives, and how the utility evaluated uncertainty (e.g., equipment and technology costs, labor availability, supply chain risks, grid contingencies)
  - Impacts considered and quantified
  - Description of uncertainty and sensitivity analysis (*Supplemental)*
    - How uncertainty of inputs used in cost-effectiveness evaluation may affect results (*Supplemental)*
    - Summary of results of sensitivity analyses (*Supplemental)*
- Detailed information on estimated costs and benefits associated with each expenditure category (subtotals for each cost and benefit considered)
- Prioritization process to identify near-term strategy to address grid needs, including any weighting/scoring system

Cost-effectiveness (2)

Utility practice example

ComEd - The 2024 Multi-Year Integrated Grid Plan describes the utility's cost-effectiveness methodologies, including the type of analysis conducted (i.e., Lowest Reasonable Cost, BCA) and range of expenditures to which it can apply (e.g., grid reliability, operational efficiency improvements, enhanced customer choice). ComEd provides the results of its cost-effectiveness analysis for each spending category included in the plan and a discussion of the associated quantitative and qualitative benefits.

Additional references for utility practices

- PGE (OR), 2024 Distribution System Plan, "Virtual Power Plant (VPP)" (p. 103)
- PacifiCorp (OR), 2022 Distribution System Plan, "Identification of Solutions" (p. 103)
- Rhode Island Energy (RI), 2022 Grid Modernization Plan, "BCA Evaluation under Docket No. 4600" (p. 170)
- NSPM (MN), 2024 Integrated Distribution Plan, "Financial and Cost Recovery Considerations" (p. 24)

11

Template for Implementation

- Roadmap
- Forecast costs
- Risks and mitigation strategies
- Performance assessment

Implementation (1)

This section of the distribution plan provides information on the utility's roadmap, forecast costs, risk and mitigation strategies, and performance assessment. Regulators and stakeholders use this information to assess the utility's framework to deliver plan priorities.

Roadmap

This part of the plan provides information on the utility's roadmap of actions over the planning period to implement the proposed capital investments and operating expenditures (including NWSs) to meet the planning objectives.

The information enables regulators and stakeholders to assess whether the proposed plan reasonably addresses the identified grid needs within the established planning horizon at least cost and can feasibly be implemented.

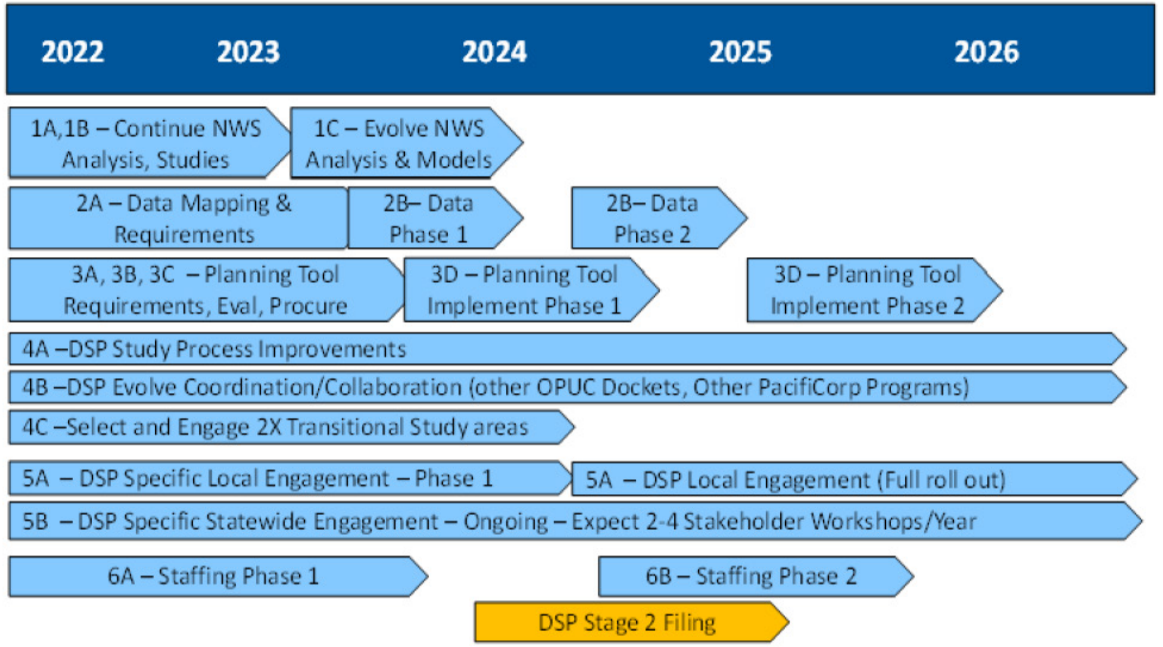
Template

- Utility's implementation plan, including major projects and programs, key milestones, and summary capital investments and expenses by year for the planning period
  - Dependencies between proposed projects and programs and with respect to other utility and state plans and programs

Implementation (2)

Utility practice example

PacifiCorp - The 2022 Distribution System Plan for Oregon provides information on near-term actions for the investment priorities identified in the planning process, including planning capabilities, projects to address grid needs, and innovations and pilots. For each of these priorities, the utility provides a detailed description of specific actions they will take and a timeline for implementation.



PacifiCorp's near-term action plan timeline
Source: PacifiCorp (OR), 2022 Distribution System Plan, "Summary of the Near-Term Action Plan" (p. 136)

Additional references for utility practices

- NSPM (MN), 2024 Integrated Distribution Plan, "Action Plan Summary" (p. 35)
- PGE (OR), 2024 Distribution System Plan, "Action Plan (2-4 yrs)" (p. 123)
- Green Mountain Power (VT), 2024 Integrated Resource Plan, "Integration and Action Plan" (p. 1)
- Xcel Energy (CO), 2024 Distribution System Plan, "Action Plan" (p. 208)

Implementation (3)

Forecast costs

This part of the distribution plan provides information on historical and projected capital and O&M costs for each planning category. Regulators and stakeholders can use this information to understand the impacts of planned expenditures on customer affordability and utility finances. The information also can be used to propose alternative near-term expenditure plans to balance costs and benefits and meet utility and state objectives.

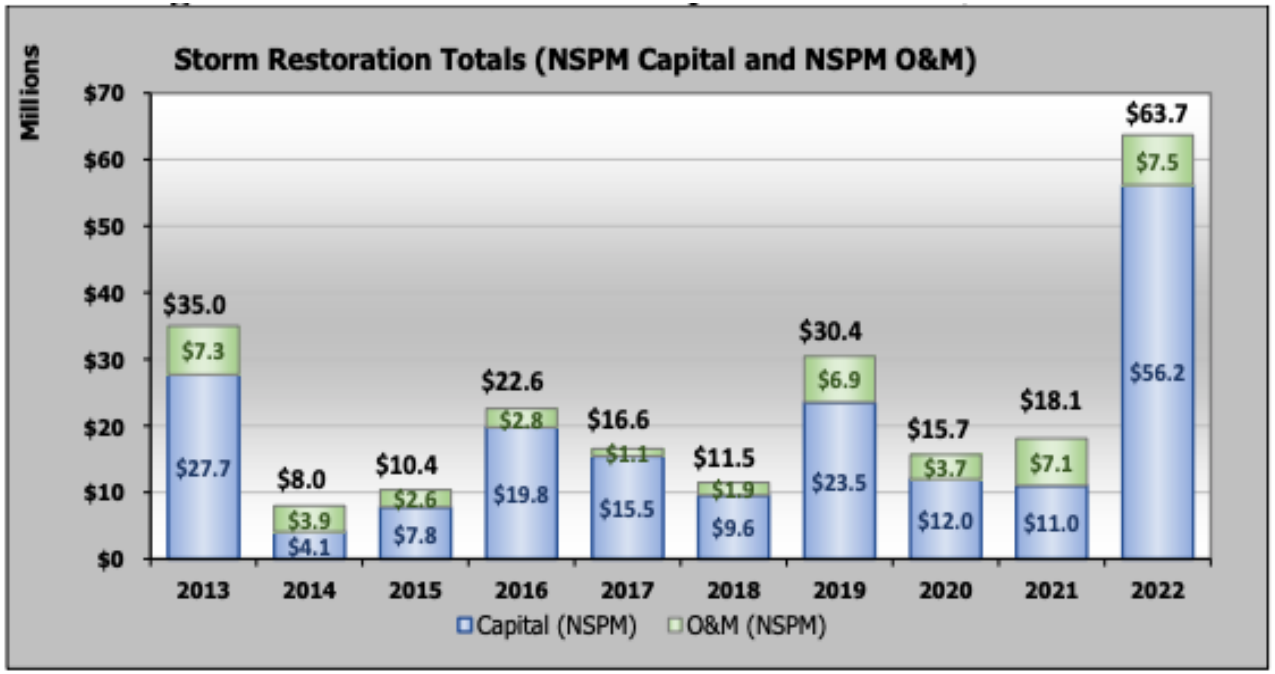
Template

- Summary of budget process and budget categories
- Summary of annual historical expenditures for the past five years by budget category for capital and O&M costs
- Discussion of cost variances relative to the last plan
- Detailed information on planned annual spending by budget category

Implementation (4)

Utility practice example

NSPM - The 2024 Integrated Distribution Plan provides financial information for each budget category covering the previous and current fiscal years, along with a five-year forecast. NSPM also provides an explanation of the budget forecasting methodology, a description of items included under each expenditure category (e.g., vegetation management under O&M, asset replacement under capital investments), and an explanation of budget items expected to increase, such as O&M contract labor. In addition, the utility highlights the iterative nature of its budgeting process, using storm restoration as an example of expenditures subject to unpredictable variability.



NSPM's storm restoration historical expenditure

Source: NSPM (MN), 2024 Integrated Distribution Plan, "Distribution Financial Highlights" (p. 23)

Additional references for utility practices

- Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Distribution Financial Overview" (p. 285)
- Xcel Energy (CO), 2024 Distribution System Plan, "Investment Needs and Budget" (p. 88)
- Village of Morrisville Water & Light Department (VT), 2023 Integrated Resource Plan, "Financial Analysis" (p. 111)

Implementation (5)

Risks and mitigation strategies

This part of the distribution plan describes risks that may negatively impact the utility's ability to implement the proposed expenditures within the planned timeline — such as challenges related to siting, permitting, supply chain disruptions, and workforce management — and potential impacts including cost overruns and schedule delays. This section also describes risks associated with assumptions used in analyses that informed the plan, such as the inherent uncertainty of long-term forecasts, and describes the utility's preventive and corrective strategies to mitigate risks.

This information facilitates assessment by regulators and stakeholders on the range of potential risks associated with proposed expenditures and the effectiveness of planned mitigation strategies.

Template

- Key implementation risks and analyses to assess them, including likelihood, and potential impact *(Supplemental)*
- Risk prioritization and mitigation measures considered and planned to address identified risks to plan implementation *(Supplemental)*

Implementation (6)

Utility practice example

Rhode Island Energy - The 2022 Grid Modernization Plan describes the utility's approach to mitigate risks associated with GER adoption, technological advancement, and development of complementary programs to deliver grid services. The utility focuses on “no regrets” investments to manage risks associated with these uncertainties. Additionally, the utility leverages its parent company's experience and industry standards, seeks stakeholder input, applies sensitivity analysis to cost-effectiveness evaluation, selects flexible solutions, creates a flexible deployment plan, and executes data governance provisions to address privacy and security risks.

Additional references for utility practices

- Consolidated Edison (NY), 2023 Distributed System Implementation Plan, “Topical sections” (p. 19)
- Eversource (MA), 2024 Electric Sector Modernization Plan, “Five-Year Electric Sector Modernization Plan” (p. 462)
- National Grid (NY), 2023 Distributed System Implementation Plan, “DSIP Update Topical Sections” (p. 29)

Implementation (7)

Performance assessment

This part of the distribution plan provides information on metrics, targets, evaluation methods, and results for assessing the utility's performance on implementing the previously filed plan.

The information facilitates regulatory review of the utility's performance metrics, alignment of performance with long-term utility and state priorities, and any needed modifications (e.g., adding new performance measures, adjusting existing performance measures to incorporate new input data).

Template

- Progress toward meeting statutory or regulatory performance metrics, including comparison of planned vs. actual performance, where available *(Supplemental)*
- Progress toward meeting other performance metrics *(Supplemental)*

Utility practice example

Xcel Energy - In its 2024 Distribution System Plan for Colorado, the utility provides information on achieving performance targets, including descriptions of legislative requirements, current utility practices, and proposed implementation approaches submitted to the Commission. In 2024, the state Legislature passed SB 24-218, requiring a performance-based framework for distribution system plans encompassing DER interconnection and energization, load management and demand flexibility. Xcel Energy's plan provides information on each of these topics and describes the requirement that the next distribution plan include a target-setting framework. For example, the utility will measure load management and demand flexibility performance in megawatts (MW) as well as an overall MW goal linked to existing program goals approved by the Commission. The table shows an example proposal for linking overall goals for flexible load and demand management to individual utility programs.

Filing	Program	2026 MW Goal
DSM	Residential Demand Response	263
DSM	Critical Peak Pricing	68
DSM	Peak Day Partners	29
DSM	Peak Partner Rewards	53
DSM	Small Commercial Building Controls	1
DSM	Interruptible Service Option Credit	195
TEP	Electric Vehicle Critical Peak Pricing	2
TEP	Electric Vehicle Charge Optimization	5
RES	Residential Battery Demand Response	10
	Total	**626**

Xcel Energy's flexible load and demand management goals
Source: Xcel (CO), 2024 Distribution System Plan, "Performance-Based Framework" (p. 205)

Additional references for utility practices

- Eversource (MA), 2024 Electric Sector Modernization Plan, "Conclusion" (p. 666)
- National Grid (MA), 2024 Electric Sector Modernization Plan, "Conclusion" (p. 479)
- DTE (MI), 2023 Distribution Grid Plan, "Work Prioritization" (p. 175)
- Ameren (IL), 2024 Multi-Year Integrated Grid Plan, "Plan to Achieve Performance and Tracking Metrics" (Appendix H, p. 90)

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Appendices

Appendix A. Distribution System Plans Reviewed

State	Utility	Plan	Year of filing	Docket
CA	SDG&E	Grid Modernization Plan	2022	A.22-05-016
CO	Xcel Energy	Distribution System Plan	2024	24A-0547E
CO	Black Hills	Distribution System Plan	2025	25A-0062E
DC	PEPCO	Annual Consolidated Report	2025	PEPACR2025-01-E - 1
DE	Delmarva Power & Light	Long-Range Distribution Plan	2022	22-0506
HI	HECO	Integrated Grid Plan*	2023	2018-0165
IL	ComEd	Multi-Year Integrated Grid Plan	2024	22-0486
IL	Ameren	Multi-Year Integrated Grid Plan	2024	22-0487
MA	National Grid	Electric Sector Modernization Plan	2024	24-11
MA	Eversource	Electric Sector Modernization Plan	2024	24-10
MI	Consumers Energy	Electric Distribution Infrastructure Investment Plan	2023	U-20147
MI	DTE	Distribution Grid Plan	2023	U-20147
MN	Minnesota Power	Integrated Distribution Plan	2023	23-258
MN	Northern States Power Company	Integrated Distribution Plan	2024	23-452
NV	NV Energy	Distributed Resources Plan	2023	23-09002
NY	National Grid	Distributed System Implementation Plan	2023	16-01444
NY	Consolidated Edison	Distributed System Implementation Plan	2023	16-01444
OR	PacifiCorp	Distribution System Plan	2022	UM 2198
OR	PGE	Distribution System Plan	2024	UM 2362
PA	PPL Electric	Long-Term Infrastructure Improvement Plan	2022	P-2022-3034972
PA	FirstEnergy	Long-Term Infrastructure Improvement Plan	2024	P-2024-3050269
PR	LUMA	10-Year Infrastructure Plan Update	2024	NEPR-MI-2021-0002
RI	Rhode Island Energy	Grid Modernization Plan	2022	22-56-EL
VT	Village of Morrisville Water & Light Department	Integrated Resource Plan*	2023	23-4003-PET
VT	Green Mountain Power	Integrated Resource Plan*	2024	24-3614-PET

*LBNL reviewed sections related to distribution system assets and planning only. For HECO, LBNL also reviewed the 2024 Integrated Grid Plan Action Plan Annual Update (2018-0165).

Appendix B. Topics Not Covered in the Template

Distribution system plans may include topics not covered in this guide and companion template. Following are examples for some of these topics.

- **Workforce** - Including information on gaps in workforce availability and expected impacts on near-, medium-, and long-term utility planning priorities, as well as training programs and other strategies to support workforce development
  - FirstEnergy (PA), 2024 Long-Term Infrastructure Improvement Plan, "Access to a qualified workforce" (p. 22)
- **Economic development** - Including the impact of proposed investments on local and state economic development such as job creation and economic growth
  - Eversource (MA), 2024 Electric Sector Modernization Plan, "Workforce, Economic, and Health Benefits" (p. 652)
- **Utility corporate policies** - Including information on corporate policies relevant to distribution system planning and operations, such as cybersecurity, data privacy, and financials.
  - Rhode Island Energy (RI), 2022 Grid Modernization Plan, "Cybersecurity, Data Privacy, and Data Governance Plan" (p. 339)

Utilities also include information to help regulators and stakeholders easily navigate and understand the plan. This may include a glossary, list of acronyms, and references.