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TOPAZ ROADMAP

NARUC-NASEO INITIATIVE: COMPREHENSIVE ELECTRICITY PLANNING IN AN ERA OF LOAD GROWTH

NARUC
National Association of Regulatory Utility Commissioners

NASEO
National Association of State Energy Officials

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Planning Categories

- Establish expectations & assumptions
- Develop scenarios
- Develop forecasts
- Identify system needs
- Identify solutions
- Evaluate solutions
- Finalize plan

About Topaz: A Fictional, Representative State	
Regulatory	
Our state's investor-owned utilities	**own generation assets**
Market	
Our state is located	**outside of an RTO/ISO market**
Planning Processes	
Our state is seeking to align	**distribution, generation, and transmission planning processes**

Introduction

This roadmap document describes a vision for best-in-class comprehensive electricity planning, shown in a flowchart and accompanying descriptive text. This idealized planning process is viewed from the state perspective, specifically a collaboration between the State Public Utility Commission (PUC) and State Energy Office. The roadmap was the result of robust engagement with a cohort of National Association of Regulatory Utility Commissioners (NARUC) and National Association of State Energy Officials (NASEO) members drawn from 24 states and Washington, DC who joined the **NARUC-NASEO Initiative: Comprehensive Electricity Planning in an Era of Load Growth**. Initiative members attended virtual and in-person workshops to collaborate in articulating their priorities for better aligning distribution, resource, and transmission planning.

This roadmap includes:

- A flowchart of the entire integrated or aligned planning process
- Brief descriptions and explanations of each section of the flowchart
- A color key—outlining each box in the flowchart—to allow for comparison with other cohort roadmaps. The colors align with seven generalized procedural and analytical planning steps that typically characterize electricity system planning processes.

While these practices may not reflect current planning across all jurisdictions, the roadmap describes what could be implemented over time as utility capabilities, data and analytical sources, resource availability, and regulatory frameworks evolve.

The roadmap is intended to support states considering taking actions to increase the alignment of their own electricity system planning processes by providing:

- A high-level understanding of the sequence of steps included in an electricity planning process
- Descriptions of ideal information flows and coordination points represented in the vision, as articulated by NARUC and NASEO members
- Starting points for all states, particularly those with similar characteristics to the Topaz cohort

Development of the Flowchart and Roadmap

An original set of five comprehensive electricity planning flowcharts and roadmaps were developed by a group of Commissioners and State Energy Office leaders from 15 states in 2018 to 2021. These resources were used by numerous states as starting points for enhancing their electricity planning processes. Given significant load growth projections and technological changes in the planning landscape since then, in 2025 NARUC and NASEO launched an

initiative to refresh the original roadmaps to support state decision makers facing today's evolving challenges.[1]

Through virtual and in-person collaborations over more than a year, members from 24 states and Washington, DC gathered to identify upgrades that would make the roadmaps relevant and actionable in an era of load growth. Researchers from the U.S. Department of Energy's (DOE) national laboratories, industry leaders, and subject-matter experts also provided input to ensure the new flowcharts and roadmaps are accurate, practical, and reflective of current and emerging industry best practices.

How to Use the Roadmap

It is important to recognize what the flowchart and the roadmap do and do not address. These materials describe the key activities, milestones, and regulatory actions that comprise the planning processes, focusing on their substance, but without trying to place them on a timeline or calendar, and without indicating which entities or actors are responsible for which activities (except where a regulatory decision is obviously the role of a PUC). The authors also note that aligning planning scopes through the Topaz process can be particularly challenging because planning timelines and horizons often differ. In other words, the flowchart and accompanying roadmap focus only on the "what"—the procedural and analytical steps that make up each planning process and the actions proposed for coordinating or integrating the processes.

While the flowchart is presented visually from left to right, in practice many steps are iterative, overlapping, and can occur in parallel. The authors have attempted to indicate where these iterations are particularly important, but any practical implementation of the flowchart will surely result in additional iteration. Accordingly, the flowchart does not need to be used as a whole: states will adapt pieces and parts of the idealized planning process that best suit their policy and regulatory contexts.

Additional Resources

During development of the roadmap, the authors identified where existing guidance, resources, or examples could support operationalizing the major process steps described in the roadmap. These references will be accessible on a public website that is searchable and can be filtered by planning process building blocks. In some cases, gaps in available resources may signal areas where new tools and approaches are needed to better align planning processes.

Flowchart Key

PLANNING CATEGORIES

- Establish expectations & assumptions
- Develop scenarios
- Develop forecasts
- Identify system needs
- Identify solutions
- Evaluate solutions
- Finalize plan
- White boxes: Coordination checkpoint

- Stakeholder engagement
- Information flows
- Iteration step (curved arrows)

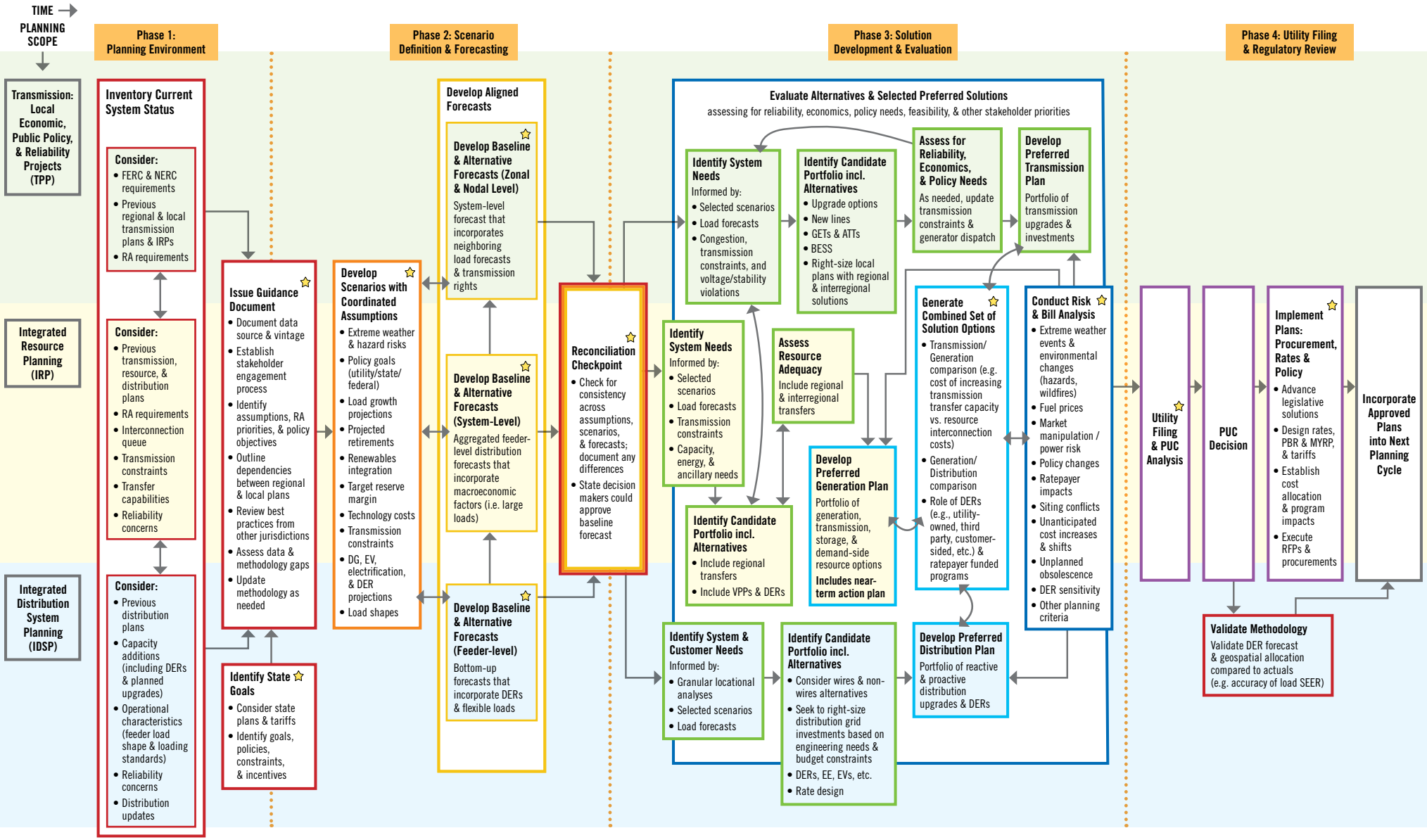
Transmission planning
Integrated resource planning
Integrated distribution system planning

ACRONYMS

ATTs: Advanced Transmission Technologies
BESS: Battery Energy Storage Systems
DER: Distributed Energy Resources
DR: Demand Response
EE: Energy Efficiency
EVs: Electric Vehilcles
FERC: Federal Energy Regulatory Commission
GETs: Grid-Enhancing Technologies
IDSP: Integrated Distribution System Planning
IRP: Integrated Resource Planning
MYRP: Multi Year Rate Plan
NERC: North American Electric Reliability Corporation
PUC: Public Utilities Commission
RA: Resource Adequacy
RFP: Request for Proposa
RTO: Regional Transmission Organization
SEER: Seasonal Energy Efficiency Ratio
TPP: Transmission Planning Process
VPP: Virtual Power Plant

1 The Topaz roadmap is a new cohort roadmap designed to reflect emerging best practices for coordinated resource and transmission planning in states that exist outside of RTO/ISO markets.

Topaz Flowchart



Topaz Flowchart Description

The Topaz flowchart outlines what an ideal comprehensive planning process could look like for a hypothetical state where utilities own generation assets (are vertically integrated) and are outside of a Regional Transmission Organization (RTO) or Independent System Operator (ISO) market.

The Topaz flowchart highlights checkpoints and synergies between three distinct planning scopes that exist today within utilities and utility regulation:

- Transmission Planning performed by the individual transmission-owning utilities (TPP)
- Integrated Resource Planning (IRP)
- Integrated Distribution System Planning (IDSP)

Each section of the Topaz flowchart contains specific process steps with information flows, as indicated by colored boxes and arrows.

The present roadmap was created to be a companion to the flowchart, to provide a more detailed description of the various elements of comprehensive electricity planning and points of coordination across the planning scopes.

Together, the flowchart and roadmap describe a comprehensive set of planning activities and coordination points that better align the three distinct planning scopes described above. These steps are explained in more detail on the following pages: each section focuses on one portion of the flowchart.

The Topaz flowchart includes the process steps and relationships between the planning scopes for transmission (TPP), resource (IRP) and distribution (IDSP) planning. The Topaz flowchart structures these planning processes in four sequential phases:

- **Phase 1. Planning Environment:** The first phase establishes a common foundation for the various planning scopes by taking inventory of the current system status, identifying policy objectives that will guide planning, and translating this information into a **Guidance Document**.
- **Phase 2. Scenario Definition and Forecasting:** The second phase develops the different planning scenarios as well as baseline and alternative load forecasts for the planning horizon.
- **Phase 3. Solution Development and Evaluation:** The third phase involves identifying system needs, proposing candidate solutions to meet those needs, evaluating the potential options, and determining the preferred solution set. Phase 3 includes a holistic review across all three planning scopes to identify the optimal set of solutions that collectively

Enabling Conditions

Cohort participants discussed two underpinning issues that need to be considered if a state intends to implement the comprehensive planning process described throughout the roadmap.

- **Access to data and information:** To successfully complete a comprehensive electricity planning process, decision makers and stakeholders will need data and information from the relevant utilities throughout the process. Acquiring information in a timely and transparent manner requires coordinated data sharing across multiple organizations. For example, early in the distribution system planning process, planners will need information on distribution circuit-level hosting capacity to target distributed energy resource (DER) development to locations with available capacity. Later in the process, third-party providers of non-wires solutions (NWS) will need information on identified system needs and proposed upgrades to respond to utility solicitations or requests for proposals (RFPs). NARUC's Grid Data Sharing Framework can be a starting point for states that do not have existing data sharing agreements in place.
- **Up-to-date methodologies for evaluating new technologies:** New technologies often lack a track record that can give grid operators confidence in their performance capabilities and reliability; additionally, their costs can vary significantly from one planning cycle to the next. These factors challenge the ability to perform traditional benefit-cost analyses to determine preferred solutions and may lead to the rejection of new technologies in favor of familiar solutions. Comprehensive electricity planning requires supplementary processes for obtaining reliable, current information on non-traditional technology options that can offer potential solutions to the system needs identified in the planning processes.

address all the system needs and culminates in a draft plan that is published for stakeholder review prior to formal submission for approval.

- **Phase 4. Regulatory Review:** The fourth phase includes the formal process whereby a regulatory commission approves or acknowledges the plan and implementation approaches.

The Topaz roadmap includes several design features that capture best practices for integrated planning. These design features include:

- **Guidance document:** The **Guidance Document** at the end of Phase 1 establishes a common understanding of **current system status**, data, policy objectives, and planning goals across planning scopes. It is a public document developed with stakeholder input that is formally adopted or acknowledged by the Commission in some manner. Once finalized, the Guidance Document serves as a foundational reference throughout subsequent phases to ensure that decisions remain aligned with state policy goals.
- **Coordinated scenario assumptions:** The IDSP, IRP and TPP **develop scenarios with coordinated assumptions** based on shared data, including load growth projections and planned retirements. Individual planning scopes may supplement these common assumptions with scope-specific variables as needed. This approach supports alignment while preserving flexibility to evaluate unique risks and constraints.
- **Aligned forecasts:** Planners **develop aligned forecasts** using consistent methodologies and assumptions across planning scopes. Bottom-up, feeder-level forecasts inform distribution planning and are aggregated to support system-level generation and transmission planning, improving consistency and enabling coordination across planning scopes.
- **Reconciliation checkpoint:** The **reconciliation checkpoint** at the end of Phase 2 provides the opportunity to assess the consistency of assumptions, scenarios and load forecasts across planning scopes and to document any justified differences. This checkpoint includes stakeholder input and may function as a standalone regulatory process that the Commission formally adopts.
- **Combined set of solution options:** Utilities **generate a combined set of solution options** that spans distribution, generation, and transmission systems. This approach enables planners to compare alternatives across traditionally separate planning processes and identify opportunities where investments in one part of the system may reduce or eliminate the need for investments elsewhere.
- **Coordination with other planning and regulatory processes:** Related state planning efforts, including economic, land use, resilience, and disaster risk and

mitigation planning, inform the state goals and planning priorities established in Phase 1 and help shape the solutions evaluated in Phase 3. In addition, non-infrastructure solutions that are often addressed through separate regulatory proceedings, such as rate design reforms, performance incentives, and tariffs, are considered alongside traditional electricity infrastructure investments.

- **Multiple stakeholder engagement opportunities:** Stakeholders may be engaged at multiple points in the process, not merely at the end of the process where utility preferred plans are filed by the utility at the Commission. The guidance document in Phase 1 should establish the stakeholder engagement process. While stakeholder engagement is valuable throughout the process, technical planning and operational decisions remain utility-led functions, given system expertise.

Phase 1: Planning Environment

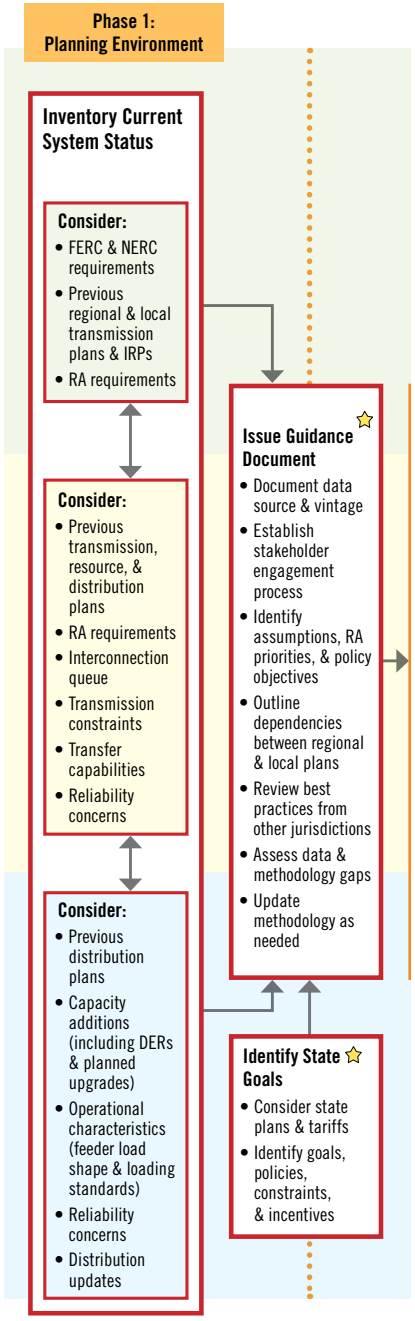
The process steps carried out in Phase 1 set the common foundation for the rest of the planning cycles. Known information about the current electric system, including scheduled additions and retirements over the planning horizon, as well as policy objectives that the planning processes should consider, are documented in Phase 1 and socialized with stakeholders through a guidance document before moving to Phase 2.

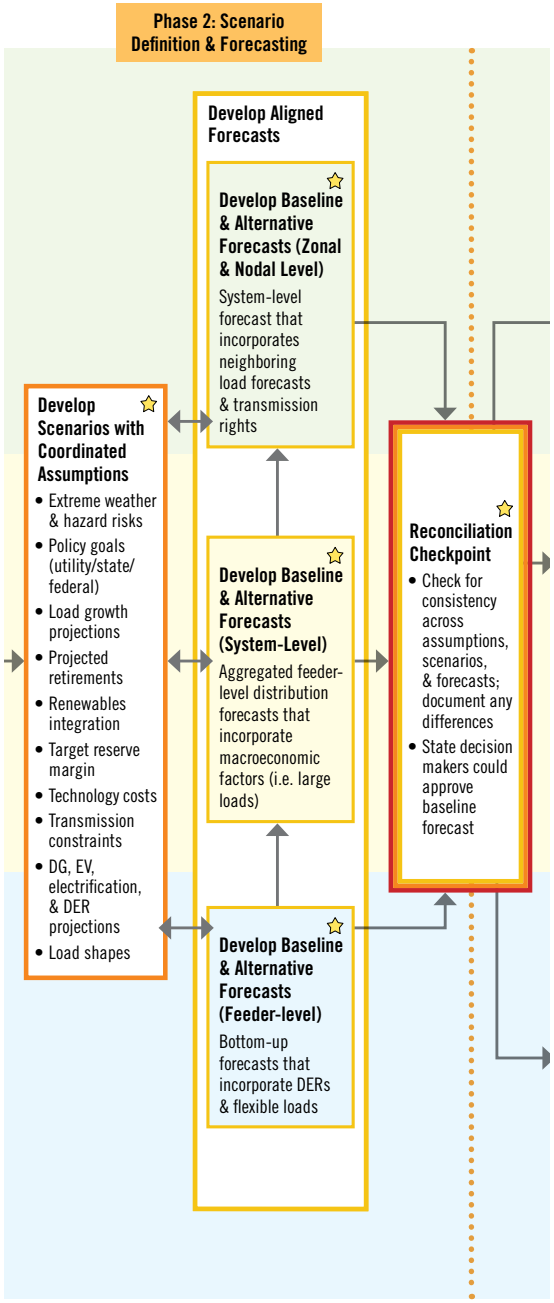
Phase 1 of the planning cycle incorporates previously approved or acknowledged utility short-term and long-term transmission plans, integrated resource plans, and distribution plans from prior cycles. These plans inform the **current system status**, influencing planning assumptions and baseline system conditions across all planning scopes. The current system status also includes an inventory of existing and planned electricity assets, including the generation mix, interconnection queue status, distribution upgrades, and fuel supply conditions.

Phase 1 also **identifies state goals** to apply across the IRP, IDSP, and TPP planning scopes. This step includes articulating legislative requirements for planning outcomes, such as renewable portfolio standards, as well as policy directives that shape the planning process, such as State Energy Plans. This step should also consider other state plans, including state energy security, economic, land use, resilience, and disaster risk and mitigation plans.

The state goals and current system status for DSP, IRP, and TPP feed into the **guidance document**, a public document formally adopted or acknowledged by the State Utilities Commission in some manner. It serves as a common foundation or consistency check across IRP, IDSP, and TPP.

The **guidance document** creates a shared view of the current electric system status and policy objectives, so that data, methodologies, and planning assumptions can be reasonably aligned across planning processes. Achieving this alignment requires the development and





sharing of data across multiple organizations and stakeholders. The guidance document should also outline processes for stakeholder engagement and inter-agency coordination, including between utility, state, and regional electricity planners.

The **guidance document** should also have an opportunity for stakeholder review and comment before it is finalized. Once the **guidance document** is adopted and included in the procedural record for the state's planning processes, it should be referred to throughout the subsequent phases to ensure that later decisions are aligned with state policy goals. For example, the **reconciliation checkpoint** in Phase 2 and the **utility preferred plans** in Phase 3 could be assessed for alignment with the policy provisions in the **guidance document**.

Phase 2: Scenario Definition and Forecasting

Phase 2 entails developing aligned planning assumptions, scenarios and load forecasts, taking into account the system status and policy objectives documented in the guidance documents. At the end of Phase 2, there is a second regulatory checkpoint to check the consistency of the assumptions, scenarios, and forecasts across planning scopes and document any differences.

Phase 2 **develops scenarios with coordinated assumptions** informed by policy objectives and projected system conditions. These scenarios are designed to capture the inherent uncertainty in long-term planning by representing a range of plausible future conditions.

This phase should establish a common set of core assumptions and scenarios based on shared data across DSP, IRP, and TPP, while allowing each process to develop additional scope-specific variables as needed. For example, assumptions around extreme weather and hazard risks, technology costs, load growth projections, and planned retirements may be developed once and used across processes. More granular inputs, such as distribution feeder upgrade costs or load shapes, may be developed within the IDSP and then aggregated and shared with the other planning scopes. This approach supports alignment while preserving flexibility to appropriately evaluate unique risks and constraints.

Phase 2 also includes the **development of baseline and alternative forecasts**. Given the uncertainty associated with projected load growth, particularly from large loads, planners may evaluate a range of scenarios reflecting different assumptions about large load materialization, electrification projections, and DER adoption.

Planners should **develop aligned forecasts** with consistent methodologies and assumptions across planning scopes. Bottom-up, feeder-level forecasts should be developed and then aggregated to support system-level generation and transmission planning. Using common bottom-up forecasts promotes consistency across planning scopes.

At the end of Phase 2, there is a **reconciliation checkpoint** that provides an opportunity to check that assumptions, scenarios, and forecasts are reasonably consistent across the IDSP, IRP, and TPP. Any differences are documented and investigated at this review step. Phase 2 ends with a written record of the assumptions, scenarios, and forecasting results, and summarizes all the information developed in Phase 1 and Phase 2. This checkpoint includes stakeholder input and may function as a standalone regulatory process that the state commission formally adopts.

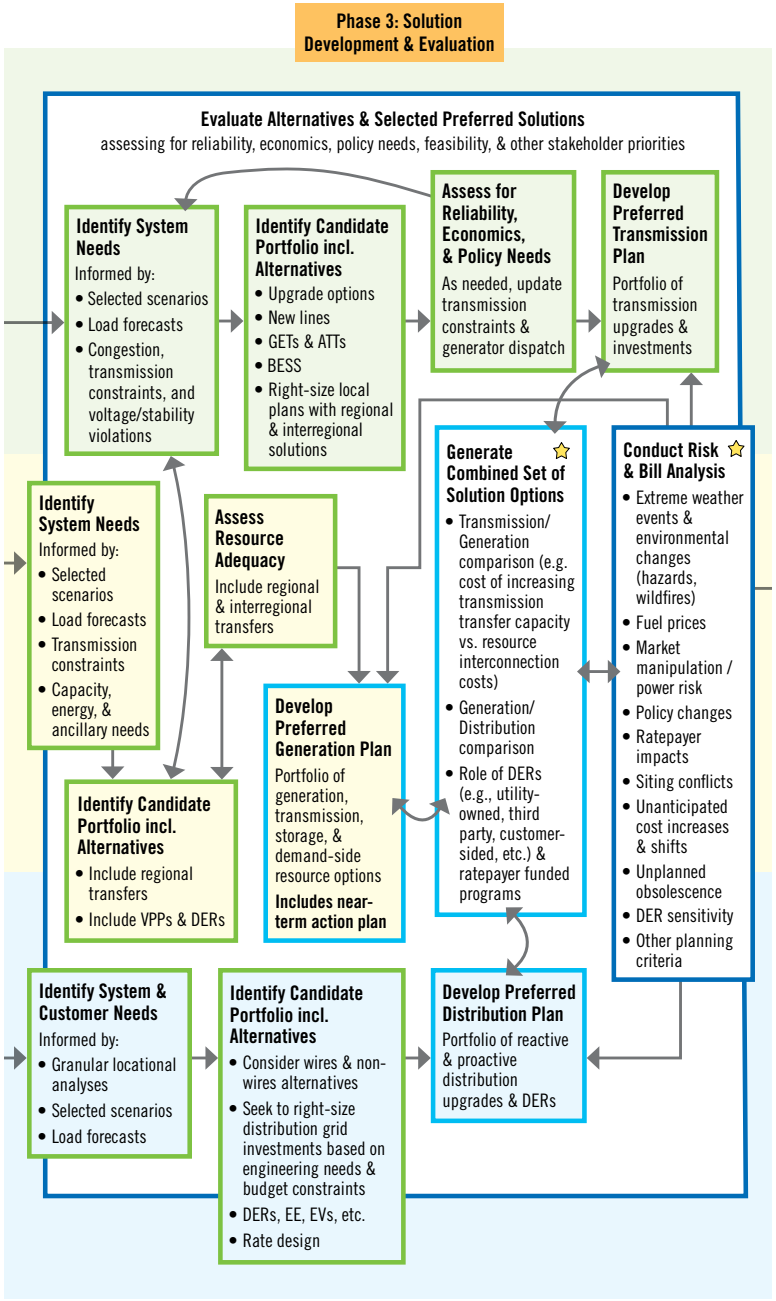
Phase 3: Solution Development and Evaluation

In Phase 3 the planners execute the models and analyses to identify and address the infrastructure needs that will arise during the planning horizon. This phase includes the iterative process of identifying candidate solutions, evaluating the proposed options, and determining the preferred set of solutions. This includes a whole-system review of proposed options across planning scopes to determine the optimal set of solutions that collectively meet all the system needs.

The vertical **"evaluate options and select preferred solutions"** process box reflects best practices for aligning solution development and evaluation across the utility planning scopes.

Using the policy objectives and planning goals established in the Phase 1 **guidance document**, along with scenarios and load forecasts developed in Phase 2, planners **identify system needs** expected to arise over the relevant planning horizons. The specific factors evaluated may vary across planning scopes and timeframes. For example, all planning scopes consider state policies and the need to reliably serve projected load. However, IRPs also assess capacity, energy, and ancillary needs, while TPP identifies congestion and voltage violations.

Planners then **identify candidate solution portfolios** to address the identified system needs, considering both conventional and alternative resources. Candidate solutions should reflect the interconnected nature of generation, transmission, and distribution planning. For instance, IRP portfolios should account for transmission constraints identified in the TPP and consider not only conventional generation resources, but also transmission investments, virtual power plants (VPPs) and distributed energy resources (DERs). Similarly, transmission planning should evaluate non-wires alternatives like battery energy storage



systems (BESS) in addition to grid-enhancing technologies (GETs) and advanced transmission technologies (ATTs) alongside traditional transmission upgrades and new lines. Where appropriate, local transmission solutions should also be evaluated with regional transmission plans to identify opportunities for larger, more efficient investments. In the IDSP, candidate portfolios should include alternatives such as non-wires solutions and innovative rate designs. In some cases, third parties may propose solutions through competitive solicitations, such as for non-wires solutions.

Candidate portfolios are then **assessed for reliability, economics, policy needs, feasibility, and other stakeholder priorities** established in the Phase 1 **guidance document**. The models and evaluation criteria may vary by planning scope, but often incorporate least-cost optimization. For instance, IRPs should **assess resource adequacy** and ensure candidate portfolios meet reliability criteria, while transmission planning should evaluate portfolios not only for reliability needs, but also for economic and public policy benefits.

The process of identifying system needs, developing candidate solutions, and evaluating options is iterative and requires coordination across planning scopes. Assumptions and findings from one planning scope may influence outcomes in another. For example, as transmission upgrades are evaluated, assumptions about transmission constraints and generator dispatch may be refined, which can reshape an IRP's candidate resource portfolio. Conversely, proposed generation and distribution solutions may create new transmission needs. The results of this iterative process are then documented in **preferred plans** for each planning scope, which should address the identified system needs.

Utilities then collectively evaluate and **generate a combined set of solution options** spanning distribution, generation, and transmission systems. This integrated assessment requires significant data sharing and enables planners to compare alternatives across traditionally separate planning processes. For example, the cost of increasing transmission transfer capacity should be compared with the costs of resource interconnection or local capacity investments. Evaluating comprehensive solution sets helps identify opportunities where investments in one part of the system may reduce or eliminate the need for investments elsewhere. Cost-effective distribution-level resources, for instance, may offset the need for more expensive transmission upgrades. Integrated solution portfolios may also include third-party DERs and rate-payer funded programs. The results of this integrated evaluation may lead utilities to refine their preferred plans, and ideally address system needs at a lower total cost.

Planners then run a **risk and bill analysis** on the integrated solution portfolios. Risk criteria, such as policy changes, siting challenges, environmental changes, unanticipated costs, and unplanned obsolescences, are identified throughout the planning process and may be outlined in the **guidance document**. This analysis is especially important in evaluating unconventional solutions with new or emerging technologies, such as small nuclear reactors.

Bill impact analysis should also be conducted to ensure selected portfolios remain affordable for customers. The results of these analyses may further inform refinements to utility preferred plans.

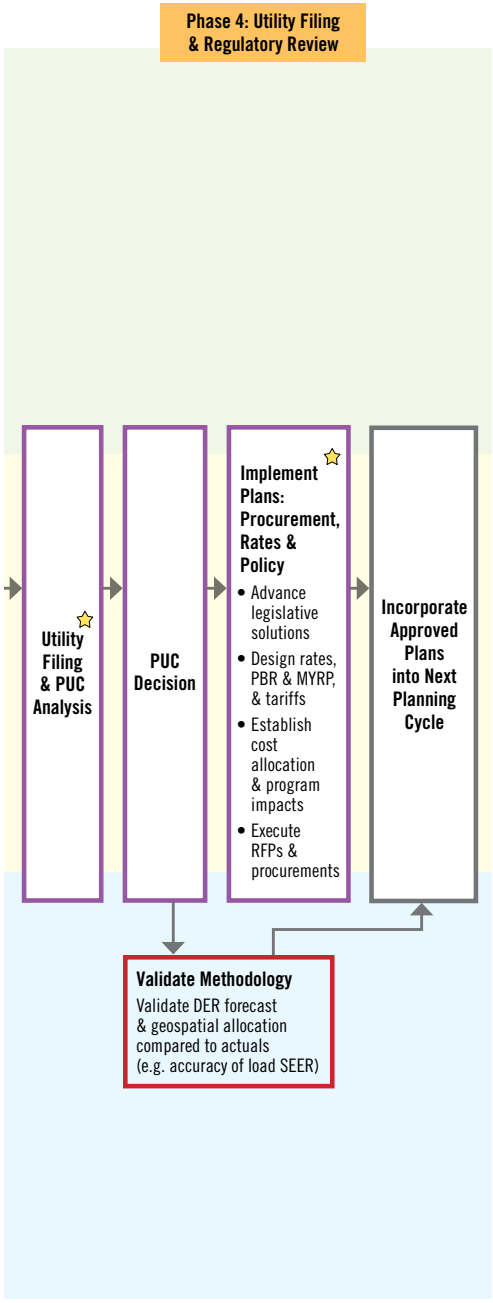
Phase 4: Utility Filing & Regulatory Review

After the analysis is completed in Phase 3, the information is formalized into a utility plan submitted for regulators to review and make decisions. Once plans are formally approved for implementation, the outcomes of the planning cycles up to this point become inputs into the next planning cycles and state goals.

In Phase 4, after the needs have been identified and preferred solutions have been determined, the utility finalizes their plan which undergoes **PUC analysis**. This PUC review process involves extensive back-and-forth information requests between the PUC and the utility. The PUC may conduct additional analysis and may also seek independent expert input to help inform its review.

There is also a formal comment period for stakeholders to provide inputs to the PUC regarding the utility plan, before the PUC issues a formal decision. Ideally, stakeholders will have surfaced key issues at earlier stages in the planning process as well, streamlining elements of their final review.

The process of plan submission to PUC approval is not always linear. The PUC decision may involve partial approvals or remands, sending portions of the plan back to Phases 2 or 3. The **PUC decision** may also introduce non-infrastructure solutions. For instance, new rate designs, performance incentives, and tariffs could be offered, particularly in the IRP and IDSP processes to promote energy efficiency and demand response program participation. Emerging best practices would encourage these non-infrastructure solutions to be considered earlier in the planning process, including during scenario development in Phase 2 and alternatives evaluation in Phase 3. **Approved plans should be incorporated into the next planning cycle**, shaping the inputs, assumptions, and state goals established in Phase 1.



Participants in the NARUC-NASEO Initiative: Comprehensive Electricity Planning in an Era of Load Growth were from the following 24 states and Washington, DC:

California
Colorado
Connecticut
District of Columbia
Illinois
Indiana
Iowa
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Missouri
New Hampshire
New Mexico
New York
North Carolina
North Dakota
Pennsylvania
South Carolina
Utah
Virginia
Washington

Acknowledgments and Disclaimers

This publication and its companion roadmaps were the result of robust engagement with NARUC and NASEO members from 28 state agencies across 24 states and Washington, DC who joined the **NARUC-NASEO Initiative: Comprehensive Electricity Planning in an Era of Load Growth** and attended virtual and in-person workshops. Participants contributed their own perspectives and expertise throughout the development of these materials, not formal positions of their states. States represented include the list at left.

The initiative was led by Danielle Sass Byrnett in the Center for Partnerships & Innovation at NARUC) and Kirsten Verclas at NASEO. Text and graphics were prepared by Celia Tandon, Katerina Stephan, Athindra Venkatraman, and Kaitlyn Bunker of RMI under contract to NARUC.

In addition, a diverse group of experts representing federal agencies, DOE National Laboratories, utilities, research institutions, nonprofit organizations, industry associations, and technology providers provided insights to support development of the flowcharts and roadmaps. Feedback from dozens of reviewers was incorporated to ensure that the flowcharts and roadmaps reflect current and emerging best practices to support state decision-makers. Particular thanks are due to Aaron Schwartz, Telos Energy, for his detailed review of an earlier version of the Topaz roadmap.

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About NARUC

NARUC is a non-profit organization founded in 1889 whose members include the governmental agencies that are engaged in the regulation of utilities and carriers in the 50 states, the District of Columbia, Puerto Rico and the Virgin Islands. NARUC's member agencies regulate telecommunications, energy, and water utilities. NARUC represents the interests of state public utility commissions before the three branches of the federal government. The NARUC Center for Partnerships & Innovation (CPI) builds relationships, develops resources, and delivers training to assist state commissions contending with complex current and emerging issues. NARUC CPI conducts work across five key energy areas and many topics within each: generation; transmission; distribution; customers; and critical infrastructure preparedness, response, and resilience.

About NASEO

NASEO is the only national nonprofit organization representing the governor-designated energy directors and their offices – the State Energy Offices – from the 56 States and Territories across the nation. Formed by the states in 1986, NASEO facilitates sharing of best practices among states, serves as a technical and policy resource for states, and advocates the interests of State Energy Offices to Congress and federal agencies.

NARUC-NASEO Initiative: Comprehensive Electricity Planning in an Era of Load Growth