NARUC GRID DATA SHARING PLAYBOOK

Fall 2023

Acknowledgments

This material is based upon work supported by the U.S. Department of Energy (DOE) under Award Numbers DE-CR0000009 and DE-OE0000925. The authors were:

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The authors would like to thank the following individuals for lending their time and insights to the Grid Data Sharing Collaborative by participating in one or more framework development workshops. Inclusion in this list is not intended to imply that the individuals or their employers agree with all parts of the framework, playbook, or use cases, nor the exact wording used to express the discussions of the Grid Data Sharing Collaborative in these materials.

- Sam Chanoski, Idaho National Laboratory
- Josh Cohen, Shell Recharge Solutions
- Rick Counihan, AnnDyl Policy Group, LLC
- Eileen Figone, Puget Sound Energy
- Kegan Gerard, Southern California Edison
- Nekabari Goka, Pepco Holdings, Inc.
- Amy Heart, SUNRUN, Inc.
- Robert Kang, Southern California Edison
- Jeffrey Loiter, National Regulatory Research Institute
- Brandi Martin, DOE Office of Cybersecurity, Energy Security, and Emergency Response
- Tom McDermott, Pacific Northwest National Laboratory
- Jeff Morris, Schneider Electric North America
- Steven Naumann, Consultant
- Christian Noyce, Minnesota Public Utilities Commission
- Arthur O'Donnell, New Mexico Public Regulation Commission
- Joe Quinn, Exelon
- Lauren Randall, Utilidata
- Hon. Ann Rendahl, Washington Utilities and Transportation Commission
- Michelle Rosier, Minnesota Public Utilities Commission
- Trevor Rudolph, Schneider Electric North America
- Matthew Rylander, Electric Power Research Institute
- Sky Stanfield, Shute, Mihaly & Weinberger LLP for Interstate Renewable Energy Council
- Samir Succar, ICF International, LLC
- Tom Tansy, SunSpec Alliance
- Hon. Emile Thompson, Public Service Commission of the District of Columbia
- Elaine Ulrich, DOE Office of Cybersecurity, Energy Security, and Emergency Response
- Megan Wu, Massachusetts Department of Public Utilities
- Yochi Zakai, Shute, Mihaly & Weinberger LLP for Interstate Renewable Energy Council

The authors would like to thank the following colleagues for their contributions and edits to the framework, playbook, and/or use cases, which helped to improve the clarity and usefulness of the materials.

- Marc Costa, The Energy Coalition
- Paul DiMartini, Newport Consulting
- Carine Dumit, EVgo
- Mikhail Falkovich, Con Edison
- Al Freeman, Michigan Public Service Commission

Disclaimer

Contents

Introduction and Objectives

In 2022, the National Association of Regulatory Utility Commissioners (NARUC) launched an initiative to support its members in addressing issues related to grid data sharing. The Grid Data Sharing Collaborative was funded by the DOE's Office of Electricity and Office of Cybersecurity, Energy Security, and Emergency Response (CESER).

NARUC invited programmatic, policy, technical, and cybersecurity subject matter experts from public utility commissions, utilities, non-governmental organizations, energy service companies, and DOE to join the two-year Grid Data Sharing Collaborative to help develop a flexible framework for states to use as a starting point when navigating complex decision-making inherent in grid data sharing. The framework took shape through a series of intensive workshops during which Collaborative participants explored illustrative use cases to identify data needs, articulate the benefits and risks of sharing such data, and assess the trade-offs. Along the way, participants offered suggestions for how the framework could be used in practice. The purpose of this playbook is to describe the elements of the Grid Data Sharing Framework and to begin supporting its implementation.

Background

State utility regulatory commissions (referred to hereafter as public utility commissions, PUCs, or commissions) are increasingly being asked to settle questions related to third-party access to power system information, or "grid data," that utilities use to plan and operate the electricity system. The definition of grid data for this initiative includes data related to the electric system, up to and including data generated by the electric meter. **For the purposes of this initiative, grid data does not include personally identifiable data, demographic information, program participation, or other data that can be used to identify an individual customer.**

To date, state approaches to grid data sharing have typically been based on jurisdiction-specific policy issues or use cases. Based on a 2023 review of state practices, more than a dozen states and at least 35 utilities have considered and allowed some grid data sharing in specific contexts, such as advanced metering infrastructure deployment, electric vehicle charger siting, and DER interconnection requests, but few have tackled the issue more broadly.[1] Spurred by ambitious state and utility decarbonization targets, projected DER growth, evolving customer preferences, and growing resilience and security concerns, questions of grid data access will become even more significant in the coming years. To meet this growing need, NARUC developed a structured grid data sharing framework, applicable across a variety of decision-making contexts and tailorable to individual state needs, to facilitate and expedite the decision-making process. The Grid Data Sharing Collaborative was established for this purpose.

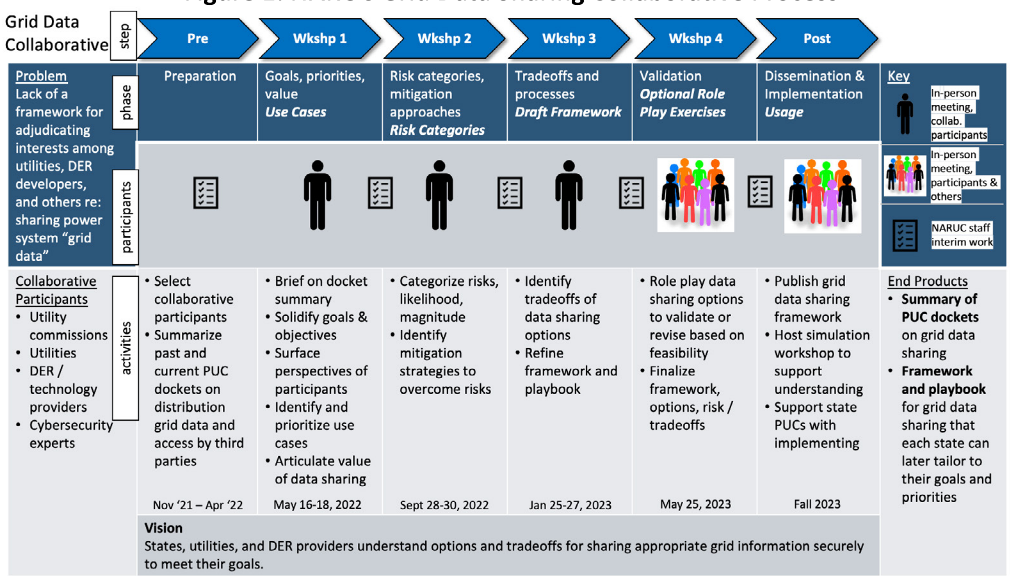
COLLABORATIVE APPROACH

NARUC formed the Grid Data Sharing Collaborative, a group of two to three dozen state utility regulators, utility leaders, DER developers, and cybersecurity subject matter experts, to help develop the Grid Data Sharing Framework throughout 2022 and 2023. Beginning in spring 2022, the Grid Data

[1] NARUC. 2023. Brief Summary of State Practices (NARUC 2023). Notable exceptions include the California Public Utilities Commission and New York Public Service Commission. Each has ongoing regulatory processes that comprehensively consider and address grid data across a variety of applications.

Sharing Collaborative convened four workshops to examine issues related to grid data sharing and define the key elements of the Grid Data Sharing Framework, playbook, and use cases (see Figure 1). The collaborative process was not a formal effort to arrive at consensus recommendations, but rather an initiative designed to draw from the experience and expertise of practitioners and experts to develop a well-thought-out starting point for state-specific decision-making on key grid data sharing questions.

Figure 1: NARUC Grid Data Sharing Collaborative Process



The first three workshops employed a facilitated, stepwise process to level set, identify issues, and conduct scenario-based analyses. Participants prioritized grid data sharing use cases, identified the value and benefits of those use cases, debated risks and mitigation options related to grid data sharing, and discussed actual and potential implementation challenges. The process resulted in a collaboratively developed framework for considering grid data sharing options and trade-offs. The fourth workshop tested the usefulness of the framework with subject matter experts who had not participated in previous workshops, which resulted in further refinements.

Throughout the Collaborative engagement, participants examined pertinent topics using illustrative data use cases. The Collaborative's use cases served as vehicles to explore intended outcomes that might be enabled through the availability of electric utility system data; they are not technical use cases.

During Workshop 1, the Grid Data Sharing Collaborative prioritized example use cases for detailed discussion: improving DER interconnection, enabling fleet vehicle electrification, and allowing DERs to provide grid services.[2] Each use case represents a real-world scenario in which a PUC has been asked or may be asked to adjudicate grid data sharing issues. Through these use cases, the Collaborative was able to deeply examine a wide spectrum of grid data sharing issues through the eyes of key stakeholders and policymakers alike. This examination, in turn, led to the creation of a generalized conceptual model—the Grid Data Sharing Framework.

[2] A fourth use case—Distribution System Planning—was initially explored but ultimately omitted due to overlap with existing and forthcoming NARUC and DOE initiatives and work products. See NARUC Center for Partnerships & Innovation Energy Distribution webpage for links to recorded and future trainings, webinars, peer sharing support, and resources including NARUC-NASEO Task Force on Comprehensive Electricity Planning Roadmaps (particularly Amber and Jade).

Readers will find references to the Collaborative's use cases sprinkled throughout this playbook. Each use case is described in more detail in Appendix A.

ABOUT THE PLAYBOOK

This playbook provides a detailed explanation of the Grid Data Sharing Framework and offers implementation guidance to assist state utility regulators and interested stakeholders with its use. The Framework and playbook represent a summary of experiences and relevant materials exchanged within Collaborative discussions (in contrast to academic research or an exhaustive literature review). Information contained in the playbook is intended to help stakeholders address matters of grid data sharing in light of articulated benefits, challenges, and trade-offs most appropriate for their jurisdictions and independent of a state's regulatory structure (restructured to vertically integrated) or wholesale market participation.

The Grid Data Sharing Framework is an information collection template. It is not intended to imply a specific process for its use—including regulatory or decision-making processes. The playbook does not serve as a step-by-step planning document or a prescriptive set of recommendations. Rather, the playbook offers considerations for effective stakeholder engagement and provides practical insights that illustrate the application of the Framework. Each PUC will follow a regulatory process for considering grid data sharing that fits its own needs and requirements.

The Grid Data Sharing Framework

The Grid Data Sharing Framework is intended to help PUCs and interested parties effectively address questions related to grid data sharing and to provide a basis for regulatory decision-making. The Framework represents a collection of seven key categories of topical considerations that provide useful inputs to grid data sharing decisions.

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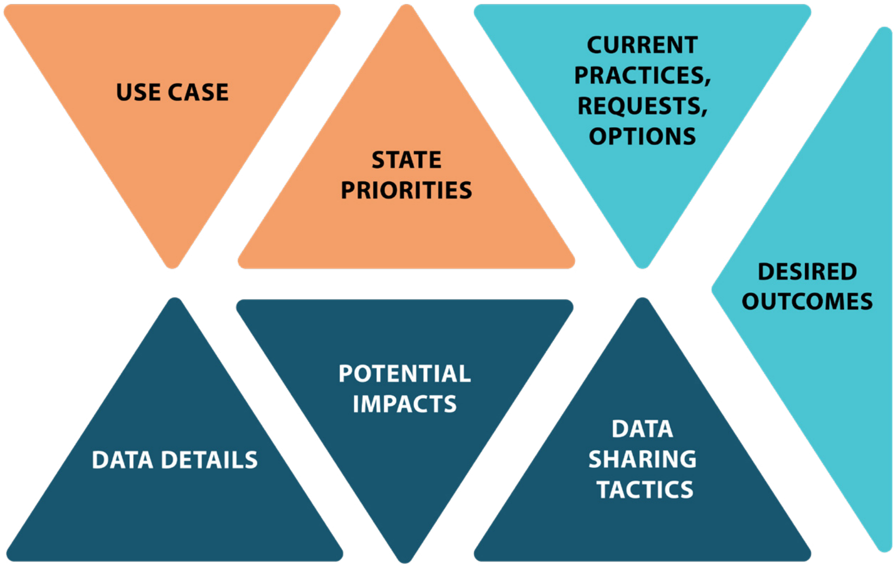


Rather than outlining a rigid process, the Framework provides a structure for collecting, examining, and documenting information that can guide decision-making related to grid data sharing. It is intended to be flexible. Individual PUCs can start where it makes most sense. That could be a use case in some instances, or state priorities in others. In some instances, a PUC may not find it necessary to address each content area to reach a decision on grid data sharing. The intent is to provide decision-makers and stakeholders with a valuable starting point. Each jurisdiction can tailor the Framework to fit its own established decision-making processes.

Each of the Framework's categories contains a series of relevant questions that help elicit meaningful input into the decision-making process.[3] The color coding is intentional. Similar colors suggest a close relationship in content within those framework categories.

The Framework categories are:

- **Use Case** – Short description of the scenario for which grid data sharing is relevant.
- **State Priorities** – State goals, policies, and authorities that may apply to the use case and grid data sharing.
- **Current Practices, Requests, Options** – Grid data already available or shared, additional data being requested, and existing options for enabling the use case.
- **Desired Outcomes** – Intended benefits enabled through the availability of electric utility grid data.
- **Data Details** – Data elements necessary to unlock the benefits of the use case.
- **Potential Impacts** – Incremental risks and consequences of sharing additional grid data details beyond current practices.
- **Data Sharing Tactics** – Approaches that can be implemented to mitigate potential negative impacts of grid data sharing.

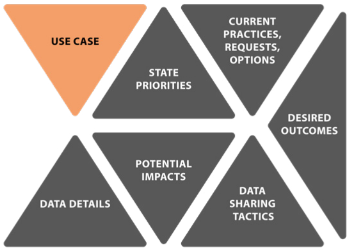
The Framework does not imply that commissions must address every category or assess every question within a category to arrive at a decision to allow or disallow grid data sharing, in whole or in part. In some cases, a detailed analysis of relevant issues in just one Framework category may be sufficient to resolve contested issues among parties. Furthermore, the order of the categories listed in the Framework and this playbook are not intended to be prescriptive.

A decision to enable, prohibit, or limit grid data sharing exists in the context of a particular set of circumstances at a particular point in time. Questions of grid data sharing may reemerge as circumstances evolve (e.g., when state policy changes or with new technology adoption). The Framework's construct provides a basis for documenting key policy, technology, market, and other considerations that offer a ready starting point for future discussions and evaluation if desired.

[3] The focus of this effort is on data that the utility might make available on a public or limited basis to nonutility parties, and/or grid data that would be beneficial for other purposes, such as public policy. A use case focused on grid operations could necessitate bidirectional data sharing, but that is not discussed here.

USE CASE

Short description of the scenario for which grid data is relevant



Key Questions:

- What is the scenario being envisioned?
- Why are electricity grid data elements relevant to the actions in the use case?
- What types of entities would need access to additional electric utility grid data in this scenario?

Use Case Summary and Practices:

The use case description intends to outline the “what” of a request for grid data sharing. The use case description outlines the actor(s) and the motivation and/or goals for grid data sharing.

This Framework category is intended as a narrative description of a specific scenario and the potential importance of grid data sharing in that scenario. It also outlines the actor or actors and their relative motivations for grid data sharing. The use case may begin with a request to a commission from an interested party, such as utility, DER developer, or other intervenor or interested party.

The use case category can be thought of as documenting the “what” and “why” to show the relative context and points of view that help anchor in-depth examinations of grid data sharing issues. The Framework provides question prompts that may be helpful to guide narrative development.

In some cases, a use case provides a helpful starting place to think through issues related to grid data sharing policies and practices. For example, the New York Public Service Commission initiated an Integrated Energy Data Resource Program, which includes development and prioritization of stakeholder use cases (see Table 1). The prioritized use cases are guiding initial policies governing grid data sharing.

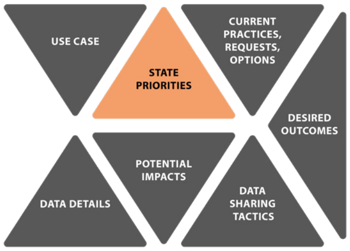
Table 1: Example – New York Public Service Commission Stakeholder Use Cases[4]
Overview of the User-Centered Design Process **Define personas** Use cases are like mini stories written from the user's perspective, so it is important to first spend time defining the different users who will be using the [program] platform. Personas are an archetype that can be used to help guide decisions about what data are included and at what levels, navigation, interactions, and visual design. **Outline persona drivers** For each persona, it is important to identify what their goals and motivations are, as well as understand their expectations for the functionality of the system. Drivers include characteristics, motivations, pain points, and the outcome the persona wants to achieve, including the problem the persona is trying to resolve with the solution. **Use case development** Use cases should be simple, concise, and align with persona drivers. Generally, use cases follow this basic format: "As (persona), I want (what), so that (why)." The curation and collection of use cases should include the identification and evaluation of acceptance criteria—what must be fulfilled so that the story can be identified and completed. **Use case prioritization** A prioritization framework must be transparently outlined to categorize use cases based on how critical they are to the overall success of the [program] platform for key stakeholders. **Develop wireframes** Wireframe development begins the transformation of ideas into a high-level solution. This step begins to clearly identify data owners, define data structure and requirements, conceptualize ideas, ideate solutions, and validate designs based on what was uncovered throughout persona research and use case discovery. **Design, test, adapt, deploy, iterate** Prototyping, testing, and adapting designs before deployment ensures that data quality and user functionality requirements are met. As new use cases are collected or prioritized, the platform can be continuously adapted and improved.

Use cases are evolving rapidly as data needs change and as new technical capabilities become available and are implemented. Use cases may be explored as incremental requests for grid data or in combination with other grid data uses. During the Collaborative workshops, participants noted that there can be some level of consistency across multiple use cases. For example, a similar set of grid data is commonly used for hosting capacity analysis, interconnection requests, and distribution grid investment planning.

[4] For more information, see NYSERDA's Integrated Energy Data Resource on Stakeholder Use Case Development.

STATE PRIORITIES

State goals, policies, and authorities relevant to the use case and data sharing



Key Questions:

- What existing state policies and goals are relevant to the use case?
- What authority and jurisdiction does the commission have on this topic?
- What are the existing precedents or requirements within the state or commission regarding data openness, data privacy, and burden of proof (e.g., some states presume data openness, so utilities need to explain risks; some states require DERs to demonstrate need)?

State Priorities Summary and Practices:

Important legal, institutional, utility, financial market, and strategic considerations differ across jurisdictions. The reasons for considering grid data sharing can be valuable to document when seeking stakeholder alignment. Decision-makers may consider ways to:

- Evaluate state goals and policies
- Identify appropriate jurisdiction and institutional alignments
- Identify existing data sharing practices and data openness
- Identify related regulatory mechanisms such as rate designs and utility programs

States often have unique priorities that impact grid data sharing policies. These may include important legal, institutional, financial market, and other strategic considerations. Grid data sharing may play a pivotal role in helping meet those goals or policy objectives. This Framework category provides a straightforward way to assess and document current policy drivers and legislative authorities, opportunities, and constraints to help frame grid data sharing matters in the context of overarching policy goals. Of note, relevant policies change over time and may impose challenges as grid data uses evolve. As with other policy changes, revisiting decisions may be required over time.

During the Grid Data Sharing Collaborative workshops, members noted the significance of policy drivers and grid data sharing decision-making. They pointed to 22 states, the District of Columbia, and Puerto Rico, all of which have established 100% clean energy/carbon-free goals for electricity through legislative or executive actions.[5] Another example, outlined in the Collaborative's fleet electrification use case (see Appendix A), was transportation electrification policies such as low emission and zero emission vehicle standards and multistate agreements to support EV deployment. These examples underscore the relationship between state policy and grid data sharing.

[5] For more information, see the National Conference of State Legislatures' State Renewable Portfolio Standards and Goals and the Clean Energy States Alliance's Table of 100% Clean Energy States.

Another consideration is the evolution of state policies and implementing processes that address utilities' investments in modernization technologies that enable data sharing capabilities. Although data sharing standards and practices are nascent at the distribution level, where oversight is primarily the responsibility of state-level PUCs, emerging policies may create DER market participation models and value propositions for grid edge innovations at specific locations, including individual and/or aggregated DERs, such as models imagined within wholesale power market reforms under Federal Energy Regulatory Commission (FERC) Order No. 2222.[6] Such policy innovations have an impact on grid data sharing decision-making as well.

Within this state priorities category, commissions may wish to document the following:

- **State goals and policies.** Consider how grid data sharing (either broadly or in a specific instance) aligns with state policy goals. Identifying the public interest benefits derived from prioritizing objectives in relation to grid data sharing helps align expectations across parties. Core policies, such as reliability, adequacy of service, resilience, and affordability, may be supported by increased grid data sharing. Many jurisdictions are considering the role of DERs—including the benefits and challenges—in attaining state goals. In a specific instance, state policy may encourage deployment of DERs for operational improvements or economic development; in this case, additional grid data sharing could be necessary to effectively deploy and operate such DERs.

- **Jurisdiction and institutional alignments.** Which institutions have jurisdiction over the sharing of grid data with third parties varies. Regulatory utility commissions, state energy officials, consumer advocates, attorneys general, regional transmission organizations and/or balancing authorities, and other institutions may have authority over aspects of grid data sharing discussions. For example, in the case of FERC Order No. 2222, which imagines aggregated distribution-level DERs participating in wholesale markets, state regulatory authorities play an important role in how data about local grids will be shared with DER operators and aggregators. Reviewing important institutional authorities and alignment may be helpful in considering grid data sharing policies.

- **Existing data sharing practices, applicable "burden of proof."** Jurisdictions may differ as to which party has the burden of proof/onus to demonstrate reasons for or against grid data sharing. For some jurisdictions, data not currently shared by the utility may require a request (from the utility or a third party), and the requestor has the burden of proof to ensure that the new shared grid data is appropriate for sharing. Alternatively, other jurisdictions may presume data openness, such that a utility or other entity must provide evidence or reasoning as to why data must be protected or its sharing limited. Still other jurisdictions may open an investigation into grid data sharing to focus parties on critical policy issues.

- **Related regulatory mechanisms, such as rate designs and utility programs.** The attractiveness of grid data sharing is impacted by regulatory mechanisms that influence potential value creation from grid data. Availability of incentives, rate designs, and programs for customers, in addition to rate recovery mechanisms for utilities for grid data sharing investments, will vary by jurisdiction.

[6] For more information, see FERC's Sept. 17, 2020 news release: FERC Opens Wholesale Markets to Distributed Resources: Landmark Action Breaks Down Barriers to Emerging Technologies, Boosts Competition.

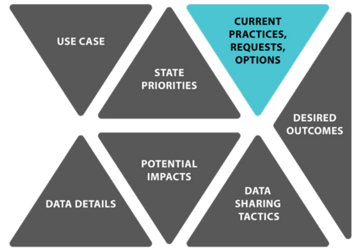
- **Critical electric infrastructure information protections.** Federal and state regulators each have authority over certain grid issues, including grid data sharing. Federal frameworks such as Critical Energy/Electric Infrastructure Information (CEII) may be particularly relevant. CEII restricts access to critical infrastructure information, "defined as a system or asset of the bulk-power system (physical or virtual), the incapacity or destruction of which would negatively affect national security, economic security, public health or safety, or any combination of such matters."[7] FERC has created rules for sharing CEII, which it defines as "specific engineering, vulnerability, or detailed design information about proposed or existing critical infrastructure (physical or virtual) that relates details about the production, generation, transmission, or distribution of energy; could be useful to a person planning an attack on critical infrastructure; and gives strategic information beyond the location of the critical infrastructure." CEII is exempt from mandatory disclosure under the Freedom of Information Act.[8] Many states have similar CEII-like frameworks, often deferring to the FERC model.[9]

Federal agencies, including FERC, the U.S. Department of Defense, the National Electric Reliability Council, and DOE, continue to assess potential impacts and risk mitigations related to energy and electric infrastructure and develop policies that either impact or may inform state-level activities. NARUC collaborates with federal agencies to enable better coordination between state regulatory authorities and federal agencies on these and other topics.

[7] Public Law 107–56: USA PATRIOT Act of 2001.

[8] For more information, see FERC's Critical Energy/Electric Infrastructure Information (CEII) (Accessed August 28, 2023).

[9] For more information, see National Governors Association (2019). State Protection of Critical Energy Infrastructure Information (CEII).



CURRENT PRACTICES, REQUESTS, OPTIONS

Data already available, additional data being requested, options for enabling the use case

Key Questions:

- Which grid data are desired? By when?
- Are grid data elements already available? If so, to whom?
- Can grid data be assembled from existing free sources or paid vendors?
- How will the grid data requested support the desired outcomes and state priorities?
- Can the goal be achieved through other means than sharing these particular data?
- What would be the impact of never sharing the grid data? What would be the impact of not sharing the grid data soon? Which grid data elements are desired, and by when?

Current Practices, Requests, Options Summary and Practices:

Identifying currently available data and applicable policies—for example, to whom grid data is available and under what conditions—provides stakeholders with a starting point for assessing new requests for access.

Assessment may include:

- Data availability
- Data quality
- Data location
- Data accessibility

Assessing requests for grid data sharing, either in the context of a specific use case or more generally, will benefit from a thorough consideration of the status quo. Documenting current grid data sharing practices, including the scope of data currently being shared, who is providing the data and to whom, and under what conditions data are currently shared, can provide regulators with a starting point. New requests for grid data, changes in state policies, advances in technology, or other factors may trigger these initial assessments or reassessments as appropriate. Documenting answers to key questions contained in this section of the Framework can also provide valuable insights into incremental data needs.

The Grid Data Sharing Collaborative found information about the status quo particularly helpful in its DER interconnection use case (see Appendix A). That use case examined grid data sharing as a mechanism to facilitate timely DER deployment to accelerate the attainment of states' clean energy policy goals. Examining the status quo provided Collaborative participants with insights into the value of additional, incremental data sharing and provided context for new data sharing requests.

It is important to consider what data utilities and third parties have, how the data are assembled, and what is involved in converting the data into a shareable format. Knowing the following details about the grid data sharing status quo may be helpful (the list below is not intended to be exhaustive):

- **Data availability** refers to the extent to which grid level data exist in a form that can be made available. Policymakers may consider the nature of information technology systems that currently produce grid level data to develop an understanding of the feasibility, applicability, and convenience of making grid data available. Utilities may not currently have the ability to collect the level of data necessary to enable a use case. Some entities that want data may not be aware of its availability, in what form the data exist, and at what cost. For some grid data, like hosting capacity, data may already be publicly available, either from the utility or a commission. There may be other data that could be available via other sources, such a local emissions data from environmental regulators.

- **Data quality** refers to the age, relevance, and reliability of data. In this context, quality is relative to the usefulness in enabling the desired outcomes. Grid data will vary in quality necessary to enable the desired outcomes. Generally, grid data are useful to the extent that the data are accurate, attainable, and actionable. Policymakers may want to consider if data quality is sufficient to enable or realize benefits. Policymakers can also consider means of improving data quality if and where appropriate.

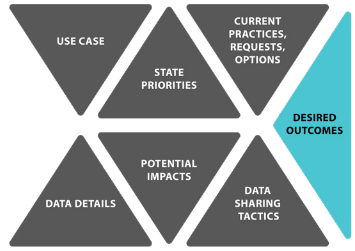
- **Data accuracy**, as a subset of data quality, refers to the extent to which records are error-free and can be used as a reliable source. Utilities, DER developers, customers, and other users of data all face issues related to data accuracy. Factors impacting data accuracy include, among others, input errors, outdated data systems, and poor access management.

- **Data location** refers to where data is produced, stored, disseminated (where applicable) and by which party. Different data sources may be required to enable desired outcomes. Both utilities and third parties may be involved in assessing the current state of grid data, and if it is possible to enable the desired outcomes.

- **Data accessibility** refers to fair access to grid-level data that helps enable or realize benefits. Understanding which grid data are accessible and how often is important for policymakers. Policymakers may need to consider the extent to which current policy enables access to specific grid data elements, and by what means.

DESIRED OUTCOMES

Intended benefits enabled through the availability of electric utility grid data



Key Questions:

- What would the use case scenario look like if a successful grid data sharing approach was in place?
- What is the value of enabling this use case? To whom does the value(s) accrue?
- What would be the public interest motivation for grid data sharing to support this use case?

Desired Outcomes Summary and Practices:

The desired outcome and its values and benefits are intended to capture the increased value creation from grid data sharing. Desired outcomes may include potential contributions to overarching policy goals, resource goals, and other initiatives; articulated outcomes could also include relevant quantitative and qualitative information.

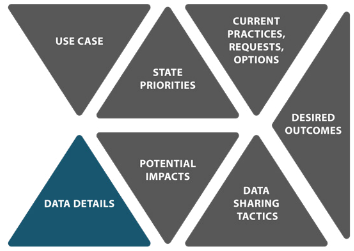
Articulating the expected benefits of sharing grid data, either generally or within the context of a given use case or state policy driver, provides valuable insights to regulatory decision-makers. Such benefits—the “desired outcomes” in Framework parlance—may be understood broadly as the public interest motivations for sharing data. They can be qualitative expressions of anticipated value creation from grid data sharing in broad terms or rooted in relevant quantitative analyses.

The value propositions or benefits can be captured in a variety of ways, including but not limited to:

- Potential contributions to overarching policy goals, resource goals, and other initiatives.
- Type of benefits enabled through grid data sharing, such as attaining policy goals or grid enhancements that provide resilience benefits.
- Parties who receive the benefits and the degree to which they share in them.[10]

Equally important to consider are the potential effects of limiting grid data sharing on relative value. For example, limits on grid data sharing may impact the degree to which state policy goals can be attained or the pace at which they can be achieved. Limits may also change the benefits accrual among utilities, customers and ratepayers, DER owners and hosts, and other third parties. The limitation of value may influence parties’ incentives for participation in a given use case or market scenario. Capturing these details provides a complete picture of the potential value that grid data sharing may unlock.

[10] For example, on page 4-1 of the National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources, it notes across DER applications that “DERs can have a wide range of impacts that can affect the electric utility system, the gas utility system, and other fuel systems, host customers, and society.”



DATA DETAILS

Data elements necessary to unlock the benefits of the use case

Key Questions:

- What level of grid data quality and granularity is necessary (e.g., temporal, locational)? How frequently should data be shared?
- Which grid data elements are required? Are some grid data “need to have” versus “nice to have”?
- Who has the grid data?
- Who needs the grid data?
- What is the relative sensitivity and/or criticality of specific grid data details?

Data Details Summary and Practices:

The usefulness of data sharing depends on the users’ access to and confidence in the data. Data may reside across multiple owners or parties, in multiple systems at multiple locations, and in varying levels of granularity. Certain levels of data granularity may be required to reach intended outcomes.

The usefulness of grid data sharing depends on access to and confidence in the data necessary to enable a set of desired outcomes. Yet, collecting, assembling, exchanging, and consuming data can be complicated. For example, data may reside across multiple owners or parties, in multiple systems at multiple locations, and in varying levels of granularity. In a study on data sharing in energy systems, Wang et al. (2023)[11] note additional challenges:

- Large volume of data. Conventional energy dispatching automation systems contain tremendous data sampling points, and the high sampling frequency implies a massive total volume of data.
- Complex data types. Many types of equipment are generating complex and diverse monitoring data.
- High processing speed requirements. For certain applications, high speed data processing systems may be necessary to gain timely insight from energy sector data.

In practice, many grid data sharing discussions before state commissions begin with specific applications that involve new, or changes to existing, data sharing. For example, lengthy interconnection delays can prompt requests for state commissions to improve grid data sharing to help third parties optimize their planning using applications that commonly include interconnection information or communication of utility system hosting capacity. During the Grid Data Sharing Collaborative workshops, participants working on the DER interconnection use case (see Appendix A)

[11] Jianxiao Wang, Feng Gao, Yangze Zhou, Qinglai Guo, Chin-Woo Tan, Jie Song, & Yi Wang. (2023), Data sharing in energy systems. *Advances in Applied Energy, 10*, 100132, ISSN 2666-7924. https://doi.org/10.1016/j.adapen.2023.100132.

developed a sample list of discrete grid data they believed, based on their experience, would support and foster more effective DER siting and interconnection. This list is shown in Table 2.

Collaborative participants considered their list of proposed data elements "must haves" to realize the desired outcomes within the use case. Regulators may want to consider the necessary and sufficient information ("need to have") for grid data. Additional data may be helpful, but not necessary ("nice to have") to satisfy the use case. Extraneous data may incur unintended incremental risks, while in other use cases, the incremental data needs enable intended outcomes.

The incremental data that a specific customer requests could make interconnection easier, although the data are typically collected and organized for other purposes. For example, interconnecting customers request data that utilities often use in planning or operations.

Table 2: Sample Grid Data Elements

Interconnection Data Elements
(Source: Grid Data Sharing Collaborative)

Feeder (and substation in some cases)

- Feeder name or identification number
- Substation to which the feeder connects
- Feeder voltage
- Number of phases
- Substation transformer to which the feeder connects
- Feeder type (e.g., radial, network, spot, mesh)
- Feeder length
- Feeder conductor size and impedance
- Service transformer rating
- Service transformer daytime minimum load
- Existing generation
- Queued generation
- Total generation
- 8760 load profile
- Percentage of residential, commercial, and industrial customers
- Currently scheduled upgrades
- Federal or state jurisdiction
- Known transmission constraint
- Presence of reverse flow protection, automated voltage regulators, load tap changers, capacitor banks that would be impacted
- Other relevant information to guide interconnection applicants

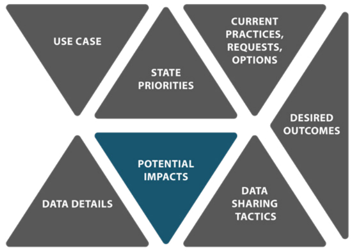
Public Queue Data

- Queue number
- Nameplate rating and export capacity
- Fuel type
- City, ZIP code
- Substation
- Feeder
- Status (e.g., active, withdrawn, connected)

Dates for

- Application complete
- Screening results
- Supplemental review results
- System impact results
- Facilities study results
- Interconnection agreement provided
- Interconnection agreement signed
- Permission to operate

NOTE: This is an illustrative list for demonstration purposes only.



POTENTIAL IMPACTS

Incremental risks and consequences of sharing additional data details beyond current practices

Key Questions:

- To whom do the risks accrue? Which grid data elements are associated with risks?
- Are the risks of sharing specific grid data elements related to privacy, consumer impact, security, or commercial risk?
- What is the likelihood of the risks being realized? How is that risk quantified (e.g., empirical evidence)?
- What are the consequences of these risks? Who would be harmed?
- Does sharing specific grid data elements realize the risk? What other things would need to occur to realize the consequence? How do specific data elements relate to other already-shared grid data?

Potential Impacts Summary and Practices:

Grid data sharing may produce new risks for utility systems and end users. Additionally, consequences attributed to interested parties may be distinct. Regulatory authorities and interested parties should seek to identify and understand risks explicitly when possible.

Risk and consequences can be understood in terms of likelihood of an event and scale of harm or severity of an event. Risks can be categorized to facilitate a more objective review of potential impacts of grid data sharing.

The UK Energy Data Task Force Data Openness Triage[12] aims to systematically find issues that could inhibit open data, including these key issues areas:

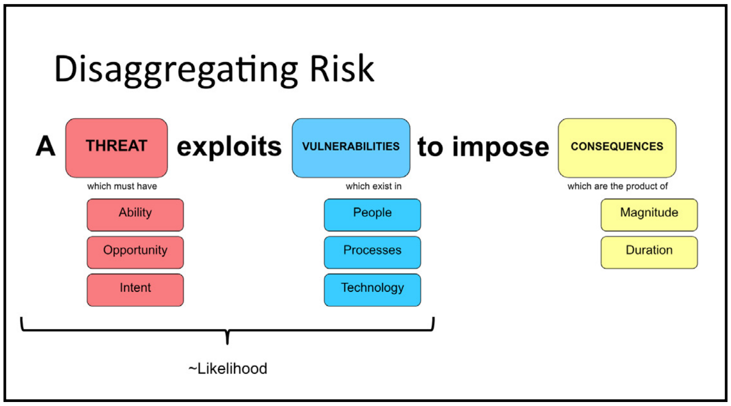
- Consumer privacy
- Negative consumer impact
- Security
- Commercial

Potential impact refers to whether sharing additional data details beyond current practices introduces incremental risk and increases the likelihood of negative outcomes. Risk and consequences are frequently cast in terms of the likelihood of a negative event happening and the scope and severity of harm that the event may cause. Risk is often cited as an impediment to grid data sharing, so thorough consideration of the topic is warranted.

During the Grid Data Sharing Collaborative workshops, a visual definition was used to conceptualize risk and provide avenues for fruitful discussion (see Figure 2).

[12] For more information on this data openness triage system, see the 2021 Strategy for a Modern Digitalised Energy System: Energy Data Taskforce Report.

Figure 2: Risk Management Conceptual Mapping



Source: Idaho National Laboratory

Risk refers to the potential for an unwanted outcome that results from an incident, event, or occurrence, as determined by its likelihood. Threat refers to anything that can intentionally or accidentally expose or exploit a vulnerability. In the energy sector, threats can be natural, technological, human or physical, or digital/cyber. Vulnerabilities are weaknesses introduced via people, process, or technology. Without means, motive, or opportunity, a threat does not exist. If vulnerabilities are absent, or if their exploit does not have real or potential negative impact, then risk is low. Risk is never zero, however, particularly within a complex technology-laden environment in which utilities operate; malicious external threat actors actively target such environments for the purpose of causing service disruptions and negatively impacting safety and security.[13]

Risk mitigation is an action or actions that defenders take to minimize the likelihood of negative impacts. From a cybersecurity perspective, vulnerabilities are frequently associated with technical flaws in software, commonly documented in a Common Vulnerabilities and Exposures (CVE) document.[14] Vulnerabilities also arise due to human fallibility through individual or organizational error, as well as insecure processes that fail to reliably produce only intended outcomes. Proactively minimizing vulnerabilities lessens the likelihood of potential negative impacts. In the context of grid data sharing decisions, vulnerability assessments should consider discrete data as well as data in the aggregate.

Consequences, or negative impacts, are a function of magnitude and duration. There is often significant nonlinearity in consequence; that is, high magnitude impacts of short duration may ultimately be of considerably lower consequence than a lesser impact that persists over a long time. Potential consequences from grid data sharing may involve the physical or operational integrity of grid assets or digital infrastructure. They also could be logical, affecting data quality, quantity, and integrity. Negative impacts are not limited to the affected party; they may be spread across a spectrum of stakeholders. For example, third parties who depend on timely, accurate data may suffer negative impacts if the data owner's information system has been unknowingly breached by an attacker who alters data values.

[13] For more information, see Annual Threat Assessment of the U.S. Intelligence Community, February 2023.

[14] See publicly disclosed cybersecurity vulnerabilities list at Common Vulnerabilities and Exposures (CVE®), August 2023.

Categories of Risk for Grid Data Sharing

The extent to which grid data sharing may lead to negative consequences is a debated question. Leveraging concepts developed by the UK's Energy Task Force,[15] Collaborative participants developed a robust list of possible threats and vulnerabilities related to grid data sharing and categorized them according to potential impacts in four areas:[16]

- **Consumer Privacy:** Data that relate to a person who can be identified directly from the information in question or who can be indirectly identified from the information in combination with other information. Because the focus of this effort is on grid data as opposed to energy consumption data, the likelihood of impact in this category is low.
- **Negative Consumer Impact:** Data that are likely to drive actions, intentional or otherwise, that will negatively impact the consumer. Similar to consumer privacy, this issue is relatively low risk in the grid data sharing context.
- **Security:** Data that create incremental security issues—or exacerbate existing security issues—that cannot be mitigated via security protocols such as physical site security, robust cybersecurity, or other means. Security professionals focus their efforts to address these risks.
- **Commercial:** Data that relate to the private administration of a business or data that were not collected as part of an obligation by a regulated monopoly and would not have been originated or captured without the activity of the organization.

Collaborative participants spent significant time during Workshops 2 and 3 discussing grid data sharing risks both generally and more specifically via the use cases (e.g., see Figure 3). Using their collective expertise, members also assigned rankings (low, medium, or high; or green, yellow, or red) associated with the likelihood and severity of potential impacts.[17] These exercises helped focus participants' attention and discussions on particular risks (see Table 3) and led to valuable considerations of feasible risk remediations or mitigations.

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[15] Energy Data Taskforce: A Strategy for a Modern Digitalised Energy System, June 2019.

[16] See publicly disclosed cybersecurity vulnerabilities list at Common Vulnerabilities and Exposures (CVE®), August 2023.

[17] NOTE: The risks and perceived potential impacts of risk identified within this document do not represent an exhaustive, definitive assessment; they are the product of the expertise of Collaborative members.

Figure 3: Grid Data Sharing Collaborative Flip Chart – Potential Impacts

NOTE: This is a work product that represents a means of exploring risks and mitigations in the Workshop context; it does not represent a consensus or conclusion.

Table 3: Methods to Assess Risk

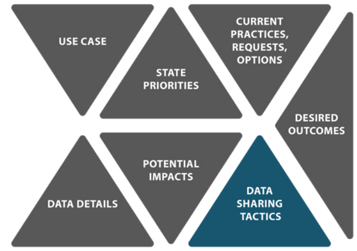
The power grid faces risks that are often challenging to quantify. Stakeholders rely on a variety of tools, techniques, and practices to help identify threats, track and manage vulnerabilities, and assess potential consequences. A small sampling is noted here.

- **Industry partnerships**. Sector participants, coordinating bodies, and organizations work closely to assess risks. NARUC partners with DOE and utilities through the Electricity Subsector Coordinating Council (ESCC), the Electricity Information Sharing and Analysis Center (E-ISAC), the Oil and Natural Gas Subsector Coordinating Council, and industry-led research partnerships. The DOE's federal partners include the U.S. Department of Homeland Security via the Industrial Control Systems Cyber Emergency Response Team (ICS-CERT), Science & Technology, and the National Cybersecurity and Communications Integration Center (NCCIC); National Institute of Standards and Technology (NIST) Smart Grid Interoperability Panel (SGIP); Defense Advanced Research Projects Agency (DARPA); the U.S. Department of Defense; and others.[18]
- **Metadata collection and management**. Risk identification may also occur when developing current practices, requests, and options. A variety of interested parties may wish to catalog their stored, shared, and produced data systematically to assess potential security risks. For example, the Electric Power Research Institute (EPRI) notes that utility data owners may be widely dispersed across operations, and that data inventory processes may help to coordinate better sharing with risks in mind.[19] Cataloging metadata with risks in mind helps to identify potential risks across parties.
- **Cybersecurity policies and procedures for event detection and response**. Risk management practices for cybersecurity guide risk assessments. For example, NARUC developed questions for utilities and regulators to consider related to preparedness.[20] Answering risk assessment questions for cybersecurity associated with data sharing may identify risk levels.

[18] For more information, see Office of Cybersecurity, Energy Security, and Emergency Response – U.S. Department of Energy.

[19] EPRI, Metadata: Enabling Data Sharing. 2023

[20] See NARUC Cybersecurity Manual including Understanding Cybersecurity Preparedness: Questions for Utilities. June 2019



DATA SHARING TACTICS

Approaches that can be implemented to minimize potential negative impacts of grid data sharing

Key Questions:

- Do relevant industry standards or standards of practice exist that would mitigate risks?
- What are the relative costs and levels of effort to implement specific risk mitigation options?
- Who would bear the costs of implementing different approaches?
- Would the mitigation approach eliminate the benefits (desired outcomes) of the use case?

Data Sharing Tactics Summary and Practices:

Data sharing tactics aim to implement grid data sharing with intent to mitigate vulnerabilities and/or reduce potential impacts.

In considering tactics, policymakers may consider:

- Applicability of industry standards
- Applicability of business practices
- Applicability of data requirements
- Availability of regulatory tactics

Data sharing tactics refer to activities that aim to mitigate vulnerabilities and/or reduce potential impacts from grid data sharing. In this context, mitigation tactics focus on understanding the extent to which sharing grid data will increase the likelihood of negative events on the grid. State regulatory authorities also often decide the extent to which limiting grid data sharing might lessen potential threats and consequences.

A variety of risk mitigation tactics are common across industry that address risks associated with grid data sharing. How grid data sharing is implemented could minimize some risk, possibly to an extent acceptable to regulatory commissions and stakeholders. Consumer privacy risks are protected by rules and laws, data aggregation techniques, business practices, and other means. Security risks are addressed by industry standards and management practices. Commercial risks are addressed by regulations, contractual agreements, and other common business practices. For grid data sharing practices, assurances of and/or compliance with certain industry standards and practices may be necessary. A thorough conversation of data sharing tactics may facilitate decision-making.

Applicability of industry standards. A variety of industry standards apply to grid data sharing scenarios, some of which may help mitigate potential risks. Industry standards may apply to grid data access, privacy, and security. The appropriate application of standards may vary by scenario. Regulators will want to consider existing or available industry standards that may mitigate potential risks of grid data sharing.

In 2008, the North American Electric Reliability Corporation (NERC) established initial Critical Infrastructure Protection (CIP) standards, along with compliance frameworks, to mitigate concerns related to the Bulk Electric System (BES). Responsible entities must implement a process to consider the potential impact on associated facilities, systems, and equipment that would affect reliable operation of the BES. Those assets may include requirements for distribution providers in certain circumstances. NERC CIP is not a standard for grid data sharing, but its policies may impact which grid data are considered sharable.

Applicability of business practices. Several potential mitigations for commercial risks are addressed in common business practices. These practices include industry standard data management practices, the use of contracts, and nondisclosure agreements.

The National Cybersecurity Center of Excellence collaborates with industry and information technology communities and is developing data classification practices with the objective to develop recommended practices for defining data classifications and data handling rule sets and communicating them to others.[21]

Applicability of data requirements. There are an array of federal, state, and utility requirements for data, including privacy and security. In California, a partnership of universities and institutes facilitated conversations related to grid data sharing. Collaborative participants noted that the lack of clarity on how to meet privacy and security requirements can lead stakeholders "to take an overly risk-averse approach to sharing grid and customer data." The partnership suggested that the Energy Commission and Public Utilities Commission initiate a regulatory guide to help governments, DER providers, and state regulators understand how data generation and sharing is limited by current law and policy.[22]

Availability of regulatory tactics. Data sharing tactics are commonly considered within regulatory proceedings. For example, commissions limit data sharing related to critical infrastructures, to protect commercial trade secrets, and to reduce other potential impacts and consequences as appropriate.

As both a matter of desired outcomes and value creation, the costs of mitigation may warrant consideration. Applying data sharing risk mitigations may impose differing costs to utilities and other entities, and those costs might impact actors' incentives. These costs can include costs associated with physical or communications technologies (e.g., software) or implementation costs. With respect to implementation, there may also be limited resources in terms of personnel, time, and other factors.

The Grid Data Sharing Collaborative participants developed dozens of ideas for data sharing tactics that could address potential threats. Participants also briefly considered the levels of cost associated with those tactics (low, medium, or high). Mitigations may prove challenging to successfully implement or achieve depending on desired outcomes, and there may be instances where mitigation tactics adversely impact the benefits.

[21] For more information, see Data Classification | NCCoE (nist.gov).

[22] For more information, see Data Access for a Decarbonized Grid - Berkeley Law, Center for Law, Energy & the Environment (2021) at pg. 23.

Considering tiered grid data classifications. In the United Kingdom, data is presumed open unless a specific potential risk is identified. In the event of a perceived risk, a data openness triage process is applied to consider potential restrictions. Further, data may initially be restricted but then be changed into one of four types of open data:

- **Open:** Data is made available for all to use, modify, and distribute with no restrictions
- **Public:** Data is made publicly available but with some restrictions on usage
- **Shared:** Data is made available to a limited group of participants, possibly with some restrictions on usage
- **Closed:** Data is only available within a single organization[23]

Considering tiered access to grid data. In 2021, the New York Public Service Commission (PSC) ordered that system data, defined as information about components and activity at the distribution level, is not subject to customer consent and should be publicly available, with an exception for pieces of the systems' data that may impact customer privacy or critical infrastructure protection. The New York PSC is currently considering a policy for a Data Ready Certification that would use a risk-based approach for the assignment of cybersecurity and privacy requirements. The Data Ready Certification Process supports Data Access Agreements.[24]

In Collaborative Workshop 4, participants posited that tiered access may be beneficial in terms of better segmenting market participants based on respective capabilities and risks. However, at the time of publishing, no jurisdiction has adopted a tiered system for classifications of distribution grid data. In 2022, the California Public Utilities Commission (CPUC) denied a request by utilities to classify broad categories of grid data. The CPUC found the investor-owned utilities (IOUs) had not provided evidence that publishing these data would lead to, or had already resulted in, adverse impacts to the distribution system. The CPUC noted that much of the data the utilities wished to classify were publicly accessible via other means. Finally, the CPUC noted that much of the data that the utilities requested to classify had been available for over a decade without any documentation of a negative outcome. More information about California's Grid Data Sharing approaches are in Table 4.

[23] Energy Data Taskforce Report - 2021 Strategy for a Modern Digitalised Energy System: Energy Data Taskforce Report, pg. 25.

[24] See State of New York Public Service Commission Order Adopting A Data Access Framework and Establishing Further Process (April 15, 2021) in Case 20-M-0082 - In the Matter of the Strategic Use of Energy Related Data.

Table 4: California Grid Data Sharing Summary
Data Portals The distribution resource plan data portals hosted by the three IOUs provide integration capacity analysis (ICA), locational net benefit analysis, grid needs assessment/distribution deferral opportunity report, and other data to the public. The ICA map is designed to help contractors and developers find potential project sites for DERs. ICA maps include distribution lines, substations, and transmission lines. Feeder data aggregation is subject to a 15/15 threshold. Data requirements include 576-hour, 24-hour peak load profiles, and 24-minute load profiles for each month. Specific requirements vary by size of utility customer base. For detailed information, relevant CPUC proceedings include: R.14-08-013 Integration Capacity Analysis (ICA); Decisions D.17-09-026 and D.18-02-004, as confirmed by ALJ rulings OIR R.21-06-017, July 2, 2021. For links to these and other utility data portals, see Grid Data Sharing: Brief Summary of State Practices (NARUC 2023).

Using the Grid Data Sharing Framework

The Grid Data Sharing Framework is a resource for commissions to use when evaluating grid data access issues. The Framework reflects the experience and expertise of Collaborative participants regarding topics and contextual questions that help identify options and weigh alternatives. These topics can be addressed in any order and to the extent deemed necessary for decision-making purposes in the context of a particular set of state circumstances. The Framework does not promote a particular regulatory process.

Though the Framework may appear at first to require significant time, resources, and effort to complete, the level of effort will be determined by the commission and its stakeholders in a state-specific context. The power of the Framework lies in its flexibility and repeatability. It helps structure deliberations and provides a mechanism to document key inputs for decision-making purposes. The Framework can be used for gathering and organizing information in a variety of contexts. It also lends itself to supporting a diverse set of decision-making strategies.

Ideas for Decision-Making

For illustrative purposes, Collaborative participants outlined a few ideas for decision-making approaches that could potentially be applied to the Framework. Individual commissions, of course, will employ a strategy that best suits their needs and process requirements.

Perform a cost-benefit analysis. Commissions and utilities frequently perform cost-benefit analyses to weigh the value of investment options and support decision-making. For grid data sharing, one could theoretically assess the expected incremental value (benefit) and costs of grid data sharing under a variety of risk/uncertainty scenarios. However, Collaborative participants frequently noted the lack of quantitative data available for this purpose.

In some cases, information may be available to support a related use case. For example, the National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources and companion guide can help design jurisdiction-specific tests to assess cost-effectiveness for DER investments; however, existing BCA tests have not currently been devised for grid data sharing.[25]

Collaborative participants noted that existing quantitative data about risk are also scant. A standardized threat assessment framework that tests a variety of threat scenarios could help inform tolerance for risk, which contributes to tailored decision-making.

Weighted decision options and rankings. Collaborative participants noted that quantitative information about benefits, risks, and trade-offs for incremental grid data sharing can be difficult to find. Another approach can be weighing different factors on a relative scale (e.g., low, medium, or high; or using a 1-5 scale) to provide a semiquantitative and normalized view of the inputs and options.

Focus on priority goals. This strategy focuses on ensuring or accelerating the achievement of state or commission goals and priorities, and weighs incremental grid data sharing tactics against their ability to achieve those results. Collaborative participants noted that one could design off-ramps or automatically triggered actions as a way of changing course should potential threats materialize differently than anticipated.

[25] For more information, see the National Standard Practice Manual (NSPM) for DERS, National Energy Screening Project, 2020

Benchmark options. Benchmarking grid data sharing proposals against other jurisdictions' decisions helps illuminate emerging practices and provide context for possible approaches.[26]

Leverage industry resources. A multitude of resources exist that can help inform the deliberation process and provide a basis upon which grid data sharing decisions may rest. Applicable industry standards, for example, provide vetted guidance pertaining to cyber risk mitigation.

Address objections in the record. Ensuring that objections raised in the record, both those of grid data owners in response to requests for access as well as third parties seeking access, are adequately addressed and concerns sufficiently mitigated may build confidence in and conformance to the ensuing grid data sharing decision.

Regulatory Process Challenges

Collaborative participants represented a range of stakeholder views and expressed concern that regulatory processes themselves can sometimes present challenges to effective decision-making and implementation (see Table 5). Being aware of these concerns—as well as leveraging the Framework, playbook, and use cases—can help commissions establish thoughtful approaches to information-gathering and decision-making about grid data sharing.

Table 5: Regulatory Process Challenges Raised by Grid Data Collaborative Participants
▸ Process can take too long. ▸ A bias toward data transparency or data protection may exist that unduly affects results. ▸ The lack of objective data, especially on potential adverse impacts of sharing specific grid data elements, may drive risk-averse decision-making. ▸ PUC staff and IT resources are limited. ▸ Participation in regulatory proceedings often requires significant resources for intervenors. ▸ Involvement of third-party experts is limited due to existing utility sector consulting arrangements (conflicts of interest). ▸ Differences in utilities' technical readiness to share grid data may drive uneven policy requirements. ▸ Establishing how or if security and quality requirements get imposed (initially and ongoing) is a challenge. ▸ Lack of clarity regarding to whom a decision applies drives uncertainty.

Grid data sharing discussions are interactive, additive, and related over time. Beyond initial decisions, playbook users should consider how existing mechanisms may enhance or impede future discussions and address challenges early.

[26] NARUC. 2023. Grid Data Sharing: Brief Summary of State Practices (NARUC 2023).

Data Sharing Implementation Challenges

If a commission decides that grid data sharing is in the public interest, a new set of questions and challenges will emerge regarding implementation of the data exchange(s). Data sharing implementation challenges can be technical, complex, and require focused attention to detail. Collaborative participants, as part of building and refining the Framework, identified some likely implementation challenges related to data and business practices that will require attention to achieve success. Overcoming these challenges is possible but involves timeliness, cost, and benefit trade-offs. Table 6 shows the likely challenges and possible solutions identified by Collaborative participants.

Table 6: NARUC Grid Data Sharing Collaborative Participant-Identified Implementation Challenges

Likely Challenges	Possible Solutions
Data	
A lack of common data standards/taxonomy can create inconsistency in the types of data that are available, the quality and granularity of available data, and the design of data access models, as well as potentially increase the cost and complexity of gathering and providing required incremental data. Incompatible data transfer needs (e.g., frequency of updates) and utility data system capabilities. A perceived lack of transparency into nonutility cybersecurity and data maintenance practices raise data confidentiality and integrity concerns. Uncertainty of regulatory recovery mechanisms to design, build, and maintain grid data access and transfer services (utility cost recovery). Uncertainty of involvement or ownership of any required buildout to enable data sharing. Which party or parties bear the burden of costs for data sharing requirements?	Establishing working groups or similar mechanisms to examine current or new data requirements, identify deficiencies in available data to meet those requirements, and outline processes for data improvements—with goals and timelines—may be productive. A standing working group may also enable continuous improvements as data characteristics mature and needs change. Utility investments in data infrastructure may be necessary. Regulatory mechanisms may be needed to drive investments to achieve expected grid data sharing value.

Table 6: NARUC Grid Data Sharing Collaborative Participant-Identified Implementation Challenges	
Likely Challenges	**Possible Solutions**
Limits exist on some data sharing parties' ability to execute NDAs. Few mechanisms in place for data sharing parties to audit the effectiveness of data sharing tactics. Data reporting and time reporting (frequency) are not standardized. Commercial risk versus liability is a concern. Data quality improvements may be necessary. For example, the usefulness of data sharing relies on users' confidence that data accurately reflect grid conditions.	Commissions and stakeholders will need to continuously evaluate data and data practices. One such practice is data validation, which refers to procedural and technical practices intended to improve data and avoid common impediments. Utilities and other parties perform data validation independently. In some jurisdictions, regulators oversee data validation processes (e.g., by requiring regular filings, plans, and tracking metrics). The grid data serve as both critical inputs to use cases, and critical means of evaluating performance against desired outcomes.

Appendix A – Grid Data Sharing Collaborative Use Cases

The use cases included in this playbook were identified and initially developed by the NARUC Grid Data Sharing Collaborative participants during in-person workshops in 2022-2023. They offer examples of the types of information that Collaborative participants thought would be used to answer the prompt questions in each category and therefore can be viewed as templates that a jurisdiction can follow to help reach a decision on whether and what grid data should be available. Participants iterated on the inputs for each use case while developing and testing the Framework categories. The Grid Data Sharing Collaborative team subsequently consulted various experts to expand the content contained in these use cases so they can be used as a starting point for future efforts. The use cases are only examples and should not be viewed as exhaustive or definitive.

As noted throughout the playbook, how each jurisdiction answers the Framework questions and fills out the details of each category will vary based on the state's laws and policies; the authority of the commission; and the status quo, needs, and capabilities to collect and provide the data. Furthermore, the content examples included in each category within the following use cases do not include judgments about the reasonableness of presented risks or availability of data. Rather, the commission, utility, or stakeholder decision-making process will include some steps to determine the reasonableness of the inputs; those activities are not represented here in these static examples.

The grid data sharing example use cases are:

- Improving DER Interconnection
- Enabling Fleet Vehicle Electrification
- Enabling Distribution Non-Wires Solutions

Use Case: Improving Distributed Energy Resources (DERs) Interconnection

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*

What is the scenario being envisioned? Why are electricity data relevant to the actions in the use case? What types of entities would need access to additional electric utility data in this scenario?
 	
Customers and developers of all types are installing distributed energy resources (DERs)* in record numbers in our state to support a variety of goals: cost savings, environmental benefits, resilience, comfort, lifestyle, and more. To ensure that DERs can be supported by existing grid infrastructure, customer equipment is required to complete an interconnection process with the local utility prior to being energized.
 	
In our state's utility territories, the wait times for DER interconnection are getting longer and longer due to a variety of factors. If customers and DER developers were aware of locations where the as-built grid could support the addition of DERs, those locations could be prioritized and areas unable to support DERs avoided. At the same time, those areas with current constraints could potentially be targeted or incentivized for EE or demand flexibility investments to enable more capacity on the same line or feeder.
 	
Grid data sharing could assist DER customers and developers by more effectively siting DERs, supporting utilities, and more efficiently interconnecting DERs that are built in locations that avoid triggering investments in grid upgrades—also reducing utility costs by avoiding interconnection application reviews for locations where new DERs should not be developed. Improving DER siting may accelerate the deployment of DERs that meet customer needs and are not detrimental to the grid.
	What would the use case scenario look like if a successful data sharing approach was in place?
	
	• An efficient, timely, quick, transparent process that enables informed decision-making for both utilities and interconnecting parties.
	• A streamlined interconnection process that facilitates more DERs.
	• Reduced customer, developer, and utility costs.
	• Deployment of resources (solar, EV charging, storage, EE, DR) that supports state policies.
	• Reduced complaints and disagreements between utilities, DER developers, and customers.
	
	What is the value of enabling this use case? To whom does the value(s) accrue?
	
	DER developers:
	• Identification of locations where there is a greater likelihood of interconnecting
	  - Fewer delays in processing interconnection requests
	  - Minimizing interconnection costs
	
	Utilities:
	• Shorter interconnection queues
	• Fewer off-cycle grid upgrades; investments are optimized
	• Enhanced reliability and operational resilience from DERs
		What data are desired? By when?
		
		• Hosting capacity and grid conditions, on a monthly basis.
		• Interconnection queue and related data continually updated.
		
		Are grid data already available and to whom?
		
		• Utility has posted a hosting capacity map with substations, feeders, and demand information on its public website.
		• Existing interconnection rules include a pre-application process that provides some locational information and sharing of some grid data between interconnecting parties.
		• Utility shares interconnection queue information periodically and publicly through filings at the commission, including size and demand of resources in the queue.
		• DER has submetering equipment that collects usage (including demand-related information).
		
		Can grid data be easily assembled from existing free sources or paid vendors?
		
		• Yes, some information is readily available from the utility and is already in the public domain (though not in an easily usable format).
		
		How will the requested information support the desired outcomes and state priorities?
		
		• Knowing the likelihood of successfully interconnecting will allow developers to locate projects in areas with sufficient capacity, which will reduce the number of interconnection requests.

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*
	Society: • Clean energy goals are met in a timely, effective manner that reduces customer costs and enhances customer participation What would be the public interest motivation for data sharing to support this use case? • An efficient, timely, quick, transparent process that enables informed decision-making for both utilities and interconnecting parties. • A streamlined interconnection process that facilitates more DERs. • Reduced customer, developer, and utility costs. • Deployment of clean energy resources (solar, EV charging, storage) that supports state policies. • Reduced complaints and disagreements between utilities, DER developers, and customers. • Higher grid reliability and resilience at prudent cost.	Can the goal be achieved through means other than sharing these particular data? • No What would be the impacts of never sharing the data? What would be the impacts of not sharing the data soon? • Not sharing data may adversely impact achievement of state renewable goals. • Not sharing data will continue to result in DER requests to interconnect in areas with little to no available capacity. Not sharing data soon will delay DER interconnection processes, and queues will continue to get longer.

* A DER (distributed energy resource) is a resource sited close to customers that can meet all or some of their immediate electric and power needs and can also be used by the system to either reduce demand (such as energy efficiency) or provide supply to satisfy the energy, capacity, or ancillary service needs of the distribution grid. The resources, if providing electricity or thermal energy, are small in scale, connected to the distribution system, and close to load. Examples of different types of DERs include solar photovoltaic (PV), wind, combined heat and power (CHP), energy storage, demand response (DR), electric vehicles (EVs), microgrids, and energy efficiency (EE).

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
What level of data quality and granularity is necessary (e.g., temporal, locational)? • Data request includes fields needed for interconnection decisions, as specified below. • To the greatest extent practical, all grid data should be provided in alignment with the common information model (CIM). **Feeder (and substation in some cases)** • Feeder name or identification number • Substation to which the feeder connects • Feeder voltage • Number of phases • Substation transformer to which the feeder connects • Feeder type: radial, network, spot, mesh, etc. • Feeder length	What data are required? Are some data "need to have" vs. "nice to have"? • To be determined through commission-utility-stakeholder process. Who has the data? • The utility has data that relate to the distribution grid. Who needs the data? • DER developers need the data to identify viable locations to install DERs (on behalf of customers). • *The utility may need data from the DER to bill the customer, compensate the customer/DER owner for any services, and to plan its system.*	To whom do the risks accrue? Are there risks associated with sensitive yet critical data elements? Are the risks of sharing specific data elements related to privacy, consumer impact, security, or commercial risk? • Security – The sharing of non-public details of critical distribution system facilities by a utility, DER developer, or other entity (whether voluntary or involuntary) may increase physical or cybersecurity risks that attackers could potentially exploit to cause operational impacts. • Commercial – If a utility, DER developer, or other entity has ineffective cybersecurity controls for sensitive non-public distribution data, they face commercial liability and compliance risk. • Commercial – Detailed 8760 load profiles about a facility may offer commercially sensitive information to competitors. What is the likelihood of the risks being realized, and how is that risk quantified (e.g., empirical evidence)? What are the consequences of these risks? Who would be harmed? • A nation state could attack grid infrastructure, leveraging reconnaissance from sensitive data made available voluntarily or involuntarily. National security agencies routinely document adversaries' targeting of electricity infrastructure data as shown through intelligence gathering and forensic analyses of successful attacks. Consequences could include service interruptions of TBD duration and impact.	Do relevant industry standards or standards of practice exist that would mitigate risks? • Details about sensitive distribution facilities are covered by existing laws (e.g., state-level CEII). • NERC CIP or other federal requirements may limit public disclosure of data on critical facilities. • In prior decisions, the commission has affirmed that state-level security and commercial privacy standards and practices are in place for utility-held grid data. Possible Approaches: *The utility will seek commission approval prior to requiring any additional data protection requirements for third parties.* • Identify data that are already in the public domain; for non-public, sensitive data, develop NDAs or similar vehicles describing acceptable data use and reuse criteria. • Provide secure login credentials to a cybersecure portal, which allows authorized access to sensitive, non-public data. This limits public exposure that may pose security risks. Access may be approved pending NDA or similar. • On public sites, employ data aggregation or masking techniques so that sensitive facility, node, or network details are obscured.

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Feeder conductor size and impedance • Service transformer rating • Service transformer daytime minimum load • Existing generation • Queued generation • Total generation • 8760 load profile • Percentage of residential, commercial, and industrial customers • Currently scheduled upgrades • Federal or state jurisdiction • Known transmission constraint • Presence of reverse flow protection, automated voltage regulators, load tap changers, capacitor banks that would be impacted • Other relevant information to guide interconnection applicants	What is the relative sensitivity and/or criticality of specific data details? • Initial assessment did not reveal any specifically sensitive data details within the requested list. The utility will provide a risk assessment to the commission in follow-up, detailing and sharing evidence if any stakeholder-requested data and elements are deemed sensitive. See subsequent columns. Public Queue Data • Queue number • Nameplate rating and export capacity • Fuel type • City, ZIP code • Substation • Feeder • Status (e.g., active, withdrawn, connected)	Does sharing specific data elements realize the risk? What else would need to occur to realize the consequence? How do specific data elements relate to other already-shared data? • Data in combination may provide more valuable insights for an adversary about criticality of asset, node, or network elements and represent a higher risk. - Location data coupled with load data for a substation or feeder, or currently scheduled upgrades, may suggest a level of criticality or point of network vulnerability that attackers could potentially exploit. • The sensitivity of the information depends on the way in which it is provided (e.g., a detailed spreadsheet of sensitive information presents a greater set of risks manifesting than a GIS representation of the system where data is only available when a specific facility is selected). • Security risks of sharing data may be reduced depending on utility-level controls already in place to mitigate physical and cyber threats to utility infrastructure. • The utility will provide a risk assessment to the commission in follow-up, detailing and sharing evidence if any stakeholder-requested data and information elements are deemed sensitive. See other columns.	What are the relative costs and levels of effort to implement specific risk mitigation options? • If data are already collected and readily available by the utility, incremental costs to share data are relatively low. • If data are available in shareable format, costs to share data are relatively low. • For data that are not currently collected by a utility or are not in a readily shareable, standardized format, or the periodicity and quality of data is insufficient for DER developers, the utility may incur added costs to collect data and make it available. Who would bear the costs of implementing different approaches? • For data already collected by the utility, the utility bears the cost. • For data not currently collected by the utility, or where the utility must undertake significant effort to prepare and share grid data, the requesting party may pay some or all of the costs of data collection and sharing. • The commission may decide to allow some costs to be recoverable through rates. Would the mitigation approach eliminate the benefits (desired outcomes) of the use case? • If the mitigation increases the cost to the requestor, then the outcome may not be realized. • If the mitigation reduces the type, frequency, granularity, and content of data needed to enable the use case, then the desired outcome may not be realized.

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
	• Dates for: - application complete - screening results - supplemental review results - system impact results - facilities study results - interconnection agreement provided - interconnection agreement signed - permission to operate		• The commission will assess whether the mitigations proposed to address documented security and commercial risks are aligned with good business practices such that they do not impose too high a barrier for new entrants to participate in data sharing.

Use Case: Enabling Fleet Vehicle Electrification

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*
What is the scenario being envisioned? Why are electricity data relevant to the actions in the use case? What types of entities would need access to additional electric utility data in this scenario? Owners and operators of large fleets of vehicles in this state are announcing plans to electrify for a variety of reasons: carbon reduction goals; total cost of ownership; simplicity of maintenance; corporate environmental, social, and governance principles; and others. These electrified fleets can include light duty vehicles (taxis, rideshare); medium duty vehicles (delivery trucks, cargo vans, service vehicles); heavy duty vehicles (long-haul trucks, electric school buses, transit vehicles); or some combination thereof. For many fleets, electrification will represent a significant increase in their site load needs, so utilities may need to add capacity in addition to “make ready” infrastructure such as line extensions. In some cases, fleet owners can buy and take delivery of electric vehicles faster than they are able to interconnect charging infrastructure to power them. Fleet owners and utilities will be better able to collaborate and plan for transportation electrification if they can understand which locations are desirable and undesirable in terms of supporting charging infrastructure near-term vs. where investments will be needed to enable charging on a larger scale in the future. Grid data sharing can assist fleet owners and their agents in developing a reasonable plan to present to the utilities who serve them, outlining a proposed pace and set of locations for charging their electrified fleet. Utilities will improve the efficiency of meeting these growing customer needs if they make grid data available to support strategic siting.	What would the use case scenario look like if a successful data sharing approach was in place? • Reduced number of ineffective or inappropriate interconnection requests (e.g., fleets able to avoid or delay requests in capacity-constrained locations given charge profile or load patterns); faster interconnection approvals for fleet charging. • Better use of utility resources, assets, and energy; specifically, preventing new grid constraints and increasing use of currently available capacity while better understanding load needs for the future. What is the value of enabling this use case? To whom does the value(s) accrue? • Fleet owners and operators – Fewer unknowns when developing initial drafts of fleet electrification plans, which will reduce uncertainty, time, costs; better insight for facility managers to meet environmental goals and reduce carbon footprint. • Fleet owners and operators – Allow for innovation in electrification approaches and expand financial opportunities by enabling compensation for grid services. • Utilities – Less time spent on interconnection requests that will be denied; better near- and long-term visibility into fleet electrification plans and improved ability to consider or seek approval of potential proactive investments in grid upgrades, thus speeding up the deployment process and timelines of charging infrastructure; better customer engagement; higher electricity sales.	What data are desired? By when? • Hosting capacity or grid constraint data, as soon as possible. Are the data already available and to whom? • Utility has some publicly accessible hosting capacity map data with feeder information, but these data are not routinely quality checked or frequently updated. • Customer has submetering equipment to monitor individual charging loads. Can the data be easily assembled from existing free sources or paid vendors? • Utility provides reports to the commission or other state agencies regarding carbon emissions, but not in a format and with granularity needed for customers to track corporate goals. How will the requested information support the desired outcomes and state priorities? • State law requires reduction of emissions from transportation sector, including the reporting of sector emissions and by site. • Expanding access to utility grid data will enable faster interconnection of charging stations at lower cost to the utility and ratepayers while enabling achievement of state policy goals. Can the goal be achieved through means other than sharing these particular data? • Unclear. Need to determine if the data can be collected.

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*
	• Communities near fleet charging stations – Reduced air pollutants and noise due to EVs vs. internal combustion engine vehicles. • Society – Reduced particulate matter and greenhouse gas emissions; meeting state public policy goals. What would be the public interest motivation for data sharing to support this use case? • Accelerate decarbonization of transportation sector. • Improve efficient and participatory planning and management of the grid. • Enable cost savings by avoiding or deferring grid upgrades due to poor planning, reducing consumer cost impacts, and delivering value to ratepayers. (Value will vary by the application of DER compensation mechanism[s].)	What would be the impacts of never sharing the data? What would be the impacts of not sharing the data soon? • Fleet owners and the utility will spend more time and money figuring out where appropriate locations are for charging depots. • If data are not shared soon, the state will not be able to achieve state policy goals or Desired Outcomes on schedule.

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
What level of data quality and granularity is necessary (e.g., temporal, locational)?	What data are required? Are some data "need to have" vs. "nice to have"? "Need to have" feeder data include frequently updated (e.g., at least quarterly): • Color-coded maps providing initial indication of loading capacity headroom by circuit	To whom do the risks accrue? What data elements are associated with the risks? Are the risks of sharing specific data elements related to privacy, consumer impact, security, or commercial risk? • Privacy – Risks can be minimized by ensuring the utility does not share customer-identifiable data and personally identifiable information. Such information and data can be shared by a fleet owner directly with an EVSE agent or operator at their discretion.	Do relevant industry standards or standards of practice exist that would mitigate risks? Options include: **Ensuring industry-standard cybersecurity protections:** • Not applicable as specified; revisit if operational data are being discussed for sharing.

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Fleet owners and their agents need access to publicly available hosting capacity maps with red-, yellow-, and green-level screening data to focus their charging depot plans and initial siting decisions that will lead to interconnection requests. • Data request includes fields needed for interconnection decisions plus air quality data. After EVSE sites are energized, additional data sharing may be valuable to support efficient charging patterns that are grid-friendly. Such operational data could include:	• Transformer, circuit, substation load data • Circuit DCFC loading capacity; voltage level, phase, amps rating • Underground or overhead circuit "Nice to have" data include: • EVSE interconnection queue by substation to enable better understanding by fleet owners of potentially changing conditions • System upgrades already planned • Forecasted grid hardening investments	• Commercial – There may be some perception of commercial risk (to the customer or charging provider) due to the implied visibility of use patterns or behavior from load profiles on the feeder if inferences can be made about operations by competitors (e.g., logistics firms can deduce one another's energy usage). What is the likelihood of the risks being realized, and how is that risk quantified (e.g., empirical evidence)? What are the consequences of these risks? Who would be harmed? • See above; unlikely Does sharing specific data elements realize the risk? What other things would need to occur to realize the consequence? How do specific data elements relate to other already-shared data? • See above; unlikely	**Aggregating data:** • Before releasing data, ensure that no individual customer or firm is identifiable or clearly implied (e.g., individual business model is not visible). If it is, minimize data exposure by aggregating data to highest level required for operations at the point applied (e.g., transformer, feeder, substation, balancing authority). For large fleet applications, this is unlikely but possible. **Contracting options:** • If utilities also collect fleet EV owner data, NDAs and noncompetes between utility and fleet providers are common practice and can be considered to limit use and reuse of data. **Provide regulatory and policy clarity:** • Identify clear roles for utility in a competitive environment to help identify commercial risk and mitigations; align data sharing policy with commission intent. • Could incentivize locational visibility with financial incentives for data sharing. What are the relative costs and levels of effort to implement specific risk mitigation options? • Low – If data are already collected by utility, costs to collect data are low. • Low – If data are available in shareable format, costs to share data are low. • Medium / High – For data that are uncollected and not in standardized format, there may be added costs to collect data and make it available.

Data Details *Data elements necessary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Day-ahead forecasts of grid conditions and needs to enable appropriate EV charging operations, inform programs to influence charging behaviors, and/or make dispatch decisions (basis of these dispatch decisions is currently unclear – likely necessary both day-ahead and in real time). • For large loads (over 7 MW), real-time data feeds may be necessary.	• Air quality emissions data and CO^2 emissions data (high granularity for 24/7 goals) for the utility service location is useful for projecting public policy outcomes, progress toward corporate emissions reduction goals, etc. Who has the data? • Utility Who needs the data? • Fleet customers, owners, and agents • EV charging companies, vendors, and consultants • *The utility will need some data from fleet owners as part of the interconnection process, which is a separate use case* What is the relative sensitivity and criticality of specific data details? • Load profiles for the feeder can be sensitive from a privacy or commercial business perspective if there are few customers on the line.		Who would bear the costs of implementing different approaches? • For data already collected and shared, the requesting party should not be responsible for costs. • For data not already collected and shared, or where the holder of the data must make significant efforts to share the data, the commission might determine that requesting party will need to pay some or all of the costs. • The commission may decide to allow some costs to be recoverable through rates. Would the mitigation approach eliminate the benefits (desired outcomes) of the use case? • The commission will assess whether the mitigations proposed to address documented security and commercial risks are aligned with good business practices such that they do not impose too high a barrier for new entrants to participate in data sharing.

Use Case: Enabling Distribution Non-Wires Solutions

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*
As adoption of DERs continues to grow, customers and regulators are increasingly looking for opportunities for DERs to assist the grid operator in operating and managing the electricity system. In some cases, DERs can be used to delay new investments in the distribution system. In other cases, DERs can be aggregated and directly participate in organized wholesale markets. Regardless, the goal is to identify opportunities for DERs to provide services to the distribution utility or regional transmission organization, as allowed by the applicable regulatory authority. Grid services can include voltage and volt-ampere reactive (var) support, DR, capacity, energy, and ancillary services. The DER can provide these services via contract, utility program, direct participation in markets, or in response to other types of prices or grid signals. In some cases, the DER can be paid for its service. The ability to provide grid services depends on the needs of the utility, structure of the market in the specific jurisdiction, and ability to participate in these products.	What would the use case scenario look like if a successful data sharing approach was in place? • Better use of utility resources, assets, and energy; specifically, preventing grid constraints and increased use of currently available capacity • Deferral of higher cost utility investments through utilization of non-wires solutions What is the value of enabling this use case? To whom does the value(s) accrue? • Utility – Avoids higher cost capital investment • Customer – Compensated for providing service to the utility • Aggregator – Compensated for providing service to the utility • Society – Overall costs to operate the grid are reduced by avoided capital investments What would be the public interest motivation for data sharing to support this use case? • Enhance the operational efficiency of the distribution grid • Assist with grid management • Enable cost savings by avoiding or deferring grid upgrades, reducing consumer cost impacts, and delivering value to ratepayers. (Value will vary by the application of DER compensation mechanism[s].) • DER can be dispatched in better alignment with system needs	What data are desired? By when? • Hosting capacity/grid constraint data that are updated regularly • Information about the location, including time and type of services Are they already available and to whom? • Utility has publicly accessible hosting capacity map with feeder information • Customer has submetering equipment to monitor individual resources, including demand, usage, and power quality • Utility makes information available through a non-wires solution solicitation • Existing interconnection rules has pre-application process that provides some locational system information Can they be easily assembled from existing free sources or paid vendors? • Utility How will the requested information support the desired outcomes and state priorities? • Will enable greater utilization of DERs and inclusion in utility operations • Expand opportunities for DERs • Reduce utility spending by avoiding or deferring utility capital • Enhance efficiency of electricity system

Use Case *Description*	**Desired Outcomes** *Intended benefits enabled through the availability of electric utility grid data*	**Current Practices, Requests, and Options** *Data already available, additional data being requested, options for enabling the use case*
This use case considers the ability of DERs to provide non-wires solutions to a distribution utility. A DER aggregator has signed up multiple end-use customers and installed a variety of DERs, including EE, energy storage, EVs, and controllable thermostats. These customers are located within an electrically contiguous and compact location in a distribution utility's service territory. The DER aggregator is responding to a distribution utility's solicitation for non-wires solutions options to defer construction on a new substation. The DER aggregator will manage its resources to reduce and shift electricity consumption away from the constrained time period and into a time period with sufficient energy and capacity. By leveraging DER for non-wires solutions, the utility will be able to reduce its costs by relying on non-utility assets without affecting reliability. Grid data sharing can assist non-wires solutions providers in identifying specific areas of need and developing a reasonable plan to present to the utilities who serve them.	• Enables new services for DERs that can be used to support the grid, such as voltage management services	Can the goal be achieved through means other than sharing these particular data? • No What would be the impacts of never sharing the data? What would be the impacts of not sharing the data soon? • Aggregators would not be able to sign up customers to participate in a non-wires solution opportunity • Value of DER would be reduced • Customer costs and bills would increase • If data are not shared soon, the state will not be able to achieve state policy goals or Desired Outcomes on schedule

Data Details *Data elements necesary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
Types of data: • Feeder (and substation in some cases) • Feeder name or identification number • Substation to which the feeder connects • Substation/ transformer/feeder rating • Feeder voltage • Number of phases • Substation transformer to which the feeder connects • Feeder type: radial, network, spot, mesh, etc. • Feeder length • Feeder conductor size and impedance • Service transformer rating • Service transformer daytime minimum load • Existing distributed generation and storage	**Aggregator data needs:** • Timing, duration, and the amount of resource required (to be provided on a seasonal, day-ahead, and/or real-time basis depending on the specific service definition) • Feeders facing injection constraints (including outage notifications) - Distribution outage notifications and/or local grid conditions impacting DER availability **Customer data needs:** • Value to the customer (in terms of resource capability delivering voltage/reactive power management.	To whom do the risks accrue? What data elements are associated with the risks? Are the risks of sharing specific data elements related to privacy, consumer impact, security, or commercial risk? • Privacy – Risks can be minimized by ensuring the utility does not share customer-identifiable data and personally identifiable information. Such information and data can be shared by a customer directly with a DER provider or aggregator at their discretion. • Commercial risks – There may be some perception of commercial risk (to the customer or charging provider) due to the implied visibility of use patterns or behavior from load profiles on the feeder if inferences can be made about operations by competitors (e.g., logistics firms can deduce one another's energy usage). What is the likelihood of the risks being realized, and how is that risk quantified (e.g., empirical evidence)? What are the consequences of these risks, and who would be harmed? • Not applicable as specified; revisit if operational data are being discussed for sharing. Does sharing specific data elements realize the risk? What other things would need to occur to realize the consequence? How do specific data elements relate to other already-shared data? • Not applicable as specified; revisit if operational data are being discussed for sharing.	Do relevant industry standards or standards of practice exist that would mitigate risks? Options include: **Ensuring industry-standard cybersecurity protections:** • Not applicable as specified; revisit if operational data are being discussed for sharing. **Aggregating data:** • Before releasing data, ensure that no individual customer or firm is identifiable or clearly implied (e.g., individual business model is not visible). If it is, minimize data exposure by aggregating data to highest level required for operations at the point applied (e.g., transformer, feeder, substation, balancing authority). **Contracting options:** • If utilities also collect DER operational and owner data, nondisclosure agreements (NDAs) and noncompetes between utility and DER providers are common practice and can be considered to limit use and reuse of data. **Provide regulatory and policy clarity:** • Identify clear roles for utility in a competitive environment to help identify commercial risk and mitigations and align data sharing policy with commission intent. • Could incentivize locational visibility with financial incentives for data sharing.

Data Details *Data elements necesary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Queued distributed generation and storage • Total generation and storage • 8760 load profile • Percentage of residential, commercial, and industrial customers • Currently scheduled distribution system upgrades • Federal or state jurisdiction • Known local area transmission constraint(s) • Time window of availability of the DER • Time period of need • Data in KVA • Price/offer (nonpublic) • Customer consent (e.g., net energy metering) **Public Queue Data** • Queue number	- Information on how often and to what extent the resource has been called upon to deliver the service(s). Smart inverters require continuous automatic operation. Data access is through customer devices or the entity that may collect the data from the inverter (not utility). • The regulator could request with an aggregated view of this data - Equipment certification (standards) What level of data quality and granularity is necessary (e.g., temporal, locational)? • DER aggregators need to identify specific circuits to target DER for non-wires solution solicitation.		What are the relative costs and levels of effort to implement specific risk mitigation options? • Low – If data are already collected by utility, costs to collect data are low. • Low – If data are available in shareable format, costs to share data are low. • Medium/High – For data that are uncollected and not in standardized format, there may be added costs to collect data and make it available. Who would bear the costs of implementing different approaches? • For data already collected and shared, the requesting party should not be responsible for costs. • For data not already collected and shared, or where the holder of the data must make significant efforts to share the data, the commission might determine that the requesting party will need to pay some or all of the costs. • The commission may decide to allow some costs to be recoverable through rates. Would the mitigation approach eliminate the benefits (desired outcomes) of the use case? • The commission will assess whether the mitigations proposed to address documented security and commercial risks are aligned with good business practices such that they do not impose too high a barrier for new entrants to participate in data sharing.

Data Details *Data elements necesary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Nameplate rating and export capacity • Fuel type • City, ZIP code • Substation • Feeder • Status (e.g., active, withdrawn, connected) • Dates for: - Application complete - Screening results - Supplemental review results - System impact results - Facilities study results - Application aging tracker - Interconnection agreement provided - Interconnection agreement signed - Projects implementation aging including abandoned - Permission to operate	What data are required? Are some data “need to have” vs. “nice to have”? “Need to have” feeder data include frequently updated (e.g., at least quarterly): • Map outlining location served by substation in need of non-wires solution • Color-coded maps providing initial indication of loading capacity headroom by circuit • Transformer, circuit, substation load data • Total amount of need (in MW) • Time period of need (total hours) • Peak period of substation (in hours) • Duration of need (in days, weeks, months, or years) • Underground or overhead circuit		

Data Details *Data elements necesary to unlock the benefits of the use case*	**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
Reliability Coordinator/ RTO/ISO/BA data needs: • None **Distribution utility data needs:** • Information on resource needs, distribution system constraints that impact DER dispatch schedules • Distribution system information to inform dispatch decisions (basis of these dispatch decisions is currently unclear – DER capacity and availability likely necessary both day-ahead and in real time). • Device validation – Information is within the device. Open question is who has access to collect the data. The authority to release data should rely on a direct agreement with customer (utility regulators likely don't have authority to ensure). • Consumption information on annualized basis (kwh), high demand (kw), and max billed demand (kw) "Nice to have" data include: • DER interconnection queue by substation to enable better understanding by DER aggregators of potentially changing conditions • System upgrades already planned • Forecasted grid hardening investments Who has the data? • Utility Who needs the data? • DER developers • DER aggregators • Customers		

Data Details *Data elements necesary to unlock the benefits of the use case*		**Potential Impacts** *Risks and consequences of sharing additional data details beyond current practices*	**Data Sharing Tactics** *Approaches that can be implemented to minimize potential negative impacts of grid data sharing*
• Outages/availability of device to perform	What is the relative sensitivity and/or criticality of specific data details? • Load profiles for the feeder can be sensitive from a privacy or commercial business perspective if there are few customers on the line.		