



**INTERCONNECTION
INNOVATION e-XCHANGE**
U.S. DEPARTMENT OF ENERGY

Queue Management & Cost Allocation Solution e-Xchange Kick-Off | 4/5/23

An initiative spearheaded by the Solar Energy Technologies Office and the Wind Energy Technologies Office

Meeting Notes

Notes synthesizing keys points, insights and questions from the meeting can be found here: [Box Link](#)

Agenda

- Introduction to i2X Solution e-Xchanges
- Virtual ribbon cutting keynote
- Scope of Queue Management and Cost Allocation (QM/CA) Solution e-Xchange
 - Interconnection Overview and Focus
 - Key Questions for QM/CA Solution e-Xchange
- Meetings Focused on Transmission and Distribution
- Interactive Feedback and Discussion



Interconnection Innovation e-Xchange (i2X)

Mission: To enable a **simpler, faster, and fairer** interconnection of clean energy resources while enhancing the **reliability, resiliency, and security** of our **distribution and bulk-power electric grids**



Stakeholder Engagement

Nation-wide engagement platform and collaborative working groups



Data & Analytics

Collect and analyze interconnection data to inform solutions development



Strategic Roadmap

Create roadmap to inform interconnection process improvements



Technical Assistance

Leverage DOE laboratory expertise to support stakeholder roadmap implementation



i2X Leadership Team



Intro to i2X Solution e-Xchanges



- **FY23 Goal:** Inform and formulate a 5-Year Strategic Roadmap for interconnection & study guides with real world action
 - Topical challenges and issues
 - Practical solutions to implement and scale
 - Knowledge gaps and new solutions to pilot
 - Success goals and measures of success
- **FY23 Schedule:** Solution e-Xchanges to be held for 2hrs on Wednesdays and/or Thursdays during April - August.
 - Queue Management and Cost Allocation for both BPS and DER most extensive number of meetings due to popular demand
 - Four other topics (e.g. EEJ, Data Transparency, Workforce)
 - Options for specialized topic meetings
- **Beyond FY23 :** Solution e-Xchanges to continue building a national forum for all stakeholders as a community of practice, excellence and innovation (Ideation. Solution-driven Collaboration. Peer-Learning.)



i2X Solution e-Xchange Topic Areas



- **Queue Management and Cost Allocation**
 - Innovative interconnection solutions exist?
 - Technology, regulation, administration, and organizational change focus
- **Grid Engineering Practices and Standards**
 - Engineering and technology focus
 - *How* can proposed solutions be executed?
- **Equity and Energy Justice**
 - Multidisciplinary
 - *Who* is impacted by and benefits from proposed solutions?
- **Data Transparency**
 - Multidisciplinary
 - *What* transparency concerns must be addressed?
- **Interconnection Workforce and Training**
 - Multidisciplinary



Additional subjects, like capacity maps, cross these topics and will be addressed from these different perspectives. Follow the schedule of events on the i2X website.

Virtual Meetings Code of Conduct



1. *Assume good faith and respect differences*
2. *Listen actively and respectfully*
3. *Use "Yes and" to build on others' ideas*
4. *Please self-edit and encourage others to speak up*
5. *Seek to learn from others*



Mutual Respect . Collaboration . Openness



A Note from Eric Ciccoretti at FERC

Eric Ciccoretti is a Senior Policy Advisor in FERC's Office of Energy Policy and Innovation. He advises the office director and the Commission on electric utility filings and on rulemakings with a focus on price formation, market design, and interconnection issues. He works with the office's economic, engineering, and technical experts to assess the state of the markets, identify emerging policy issues, and develop sound and legally-defensible policies.

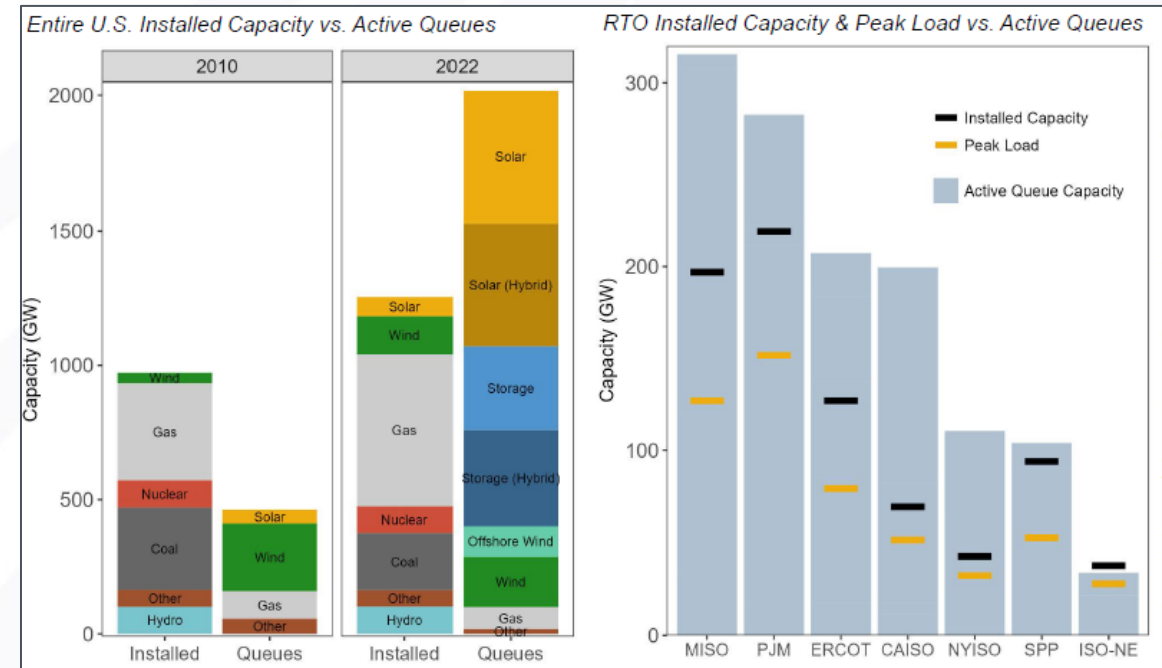


Overview of Queue Management and Cost Allocation Solution e-Xchange

Motivation for Queue Management and Cost Allocation e-Xchange



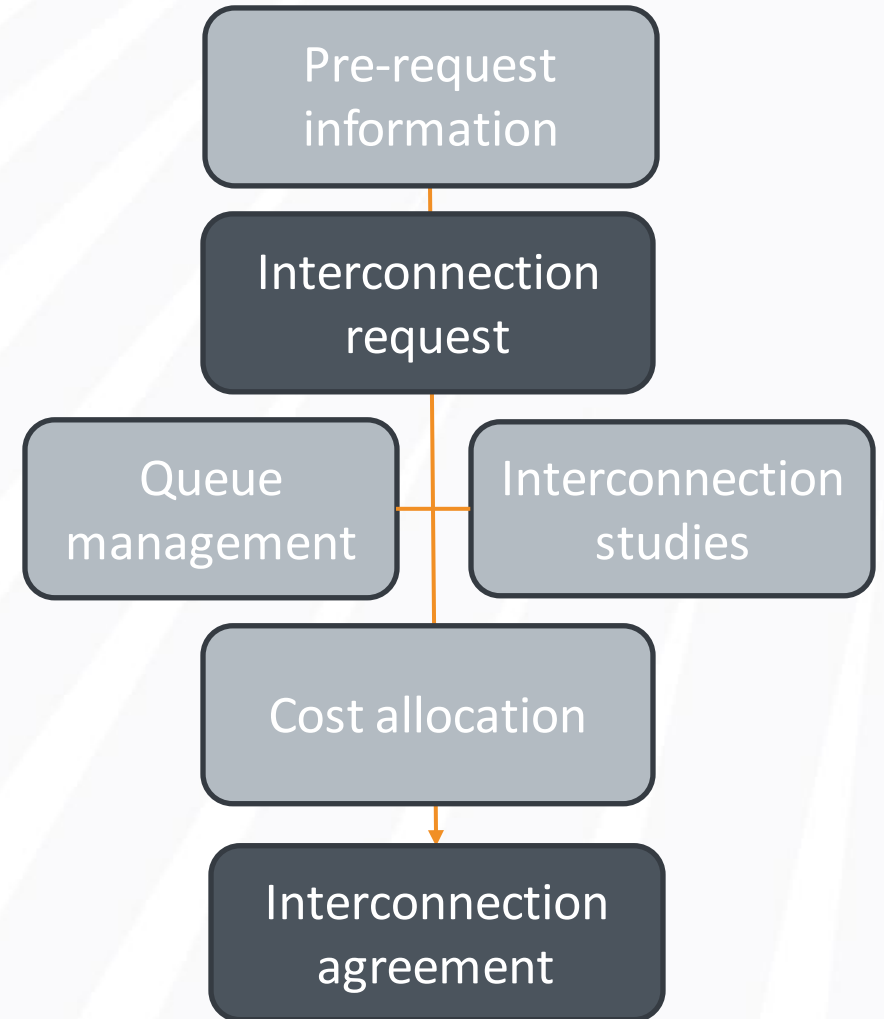
- Generators are **facing bottlenecks**, coinciding with changes in resource mix and technological innovation
- Interconnection uncertainty, delays, and higher costs may harm consumers and impede **progress toward policy goals**
- FERC and several state PUCs have **open rulemakings and proceedings** that seek to address interconnection bottlenecks; reforms underway at several ISOs
- i2X Solution e-Xchanges aim to complement FERC and state PUC interconnection reforms, by providing a forum for **stakeholders to discuss practical** – and more conceptual – solutions to current interconnection challenges



Source: Rand et al., forthcoming. DATA PRELIMINARY / NOT YET PUBLIC

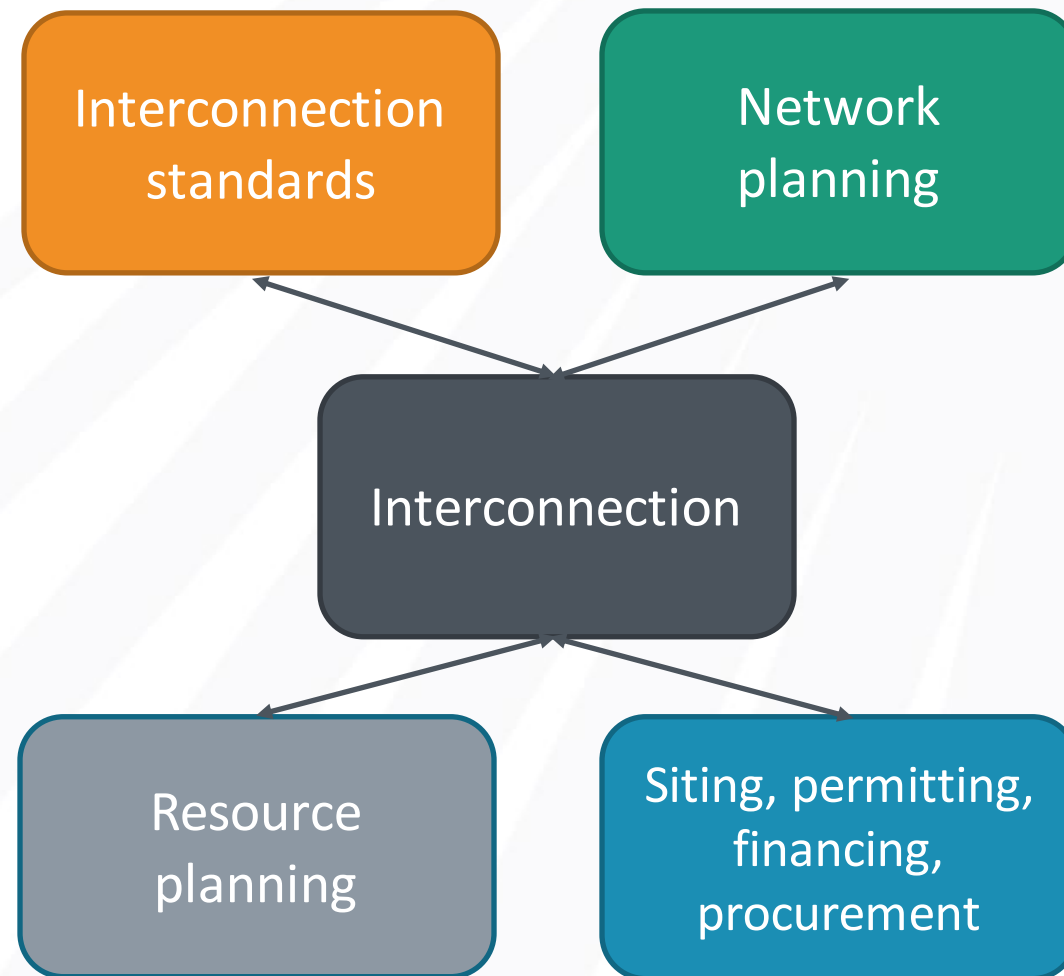
i2X Process Focus Areas

- **Pre-request information** – What information should interconnection customers have access to before they submit an interconnection request?
- **Queue management** – How do interconnection customers proceed through an interconnection queue? What requirements exist at different stages?
- **Interconnection studies** – How are the requirements for and potential system impacts of new generators studied?
- **Cost allocation** – How are facilities and network upgrade costs allocated among generators, loads, and between loads and generators?



Interconnection Intersections and Our Scope of Discussion

- **Interconnection intersects with several other areas:** interconnection standards, network planning, siting/permitting, financing/procurement, and resource planning
- For the QM/CA e-Xchange, while the intersections with other areas will be in scope, the specific areas themselves will not be
- For instance, we'll discuss the linkages between interconnection and transmission planning, but we won't discuss changes in transmission planning separately from interconnection



Transmission vs. Distribution Regulatory Jurisdiction and Frameworks



Transmission Interconnection

- Transmission interconnection is regulated by the **Federal Energy Regulatory Commission (FERC)**; Order 2003 and Order 2006 remain cornerstones of transmission interconnection policy
- FERC interconnection policy grants **significant flexibility** to ISOs for interconnection design
- Transmission interconnection has **undergone several rounds of reform** since the early 2000s; reform efforts have often been region-specific
- FERC's 2022 notice of proposed rulemaking (NOPR) on Interconnection seeks to both **standardize and innovate**
- Solution e-Xchanges will push the conversation one step further, in some areas, and also address topics that were omitted in the interconnection NOPR (e.g., cost allocation)

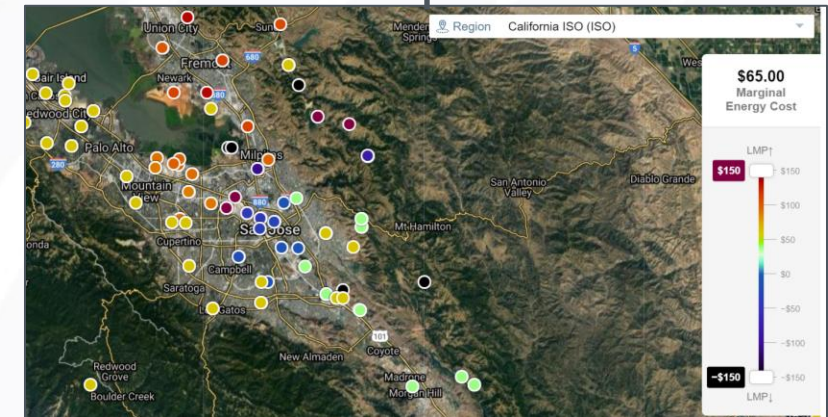


Distribution Interconnection

- Distribution interconnection is regulated by **state public utility commissions (PUCs)**, though in some cases there is jurisdictional overlap
- Several states have overhauled distribution interconnection processes to address growth in distributed energy resources (DERs); in other states, changes have been more modest, leading to **significant variation across states**
- Solution e-Xchanges will balance discussion of **leading-edge innovation** and practical steps for implementing existing technologies and practices

Separating Transmission and Distribution Sessions

- Transmission and distribution systems have historically been **planned and operated very differently...**
- ... but in the future there is significant scope for greater **convergence and coordination** between the two
 - Flexible interconnection may make the distribution system look increasingly like the transmission system
 - More resources on the distribution system will require greater coordination between the two systems, including in interconnection
- Nevertheless, concepts, terms, regulatory jurisdiction, and **stakeholders for interconnection** on the transmission and distribution systems are currently different
- Thus, QM/CA e-Xchanges will often have separate transmission and distribution meetings, with opportunities to bring the two systems back together and consider them as an **integrated whole** as needed



Key Questions for the QM/CA Solution e-Xchange

Could providing **pre-interconnection request information** improve the speed, efficiency, and fairness of interconnection? If so, what information should be provided and which entities should provide it?

What **interconnection innovations** are feasible where and when? For instance,

On the distribution system, what flexible interconnection strategies (last-in-first-out or pro-rata curtailment, competitive bidding, equity- or emissions-based priority) are most suitable, under what conditions?

On the transmission system, does the current implementation of “but for” policies allow bulk power generators that have selected energy-only interconnection to connect to the transmission system quickly with minimal upgrades?

What kinds of **cost allocation mechanisms** are most suitable for the evolving grid, under what conditions?

What **changes to interconnection studies** – from automation and staffing to study methods and network upgrade criteria – are needed in the nearer and longer term?

To what extent would **FERC’s proposed rulemakings** on interconnection and transmission planning alleviate interconnection process issues on the transmission system? To what extent will active **state PUC proceedings** alleviate issues on distribution systems? Where are the gaps?

QM/CA Transmission meetings

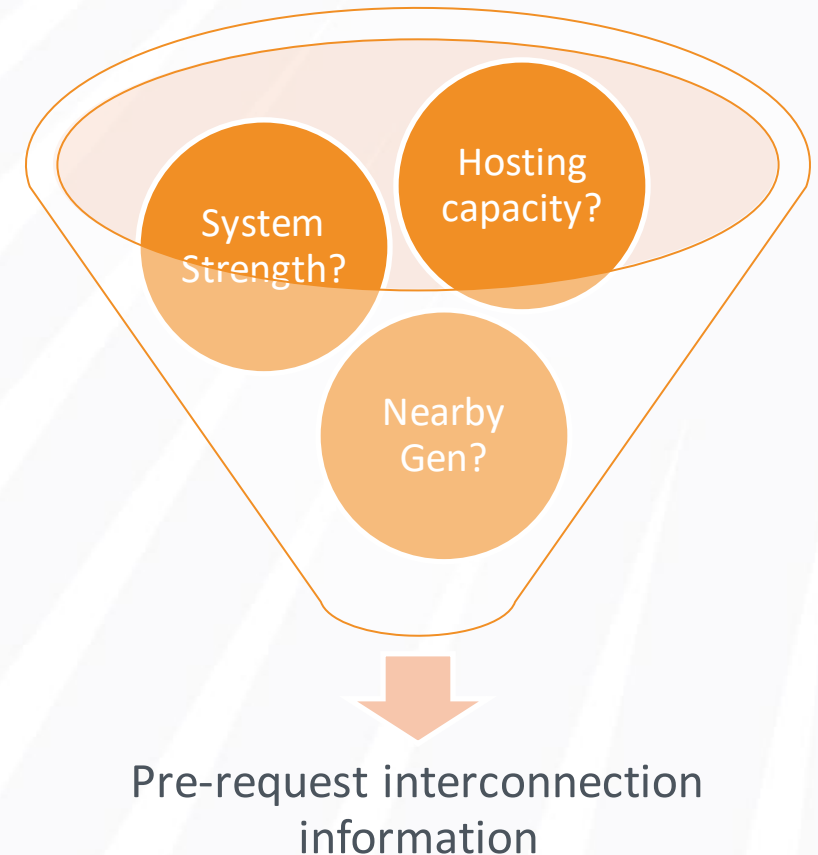
BPS Topic #1: Pre-request information

Objective: Explore options available for providing pre-request information, including those proposed by FERC and other stakeholders. The focus is on information that is helpful and can practically be made available. In addition, we hope to solicit and consolidate novel ideas for the future via a stakeholder survey.

Format: Short presentations covering ISO & developer perspectives, as well as available tools, followed by the group's discussion

Key Questions:

- Could providing pre-request information improve the speed, efficiency, and fairness of interconnection?
- What pre-request information is most valuable to provide?
- How often should this information be updated?
- Which entity should provide the pre-request information? Transmission providers or third parties?



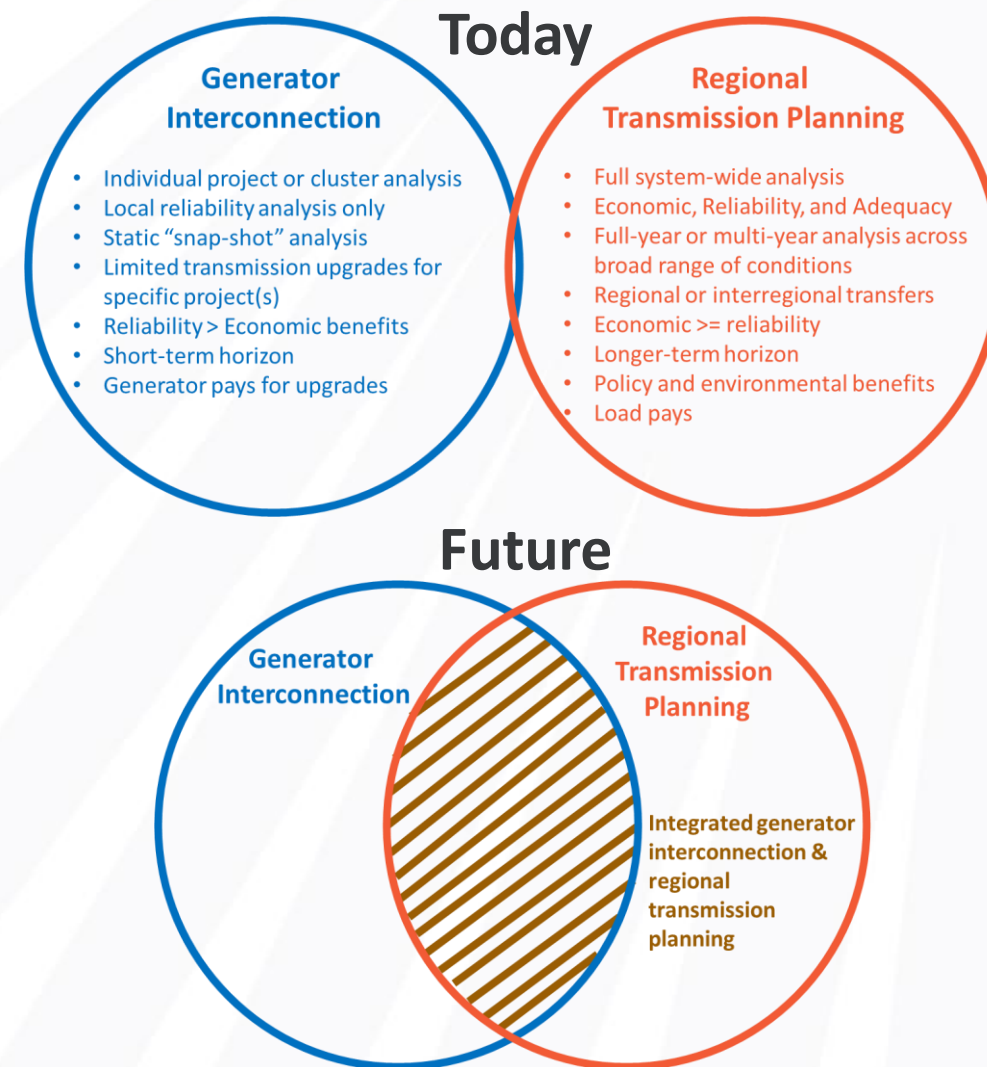
BPS Topic #2: Managing the Interconnection Study Process

Objective: To discuss additional opportunities for improvement of queue management, potentially via tighter integration of interconnection process and transmission planning process. We hope to discuss opportunities beyond FERC proposed first-ready, first-served and clustering study processes. We will consolidate and make available educational materials on the topic, using examples of recent studies and presentations from the recent workshops.

Format: Short presentations covering ISO & developer perspectives on handling the rise in queued projects, followed by the group's discussion

Key Questions:

- How can active projects be more effectively managed throughout the interconnection process?
- What are the pros and cons of integrating interconnection processes and broader transmission planning processes?
- How to manage project withdrawals more efficiently?



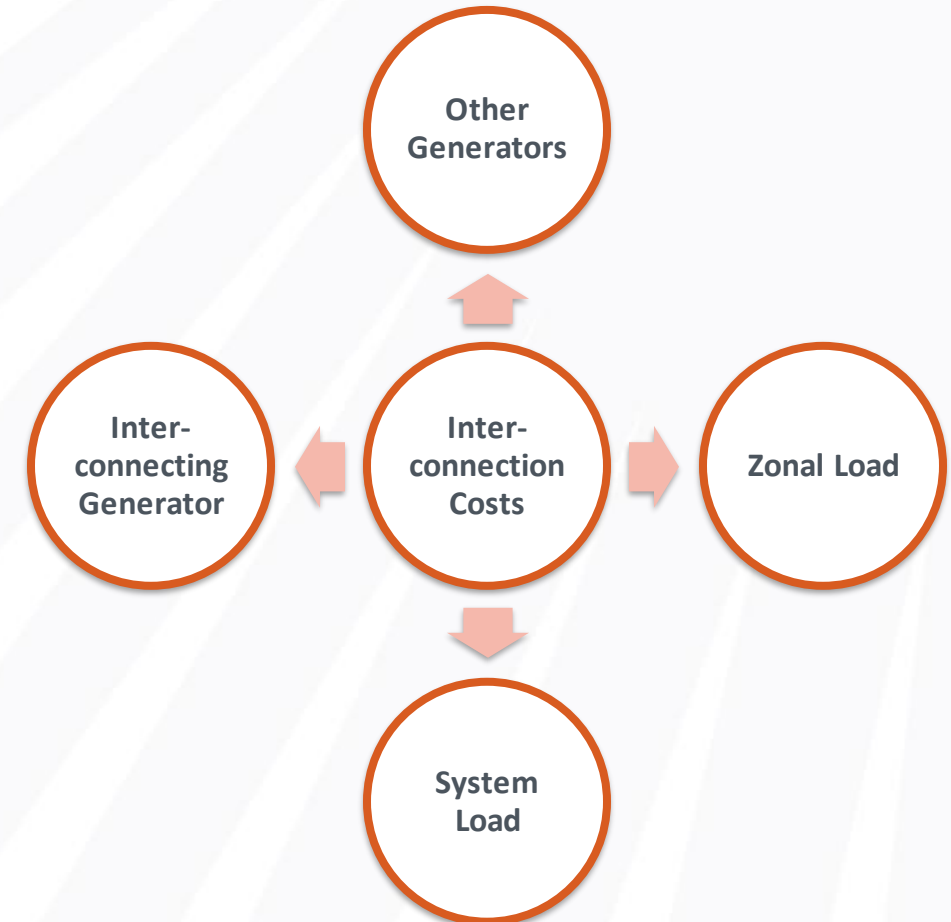
BPS Topic #3: Interconnection Cost Allocation

Objective: Explore options for reforming interconnection cost allocation, including cost allocation mechanisms and other changes in transmission planning and interconnection that may influence cost allocation outcomes

Format: Short presentations and panel discussion on current cost allocation methods and stakeholder initiatives

Key Questions:

- What kinds of changes in transmission planning and interconnection could address concerns around participant funding?
- Do existing “but for” policies and the option to build efficiently allocate costs and give interconnection customers adequate flexibility?
- Are existing cost sharing mechanisms adequate? If not, how can they be enhanced? Are other options (e.g., subscription, support for merchant transmission) an important part of the solution to cost allocation barriers? If so, how can they be best implemented?



BPS Topic #4: Improving Interconnection Study Methodologies

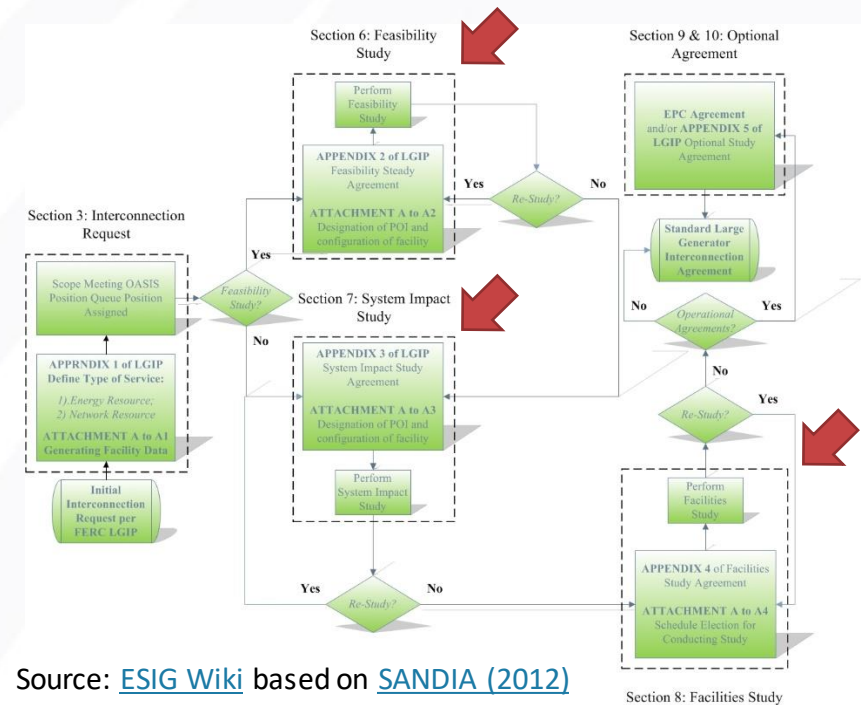
Objective: To discuss overall study process, study case selection, assumptions, and criteria to determine upgrade needs, re-study triggers as well as consideration of various upgrade options. We plan to incorporate topics such as generation dispatch assumptions including ERIS/NRIS assumptions.

Format: Short overview presentations of best practices followed by a panel and then group discussion

Key Questions:

- What triggers a restudy? What can be done to reduce number of re-studies?
- What are the critical criteria to consider to determine upgrade needs? (e.g. generation dispatch assumptions, ERIS/NRIS definitions)
- What upgrade options should be included within the interconnection study methods?

FERC pro forma Large Generator Interconnection Procedures (LGIP)



Source: [ESIG Wiki](#) based on [SANDIA \(2012\)](#)

QM/CA Distribution meetings

DER IX Queues Have Improved for Small Systems but Remain Uncertain for All

Distributed Solar

- Smaller, residential PV project timelines have improved, but uncertainty and inconsistency remain for all sizes.
 - Shift to online portals and removal of approval to build has improved timelines the most.
 - Common upgrades include transformers and main panels.
- Larger commercial, community, multifamily, or microgrid PV projects on the distribution system see longer delays but that data is a work in progress.
 - Common upgrades include substations, feeders, and communication infrastructure.
- Community solar has specifically cited IX challenges. Residential and commercial projects have clear categories and requirements for IX processing, while mid-size projects do not.

Distributed Wind

- Compared to distributed solar, distributed wind projects face similar IX issues and upgrades but can be more site dependent due to resource availability.
- The tools used to inform decision making around grid system planning and operations often do not fully characterize distributed wind compared to other distributed energy resources.
- U.S.-based manufacturers and installers of small wind turbines reported an increased interest in incorporating distributed wind in microgrids and hybrid systems. Small wind retrofits continue to account for a significant portion of new domestic small wind capacity deployment.

When asked about interconnection innovations, both industries have expressed a desire for publicly available capacity maps.

DER Topic 1: Grid Readiness and Network Upgrades

Objective: Discuss and explore what prepares the grid for future interconnection of DERs.

Prompt Questions:

- What innovative approaches have addressed and advanced DER readiness issues?
- How could pre-application processes or information be improved to better prepare developers for potential upgrades?
- What methods are developers using to predict upgrades in lieu of more information?
- What are the most common upgrades triggered by DER interconnection requests? What are the most expensive? What could be planned, instead of triggered?
- What benefits result from common grid upgrades?

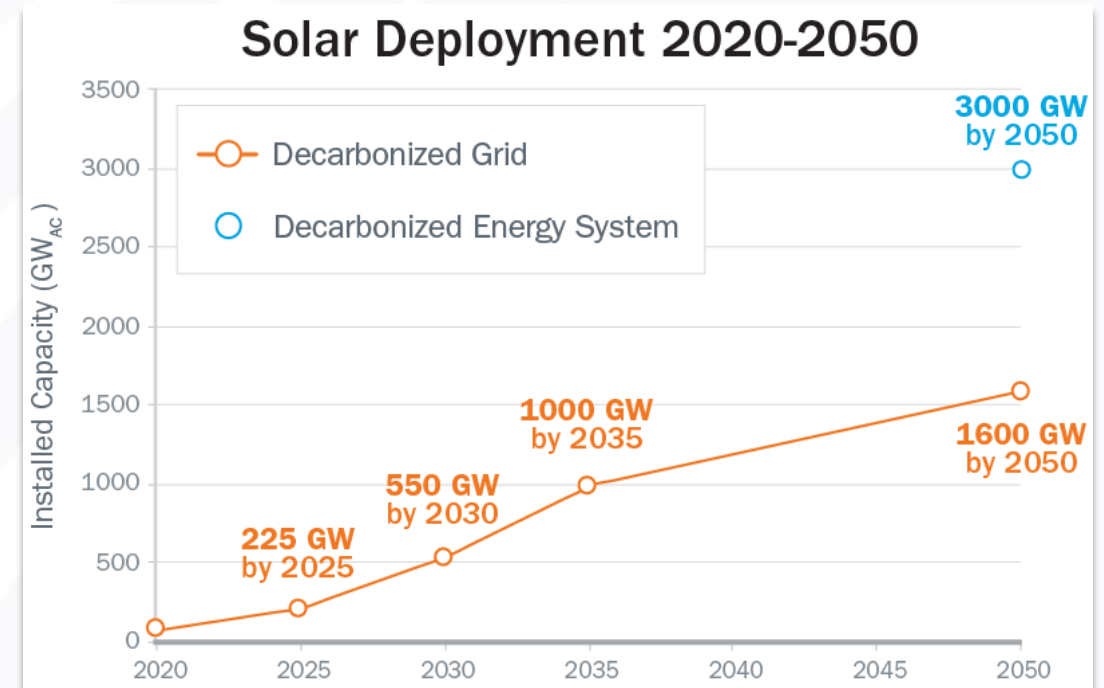
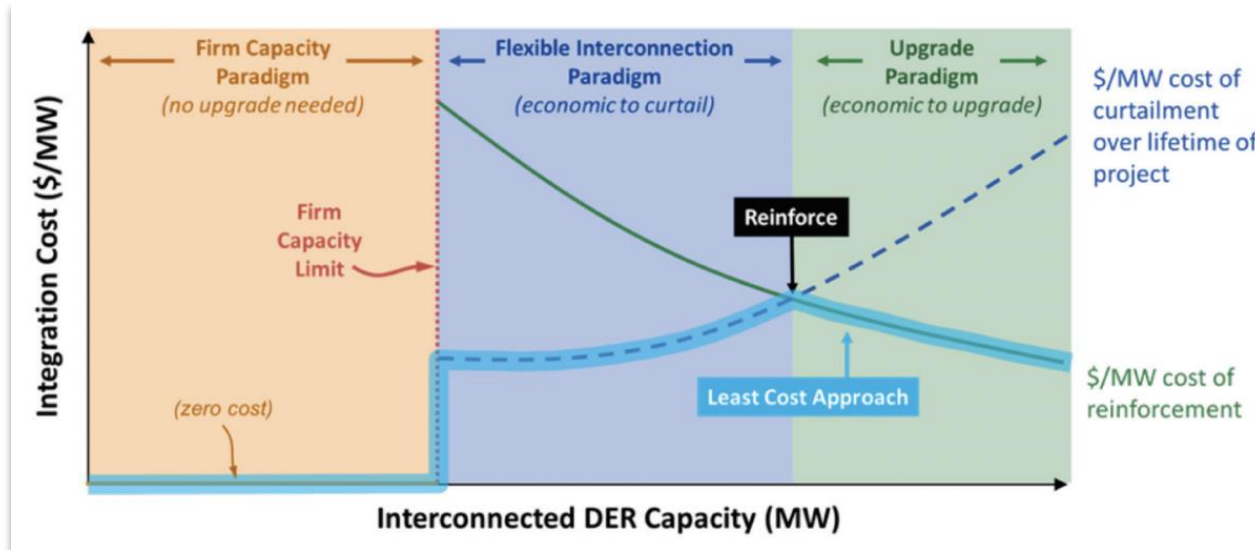


Figure from [DOE Solar Futures Study](#)

DER Topic 2: Queue Management & Flexible Interconnection

[EPRI, 2020a](#): Illustration of the economic opportunity for flexible interconnection



Objective: Discuss ways to enhance conventional interconnection approaches and explore the promise of emerging flexible interconnection approaches.

Prompt Questions:

- Which approaches to conventional and flexible interconnection are feasible, where and why?
- What flexible interconnection strategies are most suitable, under what conditions?
- What will it take to make flexible interconnection a norm? What technical, regulatory, and customer concerns must be overcome?

Examples of Curtailment Logic (adapted from [EPRI, 2020a](#))

Curtailment Logic	Description
Last-in-first-out	DER units are curtailed in the reverse order in which they applied for network connection.
Pro-rata	DER units are equally curtailed in proportion to their contribution to network constraints.
Competitive bidding	DER units with the lowest bids to use network capacity are required to curtail.
Emissions-based priority	DER units with the highest emissions are curtailed first.

DER Topic 3: Cost Allocation Perspectives and Options

Conventional DER Interconnection Cost Allocation Approaches (adapted from [EPRI, 2020b](#))

Cost Allocation Approach	Description
Group Study	Upfront interconnection costs are spread among a group of DER applications that opt-in to be studied at the same time. Costs are recovered proportionally to each project's relative need for the upgrade.
Cost Causer Post-Upgrade Cost Sharing	All upfront mitigation costs are paid for by the initial cost causer who is subsequently reimbursed by future projects that interconnect to the upgrade circuit.
Preemptive Upgraded Cost Sharing	The utility preemptively upgrades selected circuits to accommodate anticipated DER growth and recovers pro-rated costs from future FER developers that share the upgraded circuit.
Utility Prorated Cost Sharing	Similar to Preemptive Upgrade Cost Sharing except the utility waits for a developer interconnection request to trigger a needed upgrade.

Objective: Provide an overview of current cost allocation methods, explore different perspectives on these methods, and examine options for addressing stakeholder concerns around the outcomes of current cost allocation methods.

Prompt Questions:

- What changes to IX processes might improve the efficiency and fairness of interconnection cost allocation?
- Which changes to IX upgrade cost allocation might be feasible in the near term vs long term?

DER Topic 4: Implementing DER Queue Management and Cost Allocation

Objective: Use break out groups to discuss what is needed to make emerging and innovative interconnection approaches a reality.

Prompt Questions:

- What should cost allocation and flexible interconnection agreements look like and include?
- Should there be special considerations for multi-system installations (like microgrids, or multifamily home properties) or networked systems (like virtual power plants)?
- What are the barriers to standardizing flexible interconnection and cost allocation approaches?

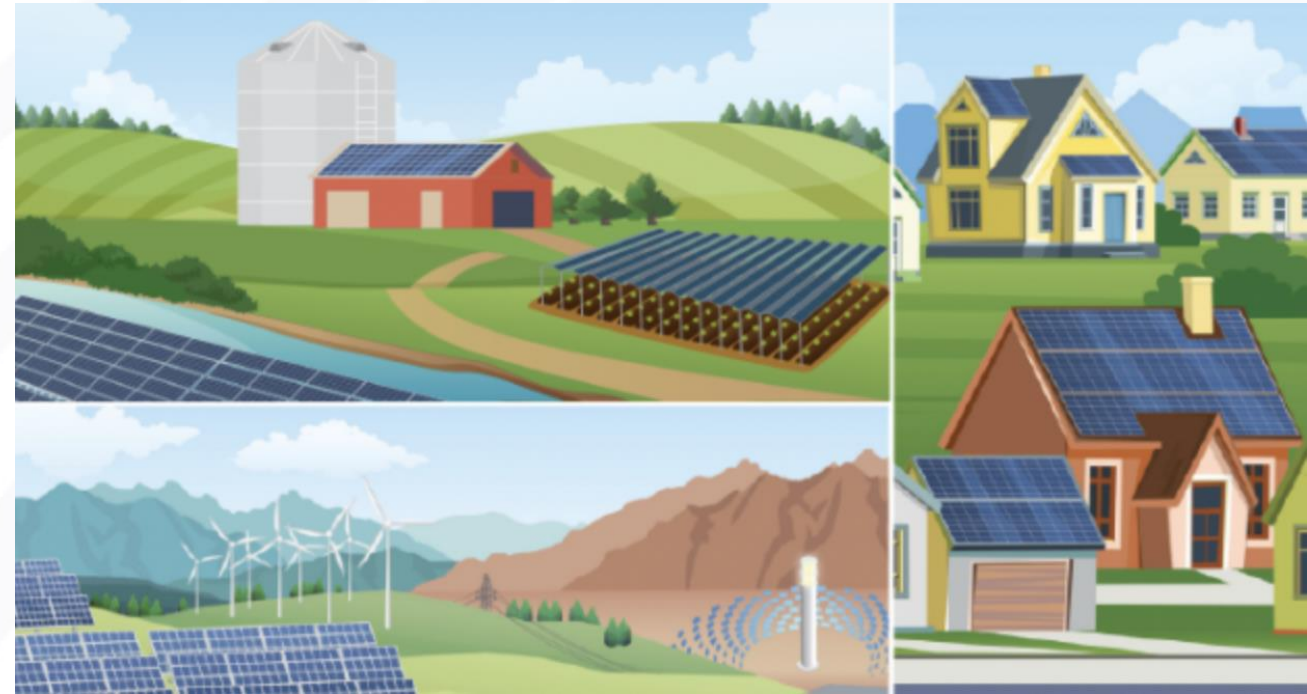


Image from [DOE Solar Futures Study](#)

Interactive Exercise