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

Draft Distributed Energy Interconnection Roadmap

September 26 | 2024

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

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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*

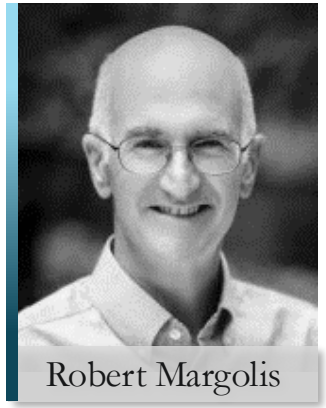
Mutual Respect . Collaboration . Openness

Agenda & Speakers

Draft Roadmap Overview

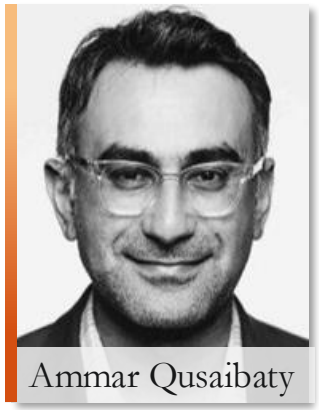
2030 Success Targets Discussion

Request For Information Overview



NREL

Robert Margolis



SETO

Ammar Qusaibaty

i2X Mission

To enable the **simpler**, **faster**, and **fairer** interconnection of clean energy resources all while enhancing the **reliability**, **resiliency**, and **security** of our electric grid.

Focus today

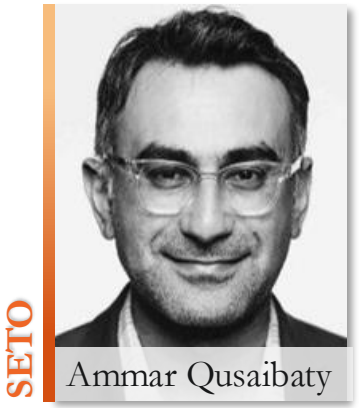
Stakeholder Engagement
Nation-wide engagement platform and collaborative working groups

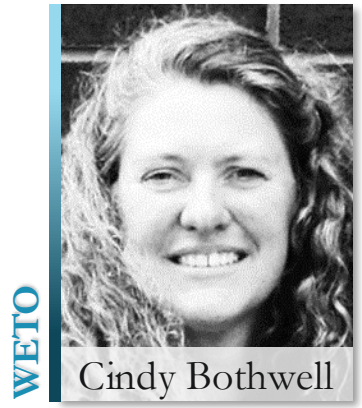
Data & Analytics
Collect and analyze interconnection data to inform solutions development

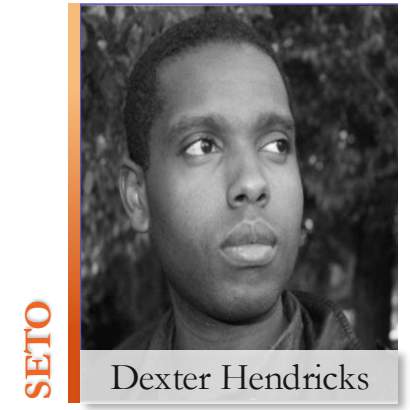
Strategic Roadmap
Create roadmap to inform interconnection process improvements

Technical Assistance
Leverage DOE laboratory expertise to support stakeholder roadmap implementation

i2X is a collaboration among DOE offices and labs







BERKELEY LAB

Pacific Northwest NATIONAL LABORATORY

Joint Office of Energy and Transportation

U.S. DEPARTMENT OF ENERGY
Office of Energy Justice and Equity

OTT Office of Technology Transitions

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
VEHICLE TECHNOLOGIES OFFICE

U.S. DEPARTMENT OF ENERGY
Office of Cybersecurity, Energy Security, and Emergency Response

Sandia National Laboratories

NREL Transforming ENERGY

GDO GRID DEPLOYMENT OFFICE

U.S. DEPARTMENT OF ENERGY | OFFICE OF ELECTRICITY

i2X INTERCONNECTION INNOVATION e-XCHANGE
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energy.gov/i2x

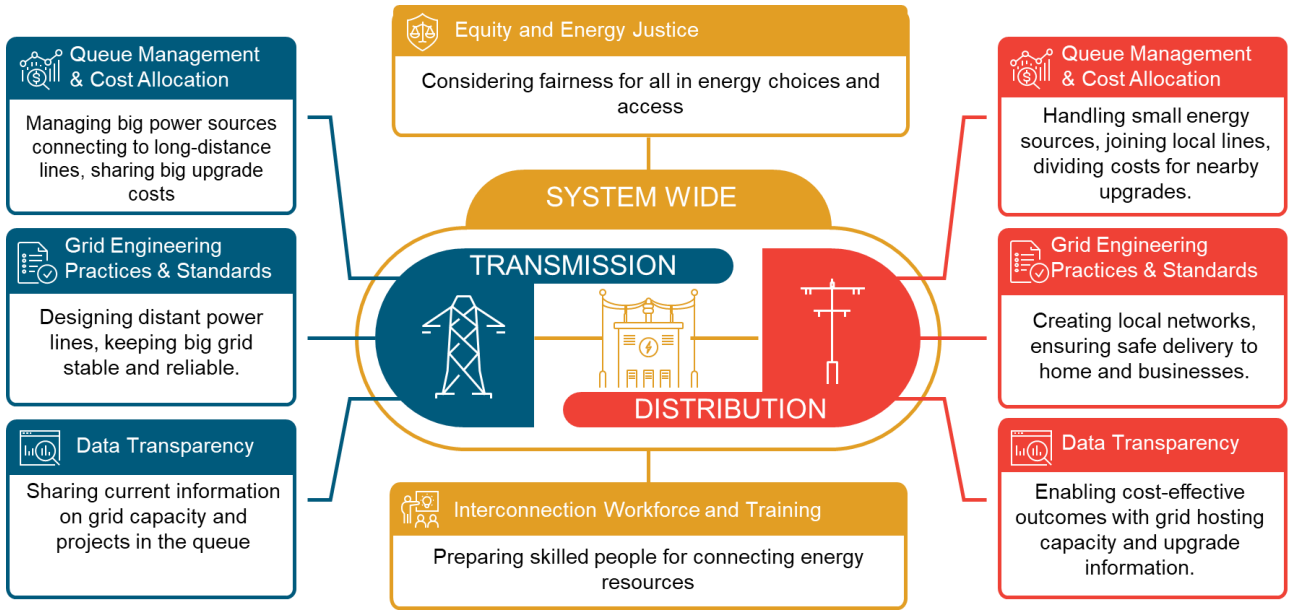
Setting up the context and purpose of this roadmap

- We aimed to ***harmonize and develop solutions*** that could provide a more comprehensive, rather than piecemeal, set of solutions based on local or state-level needs
- Solutions identified are a collection of ***viable strategies***
  → NOT rigid package of prescriptive fixes
- Some interconnection ***actors and decision makers have adopted*** a subset of these ideas already, and we try to highlight those efforts in the roadmap, where possible
- Some solutions ***are complementary*** to each other (i.e. needed to be implemented in tandem)
- Others ***are exclusive*** (i.e. adopting one might obviate the need of another)

Roadmap aims to be a starting point for discussions around pathways and solutions

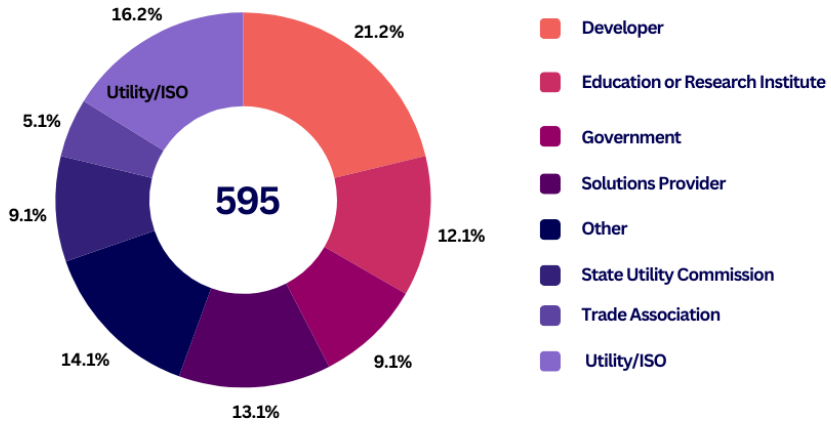
A draft roadmap informed by active stakeholder engagement

Topics Covered in our 22+ Solution e-Xchange Meetings



DER Solution e-Xchange Attendees

595 Unique attendees



Attendees from 48 utilities

Averaged 76 attendees

Total 1300 attendees

Please review the draft roadmap and share your comments and feedback by October 7, 2024

SCAN CODE

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Office of ENERGY EFFICIENCY & RENEWABLE ENERGY SCIENCE & INNOVATION ENERGY ECONOMY SECURITY & SAFETY SAVE ENERGY, SAVE MONEY

Office of Energy Efficiency & Renewable Energy

DOE Releases Draft Roadmap with Solutions to Improve Interconnection of Rooftop Solar, EV Chargers and Other Distributed Clean Energy Resources

SEPTEMBER 6, 2024

Office of Energy Efficiency & Renewable Energy »

DOE Releases Draft Roadmap with Solutions to Improve Interconnection of Rooftop Solar, EV Chargers and Other Distributed Clean Energy Resources

Stakeholders Invited to Weigh in by October 7 on How to Reduce Delays and Maintain a Reliable, Resilient, and Secure Grid

WASHINGTON, D.C.—The U.S. Department of Energy's (DOE) Interconnection Innovation e-Xchange (i2X) program released a draft roadmap to improve processes for interconnecting clean energy resources to the distribution and sub-transmission grids and seeks feedback from the public. The draft roadmap identifies strategies that the interconnection community can take within the next five years and beyond, which can lead to more reliable and resilience electric infrastructure for all Americans.

"Connecting more distributed energy resources will improve grid reliability and lower energy costs in communities across America," said **Jeff Marootian, principal deputy assistant secretary for energy efficiency and renewable energy**. "Solutions in this roadmap can help all states or regions

Please review the draft roadmap and share your comments and feedback by October 7, 2024

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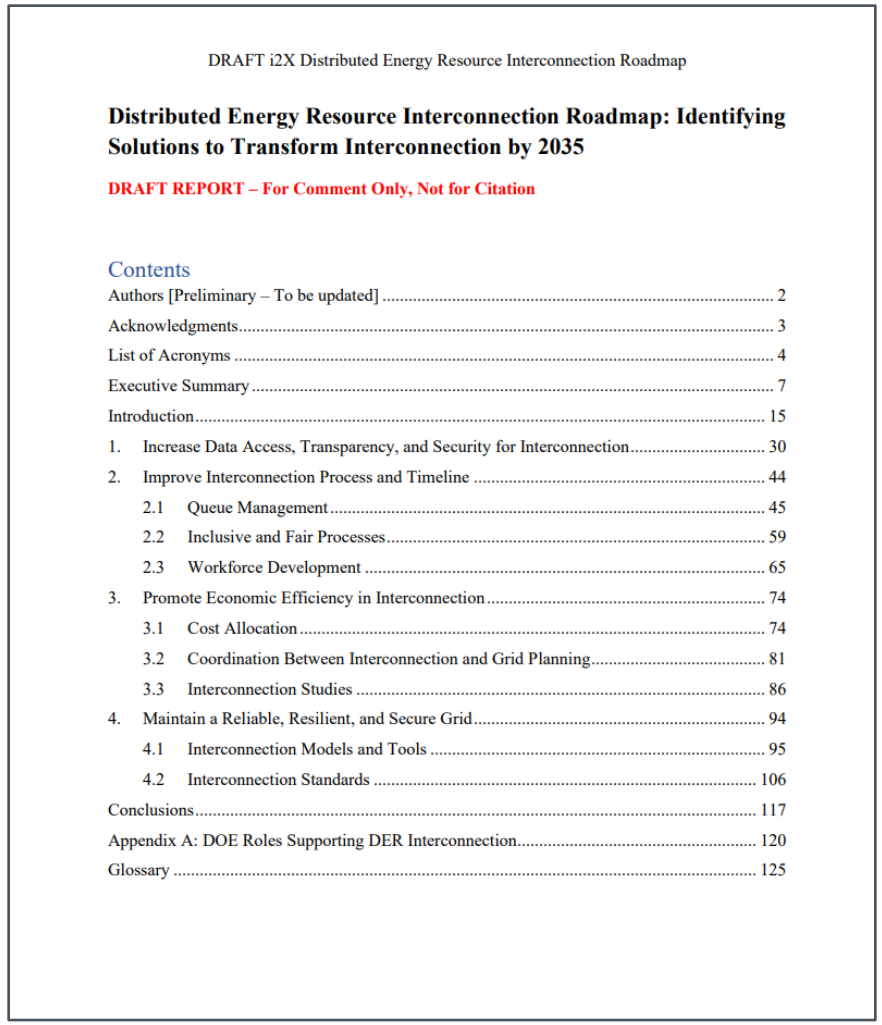


DRAFT i2X Distributed Energy Resource Interconnection Roadmap

Distributed Energy Resource Interconnection Roadmap: Identifying Solutions to Transform Interconnection by 2035

DRAFT REPORT – For Comment Only, Not for Citation

Contents

download at www.energy.gov/i2x

DER IX Roadmap Key Components and Implementation Actors

37 solutions organized in four goals

Solutions applicable at different DER deployment levels

- *Low:* Less than 5% of distribution system peak
- *Medium:* 5% -15% of distribution system peak
- *High:* Greater than 15% of distribution system peak

Solutions with different implementation time frames

- *Short-term:* within 1-3 years (by 2027)
- *Medium-term:* 3-5 years (by 2029)
- *Long-term:* beyond 5 years (2030 and after)

Solutions outline collaborative actions among key actors

- Regulators (State PUCs)
- State, local, tribal governments
- Utilities (interconnection service providers)
- Interconnection customers
- OEMs, solutions and software providers
- Equity and public benefit organizations
- Research community (including DOE)

DOE plays multiple roles in enabling Roadmap implementation

Measurable Success Targets for 2030

Interconnection processes align well with local, state, and customer's decarbonization goals

	System Size	2030 Target
 Median time from DER interconnection request to agreement	<50 kW	Instantaneous
	≥50 kW	<90 days
 Completion rate from entering the queue to execution of interconnection agreement	<50 kW	>99% within 1 day
	≥50 kW	>85% within 90 days
 Availability of public state-level interconnection queue data	N/A	50 states, DC and territories have public, detailed, and current queue data
 Reliability metric TBD	TBD	TBD

37 Solutions Organized by Four Interconnection Goals

Goal #1: Increase Data Access and Transparency

Goal #2: Improve Process and Timeline

Goal #3: Promote Economic Efficiency in Interconnection

Goal #4: Maintain a Reliable, Resilient, and Secure Grid

- Solutions are a collection of strategies rather than a rigid package of prescriptive fixes.
- Some solutions are complementary: to be effective, they would need to be implemented in tandem with others.
- Other solutions are exclusive: adopting one might obviate the need for another.
- Solutions may be topically specific (e.g., Cost Allocation)

Roadmap does not assess the costs of implementing the solutions.

37 Solutions Organized by Four Interconnection Goals

Goal 1: Increase Data Access and Transparency

- Establish guidelines for collecting and sharing grid data
- Establish and maintain frequently updated capacity analysis tools

Goal 2: Improve Process and Timing

- Automate parts of the DER interconnection study process
- Enable flexible interconnection agreements
- Upskill and expand the interconnection workforce

Key Focus Areas

- Queue Management
- Inclusive and Fair Processes
- Workforce Development

Goal 3: Promote Economic Efficiency in Interconnection

- Reform "cost-causer pays" model
- Use a group study process
- Proactively upgrade and recover costs from future DERs
- Coordinated interconnection

Key Focus Areas

- Cost Allocation
- Coordination between Interconnection and Grid Planning
- Interconnection Studies

Goal 4: Maintain a Reliable, Resilient, and Secure Grid

- Develop and implement new DER-ready system protection schemes.
- Optimize development and use of EMT models
- Use guidance from IEEE 1547.3 to address cybersecurity concerns

Key Focus Areas

- Interconnection Models and Tools
- Interconnection Standards

Goal #1 Example Solution in Detail

Solution 1.3: Standardize and clarify the technical data that developers of large DER systems must provide on interconnection applications to facilitate interconnection studies. *Short-term. Low deployment*

Actors & Activities

Actor	Engineering and Technical	Markets and Regulatory	Administrative and Organizational
Regulators		- Expand and improve requirements for study data and transparency in study assumptions.	
Utilities	- Describe study methods and requirements for supporting data that accurately model various DER technologies.	- Engage with industry trade groups to determine additional information needs for various types of DER.	- Better integrate data updates with interconnection application processing updates.
Interconnection customers		- Engage with utilities to determine additional information needs.	- Become familiar with data requirements and file correct application from the start.
Research community (including DOE)	- Develop requirements for supporting data that accurately model emerging technologies. - Update standards and certification process to account for evolving technical and operational capabilities of DER technologies	- Verify and educate industry on operating characteristics of evolving DER technologies	

Goal #3 Example Solution in Detail

Solution 3.4: Proactively upgrade feeder circuits to accommodate forecasted DER growth and recover costs from future DER developers who share the upgraded feeder circuits. *Medium-term. Medium deployment*

Actors & Activities

Actor	Engineering and Technical	Market and Regulatory	Administrative and Organizational
Regulators	- Establish method for allocating benefit from upgrades to inform cost-sharing strategies.	- Assess and mitigate potential ratepayer impacts from cost-sharing approach.	- Translate proportional benefit determinations to cost-allocation strategy.
Utilities	- Define and communicate larger-scale grid upgrade costs triggered by interconnecting customers to seek regulatory approval. - Incorporate DER forecasting into system upgrade plans.	- Seek regulatory approval to proceed with larger-scale grid upgrades triggered by interconnecting DERs or in anticipation of DER growth.	- Communicate cost-sharing expectations for projects that may want to connect to upgraded feeder circuits.
Interconnection customers		- Engage in collaborative processes to highlight potential issues and share DER forecasts.	- Industry groups could help identify where developers are most interested in deploying DERs.
Research community (including DOE)	- Help other actors develop and evaluate forecast and cost-sharing methods.		

Success Targets for 2030

	System Size	Target Value*
T1. Median time from interconnection request to agreement	<50 kW	Instantaneous
	≥50 kW	<90 days
T2. Completion rate from entering the queue to execution of interconnection agreement	<50 kW	>99% within 1 day
	≥50 kW	> 85% within 90 days
T3. Availability of public state-level interconnection queue data	N/A	50 States, DC and territories have public detailed and current queue data

These targets not intended to be authoritative or exhaustive, but aim to provide a more tangible vision for success

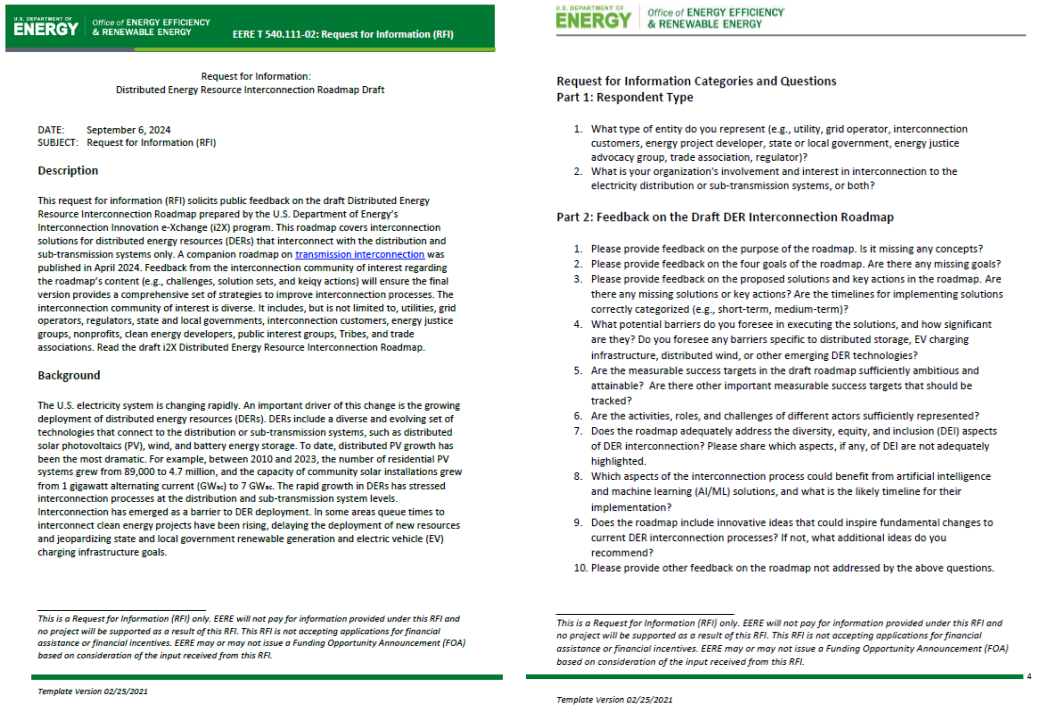
RFI responses due on 10/07

Purpose: Solicit feedback and comments from the distributed energy interconnection community about draft DER Interconnection Roadmap's content (e.g., challenges, solution sets and key actions) and to ensure the final version provides a comprehensive set of strategies to improve the interconnection processes.

Responses: Read draft Roadmap and respond to any specific question or all questions as desired. Feel free to elaborate on gaps and share your comments and feedback in your answers to the question.

Submission & Deadline: Email your feedback as an attachment to i2X@ee.doe.gov by 10/07 11:59 pm ET.

Please respond with no more than 15 pages in length, 12-point font, 1-inch margins.



U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

EERE T 540.111-02: Request for Information (RFI)

Request for Information:
Distributed Energy Resource Interconnection Roadmap Draft

DATE: September 6, 2024
SUBJECT: Request for Information (RFI)

Description

This request for information (RFI) solicits public feedback on the draft Distributed Energy Resource Interconnection Roadmap prepared by the U.S. Department of Energy's Interconnection Innovation e-Xchange (i2X) program. This roadmap covers interconnection solutions for distributed energy resources (DERs) that interconnect with the distribution and sub-transmission systems only. A companion roadmap on transmission interconnection was published in April 2024. Feedback from the interconnection community of interest regarding the roadmap's content (e.g., challenges, solution sets, and keiqy actions) will ensure the final version provides a comprehensive set of strategies to improve interconnection processes. The interconnection community of interest is diverse. It includes, but is not limited to, utilities, grid operators, regulators, state and local governments, interconnection customers, energy justice groups, nonprofits, clean energy developers, public interest groups, Tribes, and trade associations. Read the draft i2X Distributed Energy Resource Interconnection Roadmap.

Background

The U.S. electricity system is changing rapidly. An important driver of this change is the growing deployment of distributed energy resources (DERs). DERs include a diverse and evolving set of technologies that connect to the distribution or sub-transmission systems, such as distributed solar photovoltaics (PV), wind, and battery energy storage. To date, distributed PV growth has been the most dramatic. For example, between 2010 and 2023, the number of residential PV systems grew from 89,000 to 4.7 million, and the capacity of community solar installations grew from 1 gigawatt alternating current (GW_{AC}) to 7 GW_{AC}. The rapid growth in DERs has stressed interconnection processes at the distribution and sub-transmission system levels. Interconnection has emerged as a barrier to DER deployment. In some areas queue times to interconnect clean energy projects have been rising, delaying the deployment of new resources and jeopardizing state and local government renewable generation and electric vehicle (EV) charging infrastructure goals.

This is a Request for Information (RFI) only. EERE will not pay for information provided under this RFI and no project will be supported as a result of this RFI. This RFI is not accepting applications for financial assistance or financial incentives. EERE may or may not issue a Funding Opportunity Announcement (FOA) based on consideration of the input received from this RFI.

Template Version 02/25/2021

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Request for Information Categories and Questions
Part 1: Respondent Type

1. What type of entity do you represent (e.g., utility, grid operator, interconnection customers, energy project developer, state or local government, energy justice advocacy group, trade association, regulator)?
2. What is your organization's involvement and interest in interconnection to the electricity distribution or sub-transmission systems, or both?

Part 2: Feedback on the Draft DER Interconnection Roadmap

1. Please provide feedback on the purpose of the roadmap. Is it missing any concepts?
2. Please provide feedback on the four goals of the roadmap. Are there any missing goals?
3. Please provide feedback on the proposed solutions and key actions in the roadmap. Are there any missing solutions or key actions? Are the timelines for implementing solutions correctly categorized (e.g., short-term, medium-term)?
4. What potential barriers do you foresee in executing the solutions, and how significant are they? Do you foresee any barriers specific to distributed storage, EV charging infrastructure, distributed wind, or other emerging DER technologies?
5. Are the measurable success targets in the draft roadmap sufficiently ambitious and attainable? Are there other important measurable success targets that should be tracked?
6. Are the activities, roles, and challenges of different actors sufficiently represented?
7. Does the roadmap adequately address the diversity, equity, and inclusion (DEI) aspects of DER interconnection? Please share which aspects, if any, of DEI are not adequately highlighted.
8. Which aspects of the interconnection process could benefit from artificial intelligence and machine learning (AI/ML) solutions, and what is the likely timeline for their implementation?
9. Does the roadmap include innovative ideas that could inspire fundamental changes to current DER interconnection processes? If not, what additional ideas do you recommend?
10. Please provide other feedback on the roadmap not addressed by the above questions.

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After Submission: i2X team to make changes to the draft Roadmap based on feedback and comments, when possible, without attribution to respondents. We will not respond to individual submissions or publish publicly a compendium of responses.

We like your feedback on …

- Purpose of the Roadmap and its role as a guide to all
- Coverage of solutions around four foundational goals
- Significant barriers to implementing solutions
- Balancing burdens of change across all involved actors and decision makers
- Adequacy in highlighting the diversity, equity, and inclusion (DEI) aspects of interconnection
- Role of artificial intelligence and machine learning in address interconnection challenges
- Missing concepts, focus areas or goals, or solutions

Share your feedback about the Roadmap draft by 10/07/2024

Request for Information

scan QR code to access

Draft Roadmap

scan QR code to access

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

Thank You!

Website: energy.gov/i2X

Email: i2x@ee.doe.gov