PAVING THE WAY

EMERGING BEST PRACTICES FOR ELECTRIC VEHICLE CHARGER INTERCONNECTION

JUNE 2022

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AUTHOR

Mari Hernandez

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The Interstate Renewable Energy Council (IREC) builds the foundation for rapid adoption of clean energy and energy efficiency to benefit people, the economy, and our planet. Its vision is a 100% clean energy future that is reliable, resilient, and equitable. IREC develops and advances the regulatory reforms, technical standards, and workforce solutions needed to enable the streamlined integration of clean, distributed energy resources. IREC has been trusted for its independent clean energy expertise for nearly 40 years, since its founding in 1982.

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PAVING THE WAY

IREC's ***Paving the Way* series** covers three topics related to electric vehicles (EVs): vehicle-to-grid (V2G) standards, equitable shared mobility programs, and EV charger interconnection timelines. In this series, IREC provides pathways and considerations for transitioning to electrified transportation in a manner that is equitable, efficient, and beneficial to the grid.

- In ***Paving the Way: Vehicle-to-Grid (V2G) Standards for Electric Vehicles***, we review the status of V2G standards and any gaps that need to be addressed to unlock the capabilities of V2G-enabled equipment.
- In ***Paving the Way: Enabling Equitable Electric Vehicle Shared Mobility Programs***, we highlight existing programs that are demonstrating the importance of building equity into shared mobility and EV infrastructure programs.
- In ***Paving the Way: Emerging Best Practices for Electric Vehicle Charger Interconnection***, we discuss the strategies that states and utilities can use to streamline the interconnection of EV charging infrastructure.

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I. EXECUTIVE SUMMARY

As electric vehicle (EV) adoption grows, many policymakers across the country are recognizing the need for greater availability of charging infrastructure and have begun allocating funding to meet future EV charging demand. However, to efficiently deploy this charging infrastructure, improvements are needed to some of the policies and practices that govern how charging equipment is connected to the electric grid. Delays at different stages of the process currently create uncertainty for project developers and slow down the transition to electrified transportation.

To understand how to improve the process of connecting EV charging stations (EVCS) to the grid, IREC conducted a survey of EVCS developers that work across multiple states and cover a broad share of the EV charger market. According to the survey, the main factors that contribute to longer timelines include 1) interconnection process delays, 2) difficulties obtaining easements (which grant utilities the right to install, access, and service electrical equipment on a property), and 3) slow permitting processes. The table below summarizes the developer-identified challenges, the emerging or recommended practices that can be used to address them, and the entities capable of implementing the new practices or programs.

Challenge Identified in IREC Survey		Emerging or Recommended Practices to Address Challenge	Responsible Party
Interconnection process delays	Lack of utility staff and resources dedicated to EV infrastructure projects	Ensure that any staff working on EV infrastructure projects have charger-specific knowledge to more efficiently manage charger installation requests, respond to inquiries, and complete utility design and approval processes.	Utilities
	Lack of EV infrastructure-specific policies or programs	Require utilities to implement programs that allow for more cost- and time-efficient charger interconnections, such as make-ready programs.	State Legislatures
	Lack of clear interconnection processes and timelines for each step of the process	Require utilities to publish average interconnection timelines for each step of the process to help applicants with project planning and scheduling.	State Regulatory Agencies
		Publish guides for applicants that detail the interconnection steps and delineate the responsibilities of each party.	Utilities
	Long lead times for utility equipment upgrades	Ensure that transformers and other common upgrade equipment are kept on-hand to reduce timelines when grid upgrades are required. Track the time it takes to complete upgrades for EVCS projects to identify process improvements and any common issues that need to be addressed.	Utilities

Table cont. on next page

Challenge Identified in IREC Survey		Emerging or Recommended Practices to Address Challenge	Responsible Party
Interconnection process delays	Lack of grid transparency	Require utilities to publish hosting capacity maps that include data to help identify load capacity constraints on the grid.	State Regulatory Agencies
		Provide upfront evaluation services of multiple sites to help applicants identify ideal locations for charging infrastructure before submitting a service request.	Utilities
	Lack of utility performance measures or incentives	Adopt performance incentives and/or penalties to encourage more efficient processing of EV charger applications.	State Regulatory Agencies
Difficulties obtaining utility easements		Make easement language publicly available and allow it to be incorporated into the lease agreement between the EVCS developer and the site host.	Utilities
Slow permitting processes		Ensure that information about the permitting process, including a list of any materials required to be submitted along with a permit request, is online and easy to find. Other ways to improve the permitting process include: creating an online portal for applicants; adopting expedited review policies; and providing dedicated staff for review of EV infrastructure applications.	Authorities Having Jurisdiction (AHJs)
		Adopt a model statewide municipal EV ordinance that can streamline the approval process, such as designating EV charger and make-ready parking spaces as a permitted accessory use.	State Legislatures

These initial challenges and emerging best practices can provide guidance for jurisdictions looking to enable the rapid deployment of EV chargers. As EV charger penetration increases, further research will be needed to assess the effectiveness of these and other strategies to reduce interconnection timelines.

II. INTRODUCTION

Electrifying transportation is a critical part of decarbonizing the U.S. economy. The transportation sector currently comprises nearly 30 percent of U.S. greenhouse gas emissions,[1] and overtook the electric power sector to become the largest source of carbon emissions in 2017.[2] To address increasing transportation emissions, states have begun to encourage the use of electric vehicles (EVs) through incentives and mandates.

However, the rapid adoption of EVs is dependent upon the availability of a broad network of charging infrastructure, which includes both private and public chargers. A recent study estimated that to support electric vehicle growth through 2030, the U.S. will need to invest $28 billion in order to reach 2.4 million non-home chargers. These include chargers sited at workplaces, shopping centers, and at strategic points along roadways.[3] Through the Infrastructure Investment and Jobs Act enacted in November 2021, the Biden Administration plans to address a portion of the infrastructure investment needed with $7.5 billion that will be allocated to states and communities for the deployment of public charging stations.[4]
New policies and investments will help to increase the deployment of EV supply equipment (EVSE).[5] But in order to accommodate the required growth, utilities must have efficient processes in place to interconnect new chargers to the grid, especially in preparation for a surge of new service requests that could result from federal spending. Delays resulting from inefficient charger interconnection and other processes, such as permitting and obtaining easements, can add weeks or months to a project's timeline.[6] The resulting "soft costs" are hard to quantify but can significantly impact charger deployment. To meet current and future demand for EV charging, states, utilities, and local governments will need to move swiftly to incorporate interconnection and permitting policies that can enable the safe and efficient buildout of EVSE.

The purpose of this paper is to review the process for connecting EV chargers to the grid, list the challenges faced by third-party EV charging station (EVCS)[7] developers, and identify options for addressing these challenges through new policies and practices at the state, local, and utility levels. To understand EV charging infrastructure interconnection and permitting barriers as well

About the EV Charging Station Developer Survey

In 2021, IREC developed a brief, 12-question survey designed specifically for EVCS developers to determine both the interconnection challenges they are facing and the ways in which those challenges are being addressed. IREC sent the survey to 10 EVCS developers that work across multiple states, cover a broad share of the EV charger market, and install Level 2 and/or direct current (DC) fast chargers. IREC received responses from 6 of the 10 developers who shared their input on the condition of anonymity. Given the small sample size, this survey is not meant to capture the experiences of all EVCS developers in every state. Rather, the purpose of the survey is to highlight interconnection challenges and solutions that developers working nationwide are seeing emerge in multiple jurisdictions that may provide guidance for states, utilities, and local governments to improve the pace and efficiency of EV charger interconnections.

as emerging best practices, IREC conducted a survey of EVCS developers and the results have informed the challenges and potential solutions identified in the paper. Though the challenges cited by EVCS developers relate to both process and other barriers, such as costs and incentives, this paper is mainly focused on solutions to process-related challenges that impact grid connection timelines. (For the purposes of this paper, the term "interconnection" is sometimes broadly applied to include the steps not directly involved with connecting the EVCS to the electric grid, such as permitting and easements, given how those steps can impact the overall timeline. These steps and the responsible parties are discussed in greater detail on page 9.)

III. EVSE INTERCONNECTION PROCESS

The process and complexity of connecting charging equipment to the grid can vary based on the type of charging infrastructure. The figure below provides details on the three different types of EVSE, including their respective voltage levels and their charging rate per hour.

Figure 1. Types of EV Chargers

EV chargers are identified by their respective levels of charging power:[8]

LEVEL 1

Level 1 uses a standard 120 volt (V) alternating current (AC) power connection with a power output of between 12 and 16 amps, and offers charging speeds of 3.5 to 6.5 miles per hour.

LEVEL 2

Level 2 requires a 208/240 V AC connection, produces 16 to 40 amps of power output, and can charge EVs at a rate of 14 to 35 miles per hour.

DCFC

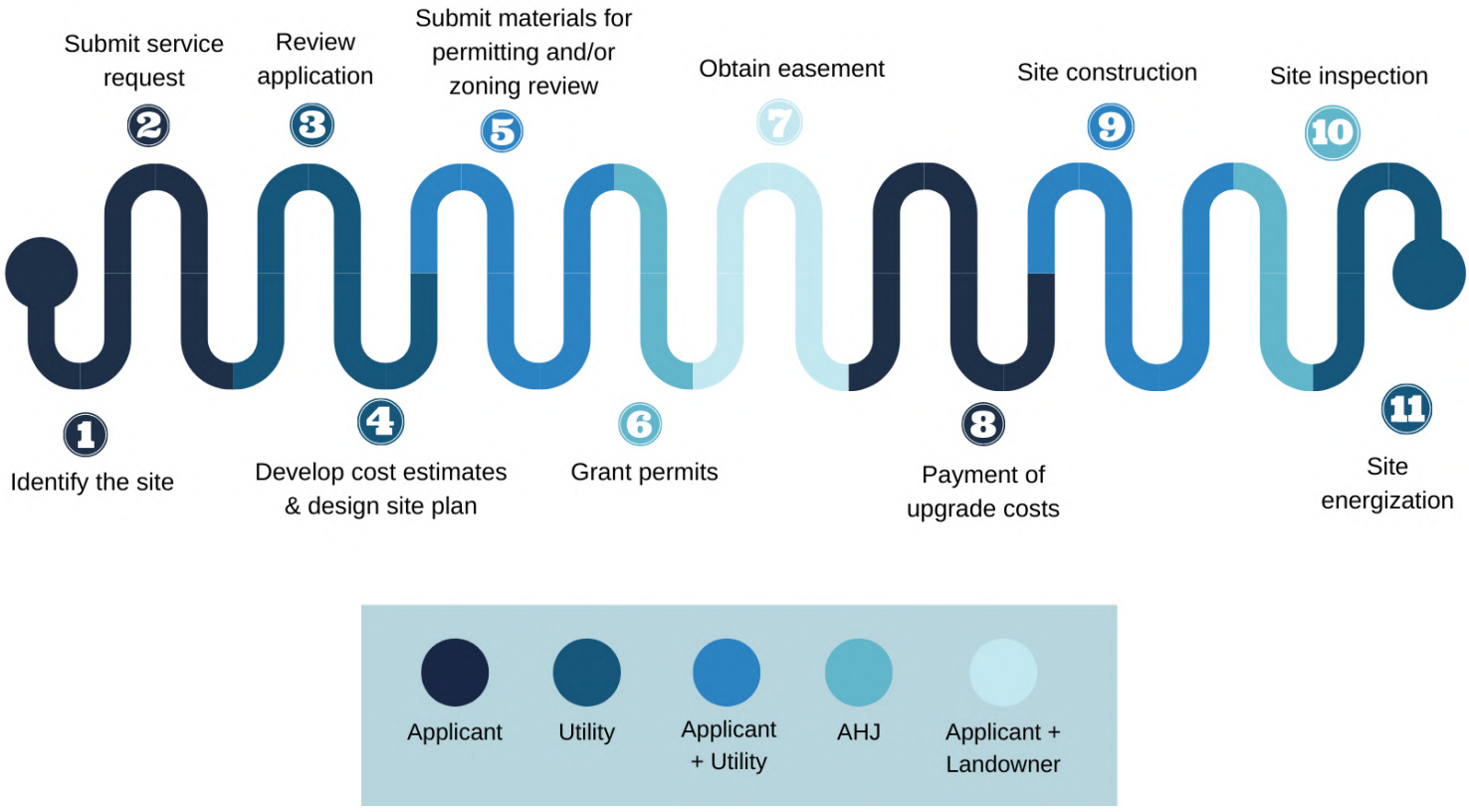
Direct current fast chargers (DCFC) typically require inputs of at least 480 volts and 100 amps of power output (50-60 kilowatts, or kW), and can provide charging speeds of 178 miles per hour and higher.[9]

The different types of chargers serve a variety of purposes, including charging at a home or workplace where a car will be parked for longer durations (Level 1 or Level 2), charging in a commercial area or parking lot when parked for shorter periods (Level 2 or DCFC), or quick charging during long distance trips (DCFC).

Interconnecting EV chargers to the grid involves steps that a customer or developer must follow to secure utility service and safely begin operation—similar to connecting other types of load, such as new residential or commercial buildings.[10] The number of steps required depends on the type of charger being used or installed. Because Level 1 chargers include standard 120 V outlets, they may not require anything other than making sure an existing outlet can support charging an EV (i.e., the circuit is not overloaded and no changes to the electricity panel, outlet, or utility service are necessary). For customers installing new outlets that trigger either building or grid upgrades (as determined by an electrician or utility, respectively) or require construction to house or protect the outlet(s), permitting, upgrade costs, and/or a utility service request may apply.

Level 2 charging stations and DC fast chargers draw more power from the grid and, thus, are more likely to involve lengthy and expensive processes, especially as compared to Level 1, because utilities must ensure that the existing power supply can meet the new demand. If not, the utility will determine the cost of any grid upgrades necessary to support new load and allow the new charger(s) to be installed. Additionally, there are permitting and/or utility easement requirements that may factor into the overall installation process. Figure 2 illustrates the process for connecting EV chargers to the grid and notes the parties responsible for each step, with a focus on Level 2 and DC fast chargers which would typically be installed in public locations, workplaces, or multi-unit dwellings. These steps may vary between jurisdictions and some of them may overlap with other steps rather than being completed sequentially.

Figure 2. The Path to Connecting EV Chargers to the Grid



Steps to Connect EV Chargers to the Grid

A. Pre-Application Work
For EV charger interconnection applicants, the process begins with identifying a potential site or sites where the charger(s) will be installed. Site selection can include: evaluating travel patterns or existing fleet routes and any other data necessary to identify a favorable location with available space for charging equipment; determining the potential site's existing electrical service and capacity; determining potential grid upgrade costs that may impact the project; identifying and negotiating with a site owner willing to have chargers installed on their property; and evaluating easement and permitting requirements.[11]

B. Application for Service
Once a location has been selected, the applicant submits an application for new service or service extension to the utility along with any other required materials. These materials can include a project information sheet, an assessment of existing site load, a site plan, a single-line diagram, and a load calculation.[12]

C. Utility Review & Design
The utility reviews the application materials for completeness and will request any missing information if necessary. When the application is deemed complete, the utility will perform a technical review, which can include a phone call or site walk with the applicant (if offered by the utility), a review of existing electrical capacity at the site, and an evaluation of potential grid impacts due to any additional load requirements.[13] The utility can then develop cost estimates and a design plan for the site.

D. Permitting & Zoning
The site plans and any other required materials are sent to the authority having jurisdiction (AHJ) for review and approval.[14] Permitting requirements vary by jurisdiction but non-residential EVCS typically require an electrical permit and, if building construction or modifications are proposed, a building permit.[15] Zoning review and approval requirements also vary by AHJ. Some states and municipalities have passed ordinances to allow applicants to bypass zoning review.[16]

E. Utility Easements
A utility easement agreement, also known as an access agreement, grants the utility the right to access, install, and maintain equipment located on private property. If easements are necessary (i.e., utility equipment will be installed on private property), the applicant must work with the landowner/potential site host to obtain permission for the utility to maintain any grid equipment added to serve the chargers at the site.

F. Payment of Upgrade Costs
If service upgrades are required for interconnection, they are included in the utility's cost estimates and the applicant must pay for them before construction begins. Depending on the specific policies in place, there may be a construction allowance for some of the costs incurred on the utility side of the meter.[17] Additionally, utilities may be permitted to distribute interconnection costs across their rate payers when the chargers benefit other customers.[18]

G. Construction
In addition to installing the charging equipment, the applicant is typically responsible for any work between the charger and the utility meter,[19] which can include trenching if underground lines are being installed or upgraded. Typically, this work is completed prior to the start of utility construction, which will require a final permit from the AHJ. The utility is responsible for completing any grid upgrades and laying any wiring to connect the charger to the grid.[20] If a contractor completed any required trenching, the utility inspects it before placing the power lines in the conduit.[21]

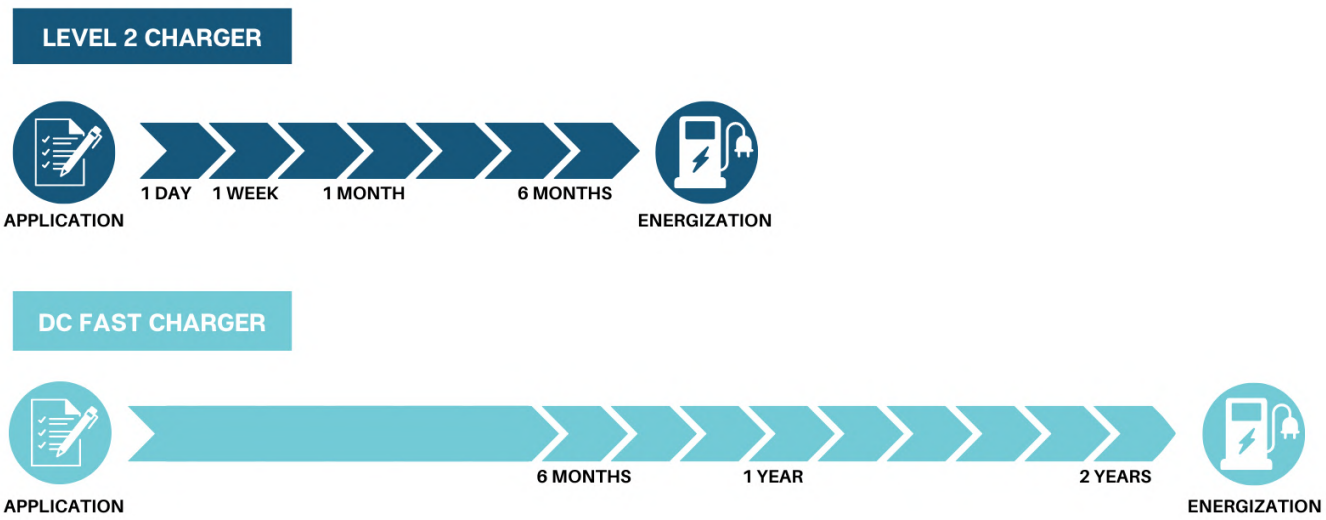
H. Local Government Inspection
Once construction is complete, the applicant arranges for inspection of the electrical panel and any other work that required a permit from the AHJ.

I. Meter Installation, Inspection & Site Energization
The last step consists of the utility installing the meter, performing a final inspection, and energizing the site.

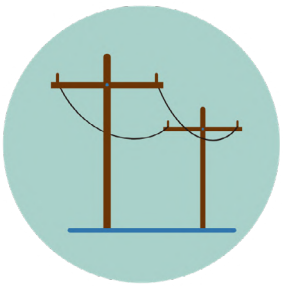
IV. INTERCONNECTION CHALLENGES

Due to potential delays at any step of the process, charger interconnection timelines can vary widely from one project to the next. This creates uncertainty for project developers and slows down the transition to electrified transportation. According to developers, timelines for Level 2 charger interconnection can range from less than one day to six months, mainly due to interconnection and permitting delays.[22] For DC fast chargers, developer-reported timelines ranged from six months to more than two years.[23]

Figure 3. Comparison of Level 2 and DC Fast Charger Timelines



Prolonged grid connection timelines can result from a variety of factors, including inefficient and sometimes unclear, policies and practices at the state, local, and utility levels.[24] According to IREC's survey, the main factors that contribute to longer timelines include interconnection process delays, difficulties obtaining easements, and slow permitting processes.[25]



Interconnection Process Delays

Difficulties Obtaining Easements

Slow Permitting Processes

Table 1 on the next page lists all challenges that impact grid connection timelines identified by developers in IREC's EV Charging Station Developer Survey, and select resources that highlight the same barriers.

Table 1: EV Charger Grid Connection Challenges

Challenge Identified in IREC Survey		Description	Additional Resources Citing These Findings[26]
Interconnection process delays	Lack of utility staff and resources dedicated to EV infrastructure projects	Utilities without dedicated staff and resources for EV charger projects may not be well equipped to efficiently handle EV charger interconnection applications.	GO-BIZ Report (p. 51); SEPA 2019 Report (pp. 17, 21); RMI 2019 Report (pp. 39-40); EVgo Connect the Watts – Utilities[27]
	Lack of EV infrastructure-specific policies or programs	States and local jurisdictions without specific policies or programs designed to decrease the costs and time involved in connecting EV chargers to the grid may have difficulty meeting electrification goals and future EV charger demand.	EVgo Connect the Watts – Public Funding[28]
	Lack of clear interconnection processes and timelines for each step of the process	Utilities may not provide applicants with clear timelines and expectations, especially related to construction work, which can make scheduling difficult and delay charger installations.	GO-BIZ Report (p. 51); SEPA 2019 Report (p. 16)
	Long lead times for utility equipment upgrades	Utilities typically have to order common upgrade equipment, such as transformers, as needed rather than keeping an inventory, which can add weeks or months to a project timeline.	SEPA 2019 Report (p. 21); EVgo Connect the Watts – Utilities
	Lack of grid transparency	Utilities may not provide easily accessible grid data or other services that could help applicants identify favorable locations for chargers before submitting an application.	GO-BIZ Report (p. 51); SEPA 2019 Report (p. 33); RMI 2019 Report (p. 22); EVgo Connect the Watts – Utilities
	Lack of utility performance measures or incentives	Utilities are not incentivized or mandated to meet minimum timelines to approve applications, study projects, or complete construction, leading to slower processes and uncertainty about project completion timeframes.	
Difficulties obtaining utility easements		Applicants are responsible for obtaining utility easements from property owners and the agreement is typically not included within the site lease between the applicant and property owner, which adds an additional step and slows down the process.	SEPA 2019 Report (p. 46); EVgo Connect the Watts – Utilities
Slow permitting processes		Obtaining permits for electrical and construction work can be a lengthy process, especially when the permitting authority lacks clear policies and practices that can shorten timelines for EVSE projects.	GO-BIZ Report (p. 18); SEPA 2019 Report (pp. 16, 18); EVgo Connect the Watts – Local Permits[29]

In IREC's EV Charging Station Developer Survey, survey respondents identified policies and practices that jurisdictions should consider to improve interconnection timelines. These include the lack of dedicated staff and resources for EV projects, the lack of EV infrastructure-specific policies or programs, the lack of clear interconnection processes and timelines, long lead times for utility equipment upgrades, the lack of grid transparency, and the lack of utility performance measures or incentives. The next section will highlight the emerging best practices that can help to address these challenges.

Emerging Issue: Grid Capacity Constraints

One challenge not mentioned in the survey, but discussed by peer reviewers, is the emerging issue of grid capacity constraints. As EV charging and other electrification efforts lead to increased electricity demand in the coming years, utilities will likely face more frequent capacity constraints across their distribution systems. These constraints can lead to more costly and time-consuming grid upgrades, which can deter or greatly delay the interconnection of EV charging stations. Regulators may need to consider a suite of tools to effectively deal with such constraints, such as load hosting capacity analysis maps and other grid transparency resources to help with project siting (discussed further in the next section). In addition, some states are currently considering proactive hosting capacity upgrade models that, if designed and implemented properly, could reduce the time and cost of interconnection by increasing the available capacity on particular sections of the grid (though current models don't focus on load).[30]

V. EMERGING BEST PRACTICES

Efforts to streamline the interconnection of EV chargers are being explored by many states and local governments to meet their climate and electrification goals as well as the growing demand for EV charging infrastructure. Many utilities are also recognizing the need for process improvements and are instituting policies and practices that help to shorten charger interconnection timelines. These emerging best practices, along with the challenges they address from the preceding section, are detailed in the tables below. For challenges that may lack existing solutions, recommended practices—based on survey responses and IREC's experience engaging in DER interconnection regulatory proceedings across the U.S.—are offered.

Challenge: Lack of Staff and Resources Dedicated to EV Infrastructure Projects	
Responsible Party	**Emerging Best Practice**
Utilities	Ensure that any staff working on EV infrastructure projects have charger-specific knowledge. Dedicated EV staff familiar with EVCS projects can manage charger installation requests, respond to inquiries, and complete utility design and approval processes more efficiently.[31] *For smaller utilities*, this could include ensuring that each project has a dedicated account representative to help applicants navigate the process and provide status updates. *For larger utilities*, in addition to a single point of contact for each project, this could include dedicated engineering, support staff, and construction crews to help with design, scheduling, and completion of the utility's portion of the construction work. *Example*: California utility Pacific Gas & Electric has a dedicated team for EV projects, including account representatives and construction crews, which some developers cited as a practice that can improve the efficiency of the interconnection process.[32] Additionally, PG&E offers an online customer portal which is an easily accessible way for applicants to check the status of their projects.[33]

Challenge: Lack of EV Infrastructure-Specific Policies or Programs	
Responsible Party	**Emerging Best Practice**
State Legislatures	Require utilities to implement programs that allow for more cost- and time-efficient charger interconnections. For example, "make-ready" programs can reduce the infrastructure costs incurred by EVCS developers and, if completed during the construction of new buildings, could help to streamline part of the interconnection process at make-ready sites. There are varying program designs, but make-ready programs generally require utilities to cover all or a portion of the cost of installing equipment and wiring on the utility side of the meter and, in some cases, the customer side of the meter as well. Make-ready investments can include "service panels, junction boxes, conduit, wiring, and other components necessary to make a particular location able to accommodate EVSE on a "plug and play" basis."[34] *Examples*: In 2020, the California legislature passed Assembly Bill 841, which requires utilities to design, construct, and maintain all distribution equipment on the utility side of the meter at no cost to the customer.[35] In 2021, Connecticut adopted a make-ready program to encourage greater deployment of EV chargers through incentives to cover infrastructure costs and included an incentive adder for chargers located in underserved communities.[36] As part of the program, the CT Public Utilities Regulatory Authority (PURA) directed participating utilities to develop a hosting capacity map that could be used by applicants to help identify potential sites located in underserved areas.[37]

Challenge: Lack of Clear Interconnection Processes and Timelines	
Responsible Party	**Emerging Best Practices**
State Regulatory Agencies	Require utilities to publish average interconnection timelines for each step of the process to help applicants with project planning and scheduling. *Example*: In October 2021, the California Public Utilities Commission (CPUC) adopted a resolution to establish clearer timeframes for the EV charging infrastructure interconnection process in order to improve customer service and transparency.[38] The resolution required regulated utilities to hold a stakeholder workshop in the first quarter of 2022 and then propose the average number of business days it should reasonably take them to process an EV charger application (from initial service request to site energization) as well as recommend internal suggestions to improve energization timelines[39] within 60 days of the workshop.[40]
Utilities	Publish guides for applicants that detail the interconnection steps and delineate the responsibilities of each party. *Example*: Xcel Energy published an EV charging station guide that provides information about each step of the process along with the party responsible and an approximate timeframe.[41] Many utility websites include some information for homeowners or business owners interested in installing an EV charger for their own use, but do not provide any type of guidance for EVCS developers.

Challenge: Long Lead Times For Utility Equipment Upgrades	
Responsible Party	**Recommended Practices**
Utilities	Ensure that transformers and other common upgrade equipment are kept on-hand to reduce timelines when grid upgrades are required. Unfortunately, there is a lack of public documentation that details internal utility upgrade processes and practices, such as whether utilities keep an inventory of equipment that can be used for commonly required EVCS upgrades. According to EVCS developers, some utilities regularly purchase “made to order” transformers, which can add a significant amount of time to the interconnection process.[42] Track the time it takes to complete upgrades for EVCS projects to determine whether any major bottlenecks are related to equipment purchasing or crew scheduling/completion of upgrade work. Use upgrade timeline tracking to identify process improvements and any common issues that need to be addressed.

Challenge: Lack of Grid Transparency	
Responsible Party	**Emerging Best Practices**
State Regulatory Agencies	Require utilities to publish hosting capacity maps[43] that include data to help identify load capacity constraints on the grid. *Example*: Nevada requires investor-owned utility NV Energy to provide feeder load profiles in its hosting capacity map.[44] Publishing load data, including minimum and peak load data, within hosting capacity maps can help applicants avoid grid locations where significant upgrades may be needed before connecting additional load. For applicants to rely on hosting capacity maps for project siting, utilities must update the data frequently enough to convey actual grid conditions.[45] Note: As an initial step, state regulators may want to consider requiring that utilities provide pre-application reports when requested by interconnection applicants. Similar to hosting capacity maps, these reports include data that can help applicants identify favorable locations for their projects, but typically require a fee for each site-specific report.[46]
Utilities	Provide upfront evaluation services of multiple sites to help applicants identify ideal locations for charging infrastructure before submitting a service request. *Example*: The Sacramento Municipal Utility District (SMUD) offers upfront services to assess interconnection costs for multiple sites to help applicants with site selection before they submit an application.[47] This type of service can drive development to less constrained areas of the grid and limit the amount of time utilities have to spend reviewing projects that are less likely to move forward.

Challenge: Lack of Utility Performance Measures or Incentives	
Responsible Party	**Recommended Practice**
State Regulatory Agencies	Adopt performance incentives and/or penalties to encourage more efficient processing of EV charger applications. This is listed as a recommended practice because no state has adopted performance incentives or penalties specifically for the EV charger interconnection process to date. However, performance incentive mechanisms have been implemented for distributed energy resources (DERs). *Example*: In 2021, the Hawaii Public Utilities Commission adopted an Interconnection Approval Performance Incentive Mechanism (PIM) to reduce interconnection timelines for DER systems under 100 kilowatts.[48] If the regulated utilities reach annual targets that show improved process efficiency (*e.g.*, the average number of days to complete all utility interconnection steps equals 21 days), they will receive a financial reward.[49] The PIM also specifies a maximum timeline that, if met, would trigger a financial penalty (*e.g.*, 42 days).[50]

Challenge: Difficulties Obtaining Utility Easements	
Responsible Party	Emerging Best Practice
Utilities	Make easement language publicly available and allow it to be incorporated into the lease agreement between the EVCS developer and the site host. *Example*: PG&E publishes sample easement language that can be incorporated into lease agreements with site hosts.[51] By posting acceptable language that can be included in a site lease, utilities can help to eliminate separate negotiations over appropriate easement terms and other acceptable language.

Challenge: Slow Permitting Processes	
Responsible Party	Emerging Best Practices
AHJs	Ensure that information about the permitting process, including a list of any materials required to be submitted along with a permit request, is online and easy to find.[52] *Example*: Fairfax County, Virginia provides detailed information on obtaining permits for new EV charging stations on its website, including any documentation required and a list of the permit process steps.[53] Other ways to improve the permitting process include: creating an online portal for applicants; adopting expedited review policies; and providing dedicated staff for review of EV infrastructure applications.[54]
State Legislatures	Adopt a model EV ordinance that municipalities are mandated to adopt to streamline the approval process. *Example*: In 2021, New Jersey enacted a model statewide municipal EV ordinance to simplify the permitting process by designating EV charger and make-ready parking spaces as a permitted accessory use.[55] This designation clarifies that parking spaces used for EV charging do not require zoning review or approval.[56]

VI. CONCLUSION

To meet transportation electrification goals and the increasing demand for EV charging options, states, utilities, and local governments will need to adopt policies that can streamline the process for connecting EV charging infrastructure to the grid. Through IREC's EV Charging Station Developer Survey, developers identified both interconnection process challenges and potential ways to address them. Compared to DER interconnection, EVCS interconnection is still relatively nascent and the associated processes are still being developed. These initial challenges and emerging best practices can be used as guidance for jurisdictions looking to enable the rapid deployment of EV chargers. As EV charger penetration increases, further research will be needed to assess the effectiveness of these and other strategies to reduce interconnection timelines.

ENDNOTES

1. U.S. Environmental Protection Agency, *Sources of Greenhouse Gas Emissions*, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (accessed 03/31/2022).
2. U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019 – Trends*, pp. 2-3 (April 2021), https://www.epa.gov/sites/production/files/2021-04/documents/us-ghg-inventory-2021-chapter-2-trends.pdf.
3. Gordon Bauer et al., *Charging Up America: Assessing the Growing Need for U.S. Charging Infrastructure Through 2030*, The International Council on Clean Transportation, pp. 29-30 (July 2021), https://theicct.org/sites/default/files/publications/charging-up-america-jul2021.pdf.
4. Infrastructure Investment and Jobs Act, Pub. L. 117-58 (Nov. 15, 2021), https://www.govinfo.gov/content/pkg/PLAW-117publ58/pdf/PLAW-117publ58.pdf.
5. Electric vehicle supply equipment (EVSE) includes the "cables, cords, conductors, connectors, couplers, enclosures, attachment plugs, power outlets, power electronics, transformer, switchgear, switches and controls, network interfaces, and point of sale equipment and associated apparatus designed and used for the purpose of transferring energy from the electric supply system to a plug-in electric vehicle." *For more information, see*: New Jersey Department of Community Affairs, et al., *Charge Up Your Town: Best Management Practices to Ensure Your Town is EV Ready*, p. 7 (Feb. 2022), https://nj.gov/dep/drivegreen/pdf/chargeupyourtown.pdf.
6. Chris Nelder and Emily Rogers, *Reducing EV Charging Infrastructure Costs*, Rocky Mountain Institute, p. 29 (2019) ("RMI 2019 Report"), https://rmi.org/insight/reducing-ev-charging-infrastructure-costs (accessed April 15, 2022).
7. In this paper, "EVCS" is used in addition to "EVSE" and is meant to specifically denote charging stations and not charging equipment that could include power outlets located at a single-family residence.
8. California Electric Vehicle Infrastructure Project (CALeVIP), *Electric Vehicle Charging 101*, https://calevip.org/electric-vehicle-charging-101 (accessed April 15, 2022).
9. Newer DC fast chargers that are starting to come online are capable of producing up to 350 kW of power. Note: not all EVs are able to charge from DC fast chargers.
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