TECH NEXT™

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Tech Next FYI: EV Charging Infrastructure

In this edition of the Tech Next series, we will explore:

Types of EV Chargers

Available Funding Sources

Challenges and Considerations

Stakeholders

Planning Questions to Ask

Around the States

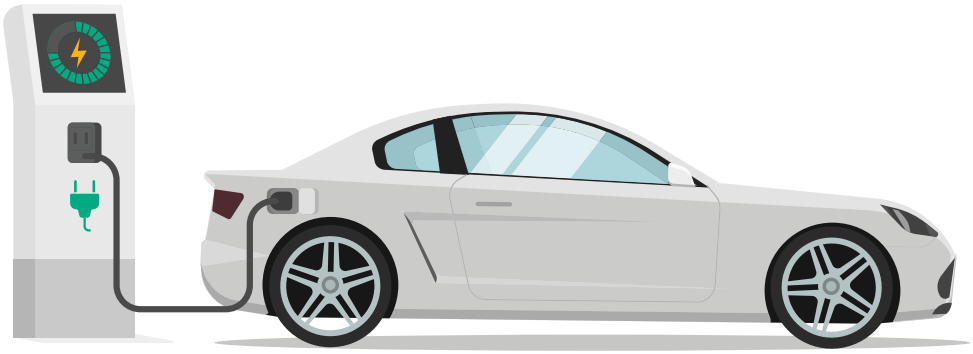
INTRODUCTION

By now, you are almost certainly familiar with the term EVs, or "electric vehicles." EVs are powered by an electric engine fueled by high-capacity batteries that require "supply equipment" (EVSE) to charge for use.

Today, manufacturers are building not only traditional passenger vehicles but also heavy-duty vehicles, construction vehicles, buses, and firetrucks that are low, or zero-emission vehicles. The increasing EV adoption rate is pushing the charging infrastructure issue onto the to-do list of governments at all levels. The planning for EV charging infrastructure and the procurement of EVSE can be a complex, multi-jurisdictional project that may require close collaboration across multiple agencies and governments at all levels. This brief overview of electric vehicle charging infrastructure projects from a public procurement perspective will identify key components and help you prepare for your EV charging procurements.

Figure 1: Types of Electric Vehicles

ELECTRIC VEHICLES BY OTHER NAMES	
BEV	Battery Electric Vehicle
PHEV OR (ERVE)	Plugin Hybrid Electric Vehicle (Extended-Range Electric Vehicle)
PEV	Plugin Electric Vehicle
HEV	Hybrid Electric Vehicle
FCEV	Fuel Cell Electric Vehicles
ZEV	Zero Emission Vehicle



TYPES OF EV CHARGERS

Electric Vehicle Supply Equipment (EVSE), or charging equipment, can be categorized by connectivity. These are commonly known as "smart" and "dumb" chargers. Smart chargers are connected to a broader network with IT capabilities that allow them to control access to electricity, collect and process payments, and manage electrical loads. Dumb chargers connect the EV to a power source and charge its batteries without any user software or data collection involved.

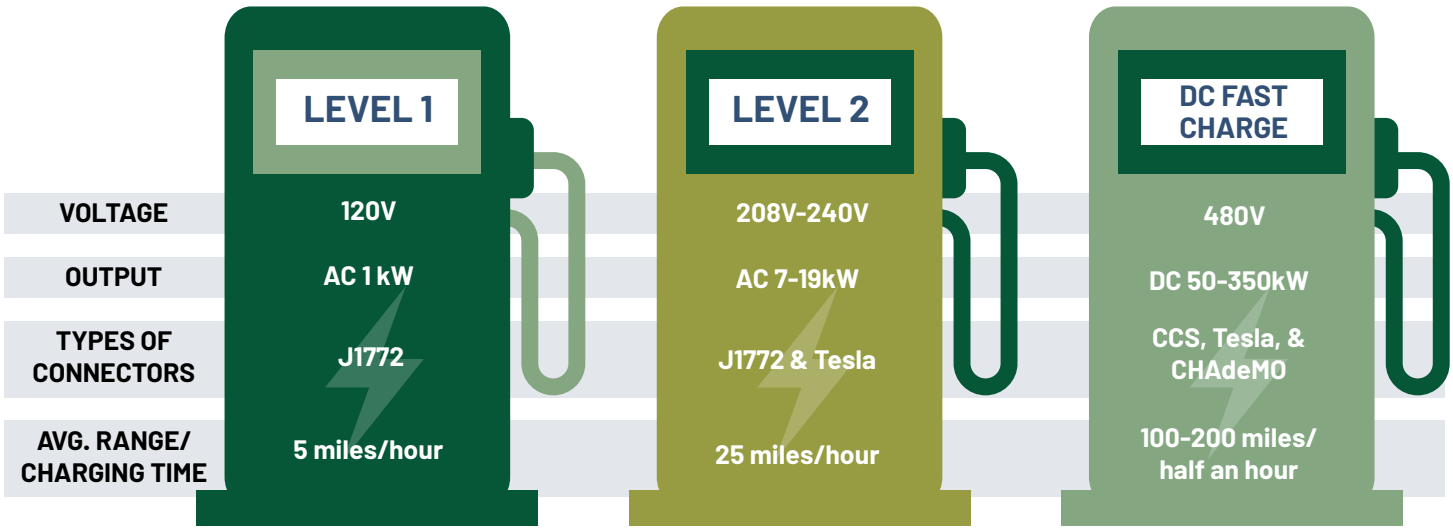
EVSE can also be categorized by "Level," which describes the strength and speed of the charging process:[1]

LEVEL 1 chargers are commonly used in residences. They can plug into a standard wall outlet but charge vehicles at the slowest rate.

LEVEL 2 chargers are easier to build and are practical for local governments and daily residential usage. They plug into outlets commonly used for residential or commercial electric dryers and stoves.

LEVEL 3 or DC Fast Charge is the most efficient for recharging batteries but requires the highest electrical capacity and is significantly more expensive to purchase and install than Level 2 chargers. DC fast charging is ideal for long-range travel and is mandated along highways paid for with federal grants.[2]

Figure 2: Charging Types



According to S & P, the U.S. currently has over 140,000 EV charging stations to support roughly 1.9 million electric vehicles on the road.[3] Of those, approximately 126,500 are Level 2 stations, and just over 20,000 are DC fast chargers. That same report estimates that the country will need about 770,000 total charging stations to match EV growth rate and usage by 2025.

SAE-J1772 is the North American standard for Levels 1 and 2 EV charging connectors (also known as a J-plug or Type 1), which covers the basic physical, functional, and performance specifications to facilitate charging.[4] Every electric vehicle manufacturer in the U.S. uses this plug, except for some Tesla models (for which there are adapters to ensure compatibility). Protocols have been developed by SME organizations that facilitate the communication and exchange of data between components in the EV charging process.

SAE-J1772 CONNECTOR

Figure 3: EV Protocols

PROTOCOL	FUNCTION	MAINTAINED BY
OCPP (Open Charge Point Protocol)	Facilitates communication between EVs, EVSE, charging station management systems,[5] and charging network management systems, allowing for compatible products developed by different suppliers.	Open Charge Alliance
OSCP (Open Smart Charging Protocol)	Facilitates communication between charging network management systems and energy/utility management systems, allowing for reporting and forecasting of accessible electric grid capacity	Open Charge Alliance
OCPI (Open Charge Point Interface)	Facilitates communication between differing charging networks and service providers, allowing users to charge at any compliant station	EVRoaming Foundation

Another available technology that is compatible with Levels 2 and 3 EVSE is Vehicle-to-Grid (V2G) transfer. This utilizes 2-way charging and allows EVs to contribute power to on-site storage batteries or directly back into the local electrical grid. New charging technologies continue to emerge, especially for industrial and commercial fleet applications.

AVAILABLE FUNDING SOURCES

Through formula grant funding, competitive grant funding, tax incentives and credits, and rebates for infrastructure, there are potential funding sources available for EVSE installation projects of all sizes. Recent federal legislation provides the most relevant support for government entities expanding EV charging networks and capabilities.

The 2021 Interstate Investment and Jobs Act (IIJA) designated guaranteed federal funding to provide EV charging infrastructure for public use.

- **Charging and Fueling Infrastructure (CFI) Discretionary Grant Program** provides $2.5 billion to a wide range of applicants over five years, including states, cities, counties, tribes, and other local government entities. Approximately half of these funds will go to community projects that install chargers in public locations (streets, parks, schools, parking lots, public buildings, etc.). The rest will go to provide local charging infrastructure along important state highways and traffic corridors. The U.S. Department of Transportation's Federal Highway Administration (FHWA) accepts applications through **www.grants.gov**.

- **National Electric Vehicle Infrastructure (NEVI) Program** provides $5 billion to build Level 3 DC charging networks along key highways nationwide. States automatically receive funding allotments for this program once they have submitted charging network plans and required updates. NEVI funds cover up to 80% of an eligible project's costs, including:[6]

    - procurement, installation, and network connection of EV charging stations,
    - operation and maintenance of EV charging stations, and
    - long-term EV charging station data sharing.

The minimum standards and requirements for projects funded under the NEVI Formula Program are covered by **FHWA's 88 FR 12724**.

The 2022 Inflation Reduction Act (IRA) provides tax credits, loans, and grants for various EV-related projects.

- **Clean Heavy-Duty Vehicle Program** provides $1 billion to state, local, and tribal governments or non-profit school transportation associations to replace heavy-duty vehicles with EVs via direct pay rebates. This includes up to 100% of the vehicle costs, charging infrastructure, training, and/or technical activities to support electrification.[7]

- The IRA provides multiple tax credit programs for citizens and businesses to purchase EVs and install EVSE, with an emphasis on low-income and rural areas. It also designates numerous funding streams for expanding electrical utility capacity.

See the **official guidebook** for more about the programs and funding available under the Inflation Reduction Act.

For more information on federal grant funds, purchasing requirements, and federal EV resources, visit the **Joint Office of Energy and Transportation**. Consider consulting your local U.S. EPA or Department of Energy offices and officials for grant assistance or funding usage guidelines and clarification.

Other potential funding sources for EV infrastructure projects include the **Volkswagen Mitigation Trust**, State Energy Commissions/Departments of Energy, utility providers, and manufacturer rebate programs.

CHALLENGES AND CONSIDERATIONS

CONSTRUCTION AUTHORITY: Depending upon the size, scale, and location(s) of the charging infrastructure project, state procurement officials may need to work with designated state construction entities. Several states have separate construction offices with authority to establish and execute contracts for construction projects of a certain scale or type or above a certain value threshold. Just as state Departments of Transportation may ultimately own EV infrastructure projects, a state construction authority may lead the site development and construction phase.

ZONING, ORDINANCES, AND PERMITS: The charging site design process must consider the planning and zoning requirements and other public ordinances of the location where it will be built. This will require coordination between the entity leading the project, local regulatory agencies, installation contractors, and/or EVSE suppliers to obtain the necessary permits and meet applicable standards. It could be advantageous to develop statewide EVSE and charging site standards to help streamline permitting processes in the future.

RIGHT-OF-WAY REGULATIONS: Creating publicly accessible charging stations will require navigating or altering existing right-of-way accommodations in developed areas, such as fire lanes and hydrants, bus lanes and stops, bike lanes and racks, sidewalks, streetcars, and other existing infrastructure. The need for convenient charging can conflict with already limited parking availability. Coordinate with city planners to find solutions that balance current and future needs.

PROPERTY EASEMENTS: Charging station construction and installation on land not already owned by the state will likely require agreements with other entities concerning site preparation and usage. Coordination with local governments, utility providers, local businesses, and/or property owners will be necessary to determine and obtain any easements needed to facilitate site development and implementation.

LOCATION: Charging stations are most needed in high-traffic areas and heavily traveled corridors where gaps exist in current charging amenities. Areas with high population density will require a greater number of charging stations or locations. Federal funding is also promoting equity in station placement, emphasizing the need for all neighborhoods to have access to charging infrastructure and to expand charging networks into rural areas.

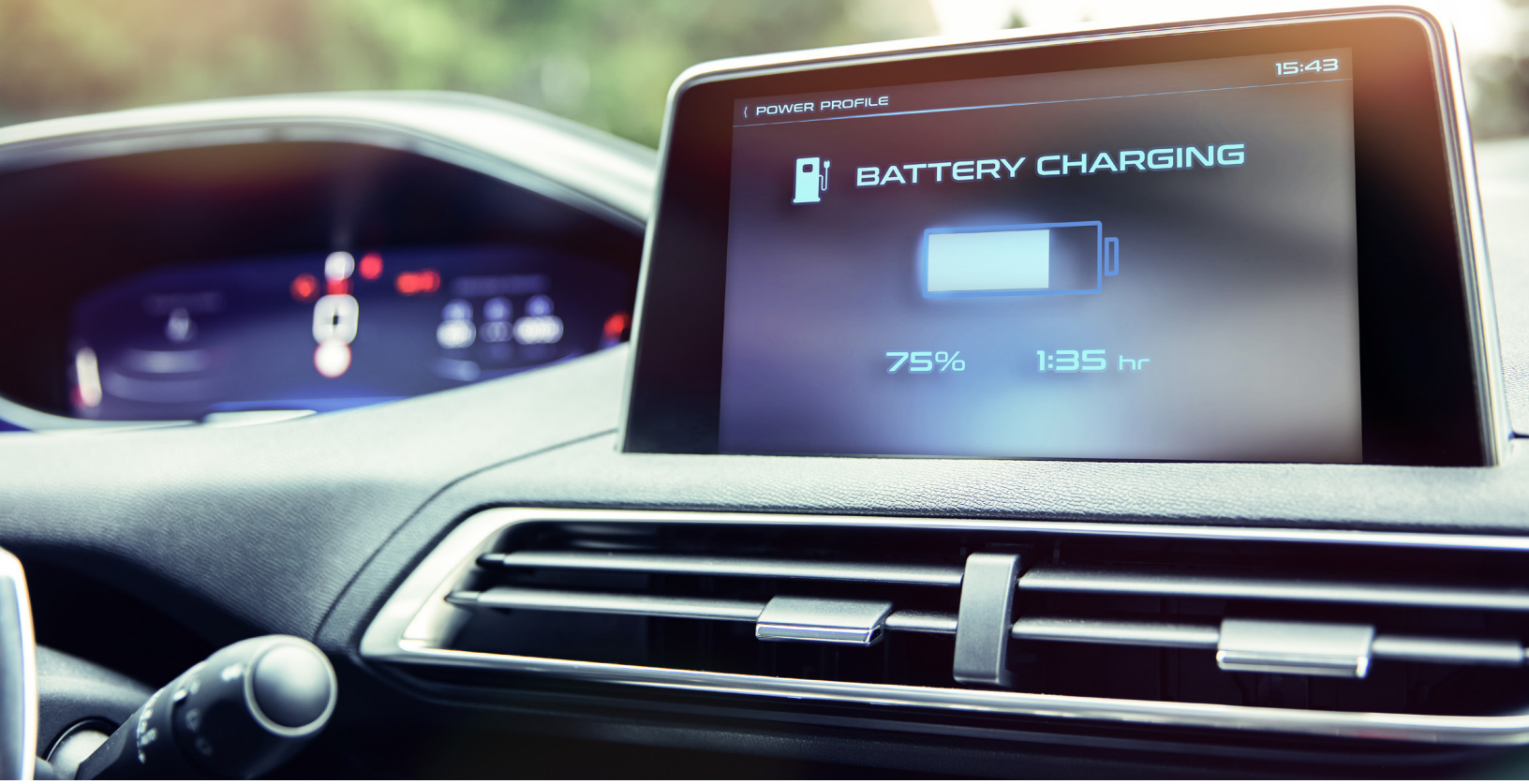
TRAFFIC: Heavy traffic can present challenges when driving an EV. Public charging station sites need to be in common areas, readily accessible, but without potentially obstructing or negatively impacting the regular flow of traffic. Range anxiety is created when traffic is heavy, and finding an available charging station might be difficult. The prevalence of charging infrastructure in some areas should be considered when traveling long distances or in stop-and-go traffic.

ELECTRIC GRID AND UTILITY CAPACITY: The importance of grid capacity cannot be overstated. Utility infrastructure, balancing supply and demand, grid modification cost, and interoperability are all causes for consideration. Rural areas are more likely to need potential upgrades to supply ample power. EVSE has potential impacts for other customers in the area stemming from shared power draw, including peak usage billing rates. DC fast chargers require significantly more capacity than Level 2 EVSE. High-population density areas create the potential for grid strain and inflated demand pricing during peak electric usage hours. Necessary grid upgrades will require close planning and partnership with utility providers.

CONNECTIVITY: The decision between "smart chargers" and "dumb chargers" requires connectivity considerations for monitoring charger performance, tracking usage, and processing payments. Reliable internet connectivity may present an obstacle in some rural or remote locations, and connectivity also requires cybersecurity and data privacy considerations.

CYBERSECURITY: An interconnected network of chargers that can collect and report usage data requires a reliable internet connection and the accompanying cybersecurity measures. Payment processing software will collect and transfer sensitive personal data tied to users and financial accounts, which must be kept secure at all times. Remember that chargers requiring IT software and/or internet connectivity will need to meet the cybersecurity standards of the responsible government entity.

PAYMENT MODELS AND PROCESSING SERVICES: Unless chargers are provided as an amenity, they typically require payment for use. These can be time-of-use fees ($/time connected), energy use fees ($/kW consumed), or a custom formula combining both. Chargers open to public use will require software to process purchases. The revenues generated may need to be distributed to multiple entities (utility company, government entity, business or property owner, etc.) depending on agreements, usage, and operation of the charging site. Legislative amendments may be required for public or private entities to engage in the reselling of electricity. For example, in 2021, South Carolina amended a law to change the definition of an electric utility to clear the way for EV charging infrastructure.[8]



SOFTWARE: The necessary software for a charger can be determined by the question, "What data do you need to collect or preserve?" Some capabilities include payment processing, exporting usage data, status monitoring, and emergency alert notification. Government administrators may require fleet usage tracking and record keeping. Software can be included as part of MRO contracts with EVSE suppliers. EV fleet management software is available that can schedule the charging of fleet vehicles at identified times of low demand for optimal pricing and minimal draw.

ON-SITE MAINTENANCE: Determination of which entity will be responsible for the maintenance, repair, and operation (MRO) of charging sites is vital to success. Plans should identify the body authorized to develop and execute MRO contracts and consider the availability of potential suppliers and subcontractors in charger locations to ensure maintenance and support of EVSE throughout its usable lifespan. A recent study found that maintenance of existing chargers was a nationwide challenge, with 20% of participants reporting the inability to charge their vehicle during a stop due to station malfunctions or being out of service.[9]

FLEXIBILITY: Do not limit your scope of concern to cost alone when choosing locations and equipment for charging stations. Remember to consider the compatibility of chargers, their upgradability, the site's scalability, and access to support services. Consider the potential future needs of the site and its users.

SAFETY AND ACCESSIBILITY: Make sure that you address both electrical safety measures for the vehicles and the physical safety of drivers. Sites must adhere to all safety standards and regulations, including those of the locality where the charger is located; these charging stations take longer to utilize than a traditional gas pump, so having a safe space for drivers while they wait is a must. To help ensure the accessibility of sites for all users, the U.S. Access Board created **technical design recommendations for accessible charging stations**.

FEDERAL FUNDING GUIDELINES: IIJA funds, like many other federal appropriations, come with requirements around sourcing, equipment standards, and reporting. States must comply with the **minimum standards and requirements**. Sourcing of materials may be subject to the Build America Buy America plan or other purchasing rules.

SUPPLIER MARKET: Your planning process should include market research into the EVSE suppliers available to provide service in your state. This should include the equipment and services available. EV charging networks offer ample opportunity for Public-Private-Partnership (PPP) development that benefits all parties.

STAKEHOLDERS

YOUR STATE DEPARTMENT OF TRANSPORTATION: Depending on individual state statutes and regulations, your Department of Transportation may have independent procurement authority over its projects. Public charging networks along state and interstate highways will likely fall under their jurisdiction, requiring state procurement officials to work closely with DOT colleagues to help facilitate the procurement process. Central procurement should work with DOT on market research, solicitation development, negotiations, and contract development, and be represented on evaluation teams.

YOUR STATE CONSTRUCTION PROCUREMENT AUTHORITY: Similarly to the Department of Transportation, your state may authorize another entity to conduct construction project procurements independently or with the central procurement office. The scope of the infrastructure project may determine the level at which such other entities are involved. Upgrading existing state-owned or public sites with charging equipment could be directed by central procurement officials, while construction of new rest areas or large-scale renovations of government properties to implement charging stations may place the project under a state construction authority.

LOCAL GOVERNMENTS: Partnership with local entities can provide valuable insight into local needs and information about charging sites. They can assist with zoning and ordinance compliance and provide permits. Sites shared by multiple entities may require usage agreements and guidelines for fleets and share the costs of MRO contracts.

UTILITY PROVIDERS: Close coordination with utility providers is required to analyze capacity for charging site locations, ensure charging site readiness, and mitigate grid strain issues. State and local governments should work with area utility providers to acquire available federal funds for grid improvements connected to EV charging infrastructure. Fleet administrators should consider coordinating with utility providers to determine optimal charging times for fleet vehicles or to negotiate rates for non-peak charging.

INFORMATION TECHNOLOGY AUTHORITY: Your state's Information Technology Authority will be crucial in outlining requirements for connectivity, cyber security, operating software, and data management services. You may also want to consult with your state's CIO and/or CISO and any local government IT officials in the areas where the stations will be placed.

SUPPLIERS: Suppliers will provide the materials, services, and equipment for your fleet and charging stations. They are experts on the availability and capabilities of the various technologies involved. PPPs with suppliers may make station construction, operation, and maintenance more feasible or simple in some areas.

FEDERAL ENTITIES: If using federal government funding, the authorizing federal entity (e.g., EPA, Dept. of Energy, or Dept. of Transportation, etc.) will have rules and requirements that must be met. These funds come with guidelines for construction, materials, accessibility, security, reporting, and other facets of the project.

USERS/CUSTOMERS/RESIDENTS: This project will directly impact these groups. Collecting their input on performance needs and location preferences, and identifying any concerns or issues, is essential for successfully planning and implementing charging infrastructure.

PLANNING QUESTIONS TO ASK

- **Will your charging infrastructure be for fleet and public use or government use only?**
- **What is your expected usage/traffic for your stations?**
- **How many chargers are needed to accommodate usage at each location?**
- **Who is responsible for site readiness?**
- **Who will be responsible for on-site issue resolution?**
- **Can the available suppliers maintain EVSE throughout its usable life?**

AROUND THE STATES

IOWA:

In 2018, the Iowa Economic Development Authority, the Iowa Transportation Commission, and the Iowa Department of Transportation investigated the infrastructure needed to support the expanding usage of electric vehicles and alternative fuels. The study produced a report ***Charging Forward: Iowa's Opportunities for Electric Vehicle Infrastructure Support*** which evaluated the associated costs and benefits and made recommendations for updating state policies. It called for comprehensive planning on the development of charging stations to maximize their impacts and benefits for communities and users. Its findings were incorporated into the **Iowa Energy Plan** and informed the creation of **Iowa's Electric Vehicle Infrastructure Deployment Plan**, adopted in 2022.

OHIO:

The Ohio Department of Transportation is leading statewide efforts to expand EV charging infrastructure. Presently, Ohio has 143 EV charging stations offering DC fast charging and an additional 1,033 Level 2 stations for public use on more than a dozen charging networks.[10] The **Infrastructure Deployment Plan** outlines necessary development steps and related stakeholders at the statewide, regional, and local levels. They also include coordination with neighboring states to reduce charging gaps in designated corridors that cross state lines. According to the plan, the state will receive more than $100 million in NEVI funding over the next five years to install DC Fast chargers along designated highway corridors. The **Ohio Department of Transportation's DriveOhio initiative** produced an **interactive map** showing potential charger locations within identified gaps and inviting public feedback for each site.

UTAH:

The State of Utah was an early adapter of EV technologies, as evidenced by its **Electric Vehicle Master Plan**, released in 2018. This plan was partly in response to Utah's participation in the Regional Electric Vehicle (**REV West**) partnership with seven other western states to expand EV charging infrastructure along major shared roadways. The plan focused on working with cities, counties, and local businesses to fill in gaps in EVSE availability and provide charging stations in some of the state's rural and remote areas. It also bolstered the state's use of EV fleet vehicles and offered statewide EVSE contracts for use by approved entities. The 3-phase plan leveraged multiple funding sources, including grants from local power utilities and the Volkswagen Mitigation Trust. The enactment of **Utah Code 72-1-216** in 2020, and the subsequent creation of Utah's **Statewide Electric Vehicle Charging Network Plan** in 2021, expanded the state's commitment to providing charging stations along all major roadways, designing expandable sites for increased future usage and partnering with local utility providers and businesses to facilitate charging projects. Utah's Department of Transportation is leading its **NEVI plan**, which includes upgrading existing EV infrastructure, incentivizing local business ownership of EV charging stations, and expanding the network into underserved communities.

RESOURCES

Tech Next Series: Electric Vehicles and Hybrid Vehicles **https://cdn.naspo.org/RI/TechNext_ElectricVehicles.pdf**

Sustainability: **https://www.naspo.org/sustainability/**

Repository of State Practices: **https://www.naspo.org/rosp/**

National Governors Association's (NGA) **Infrastructure Investment and Jobs Act (IIJA) Implementation Resources**

National Governors Association's **Electric Vehicles Resources**

American Association of State Highway and Transportation Officials (AASHTO) **Electric Vehicles Website** National

Association of State Energy Officials (NASEO) **Transportation Resources**

AASHTO and NASEO's **EV States Clearinghouse** – State agencies must register for a free account to access this repository for state EV charging infrastructure plans, solicitation documents, and guidance.

United States Department of Transportation: **EV Infrastructure Project Planning Checklist** and **Rural EV Infrastructure Toolkit** – A comprehensive look at the entire process from planning to implementation, complete with dozens of links to expert resources.

United States General Services Administration: Electric Vehicle Charging Stations – The site for federal entities to purchase EV charging supplies from multi-award contracts provides a wealth of useful templates and information that state and local governments can look to for solicitation and contract examples.

ENDNOTES

[1] "Developing Infrastructure to Charge Electric Vehicles," Alternative Fuels Data Center, accessed March 29, 2023, **https://afdc.energy.gov/fuels/electricity_infrastructure.html**.

[2] "The National Electric Vehicle Infrastructure (NEVI) Formula Program Guidance," Federal Highway Administration, last modified February 10, 2022, **https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf**.

[3] "EV Chargers: How Many Do We Need?" S & P Global Mobility Special Report, accessed January 9, 2023, **https://press.spglobal.com/2023-01-09-EV-Chargers-How-many-do-we-need**.

[4] "Developing Infrastructure to Charge Electric Vehicles," Alternative Fuels Data Center, accessed March 29, 2023, **https://afdc.energy.gov/fuels/electricity_infrastructure.html**.

[5] EV charging management software is technology that allows for the management and optimization of electric vehicle charging operations. Fleet operators, property managers, and other providers can use EV charging management software as their mission control center. "What is EV Charging Management Software?" Chargelab, accessed April 24, 2023, **https://www.chargelab.co/blog/ev-charging-management-software#:~:text=EV%20charging%20management%20software%20is,as%20their%20mission%20control%20center**.

[6] "National Electric Vehicle Infrastructure (NEVI) Formula Program," Alternative Fuels Data Center, accessed March 22, 2023, **https://afdc.energy.gov/laws/12744**.

[7] Biden Administration, "Building A Clean Energy Economy: A Guidebook to the Inflation Reduction Act's Investments in Clean Energy and Climate Action, January 2023, ver. 2," accessed May 8, 2023, **https://bidenwhitehouse.archives.gov/cleanenergy/inflation-reduction-act-guidebook/**.

[8] S.C. Code Ann § 58-27-1060 (2021).

[9] "Growing Electric Vehicle Market Threatens to Short-Circuit Public Charging Experience, J.D. Power Finds," J.D. Power, accessed April 25th, 2023, **https://www.jdpower.com/business/press-releases/2022-us-electric-vehicle-experience-evx-public-charging-study**.

[10] "Alternative Fueling Station Counts by State," Alternative Fueling Station Counts by State, Alternative Fuels Data Center, Accessed March 30, 2023, **https://afdc.energy.gov/stations/states**.

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