Utilities and EVs at the 'Inflection Point'

4 Trends to Watch

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By 2025, Hyundai plans to offer 23 electric vehicles (EVs)—nearly as many as currently sold by all automakers in the United States. GM plans to sell only electric vehicles by 2035, and Volkswagen has the same target for Europe. Meanwhile, Ford has invested $22 billion over the next three years to switch 40% of its vehicles to electric power by 2030. Still, these initiatives are only a few of the ambitious fleet-electrification announcements made over the past year.

Demand is surging, too. A recent Ipsos survey found consumer interest has tripled since 2018, with more than a third of car buyers now willing to consider electric vehicles. Global EV sales increased 80% in 2021, with expectations of reaching a minimum of 10% of all sales by 2025 and possibly as high as 34% by 2030, according to the International Energy Agency (IEA). The recent extension of federal tax credits for EV purchases in the U.S. will help push sales towards the higher end of the IEA forecast.

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These trends toward the adoption of EVs represent the biggest challenge — and opportunity — facing the utility industry today. On the one hand, EVs provide a tremendous source of new revenue generation, and the industry must move quickly to enable the construction of a robust charging infrastructure. But on the other hand, EVs also pose a threat to grid stability and decarbonization goals.

"There's a race to put in charging infrastructure, but we don't necessarily have a stable enough grid to support it," noted Shuli Goodman, Ph.D., founder and executive director of LF Energy, a Linux Foundation program focused on enabling electrification at scale. "The industry has a long, long way to go in learning to manage the intermittent and wildly distributed power network that EVs present. Plus, we still need to create the markets that will drive it all."

With milestones like the National Electric Vehicle Infrastructure (NEVI) program and the Environmental Protection Agency's Clean School Bus Program, 2022 has been significant in the convergence of the utility and transportation sectors. This playbook goes beneath the sales figures and fleet announcements to present insights from EV and utility industry experts regarding four near- and mid-term trends shaping the emergence of electric vehicles in the U.S. and abroad.

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Faster Development of Charging Infrastructure

Regardless of how many EV models are on the market, consumers won't buy them if they feel concerned about running out of charge away from home. In 2021, the U.S. Congress approved $5 billion in NEVI funding to jumpstart the development of comprehensive charging infrastructure across the country. Those funds will begin to flow by the end of 2022 to state-level departments of transportation (DOTs) that will decide how to deploy the funds to establish charging stations (which may also include solar and charging components) along designated alternative fuel corridors.

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Marcy Bauer
Senior Vice President of Program Delivery at EVgo

The integration of solar, storage and EV charging has many potential benefits. For instance, depending on the location and capacity of a charging station, distribution grids may require upgrades to accommodate the significant new load. These upgrades can be expensive and time-consuming, possibly imperiling the timeline and financial viability of a new charging station. Incorporating solar and storage, though, can eliminate or reduce the need for grid improvements.

Adding solar and storage to EV charging stations can also help stabilize the grid by providing both additional generation capacity as well as dispatch flexibility that comes with storage. When demand on the grid is high, for example, batteries can be deployed to charge EVs. Not only does this benefit the grid, it can also help the EV charging station owner by reducing expensive demand charges.

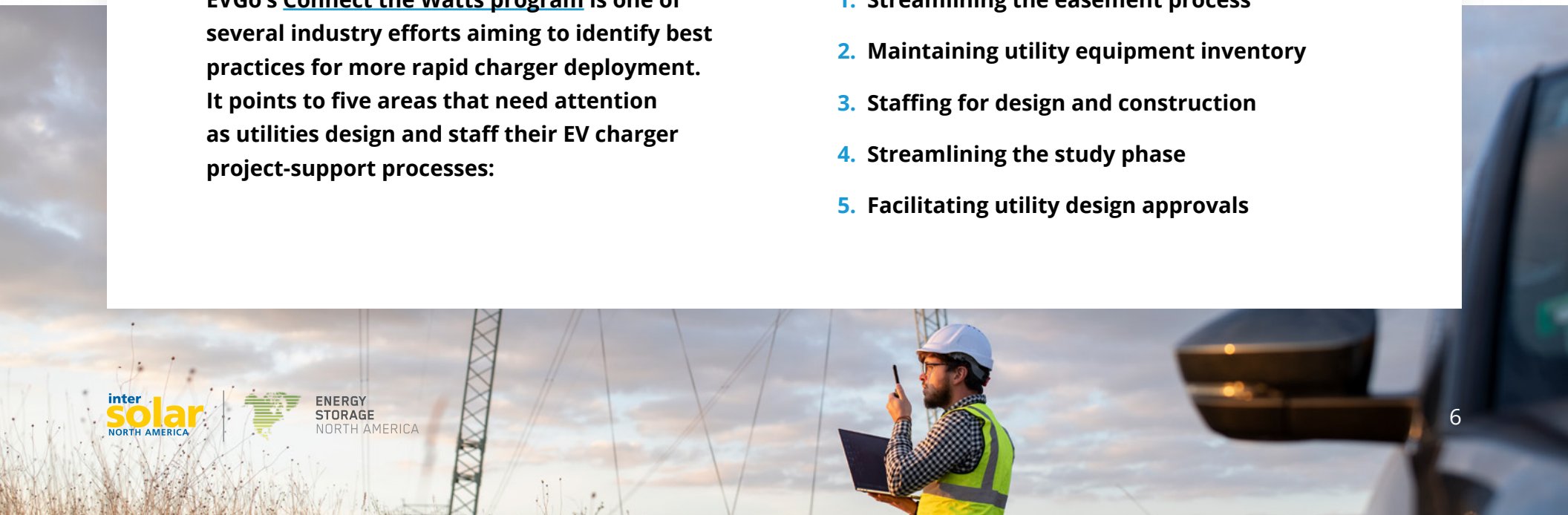
Despite the availability of funds and the relative ease of constructing charging stations, existing processes for new grid connections could cause major delays in service territories across the country.

"We can build a charging station very quickly, in just a month or two," explained Marcy Bauer, senior vice president of program delivery at EVgo, a company building EV charging stations across the U.S. "But utilities are typically accustomed to construction projects with timelines of a year or more. For those, it doesn't matter if it takes three to six months to get the utility design or schedule the interconnection. But it's a painful delay for a simple charging station."

To reduce delays in the easement process, for example, Connect the Watts suggests utilities make easement language available to the public, like how Pacific Gas & Electric (PG&E) has provided language to insert into lease agreements for site hosts. Other specific recommendations include keeping a stocked inventory of appropriate transformers and establishing a dedicated field study assessment process to determine capacity constraints and points of interconnect. Ultimately, utilities will likely need dedicated staff to manage the rapid growth of charging projects.

EVGo's Connect the Watts program is one of several industry efforts aiming to identify best practices for more rapid charger deployment. It points to five areas that need attention as utilities design and staff their EV charger project-support processes:

1. **Streamlining the easement process**
2. **Maintaining utility equipment inventory**
3. **Staffing for design and construction**
4. **Streamlining the study phase**
5. **Facilitating utility design approvals**



New State Regulations and Mandates

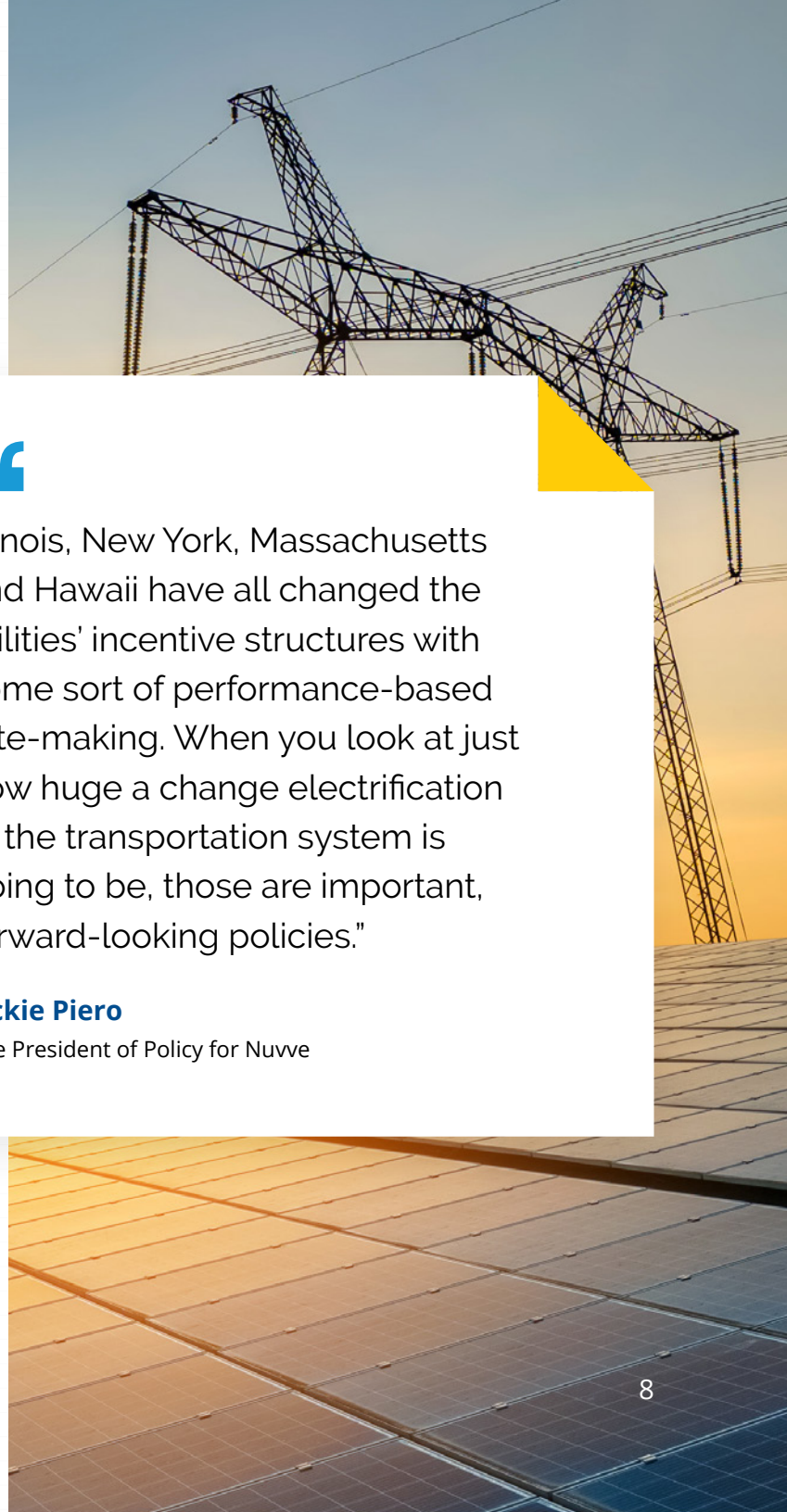
With the arrival of federal funding and the wave of new EVs coming on the market, regulators and legislatures are becoming increasingly committed to state-level policies and programs for EV charging.

“Everyone seems to recognize that we’re at the inflection point,” noticed Jackie Piero, vice president of policy for Nuvve, a global energy infrastructure management company headquartered in San Diego. “In terms of regulatory development, I’ve seen more in the last year or two than I saw in the previous eight. And it’s very exciting.”

Previously, California had been the only state with EV-specific programs, Piero explained, but now more than a dozen states have formal EV programs, and many more are in development. As a first step, regulated utilities and commissions typically create EV-related time-of-use charging rates or establish separate funding programs for utilities to pay for equipment upgrades or customer-facing services. “These make-ready programs are about preparing processes, teams and budgets, and determining the allowable costs for charging installations,” Piero said. “Utilities will write their advice letters spelling out the processes, product lists, technical standards, and other details for regulatory approval.”

In addition to California, Piero pointed to Massachusetts, New York and Minnesota as states leading the way in transport electrification. Similarly, Colorado has worked to integrate EV policy with its planning for distributed energy resources (DERs) and climate goals, and Illinois' "beneficial electrification" process gave the state an early start on determining which locations need charging most to accelerate EV adoption. "Illinois, New York, Massachusetts and Hawaii have all changed the utilities' incentive structures with some sort of performance-based rate-making," Piero pointed out. "When you look at just how huge a change electrification of the transportation system is going to be, those are important, forward-looking policies."

At the same time, more states are considering mandates for specific transport sectors like school buses or medium- and heavy-duty trucks. California subsidized the development of electric school buses, which already noticed a big spike in orders from the launch of the EPA's new funding program for electric school buses. In short, states give additional momentum to the movement created by the auto industry and federal funding.



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Evolving Standards for EV Charging

When Nissan announced that its new Ariya model EV would come with a combined charging system (CCS) port instead of CHAdeMO, it marked a significant step towards unifying the auto industry around a standardized charging plug. The Biden Administration's proposal for EV infrastructure also favors the CCS port, all but ending the tug-of-war between the design favored by American and European automakers versus the one developed by Nissan and other Japanese automakers.

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Founder and Executive Director of LF Energy

However, ports and plugs make up just the hardware piece of the standardization puzzle. Charging capacity and communication protocols are the two other aspects likely to require attention in the near term. Capacity is the simpler of the two, with the Biden proposal calling for charging stations built with NEVI funds to have at least four DC fast chargers capable of delivering at least 150 kilowatts (kW) of electricity each.

At 150kW, the new Nissan Ariya with a 92-kilowatt-hour battery and range of just over 300 miles would require roughly 40 minutes to charge fully. However, the Ariya is currently only capable of charging up to 130kW. Automakers now work to improve the rates at which their vehicles are capable of fast charging, and some Hyundai, Kia and Tesla models bring on power at up to 250 kilowatts.

“Most vehicles can charge at higher rates for a brief amount of time, and then the vehicle and the charger communicate to bring the rate down as necessary,” EVgo’s Bauer said. “To ensure that our chargers are useful for years to come, we’re deploying ones that can charge up to a rate of 350 kilowatts.”

The ability for chargers to communicate with dozens — if not hundreds — of different types of vehicles, payment systems, web applications and utility control systems presents the final piece of the standardization puzzle needed to create viable markets and customer experiences. "Having incompatible protocols on the market is a major drag on innovation and efficiency," observed LF Energy's Goodman. "I expect automobile manufacturers will assert enormous pressure to consolidate into a universal approach over the next few years."

The administration's proposal calls for adopting Open Charge Point Protocol (OCPP) standards, but Goodman pointed to broader, more flexible software solutions for achieving interoperability.

"So, whether it's OCPP or ISO 15118 or another protocol, we can use software and just abstract it," she explained. "I'm bullish on our open source Everest project because it's an interoperability gateway that has the ability to keep adding different standards and approaches for demand response, or vehicle to grid, or charging infrastructure to the grid, or whatever the future may hold." She likened it to the coalescence around web browsers in the early days of the Internet. "The underlying structure of web browsers is the same whether you're using Safari or Chrome or Mozilla. They're all using the same open source, and that's the reason why the Internet is basically seamless. The sooner we get to that with EVs, the faster things will be able to develop and avoid a future with lots of stranded assets."

Bi-directional Charging Capabilities

For years, smart grid proponents have discussed a future in which EVs will function as DERs capable of returning power to the grid rather than just taking it. After all, EVs are essentially big batteries on wheels, and to reach decarbonization goals the utility and transport sectors will both need vast amounts of flexible power storage.

The complexity of the technical challenge means widescale vehicle-to-grid (V2G) charging still looks several years away.

However, recent advances have made bi-directional charging a trend to watch closely. The most high-profile breakthrough included the launch of Ford's all-electric F150 truck with a marketing campaign touting the vehicle's ability to provide backup power to the owner's home. While different from feeding power back to the grid, the promise of this feature and its availability in a growing number of vehicles sets the stage for a more modern and resilient grid.

Ultimately, it will take a tremendous number of consumer EVs working in concert to have a beneficial effect on grid operations, which explains why fleets of bigger vehicles offer the logical starting point for V2G capabilities. This year, the EPA launched a new website explaining to school systems the capabilities of electric school buses and how to begin working with utilities to realize the potential for dispatching power during blackouts or peak demand. "That recognition and guidance at the federal level is very exciting," Nuvve's Piero said. "I never saw that kind of thing five years ago, or even two years ago. And now, even West Virginia is requiring vehicle-to-grid capability in their school bus procurement."

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Federal funding programs under the Infrastructure Investment and Jobs Act (IIJA) also require bi-directional charging capabilities for new grid infrastructure. However, widescale studies still need to happen to ensure the feasibility of dispatching power from vehicles back to the grid. Automakers actively test battery life-cycle effects and determine what allowances fall under their vehicle warranties.

At the same time, leading utilities work to understand the systems and processes needed to optimize bi-directional charging. In May, the California Public Utilities Commission approved three pilots proposed by PG&E — a vehicle-to-grid residential program, a vehicle-to-grid commercial program, and a vehicle-to-microgrid program that could help power communities during wildfire-related power outages. "What a Nissan Leaf is to the grid will not be the same as what a school bus is to the grid," Piero explained. "So, figuring out integration will mean determining how best to use a vehicle's flexibility when needed. That might mean helping to balance solar generation at a grid level, or it may just mean avoiding demand charges for an individual or building."

A Brave New World

The next few years will provide a time of rapid development and learning around the globe. EV technologies from automakers will remain relatively consistent, as will the importance of 5G communications and cloud-based systems for choreographing networks. But the development of markets and physical infrastructure will vary depending on regional regulations, mandates and multi-stakeholder programs. “Europe is about five years ahead,” LF Energy’s Goodman noted. “So, it’s really important for America to look at what is working there in terms of policies and programs for balancing the revenue opportunity, the demand response capabilities and the market development.”

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Vendor and aggregator partnerships also set themselves up to become more important for utilities as the complexity of EV integration will be more than most utilities can manage on their own. “Aggregators like Nuvve will be central in making EVs predictable, dispatchable resources for grid planning,” Piero observed. “As a result, you’ll probably start to see aggregator certifications, registrations and deposits established to help ensure the expectations and reliability of the grid.”

Lastly, utilities will need to develop a certain amount of in-house expertise for understanding and managing the project needs of transport electrification. “Utilities won’t be able to have a hundred staff members working on this, but you need to have strong technical leads who have the capacity to understand from an architectural standpoint how all the pieces fit together,” Goodman explained. “These leads need to be able to face off with an aggregator or an automaker, and then need to be confident purchasing the right systems and services because it’s a bit of a brave new world for the industry.”

Regardless of the development paths chosen from state to state, the EV landscape in the U.S. will be far more advanced by 2025 than it is today, and utilities will be intrinsic to the progress.

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This playbook is sponsored by the Intersolar North America and Energy Storage North America conference and trade show. Next held February 14-16, 2023, in Long Beach, CA, the event will include education and exhibitors focused on the ever-growing intersection of EV charging, solar, and power storage.

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