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Source: Capital District Clean Communities Coalition
About SolSmart

SolSmart is a national designation and technical assistance program that recognizes leading solar communities and empowers additional communities to expand their local solar markets. Funded by the U.S. Department of Energy Solar Energy Technologies Office, SolSmart strives to cut red tape, drive greater solar deployment, and make it possible for even more American homes and businesses to access solar energy to meet their electricity needs. As of July 2020, more than 370 local governments in 41 states and the District of Columbia have achieved SolSmart designation, representing more than 90 million Americans.

SolSmart is led by The Solar Foundation and the International City/County Management Association. The SolSmart program can provide no-cost consultations and technical assistance to help local governments learn more about promoting PV and EV integration. Learn more at SolSmart.org.

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Overview

Solar photovoltaic (PV) energy and electric vehicles (EVs) are two important tools to help local governments meet their climate and energy goals and encourage economic growth. When paired together, PV and EVs can provide even greater benefits. Charging EVs with renewable energy instead of power generated by coal, oil, or gas reduces their greenhouse gas emissions, which are largely determined by the electricity source. Moreover, homes, businesses, and municipal buildings can install larger PV systems to account for the anticipated EV charging load. Larger solar installations provide increased clean energy benefits and can result in a more attractive payback period than if the solar panels and EV charging stations were installed separately. Conducting site analyses, permitting, and inspections for electric vehicle supply equipment (EVSE) and PV simultaneously can also save local governments and community members time and money. Beyond cost and emissions savings, integrating PV and EVs can generate benefits for the electricity grid, although such benefits are highly dependent on the geographic location of the project and the nature of the local electricity market.*

Both solar PV and EVs are quickly becoming more popular among businesses, local governments, and households, as costs dramatically go down and more people seek out the benefits of these clean energy technologies. The long-term trend remains clear: Solar PV and EVs are poised to take over increasing shares of the electricity and transportation fuels markets in the next few years. Local governments can optimize the impact of combining these two technologies by working with utility commissions, industry, and other stakeholders to develop coordinated PV and EV policy approaches that take into account the unique attributes of the local grid.

Local governments can maximize the benefits of these technologies in five main ways. First, they can educate property owners and community members on the opportunities to integrate PV and EVs and the benefits of doing so. Second, they can organize group purchase campaigns to support both PV and EV technologies. Third, they can lead by example through public actions and investments and share their lessons learned to encourage integration by other public or private entities. Fourth, governments can provide financial and non-financial incentives to encourage action on PV and EV integration. And fifth, they can adjust local regulations to help reduce the costs and ease the integration of PV and EV charging. Through these five levers of impact, local governments can facilitate substantial decarbonization and help residents and businesses enjoy the benefits of clean energy.

*In some utility settings like much of California, additional load from EV charging during the day can absorb excess power generated by PV, and potentially shift demand from later in the day when demand peaks. On the other hand, the wrong type of EV load or the wrong timing could have no benefit or even adverse effects. Striking the right balance can reduce the need for investments in the local distribution system. Additional information on how local governments can collaborate with their utilities on solar and electrification policies is found in the SolSmart issue brief Solar and Electrification: A Beneficial Partnership, available here: https://solsmart.org/resources/solsmart-issue-brief-solar-electrification-a-beneficial-partnership/.

THIS REPORT OUTLINES:

- The different technical configurations that can be used to integrate PV and EVs.
- The programs and policies that local governments can use as levers to promote PV and EVs together, with examples from across the nation.

Local governments that are interested in using these tools are encouraged to join the national SolSmart program, which provides no-cost technical assistance and the opportunity to achieve designation as SolSmart Gold, Silver, or Bronze. Learn more at SolSmart.org.
Background: Configuring PV and EV Charging

Before discussing the levers of impact available for local governments, it is important to understand the range of technical configurations that can be used in projects involving both solar PV and EVs. First, we describe some common options for physically linking PV and EV charging by co-locating the two technologies on the same site. Second, we consider configurations in which the customer may use PV at a different site from where EV charging occurs, such that the two are only economically linked by providing solar credits to offset electricity consumption.

**POLICY BACKGROUND FOR CONFIGURING PV AND EV CHARGING SYSTEMS**

**Net Metering** is a metering and billing arrangement that allows owners of solar energy systems to export excess electricity generated to the utility grid. In the context of a combined PV-EVSE system, customers will export any electricity the solar panels produce beyond what is required for EV charging or other electricity needs. Customers thus offset the electricity they draw from the grid throughout the billing cycle and pay for the net energy consumed or receive credit or payment for the net energy produced.

**Virtual Net Metering** uses the same compensation mechanism and billing schemes as net metering without requiring the energy generation and the electrical loads to be located behind the same meter. This setup has been used in shared renewable energy projects where multiple customers, or a single customer with multiple electrical loads, partake in net metering based on their portions of a single system.

Net metering policies vary widely between states and in specific utility service territories, and the structure of the policy can have a significant impact on the value of PV alone and the value of coupling PV with EV charging. Local governments can turn to resources such as the N.C. Clean Energy Technology Center Database of State Incentives for Renewables and Efficiency (DSIRE) to learn about the utility regulatory context in their states, as well as other policies and incentives related to renewables.

When considering these options, an important factor to keep in mind is the level of EV charging that will be required. The boxes below describe the different charging levels available for light-duty EVs. Understanding the different charging levels will help inform the feasibility of each configuration option, as further explained below.

**LEVEL 1**

*Level 1 charging* only requires a regular wall outlet and can charge an EV in about 8-15 hours. Level 1 is predominantly used for home charging, though in certain cases it can also be used for workplace and public charging (e.g., when vehicles are expected to park for a very long time).

**LEVEL 2**

*Level 2 charging* requires installation of specialized equipment and can charge an EV in about 3-8 hours. Level 2 is used for home charging as well as workplace and public charging.

**LEVEL 3**

*Level 3 charging* (commonly referred to as Direct Current Fast Charge, or DCFC) requires installation of specialized equipment and typically electrical upgrades too. It can charge an EV in about 20 minutes-1 hour and is used for public, on-the-go charging.
Physical Configurations on the Same Site

Geographic co-location of both PV and EVSE is one of the simplest ways that linkage can occur. In these cases, not only are the PV and EV charging co-located, but they are typically also economically linked by virtue of being on the utility bill of the same customer. There are several options for what a physical configuration can look like, including whether solar and EV charging are metered separately or together. The benefits of installing both solar and EV charging behind the same meter include lower metering costs and simpler billing structures. In areas where net metering policies are in place, customers can offset the cost of power used with any extra PV production that goes back to the grid (see box, p 4).

Another option is to include a feature known as charge management. For the purposes of this discussion, charge management refers to the ability of the host of the charger (the site host) to control charging via software on the charger side (as opposed to software on the vehicle itself). The site host can establish software protocols to reduce electricity costs by pausing, delaying, or ramping EV charging speed up or down in order to reduce peak demand and/or peak period electricity consumption (see box, p 4). Charge management is particularly useful in settings where multiple vehicles may be charging at the same location and/or where high-powered charging is offered. When battery energy storage is included, change management can be used to enable greater value from on-site renewable energy sources such as solar, although it does add substantially to project costs.

MANAGING VARIABLE ENERGY BILLS

The integration of charging and PV has implications for managing energy bills. Two bill features are important to understand in order to reduce and stabilize electricity costs for consumers.

Demand charges refer to a component of a bill that is typically based on the maximum amount of power drawn over a specific period of time (e.g., 15 minutes) across the whole billing period. Given that EVs can draw significant load, they can lead to large and variable demand charges.

Peak period usage is the amount of energy used by customers during times defined as “peak,” which tend to be more expensive because it is more costly for the utility to provide power. In some jurisdictions, under an arrangement known as time-of-use rates, customers are charged more for electricity used during these peak periods.

As both of these features become more common, charge management allows customers to co-optimize solar output and EV charging to reduce their overall electricity costs.

Source: Jason Wagner, NREL
BEHIND THE SAME METER WITHOUT CHARGE MANAGEMENT OR STORAGE

**Description:** PV and EVSE can be installed behind the site’s electric meter without charge management or storage. The solar energy production supports the EV charging and any other on-site load, with any excess energy produced going back to the grid. Without a charge management system, EV charging is simply controlled by the vehicle’s needs, without regard to the impact on the utility bill or how much solar production is available. And without storage, EV charging powered directly by solar can only occur when PV production is occurring.

**Suitability:** This simple configuration is well suited in cases with Level 1 or Level 2 charging with a low number of charging ports, and/or in settings where demand charges are not a priority concern. As the simplest configuration, it is desirable in situations where the site host is interested in reducing upfront costs and in which the savings associated with charge management and storage are not likely to offset the increased costs. This configuration may not be optimal in cases where many EVs are charging at the same time, or there are large power draws through Level 2 or DCFC that can lead to high utility bills because of demand charges.

**Example:** Having EV chargers in the garage of a commercial building that has PV on the roof, but without any mechanisms to coordinate production and consumption between the two or to store excess energy.

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BEHIND THE SAME METER WITH CHARGE MANAGEMENT

**Description:** This is the same as the basic system with PV and EVSE installed behind the meter, but with charge management included. Charge management software is a critical link to optimize the benefits of PV and EV together, allowing the system to ramp up charging during times of solar production and ramp down during other times.

**Suitability:** This configuration is particularly valuable for settings such as (1) DCFC public charging, (2) locations with large numbers of vehicles that could charge simultaneously, and (3) locations where medium- and heavy-duty vehicles charge, since all these examples can include very high demand charges and uneven utilization from hour to hour and day to day.

**Example:** The Pittsburg Unified School District in Pittsburg, California uses a custom charge management solution for its charging of electric school buses, enabling the district to maximize the consumption of its on-site solar and wind generation.

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1. External reference.
BEHIND THE SAME METER WITH STORAGE

**Description:** Another way to augment a behind-the-meter setup is to include battery storage. Behind-the-meter storage allows customers to capture the energy from on-site PV generation and utilize it later when needed. This can help reduce demand charges and match PV production to EV charging demands. With the proper equipment, it can also enable more rapid charging of vehicles than would otherwise be possible based on the site’s electric service constraints. Additionally, installing on-site storage can enhance a customer’s resilience in the face of disruptions to the electricity grid. However, while battery prices are falling rapidly, the additional cost remains a major drawback for many customers.

**Suitability:** Regardless of the level of charging, including storage as part of an integrated PV and EV system can make sense if a customer would like to store PV energy as it is produced and use it for EV charging when PV resources are not available (such as at night) or when grid energy is more expensive. In cases where charging occurs primarily during the day, such as at workplaces and public locations, storage may not be necessary. Battery storage systems may also help owners get through certain utility power outages if the system was designed that way. However, the load required for EV charging may be substantial enough that charging EVs during such an outage may compromise the ability of the system to generate enough electricity to meet the building’s needs throughout the entire outage.

**Example:** Property owners can purchase battery storage systems that store PV energy and can be integrated with EV charging. Another example is a type of solar PV canopy unit that has battery storage integrated within it. This technology has been piloted in public charging settings by municipalities and other customers but has not yet been deployed at any scale. A unique benefit of such a product is that it can eliminate interconnection costs and, in some configurations, may be moved easily from location to location. However, it currently tends to be relatively expensive and may have limitations if the solar resource on-site is too variable.

METERED SEPARATELY

**Description:** Customers can elect to meter PV and EV charging separately. In some cases, utilities may require or encourage customers to meter separately in order to qualify for an EV-specific electric rate. A benefit of metering separately is that rates can be tailored to the specific end uses they serve, allowing customers to navigate costs more easily. However, installing an additional meter and electric panel can add extra cost to a project’s bottom line.

**Suitability:** A configuration in which PV and EV charging are metered separately can be applied to any level of EV charging and is predominantly determined by how customers would like to manage their costs and applicable utility requirements. Separate metering is well suited for applications where a customer needs to allocate costs incurred by EV charging separately from other operational costs (e.g., workplaces, public charging locations, and places where consumption data could help the site host determine how to bill users for charging).

**Example:** Utilities such as Pacific Gas and Electric in California, Dominion Energy in Virginia, and DTE Energy in Michigan offer EV time-of-use rate plans that require the EV charging load to be metered separately in order to qualify for the special rates.²
Virtual Configurations Across Different Sites

Physically co-locating PV and EV charging is not always necessary to capture simultaneous benefits. Another option is to create links between PV and EV systems across different sites.

**Description:** Technologies located at different sites can still be linked economically, depending on the regulatory context and available utility rates or tariffs. For instance, if virtual net metering is enabled (see box, p 4), a customer having properties at multiple locations, such as a local government, could allocate solar net metering credits from one site to cover EV charging loads at another. Community solar, which allows customers to lease or own shares of an offsite PV array, is another mechanism that can offset the cost of EV charging at the customer site.¹

**Suitability:** Along with local government properties that have multiple locations, virtual configurations are normally used when it is not feasible to install PV on-site. For instance, multifamily unit residents, customers with inadequate roof space, tall buildings in urban environments, and renters or lessees may benefit from such an approach if they are located in areas that allow virtual net metering.

**Example:** Many community solar programs have been established throughout the U.S. For instance, Evergy (formerly Kansas City Power and Light Company) maintains a solar subscription service within its Kansas Central service territory, which enables customers to purchase clean power shares without the cost of panel installation and maintenance fees. Just as with any other community solar program, EV charging load could be offset with the subscription.²
Local Government Impact Levers

Local governments’ opportunities to promote the synergy between PV and EV can be grouped into five categories: (1) education and outreach; (2) group purchase campaigns; (3) public actions and investment; (4) incentives; and (5) regulations. Each impact lever is described below, including factors and examples for local governments to consider as they evaluate which actions to pursue in their own communities. Through no-cost consultations and technical assistance, the SolSmart program can help local governments determine the best ways to use these levers to influence PV and EV integration.

Achieving SolSmart Designation Using PV and EV Integration

Promoting the integration of PV and EVs can result in significant benefits to the community, from saving money to reducing pollution. Communities that take these actions can receive credit toward designation under the SolSmart program. Integration of solar PV and EVs can support achievement of SolSmart designation under the following credits:

- MDF-10a: Conduct feasibility analysis for solar PV integrated with other technologies such as combined heat and power or electric vehicle charging on/at a local government facility.
- MDF-10b: Install solar PV integrated with other technologies such as combined heat and power or electric vehicle charging on/at a local government facility.

For more information about how the SolSmart program can help communities meet their solar and EV charging objectives, visit SolSmart.org. As an additional resource, a SolSmart webinar on PV and EV integration geared toward local governments is available at https://www.solsmart.org/resources/upcoming-webinar-7-31-what-local-governments-need-to-know-coordinating-efforts-on-solar-pv-and-electric-vehicles/.

Education and Outreach

Local governments can educate community members and facilitate outreach to help them better understand the opportunities and benefits of integrating PV and EVs. Early PV adopters may also be early EV adopters, so a coordinated education and outreach approach can save staff time and utilize existing channels more thoroughly. Furthermore, community members may see a better payback if they complete their solar and EVSE projects concurrently and size their solar systems to be appropriate for their load, inclusive of EVs. As part of, or in addition to, the approaches featured below, local governments can use community events to cross-promote PV and EVs. Events where staff provide educational materials about one of the technologies could be enhanced with the inclusion of information or an on-hand expert to discuss the other.
Combined PV and EV Information Clearinghouse

By combining PV and EV information into a single clearinghouse, local governments can provide a one-stop-shop for guidance on both processes. In order to provide the most value, a clearinghouse should make it easy for residents, business owners, PV and EVSE project developers, and other community members to find information most relevant to them. If hosted on a website, a useful way to structure the information is to first articulate why the local government is invested in promoting PV and EVs together, then provide guidance for each target audience. The website can also include frequently asked questions and other resources where community members can get more details. Many local governments may already have information on PV and EVs hosted separately on their websites, so implementing this action would be a matter of providing resources about the intersection of the technologies. Lastly, local governments can link to existing tools, calculators, and templates instead of having to create these resources themselves. Creating an information clearinghouse can be a low-cost, low-effort way to encourage community members to consider the two technologies together.

Examples of the types of information local governments should consider incorporating into a PV and EV clearinghouse include:

- Available financing and incentive opportunities.
- Ways to estimate greenhouse gas emissions reduction and pollution reduction.
- Ways to calculate cost savings.
- A list of products tailored for PV and EV integration.
- A list of local installers, including those that can cover both PV and EVSE.
- Consumer protection resources such as guidance on how to select an installer, and what to expect from them.
- Comparisons of available utility rates.
- Planning considerations, such as (1) how large of a PV array to install based on existing electric usage from the building plus anticipated EV consumption; (2) optimal times to charge an EV based on utility rates, net metering policy, and amount of PV generation; and (3) descriptions of types of products that may be of interest, like inverters that also come with an EV charging function and software tools/apps for managing PV and EV adoption.
- Guidance on future-proofing installations, such as by using microinverters so additional PV capacity can be added in the future.
- Zoning and permitting information.

SolSmart has template language for solar web pages available on request. For any municipality that participates in the SolSmart program, SolSmart can also provide further input on what a combined PV and EV clearinghouse website could look like.

Solarize Massachusetts Plus Program

The Solarize Mass Plus program provides a combined information clearinghouse that shows the complementarity of PV and EV technologies in terms of fuel cost savings, and identifies incentives that are available to fund their integration. On the website, see the section “Program Background: Solarize Mass Resources Toolkit.”

Source: Fotolia
Tailored Information and Guidance for Sites Developing PV and EV Charging

Local governments can provide information about PV and EVSE integration to potential hosts for both technologies, such as workplaces, multi-unit dwellings, school districts, transit agencies, or popular destinations. Useful information to convey includes guidance on local permitting processes, considerations for siting infrastructure, costs associated with installation and operation, and ways to address anticipated challenges. Some host locations are ideal for daytime EV charging when there is ample PV production. For example, workplaces and schools have ample opportunity for daytime charging, as most vehicles are parked on-site for long periods during the day. Local governments can provide guidance to these audiences on how to take advantage of these opportunities and provide their students and/or workforce with a desirable benefit, while enhancing their public image and advancing sustainability goals.

Policy guidance

Local governments can publish guidance covering pricing policies, parking policies, and demand charge management approaches. Guidance could be provided for internal local government audiences, as well as site hosts that would install PV and charging on their own facilities and campuses.

Pricing policy guidance could include information on:

- Which pricing mechanisms for EV charging are allowable under state regulations. (For example, Massachusetts requires that public charging should not necessitate membership in any charging network or charge a subscription fee, and all chargers should be accessible by credit card payment.)
- How to evaluate the upfront and ongoing cost of installing PV and EV charging at the same site, and how to set rates for users of the chargers that are reasonable (e.g., helping the site host recover costs with rates that are not so high as to discourage use).
- Systems to manage free EV charging if it is provided as a perk.
- Managing the tension between (1) providing ample and inexpensive public charging as a method to advance the local market for EVs and (2) ensuring that EV charging strategies do not disproportionally benefit wealthier constituents while leaving behind the less well off. Since many early adopters of EVs have tended to be more affluent, providing free or highly subsidized charging can raise concerns about whether subsidizing the cost of charging is a fair way to invest public money.

Parking policy guidance could include suggestions on:

- Etiquette, including encouraging EV owners to move vehicles when fully charged and notifying them of state of charge status if possible.
- Enforcement, including when to tow or fine vehicles that should not be occupying the charger parking spot, like a gasoline vehicle or an EV that has occupied the space for a longer time period than permitted.

Finally, demand charge management guidance is important for site hosts that expect a large volume of vehicles to charge or that expect to offer Level 2 or DCFC charging. Particularly given that solar power is intermittent, site hosts could expect substantial spikes in demand, for instance, if a rainy day coincides with heavy usage of the charging ports. Many utilities and EV charging providers are providing options for modulating the charging of EVs in a way to limit exposure to demand charges.
Multifamily and rental building guidance

For some potential hosts, particularly rental properties, multifamily buildings, condos, and other real estate with short-term occupancy, both PV and EV charging face the classic “split incentive” challenge. The split incentive is that the landlord is responsible for covering upfront costs, but tenants benefit from reduced utility bills and/or the opportunity to charge their cars. Local governments can assist these entities by identifying the challenges and providing them with potential mitigation strategies and assistance.

Several local governments have provided resources and guidance to help entities facing these unique challenges. To date, however, most guidance documents have addressed solar PV and EV charging separately. For example, through its Sunny Cambridge initiative, the City of Cambridge, Massachusetts (SolSmart Gold) developed a step-by-step guide for landlords and condominium owners to walk them through the process of installing rooftop PV. The guide also provides resources about eligibility for tax credits.

The San Diego Association of Governments developed a guidance document for multi-unit dwellings that focuses on EV charging, which includes discussions on challenges and common solutions. While these documents are both useful, local governments could consider combining information about both technologies to help address related barriers concurrently, and potentially encourage hosts to install PV and EV charging at the same time.

Local governments do not have to develop these resources from scratch. There are several host-specific guidance documents for PV and EV charging at the federal, state, and city levels that they can borrow from and customize with local information. Examples include the U.S. Department of Energy best practices and case studies for EV charging for multi-unit dwellings, the Multifamily Housing Charging Station Installation Handbook from Plug-In North Carolina, the Solar Guide for Condominium Owners and Associations in Massachusetts from the Massachusetts Department of Energy Resources, and the New York City Multifamily Solar Guide.

Solar and EV Group Buys

Local governments can organize group buys, which leverage participant numbers to increase negotiating power and secure group purchase discounts. Group buys can be organized to purchase PV, EVSEs, and/or EVs. The role of a local government when leading a group buy is to negotiate discounts, coordinate marketing and outreach campaigns, and educate residents about the benefits of the available technologies and the corresponding discounts. These programs are relatively inexpensive for local governments to run and can have significant impact. Group buy discounts can also be combined with state and federal tax credits and financial incentives to further reduce costs for consumers. As examples, successful multi-year campaigns that offer both EVs and PV have been run in the Front Range in Colorado and the Bay Area in California.
In 2015, Boulder County (SolSmart Silver) led Solar Benefits Colorado, the first combined PV and EV group purchase program. Residents of Boulder, Adams, and Denver counties could purchase both an electric vehicle and a rooftop solar array at a discount. Boulder County worked with a local Nissan dealership to offer an $8,349 group discount for the 2015 Nissan LEAF. The net price of the LEAF was a 62% discount off the retail price when combined with state and federal tax credits. Of those that purchased an EV, only 28% were already considering doing so, indicating that the program brought in new customers.

PV was available at a price of $3.50 per watt with an incentive of $250 or $750 for each signed contract, depending on the dealer.

Although Boulder Nissan offered participants EV charging at its DCFC network for 24 months after purchase, EV chargers were not directly part of the group buy. In a post-program survey, participants suggested including charging stations as part of the program. According to program results, about 16% of participants who bought an EV also installed PV, and nearly 58% of the participants who did so sized their systems to handle both loads. The amount of overlap is promising, but also suggests the need for further education to help optimize participation in both components of the program.
Keys to a successful group buy include (1) providing limited-time offers to motivate participants, (2) focusing on a limited number of dealers, vendors, and products, and (3) implementing substantial stakeholder engagement upfront. The Southwest Energy Efficiency Project created The Electric Vehicle and Photovoltaic Power Purchase Handbook as a toolkit for developing coordinated EV and rooftop PV group buy programs. The Handbook includes discussion of the benefits of including PV in combination with EV discounts as part of a program. As the Handbook explains, a substantial number of participants choose to participate in discounted offers for both PV and EVs, due to the benefit of offsetting the electricity used by the purchased EVs with renewable energy. The Handbook also provides guidance on how to administer a program, sample language to use in requests for proposals (RFPs), and examples of outreach materials.

The Handbook also describes some challenges associated with conducting a joint campaign, particularly that it may add complexity to program development. Participants choosing to purchase solar panels, EVs, and charging systems need to make decisions about home energy improvements, mobility choices, and whether to install higher-powered (Level 2) charging. From the organizer perspective, doing a joint campaign requires two separate RFP processes to solicit PV installers and EV dealers, increased coordination and communication, and a robust customer tracking system. Local governments can work to mitigate these challenges by using existing templates for RFPs and other materials as much as possible and bringing in an outside administrator to manage the program.

Local governments may also consider incorporating a charging strategy as part of the program in addition to the vehicle purchases. For single-family homeowners with garage or driveway access, a group buy program could include an incentive for a Level 2 charger. For programs targeting tenants, residents of multifamily housing, and others without access to a driveway or garage, the program could consider ways to encourage charging infrastructure in shared and/or public locations. As part of Drive Electric Northern Colorado’s EV group buy in 2015 (which did not include PV), all participants that purchased a Nissan LEAF received a Level 2 charger for free.

Coordinated PV and EV group buys, particularly those that involve more support for EV charging, warrant additional engagement from stakeholders such as electricians and utilities. Although some solar installers will be able to cover the electrical upgrades for EV charging at the time of the install, many EV buyers may wait to decide whether they need an upgrade. Therefore, the local government might consider developing a list of qualified electricians through a procurement process, making it easier for group buy participants to install infrastructure during or after the campaign. Organizations such as Electric Vehicle Infrastructure Training Program (EVITP) provide training for electricians to ensure they understand the importance of load calculations and taking proper precautions for Level 2 installation, since an EVSE can be a sizable continuous load compared to other household loads. Selection of contractors could involve factors such as their participation in such trainings, experience, ability to scale quickly, ability to cover the whole community, and pricing.

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‡RFPs are traditionally used by a program administrator (such as a local government, nonprofit, or other organization) to select EV dealers and/or PV installers that will offer a discount as part of the group buy based on factors such as best discount offered, financing options, and inventory availability. Program administrators can forgo the RFP process by negotiating directly with vendors, though this is often done as part of a second round when vendors were already selected via RFP for the first round or when the number of vendors is limited.

§Not all residents will choose to upgrade to a Level 2 charger, as the upgrade often requires more electrical work than simply relying on an existing wall outlet for Level 1 charging. The motivation to upgrade to Level 2 at home is dependent on driving routines and availability of public or workplace charging, and if driving is modest (typically less than 20-40 miles per day), a Level 1 charger is likely sufficient.
Just as with any PV group buy, a coordinated PV and EV group purchase campaign may have implications for the utility serving the participants. The utility may need to plan for a sudden uptick in PV interconnection requests, while also anticipating growth in the overnight EV charging load.\(^5\) Solarize programs have run into hurdles when they have attracted participants in particularly constrained grid locations, leading to a larger percentage of interconnection delays and/or denied interconnection applications. For that reason, advance planning and coordination with the utility is very important.

Public Actions and Investment

Government actors can lead by example. Local governments are not only governing bodies, but also serve as workplaces, landlords, and consumers. They can save money and/or provide amenities for their constituents by integrating PV and EV infrastructure, and they will often get the most benefit from synchronizing the two investments. Demonstrating leadership at the local government level can encourage residents and private sector actors to follow suit.

**Leading by Example**

Given that initiatives taken at the local level can be highly visible to constituents, municipal governments are in a unique position to lead by example. Municipalities can adopt both PV and public EV charging together, particularly in highly trafficked central locations like libraries, parking garages, civic centers, and more. When installing EV charging at these locations, local governments will need to decide whether they should be dedicated to public access, municipal fleet use, or some combination of both.\(^\text{1}\) Offering public access can leave a positive impression that the community has a wide network of public charging locations, particularly if the destination is highly trafficked. On the other hand, dedicating the EV charging to municipal fleets can enable the local government to directly capture any cost savings associated with the PV system, and can potentially enable a lower cost per mile for fleet vehicles. Whichever approach a community chooses, the commitment to PV and EV can be formalized in a sustainable building policy, such as is the case in Saint Paul, Minnesota (see box).\(^\text{18}\)

A second way in which local governments can integrate PV and EV charging is by integrating solar into their fleet transition plans. Common examples of municipal fleets that can be electrified include pooled employee vehicles, shuttles and vans, and pickup and work trucks (which are primed to have many more makes and models available in the next few years). Sometimes, the local government may have control or influence over other fleets as well, such as transit bus fleets and/or school buses, which both provide excellent opportunities for PV and bus electrification. In cases where municipal governments do not have control over such fleets, they can still share best practice examples, which can be found in SolSmart’s webinar on solar and bus electrification.\(^\text{19}\) With their speed and performance capabilities, EVs are also beginning to be deployed as police cruisers.

For additional information on solar group buys, consult the recorded SolSmart webinar: How to Conduct a Solarize Campaign. Further information can be found in the Market Development and Finance section of SolSmart’s Toolkit for Local Governments. For a complete list of resources from SolSmart, see Additional Resources, p 20.

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**SUSTAINABLE BUILDING POLICY**

The city of Saint Paul, Minnesota (SolSmart Gold) has articulated its commitment to PV and electric vehicles as part of its sustainable building policy. In cases where Saint Paul is a financial participant in the development process and where public investment exceeds $200k, the local government requires that new developments are built to the highest green standards, which could include installing EV charging infrastructure and having on-site PV.\(^\text{20}\)

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\(^\text{1}\)Combining public access and municipal fleet access in one location can run up against significant barriers. For example, fleets need reliable charging access and governments need to come up with an approach for payment allocation. However, it is a concept that has been gaining interest as local governments start to explore how they can maximize the value of their PV and EV assets.

\(^\text{5}\)Assuming a substantial percentage of participants are those who work outside of the home and whose vehicles are not frequently garaged at home during the day.
In certain cases, local governments can even establish microgrids powered by PV and use some of the power to charge EVs. Microgrids that can be “islanded” or shut off from the rest of the grid can increase energy security for the users of the microgrid in the event of a blackout. However, undertaking a microgrid project involves substantial complexity, cost, and stakeholder coordination, such that the value proposition does not always pencil out. In-depth feasibility studies and utility coordination are required if local governments choose to go this route.

To amplify the benefits of “lead by example” initiatives for PV and EV deployment, municipal governments should consider tracking their progress, documenting lessons learned, promoting success metrics like reduced operational costs, and presenting their policy solutions, so that public and private fleets can plan their own deployments with the benefit of learning from the local government’s experience.

### Incentives

Local governments can offer incentives, both financial and non-financial, to encourage the private sector and residents to integrate PV and EVs.

#### Financial Incentives

Local governments have the ability to offer financial incentives and/or financing to offset the cost of PV and EV charger installation. Given that there are often other entities providing financial incentives for both PV and EV (e.g., federal, state, and utility incentives), and since many local governments have opted to focus more on policy mechanisms than on direct investment in subsidies, this report will not dive deeply into financial incentives that can be offered by the local government. Nonetheless, it is worth noting a few actions that municipalities have employed, either through direct financial incentives or through financing.

- **Property assessed clean energy financing (PACE).** Where authorized by state law, PACE enables building owners to take on debt that is repaid through an assessment on their property tax bills, and this debt is typically transferred when the property is sold. Subject to state guidance, it can be applied to both PV and EV charging separately. California, Minnesota, and Rhode Island are among the states in which either residential PACE or commercial PACE guidelines explicitly enable using PACE for EV charging. The cities of Pleasant Hill and Redlands in California both explicitly allow EVSE to be financed in this way. However, the application of PACE to EV charging comes with some potential drawbacks. There does not appear to be any reason that PACE programs would need to be customized to address both PV and EV charging, since both technologies can be financed through PACE in certain states.

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‡Since EV charging leads to savings at the pump and on vehicle maintenance (neither of which are savings associated with the building in which charging is installed), and since future purchasers of the property may not own EVs, it could be less likely that the future owner of the property would benefit in the same way that they would for a more conventional use of PACE like energy efficiency, water efficiency, or solar improvements.
- **Permit fee waivers or reduced permit fee levels.** Local governments can encourage PV projects and/or EVSE installations by reducing or waiving the permit fee (either across the board or for certain property owner types like nonprofits, governments, or organizations providing services to the community). One possibility is that if a joint PV/EVSE application is allowed (see Permitting Processes, p 19), the applicant could be responsible for a single permit fee instead of paying a separate fee for each permit.

- **Rebates for purchasers and/or property tax credits for organizations that install PV and EV charging.** As noted above, other levels of government provide tax credit or rebate incentives for PV, EV, and EVSE to support personal/at-home adoption and to support adoption in a corporate, organizational, or public setting. Most municipalities have shied away from adding another layer of incentives. However, sometimes municipal utilities, as opposed to the local governments, will offer incentives for PV adoption and/or EV adoption. At the time of writing, there are no known examples of special incentive adders for property owners who concurrently install PV and EV charging, though many municipal utilities support PV, EV charging, or both separately. Likewise, local governments can also provide tax incentives for businesses that install EV charging for use by employees, customers, and visitors.

### Non-Financial Incentives

Municipalities should consider non-financial incentives as well. In particular, they can make it easier and faster for developers to incorporate PV and EV charging. For example, municipalities can allow additional bonus density or reduce parking minimums for buildings integrating PV and EVSE. Precedent exists for municipalities counting EV charging spaces as double toward any minimum parking requirements, so a broader policy to provide a higher multiplier for PV canopies could be enacted.

Local governments can consider expediting permitting of development projects that include innovative sustainability actions such as installing PV and EV charging together (see Regulations, below). For many project developers, time is money. A speedier approval process is an extremely valuable incentive that could motivate them to take action. Such incentives would need to be carefully evaluated within the legal setting where the jurisdiction operates and would also need to be balanced with many other policy priorities.

### Regulations

While local governments must operate within the confines of the regulatory frameworks established at higher levels of government (e.g., they cannot regulate fuel economy and EV ownership), they do have several regulatory mechanisms at their disposal. These include building codes, zoning ordinances, and the implementation of permitting and inspection processes. While this report is focused on how to encourage PV and EV charging together, local governments must still be thoughtful in how they shape regulations to avoid unintended consequences. For example, requiring that PV and EV be paired in all cases may deter property owners from installing any EV chargers if they are in a location with limited solar exposure. As another example, solar arrays have long lifespans, so providing regulations or incentives to push property owners to install solar canopies and charging on parking lots could be counterproductive if the long-term plan for that land is something other than parking.

Local governments should find a balance between the “carrot” of incentivizing behavior and the “stick” of enforcing requirements, in order to encourage PV and EV integration in cases where it provides the most benefit.
Building Code Requirements

Building codes present a powerful opportunity to encourage both PV and EV charging, since they apply to all building construction including major renovations. However, not all local governments are authorized to adopt codes that go beyond their state’s building codes. Those that are often obtain this authority by virtue of being in a state that allows “stretch” or “reach” codes, which are more advanced than those required by the state. Many jurisdictions already require new construction to be either PV-ready or EV-ready, meaning the electrical infrastructure must be in place to support future installation of the technologies. Synchronizing the two can be a natural next step. San Diego County (SolSmart Gold) includes language in its building code that all new residential construction must include sufficient capacity and space for future PV and EV charging systems on the main electrical service panel. Furthermore, the county requires conduit and electrical junction boxes that are sufficient for future installation of wiring and equipment associated with PV and EV charging.\(^25\)

For renovation of existing buildings, additional nuance is needed to determine when code requirements for PV and/or EV charging make sense. Local governments can consider instituting conditions that would trigger EV charging installation, such as when a parking lot renovation is planned.

Zoning Code Requirements

Zoning codes are another mechanism through which local governments can influence the integration of PV and EV, both through regulation of primary and accessory uses and through parking standards. While building codes apply universally, zoning codes can be customized to be appropriate to each land use classification within a municipality, enabling more stringent requirements in some zones and more permissive requirements in other zones.

Allowing small, standard installations “by-right” is a gold standard for reducing unnecessary barriers to both PV and EV charging. By defining the types of PV installations and the types of EV charging installations that qualify by-right, municipalities can ensure that discretion is removed from the process of obtaining a permit and that all potential installations are held to the same objective standards, rather than requiring conditional permits, special use permits, or variances. Solar canopies are a great example of the type of integrated PV and EV charging that could be allowed by-right, subject to specific dimensional requirements. To this end, the Great Plains Institute’s Local Government Solar Toolkit provides model ordinance language that includes PV canopies as permitted accessory uses, which could be used for EV charging. The model language also specifies that PV canopies are an allowed use whether or not they are on the same lot as the building.\(^26\) The City of Cumberland, Rhode Island facilitates the development of solar canopies on parking lots by creating a definition for “Solar Energy System, Covered Parking” (Zoning Ordinance 17-01). This definition includes distinctions between minor, medium, or major-scale canopies, permitting minor and medium-scale canopy systems under the same zoning requirements as similarly sized ground- or roof-mounted systems.

Local governments can institute parking standards requiring parking lots to be equipped with the necessary electrical infrastructure to support both future charging stations and solar parking canopies. They can also consider how to adapt parking minimums to incentivize or at least not deter the inclusion of PV and/or EV charging. In October 2019, California changed its vehicle code to state that a parking space with existing or future EV charging equipment will count as at least one standard parking space for the purpose of complying with minimum parking space requirements, and a handicap-accessible space meeting the same parameters will count as two. Prior to the change, some local governments required developers to build parking spaces in addition to those with EV charging equipment in order to comply with minimum parking requirements. Some local governments now go beyond the requirements of the state vehicle code and count any EV charging parking spot as multiple parking spots, which can be a valuable incentive for developers. Examples within California include the counties of Los Angeles, Sonoma, and Sacramento, and the cities of Stockton, West Hollywood, Santa Barbara, and Pleasanton. In a similar vein, local governments could count parking spots equipped with both PV and EV charging as multiple spots.

Source: Fotolia
Permitting Processes

Local governments can streamline permitting processes to support PV and EVSE integration. This can be done by fast-tracking projects with both technologies (see Non-Financial Incentives, p 17) or by offering a combined permit application or inspection. While a number of communities offer expedited permitting for PV and EVSE, the two permits are typically offered separately. For example, the City of Piedmont, California offers two separate permits with identical processing times. The only difference lies with the fees. However, given that many elements of the permitting processes are similar, such as electrical requirements, site inspections, and processing times, combining them into a single application is a highly feasible option.

SolSmart has published a Simplified Solar Permitting Guide that provides step-by-step instructions for local governments seeking to develop simplified permitting processes for PV. Although it does not specifically address EV charger installations, the guidance can serve as a starting point for developing a streamlined permitting process for PV and EV combined. SolSmart has also been a leader in the Solar Automated Permit Processing (SolarAPP) initiative. In coordination with the National Renewable Energy Laboratory, The Solar Foundation, the Solar Energy Industries Association, national solar installation companies, code officials, and other stakeholders, SolarAPP has developed an online permit portal for local jurisdictions that automatically reviews project applications for compliance with model building, electrical, and fire codes, and instantaneously issues permits for compliant systems. Initially designed for roof-mounted residential PV, the SolarAPP platform will be expanded to include other clean energy technologies including storage and EVSEs.

Additional information on streamlining local permitting processes is available in the Codes, Permitting, and Inspection chapter of SolSmart’s Toolkit for Local Governments.

SUSTAINABLE BUILDING POLICY

Morgan Hill, California has a single combined permit for PV and EV that can be submitted online, rather than having two separate permits and inspections.
In considering strategies for integrating solar PV and EV infrastructure, local governments are encouraged to consult these other resources, all of which are available on SolSmart’s website at SolSmart.org.

**SolSmart Webinar: Solar and Electric Vehicle Best Practices for Local Governments**

This webinar provides additional information and resources for local governments on the co-development and integration of solar PV and EVs.

**Issue Brief: Solar and Electrification: A Beneficial Partnership**

This guide explains how communities can collaborate with their utilities on programs that produce complementary benefits for solar and electrification policies.

**Issue Brief: Expanding Solar Participation Through Community Solar**

This guide describes the community solar model and highlights options for developing new projects.

**SolSmart Webinar: How to Develop a Solarize Campaign**

This webinar covers the basics of how to develop a solar group purchase campaign, featuring national experts as well as case studies.

**Solar Energy: SolSmart’s Toolkit for Local Governments**

This comprehensive guide for local governments includes detailed sections on permitting, planning and zoning, community solar, and market development and finance, among other topics.
References


15. Ibid.

16. Ibid.


