



Multi-Unit Dwelling Electric Vehicle Charging

Overview, Developer Survey & Program Recommendations

Prepared for: Chittenden County Regional Planning Commission
110 West Canal St, Suite 202



August 2020 Partner Review Draft

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DISCLAIMER

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Executive Summary

- Plug-in Electric Vehicles (EVs) are widely available in Vermont and are an important strategy in reducing greenhouse gas emissions and advancing efficient and renewable energy use in the state. Policies and plans at the State, regional and local level call for greater adoption of EVs, reaching nearly 90% of registered vehicles by 2050 in the State of Vermont's Comprehensive Energy Plan.
- Most EV owners charge at home for 80% or more of their energy needs - it is usually the lowest cost and the best time to charge is during off-peak hours when vehicles are parked at home.
- Multi-unit dwelling (MUD) residents in apartments and condominiums often have more challenges in gaining access to home EV charging due to parking issues and cost. Renters in MUDs have additional barriers to long-term investments in charging infrastructure for shorter-term housing. Approximately 36% of Chittenden County housing units are in MUD communities and of those 86% are rental units, so overcoming these barriers is critical to meeting energy and equity goals.
- VEIC worked with CCRPC and Drive Electric Vermont stakeholders to develop a survey to gauge MUD property owners' interest in EV charging infrastructure and better understand what resources and assistance may be most helpful in supporting them.
- The survey found the cost of installing EV charging was the greatest barrier for MUD property owners. Incentives or other means of bringing costs down were the most favored types of assistance.
- Additional resources prioritized by MUD owners and developers included EV charging equipment and installation service provider listings, information on setting fees to cover electric costs and installation guide resources.
- This report concludes with several recommendations for resources, outreach and education to address barriers and empower MUD owners and residents to move forward with EV infrastructure plans.

Electric Vehicle Overview

Plug-in electric vehicles (EVs) receive energy from an external source to recharge a battery that powers an electric motor. They are vastly more efficient than gasoline or diesel-powered vehicles due to inherent advantages of electric motors over internal combustion engines.

In Vermont, 45 percent of the state's greenhouse gas emissions come from the transportation sector¹. Since Vermont's electric supply is among the cleanest in the nation², converting to an electric vehicle in our state brings significant economic and environmental benefits, including:

- Improved environment and health – Electric vehicles have reduced or zero emissions compared to traditional internal combustion engine powered vehicles. Reducing our emissions, including greenhouse gases, will help mitigate the most damaging impacts from harmful tailpipe emissions, including carbon dioxide, carbon monoxide, nitrogen oxides and other toxic pollutants.
- Insulation from fluctuating gas prices - In Vermont, electric prices have been stable for nearly 20 years and even at current low prices for gasoline there can be significant savings when driving on electricity. Widespread adoption of EVs is expected to put downward pressure on electric rates, further enhancing their economic benefits³.
- Supporting Vermont's economy - Rather than sending gasoline dollars out of the region, electric powered vehicles support the Vermont economy and contribute to our local renewable energy goals.

In order to reduce greenhouse gas emissions, improve air quality and save consumers money, increased adoption of electric vehicles is a key component of the State of Vermont's Comprehensive Energy Plan (CEP). The CEP is developed by the Vermont Department of Public Service to examine Vermont's energy requirements across all sectors and develop strategies to reduce energy consumption and move towards a more efficient and renewably powered future. The current CEP includes puts Vermont on a path to obtain 90% of its total energy from renewable sources by 2050. Since over 90% vehicles in Vermont currently obtain their energy from non-renewable sources (gasoline and diesel fuels), electric vehicles are a key strategy to reach the CEP goals.

In addition to the CEP goals, Vermont has signed a memorandum of understanding (MOU) with seven other states to bring 3.3 million zero emission vehicles, including EVs, to their roads by 2025. In order to support this MOU, the State of Vermont has developed the Vermont ZEV Action Plan which outlines specific steps and strategies to support the proliferation of ZEVs in

¹ Vermont ANR 2016 Greenhouse Gas Inventory Update. January 2020.

https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/Vermont_Greenhouse_Gas_Emissions_Inventory_and_Forecast_1990-2016.pdf

² Energy Action Network. 2019 Annual Progress Report. March 2020. <https://www.eanvt.org/2019-progress-report/>

³ Natural Resources Defense Council. Electric Vehicles are Driving Rates Down. July 2020.

<https://www.nrdc.org/experts/max-baumhefner/electric-vehicles-are-driving-rates-down>

the state, including the use of these vehicles in fleet applications⁴. The State has also recently signed on to a 15-state MOU advancing electrification of heavy-duty trucks and buses, getting to 30% of new sales by 2030 and 100% by 2050⁵.

In Chittenden County, the Chittenden County Regional Planning Commission's 2019 ECOS regional plan, includes a regional energy plan calling for reducing fossil fuel consumption in the transportation sector through increased efficiency and electrification. CCRPC has also assisted several municipalities on local energy plans which include electrification goals as well as development of resource materials to reduce barriers to EV market development.⁶

The City of Burlington's Net Zero Energy (NZE) initiative is also calling for increased transportation electrification in the City, with this shift creating about 20% of the anticipated total fossil fuel reductions in the Roadmap analysis released by the City in September 2019.⁷

Purchasing an Electric Vehicle

Over the past five years, the number of EV models available in the marketplace has grown considerably. These fall into two basic categories:

1. **All-Electric Vehicles** (AEV), also referred to as battery electric vehicles, are powered solely by energy stored in a battery. Typical range is 150-300 miles before they need to plug-in to charge.
2. **Plug-in Hybrid Electric Vehicles** (PHEV) can be powered by battery or gasoline for extended range. Typical range on the battery 20-50 miles before they need to recharge or run on the gasoline engine.

There are many AEVs and PHEVs at various price points and sizes. Most of these EV models can be found at local dealerships throughout Vermont. While EVs tend to have higher purchase prices than internal combustion powered counterparts today, there are a variety of federal, state, electric utility and automaker incentives that can reduce up-front costs to a point where some EV models are comparable or lower in cost than similarly configured gasoline vehicles. Some of these incentives provide greater assistance to lower income purchasers to expand access to those who may not be able to afford the investment otherwise.

As EV battery technology continues to improve many industry experts anticipate EVs may reach price parity without the need for incentives in the next 5-10 years.

⁴ Vermont Dept of Environment Conservation ZEV Program Resources:

<https://dec.vermont.gov/air-quality/mobile-sources/zev>

⁵ Multi-state Truck and Bus Electrification MOU announcement: <https://governor.vermont.gov/press-release/governor-phil-scott-signs-multi-state-agreement-electrify-trucks-and-buses>

⁶ CCRPC energy planning resources available at:

<https://www.ccrpcvt.org/our-work/environment-natural-resources/energy/>

⁷ City of Burlington Net Zero Energy Program: <https://www.burlingtonelectric.com/nze>

In addition, used EVs represent about 15% of current EV sales in Vermont and are expected to grow in popularity as the market matures and more off-lease vehicles enter the secondary market. Some of these used models are available for less than \$10,000 and should have many years of reliable service to offer, albeit with less electric range than newer models.

The Drive Electric Vermont website includes resources to compare different EV models, understand applicable incentives and determine what purchasing options are appropriate for different households.⁸

Electric Vehicle Charging

EVs require a connection to an external source of power to recharge their batteries. Most EV drivers plug in to charging equipment at home for overnight charging. Drivers who do not have dedicated off-street parking spaces often have additional challenges with EV ownership since they may not be able to install charging equipment. Even those with dedicated spaces may have difficulties installing charging if there are restrictions on resident improvements in common areas and/or high costs to provide electrical service to their space. As a result, access to charging at workplaces and other public destinations can be an important component to encouraging EV ownership and support their use on longer trips away from home.

Types of Electric Vehicle Charging

Electric vehicles connect to a source of electric power through Electric Vehicle Supply Equipment, or EVSE, to charge. These devices function primarily as a safety mechanism that does not allow current to flow when a shock hazard is detected. Some EVSE also contain networking capabilities that allow owners and/or their electric utilities to control when charging is happening to minimize cost and impacts on the electric grid. There are three types of EVSE:

- Level 1 uses a 120V AC connection to a standard residential/commercial electrical outlet capable of supplying 15-20 amps of current, for a power draw usually around 1.4 kW when charging. EVs come equipped with Level 1 EVSE, often called “portable” or “trickle” chargers, when sold by the auto maker. AEVs with 200 miles of range may require more than 40 hours to fully charge using Level 1 EVSE - although in most cases batteries are not completely depleted so it typically does not take that long.
- Level 2 requires a 208/240V AC connection to supply higher power to the vehicle, reducing the amount of time required to charge the EV battery. Level 2 charging power can range from 3-10 kW, or higher in some cases depending on the EV model, EVSE and installation method. This is similar to an electric clothes dryer’s power draw. AEVs with 200 miles of range will usually require 6-8 hours for a full charge using Level 2 EVSE. Many Vermont utilities are offering free networked level 2 EVSE or incentives to support

⁸ Drive Electric Vermont: <https://www.DriveElectricVT.com/>

customer purchases of this equipment to help ensure charging activity will occur in off-peak periods. Level 2 equipment starts around \$500 per charging port for the equipment (without any incentives), with installation costs highly variable depending on the distance to power, existing electric service capacity and availability of existing parking.

- DC Fast Charging, sometimes referred to as Level 3, delivers high power DC energy directly into the EV battery, enabling rapid charging. Typically, an 80% charge takes 30-60 minutes for AEVs equipped with this capability. This equipment is much more expensive (typically over \$50,000 per charging port) and usually is found along busy travel corridors or in dense urban communities.

More information on EVSE installation costs and recommendations can be found on the Drive Electric Vermont Charging Station Installation Guide.⁹

EV Charging in Vermont

While the majority of EV charging occurs at home, a growing number of workplace and public charging stations have been installed throughout the state to provide increased confidence to drivers and enable greater miles traveled on electricity. As of June 2020, there were 234 public electric vehicle charging stations in Vermont, 25 of which offered DC Fast Charging services. Many of these stations were installed by businesses for employees and customers.

The State of Vermont has provided grant funding for about 30 locations over the past few years through the Volkswagen diesel settlement environmental mitigation fund.¹⁰ Interest in public support for EV charging remains strong as many applications to the State did not receive funding due to limited resources for the program.

Many businesses have invested in EV charging to foster greater loyalty among existing customers and expand their brand awareness to attract EV owners. Retail customers driving EVs spend twice as much time at retailers with charging as average customers, and 43% are likely to return weekly to retail locations with EV chargers. For employees, EV charging stations can offer a valuable and tangible benefit providing them with a low-cost, reliable form of transportation.

The easiest and most cost-effective time to install charging is when they are a component of a larger construction project. To this end, the Vermont Building Energy Code has required EV charging for larger commercial and multi-unit residential developments since 2015, and will be further enhanced as the 2020 energy code comes into effect in September 2020.¹¹ These

⁹ Drive Electric Vermont charging installation guide:
<https://www.driveelectricvt.com/charging-stations/installation-guide>

¹⁰ Vermont Agency of Commerce and Community Development EVSE grant program:
<https://accd.vermont.gov/community-development/funding-incentives/electric-vehicle-supply-equipment-evse-grant-program>

¹¹ Vermont Dept of Public Service 2020 Building Energy Standards Update:
<https://publicservice.vermont.gov/content/building-energy-standards-update>

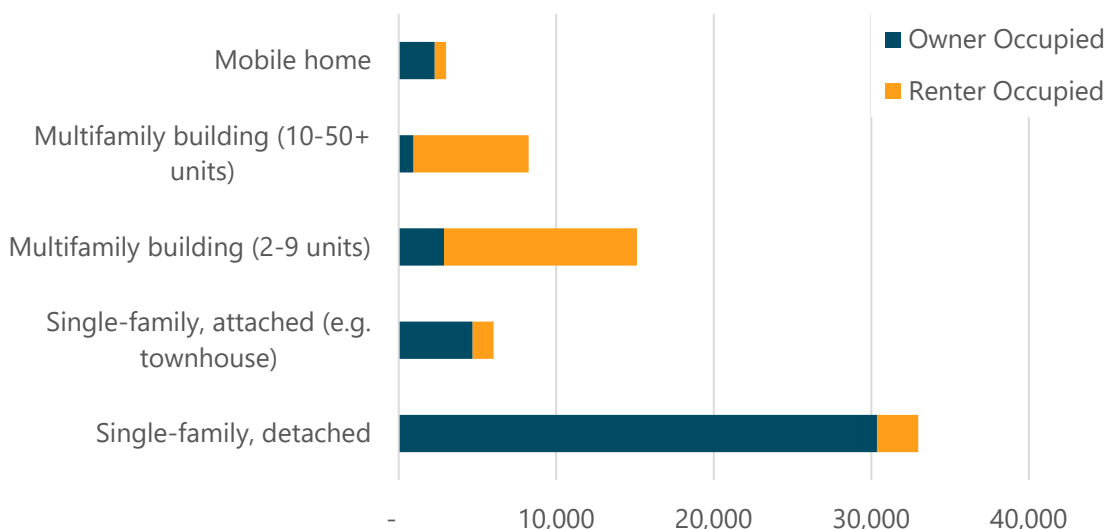
requirements help ensure workplaces and future housing stock will be ready to accommodate EV owners.

Electric Vehicles at Multi-Unit Dwellings

Multi-unit dwellings, or MUDs, include apartments and condominiums where more than one household resides within the same structure. This includes many condominium and apartment buildings where residents may not have a convenient location to charge an EV overnight due to a lack of dedicated parking and/or challenges with installing charging equipment that is metered by the occupant's electrical service or configured so that energy costs associated with EV charging are borne by the user and not the community as a whole.

According to the US Census' 2018 American Community Survey (ACS) data, about 23% of Vermont's existing housing stock falls into the MUD category, or 61,000 out of 260,000 total housing units in the state. In Chittenden County, this percentage increases to 36% of total housing, or about 23,500 units out of 65,400. Of those Chittenden County MUD housing units, approximately 84% are occupied by renters who frequently have additional barriers to getting access to EV charging where they park overnight.

Figure 1. Chittenden County Residential Building Types¹²



Another data source helpful in understanding potential availability of home EV charging is the Residential Energy Consumption Survey (RECS) completed by the US Energy Information Administration (EIA) every five years. The most recent 2015 RECS included a question asking respondents in buildings with less than 5 units whether there was an electrical outlet within 20

¹² 2018 US Census Data available through VHFA portal:

<https://www.housingdata.org/profile/housing-stock/residential-building-type>

feet of vehicle parking. The 2015 RECS data does not include state-specific results, but can offer information at the New England census division level (including CT, ME, MA, NH, RI and VT).

For single family detached homes in New England the 2015 RECS reported about 63% of these homes had an outlet available near parking. For those living in MUDs with 2-4 units, the outlet availability dropped to only 32% of residents and would likely be much lower for larger MUDs with 5 or more units.¹³

Issues MUD residents may encounter getting access to EV charging include:

- Limited interest from property owners to provide EV charging for tenants, especially if it requires significant capital expenditures;
- Less financial resources among residents to cover the cost of installing their own EV charging;
- Lack of dedicated off-street parking spaces;
- More expensive installation costs for EVSE compared to single family homes, especially if existing electrical service at the property does not have enough capacity to support EV charging;
- Complications arising from home owners associations (HOAs) and/or rental lease agreements that may place restrictions on resident improvements, including EVSE installations; and
- Metering individual electrical use associated with EV charging activity in parking areas due to sharing electrical service across common areas on many MUD properties.

The 2020 energy code update requires MUDs with 10 or more units to offer a connection for level 2 charging equipment at 4% of parking spaces at the property. As an example, a 25 unit property will require one space with level 1 or level 2 charging available on occupancy, with the ability to easily upgrade to level 2 if needed. These requirements are important, but it should be noted that offering charging options at more than 4% of spaces will be needed as the State promotes more widespread adoption of EVs.

Meeting state, regional and municipal renewable energy goals will likely require the majority of the 60,000 existing MUDs across the state to make EV charging available to residents or ensure charging is available nearby over the next 30 years.

Multi-Unit Dwelling EV Charging Survey

VEIC developed a survey directed to the MUD development community to better understand perceived barriers to EV charging installation and potential opportunities to make this amenity

¹³ US EIA 2015 Residential Energy Consumption Survey: <https://www.eia.gov/consumption/residential/>

more widely available to their residents. The sections below summarize the development, distribution and results of the MUD EV charging survey.

Survey Development & Distribution

The survey was developed to connect with MUD property managers, owners and developers as well as others in the broader development community who support them, such as engineers and architects.

The survey instrument is included in Appendix 1, and included questions to establish the type of business the respondent represented, their familiarity with EV charging generally, the level of current EV charging demand among residents at their properties, and what resources and technical support would be most helpful in accelerating availability of EV charging at MUD properties.

A draft survey was distributed to partners involved in the Drive Electric Vermont public-private partnership as well as one of the largest funders of MUD developments in the state for feedback prior to implementation.

The finalized survey was programmed into SurveyMonkey and sent via email to 13 of the largest MUD developers and property management companies in Vermont via a list provided by Allen, Brooks, & Minor as well as the Vermont Development email listserv administered by White + Burke in March 2020. The response time for the survey was extended and reminders were sent to encourage participation as this was in the midst of the initial shutdowns and business operations adjustments associated with the COVID-19 pandemic.

Survey Results

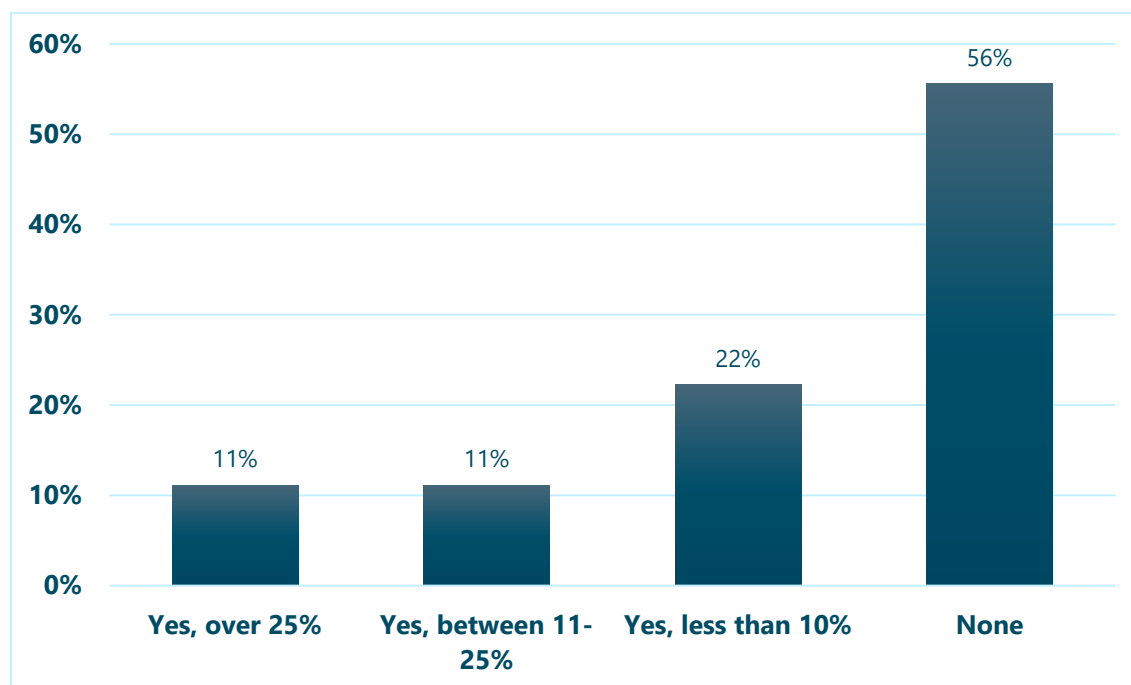
Ten survey responses were collected in March from representatives of the following types of organizations:

- a. MUD Property Owners (n=4)
- b. MUD Developers (n=2)
- c. Combination of MUD Developer, Owner, and/or Manager (n=2)
- d. Others, including an engineer and property manager (n=2)

Taken together the respondents collectively managed 290 properties with 1,465 housing units, ranging from zero or small amounts up to 200 properties and 800 units at the high end.

Just under half of respondents indicated that at least some portion of their housing was intended for low or moderate income households as shown in Figure 2 below.

Figure 2. Survey responses to “Are any units designated for low or moderate income residency?”



The majority (60%) reported they were “very familiar” with plug-in electric vehicles and electrical infrastructure required for home charging, with 30% “somewhat familiar” and 10% “not familiar”.

Most (70%) also reported there were no residents of their MUD communities currently driving EVs, at least to their knowledge. Several (30%) reported they did have EV-driving residents, with one respondent estimating 15 current EV drivers at their property (or properties).

Just under half of the respondents (44%) indicated they had received between one and five requests for EV charging at a property.

Most (80%) felt MUD developers should be investing in EV charging, or at least installing conduit and electrical capacity to ease future installations.

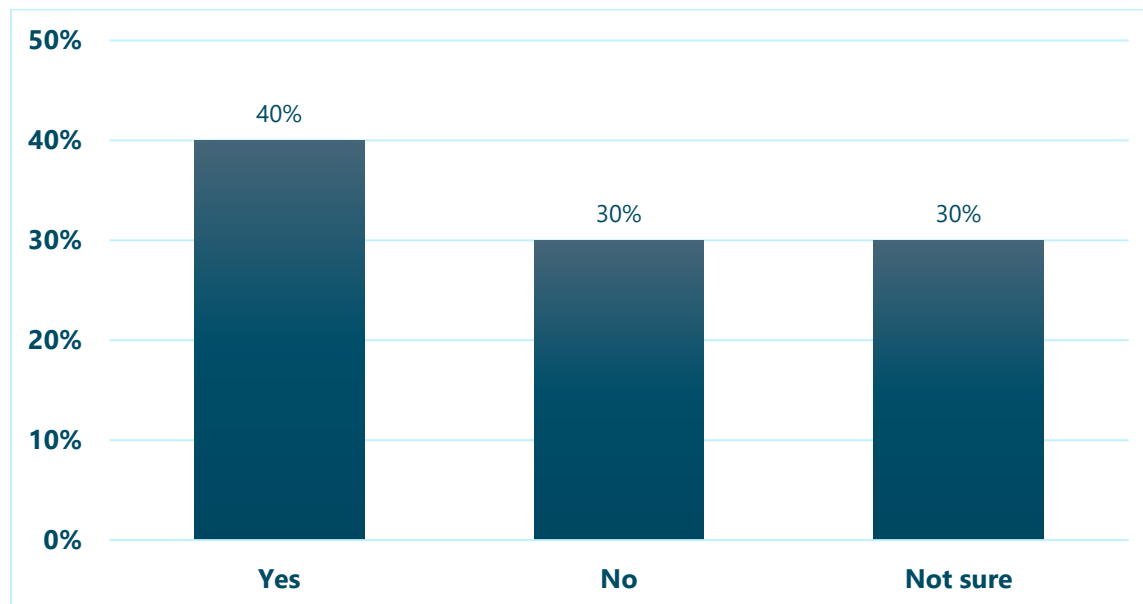
One respondent provided an anticipated cost of \$7,500 to provide a charging port for a resident. Other respondents indicated the cost was too variable to estimate or they were unsure what it would be.

Overnight parking occupancy rates varied considerably among responses with about 78% indicating at least 5% parking space vacancy during overnight hours that could be set aside for EV charging. Conversely, about 22% reported occupancy rates over 95% which could indicate challenges to setting aside any parking spaces for resident EV charging.

Figure 3 below summarizes responses to a question on availability of standard 120V outlets near parking spaces that could potentially be used for level 1 charging. Just under half of respondents indicated this was a possibility, although issues with metering usage and

developing payment solutions could create challenges for property owners in covering operating costs.

Figure 3. Survey responses to “Is there access to 120V outlets within 20 feet of parking spaces at your property(ies)?”



When asked what barriers they had to installing charging infrastructure the following issues were noted:

- Cost** was universally noted as the primary barrier. Other issues included:
- Restructuring parking arrangements
- Time required to manage installation and operation
- Snow removal space needs
- Perceived limited interest / potential use by tenants

One respondent provided the following supplemental statement describing concerns of shifting responsibility for charging infrastructure costs to the development community:

Energy infrastructure is usually provided by private service providers (gas stations, electric companies, natural gas service companies). EV charging station is a cost for developers to incorporate into their project that does not directly create a return on investment and only benefits a limited number of occupants. If they were free to install and owned by someone else that would not create the barrier. But incorporating costs into real estate that already must absorb countless fees and regulatory costs (coupled with increasing costs of labor and raw materials) looking to developers to address an infrastructure need is just another way for governments to pass the obligation to tax payers and consumers.

Respondents were asked what assistance would be most helpful to increasing availability of EV charging at their properties. Ten different types of assistance were provided, along with no assistance and an “other” class with an open response. Respondents were asked to select all that applied. Ranked in order of popularity, responses included:

- a. Incentives or other funding assistance programs for EV charging installation (n=8)
- b. Directory of service providers who can help install of EV charging (n=4)
- c. Information on how to charge a fee to cover EV charging electric costs (n=4)
- d. Website resources with information on charging equipment options and power supply requirements (n=3)
- e. Resources to engage with residents on current and future EV charging needs (n=3)
- f. Information on constructing new MUD developments to streamline adding EV charging in the future (n=3)
- g. Phone or in-person technical support (n=2)
- h. Permitting assistance for EV charging installation (n=2)
- i. Resources related to meeting Vermont Building Energy Code requirements for EV charging (n=2)
- j. Templates or resources for resident / homeowners’ association policies related to EV charging (n=1)
- k. Do not need any assistance (n=1)

One “other” response was collected on this question:

There has to be a value proposition in any business. What is the value proposition of the EV charging stations? Perhaps I don't know enough about the business model - but it seems like a sunk cost with no ROI.

When asked “what would motivate you to install more EV charging infrastructure in the future?”, responses included:

- a. Demand from tenants (n=3)
- b. Incentives or subsidies to offset installation costs (n=2)
- c. Higher gasoline prices and more price volatility (n=1)
- d. A business model that would create a return on investment (n=1)

When asked for any final thoughts on EV related topics respondents offered the following thoughts:

- As a designer of building electrical systems I am constantly trying to bring attention to this infrastructure development. I find it is a "catch 22" issue. Developers don't see the demand from EV tenants/customers, tenants don't see the infrastructure so are reluctant to invest in the EV market. I believe the infrastructure market must develop in a more visible manner to encourage EV ownership.
- Talk to other large in-state entities with commercial office and healthcare, manufacturing populations about their efforts. Perhaps the UVM's, Global Foundaries, SOV's, UVM Medical Center can use their buying power scale to help offset costs of smaller developers, housing non-profits. Can Efficiency Vermont get into the EV and capacity building, technical services business? Encourage more incentives to induce homeowner and small business purchase or lease of EVs from power producers. Mandate gas stations to begin installing EV charging stations.
- We would like to have them at our office for charging during the day.
- Why is real estate being burdened with addressing an infrastructure need? Why is the standard energy distribution model not being applied? The current regulatory environment for developers seems a whole lot like "the developers will pay for it". That doesn't work. Projects don't get constructed because of cost burdens - or the consumer has to indirectly pay the costs from higher sales prices/rents. Real estate is not the avenue to solve all of the world's problems.

Detailed survey responses for all questions are included in Appendix 2.

Resource Recommendations

Based on the survey results, ongoing feedback from Drive Electric Vermont stakeholders, and industry efforts across the country we know there are significant barriers to installing EV charging at existing structures, especially at MUDs. We also know EV drivers who are unable to charge at home face higher barriers to enjoying EV ownership.

The survey identified the cost of purchasing and installing EV charging equipment to be the primary barrier for MUD properties with incentives or other similar cost reduction measures foremost among the desired assistance options for MUD EV charging.

The State of Vermont and electric utilities have already offered incentive programs to support home, workplace and public charging installations. Several utilities are now pilot testing EVSE technologies and programs that may significantly reduce costs for charging equipment that can charge fees for use to help property owners cover their operating costs. These programs should be encouraged, monitored and widely implemented as new these technologies are refined and proven.

Survey respondents identified several additional resources that would be helpful in MUD development of EV charging infrastructure, including EVSE service provider directories, information on setting fees to cover electric costs and general EV charging installation resources with information on equipment options and power requirements. A general reference covering several aspects of these issues is included in Appendix 3.

It is also clear that beyond the MUD property owners, their residents need to better understand what EV options are most suited for their unique circumstances, including how to engage with their property owners on EV charging issues. Some states have developed “right to charge” laws that give residents additional tools to engage with property managers. These laws typically include many exemptions and still require the resident to cover most of the installation costs. While Vermont does not currently have one of these laws in statute, it may be helpful to explore this further as the EV market matures in Vermont.

Additional resource ideas and best practices will be explored as this research is discussed with the MUD community and DEV stakeholders.

Appendix 1 Survey Instrument



Vermont Multi-Unit Dwelling Electric Vehicle Charging Survey

For Property Managers, Owners and/or Developers

Plug-in electric vehicles (EVs) are growing in popularity in Vermont. There are already over 3,500 EVs registered in the state and lower-cost models with over 200 miles of range are making it easier than ever to make the switch.

State, regional and local plans call for advancing transportation electrification to help meet energy and climate goals.

Most EV owners prefer to charge their vehicles at home during the overnight hours. However, installation of EV charging equipment can be challenging for residents of multi-unit dwelling (MUD) housing.

This survey of the Vermont development community is supported by the Chittenden County Regional Planning Commission (CCRPC) to help planners and policy makers better understand MUD EV issues and prioritize resources, technical support and funding/financing programs to address barriers to EV charging.

VEIC, as coordinator of the Drive Electric Vermont program, is implementing this survey.

If you provide your contact information at the end of the survey we may reach out to discuss responses. A summary survey report will be developed that does not include attribution of responses.

We expect this survey will require about 10 minutes of your time.

Thank you for your participation!

Top of Form

1. Are you a

- ☐ Property Manager
- ☐ Property Owner
- ☐ Multi-unit Dwelling Developer
- ☐ Mixed Use Developer (commercial / residential)
- ☐ Combination of Developer, Owner, and/or Manager

☐ Other (please describe)

2. How familiar are you with plug-in electric vehicles (EVs)?

☐ Very familiar

☐ Somewhat familiar

☐ Not familiar

3. How familiar are you with electrical infrastructure required for home charging of EVs?

☐ Very familiar

☐ Somewhat familiar

☐ Not familiar

4. Do you know if any of your current tenants / condo owners drive an EV?

☐ No

☐ Not sure

☐ Yes, the estimated number of our total current EV drivers is:

5. Have you received any requests related to EV charging installations?

- ☐ More than five
- ☐ Between one and five
- ☐ None

6. Do you think multi-unit dwelling developers should invest in EV charging?

- ☐ Yes
- ☐ No
- ☐ Other (please specify)

7. Do you have an anticipated or actual cost per charging port for installation and operation of EV charging equipment? (e.g. cost to offer charging for one vehicle)


8. Please provide an estimate of overnight parking occupancy at your property(ies).

- ☐ Less than 50% of spaces occupied
- ☐ 50%-74% of spaces occupied
- ☐ 75%-94% of spaces occupied
- ☐ 95% or more of spaces occupied

9. Is there access to 120V outlets within 20 feet of parking spaces at your property(ies)?

- ☐ Yes
- ☐ No
- ☐ Not sure

10. What barriers do you have to installing charging infrastructure?



11. What kind of assistance would you find most helpful to increase availability of EV charging at your property(ies)? Select all that apply:

- ☐ Directory of service providers who can help install of EV charging
- ☐ Phone or in-person technical support
- ☐ Permitting assistance for EV charging installation
- ☐ Website resources with information on charging equipment options and power supply requirements
- ☐ Information on how to charge a fee to cover EV charging electric costs
- ☐ Resources to engage with residents on current and future EV charging needs
- ☐ Resources related to meeting Vermont Building Energy Code requirements for EV charging
- ☐ Information on constructing new MUD developments to streamline adding EV charging in the future

☐ Templates or resources for resident / homeowners' association policies related to EV charging

☐ Incentives or other funding assistance programs for EV charging installation

☐ Do not need any assistance

☐ Other (please specify)

12. What would motivate you to install more EV charging infrastructure in the future?

13. How many buildings/properties do you manage / own in Vermont?

14. How many housing units/apartments do you manage / own in Vermont?

15. Are any units designated for low or moderate income residency?

☐ Yes, over 25%

☐ Yes, between 11-25%

☐ Yes, less than 10%

☐ None

16. Do you have any other thoughts related to EVs you'd like to share?

17. Would you be interested in hosting an electric vehicle presentation for your staff and/or residents?

- ☐ No
- ☐ Yes, please contact the email address below to discuss

18. Survey Respondent Contact Information (optional)

Name

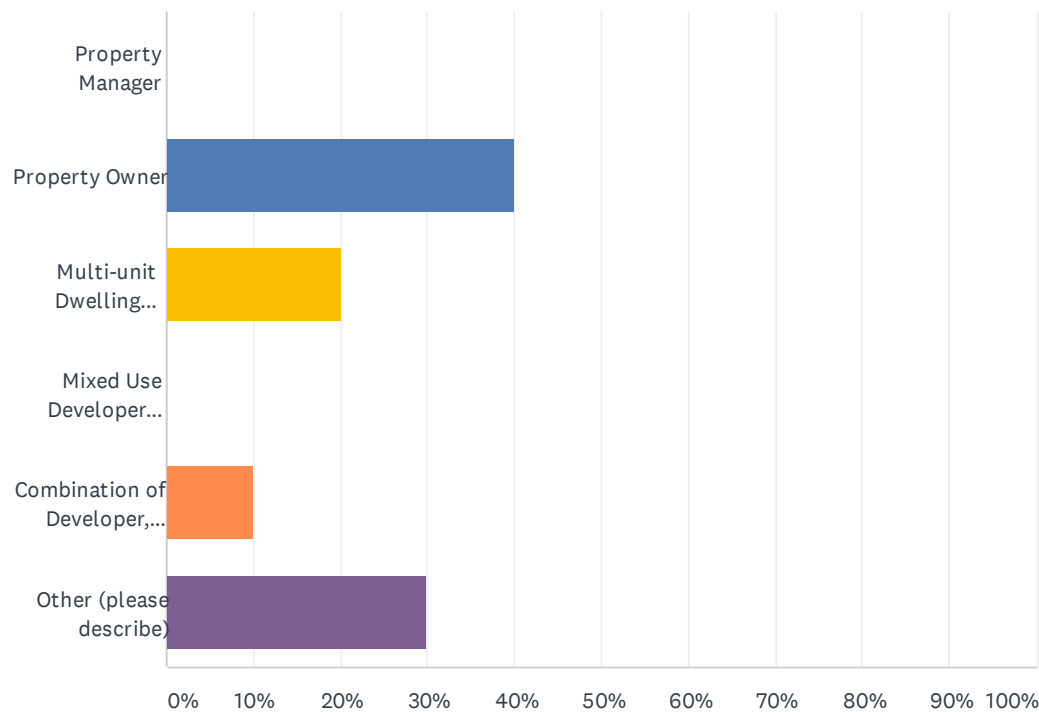
Email Address

Organization

Appendix 2 Survey Response Detail

Q1 Are you a

Answered: 10 Skipped: 0

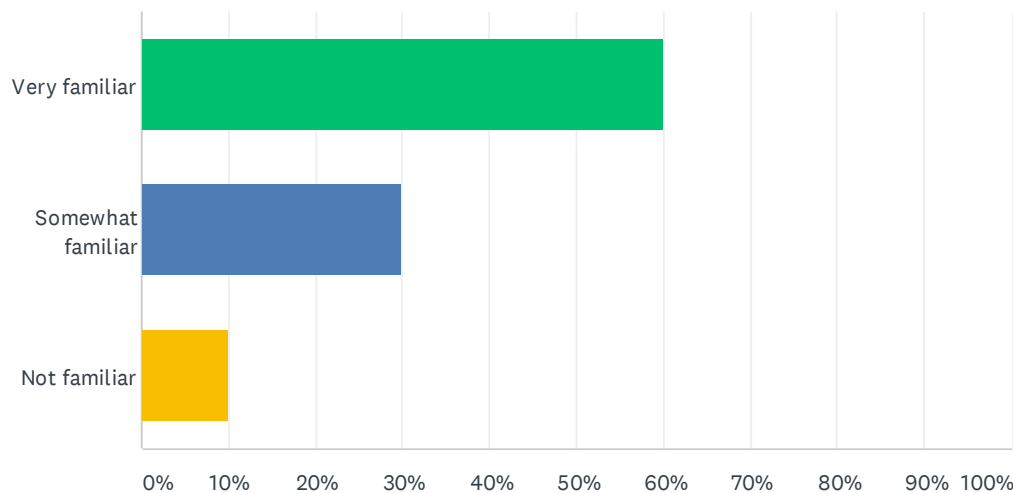


ANSWER CHOICES		RESPONSES	
Property Manager		0.00%	0
Property Owner		40.00%	4
Multi-unit Dwelling Developer		20.00%	2
Mixed Use Developer (commercial / residential)		0.00%	0
Combination of Developer, Owner, and/or Manager		10.00%	1
Other (please describe)		30.00%	3
TOTAL			10

#	OTHER (PLEASE DESCRIBE)	
1	Electrical Consulting Engineer	
2	owner, manager and developer	
3	State of Vermont BGS, own, manage, lease 4,000,000 SF statewide with 8,000 plus employees.	

Q2 How familiar are you with plug-in electric vehicles (EVs)?

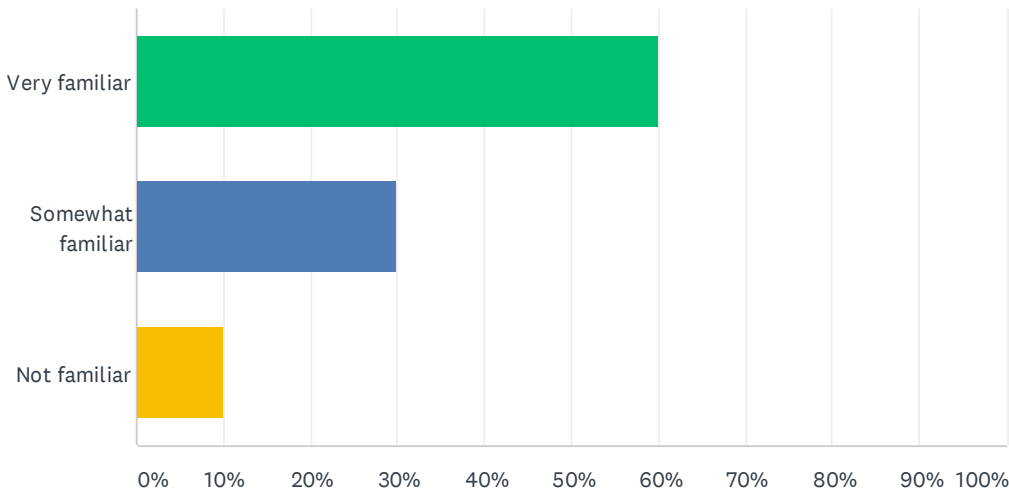
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very familiar	60.00%	6
Somewhat familiar	30.00%	3
Not familiar	10.00%	1
TOTAL		10

Q3 How familiar are you with electrical infrastructure required for home charging of EVs?

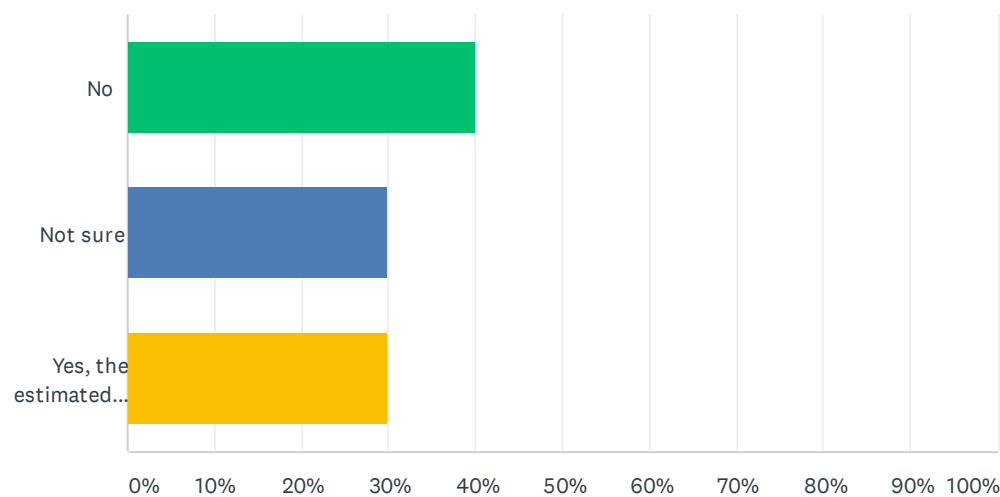
Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very familiar	60.00%	6
Somewhat familiar	30.00%	3
Not familiar	10.00%	1
TOTAL		10

Q4 Do you know if any of your current tenants / condo owners drive an EV?

Answered: 10 Skipped: 0

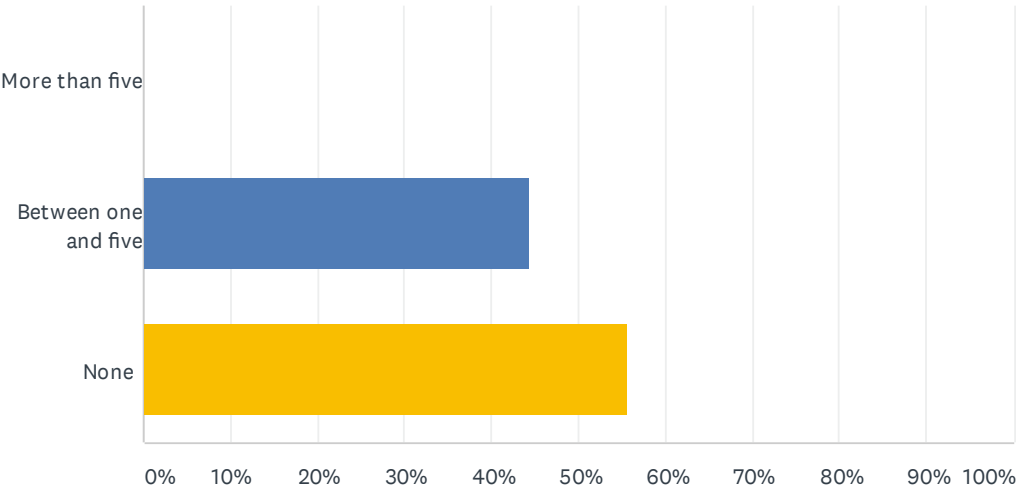


ANSWER CHOICES		RESPONSES	
No		40.00%	4
Not sure		30.00%	3
Yes, the estimated number of our total current EV drivers is:		30.00%	3
TOTAL			10

#	YES, THE ESTIMATED NUMBER OF OUR TOTAL CURRENT EV DRIVERS IS:	
1	0	
2	15	
3	2	

Q5 Have you received any requests related to EV charging installations?

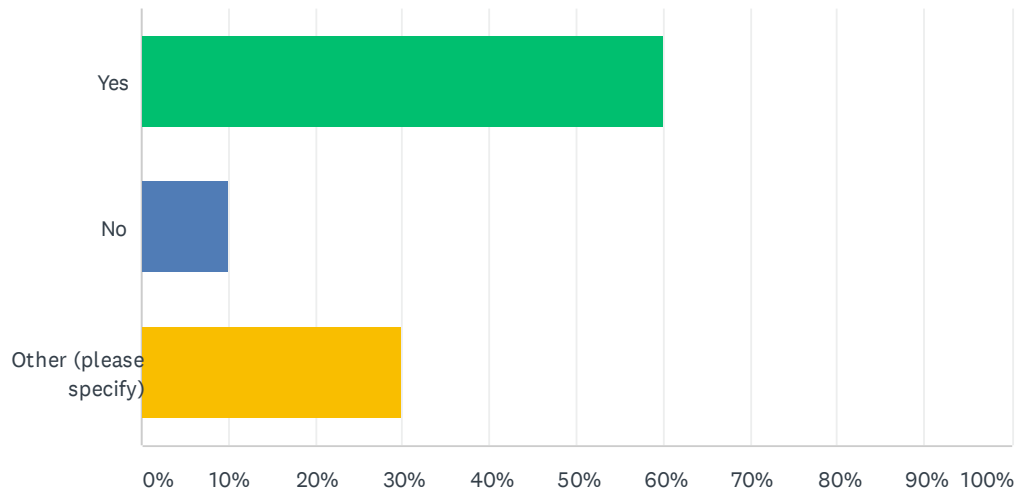
Answered: 9 Skipped: 1



ANSWER CHOICES	RESPONSES	
More than five	0.00%	0
Between one and five	44.44%	4
None	55.56%	5
TOTAL		9

Q6 Do you think multi-unit dwelling developers should invest in EV charging?

Answered: 10 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	60.00%	6
No	10.00%	1
Other (please specify)	30.00%	3
TOTAL		10

#	OTHER (PLEASE SPECIFY)	
1	I think we should install a conduit to allow for potential future installation of charging stations at new construction projects	
2	Developers should install electrical conduit and consider how EV charging can be added to new development. EV charging should not be required.	
3	Their decision based on tenant and market demand	

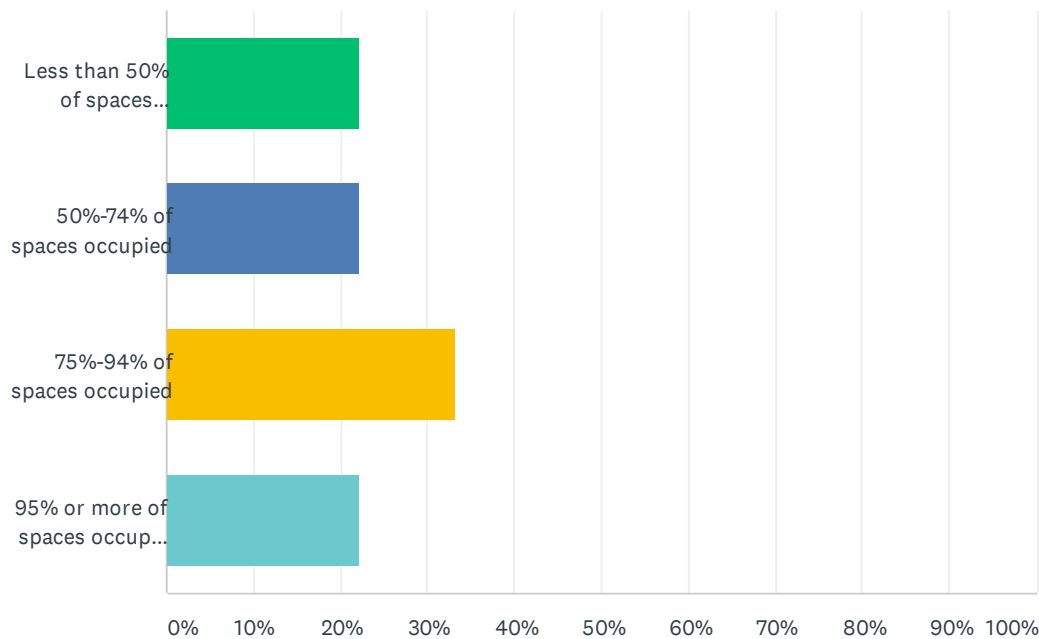
Q7 Do you have an anticipated or actual cost per charging port for installation and operation of EV charging equipment? (e.g. cost to offer charging for one vehicle)

Answered: 8 Skipped: 2

#	RESPONSES	
1	Varies, depending upon type and quantity	
2	no. Although we would like hard data on the cost.	
3	no	
4	Don't know.	
5	No	
6	\$7,500	
7	no	
8	No	

Q8 Please provide an estimate of overnight parking occupancy at your property(ies).

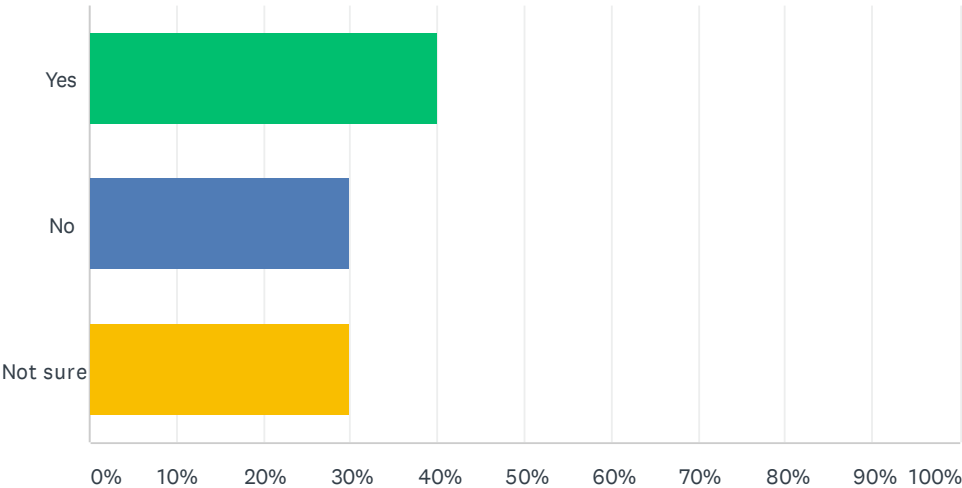
Answered: 9 Skipped: 1



ANSWER CHOICES	RESPONSES	
Less than 50% of spaces occupied	22.22%	2
50%-74% of spaces occupied	22.22%	2
75%-94% of spaces occupied	33.33%	3
95% or more of spaces occupied	22.22%	2
TOTAL		9

Q9 Is there access to 120V outlets within 20 feet of parking spaces at your property(ies)?

Answered: 10 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		40.00%	4
No		30.00%	3
Not sure		30.00%	3
TOTAL			10

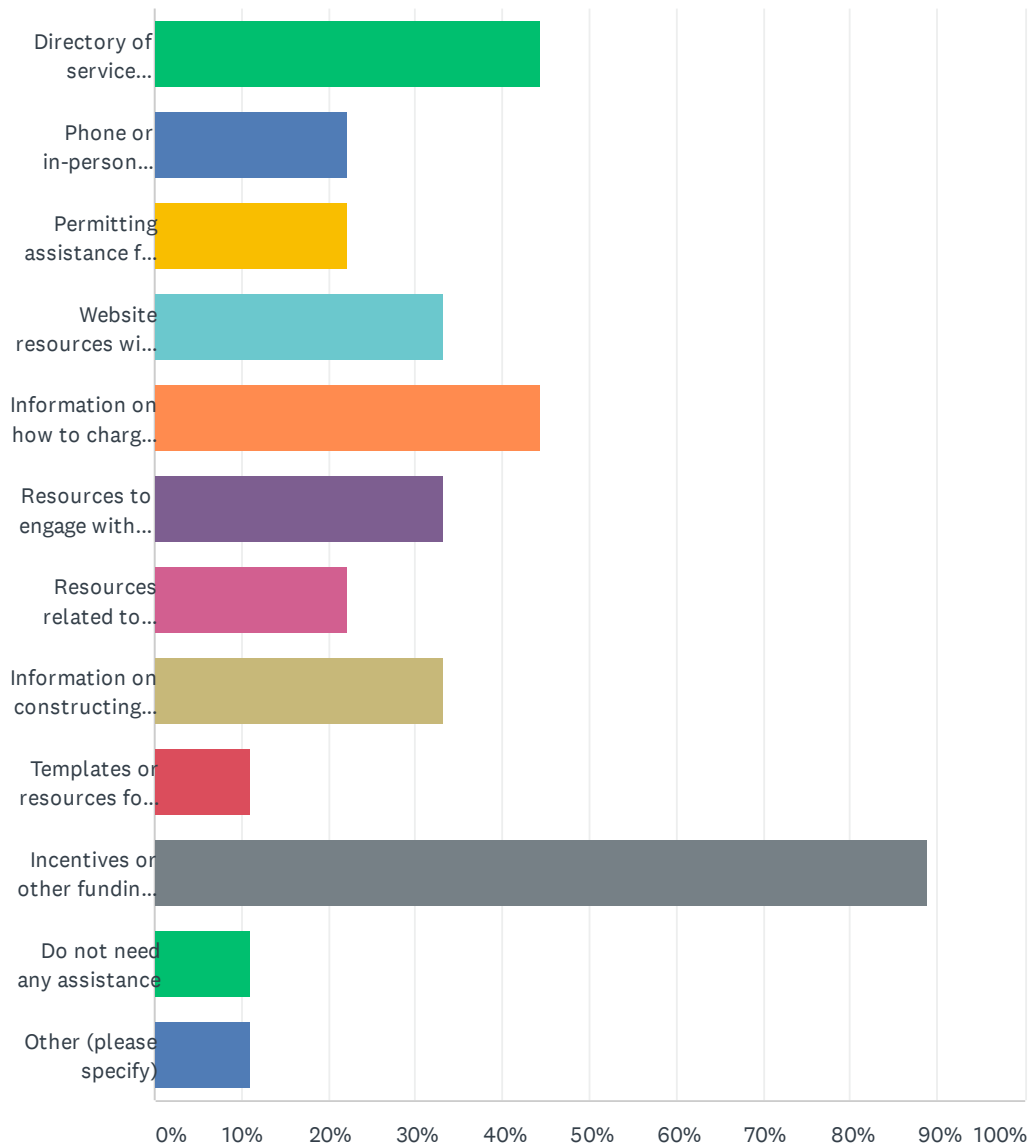
Q10 What barriers do you have to installing charging infrastructure?

Answered: 8 Skipped: 2

#	RESPONSES	
1	Cost. Restructuring parking arrangements. Installation. Time.	
2	cost they are not needed as they are not used	
3	Our energy manager would know. He's in charge of adding charging stations statewide.	
4	Cost of installation	
5	Cost vs. speed	
6	Cost, snow removal space, interest from tenants, additional metering and infrastructure.	
7	cost	
8	cost. The installation will not really create an increase in rents. Energy infrastructure is usually provided by private service providers (gas stations, electric companies, natural gas service companies). EV charging station is a cost for developers to incorporate into their project that does not directly create a return on investment and only benefits a limited number of occupants. If they were free to install and owned by someone else that would not create the barrier. But incorporating costs into a real estate that already must absorb countless fees and regulatory costs (coupled with increasing costs of labor and raw materials) looking to developers to address an infrastructure need is just another way for governments to pass the obligation to tax payers and consumers.	

Q11 What kind of assistance would you find most helpful to increase availability of EV charging at your property(ies)? Select all that apply:

Answered: 9 Skipped: 1



Vermont Multi-Unit Dwelling Electric Vehicle Charging Survey

ANSWER CHOICES	RESPONSES	
Directory of service providers who can help install of EV charging	44.44%	4
Phone or in-person technical support	22.22%	2
Permitting assistance for EV charging installation	22.22%	2
Website resources with information on charging equipment options and power supply requirements	33.33%	3
Information on how to charge a fee to cover EV charging electric costs	44.44%	4
Resources to engage with residents on current and future EV charging needs	33.33%	3
Resources related to meeting Vermont Building Energy Code requirements for EV charging	22.22%	2
Information on constructing new MUD developments to streamline adding EV charging in the future	33.33%	3
Templates or resources for resident / homeowners' association policies related to EV charging	11.11%	1
Incentives or other funding assistance programs for EV charging installation	88.89%	8
Do not need any assistance	11.11%	1
Other (please specify)	11.11%	1
Total Respondents: 9		

#	OTHER (PLEASE SPECIFY)	
1	There has to be a value proposition in any business. What is the value proposition of the EV charging stations. Perhaps I don't know enough about the business model - but it seems like a sunk cost with no ROI	

Q12 What would motivate you to install more EV charging infrastructure in the future?

Answered: 7 Skipped: 3

#	RESPONSES	
1	Tenant requests	
2	demand from tennants	
3	Higher gas prices and more intense price volatility.	
4	Heavy subsidy to cover the cost of installation	
5	Incentives	
6	demand	
7	A business model that would create a return on investment.	

Q13 How many buildings/properties do you manage / own in Vermont?

Answered: 9 Skipped: 1

#	RESPONSES	
1	10	
2	0	
3	20	
4	200	
5	50	
6	1	
7	1	
8	4	
9	3	

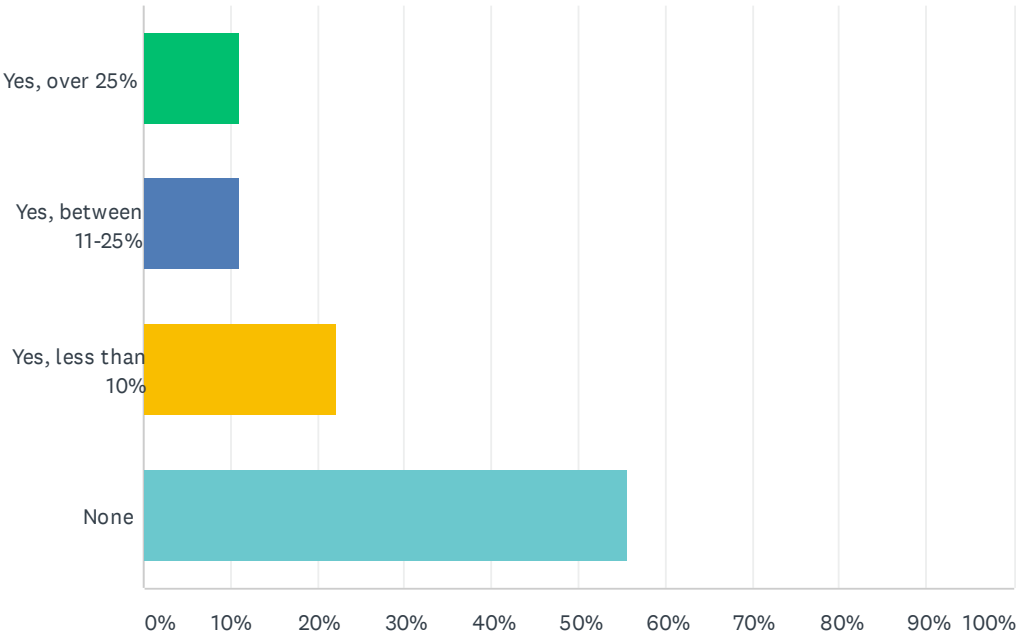
Q14 How many housing units/apartments do you manage / own in Vermont?

Answered: 9 Skipped: 1

#	RESPONSES	
1	45	
2	0	
3	550	
4	0	
5	800	
6	0	
7	4	
8	9	
9	57	

Q15 Are any units designated for low or moderate income residency?

Answered: 9 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes, over 25%	11.11%	1
Yes, between 11-25%	11.11%	1
Yes, less than 10%	22.22%	2
None	55.56%	5
TOTAL		9

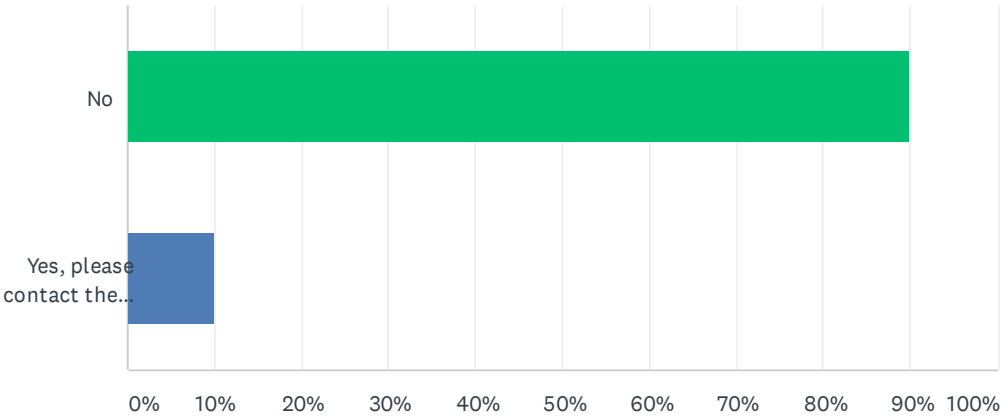
Q16 Do you have any other thoughts related to EVs you'd like to share?

Answered: 6 Skipped: 4

#	RESPONSES	
1	As a designer of building electrical systems I am constantly trying to bring attention to this infrastructure development. I find it is a "catch 22" issue. Developers don't see the demand from EV tenants/customers, tenants don't see the infrastructure so are reluctant to invest in the EV market. I believe the infrastructure market must develop in a more visible manner to encourage EV ownership.	
2	Talk to other large in state entities with large commercial office and healthcare, manufacturing populations about their efforts. Perhaps the UVM's, Global Foundaries, SOV's, UVM Medical Center can use their buying power scale to help offset costs of smaller developers, housing non-profits. Can Efficiency Vermont get into the EV and capacity building, technical services business? Encourage more incentives to induce homeowner and small business purchase or lease of EV's from power producers. Mandate gas stations to begin installing EV charging stations.	
3	No	
4	We would like to have them at our office for charging during the day.	
5	no	
6	Why is real estate being burdened with addressing an infrastructure need? Why is the standard energy distribution model not being applied? The current regulatory environment for developers seems a whole lot like "the developers will pay for it". That doesn't work. Projects don't get constructed because of cost burdens - or the consumer has to indirectly pay the costs from higher sales prices/rents. Real estate is not the avenue to solve all of the worlds problems.	

Q17 Would you be interested in hosting an electric vehicle presentation for your staff and/or residents?

Answered: 10 Skipped: 0



ANSWER CHOICES		RESPONSES	
No		90.00%	9
Yes, please contact the email address below to discuss		10.00%	1
TOTAL			10

#	YES, PLEASE CONTACT THE EMAIL ADDRESS BELOW TO DISCUSS	
1		

Q18 Survey Respondent Contact Information (optional)

Answered: 4 Skipped: 6

ANSWER CHOICES	RESPONSES	
Name	100.00%	4
Email Address	100.00%	4
Organization	100.00%	4

Appendix 3 MUD EV Charging Overview Resource

Electric Vehicle charging for your multi-unit dwelling



Overview

Drive Electric Vermont (DEV) has resources on plug-in electric vehicle (EV) charging technology which are a good place to learn about EV charging and related issues:

<http://driveelectricvt.com/for-businesses>

DEV's EV Charging Installation Guide has more detailed information on siting considerations, including recommendations to ensure charging is accessible for disabled EV owners:

<http://www.driveelectricvt.com/charging-stations/installation-guide>

Multi-unit dwellings (MUDs), such as apartments and condominiums often have unique issues associated with EV charging installations. The following information will help orient potential installers/users to these issues and provide guidance on recommended practices.



EV charging at Burlington Co-housing East Village Community

EV Charging Installation Considerations

1. **Location** – If MUD residents have assigned parking spaces and own their residence then it is usually simplest to install charging in those spots. This is usually done at the owner's expense, although grants or incentives may be available to offset the cost. If parking spaces are not assigned or occupants are renters, then MUDs should look to minimize the distance to existing electric service connections to reduce installation costs.
2. **Type of Charging** – Level 2 (208/240V AC) is the most common variety of public charging infrastructure and uses a standardized connector for all EVs except Tesla, which has an adapter available as well as their own 240V charging equipment. On a Level 2 charger, a vehicle takes about 4-6 hours to reach full battery charge, which makes it ideal for overnight home charging. Level 1 charging is simply plugging into a standard 120V receptacle. It takes much longer and is less efficient than Level 2, but is worth considering in some cases, especially if there are existing receptacles available near where residents park.
3. **Number of Charging Ports** – Charging equipment vendors have various models available, many of which have "dual-port" configurations with the ability to charge two EVs at once from one piece of equipment. Single port equipment can be a good, low cost solution for parking spaces dedicated to individual residents. For shared or public use, a minimum of two charging ports is recommended. Including additional conduit for potential future expansion of EV charging as demand warrants is also worth considering.

4. **Cord Management** – Equipment manufacturers have developed various ways to manage the cord running from the charging equipment to the vehicle charging port. Keeping cords off the ground will reduce maintenance issues, simplify snow removal, and provide a more pleasant experience for users. Cords should not stretch across pedestrian walkways when in use.
5. **Signage** – Shared or public EV charging parking spaces should include standard signage. Regulatory signage indicating no parking “except electric vehicle charging” is recommended. For public EV spaces, special time or other restrictions could be demarcated, for example “residents only from 8 PM to 9 AM.”

Dual Port ChargePoint Level 2 networked EV charger



EV Charging Cost Considerations

1. **Capital Costs** – Level 2 (208/240V) charging requires purchasing EV charging equipment. The equipment cost varies depending on monitoring and metering capabilities and/or the ability to collect payment for charging sessions.

Basic single-port Level 2 chargers suitable for MUD use are available starting around \$600, with more advanced dual-port networked equipment costing up to \$7,000 or more. Many electric utilities offer incentives for Level 2 charging purchases.

Installation costs will vary significantly depending on proximity to existing power connections, capacity of existing electric service, and type of unit installed. A typical home installation may cost \$500-1,000, but it is possible to cost \$10,000 or more for MUD locations, depending on whether upgrades are needed to the existing electrical service capacity and other factors. Getting an estimate from a licensed electrician is necessary to better understand cost.

Use of wall mounted equipment is generally less expensive than pedestal or bollard style units due to reduced installation costs, as there is no need for a concrete pedestal mount.

2. **Non-Electricity Operating Costs** – Networked charging equipment often requires an annual fee to provide monitoring services using software and cellular data service or Wi-Fi. Depending on the vendor, this might add another \$120-400 per port in annual operating expense for this capability. Chargers that are only available to residents may need fewer capabilities than those made available to the public, which often use fully networked equipment with the capability to charge a fee for the electricity used - collected as an hourly and/or per kWh charge on a credit card or user account.

Summary of Capital and Non-Electricity Costs with Example Equipment Models

Type	Costs (excluding installation)	Example Models
Non-internet connected	Hardware: \$500-\$700 Software: N/A	Clipper Creek ruggedized models
Internet Wi-Fi connected, 3 rd party payment & reservation	Hardware: \$800-\$1,200 Software: \$10/mo	Enel X with Juicebox EV Match
Cellular networked commercial charger	Hardware: \$4,000-\$7,500 Software: \$250-\$400/yr Subscription: \$1,200/year per port (incl. hardware, software & installation)	ChargePoint CT 4000 family Flo Commercial EV Box

- 3. Electricity Costs** – Ongoing operating costs also depend on the amount of use the charging stations receive. Individual models of EVs can charge at different rates, typically ranging from 3.3-6.6 kW for Level 2 charging. An average all-electric EV driver that charges at home 85% of the time will use about 250 kWh per month. That adds up to around \$50/month in electric costs for power based on Vermont's average electric rate of about \$0.19/kWh. If the charger is also accessible to the public, another 125 kWh per month, or about 30 hours of active use, could be expected costing about \$25/month.

Depending on your facility's level of electric use and rate structure, it may be subject to peak demand charges which could add additional costs to your electric bill if EV charging activity occurs during peak periods.

Setting Fees to Cover Costs

MUDs have a few options to assess fees on EV charging activity to cover their electrical costs:

- 1. Resident meter** – If EV owners have their own equipment tied into their meters, covering costs is a non-issue - they will pay for their own electricity like usual.
- 2. Pass-through** – If residents have their own dedicated space and charging equipment, but it is connected to a shared meter, then charging equipment is available that will allow them to report on how much energy is used and this could be added to their fees. Alternatively, there is charging equipment available that can automatically collect a fee based on the electric rate for the property, which can then be deposited into an account for the homeowners' association (HOA) or management company.
- 3. Flat rate** – If charging equipment is made available to multiple residents, EV charging could be offered to residents as an amenity, either to all residents, similar to a fitness center, or to residents who opt in for a flat rate. The charger in this case should be limited to resident use only.
- 4. Cost to charge** – Another option for a shared charger or a charger with public access is collecting fees based on the applicable energy rate and operating costs using a networked charger. Cellular networking fees, payment processing costs, and extended warranties should all be considered in setting charging rates to ensure all operating costs are covered.

In addition to operating costs, the cost of installing a charging station can also be shared with residents. In the case of a resident-owned charger, the resident is typically responsible for installation costs. In cases where upgrades are needed to the building electrical panel or in the case of a community charger, these costs could be shared across the residents through an HOA fee or through a dedicated fundraising effort.

Incentives

Many electric utilities in Vermont are offering incentives for EV chargers, typically in the range of \$500 per port, and publicly accessible chargers might be eligible for additional incentives. Contact your local utility for more information.

Federal tax credits are also available for EV chargers, but currently expire at the end of 2020. Businesses, including property managers, may be eligible for 30% off, up to \$30,000, the purchase and installation of EV charging stations. For individuals, the tax credit is 30% off, up to \$1,000.

Additional Resources

The Drive Electric Vermont team is available to respond to questions and help you get started:
<https://www.driveelectricvt.com/contact-us>

The US Dept of Energy has EV charging resources for multi-unit dwelling residents:

https://afdc.energy.gov/fuels/electricity_charging_multi.html

A few Vermont utilities have pilot programs with EV Match, a charging equipment provider that offers low cost solutions for access-controlled charging and fee collection appropriate for MUDs:

<https://www.evmatch.com/>

Other companies that provide services for charging at MUDs are ChargePoint, EV Safe Charge, and SemaConnect:

- ChargePoint: <https://www.chargepoint.com/blog/ev-charging-condos-get-your-hoa-say-yes/>
- EV Safe Charge: <https://evsafecharge.com/ev-charging-for-apartments/>
- SemaConnect: <https://semaconnect.com/applications/apartments-and-condos/>

A few cities have developed case studies for MUDs that explore common barriers and solutions:

- Smart Columbus MUD Case Study
<https://d2rfd3nxvhnf29.cloudfront.net/legacy/uploadedfiles/playbook-assets/electric-vehicle-charging/mud-case-study-final.pdf>
- Plug In SD MUD EV Charging
https://www.sandag.org/uploads/projectid/projectid_511_25855.pdf
- Seattle City Light MUD Guide https://energysolutions.seattle.gov/wp-content/uploads/Electric_Vehicle_Service_Equipment_for_Multi.pdf



EV Match enabled level 2 charging at Burlington Electric Department pilot location - 316 Flynn Ave mixed use development

