The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

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Debra A. Howland, Executive Director
State of New Hampshire
Public Utilities Commission
2l S. Fruit Street, Suite 10
Concord, New Hampshire 03301-2429

RE: Docket No. IR 20-004, Investigation into Rate Design Standards for Electric Vehicle Charging Stations and Electric Vehicle Time of Day Rates

NHDES Comments on Staff Recommendations Regarding Investigation of Electric Vehicle Rate Design Standards, Electric Vehicle Time of Day Rates for Residential and Commercial Customers

Dear Director Howland:

Thank you for the opportunity to provide written comments relative to the Public Utility Commission (PUC) Docket No. IR 20-004 "Investigation into Rate Design Standards for Electric Vehicle Charging Stations and Electric Vehicle Time of Day Rates" that was issued by Commission on January 16, 2020 and the document "Recommendations Regarding Investigation of Electric Vehicle Rate Design Standards, Electric Vehicle Time of Day Rates for Residential and Commercial Customers" that was filed by Commission Staff on January 10, 2020.

NHDES is responsible for implementing laws, regulations, and policies that are protective of public health and the environment. Our air quality is directly impacted by our energy use. The transportation sector is the single largest source of air pollution in New Hampshire and in the region. In 2017, the most recent year for which data is available, the transportation sector in New Hampshire was responsible for 47 percent of the total greenhouse gas (GHG) emissions, and 42 percent of the total end-use energy.[1]

Currently, most vehicles are powered by fossil liquid and gaseous fuels. According to the US Department of Energy: *"An EV electric drive system is only responsible for a 15% to 20% energy loss compared to 64% to 75% for a gasoline engine. EVs also use regenerative braking to recapture and reuse energy that normally would be lost in braking and waste no energy idling."*[2] Transitioning to electric vehicles (EVs) is one of the most effective and achievable strategies to reduce transportation -related emissions.

[1] NHDES calculations February 2019, using US DOE State Energy Data System (SEDS): 1960-2017 https://www.eia.gov/state/seds/seds-data-complete.php?sid=NH, (Last accessed February 14, 2020).

[2] US DOES (2020). Where the Energy Goes: Electric Cars, Office of Energy Efficiency & Renewable Energy, https://fueleconomy.gov/feg/atv-ev.shtml, (Last accessed February 19, 2020).

EVs are a small but rapidly growing part of the overall vehicle fleet (See appendix A). They will only become more common as prices fall and drivers become more familiar with their performance and other benefits. EVs present economic, energy, and environmental opportunities for the state, region, and nation. Currently they are having a marginal impact on daily and seasonal peak demand and total generation, but these impacts will grow as fleet penetration increases.

This transition to a significantly cleaner, and more efficient vehicle fleet is not just an environmental and public health issue. Vehicle electrification is consistent with the New Hampshire Energy Policy:

> *"The general court declares that it shall be the energy policy of this state to meet the energy needs of the citizens and businesses of the state at the lowest reasonable cost while providing for the reliability and diversity of energy sources; to maximize the use of cost effective energy efficiency and other demand side resources; and to protect the safety and health of the citizens, the physical environment of the state, and the future supplies of resources, with consideration of the financial stability of the state's utilities."*[3]

As such, EVs should be considered for the full range of potential benefits and impacts. The rate design standards that the state ultimately elects to follow will have environmental, economic, and energy impacts while affecting our competitiveness within the northeast region.

Electric rates, particularly Time of Use (TOU) and demand charges, can influence both the adoption rate of EVs, as well as their impact on the regional grid. EVs currently cost more than conventional vehicles. One mitigating factor is that "fuel" costs can be lower for EVs, thus providing some relief from the higher vehicle cost. If those "fuel" costs are lowered, such as through TOU rates for residential Level 1 and 2 charging, or are increased due to demand charges on Direct Current Fast Charging (DCFC), the calculus for EV adoption can be either positively or negatively impacted.

NHDES views TOU rates and demand charges as the most significant influences on EV charging behavior and EV adoption in the near term, and as such have limited its comments to these rate design mechanisms at this time.

Time of Use Rates

Rates can have a significant influence on charging behavior, and therefore, can be used to assist the utilities in reducing EV charging during peak demand periods. The current number of EVs in operation in the region are having a marginal impact on daily and seasonal peak demand and total generation today, but these impacts will grow as penetration rates increase. Currently most EV charging occurs at home and New Hampshire utilities need to be prepared to mitigate any negative impact EV charging may have on peak demand. Absent price signals, a typical EV owner is likely to plug their vehicle into their home charger when they arrive home from work. This typically coincides with the evening peak demand.

By offering TOU rates with strong price signals, utilities increase the likelihood that EV owners will hold off on charging until the daily peak has passed. Off-peak charging of EVs not only saves EV owners money, but it also has the potential to largely mitigate the impact of EVs on the grid by

[3] NH RSA 378:37 New Hampshire Energy Policy, http://gencourt.state.nh.us/rsa/html/XXXIV/378/378-37.htm, (Last accessed on February 15, 2020).

shifting load to off-peak hours,[4] which will minimize impact on overall seasonal peak, as well as New Hampshire's share of the load. The implementation of EV TOU rates now, before EV numbers increase to a significant percentage of the on-road fleet and begin to register a negative impact to the grid, can better establish off-peak charging as the norm for EV owners from the very beginning.

TOU rates have the potential to influence flexible load, and also have the potential to improve all-around load factor, by shifting consumption and demand to the times of day when the generation, distribution, and transmission systems are significantly underutilized.[5] In addition, TOU rates may reduce the need for costly distribution system upgrades that could be needed in areas with denser EV penetration were EV charging behavior to remain unmanaged.

This was supported by a recent study conducted for the New Hampshire Department of Business and Economic Affairs that noted,

> *"If the vehicles can be primarily charged off-peak (accomplished through time-of-use pricing or time-of-use incentives), then all ratepayers, not just the EV owners, will benefit from downward pressure on electricity rates as utilities achieve greater utilization of their assets."*[6]

The three investor-owned utilities, similarly observed, in joint comments on the Grid Modernization Docket, IR-296, that while EVs have the potential to grow electric loads, this load growth can result in savings to all customers if forecasted and managed properly. As EVs consume more electricity, there are more KWHs over which to spread the other utilities' fixed costs.[7] TOU rates are a critical element of achieving this improved resource utilization.

Demand Charges

As DCFC stations increase in both number and geographic distribution across the state, they reduce the range anxiety that EV drivers, from inside and outside the state, may feel. Reduced range anxiety can contribute to greater comfort in purchasing an EV.[8] However, demand charges can have an enormous impact on the business case, or value proposition, for owning and operating DCFC.

At present time, with relatively few EVs on the road, a DCFC may be used by only a few vehicles each day, or in remote areas, a few vehicles each week. Regardless of the frequency of use, DCFCs can draw a significant amount of power. DCFC requires a three-phase 480-volt AC electric circuit.

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[4] NESCAUM (2018). Northeast Corridor Regional Strategy for Electric Vehicle Charging Infrastructure 2018 – 2021, Northeast States for Coordinated Air Use Management, https://www.nescaum.org/documents/northeast-regional-charging-strategy-2018.pdf/download, (Last accessed February 20, 2020).

[5] Salisbury, M. and Toor, W. (2016). How Leading Utilities are Embracing Electric Vehicles, Southwest Energy Efficiency Project, http://www.swenergy.org/data/sites/1/media/documents/publications/documents/How_Leading_Utilities_Are_Embracing_EVs_Feb-2016.pdf, (Last accessed February 19, 2020).

[6] Evaluating Electric Vehicle Infrastructure in New Hampshire, July 2019, https://www.nh.gov/osi/resource-library/documents/nh-ev-infrastructure-analysis.pdf, (Last accessed February 20, 2020).

[7] Page 13. Joint Comments of Liberty Utilities (Granite State Electric) Corp. D/B/A Liberty Utilities, Public Service Company of New Hampshire D/B/A Eversource Energy, And Unitil Energy Systems, Inc. Re: Order No. 26,254. http://www.puc.state.nh.us/regulatory/docketbk/2015/15-296/letters-memos-tariffs/15-296_2019-09-06_gsec_eversource_unitil_joint_comments.pdf, (Last accessed February 18, 2020).

[8] UCS (2016). Electric Vehicle Survey Methodology and Assumptions: Driving Habits, Vehicle Needs, and Attitudes toward Electric Vehicles in the Northeast and California, https://www.ucsusa.org/sites/default/files/attach/2016/05/Electric-Vehicle-Survey-Methodology.pdf, (Last accessed December 15, 2019).

Most existing DCFC stations are 50 kilowatts (KW) with much faster DCFC stations, including ones that deliver up to 350 KW starting to be installed. DCFC chargers, particularly if multiple vehicles are charging at the same time can result in a significant demand charge. At current EV penetration rates and expected low utilization rates for the DCFC at present, the demand charge would be spread across just a few users making the cost per unit of charge (kwh or time) that a station owner must charge to recoup the demand related costs unreasonable, thereby discouraging the use of that station.

With today's EV market penetration and current public DCFC utilization rates, demand charges can be responsible for over 90 percent of electricity costs.[9] Therefore, the value proposition for third parties owning and operating DCFC limits the current availability of these chargers and prospects of additional investment.

This results in fewer stations being built, reducing the viability of owning an EV, reducing the business case for owning DCFC, and the cycle continues. Addressing the impact that demand charges can have on profitability of DCFC stations, and therefore increasing their economic viability, is likely to result in a greater number of stations across the state. This issue has been documented independently.[10,11,12,13]

During the Electric Vehicle Charging Stations Infrastructure Commission meeting on October 4, 2019, at which Tom Frantz, Director of the NH PUC Electric Division presented, there was considerable discussion about TOU rates, as they relate to Level 2 and home charging, and demand charges as they relate to DCFC. There was general agreement from Mr. Frantz that TOU rates could address peak charging issues. Mr. Frantz also indicated that given the issue presented by demand charges for DCFC, potential solutions that could be explored included either a DCFC specific rate class or customer class.

NHDES Recommendations

Based on the above, NHDES makes the following recommendations:

1. Each utility should develop and offer an EV TOU rate in order to minimize any potential negative impact from increased EV charging. Further, the PUC should consider whether such rates would be more effective if they were to be structured as "opt out" rates rather than as "opt in" rates.

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[9] Fitzgerald, G. and Nelder, C., (2017). EVgo Fleet and Tariff Analysis: Phase 1: California, Rocky Mountain Institute, https://rmi.org/wp-content/uploads/2017/04/eLab_EVgo_Fleet_and_Tariff_Analysis_2017.pdf, (Last accessed February 7, 2020).

[10] Utility Dive (2019). PG&E Wants EV Demand Charges to Mimic Smartphone Plans. Regulators Are Skeptical, https://www.utilitydive.com/news/pge-wants-ev-demand-charges-to-mimic-smartphone-plans-regulators-are-skep/563757/, (Last accessed February 18, 2020).

[11] Fitzgerald, G. and Nelder, C., (2017). From Gas to Grid: Building Charging Infrastructure to Power Electric Vehicle Demand. Rocky Mountain Institute, https://www.rmi.org/insights/reports/from_gas_to_grid, (Last accessed February 18, 2020).

[12] Fitzgerald, G. and Nelder, C., (2017). EVgo Fleet and Tariff Analysis: Phase 1: California, Rocky Mountain Institute, https://rmi.org/wp-content/uploads/2017/04/eLab_EVgo_Fleet_and_Tariff_Analysis_2017.pdf, (Last accessed February 7, 2020).

[13] Salisbury, M. and Toor, W. (2016). How Leading Utilities are Embracing Electric Vehicles, Southwest Energy Efficiency Project, http://www.swenergy.org/data/sites/1/media/documents/publications/documents/How_Leading_Utilities_Are_Embracing_EVs_Feb-2016.pdf, (Last accessed February 19, 2020).

2. Each utility should develop and offer a DCFC rate or a customer class that provides flexibility around demand charges in order to give owners of DCFC stations much greater potential to recover costs and make a business case for their stations.

Respectfully,

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Technical Services Bureau
Air Resources Division

Docket No. IR 20-004, Investigation into Rate Design Standards for Electric Vehicle Charging Stations and Electric Vehicle Time of Day Rates

NHDES Comments on Staff Recommendations
Appendix A – Overview of Electric Vehicles and Electric Vehicle Charging in New Hampshire

Rapidly Changing Market

Currently, there are around 40 different models of electric cars available for sale in the U.S., including sports cars, sedans, SUVs, and minivans.[1] Of those, 30 different EV models are available today in the Northeast.[2] Most major vehicle manufacturers have invested significantly in electrification and have announced that exciting new products are on the way, including more EVs with four-wheel drive, longer ranges, and electric pickup trucks.

EV-related technology is rapidly progressing. The price of EV batteries has fallen from $1,100 per KWH storage capacity in 2010 to $156 in 2019. It is anticipated that costs will fall below $100 per KWH in 2024, at which point EVs will reach price parity with ICE vehicles.[3]

In the United States, annual sales of EVs today are relatively low, approximately one percent of passenger vehicle sales in 2018, but are projected to exceed 3.5 million vehicles, more than 20 percent of annual vehicle sales, by 2030. This translates to 18.7 million EVs on the rode in the US in 2030, up from slightly more than one million at the end of 2018. At this point, EVs will make up about seven percent of the 259 million vehicles, including cars and light trucks, expected to be on U.S. roads in 2030.[4]

Additionally, other segments of the transportation sector will also electrify, with light commercial EV sales projected to reach 56 percent, and medium commercial EV sales expected to reach 31 percent in 2030.[5] Already, electric bus manufacturers, like Lion Electric, New Flyer and BAE Systems are working with communities to deploy electric transit buses and school buses.

EV Adoption in Northeast

Vehicle electrification is transforming transportation across the region. All other New England states and many other Northeast states have adopted policies and regulations, and are offering incentives, that will result in increased adoption of EVs in our region in the coming

[1] Plug In America, (2019). EV model availability webpage, https://plugstar.com/cars, (Last accessed December 18, 2019).

[2] Drive Change. Drive Electric. (2020), Online Vehicle Search Tool: Explore Available Electric Cars, https://driveelectricus.com/explore-electric-cars/, (Last accessed February 18, 2020).

[3] BNEF (2019). 2019 Electric Vehicle Outlook, Bloomberg NEF, https://about.bnef.com/electric-vehicle-outlook/, (Last accessed December 18, 2019).

[4] NESCAUM (2017). Multi-State Zero Emission Vehicle Action Plan, http://www.nescaum.org/documents/2018-zev-action-plan.pdf, (Last accessed February 18, 2020).

[5] BNEF (2019). 2019 Electric Vehicle Outlook, Bloomberg NEF, https://about.bnef.com/electric-vehicle-outlook/, (Last accessed December 18, 2019).

years. As of 2019, more than 40,000 EVs were registered in the New England states surrounding New Hampshire.[6] The largest growth in EVs has occurred in New Hampshire's neighbor to the North, in the Canadian province of Quebec where, since 2014, EVs have grown from just under 3,000 vehicles on the road to more than 43,000 EVs in 2019 (as of March). The 2019 registrations represent 0.83% of all vehicles,[7] with total EV registrations rising 75 percent between 2018 and 2019.[8]

All of the New England states except New Hampshire, as well as New York, are signatories to California's Zero Emission Vehicle (ZEV) regulation[9]. In 2013, four New England states and New York agreed to a target of 15 percent of vehicles being ZEV by 2025, meaning BEV, PHEV, or fuel cell.[10] Recent projections for the Boston Metro area, including New Hampshire and Rhode Island, estimate there will be 266,000 EVs on our roads by 2030.[1] However, the ZEV program targets are minimum percentages. The State of Massachusetts alone has set a goal of having 300,000 EVs on the road by 2025.[11]

Quebec has also set targets of 100,000 EVs on the road by 2020 and 300,000 on the road by 2025.[12] With New Hampshire's natural resources attracting so many visitors from around the region, the economic pressure to build infrastructure to "fuel up" EVs will be great.

EV Adoption in New Hampshire

As of the end of 2019, there were 4200 EVs were registered in New Hampshire: with around 2,300 plug-in hybrid electric vehicles PHEVs and over 1,900 BEVs. This represented only 0.29 percent of all vehicles in New Hampshire and 0.33 percent of the light-duty vehicles in New Hampshire. The growth from 2017 to 2018 was 58 percent, up from 37 percent growth

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[6] NEG-ECP (2020). 2019 NEG-ECP Transportation and Air Quality Committee 2019 Annual Report, https://www.coneg.org/wp-content/uploads/2020/01/TAQC-2019-Report-Final.pdf, (Last accessed February 18, 2020).

[7] Data provided by Ministry of Sustainable Development, Environment, and Fight Against Climate Change, Ministry of Sustainable Development, Environment, and Fight Against Climate Change, http://www.environnement.gouv.qc.ca/index_en.asp, (Last accessed December 18, 2019).

[8] Institut de la Statistique du Québec (2019). *Panorama des régions du Québec. Édition 2019*, [En ligne], Québec, L'Institut, 162 p. http://www.stat.gouv.qc.ca/statistiques/profils/panorama-regions-2019.pdf, (Last accessed December 18, 2019).

[9] NESCAUM (2018). Multi-State Zero Emission Vehicle Action Plan, http://www.nescaum.org/documents/2018-zev-action-plan.pdf, (Last accessed December 18, 2019).

[10] Shulock, C. (2016). Manufacturer Sales Under the Zero Emission Vehicle Regulation: 2012 Expectations and Governors' Commitments Versus Today's Likely Outcomes, Shulock Consulting , https://www.nrdc.org/sites/default/files/media-uploads/nrdc_commissioned_zev_report_july_2016_0.pdf, (Last accessed December 18, 2019).

[11] Press Release, Governor Baker Signs Electric Vehicle Promotion Legislation, https://www.mass.gov/news/governor-baker-signs-electric-vehicle-promotion-legislation, (Last accessed December 18, 2019).

[12] Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques. *Analyse d'impact réglementaire du règlement d'application de la Loi visant l'augmentation du nombre de véhicules automobiles zéro émission au Québec afin de réduire les émissions de gaz à effet de serre et autres polluants.* 2017, 57 p. [En ligne]. http://www.mddelcc.gouv.qc.ca/changementsclimatiques/ vze/AIR-reglement201712.pdf, (Last accessed December 18, 2019).

between 2016 and 2017.[13] From 2018 to 2019, the growth rate was 28 percent, but a higher proportion of that being BEVs rather than PHEVs.

With many new models in a variety of body types coming out, along with longer ranges, and falling purchase price, the rate of EV adoption in New Hampshire is expected to increase.

As noted, electric buses are another use case. Nashua Transit held a ribbon cutting for their two new hybrid-electric Transit Buses equipped with BAE Systems HybriDrive Electric Propulsion System.[14] School systems across the state have also expressed interest in electrifying portions of their school bus fleets.

Environmental and Public Health Benefits

EVs present economic, energy, and environmental opportunities for the state, region, and nation by reducing overall energy consumption, reliance on energy imports from out of state, and the emission of air pollutants.

The transportation sector is responsible for over half of the emissions of oxides of nitrogen (NOx) and volatile organic compounds in New Hampshire,[15] which lead to the formation of ground level ozone, a respiratory irritant that can pose a significant health risk to susceptible people including children, the elderly, and those with respiratory ailments such as asthma. This sector also is responsible for over 40 percent of the state's GHG emissions. Global GHG emissions are the primary contributor to climate change.[16]

In comparison to gasoline and diesel vehicles, EVs operating in the Northeast emit fewer NOx and GHG emissions, even when factoring in the power plant emissions from charging the batteries. This is in part because the electric grid in the Northeast is relatively "clean" as compared to other regions, and because EVs are much more efficient than internal combustion engine (ICE) vehicles, using 25 percent of the energy of a conventional ICE vehicle to travel the same distance. As the ISO-New England grid becomes even cleaner, through the interconnection of distributed energy resources (DERs) and large renewable energy projects, the net environmental benefit of EVs will grow larger. This is why transportation electrification is a key strategy for achieving air quality and climate goals and for integrating renewable energy into the transportation sector.

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[13] NHDES analysis of NH DMV registration data query run December 31, 2018.

[14] GSCCC (2018). Nashua Transit System and BAE Systems Partner to Bring Hybrid Diesel-Electric Transit Buses to the Streets of New Hampshire, http://www.fuelsfix.com/2018/12/nashua-transit-system-and-bae-systems-partner-to-bring-hybrid-diesel-electric-transit-buses-to-the-streets-of-new-hampshire/, (Last accessed December 18, 2019).

[15] NHDES (2017). State of New Hampshire Air Quality - 2017: Air Pollution Trends, Effects and Regulation, https://www.des.nh.gov/organization/commissioner/pip/publications/documents/r-ard-17-01.pdf, (Last accessed December 18, 2019).

[16] NHDES (2017). State of New Hampshire Air Quality - 2017: Air Pollution Trends, Effects and Regulation, https://www.des.nh.gov/organization/commissioner/pip/publications/documents/r-ard-17-01.pdf, (Last accessed December 18, 2019).

Economic Benefits of EVs

The energy and economic impacts of EVs are also increasingly positive, for the individual consumer and for the state and region. While the upfront costs of EVs are still high enough that the lifecycle costs of an EV have not reached parity with conventional ICE vehicles, the operation and maintenance costs of EVs are considerably lower than their counterparts. EVs are, as noted above, 77 percent efficient compared to 17–21 percent efficient than and gasoline ICE vehicle. This gives EVs a cost of operation of $1.53 per gas gallon equivalent[17] compared to a New Hampshire average price of $2.39 per gallon.[18]

New Hampshire imported 16.6 million barrels of motor gasoline and 2.3 million barrels of diesel fuel in 2017,[19] resulting in combined expenditures of just under $2 billion.[20] As New Hampshire has no fossil fuel reserves, the purchase of transportation fuels result in a net export of energy dollars from the state and the region as a whole. Expanding the use of EVs can reduce the scale of this expenditure, a reduction that will again be compounded as the state and region expands the deployment of DERs and large-scale renewable energy resources.

Impacts of EVs to the Energy Sector

While the impact of EVs on the environment and economy is likely to be a net positive, the impact to the energy sector and specifically the electric sector has the potential to be mixed. As the EV fleet in New Hampshire grows, it will displace motor gasoline and on-road diesel consumption, reducing total energy consumption and total imported energy, while increasing electricity consumption and potentially driving growth in demand.

Based on NHDES calculations, it is estimated that EVs registered in the state in 2018, representing 0.28 percent of the passenger vehicle population, consume 10,100 MWH annually. If EVs rose to 30 percent of the passenger fleet, all else being equal, that could require an additional 1,100 GWH of generation.[21]

This growth in consumption has potential positive and negative consequence. As EVs continue to increase in their share of the New Hampshire fleet and the share of vehicles carrying visitors, the rise in electric power consumption has the potential, if not properly

[17] Assumes 3.5 miles/KWH in a BEV, 30 miles per gallon fuel economy in gas-powered ICE vehicles, and an Eversource residential electric rate of 0.17924/KWH. Rate obtained from Eversource website: https://www.eversource.com/content/docs/default-source/rates-tariffs/nh-summary-rates.pdf?sfvrsn=2947c862_2, (Last accessed December 18, 2019).

[18] AAA Gas Prices, NH Average Gas Price, https://gasprices.aaa.com/?state=NH, (Last accessed February 19, 2019).

[19] EIA (2019). Table CT7. Transportation Sector Energy Consumption Estimates, Selected Years, 1960-2017, New Hampshire, https://www.eia.gov/state/seds/sep_use/tra/pdf/use_tra_NH.pdf, (Last accessed February 18, 2020).

[20] EIA (2019). Table ET6. Transportation Sector Energy Price and Expenditure Estimates, Selected Years, 1970-2017, New Hampshire, https://www.eia.gov/state/seds/sep_prices/tra/pdf/pr_tra_NH.pdf, (Last accessed February 18, 2020).

[21] NHDES calculations, December 2019. Assumes EV-registration fraction equal to EV passenger-miles fraction and 3.5 miles per KWH.

managed, to increase the total ISO-NE daily and seasonal peaks, as well as New Hampshire's share of that peak. This has the potential to impact all New Hampshire ratepayers by increasing both the energy supply charge and the transmission charge.

However, the three investor-owned utilities observed, in joint comments on the Grid Modernization Docket, IR-296, that while EVs have the potential to grow electric loads, this load growth can result in savings to all customers if forecasted and managed properly. As EVs consume more electricity, there are more KWHs over which to spread utilities' fixed costs.[22]

EV Charging Considerations

Electric vehicles need to be charged with electricity to "fuel" their batteries. An EV "charging station," typically referred to as "Electric Vehicle Supply Equipment" (EVSE), utilizes an electric cord to funnel electric current to the vehicle. The actual charger, typically called the "onboard vehicle charger," is a device that is located in the vehicle. This onboard device receives the electric current from the EVSE and charges the battery.

EV drivers typically behave differently with regard to refueling than ICE drivers do. Rather than waiting until the fuel gauge is near empty to refuel, EV drivers often take advantage of opportunities to "top off." While it takes longer to charge your car with electricity, it can be accomplished while drivers are doing something else. While most charging is typically done at home or at work (if the workplace has installed charging stations for employees), public charging plays a vital role in driving EV adoption.

There are three levels of charging: Level 1, Level 2, and DCFC. Level 1 charging consists of plugging the cord that comes with the car into a standard 120-volt AC wall outlet. Level 1 typically provides about 2 to 5 miles of range per hour and is best for overnight charging. Level 2 charging requires a 240-volt outlet, the same kind used by a clothes dryer or electric stove, and delivers 10 to 25 miles of range per hour of charging. This is best for use in homes, workplaces, fleet facilities and public facilities where people park for several hours. The cost of installation is highly dependent on location and existing power supply.

DCFC requires a three-phase 480-volt AC electric circuit, with the DCFC equipment converting AC to DC, and delivers a significantly faster charge. Most existing DCFC stations are 50 kilowatts (KW), delivering 60 to 80 miles of range in 20 minutes and are used primarily to charge BEVs. However, there are now much faster DCFC stations, including ones that deliver up to 350 KW, a wattage capable of delivering 200 miles of range in 10 minutes.

DCFC stations are an essential component of the EV charging ecosystem. While it is generally understood that DCFC is needed to facilitate long distance travel, there are many DCFC applications for local EV drivers as well. DCFC stations provide a viable charging option for

[22] Page 13. Joint Comments of Liberty Utilities (Granite State Electric) Corp. D/B/A Liberty Utilities, Public Service Company of New Hampshire D/B/A Eversource Energy, And Unitil Energy Systems, Inc. Re: Order No. 26,254. http://www.puc.state.nh.us/regulatory/docketbk/2015/15-296/letters-memos-tariffs/15-296_2019-09-06_gsec_eversource_unitil_joint_comments.pdf, (Last accessed December 18, 2019).

people without the ability to charge at home, such as those who live in apartment buildings, and are also used by EV drivers looking to top off their battery.

EVSE Deployment in New Hampshire

There are currently over 19,000 publicly accessible, non-Tesla, EV charging locations in the United States, 80 of which are in New Hampshire.[23] These figures do not include the number of Level 1 and Level 2 chargers used for home charging, which is not known. It is likely very close to the total number of registered EVs and PHEVs.

The number of publically-accessible chargers is expected to grow as automakers bring more EVs to the market and the demand for charging increases. Moreover, there are billions of dollars of planned investment in EV charging equipment from electric utilities, states, and private EVSE companies. Therefore, there will likely be more applications for EV charging stations in the coming months and years.

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[23] US DOE (2019). Alternative Fueling Station Locator, Office of Energy Efficiency & Renewable Energy, https://afdc.energy.gov/stations/#/find/nearest, (Last accessed December 18, 2019).