STATE OF NEW HAMPSHIRE

BEFORE THE

PUBLIC UTILITIES COMMISSION

DE 21-078

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
d/b/a EVERSOURCE ENERGY

Petition for Electric Vehicle Make-Ready
and Demand Charge Alternative Proposals

TESTIMONY OF

CHRISTOPHER J. SKOGLUND

On behalf of Clean Energy New Hampshire

February 25, 202

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I. Introduction

Q. Mr. Skoglund, please state your name, business address and position.

A. My name is Christopher J. Skoglund. I am employed by Clean Energy New Hampshire (CENH), located at 14 Dixon Ave in Concord NH, as the Director of Energy Transition. Included in this testimony is Addendum CS-1, a statement of my education and work experience.

Q. Please briefly describe your experience and specific knowledge or skills that relate to your testimony in this docket.

A. I am currently employed by CENH as the Director of Energy Transition since January 2022. In this role, I am the organization's lead at the NH Public Utilities Commission, while also providing support for legislative, planning, and educational initiatives.

Prior to joining CENH at the beginning, I worked for the NH Department of Environmental Services (NHDES) from 2008 until the end of 2021. While working at NHDES, I was involved in planning, projects, and programs across the electric power, building, and transportation sectors. My main roles were in coordination of multi-sector planning and policy initiatives including the: 2009 NH Climate Action Plan; the 2012 EESE Board Review on the Independent Study of Energy Policy Issues ("SB 323 (2010) Study"); and the New England Governors/Eastern Canadian Premiers 2017 Regional Climate Action Plan Update. In addition, I also regularly testified before the New Hampshire state legislature, and conducted energy and greenhouse gas (GHG) emissions analysis for NHDES and the State of New Hampshire, inclusive of the electric power, building, and transportation sectors.

Q. Have you previously testified before the Commission?

A. Yes. Previously, I testified before the Commission in DE 20-092, New Hampshire's Electric and Natural Gas Utilities 2021-2023 New Hampshire Statewide Energy Efficiency Plan, and in DE 19-057, Eversource Rate Case. In addition, I recently provided significant input on NHDES' comments for IR 20-004, Investigation into Rate Design Standards for Electric Vehicle Charging Stations and Electric Vehicle Time of

Day Rates, as well as NHDES's extensive letter of support for key elements of the DE 19-064, Liberty Utilities Rate Case Settlement Agreement. In addition, I am presently an intervenor in DE 21-170, EV Time of Use Rates and DE 21-030, Unitil Rate Case, and have been active participant in the DE 16-576 Net Metering pilot studies and was engaged throughout the IR 15-296 Grid Modernization proceeding, and the DE 17-136 EERS working groups.

II. Overview and Summary

Q. Please describe the purpose of your testimony, including an overview of your analyses, conclusions, and the focus of your testimony.

A. Specifically, the purpose of my testimony is to recommend that Eversource's make-ready proposal be approved in order to support electric vehicle (EV) adoption in the New Hampshire, 2) that Eversource be permitted to expand their make-ready investment to reflect the fact that they serve 60 percent of the state land area, and 3) that Eversource's demand charge alternative be approved. However, a more thorough representation of CENH's views on the demand charge alternative is reflected in the testimony of our consultant, Christopher Villareal, who we share with the Conservation Law Foundation.

My testimony begins (Section III) with an overview of EVs, which are part of a larger, emerging trend in strategic electrification of the entire energy system. This includes a summary of the current EV market and the potential environmental, energy, economic impacts that EVs may incur. The second part of my testimony (Section IV) addresses the role that rates can have on EV adoption and charging behavior, and the potential for rates to reduce the impact that EV charging can have on the grid. My testimony concludes (Section V) by considering the importance make ready programs will have in New Hampshire.

III. EV Overview

Q. How do EVs compare to conventional internal combustion engines?

A. Motor vehicles with conventional gasoline and diesel internal combustion engines (ICE) have been around for over a century. These vehicles rely on the combustion of

liquid fuels to power the vehicle. EVs rely on an external power source to charge an onboard battery, which powers the electric motor as well as the vehicle's electronics. There are two main types: battery electric vehicles (BEVs), and plug-in hybrid electric vehicles (PHEVs).

BEVs are pure electric. They use one or more electric motors powered by a battery pack. The range of BEVs varies from 80 to 335 miles, depending on the model. The range of an EV can vary based upon driving conditions, such as outside temperature and high driving speeds. BEVs are plugged into an electric power source to charge. The battery also recharges during operation through regenerative braking.

PHEVs are much like regular hybrid-electric vehicles (HEVs) in that they have both an electric motor and a gasoline engine, but unlike HEVs they can be plugged in to charge and have all-electric ranges that vary from 10 to 50 miles. They use the electric motor, at times selectively, until the battery is depleted, and then the vehicle switches seamlessly to the gasoline engine. Similar to regular hybrid vehicles, PHEVs also recharge the battery during operation through regenerative braking.

According to the US Department of Energy, EVs are significantly more efficient than ICE vehicles. EVs convert over 77 percent of the electrical energy from the grid to power at the wheels, whereas conventional gasoline vehicles only convert about 17–30 percent of the energy stored in gasoline to power at the wheels.[1]

Q. How does the efficiency of EVs relate to New Hampshire?

A. New Hampshire's economy, public health, and environmental quality are directly impacted by our energy use, and the transportation sector is the single largest source of air pollution in New Hampshire and in the region. For the most recent year that data is

[1] US DOE (2022). All-Electric Vehicles, Office of Energy Efficiency & Renewable Energy, https://fueleconomy.gov/feg/evtech.shtml, (Last accessed February 20, 2022).

available, the transportation sector accounted for nearly one third of the total end use energy consumed in the state, and nearly half the total GHG emissions.[2]

Reducing total energy consumption lowers emissions of smog-forming compounds and particulate pollution that cause direct health impacts, mercury emissions that impact our lakes and streams, and greenhouse gas (GHG) emissions that contribute to climate change. Addressing the economic, public health, and environmental impacts of energy consumption in New Hampshire has been reinforced by the NH General Court on numerous occasions, as reflected in NH statutes.[3,4,5,6,7]

Increasingly, the solutions to energy system reliability, energy system costs, and environmental impacts intersect. As clean energy technologies evolve and come down in price, they present a significant opportunity to reduce overall system costs while providing for a cleaner environment with improved public health outcomes. For this reason, the

[2] CENH calculations February 2022, using US DOE State Energy Data System (SEDS): 1960-2019, https://www.eia.gov/state/seds/seds-data-complete.php?sid=NH, (Last accessed February 20, 2022).

[3] NH RSA 125-C: Air Pollution Control, http://www.gencourt.state.nh.us/rsa/html/X/125-C/125-C-mrg.htm, (Last accessed February 20, 2022).

[4] NH RSA 125-D: Acid Rain Control Act, http://www.gencourt.state.nh.us/rsa/html/X/125-D/125-D-mrg.htm, (Last accessed February 20, 2022).

[5] NH RSA 125-J: Emissions Reduction Trading Programs, http://www.gencourt.state.nh.us/rsa/html/X/125-J/125-J-mrg.htm, (Last accessed February 20, 2022).

[6] NH RSA 125-M: Mercury Emissions Reduction And Control Program, http://www.gencourt.state.nh.us/rsa/html/X/125-M/125-M-mrg.htm, (Last accessed February 20, 2022).

[7] NH RSA 125-O: Multiple Pollutant Reduction Program, http://www.gencourt.state.nh.us/rsa/html/X/125-O/125-O-mrg.htm, (Last accessed February 20, 2022).

policy approaches that support strategic electrification,[8] and energy optimization[9] are consistent with longstanding New Hampshire precedent.

Q. How is the vehicle market and the vehicle fleet changing because of the commercialization of EVs?

A. EV technology is rapidly progressing. The price of EV batteries has fallen 89 percent from $1,100 per KWH storage capacity in 2010 to $137 in 2021, by. It is forecast that costs will fall below $100 per KWH in 2024, at which point EVs will reach price parity with ICE vehicles, and prices will reach $58 per KWh by 2030.[10]

In 2018, more than two million EVs were sold globally, and global passenger vehicle sales are expected to rise sharply in the next few years. Predictions vary, but largely agree with regards to the order of magnitude of the change that is anticipated. The most bullish forecast is that EV sales will rise from 3.1 million in 2020 to 14 million in 2025, to nearly 30 million by 2030, and nearly 60 million by 2040. In 2040, this equates to 57 percent of all passenger vehicle sales being electric, with up to 30 percent of the

[8] "Strategic electrification involves powering end uses with electricity instead of fossil fuels in a way that increases EE and reduces pollution, while lowering costs to customers and society, as part of an integrated approach to decarbonization."

This definition comes from: Navigant Consulting (2019). Energy Optimization through Fuel Switching Study, Prepared for: The New Hampshire Evaluation, Measurement, and Verification (EM&V) Working Group, pg. 28, https://www.puc.nh.gov/regulatory/docketbk/2017/17-136/letters-memos-tariffs/17-136_2019-10-31_staff_nh_energy_optimization_study.pdf, (Last accessed February 24, 2022).

[9] "We interpret energy optimization as a strategy to minimize energy use and maximize customer benefits. Energy optimization considers efficiency and the mix of fuels used. Energy optimization measures are a subset of fuel switching measures, but the two are not synonymous because fuel switching does not necessarily account for efficiency. Similarly, energy optimization measures are a subset of [energy efficiency] EE measures, though EE measures do not necessarily consider the fuel mix. Beneficial or strategic electrification approaches may involve energy optimization, but these terms are not synonymous either. Beneficial or strategic electrification involves powering end uses with electricity instead of fossil fuels in a way that increases EE and reduces pollution, while lowering costs to customers and society, as part of an integrated approach to decarbonization, while energy optimization focuses on any strategy that minimizes energy use and maximizes customer benefits."

This definition comes from: Navigant Consulting (2019). Energy Optimization through Fuel Switching Study, Prepared for: The New Hampshire Evaluation, Measurement, and Verification (EM&V) Working Group, pg. 1, https://www.puc.nh.gov/regulatory/docketbk/2017/17-136/letters-memos-tariffs/17-136_2019-10-31_staff_nh_energy_optimization_study.pdf, (Last accessed February 20, 2022).

[10] BNEF (2022). 2021 Electric Vehicle Outlook, Bloomberg NEF, https://about.bnef.com/electric-vehicle-outlook/, (Last accessed February 20, 2022).

global passenger fleet being electric.[11] Less aggressive forecasts suggest that globally we will achieve 30 percent of light passenger fleet electrification in 2050.[12]

In the US, annual sales of EVs could exceed 3.5 million vehicles in 2030, reaching more than 20 percent of annual vehicle sales. The stock of EVs on the road is projected to reach 18.7 million 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.[13]

Additionally, other segments of the transportation sector will also electrify. Also, by 2030, light commercial EV sales are projected to reach 56 percent and medium commercial EV sales are expected to reach 31 percent.[14] Already, electric bus manufacturers, like Lion Electric, New Flyer, Blue Bird, Thomas Built, and BAE Systems are working with communities to deploy electric transit buses and school buses, including communities in New Hampshire.

Q. What factors influence the rate of adoption?

A. Lack of charging infrastructure is the primary concern that consumers cite when asked if they would adopt an EV. Other concerns include the range of available BEVs, their up-front cost and the time required to recharge the battery.[15] As such, EV adoption will be increased as:

- more charging infrastructure is deployed, leading to reduced range anxiety;
- the cost of EVs continues to decrease;
- the range of the travel continues to increase; and
- consumers become increasingly aware of the benefits of driving electric.

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[11] Id.

[12] EIA (2021). Annual Energy Outlook 2021, https://www.eia.gov/outlooks/aeo/consumption/sub-topic-01.php, (Last accessed February 24, 2022).

[13] NESCAUM (2017). Multi-State Zero Emission Vehicle Action Plan, http://www.nescaum.org/documents/2018-zev-action-plan.pdf, (Last accessed February 20, 2022).

[14] BNEF (2022). 2021 Electric Vehicle Outlook, Bloomberg NEF, https://about.bnef.com/electric-vehicle-outlook/, (Last accessed February 20, 2022).

[15] Deloitte (2020). Electric Vehicles Setting A Course For 2030, https://www2.deloitte.com/uk/en/insights/focus/future-of-mobility/electric-vehicle-trends-2030.html, (Last accessed February 24, 2022).

Consumer acceptance will also continue to grow as new and diverse models are introduced. [16] Currently, there are around 40 different models of electric cars available for sale in the U.S., including sports cars, sedans, SUVs, and minivans.[17] 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 acceptance and adoption in the US is also expected to rise as EV pickups become available in the next couple of years.[18]

Q. Please characterize the EV market and fleet in the broader Northeast, including New England and Eastern Canada, whose residents may visit or pass through New Hampshire seasonally?

A. Vehicle electrification is transforming transportation across the region. Major automakers, like Volvo, Ford, GM, and Volkswagen are making investments and commitments to electrification. While in 2010 there were only two EV models commercially available to consumers,[19] there are now over 40 different battery electric models and nearly 30 plug-in hybrid electric models available today, just in the Northeast.[20]

All the other New England states, and many other Northeast states, are offering incentives that will result in increased adoption of EVs in our region in the coming years. Since 2014, EVs have grown from just under 3,000 vehicles on the road to - as of March of 2019 - more than 43,000 EVs were registered in the New England states surrounding

[16] Consumer Federation of America (2016). New Data Shows Consumer Interest in Electric Vehicles Is Growing, https://consumerfed.org/press_release/new-data-shows-consumer-interest-electric-vehicles-growing/, (Last accessed February 20, 2022).

[17] Plug In America, (2022). EV Model Availability Webpage, https://plugstar.com/cars, (Last accessed February 20, 2022).

[18] BNEF (2022). 2021 Electric Vehicle Outlook, Bloomberg NEF, https://about.bnef.com/electric-vehicle-outlook/, (Last accessed February 20, 2022).

[19] NGT News (2019). DOE Lays out Light-Duty EV Numbers Over the Years, https://ngtnews.com/doe-lays-out-light-duty-ev-numbers-over-the-years, (Last accessed February 24, 2022).

[20] *Id*

New Hampshire.[21] The largest growth in EVs has occurred in New Hampshire's neighbor to the North in Quebec. New England's 2019 registrations represent 0.83% of all vehicles,[22] with total registrations rising 75 percent between 2018 and 2019.[23] In Quebec 9.5 percent of new vehicle sales were EVs in 2021.[24]

Q. How is that regional market expected to change?

A. 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.[25] All of the other New England states, as well as New York, are signatories to the California's Zero Emission Vehicle (ZEV) regulation,[26] with Maine re-joining in 2019. In 2013, the four New England states and New York agreed to a target of 15 percent ZEV vehicles by 2025, meaning BEV, PHEV, or fuel cell.[27] However, the ZEV program targets are minimum percentages, and are likely to be exceeded in some states. The State of Massachusetts has set a goal of having 300,000 EVs on the road by 2025.[28]

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[21] 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 20, 2022).

[22] 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 19, 2019).

[23] 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, (February 20, 2022).

[24]IHS Markit (2021). Automotive Insights A curated collection of Canadian EV information, analysis, and insights from IHS Markit, https://cdn.ihsmarkit.com/www/prot/pdf/0222/Canada-EV-Newsletter-Q4-2021.pdf, (February 20, 2022).

[25] Link to National PEV Infrastructure Analysis released by US DOE September 2017: reference the table on page 16, https://www.nrel.gov/docs/fy17osti/69031.pdf, (Last accessed December 19, 2019).

[26] NESCAUM (2018). Multi-State Zero Emission Vehicle Action Plan, http://www.nescaum.org/documents/2018-zev-action-plan.pdf, (Last accessed December 19, 2019).

[27] 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 19, 2019).

[28] Press Release, Governor Baker Signs Electric Vehicle Promotion Legislation, https://www.mass.gov/news/governor-baker-signs-electric-vehicle-promotion-legislation, (Last accessed December 20, 2019).

Quebec had also set targets of 100,000 EVs on the road by 2020 and 300,000 on the road by 2025.[29] The province has just proposed a policy goal of 100 percent EV sales by 2035.[30] With New Hampshire's natural resources attracting so many visitors from around the region, the economic pressure to build the necessary infrastructure to "fuel up" EVs will be tremendous.

Q. What is the status of EV adoption in New Hampshire?

A. As of the end of 2018, a little over 3,300 EVs were registered in New Hampshire: with around 2,000 plug-in hybrid electric vehicles PHEVs and nearly 1300 BEVs. By 2020, that number had increased to nearly 4500. While this represented only 0.23 percent of all vehicles and 0.28 percent of the light-duty vehicles, it was a substantial acceleration in the rate of EV adoption. Between 2016 and 2017, EV registrations grew 37 percent, and from 2017 to 2018 they grew 58 percent.[31] With a broader range of newer 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 will likely continue to increase.

Q. What are the known and potential benefits of EVs to the state's environmental and public health?

A. 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.

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[29] Gouvernement du Quebec (2017). *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], Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, http://www.mddelcc.gouv.qc.ca/changementsclimatiques/ vze/AIR-reglement201712.pdf, (Last accessed December 19, 2019).

[30] Government of Quebec (2022). Draft Regulations To Strengthen The ZEV Standard In 2025-2035, Ministry of Sustainable Development, Environment, and Fight Against Climate Change, Ministry of Sustainable Development, Environment, and Fight Against Climate Change, https://www.environnement.gouv.qc.ca/changementsclimatiques/vze/consultation-janvier-mars-2022/index-en.htm, (February 20, 2022).

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

Internal combustion engines are the primary source of oxides of nitrogen and volatile organic compounds in New Hampshire. Over half of the pollutants that lead to the formation of ground level ozone, the main ingredient of smog, is nitrogen oxide or (NOx) emissions from cars and trucks.[32] ICE vehicles are also the largest single source of GHG emissions in the state. Over 40 percent of GHG emissions, the primary cause of climate change, in New Hampshire come from the transportation sector.[33]

EVs help to reduce both NOx and GHG emissions, because they produce no tailpipe emissions when running on electricity. Even when including power plant emissions, EVs reduce pollutants and GHG emissions, because electric engines are so much more efficient than ICE vehicles, using 25 percent of the energy of a conventional ICE vehicle. As the ISO-New England grid becomes cleaner, through the interconnection of distributed energy resources (DERs) and large renewable energy projects, the net environmental impact of EVs will grow larger. This is why transportation electrification is a key strategy for achieving air quality and other public health and environmental outcomes, and for integrating renewable energy into the transportation sector.

Q. What are the known and potential benefits of EVs to the state's economy?

A. 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 total cost of ownership 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 17–30 percent efficient gasoline ICE vehicles. This gives EVs a cost of operation of $1.70 per gas gallon equivalent compared to a New Hampshire average gas price of $3.38 per gallon.[34]

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[32] NHDES (2021). State of New Hampshire Air Quality – 2020 Update, https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/r-ard-21-05.pdf, (Last accessed February 21, 2022).

[33] Id.

[34] NHDOE (2022). Fuel Prices Website, https://www.nh.gov/osi/energy/energy-nh/fuel-prices/, (February 20, 2022).

The economic impact to the state of a transition to EVs could be considerable as New Hampshire imported 16.6 million barrels of motor gasoline and 2.3 million barrels of diesel fuel in 2017,[35] resulting in combined expenditures of just under $2 billion.[36] As New Hampshire has no fossil fuel reserves, 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.

Q. What are the known and potential benefits and impacts of EVs to state's energy sector?

A. 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. If EVs rose to 30 percent of the passenger fleet, all else being equal, that could require an additional 1,100 GWH of generation.[37]

This growth in consumption has potential positive and negative consequences. The rise in electric power consumption has the potential, if unmanaged, to increase the total ISO-NE daily and seasonal peaks, as well as New Hampshire's share of that peak. This

[35] 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 December 16, 2019).

[36] 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 December 16, 2019).

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

has the potential to impact all New Hampshire ratepayers by increasing both the energy supply and the transmission charges.

However, the three investor-owned utilities, including Eversource, observed, in joint comments on the Grid Modernization Docket, IR15-296, 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 Eversource's and the other utilities' fixed costs.[38] This was independently supported by Eversource analysis provided its previous filing in DE 19-057.[39] In an analysis of two California utilities over an eight year period, Synapse Energy Economics found that EV drivers in PG&E's and SCE's service territories have contributed $806 million more in revenues than associated costs, driving rates down for all customers.[40]

Q. What is involved in charging EVs and PHEVs?

A. EVs need to be charged with electricity to "fuel" their batteries. An EV "charging station," typically referred to as an "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.

Charging an EV is a different experience than fueling a car at a gas station. Rather than waiting until the fuel gauge is near empty, 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 can be 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.

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[38] 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).

[39] Eversource Response to PUC (Staff 13-013a), October 25, 2019.

[40] Frost, J., Whited, M. and Allison, A. (2020). Electric Vehicles Are Driving Electric Rates Down, Synapse Energy Economics, https://t.co/HRSXpTTolb, (Last accessed February 24, 2022).

There are three levels of charging: Level 1, Level 2, and Direct Current Fast Charging (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. Beyond delivering a faster charge, one major factor that differentiates DCFC from Level 2 chargers is the need for an equipment pad to mount the DCFC equipment.

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 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.

Q. What is the status of EVSE deployment in New Hampshire?

A. While there are currently over 47,224 publicly accessible, non-Tesla, EV charging locations in the United States, only 160 of those are in New Hampshire. Meanwhile 290 stations were reported for Maine and 327 for Vermont.[41] However, the number of Level 1

[41] US DOE (2019). Alternative Fueling Station Locator, Office of Energy Efficiency & Renewable Energy, https://afdc.energy.gov/stations/states, (Last accessed February 20, 2022).

and Level 2 chargers used for home charging is not known. It is likely very close to the total number of registered EVs and PHEVs in the state.

The demand for publicly 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 in other US states. Therefore, there will likely be more applications for public EV charging stations in the coming months and years.

Q. How has the New Hampshire policy landscape changed recently with respect to EVs?

A. New Hampshire is behind, as compared to neighboring states, in our planning and installation of infrastructure to support EV travel to and within New Hampshire. In 2018, an Electric Vehicle Charging Stations Infrastructure Commission (EVSE Commission)[42] was established by SB517[43] to help ensure strategic investment in EV charging infrastructure. The EVSE Commission was created in recognition that such strategic investment will help minimize the "range anxiety" that often hinders the purchase of these cleaner advanced technology vehicles. In its final report, the EVSE Commission recommended that:

> *"The state should commit to the development of [ZEV] technology and infrastructure, including the state, private and rental residence, business, and municipal installation of EV charging stations to reduce air pollution emissions and stimulate the transformation to a lower carbon transportation system."*[44]

[42] Electric Vehicle Charging Stations Infrastructure Commission, https://www.des.nh.gov/organization/divisions/air/tsb/tps/msp/sb517.htm, (Last accessed February 20, 2022).

[43] Senate Bill 517, An Act Establishing an Electric Vehicle Charging Stations Infrastructure Commission, http://gencourt.state.nh.us/bill_Status/billText.aspx?sy=2018&id=1829&txtFormat=pdf&v=current, (Last accessed February 20, 2022).

[44] EVSE Commission (2020). Electric Vehicle Charging Stations Infrastructure Commission (Senate Bill 517) Final Report (2018), https://www.des.nh.gov/sites/g/files/ehbemt341/files/inline-documents/2020-12/20201030-final-report.pdf, (Last accessed February 20, 2022).

The Commission, which began meeting in the fall of 2018, was timely given the recent settlement agreement between Volkswagen and the Federal Department of Justice.[45] New Hampshire has received approximately $31 million from the Volkswagen Settlement, and Governor Sununu has committed 15 percent or approximately $4.6 million – the maximum allowed under the settlement – to be used for EV charging stations. In its report, the EVSE Commission further recommended that:

> *"The State should move quickly to use the VW Settlement funds to deploy DC fast charging stations along major corridors and to deploy level 2 EVSE on other corridors and locations, including municipalities and businesses[.]"*[46]

Recently, NHDES, New Hampshire's VW lead agency, released its 2nd competitive solicitation for charging along New Hampshire's principal travel corridors. During the first solicitation, no qualifying bids were received.[47]

In addition to the $31 million allocated specifically to reduce emissions statewide, the VW settlement provides the opportunity to apply for funding from a pool of $1.2 billion dollars intended to support the infrastructure for and promotion of zero emissions vehicle technologies. In addition to this funding, New Hampshire is expected to receive about $17 million for EV infrastructure from the Infrastructure Investment and Jobs Act (IIJA) of 2021.

While this seems a significant amount of money to be invested in New Hampshire's public charging network, it may not be enough to support the build out of the DCFC infrastructure in New Hampshire. The State has prioritized development of DCFC charging stations at 50-mile intervals along the six EV charging corridors designated by the US Department of Transportation (See NH Department of Transportation Map in

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[45] United States of America vs Volkswagen AG, Docket No. 16-CR-20394, https://www.justice.gov/usao-edmi/us-v-volkswagen-16-cr-20394, (Last accessed February 20, 2022).

[46] EVSE Commission (2020). Electric Vehicle Charging Stations Infrastructure Commission (Senate Bill 517) Final Report (2018), https://www.des.nh.gov/sites/g/files/ehbemt341/files/inline-documents/2020-12/20201030-final-report.pdf, (Last accessed February 20, 2022).

[47] Id.

CENH Attachment 1).[48] However, at that spacing interval, there would need to be nearly 50 DCFC locations for just the numbered highways. At this time, New Hampshire has five DCFC stations excluding the Tesla stations with their proprietary EVSE), so the state needs an additional 45 DCFC stations installed on the highways. DCFC units range in cost, including installation, from $75,000-150,000, depending on the units' power levels and additional features, as well as how close the DCFC is to the electrical service and whether there is sufficient electrical capacity for the DCFC's high power needs.[49] With a preferred two DCFC chargers at each site, for a total of four ports, the costs to develop each site are even higher. The public dollars available may cover the numbered highways, but the rural regions of the state are more likely to be overlooked.

In addition to the limited public investment, the current low adoption rate of EVs in the state and region, and therefore the lower utilization rate of existing and future public charging stations, means that there may be limited private investment capital that is available to build out the public charging network that needs to be in place before the EVs reach the road en masse.

IV. Relationship Between EVs and Rates

Q. How does rate design influence EV adoption and charging behavior?

A. Electric rates can, based on how they are structured, influence both the adoption rate of EVs, as well as their impact on the regional grid. Electric rates can influence adoption by providing a price signal to customers, both EV owners and charging station operators. Electric rates, therefore, have the potential to influence EV adoption at multiple levels.

As noted, extensively in Docket No. DE 20-170, EV rates can influence the business case, or value proposition, for owning and operating an EV by offering TOU rates that allow EV owners to take advantage of their flexible demand, and in doing so, further

[48] NHDES (2021). New Hampshire VW Environmental Mitigation Trust Direct Current Fast Charging Infrastructure Request for Proposals, New Hampshire Electric Vehicle Supply Equipment Grant Program, NH Department of Environmental Services, https://das.nh.gov/purchasing/docs/bids/RFP%20DES%202022-06.pdf, (Last accessed February 24, 2022)

[49] NYSERDA (2021). Installing a Charging Station, New York State Energy Research and Development Authority, https://www.nyserda.ny.gov/All-Programs/ChargeNY/Charge-Electric/Charging-Station-Programs/Charge-Ready-NY/Installing-a-Charging-Station, (Last accessed February 24, 2022).

reduce the cost to operate an EV. As battery prices have not yet reached the point where EVs and ICE vehicles have achieved price parity, TOU rates with strong price signals have the potential to improve the economics of ownership. TOU rates also provide the price signals that encourage off-peak charging lowering overall grid and environmental impacts associated with electrification of the transportation sector. However, EV TOU rates are not appropriate for public charging settings during this transition period with low utilization rates. Consumer behavior is less responsive to time-based price signals when accessing public charging, as the decision to charge is typically based on convenience. As such site operators have little option except to invest in technologies such as co-located battery storage to mitigate their impact on the local distribution grid. This drives up capital cost of charging infrastructure and will slow charging deployment and EV adoption rates.

Electric rates can also influence the business case to operate DCFC stations or station networks in the state. As these stations increase in both number and geographic distribution across the state, they reduce the range anxiety that EV drivers may feel. Reduced range anxiety can contribute to greater comfort in purchasing an EV.[50]

However, the demand charges incurred by DCFC stations, at current and near-term levels of EV adoption, undermine the business case for installing and operating this essential EV infrastructure. This is because they incur the same demand charge whether they have low utilization or high, which must be amortized over a small number of total KWh sold. This presents site-hosts the unenviable choice of pricing the electricity to cover their costs, which would be prohibitively expensive and drive away users, or selling the electricity at a substantial loss. This has also been documented

[50] 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 February 24, 2022).

independently.[51,52] 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.

Q. What is your position regarding demand charge alternatives in this proceeding?

A. CENH supports the inclusion of demand charge alternatives for EV charging at low utilization rates, and this issue has been comprehensively addressed by Christopher Villareal, who has submitted Direct Testimony on behalf of CENH and the Conservation Law Foundation.

Q. Why is it important to consider rates relative to EVs now, when EVs represent such a small part of the total vehicle fleet?

A. EVs are here and will only become more common as prices fall and drivers become more familiar with their capabilities. However, as noted previously, the current low adoption rate of EVs in the state and region, and therefore the low utilization rate of existing and future public charging stations, hampers the business case for private investment capital to build out the public charging network that needs to be in place before the EVs reach the road en masse.

V. Make Ready Programs

Q. Why are the make-ready programs and investments proposed by Eversource important?

A. Capturing the substantial economic and public health benefits of the electrification of transportation will require some investment up front. As the transition to EVs is in its infancy, New Hampshire's energy policy should be focused on spurring market adoption and the buildout of associated infrastructure to support and ease this transition and enable

[51] 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 24, 2022).

[52] Fitzgerald, G. and Nelder, C. (2019) DCFC Rate Design Study: For The Colorado Energy Office, Rocky Mountain Institute, https://rmi.org/insight/dcfc-rate-design-study/, (Last accessed February 24, 2022).

the increasing number of EVs to be readily accommodated. This can occur by supporting utility "make-ready" investments where appropriate as well as by developing and offering EV charging rates that are appropriate for the level of market penetration that EVs have achieved. As these investments and rates are being made, costs should be appropriately distributed across the system's users.

Q. What investments are proposed by the Company?

A. Eversource proposes to invest $2 million in distribution facilities for EV charging stations as a component of a public-private partnership ("Program") to deploy DCFC throughout New Hampshire. As noted in the Testimony of Edward A. Davis, Brian J. Rice and Kevin M. Boughan, the "*EVSE sites will be determined through the NH Trust RFP process*."[53]

This proposal is consistent with a "make ready" program design, which typically refers to the line extension on the distribution side of the meter, as well as wiring, conduit, and sub-panels that are often needed to provide power to EV chargers located on the customer's side of the meter. Make ready construction costs downstream from the customer's utility meter include trenching or boring, conduit, wiring, labor, mounting, site reconditioning and landscaping along with signage. Such make-ready costs are unlikely to experience significant reductions over time.

Q. What public funding is available for make ready investments?

A. There is no publicly available funding for make ready investments at this time. On September 17, 2021, NHDES issued a second New Hampshire VW Environmental Mitigation Trust Direct Current Fast Charging (DCFC) Infrastructure Request for Proposals (the "RFP").[54] Section 2.4:1,L of the RFP did state that "Make-ready costs not

[53] Eversource Energy, Docket No. DE 21-078, Testimony of Edward A. Davis, Brian J. Rice and Kevin M. Boughan, https://www.puc.nh.gov/regulatory/docketbk/2021/21-078/initial%20filing%20-%20petition/21-078_2021-04-15_eversource_testimony_davis_rice_boughan.pdf, (Last accessed February 21, 2022).

[54] NHDES (2021). New Hampshire VW Environmental Mitigation Trust Direct Current Fast Charging Infrastructure Request for Proposals, https://www.des.nh.gov/business-and-community/loans-and-grants/volkswagen-mitigation-trust, (Last accessed February 21, 2022).

covered by utility(ies)" were eligible to be covered by funds from the VW Mitigation Trust. However, on a December 3, 2021 NHDES issued Amendment #2 removing that make ready language.[55]

Q. Why were make-ready costs removed from eligibility under this RFP?

A. It is CENH's understanding that make ready costs were included in the original RFP language in error. Due to the limited number of public dollars that are available to support the development of publicly accessible EV charging stations in New Hampshire, NHDES designed the RFP to fund charging site work in front of the meter, and to work in concert with the electric distribution utilities' pending make ready proposals. By not funding the utility side upgrades the limited funding could be used to maximize the number of sites developed across the state.

Q. Is there any evidence of the lack of publicly available funding for make-ready investments impacting public charging projects in the New Hampshire?

A. Yes. The Town of Bristol, located just off Interstate-93 in Grafton County, has been working for the past several months to develop a proposal for a DCFC station with co-located Level 2 charging ports at their library. However, the engineering estimates that Eversource provided regarding the necessary electrical upgrades totaled $18,952.18. This proved to be too expensive for the site operator that they had been working with, who subsequently backed out. As a result, the Town is unable to go forward with the project.

Further, CENH has heard from several EV charging site developers that the elimination of make-ready costs from the RFP was impacting the financial viability of projects they were considering. They expressed additional concerns that the RFP would fail because of the lack of access to this critical funding element.

[55] NHDES (2021). Amendment #2, New Hampshire VW Environmental Mitigation Trust Direct Current Fast Charging Infrastructure Request for Proposals, https://das.nh.gov/purchasing/docs/bids/Addendum_2_RFP%20DES%202022-06.pdf, (Last accessed February 21, 2022).

Q. Do you have any recommendations related to the Company's proposal?

A. Yes. CENH would recommend two things. The first is that that the PUC authorize Eversource to make a larger investment than proposed. In its proposal, Eversource proposed to make $2 million in make ready investments within its territory. This matches its original proposal in Docket No. DE 19-057.[56] However, the Eversource electric distribution territory covers 60 percent of the state's land area and is the largest utility in the state. While, it has proposed a $2 million dollar program, Until Energy Systems (Unitil) and the intervenors in Docket No. DE 21-030, Until Energy System Rate Case Settlement Agreement (Unitil Settlement) proposed in Section 7.2.3:

> *"The Company may spend up to $2,362,000 to provide the make-ready infrastructure described above, with spending limits for each category of infrastructure as follows: $572,000 for DCFC stations; $1,540,000 for Level 2 public charging sites; and $250,000 for pole-mounted Level 2 charging sites."*[57]

Based on this level of proposed investment for Unitil, CENH would recommend that Eversource be authorized to make a significantly larger investment that is more proportional to the size of its territory and customer base than its current proposal of $2 million. While Unitil's New Hampshire electric distribution system serves 31 municipalities and covers 408 square miles,[58] Eversource NH's service territory at covers 211 towns and 5,628 square miles.[59] A larger make-ready investment would make sense given its size and potential to positively benefit the state's economy.

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[56] Eversource Energy, Docket No. DE 21-078, Testimony of Edward A. Davis, Brian J. Rice and Kevin M. Boughan, https://www.puc.nh.gov/regulatory/docketbk/2021/21-078/initial%20filing%20-%20petition/21-078_2021-04-15_eversource_testimony_davis_rice_boughan.pdf, (Last accessed February 21, 2022).

[57] Until Energy Systems, Docket No. DE 21-030, Settlement Agreement, pg. 15, https://www.puc.nh.gov/regulatory/docketbk/2021/21-030/motions-objections/21-030_2022-02-11_ues_settlement-agreement.pdf, (Last accessed February 21, 2022).

[58] Eversource (2022). Service Territory Webpage, https://www.eversource.com/content/general/residential/about/our-company/service-territory, (Last accessed February 24, 2022).

[59] Unitil (2020). 2019 Annual Report, https://investors.unitil.com/static-files/6d26ea83-509c-466a-9111-542b6e035488, (Last accessed February 24, 2022).

CENH further recommends that this funding not be limited to funding sites identified through the VW RFP as described in the Eversource testimony. As noted previously, the state will need significant investment in public DCFC stations for just the numbered highways in New Hampshire. The state does have $4.6 million in the VW fund but is anticipating around $17 million in additional funding from the federal government through the IIJA. Limiting the Eversource make ready program to funding sites identified through VW RFPs would be overly restrictive and not meet the needs of the state.

VI. Conclusion

Q. Does this conclude your testimony?

A. Yes.

Addendum CS-1

Qualification of Christopher J. Skoglund

My name is Christopher J. Skoglund. I am employed as the Director of Energy Transition by Clean Energy New Hampshire (CENH). My business address is 14 Dixon Ave in Concord NH.

I earned a Bachelor of Arts in Biology from Johns Hopkins University in 1997 and a Master of Science in Natural Resources from the University of New Hampshire in 2012. In between those degrees, I was principally employed teaching environmental and science education to middle and high school students across the country.

In 2007, I began working part-time as a Climate Program Specialist working on developing background data and analysis and planning tools to support a potential state climate action plan. In 2008, I was hired full time as an Energy and Transportation Analyst, primarily coordinating the development of the 2009 NH Climate Action, which included managing the analysis of the electric power, building, and transportation sectors. In this position, I was also engaged in transportation planning and analysis, working with the NH Department of Transportation and the four Metropolitan Planning Organizations in the southeast corner of the state.

In 2010, I moved into the Energy and Climate Analyst position, focusing more on building and electric sectors with high-level energy and climate-change planning focused at the local, state, and regional level. In 2012, I oversaw the state's Energy Efficiency and Sustainable Energy Board's development of the 2012 EESE Board Review on the Independent Study of Energy Policy Issues ("SB 323 (2010) Study").

In 2016, I moved to the Climate and Energy Program Manager position at NHDES. In this role, I regularly tracked legislation and testified before the state legislature. I was also a regular participant in PUC dockets, including Grid Mod, Net-Metering, Utility Energy Efficiency Programs, and the individual electric utility rate cases.

While at NHDES, I was also a member of the New England Governor's Eastern Canadian Premiers (NEG/ECP) Climate Change Steering Committee and helped lead efforts in 2015 and 2016 to establish a new regional GHG emissions reduction target for

2030. In 2016 and 2017, I led the successful effort to develop an update to the region's 2001 climate action plan, a plan that was economy wide and inclusive of the electric power, building, and transportation sectors.

Throughout this time at NHDES, I maintained the statewide GHG inventory, inclusive of the electric power, building, and transportation sectors and took a lead role in the GHG inventory for the entire NEG/ECP region.

I joined CENH in January of 2022. In this role, I am the organization's lead at the NH Public Utilities Commission, while also providing support for legislative, planning, and educational initiatives.