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August 2, 2022

Via Electronic Filing

Cru Stubley
Secretary to the Commission
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

RE: Application of Northern States Power Company, a Wisconsin Corporation, for Approval of Electric Vehicle Programs **Docket 4220-TE-113**

Attention: Mr. Martin Day

Dear Mr. Cru Stubley:

Northern States Power Company, a Wisconsin Corporation (NSPW or the Company), submits to the Public Service Commission of Wisconsin (Commission) this application for approval of electric vehicle programs and request for feedback on other electric vehicle programs that the Company intends to propose with its next rate case (Application).

As described in this Application, the Company is proposing modifications to its existing residential and commercial electric vehicle program tariffs. The Company is also proposing a new multi-family electric vehicle service pilot. The new multi-family electric vehicle service pilot is effectively an extension of the existing residential and commercial electric vehicle programs. The Application further previews several changes to residential and commercial programs that the Company intends to propose in its next rate case filing. Finally, the Company is requesting feedback on a company owned public electric vehicle charging program which the Company intends to propose in its next rate case filing.

The Company also includes the following Attachments in support of this Application:

- Attachment A Modified Residential Tariffs (EVR-1 and EVR-2)
- Attachment B Support for Residential Tariff Modifications
- Attachment C Modified Commercial Tariffs (EVC-1)
- Attachment D Support for Commercial Tariff Modifications
- Attachment E Multi-Family Housing Electric Vehicle Service Pilot Tariff (EVC-2)
- Attachment F Charging Station Siting Memo
- Attachment G Electric Vehicle Cost Benefit Analysis
- Attachment H Company Owned Public Electric Vehicle Charging Tariff (EVP-1)
- Attachment I Letters of Support

Because customer participation in the proposed electric vehicle tariffs is voluntary, and this Application does not request an increase in rates or a reduction in service for non-participating customers, the Company does not believe a contested case proceeding or hearing is required.

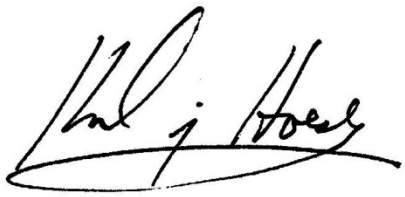
The Company respectfully requests that the Commission issue an Order approving the programs and provide feedback on the program changes and public charging plan by February 1, 2023. This allows the modifications to existing programs and the new multi-family program to be made available to customers beginning in mid-2023. That timeline will also allow the Company to consider and incorporate, as necessary, the feedback received on its program revisions and public electric vehicle charging program into its 2024 test year rate case.

Please call Tyrel Zich at (715) 737-2476 if you have any questions regarding this filing. All correspondence concerning this filing should be sent to each of the following:

Tyrel J. Zich
Xcel Energy
1414 West Hamilton Avenue
Eau Claire, WI 54702

Mara K. Ascheman
Xcel Energy
414 Nicollet Mall, 401-08
Minneapolis, MN, 55401

Sincerely,



Karl J. Hoesly
Regional Vice President, Rates and Regulatory Affairs

Encl.

CC: Tyrel J. Zich
Mara K. Ascheman

BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Northern States Power Company, a Wisconsin	**}**	
Corporation, for Approval of Electric Vehicle Programs	**}**	**4220-TE-113**

Pursuant to Wis. Stat. §§ 196.19 and 196.20, Northern States Power Company, a Wisconsin Corporation (NSPW or the Company), a wholly owned subsidiary of Xcel Energy Inc. (Xcel Energy), submits this request for approval of electric vehicle programs and request for feedback on other electric vehicle programs that the Company intends to propose with its next rate case (Application). In support of the Application, NSPW respectfully states the following:

A. Background:

In December 2020, the Governor's Task Force on Climate Change Report was published which, among other focus areas, highlighted the need to reduce emissions from the transportation sector and, specifically, the important impact that increasing electric vehicle (EV) adoption can have on transportation emission reductions. In 2020, Xcel Energy (the Company's parent) announced an EV vision to power 1.5 million EVs (corporate-wide) by 2030 reducing emissions from the transportation sector and reducing customer fueling costs. Xcel Energy also plans to work towards ensuring all customers have access to chargers at or near their home in the future. Xcel Energy's EV vision aligns with Wisconsin's goal to reduce transportation emissions.

By way of background, the Commission approved the Company's current residential and commercial EV program and subsequent modifications in Docket No. 4220-TE-104. The Company also collaborated with stakeholders leading up to this filing to evaluate, develop, and file for approval the innovative EV programs contained in this filing which was a term included in the Company's latest rate case settlement agreement in Docket No. 4220-UR-125. The Application—proposing new programs for approval and others for comment—is also informed by the Commission's work in the Investigation of EV Policy and Regulation in Docket No. 5-EI-156 and the Roadmap to Zero Carbon Investigation in Docket No. 5-EI-158. The proposed modifications and new programs for which the Company requests approval in this Application are designed to implement best practices learned from the existing NSPW residential and commercial EV programs and EV programs implemented across the Xcel Energy enterprise. As noted above, the Company is also requesting feedback on future residential and commercial program modifications and new public charging program proposals which the Company intends to include in the Company's next rate case filing. By previewing future changes, the Company plans to incorporate feedback from the Commission and stakeholders and work through outstanding issues prior to their inclusion in a rate case filing. By previewing the public charging program, the Company will also be better positioned to assist in securing and utilizing federal funding from the Infrastructure Investment and Jobs Act (IIJA) to support public charging infrastructure in Wisconsin. The Company thus builds on its reputation as a leader in innovative EV customer programs in this Application through modifications to existing residential and commercial programs to drive EV adoption, requesting for approval in this docket a proposal for a new multi-family housing EV service pilot to increase EV charging access, and requesting feedback program proposals the Company is still developing and intends to bring forward in its next rate case.

B. Residential Program Modifications

1. Current Program Overview

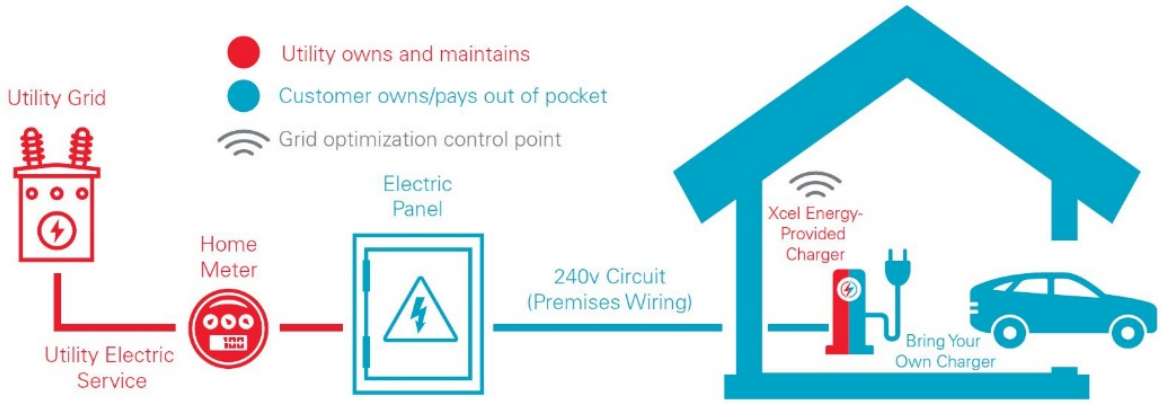
The Company's residential EV programs provide customers with charging equipment, allowing customers to charge their EVs at home and utilize Time of Day (TOD) rates to incentivize EV customers to charge during off-peak times. These programs help customers navigate charging installation and TOD rates with a simple, turn-key solution working with local electricians to install and program the charging equipment. Having a simple, turn-key solution helps customers transition to EVs and do so in a way that can benefit the electric system with managed charging. The Company currently offers two residential EV programs; the Residential EV Home Service Program (EVR-1) and Voluntary EV Charger Service Program (EVR-2). The Home Service Program is for customers on the Company's standard Residential Service (Rg-1), or Farm Service (Fg-1) and the Voluntary Charger Service Program is for customers on the Company's Residential Time-of-Day Service (Rg-2). Both programs provide customers with the choice to either prepay for the charger and installation or pay a bundled monthly customer charge for the charger and installation.

As of May 1, 2022, the Company had 50 enrolled customers in EVR-1 and 0 enrolled customers in EVR-2.[1] This amount is lower than the 120 total participants forecast in 2022 contained in the Company's most recent rate case, though the numbers only reflect the first five months of the year. The programs launched at the beginning of the COVID-19 pandemic. The Company believes the timing of the product launch and subsequent supply chain disruptions explains the lower-than-expected customer enrollment. However, the Company has identified changes to the residential programs it expects will improve the customer experience and lift participation.

In this Application the Company is requesting approval to close the Prepay option to new customers and create in its place a new Bring Your Own Charger (BYOC) option. The Company also plans to modify charger pricing due to updated vendor costs, but because this is a change in rates, the Company does not propose to do so in this Application and instead plans to update program pricing in the Company's next rate case filing. In the rate case, the Company plans to incorporate removal fees, eliminating those fees as separate items chargeable to specific customers. Lastly, the Application addresses the order point from Docket No. 4220-TE-104 on charger accuracy testing and incorporates a vehicle and charger safety recall provision. Each of these changes are discussed in detail below. Attachment A provides redlined EVR-1 and EVR-2 tariffs and Figure 1 below summarizes the residential EV program customer experience.

[1] As explained in Section E.2., the number of residential customers enrolled in the EVR-1 and -2 tariffs does not align directly with the number of registered electric vehicles in the Company's service territory. Residential customers owning EVs can, but need not, be enrolled in an EV tariff to charge their EVs.

Figure 1: Residential EV Program Customer Experience



2. Bring Your Own Charger (BYOC) Option

When the Company first proposed its residential EV programs, participating customers needed to procure their chargers from the Company. This Application proposes to replace the EVR-1 Prepay option[2] with a BYOC option. Among the current program participants, the Prepay option has been a fairly popular choice (enabling them to pay up front for the cost of charging equipment and installation). The BYOC option will preserve this characteristic by allowing customers to source their own charging equipment and enable customers who already have qualified charging equipment installed to participate in the Company's program. The BYOC option will enable customers to procure and install their own charging equipment and enroll in the same EVR-1 TOD rate that customers receive when choosing Company-provided charging equipment. The EVR-1 BYOC option supports subtractive billing from the customers whole home Rg-1 or Fg-1 rate, meaning that the EV load measured at the customer-provided charging equipment will be subtracted from the whole home rate and assessed the EVR-1 TOD, this reduces rate reducing the need for additional utility infrastructure by negating the need for a separate utility meter or service to separately bill the EV load on a TOD rate.

During enrollment, customers can choose to have the Company install charging equipment or to bring their own charging equipment. Like the Bundled option today, the BYOC option will be eligible using only the same ChargePoint and Enel X charging models as are available for bundled customers. Additional eligible charging equipment may be added to the program in the future. Customers will also select how they wish to pay for energy, by selecting either the EVR-1 TOD rate or EVR-2 whole home Rg-2 TOD rate (primarily for customers with on-site generation). The EVR-2 tariff will not include a BYOC option because the charging equipment procured by a customer enrolled in EVR-2 will have no need to enroll their self-procured charging equipment in a program to be subject to TOD rates, which apply to the entire home load under the Rg-2 tariff. Like the Prepay option, the BYOC option will not be

[2] Customers enrolled in Prepay up until the effective date of the proposed tariff will remain on Prepay. When no existing customers are enrolled in the Prepay program, that option will be removed from the EVR-1 and EVR-2 tariffs.

subject to the $200 removal fee if they terminate the agreement. BYOC customers must have adequate Wi-Fi in range of their charging equipment to enroll.

Currently, Company-provided charging equipment provided through the Bundled and Prepay options are pre-programed to begin charging after midnight during install and customers can create their own schedules or override schedules to meet their charging needs. For BYOC customers, the Company will send an electrician to the site upon enrollment to make sure the charger is hard-wired, perform hard-wiring if needed, and program it for use to align charging times with TOD rates. Resources will be provided to the customer on charging and TOD rates. The BYOC eligible chargers are capable of managed charging, which will enable enrollment in future EV-specific demand response programs[3].

The BYOC option will be priced similarly to the existing Bundled and Prepay options. Like the Prepay, the BYOC pricing will not include Bundled charging equipment and installation capital costs because the customer is paying for the charging equipment and installation themselves. Also, like Prepay, the BYOC option will assess customers a portion of Operations & Maintenance (O&M). Because the customer owns and operates the charging equipment, maintenance will not be assessed to the customer; however, the cost of the initial electrician visit for necessary hardwiring and programming will be included in the O&M portion of the monthly charge. Additionally, BYOC customers will pay for an average share of embedded administrative and general O&M expenses (FERC accounts 901, 902, 903, 905, and 908) and data services like the Bundled and Prepaid options. Attachment B provides EVR-1 BYOC pricing details based on the approved EVR-1 program costs from Docket 4220-TE-104 which are summarized in Table 1 below. As described below, the Company intends to update pricing in its next rate case.

Table 1: Residential Program Pricing Components

	EVR-1 Bundled	**EVR-1 Pre-Pay (Closed)**	**EVR-1 BYOC (New)**	**EVR-2 Bundled**	**EVR-2 Prepay (Closed)**
Charging Equipment	Yes	No	No	Yes	No
Installation	Yes	No	No	Yes	No
Maintenance O&M	Yes	Yes	No	Yes	Yes
Electrician O&M	Yes	Yes	Yes	Yes	Yes
A&G O&Ms	Yes	Yes	Yes	No	No
Data Services O&M	Yes	Yes	Yes	No	No
$ per Month	$17.00	$7.00	$7.00	$13.00	$3.00

3. Charger Accuracy Testing Order Point

When the Commission approved the Company's residential EV programs in Docket No. 4220-TE-104, the Commission ordered the Company to work with Commission staff to propose, by September 1, 2022, an ongoing meter accuracy standard. There are three key reasons why the Company is requesting an extension to this order point. The primary reason

[3] The Company intends to continue to evaluate the appropriate time to introduce EV-specific demand response programs as EV adoption increases in the Company's Wisconsin service territory.

for the September 1, 2022 compliance date for this order point was to allow time for the EV market to develop and standardize charging equipment accuracy testing. The Company believes more time is necessary for the EV market to mature and standardize accuracy testing which will become increasingly necessary as more residential, commercial, and multifamily charging occurs. Public charging applications may also necessitate accuracy testing standards. The Company therefore addresses this requirement in this filing by proposing to delay establishing meter accuracy standards for EV charging equipment. The Company proposes to delay the prior order point from September 1, 2022 to September 1, 2025 and commits to work with Commission staff to develop such standards.

The Company proposes 2025 in part because Xcel Energy's Colorado company, Public Service Corporation (PSCo), has proposed an EV pilot program to study alternatives to using EV charging equipment to measure and separately bill EV load. The PSCo pilot proposes to utilize Advanced Metering Infrastructure (AMI) with load disaggregation capabilities to separately measure EV load from the remainder of their home load from a single metering point with no sub-metering or utilization of charging equipment load measurement. The Company believes the Colorado pilot may provide a superior solution to the meter accuracy problem, which would partly address the need for charger accuracy testing for the Company's residential program. Results from the PSCo pilot are expected at the end of 2023 and the Company expects AMI to be installed in Wisconsin by the end of 2025.

Finally, the Company is not aware of standard equipment in the EV charging market that enables the in-home or on-site testing of charger accuracy. The Company's accuracy testing of charging equipment to-date has been done by testing equipment in the Company's metering shop during competitive solicitations through Request for Proposals (RFP). Implementing an accuracy testing program today would require the Company to temporarily uninstall Company-owned charging equipment, and Customer-owned charging equipment for the BYOC program, to be tested at the Company's metering shop. This would create a significant charger accessibility issue for customers and is incompatible with the BYOC option when the Company does not own the charging equipment.

4. Vehicle Recall Provision

In August 2021, the Company filed a letter with the Commission in Docket No. 4220-TE-104 (PSC REF #419026) requesting a temporary suspension of some electric vehicle program tariff provisions to accommodate an EV charging safety recall notice. Instead of handing future similar scenarios individually as it did with the mid-2021 safety recall notice, the Company proposes to address the issue of safety recall notices generally in its tariff. In this Application, the Company has proposed adding tariff language to govern future safety recalls. The added tariff language allows the Company to suspend the tariff until the safety issue is resolved.

5. Future Rate Case Changes

As mentioned above, in the Company's next rate case filing, the Company plans to update pricing and propose additional tariff changes. First, the Company recently completed an

updated Request for Proposal (RFP) for charging equipment. Charging equipment vendors submitted bids to Xcel Energy to purchase Level 2 charging stations for the residential programs. As a result, the Company will update charging equipment pricing in its next rate case filing for EVR-1 and EVR-2. Secondly, in the RFP charging equipment vendors also submitted bids for Xcel Energy to purchase services and functionality that provides 15-minute interval energy data to facilitate EVR-1 subtractive and EV TOD billing. As a result, the Company intends to update data services pricing for EVR-1 in its next rate case filing.

Lastly, if an EVR-1 or EVR-2 bundled customer elects to end their contract and exit the program early they must pay the Company a $200 removal fee that covers electrician time and materials for removing the charger and bringing it back into inventory. Further, EVR-1 and EVR-2 customers choosing the Bundled have also asked to relocate charging equipment to the customer's new home if that home is in the Company's service territory. In such cases, the customer service agreement specifies that customers are required to pay for the time and materials to relocate the charger to a premise within the Company's service territory to maintain program participation. The Company plans to estimate and include these costs in applicable EVR-1 and EVR-2 customer charge pricing in its next rate case filling. This modification is based upon customer feedback from those who have gone through the charger removal process or have requested relocation. Customers responded negatively to paying a removal fee. For example, some customers have removed their own charging stations (breaching the contract) and requested to ship the station back to the Company's contracted electrician to avoid the electrician visit or $200 removal fee. The Company has also observed customers relocating (again, breaching the contract) the charging stations themselves or moving out without informing the Company. Adding a forecast of these anticipated costs to the overall program administration cost that is the basis for all customers' monthly pricing, rather than charging them to individual customers, would make the Company's program more flexible and safer for participating customers. Incorporating the removal and relocation fees would also alleviate administrative and billing efforts since the Company cannot remove the charging station until the payment from the customer is collected up front.

The Company welcomes feedback from stakeholders and the Commission on these proposed future modifications in this proceeding.

6. Forecasted Participation and Program Budget

Table 2 below provides a forecast of customer participation in the residential EV programs.

Table 2: Residential EV Program Forecast

Annual Incremental	**2022***	**2023**	**2024**	**2025**	**2026**
Participation:					
Bundled	29	100	202	286	579
BYOC	0	0	68	96	195
Pre-Pay	21	0	0	0	0
Total	50	100	270	382	774
Budget:					
Capital	$30,000	$100,000	$162,000	$230,000	$465,000
O&M	$5,000	$10,000	$31,000	$31,000	$51,000
Total	$35,000	$110,000	$193,000	$261,000	$516,000

* 2022 YTD Actuals through May 1, 2022

7. Accounting and Regulatory Treatment

The Company is not proposing changes to the accounting or regulatory treatment of the residential EV charging programs. The new BYOC option will have no rate base impact for the Company and the A&G and data services O&M for the BYOC option will be tracked identically to the Bundled option. The BYOC customer charge revenue will also be treated identically to revenue from the Bundled option.

The Company is not requesting a deferral in this Application for revenue requirement impacts of the BYOC option. The Company does not anticipate the revenue requirement impact in 2023 to be substantial. Also, there should be no revenue requirement impacts for other customers as the BYOC option has no rate base impact for the Company and all O&M costs will be recovered through the customer charge.

8. Reporting Requirements

The Company proposes to include the BYOC option to the residential EV program reporting requirements ordered by the Commission in Docket No. 4220-TE-104.

9. Waivers

The Company proposes to extend specific waivers related to certain customer bill information and meter requirements. Specifically, the Company requests extension of the Wisconsin Administrative Code and NSPW tariff provision waivers authorized by the Commission in Docket No. 4220-TE-104 for EVR-1 to the BYOC option which will be included as a modification to the EVR-1 tariff. These waivers include to Wisconsin Admin. Code § PSC 113.0406(1)(a)3., 4., and 5. pertaining to information displayed on customer bills; Wisconsin Admin. Code § PSC 113.0406(1)(c) and Schedule Ex.-15, Section 3.3 pertaining to marking bills based on usage measured by the EV charging unit sub-meter as

estimated; Wisconsin Admin. Code § PSC 113.0406(3) pertaining to identifying credits and original charges for meter inaccuracies, errors in billing, or misapplication of rates; Wisconsin Admin. Code § PSC 113.0811(1)(c) pertaining to meter accuracy requirements; Wisconsin Admin. Codes §§ PSC 113.0901, 113.0903, 113.0905, 113.0924, and Schedule Ex-16, Section 3.4 pertaining to meter testing standards and recalculating bills for inaccurate meters; and NSPW tariff Schedule Ex.-19, Section 4.4 pertaining to a prohibition against installing additional meters under any one account.

C. Commercial Program Modifications

1. Current Program Overview

The Company's commercial EV program supports access to EV infrastructure and charging equipment through reduced upfront costs. The program supports all non-residential EV charging applications including commercial fleets, workplace charging, and public charging. The Company currently offers one commercial EV program: the Commercial EV Service Program (EVC-1). Through the Commercial EV Service Program, the Company provides EV Supply Infrastructure (EVSI), the infrastructure from the meter to the charging equipment, and EV Supply Equipment (EVSE), the charging equipment. Customers can choose from one of three flexible service options today.

Full-Service Option: The Company installs the EVSI with the Company providing an allowance that offsets traditional distribution extension and EVSI costs with the customer making a Contribution in Aid of Construction (CIAC) payment for any remaining costs. The Company installs and owns the EVSE through an Optional Charger Service for a monthly fee.

EVSI-Only Option: The Company installs the EVSI with the Company providing an allowance that offsets traditional distribution extension and EVSI costs with the customer making a CIAC payment for any remaining costs. The customer installs and owns their own EVSE.

EVSE-Only Option: Customer does not need additional EVSI but would like the Company to install and maintain the EVSE for a monthly fee through the Optional Charger Service.

The commercial program contains distribution revenue-based extension rules to calculate the allowance offsetting traditional distribution extension and EVSI costs. The distribution revenue-based allowance formula calculates an extension allowance whereby the levelized annual revenue requirement of the investments necessary to serve the new customer load equals the incremental distribution demand revenues that will materialize to the Company due to the load growth. In this regard, the revenue-based formula provides an allowance customized to each customer specific extension cost and incremental revenues.

As of May 1, 2022, the Company had 98 commercial projects in various stages of development with 4 projects in-service, 14 projects in design, 3 contracts to begin design, and 66 projects with preliminary meetings or site visits held. All four projects in-service

utilized the EVSI-Only Option. Three installed below 200 kW in charging capacity and only one project, the project above 200 kW, utilized the distribution revenue-based extension rules to fund EVSI work with the remainder utilizing the standard extension rules. No customers have opted to utilize Company-provided EVSE. Table 3 below summarizes the 4 in-service projects.

Table 3: Commercial EV Program Projects

Charging Capacity	Extension Rules	EVSI Cost	Distribution Cost	LARR	Load Based Allowance	Rev. Based Allowance	CIAC	Customer Savings
180	Load Based	$9,200	$11,675	12.51%	$20,880	$8,630	$0	$9,200
50	Load Based	$32,900	$0	15.82%	$5,800	$1,896	$27,100	$5,800
50	Load Based	$29,700	$0	15.82%	$5,800	$1,896	$23,900	$5,800
300	Rev. Based	$71,100	$20,374	14.50%	$21,900	$62,073	$20,401	$41,699

The Company has identified changes to the commercial program to improve the customer experience and address low participation in the revenue-based extension rules. First, the Company requests approval to alter the availability criteria for the EVC-1 tariff. Second, the Application requests approval to alter the revenue-based extension rules formula both simplifying the calculation to improve customer communication and understanding and to improve the allowance amounts for customers installing less than 200 kW of charging capacity. Lastly, the Company is proposing several tariff modifications. Each of these changes are discussed in detail below. Attachment C provides redlined EVC-1 tariff.

2. Availability Criteria

The EVC-1 tariff is currently available to Cg-7, Cp-3, Cg-9, or Cp-1 customers (customers with peak demands greater than 25 kW) who have a minimum of four EV charging ports per site or a minimum of 50 kW of estimated incremental EV charging load. In addition, to be eligible for the Full-Service or EVSI-Only Options, customers must be served through a Company-owned service and dedicated meter. The EVSE-Only Option does not require a dedicated service or meter. To improve access and understanding for customers, the Company is proposing to lower the availability criteria to a minimum of two Level 2 EV charging ports per site or one Direct Current Fast Charger (DCFC or Level 3) per site[4] and open the tariff up to EVC-2 (Multi-Family Housing EV Service Pilot discussed below), DS-1 (Military Service), Cg-1, and Cg-2 customers (Cg-1 and Cg-2 are customers with peak demands less than 25 kW). This change enables the Company to provide the EVSE-Only Option to small, non-demand metered customers on their existing service who do not need a new service or EVSI to support their charging equipment. To ensure that customers participating in the Full-Service or EVSI-Only Options are assessed demand charges, the funding mechanism for the distribution revenue-based extension rules, the Company proposes to also require those options to take service from the DS-1, Cg-7, Cp-3, Cg-9, or Cp-1 tariffs limiting Cg-1 and Cg-2 customers to the EVSE-Only Option. EVC-2 customers

[4] Level 2 charging is defined as having a charging capacity equal to or less than 22 kW and DCFC is defined as having a charging capacity greater than 22 kW.

will also be eligible for distribution revenue-based extension rules despite being billed on a non-demand metered rate class. This is essential for the ability of the Company to provide EVSI support for multi-family customers. These customers would be demand metered but for the subtractive billing component of that program. In other words, there is enough charging capacity to qualify for Cg-7 but the usage is being subtracted from that meter and being assessed residential rates as discussed in more detail in the following section on the new multi-family housing program.

3. Distribution Revenue-Based Extension Rules

Table 3 above highlights a problem with the distribution revenue-based extension rules whereby all Cg-7 or Cp-3 customers (customers with less than 200 kW in peak demand) receive a greater allowance from the traditional load-based allowance formula than is provided by the distribution-revenue-based extension rules outlined in the EVC-1 tariff. This is because the revenue formula outlined in the EVC-1 tariff relies on distribution demand charges to calculate the allowance. Distribution demand charges are relatively new to the Cg-7 and Cp-3 tariffs and have not yet reached a level where all, or even a majority, of distribution costs are recovered through those charges. The Company incrementally increases these charges, as opposed to a one-time large increase, to avoid drastic customer rate impacts when designing rates in rate cases. Table 4 below, and as provided in detail in Attachment D, compares the 2022 and 2023 authorized distribution demand charges from the Company's latest rate case, Docket No. 4220-UR-125, to the distribution functional revenue requirement per kW. The Cg-7 and Cp-3 distribution demand charges are substantially below a cost-based rate and, as a result, the standard load-based extension rules result in greater compensation than the revenue-based extension rules.

Table 4: Distribution Rates

	Cg-7 / Cp-3 (< 200 kW)	**Cg-9 / Cp-1 (200 kW +)**
Distribution Demand per kW	2022: $1.50 2023: $2.50	2022: $3.00 2023: $3.50
Distribution Revenue Requirement per kW	$4.49	$3.60

To resolve this issue, the Company proposes to replace the distribution demand charge in the EVC-1 revenue-based extension allowance formula with the distribution revenue requirement per kW values shown above. This approach allows for a more appropriate Cg-7 and Cp-3 allowance calculation without having to wait until Cg-7 and Cp-3 distribution demand charges are increased to cost-based levels over the next several rate cases. These new values would be updated in each subsequent rate case until such a time when the distribution demand charges are at a level that more appropriately reflects the distribution revenues being collected from customers.

Additionally, this Application seeks to improve customer communication during the sales process by simplifying the weighting of the Levelized Annual Revenue Requirement (LARR). Currently, the EVC-1 distribution revenue-based extension formula utilizes an annual average carrying charge or LARR for each FERC account weighted by the capital cost of the customer's specific distribution and EVSI work that falls in each FERC account.

This calculation can be confusing for customers to understand and can be simplified without material impacts to the resulting allowance amount. The Company proposes to simplify this calculation by combining all the distribution FERC account LARR values providing a single pre-weighted distribution LARR for FERC accounts 364 through 367. This simplifies the LARR weighted to two percentages: one for all distribution costs and a second for EVSI costs. Table 5 below, and as provided in detail in Attachment C, outlines the new percentages based on the authorized calculations in the Company's last rate case in Docket No. 4220-UR-125. FERC accounts 364 through 367 are the only costs chargeable to customers during the extension process. The other FERC accounts are not chargeable and cannot impact the calculation. LARR percentages for FERC accounts 364 through 367 on the current EVC-1 tariff are in the small range of 8.30% to 9.33%. In addition to improving customer understanding, this approach will also simplify the calculation for the Company's internal teams to reduce the amount of time needed to provide designed project cost estimates to customers.

Table 5: Carrying Charges

Cost Category	Carrying Charge (LARR)
Distribution	9.02%
EVSI	15.53%

Table 6 below summarizes the impact of the proposed distribution revenue-based extension rule changes using the same data provided in Table 3[5].

Table 6: Commercial EV Program Projects

Charging Capacity	Extension Rules	EVSI Cost	Distribution Cost	LARR	Load Based Allowance	Rev. Based Allowance	CIAC	Customer Savings
180	Load Based	$9,200	$11,675	11.89%	$20,880	$81,574	$0	$9,200
50	Load Based	$32,900	$0	15.53%	$5,800	$17,347	$15,553	$17,347
50	Load Based	$29,700	$0	15.53%	$5,800	$17,347	$12,353	$17,347
300	Rev. Based	$71,100	$20,374	14.08%	$21,900	$92,043	$0	$71,100

Lastly, the Company is requesting approval in this Application to eliminate the Allowance Refund provision. This provision was included in the original filing in Docket No. 4220-TE-104 as a protection that customers were adding the charging load that underlines the distribution revenue-based extension formula to ensure that non-participating customers are not impacted. Load true-ups are not present in the traditional load-based extension rules. Further, this provision is confusing for customers and results in apprehension and often loss of customer enrollment due the risk posed to the customer by this provision. Customers do not yet understand how EV load will materialize and this provision asks customers to predict and accept future risks as they adopt EVs. The risk of this load not materializing is not overly large given the cap on the program size. Further, as will be discussed later in this application, a view of the entire EV sector (residential, commercial, and public charging)

[5] The Company has also conducted a similar analysis based on a larger sample of Commercial projects from Minnesota.

shows that EV load growth provides net benefits for non-participating customers. This provision asks commercial EV customers to accept risks to avoid negative impacts to non-participating customers when, as is discussed later in this Application, non-participating customers are positively impacted by incremental EV load. The net benefits associated with EV growth in general outpaces the small risk to non-participating customers posed by eliminating the EVC-1 Allowance Refund provision. Additionally, the funding of EV distribution and EVSI costs applies to the multifamily housing EV program discussed in the following section of this Application. Multifamily housing EV applications require distribution and EVSI support like commercial applications and the allowance refund provision complicates enrollment in the program and creates issues of risk sharing between tenants and property owners. Finally, despite the elimination of the refund provision, the Company will continue to report, when actuals are available, a comparison of actual and estimated load showing how distribution revenues record the revenue-based distribution allowance.

4. Optional Charger Service Changes

For Optional Charger Service, the Company proposes to cancel or close the Prepay Option offered under the EVC-1 tariff as customers can bring their own charging equipment to the program. No customers have taken service under the Optional Charger Service. The Prepay Option will be cancelled and removed from the EVC-1 tariff if there are no customers on the Prepay Option when the tariff is approved. In the event customers enroll in the Prepay Option before the tariff becomes effective the Prepay Option will be closed to new customers and existing customers will remain on Prepay until their contracts expire.

5. Future Rate Case Changes

In the Company's next rate case filing, the Company plans to update Optional Charger Service pricing. As noted earlier, the Company recently completed an updated Request for Proposal (RFP) for charging equipment. Charging equipment vendors submitted bids to Xcel Energy to purchase Level 2 charging stations for the commercial program. As a result, the Company will update charging equipment pricing in its next rate case filing for EVC-1. Additionally, the RFP contemplates new charger options for customers, such as chargers that accept card payment and streetlight mounted charging equipment, that may be included in the Company's next rate case within the existing pricing tiers or through the creation of new pricing tiers. The Company welcomes feedback from stakeholders and the Commission on these proposed future changes in this proceeding.

6. Forecasted Participation and Program Budget

Table 7 below provides a forecast of customer participation in the commercial EV program and Multifamily Housing EV (EVC-2) program discussed in the following section.

Table 7: Commercial EV Program Forecast

Annual Incremental	**2022***	**2023**	**2024**	**2025**	**2026**
Participation EVSI:					
Multifamily	0	57	60	124	194
Fleet	2	0	0	51	101
Other	2	66	69	139	419
Total	4	123	129	314	714
Participation EVSE:					
Multifamily	0	57	60	124	193
Fleet	0	0	0	13	29
Other	0	66	69	139	419
Total	0	123	129	276	641
Budget:					
Capital	$283,000	$660,000	$691,000	$2,011,000	$3,756,000
O&M	$5,000	$5,000	$9,000	$21,000	$32,000
Total	$288,000	$665,000	$700,000	$2,032,000	$3,788,000

* 2022 YTD Actuals through May 1, 2022

7. Accounting, Regulatory Treatment, and Reporting Requirements

The Company is not proposing any changes to the accounting or regulatory treatment of the commercial EV charging program. The Company is not requesting a deferral in this Application for revenue requirement impacts. The Company proposes to maintain the current commercial EV program reporting requirements ordered by the Commission in Docket No. 4220-TE-104.

8. Waivers

The Company proposes to maintain the Wisconsin Administrative Code and NSPW tariff provision waivers authorized by the Commission in Docket 4220-TE-104 for EVC-1. These waivers include to Wis. Admin. Code § PSC 113.1005(1); Wis. Admin. Code § PSC 113.1007(1); Wis. Admin. Code § PSC 113.1008(3); Schedule Ex.-25, Section 5.32; Schedule Ex.-26, Section 5.33; Schedule Ex.-30, Section 5.342; Schedule Ex.-31, Section 5.343; and Schedule Ex.-34, Section 5.6.

D. Multi-Family Housing Electric Vehicle Service Pilot (EVC-2)

1. Background

The Multi-Family Housing ("MFH") EV Service Pilot is designed to encourage EV adoption among residents of MFH (i.e. apartment and condominium buildings), a market that is not eligible to participate in the Company's previously approved residential EV programs approved in Docket No. 4220-TE-104. This market segment is important, however, because many of the Company's customers are MFH residents. According to U.S. Census data, approximately 35 percent of total housing units in the State of Wisconsin are considered MFH.[6]

The Company's affiliates that provide electric service in other states have also started to provide MFH EV programs to their customers. In June of 2021, the Company's Colorado affiliate launched a robust set of advisory services to support its customers in applying for that company's MFH EV programs. In Colorado, interested MFH owners, property managers, residents, and others can work directly with an Xcel Energy Commercial EV Advisor by submitting a short intake form linked on the program webpage at xcelenergy.com. The Company's Colorado Multifamily EV solutions provide EV infrastructure and charging options for existing and new construction multifamily buildings. Services include design and construction of infrastructure, advisory services, and the option to pay a monthly fee for Xcel Energy-provided charging equipment. On September 9, 2021, the Company launched applications for all MFH Programs. As of March 1, 2022, 179 intakes have been received for the MFH projects in Colorado.

In Minnesota, Xcel Energy has also received approval for the Multi-Dwelling Unit (MDU) EV Charging Pilot.[7] The Company began accepting applications for the MDU Pilot between December 1, 2021 and January 14, 2022. Interest in the program far exceeded expectations with 52 applicants seeking Tranche 1 level funding. Tranche 1 included full funding for the line extension and the EV Supply Infrastructure. After conducting the review and scoring of all applications, 10 applicants representing 368 multifamily charging ports have been selected for Tranche 1 level funding. This high number demonstrates the substantial demand and interest from multifamily customers in EV programs. It also illustrates the importance of a multifamily solution since, as one customer commented, "…large, complex and older multi-unit buildings such as ours will need extensive electrical infrastructural overhauls..." Applicant sites were located across 15 different cities, with the bulk in the Minneapolis and St. Paul metro area. The Company's team of Commercial EV Advisors in Minnesota have played a critical role in informing customers about the program.

In Wisconsin, the Company has seen interest from several multi-family site hosts in installing EVSE under its existing commercial EV program. There are currently nine multi-family projects that are in the beginning project stages.

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[6] American Community Survey (2019 1 Year Estimates)

[7] MDU EV Service Pilot approved by the Commission on July 2, 2021 Order Approving Pilot Program with Modifications in Docket No. E002/M-20-711.

As with other market segments, one of the primary barriers to installing EV charging at MFH locations is the high upfront cost for the installation of infrastructure necessary for EV charging. This issue is compounded for MFHs, however, where the location for EV charging is often owned or controlled by a person or entity other than the potential EV customer. This pilot is designed to allow the Company to study how to best overcome the barrier of entry into this critical EV charging segment. This will be accomplished by providing Company investment in and ownership of the EV charging infrastructure and options for site hosts regarding ownership of the charging equipment.

As part of this pilot, the Company seeks to address the following key barriers to entry to MFH charging options:

- **Lack of awareness, education, and technical knowledge:** The Company will engage directly with site hosts and developers (property managers, building owners, home-owners associations) and MFH residents to increase awareness of the benefits of providing EV charging in buildings, and provide technical support to potential MFH site hosts interested in installing EV charging equipment.
- **Parking for EV Charging:** In order to participate, the site host must be able to provide suitable parking spaces for EVs. This can be a challenge for urban MFH buildings with structured parking (above or below ground garages) with limited availability compared with suburban MFH buildings with surface parking. Buildings with surface parking, on the other hand, often face challenges associated with higher construction costs due to the need to trench parking lots to run conduit. Furthermore, some MFH buildings have assigned or deeded parking that makes it more difficult to locate continuously available parking spaces that can be dedicated for EV charging. The MFH EV Service Pilot program will provide technical support to identify the best locations for EV charging for interested site hosts.
- **Landlord-Tenant Issues:** Electricity usage in common areas of MFH buildings, including the parking garage and/or parking lots, is most often measured through a common area meter for which the property owner or manager (and not the tenants) is responsible. Due to this, at some properties there is a disincentive for the property owners to install EV charging, which will increase their utility bills and add additional operations and maintenance responsibilities. Additionally, were such a property to install charging equipment, residents may not be incentivized to limit their charging usage, or charge at lower-cost periods of time, as they are not directly responsible for the charging bill. The MFH EV Service Pilot program will help address these issues by providing access to high-quality charging equipment with robust billing and payment options that owners of such properties can leverage to assign responsibility for electricity usage to the residents charging EVs and a unique option that enables the EV drivers to pay Xcel Energy directly for their energy consumption.

The Company's proposed MFH EV Service Pilot is designed to alleviate barriers to installation of EV charging equipment at MFH locations by providing Company investment in, and ownership of, the EV charging infrastructure and by providing customer choice regarding ownership of the charging equipment. The pilot is designed to provide service for MFH sites that both assign parking spots to each unit (Assigned Parking Billing Option), and those that do not (Standard Billing Option). The sections below describe the pilot design for each billing option and how EVSI (the wiring between the metering point and the EV

charging equipment) will be provided to customers and site hosts. In order to implement the MFH EV Service Pilot, the Company is proposing a new Multi-Family Housing EV Service Pilot tariff (EVC-2) which can be found in Attachment E.

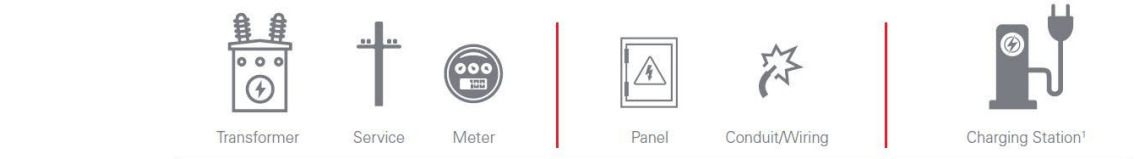
2. Make-Ready Infrastructure

For both Standard and Assigned Parking Billing Options, the Company proposes to install, own, and maintain the make-ready infrastructure for new, dedicated EV services which includes everything from necessary transformer upgrades up to the charger stub. The make-ready infrastructure consists of two primary components: the traditional distribution extension and the EVSI.

The Company will install, own, and maintain all equipment for the distribution extension on the utility's traditional side of the point of connection, which includes necessary transformer upgrades, pads, poles, new service conductors, as well as metering equipment for EV charging separate from any existing service at the site. This work will be performed by the Company using its current practices and policies, as with any line extension. The Company will install, own, and maintain the EVSI including new panels, conduit, and wiring up to the charger according to the already approved EVC-1 tariff. This work will be completed by a third-party contractor overseen by the Company. Costs associated with distribution extension and EVSI will be offset by an allowance derived from the greater of the current extension allowance or the distribution revenue-based extension rules under the EVC-1 tariff. The site host will be responsible for the remainder of make-ready infrastructure costs not covered by the allowance. The Company proposed elimination of the EVC-1 Allowance Refund provision (discussed in Section C.3 above) will be important to this MFH program to eliminate future cost uncertainty for site hosts.

In addition to the EVSI, and as discussed below in greater detail, the Company proposes three options for ownership of the EVSE. For MFHs choosing the Assigned Parking Billing Option, the Company proposes to install, own, and maintain all chargers, which will facilitate assigning costs for the chargers to residents participating in the program. For MFHs implementing the Standard Billing Option, building owners may opt for either a Full-Service Option, in which the Company will own the chargers, or the building owners may opt to install their own chargers. Figure 2 below shows an overview of the three options, and the ownership assignments for distribution extension, EVSI, and EVSE. Figure 2 also shows the already approved options under the Company's existing EVC-1 tariff.

Figure 2: MFH EV Service Pilot Level Options



Service Options	EV Service Connections	EV Supply Infrastructure	Charging Equipment
Full-Service	Utility	Utility	Utility
EV Make-Ready Infrastructure Only[2]	Utility	Utility	Customer
Charging Equipment Only[2]	Customer	Customer	Utility

[1]Utility-provided charging equipment will be facilitated through the EVC-1 tariff Optional Charger Service for the Standard Billing Option and the EVR-1 tariff Bundled Service for the Assigned Parking Billing Option. Assigned Parking Billing Option is available only under the full-service option.

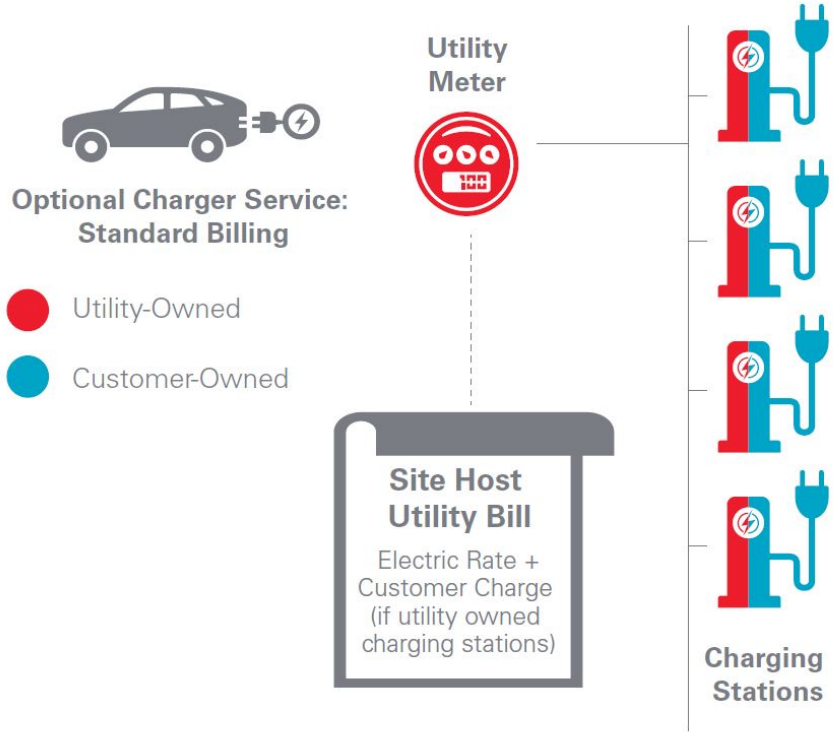
[2]The Assigned Parking Billing Option is not available through this service option.

3. Standard Billing Option

Under the Standard Billing options, the Company will enter into a service agreement with the site management to provide charging service. As described in more detail below, the site host will have the option to install, own, and maintain its charging equipment or have the Company do so. The site host will then be responsible for the monthly cost of charging and other relevant changes for the services they select. The Company has designed the Standard Billing Option of the pilot to service MFHs with shared parking setups, along with those who normally assign parking spots to residents, but do not want to participate in the Company's assigned parking billing options discussed in the Assigned Parking Billing Option section below.

These sites have options when it comes to charging equipment ownership. Owners or managers of the sites can choose to procure their own charging equipment or alternatively, owners or management of the site can have the Company own and operate charging equipment as part of a turn-key service for an additional fee. The Company believes these options recognize the differing needs of MFH customers. In the event a customer chooses to have the Company acquire, install, own, and maintain charging equipment the customer can select chargers from a pre-qualified list of smart chargers that comply with applicable safety standards and specification requirements. This list of chargers is contained within the groups outlined on the Commercial EV Service tariff (EVC-1). Figure 3 below provides an overview of the Standard Billing Option.

Figure 3: Standard Billing Option



a. Standard Billing – Site Host-Provided Equipment Option

Under this option, the Company will install, own, and maintain the EVSI. The site host will acquire, install, own, and maintain their own charging equipment. The Company will provide a new meter dedicated to the shared EV parking. The site host will be responsible for the monthly cost of charging based on the standard applicable commercial rate. However, they will have the ability to set access policies and billing arrangements through the charging equipment vendors software at their option.

b. Standard Billing – Full-Service Option

Under this option, the Company will install, own, and maintain the EVSI and the on-site EVSE. The site host will be able to choose the model of charging equipment from a Company-approved list. The Company will provide a new meter dedicated to the shared EV parking. The site host will be responsible for the monthly cost of charging based on the standard applicable commercial rate plus a fixed monthly bundled charge that is designed to recover the cost of the charging equipment and ongoing data services related to the operation of the equipment. However, they will have the ability to set access policies and billing arrangements through the charging equipment vendors software at their option.

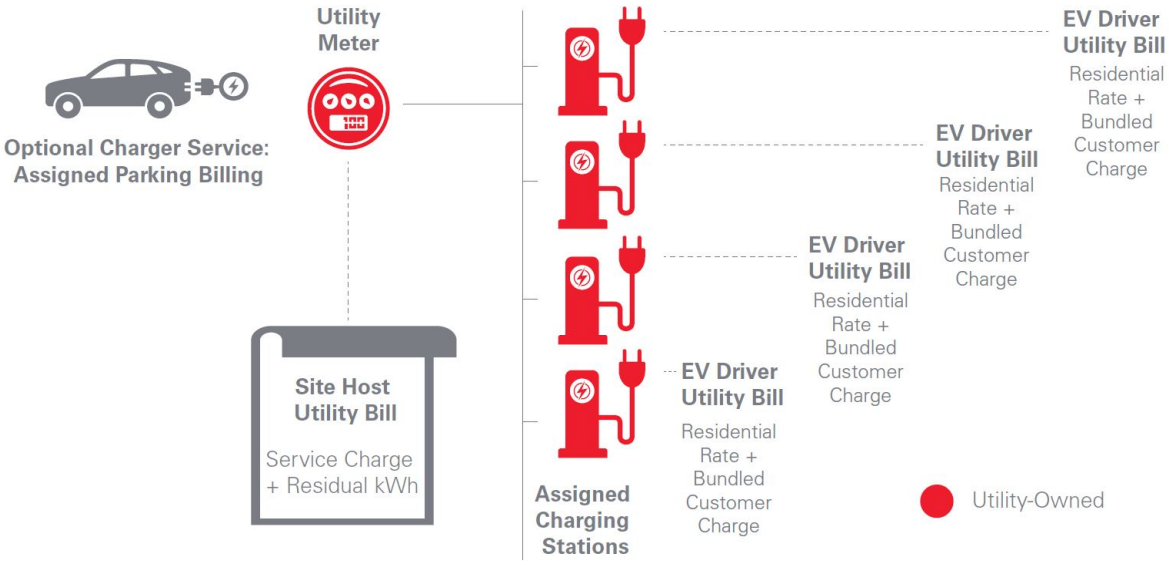
The term of the service agreement for customers participating in the program will be ten years for site hosts participating under both shared parking options. Under both options, the Company will enter into a Customer Service Agreement (CSA) with the site manager. For the duration of a CSA's term, the Company would retain ownership and maintenance obligations for the EV charging infrastructure and equipment. To facilitate maintenance activities, customers would continue to provide all necessary access to the property. At the end of the CSA the Company would transfer ownership of the charging infrastructure and equipment to the site management. The site management could also opt to have the Company retain ownership of the charging infrastructure under a new CSA. In the event the customer signs a new CSA, they have the option of accepting ownership transfer of the charging equipment or having the Company replace the charging equipment under the new CSA.

4. Assigned Parking Billing Option

Under this option, the Company will install, own, and maintain the EVSI and EVSE that the site host selects from the residential EVR-1 program charging equipment. However, unlike the shared parking program, this option is designed for individual EV driving residents with a dedicated parking space and charger—allowing the Company to assign energy usage associated with that charger to the EV driver's utility bill rather than the building owner's bill. Site hosts with assigned parking who do not wish to participate in this billing arrangement can participate in the Shared Parking Option.

Each participating customer's energy usage will be measured by the EV charger installed owned and maintained by the Company serving the customer's assigned parking space, and the participating customers will be billed for their energy usage recorded by their EV charger. Individual customers will pay the EVR-1 bundled monthly charge to recover the cost of the charging equipment, installation, and ongoing data services. The Company will work with the charging equipment manufacturers to provide participating customers access to their energy usage data and to ensure accurate measurement of customers' energy usage through the EV charger. Figure 4 below provides an overview of the Assigned Parking Billing Option.

Figure 4: Assigned Parking Billing Option – Full-Service Billing Model



Individual participants will be billed for their energy usage for charging as measured by the EV charger assigned to their parking space. Participants will see their additional EV consumption added to their existing utility bill in addition to the bundled monthly charge. Charger energy usage will be billed based on the same rate structure approved in the approved EVR-1 tariff. The site host will receive a monthly bill based on the Small General Service (Cg-2) tariff including the customer charge and the billed residual energy—any difference between what the chargers recorded and what the meter recorded.

For those customers individually participating in this option, their participation will be on a month-to-month basis. The Company will execute a CSA with each individual customer. The Company proposes to maintain ownership and maintenance responsibility for the charging equipment. Customers participating on a month-to-month basis will be required to offer notice to terminate their participation as laid out in the terms of the CSA. At any point during their participation, an individual customer may choose to terminate their participation. In this situation, the site host would be responsible for reassigning the parking spot to another resident who is interested in participating in an EV charging program.

The Company will also enter into a ten-year agreement with the site host to facilitate a land easement for charging equipment and to establish additional responsibilities for the site host. The site host will serve as a fallback option for charges: if the site host cannot assign another EV user to an assigned parking spot with charging, then the site host would be responsible for the monthly customer charge applicable to assigned parking participants. Site hosts are also responsible for any residual energy consumption, which is any usage measured by the meter that is greater than the aggregate measured by the individual charging stations.

For the duration of a CSA's term, the Company would retain ownership and maintenance obligations for the EV charging infrastructure and equipment. To facilitate maintenance activities, customers would continue to provide all necessary access to the property. At the end of the CSA the Company would transfer ownership of the charging infrastructure and equipment to the site management. The site management could also opt to have the Company retain ownership of the charging infrastructure under a new CSA. In the event the customer signs a new CSA, they have the option of accepting ownership transfer of the charging equipment or having the Company replace the charging equipment under the new CSA.

The Company will provide EVSI, and the Company will acquire, install, own, and maintain EVSE that the site host selects from a company-approved list. However, unlike the Standard Billing Option Option—the Assigned Parking Billing Option is designed for individual EV drivers with a dedicated charger to pay for the charging equipment and energy use on their individual utility bill. The individual EV drivers will be billed for their energy consumption for the EV charging based on the same rate structure approved in the EVR-1 tariff. In addition, these customers will pay the EVR-1 bundled monthly customer charge to recover the cost of the charging equipment, installation, and ongoing data services fees.

5. Customer Application and Enrollment Process

To help increase awareness, answer customer questions, and facilitate enrollment, the Company will develop a website dedicated to the pilot. This website will include a landing page, and enrollment portal, information on the service agreement and tariffs, and a Frequently Asked Questions Section. Customers will begin the process for enrollment by applying in the enrollment portal and voluntarily providing site information for the charging infrastructure. To help facilitate this application process, potential site hosts will have access to Company's Advisory Services for Site Hosts, part of the advisory services, in addition to the online resources.

Under the Standard Billing Option, the Company will execute a CSA with the site host only. Under the Assigned Parking Billing Option, the Company will enter into CSAs with each participating driver, and the site host separately. The CSAs will:

- Specify customer commitments / terms of participation;
- Govern infrastructure and technology procurement, installation, ownership, and maintenance;
- Provide Company and / or third-party contractor access to equipment, and any other customer property needed to access and / or service the equipment, at any time;
- Provide terms for relocations and early terminations;
- Specify end of program transitions and disposition of equipment/infrastructure; and
- Clarify permissions for data usage.

6. Site Eligibility and Evaluation

Site hosts eligible to enroll in the MFH EV Service Pilot must be MFH customers located in the Company's electric service territory. This includes, but is not limited to, apartment buildings, condominiums, and mixed-use buildings and excludes individually-owned townhouses, row houses, mobile homes, and single-family homes.[8]

To be eligible for MFH EV Service Pilot, the MFH site host must:

- Take Secondary Voltage Service;
- Own, lease, or operate a MFH site that provides long-duration (at least 8 consecutive hours) parking for MFH residents;
- If the MFH site host is not the owner of the MFH site at which EVSI is to be installed by the Company, the MFH site host must obtain express written consent from the property owner, in a form acceptable to the Company;
- Meet the eligibility requirements of the EVC-1 and EVC-2 tariffs including installing a minimum of two Level 2 charging ports;
- Provide the Company with any required license agreements, permits, or easements to install, own, and maintain the EV Supply Infrastructure;
- Agree that all charging-station load will be the primary purpose of the separately metered service;
- For the Assigned Parking Billing – Full-Service Option, the building must not be master-metered. All residents must receive an electric bill;
- For the Assigned Parking Billing – Full-Service Option, the MFH site host or property owner must agree to be billed for participating residential customers' residual energy usage (the difference between the energy usage measured by the EV chargers and the energy usage measured on the meter) and for a service and the applicable customer charge on the Cg-2 tariff.
- For the Standard Billing – Full-Service Option and Site-Host Provided Equipment Option, the site host or property owner must pay for charging based on the standard applicable commercial rate.

After a customer submits their application to participate in the program, a Company representative will follow up with the customer and discuss the program details, the number of charging stations needed, and the program options, including charger choices and ownership options.

The Company will work directly with customers to determine the infrastructure needs for each site and to identify the most suitable locations for the installation of EVSI and EVSE. The determination will be based on factors such as proximity to transformers, length of trenching, whether parking is a surface lot or in a garage structure, and distribution capacity. The Company will have the right to deny participation of a site if it cannot agree with the site host on a suitable location.

[8] The Company has offerings for the excluded dwelling types. These include the Residential EV Home Service Program (EVR-1) and Voluntary EV Charger Service Program (EVR-2).

The ideal site location for MFH EV Charging should include charging stations that:

- Are located as close as possible to the existing transformer (if enough capacity) or to a new transformer (if needed to service the EV charging load);
- Are grouped in a single location (e.g., the same floor of a parking garage);
- Allow adequate space for the installation and operation, in compliance with all applicable laws, rules, and regulations and existing Xcel Energy standards for service.

Through this process, the Company, with support from third-party contractors, will estimate the cost of providing infrastructure and complete design and engineering work. Once the design is complete, the Company will confirm that the site design meets the customer's needs and is in compliance with all applicable laws, rules, and regulations.

7. Planning and Construction

The Company will be responsible for the typical upgrades to install a new distribution extension and new metering equipment. For infrastructure beyond the traditional point of connection, the Company will select and oversee third-party contractors to perform the necessary electrical and civil work, including design, installation, and ongoing maintenance. The Company may also select an approved contractor for the installation of the distribution extension and metering equipment.

The Company will work with third-party contractors for the design, installation, and maintenance of the EVSI under the pilot. The selected third-party contractors also will be responsible for commissioning the utility owned EVSE after installation. The Company plans to work with third-party contractors already selected through an RFP process from previously approved EV pilots and programs and will use competitive processes to find resources for future needs.

For technology vendors, the Company has issued an RFP to develop a pre-qualified charging equipment list. Site hosts must select from this list for chargers that will be owned by the Company. The Assigned Parking Billing Option chargers mirror the options available to the EVR-1 program. The Standard Billing Option chargers mirror the options available under the Optional Charger Service within the EVC-1 program.

8. Ongoing Site Host Obligations

Like ongoing requirements for the Company's other EV pilots and programs, as a part of the terms of participation, site hosts agree to the following requirements.

- Promptly notify Xcel Energy of any problems related to the EV infrastructure of which the customer becomes aware, including if charging infrastructure fails to operate or otherwise requires repair;
- Maintain the area surrounding the EV infrastructure, including, but not limited to, pavement maintenance, pruning of vegetation, snow removal, and the repair of security lighting;
- Consent to and permit both Xcel Energy and any charging equipment manufacturers, vendors, or subcontractors, who provided services in connection

with installing and maintaining the EV infrastructure, to access, collect, and share data from the charging equipment with respect to charging activity, vehicle usage, and technical performance for the term of the service agreement; and

- Participate in customer surveys and provide feedback about the pilot.
- Additionally, for the Assigned Parking Option, the site host shall provide and maintain a Wi-Fi or cellular connection with the charging equipment.

9. Marketing and Outreach

While the Company will employ traditional tactics such as direct mail and advertising, the Company will primarily focus on more targeted channels to directly reach and inform key decision makers. Through existing community and business relationships, the Company can identify potential participants and provide personalized outreach, as well as ensure high visibility for the pilot through public relations, events, advertising and email and direct mail campaigns. The Company's preliminary marketing plan includes the following tactics:

- Equip Company Account Managers and Community Relations Managers with information and materials to share with their stakeholders: property management companies, building owners, community leaders, affordable housing advocacy groups and others;
- Leverage Partners in Energy communities focused on EV adoption. The Partners in Energy program helps communities develop customized energy and electrification plans and supports implementation of outreach;
- Work with local and trade media on news coverage of the pilot at launch;
- Advertise in trade and industry publications and websites;
- Exhibit at virtual or in-person trade events;
- Use email and direct mail to reach building owners or landlords, HOAs and management companies.

10. Accounting and Regulatory Treatment

From an accounting perspective, the MFH EV Service Pilot distribution extension costs, including make-ready infrastructure costs, and charging equipment costs will be treated identically to the Company's approved residential and commercial EV programs (EVR-1, EVR-2, and EVC-1). Extension costs will be added to rate base in FERC Account 371 and offset by customer contribution in aid of construction paid by the site host. The purchase and installation of the charging equipment will also be included in FERC Account 371. The bundled service customer charges are designed to recover the revenue requirement for the installed charger unit cost along with charger maintenance and administrative costs.

The Company is not requesting a deferral in this Application for revenue requirement impacts of the MFH EV Service Pilot. This pilot enrollment will be capped under the existing EVC-1 cap of 30 MW. The Company does not anticipate the revenue requirement impact in 2023 to be substantial given the pilot Commercial Program's 30 MW cap. Also, as described above, there should be no revenue requirement impacts for other customers over the life of the assets as the distribution extension costs and distribution demand incentives

will be offset with incremental load and associated revenues. The Company will fully address issues of cost recovery in its next rate proceeding.

11. Reporting Requirements

In Docket No. 4220-TE-104 approving the Company's residential and commercial EV programs, the Commission ordered several reporting requirements. The Company proposes to incorporate but separately identify the MFH EV Service Pilot into the existing reporting requirements approved for EVR-1 and EVC-1.

Residential EV Program Annual Reporting:

- Order Point 4a – Number of customers and selected options (applicable to the MFH Assigned Parking – Full-Service Billing Model)
- Order Point 4b – Total amount of electricity sold by time-of-day
- Order Point 4c – Program budget and spending; and
- Order Point 4d – Survey results regarding customer satisfaction and installation experiences annually.

Residential EV Program September 2024 Reporting:

- Order Point 5 – NSPW shall provide reporting for the MFH EV Service Pilot on aggregated interval data, analysis of customer cost savings, and analysis of load management. This information shall be filed in September 2022 and in September 2024

Commercial EV Program Annual Reporting:

- Order Point 6a – Number of MFH EV Service Pilot customers (site hosts) participating in revenue-based extension rules, including each customer's estimated load, total allowance, customer contribution, and total extension costs for both distribution extension and make-ready infrastructure with a comparison to current extension rules.
- Order Pont 6b – When actuals are available, the annual reports shall include a comparison of actual and estimated load showing how the distribution revenues recover the revenue-based distribution allowance.
- Order Point 6c – Number of customers under each of the Optional Charger Service options (applicable to the MFH Standard Billing Option – Full-Service Equipment Model).

Other Applicable Order Points

- Order Point 8 – NSPW shall file to continue, modify, expand, replace or close out the MFH EV Service Pilot program by April 1, 2025.

12. Waivers

The Company requests the Commission maintain and extend the same waivers approved in Docket No. 4220-TE-104 for the residential (EVR-1) and commercial (EVC-1) programs to the EVC-2 tariff. These waivers include to Wisconsin Admin. Code § PSC 113.0406(1)(a)3., 4., and 5. pertaining to information displayed on customer bills; Wisconsin Admin. Code § PSC 113.0406(1)(c) and Schedule Ex.-15, Section 3.3 pertaining to marking bills based on usage measured by the EV charging unit sub-meter as estimated; Wisconsin Admin. Code §

PSC 113.0406(3) pertaining to identifying credits and original charges for meter inaccuracies, errors in billing, or misapplication of rates; Wisconsin Admin. Code § PSC 113.0811(1)(c) pertaining to meter accuracy requirements; Wisconsin Admin. Codes §§ PSC 113.0901, 113.0903, 113.0905, 113.0924, Wis. Admin. Code § PSC 113.1005(1); Wis. Admin. Code § PSC 113.1007(1); Wis. Admin. Code § PSC 113.1008(3); Schedule Ex.-25, Section 5.32; Schedule Ex.-26, Section 5.33; Schedule Ex.-30, Section 5.342; Schedule Ex.-31, Section 5.343; and Schedule Ex.-34, Section 5.6; and Schedule Ex-16, Section 3.4 pertaining to meter testing standards and recalculating bills for inaccurate meters; and NSPW tariff Schedule Ex.-19, Section 4.4 pertaining to a prohibition against installing additional meters under any one account. In addition, the Company seeks a billing adjustment wavier for customers on EVC-1, providing that any Customer choosing to be served on this rate schedule waives all rights to any billing adjustments arising from a claim that the bill for service would be cheaper on any alternative rate schedule for any period of time, including any rights under Wis. Adm. Code section PSC 113.0406(4).

E. Request for Feedback on a Public Charging Proposal the Company Expects to Propose in its Next Rate Case

1. Background

In this filing, the Company is previewing a significant expansion in the ability of NSPW customers, and all EV drivers in or passing through the NSPW's service area, to access public and affordable fast charging stations. Specifically, the Company plans to install, own, and operate roughly 12 MW of public charging over the 2024-2026 period across the Company's service territory in Wisconsin, under a plan that will develop multiple charging ports per site in the form of "charging hubs." This plan is intended to address the significant absence of public fast charging that is present across NSPW's service territory. The focus of this initiative will be direct current fast charging (DCFC) ports with capacities anticipated to vary between 150-350 kW, subject to certain site characteristics.

In 2020, Xcel Energy announced its EV Vision of powering 1.5 million EVs on the road in the Company's service areas by 2030. The Company's goal aligns with the Regional Electric Vehicle (REV) Midwest Coalition Memorandum of Understanding[9] and the Governor's Task Force on Climate Change Report,[10] both of which highlight the need to reduce emissions from the transportation sector and, specifically, the important impact increasing EV adoption can have on transportation emission reductions. Access to public charging can help unlock EV adoption for all drivers that travel between communities and need to rely on a safe, reliable, and convenient network of charging stations to enable these types of trips to be completed with an EV. This "range anxiety" is real, and countless surveys have documented how it is one of the top concerns cited by potential vehicle shoppers when

[9] Regional Electric Vehicle Midwest Coalition MOU: https://www.michigan.gov/-/media/Project/Websites/leo/REV_Midwest_MOU_master.pdf?rev=6dd781b5a4eb4551b3b3a5b875d67fb9

[10] Governor's Task Force on Climate Change Report: https://climatechange.wi.gov/Documents/Final%20Report/GovernorsTaskForceonClimateChangeReport-LowRes.pdf

considering an EV purchase.[11] Fortunately, research has demonstrated that access to public EV charging can significantly help increase EV adoption. Therefore, the Company has chosen to detail its plan to propose investments in DCFC in the near future in this filing.

Investment in DCFC by the Company would offer an opportunity for drivers in Northwestern Wisconsin to drive an EV more easily for personal, business, or public transportation purposes. The Company's plan is supported by an analysis conducted by Guidehouse forecasting EV adoption and the corresponding charging infrastructure needed across the Company's service territory. The analysis indicates a deficiency in charging capacity today and forecast through 2030. The Company plans to fill a portion of this gap with public charging hubs installed, owned, and operated by NSPW. The Company believes that funding for the Company's public charging plan will be supported by the benefits EVs bring to system both for drivers and all ratepayers. The Company consulted with Energy and Environmental Economics (E3) to complete a Cost Benefit Analysis (CBA) evaluating the costs and benefits of EVs and the Company's proposed EV programs which indicates transportation electrification offers significant and persistent net benefits for drivers, electric customers in general, and for the State of Wisconsin.

The Company is requesting the Commission and stakeholders provide feedback on the proposed public charging program, supporting details, overall investment, and a public charging tariff. The Commission's order in the Investigation of EV Policy and Regulation (Docket No. 5-EI-156) encouraged utilities to propose residential EV programs and other pilot programs to serve customer needs and explore EV-related issues. As discussed, the lack of access to public charging in the Company's service territory is a barrier to the adoption of EVs. In the spirit of the Commission's order, the Company is requesting feedback on the overall public charging plan discussed in detail below. The Company is not asking for specific approvals, cost recovery, or deferrals of public charging investments in this filing but is instead asking for input on the public charging plan and requirements for approval of such a plan in the future. After considering Commission and stakeholder feedback in this docket, the Company will seek formal approval in its 2024 test year rate case to be filed in early 2023. Recent rate case filings have resulted in settlement agreements, to which the Commission has expressed concerns over the lack of transparency and analysis into new programs and initiatives included in rate case settlement agreements. In the event the Company's 2024 test year rate case results in a settlement agreement that includes the Company's public charging proposal, this docket is designed to serve as a platform for the Commission and stakeholder to review the Company's proposal in detail.

In addition to receiving feedback through this Commission-driven process, the Company plans to work with interested site hosts to install DCFC ports in both urban and rural areas, particularly along interstates, state highways, and other traffic corridors. The Company plans to design certain charging hubs to specifically accommodate charging for smaller Light Duty Vehicles (LDV) and larger Medium and Heavy Duty Vehicles (MDV and HDV). Furthermore, the program seeks to complement existing state investments and future

[11] JDP Public Charging 2021 – Supplemental Learnings and Xcel Energy Public Charging Perceptions Research_2022.04, Consumer Reports: Battery Electric Vehicles and Low Carbon Fuels: https://article.images.consumerreports.org/prod/content/dam/surveys/Consumer_Reports_BEV%20AND%20LCF%20SURVEY_18_FEBRUARY_2022

investments in public charging infrastructure, such as new funding being provided by the federal Infrastructure, Investment, and Jobs Act (IIJA). These program details are discussed in more depth in the following subsections.

2. Vehicle and Charging Infrastructure Forecasts

To determine the number of EVs on the road that would be necessary for the Company to achieve its stated EV goal, the Company worked with Guidehouse to develop a forecast of EV adoption and need for public charging infrastructure within its service territory. Increasing the number of EVs on the road to align with the Company's goal of electrifying 1.5 million vehicles across its corporate-wide service territory would entail a significant and persistent increase in EV adoption each year leading up to 2030. Table 8 below shows the breakdown of LDVs, MDV, and HDVs by year under two scenarios: the 2030 Target Forecast meeting the Company's 2030 EV goal and the Status Quo Adoption Forecast. The 2030 Target Forecast is based on Guidehouse modeling forecasting a high rate of EV adoption based on factors such as increased public charging investment, decreases in forecasted EV costs and adjustments to other modeling inputs. The Status Quo Adoption Scenario reflects a business-as-usual case not including the impacts of new Company programs and with EV adoption and public charging investment following current trends. See Attachment F for Guidehouse's charging station siting memo that includes details regarding its methodology.

Table 8: NSPW Service Territory Electric Vehicle Forecasts

Count of EVs	**2022**	**2026**	**2030**
2030 Target Adoption Forecast:			
LDV	2,135	13,165	44,088
MDV	3	203	904
HDV	1	139	849
Status Quo Adoption Forecast:			
LDV	1,266	3,747	9,434
MDV	2	58	248
HDV	0	36	229

After establishing these vehicle forecasts, the Company and Guidehouse worked to develop charging infrastructure forecasts to have a clearer understanding of the public charging infrastructure required to support the forecasted number of EVs. Guidehouse's forecasts for the charging infrastructure necessary to serve an increasing number of EVs is also expected to exponentially increase over the coming decade. Table 9 below provides a summary of the charging infrastructure needs stemming from the 2030 Target and Status Quo Adoption Forecasts.

Table 9: NSPW Service Territory Public Charging Infrastructure Forecasts

MW Capacity & # Ports	**2022**	**2026**	**2030**
2030 Target Adoption Scenario:			
Public Level 2 (MW)	1	7	28
Public Level 2 (Ports)	184	593	1,708
Public DCFC (MW)	7	26	81
Public DCFC (Ports)	91	168	333
Status Quo Adoption Scenario:			
Public Level 2 (MW)	1	3	7
Public Level 2 (Ports)	131	264	469
Public DCFC (MW)	4	15	33
Public DCFC (Ports)	59	111	149

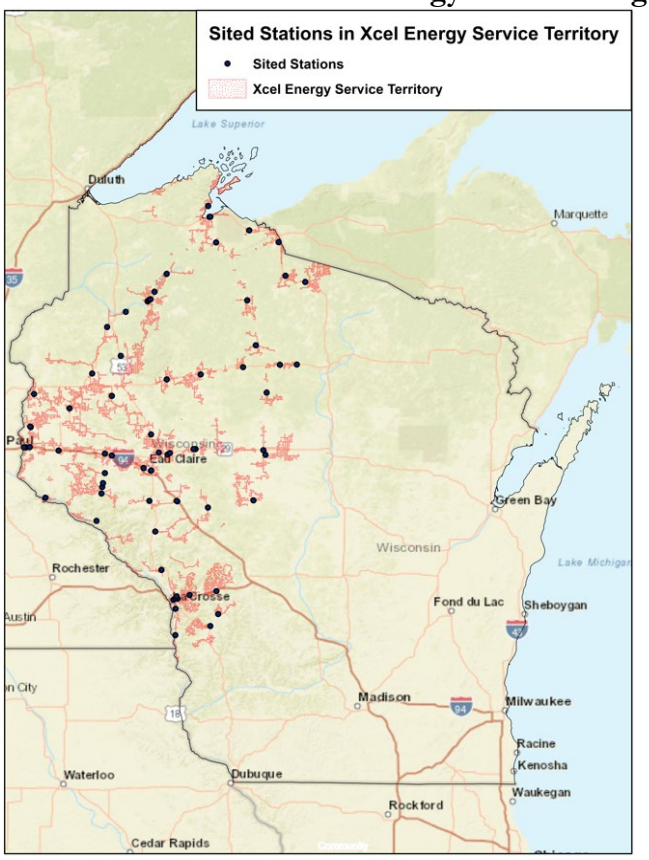
NSPW's service territory is currently host to only 10 public (non-proprietary network) DCFC ports[12]. The Guidehouse analysis indicates that 59 ports or 4 MW of DCFC capacity is required to support the roughly 1,200 EVs registered in NSPW's service territory today plus EV registered elsewhere that are passing through. The Guidehouse analysis also estimates 149 to 333 ports or 33 to 81 MW of DCFC capacity will be needed by 2030. The current amount of public charging and pace of public charging adoption in the Company's service territory is lagging the market need. The Company is proposing to add approximately 12 MW or 80 ports of DCFC infrastructure in 2024 through 2026 to fill a portion of the gap in public charging availability. The Company's proposal would meet 15 percent of the 2030 charging capacity need in 2030 at the 2030 Target Adoption Forecast or 36 percent at the Status Quo Adoption Forecast. The remaining gap is expected to be filled by market participants with the support of the Company's Commercial EV Program.

3. Siting Analysis

To identify locations within the electric service area that are well suited to support DCFC, the Company sponsored a siting analysis with Guidehouse. The geospatial siting analysis is the third step in Guidehouse's process. The analysis relies on federal data on traffic volumes for roads, highways, and interstates, vehicle miles traveled along with locational information in Guidehouse's vehicle forecasts and resulting charging infrastructure needs and then determines where charging hubs spread across the service area could best support public fast charging. Importantly, the siting analysis seeks to place charging hubs in a variety of contexts and wherever charging is needed – in more rural areas to create sufficient geographic coverage to enable intercommunity travel, including along state highways and federal interstates, and also in more urban areas to ensure there is sufficient access to charging to those that need it and may not have access to home or workplace charging. Figure 5 below shows the distribution of potential charging hubs across the Company's service area highlighting a concentration around urban centers and the focus on increasing rural access.

[12] Guidehouse modeling estimate

Figure 5: Suitable Locations for Xcel Energy Public Charging Hubs



Ultimately, the exact sites, number of chargers, sizes, and types of hubs the Company would develop to host the charging hubs would depend on land availability as well as site host interest in the program and the submittal and review of site host applications. As a result, the final sites that the Company would develop would likely differ from the specific site locations shown here, though the Company expects the general distribution to remain the same – with broad geographic coverage, a focus on site development along major corridors, and a concentration of sites in the metro area. Through the Commercial EV Program included in this filing, the Company will also provide infrastructure and charging support to customers that wish to own and operate public charging stations themselves. This comprehensive approach ensures the Company's charging hubs and commercial programs are adequately meeting the public charging needs in the Company's service territory by 2030. The Company has begun conducting targeted outreach to potential site hosts and communities to discuss how to achieve these goals through the siting of actual charging hubs.

4. Budget

Table 10 below provides a forecast of proposed public charging capacity, ports, hubs and an estimate of the associated capital cost, O&M expense, and revenue requirement impact. It is important to recall that the Company is not requesting or seeking approval of these costs at this time, but rather seeing feedback on the program and this approximate amount of

expenditure. Capital expenditures include information technology costs, and EVSI and EVSE costs associated with the public charging hubs. O&M expenses include education costs, O&M for the public charging hubs, program administration costs, information technology costs, and other costs consisting of gross receipts taxes and insurance. Revenues associated with use of the public charging hubs and energy supply costs are not included. An estimated revenue requirement for informational purposes is provided at the bottom of Table 10.

Table 10: EV Public Charging Program Forecast

	2024	2025	2026	Total
Capacity (MW)	1.06	1.76	8.80	11.62
Ports	8	12	60	80
Hubs	2	3	15	20
Capital:				
IT	$510,000	$310,000	$310,000	$1,130,000
EVSI	$340,000	$590,000	$2,980,000	$3,910,000
EVSE	$390,000	$650,000	$3,310,000	$4,350,000
Total	$1,240,000	$1,550,000	$6,600,000	$9,390,000
O&M:				
Hub O&M	$90,000	$140,000	$660,000	$890,000
Program Admin.	$40,000	$50,000	$50,000	$140,000
IT & Other	$80,000	$80,000	$210,000	$370,000
Total	$210,000	$270,000	$920,000	$1,400,000
Revenue Requirement	$360,000	$710,000	$2,170,000	$3,240,000

5. Electric Vehicle Cost Benefit Analysis

The CBA completed by E3 indicates transportation electrification offers significant and persistent net benefits for drivers, electric customers in general, and the State of Wisconsin over the coming decade. The increase in EV adoption across the Company's service territory forecasted by Guidehouse results in system benefits, as modeled by E3's Base Case Scenario, derived from additional electricity sales and revenues which outpace costs of energy supply and infrastructure costs in most EV sectors. The Company proposes to utilize net benefits shown from the broader EV market to fund the Company's DCFC investment. E3 models the inclusion of the Company's program costs in the Public Charging Scenario. In this scenario, ratepayers will still see net benefits through 2030 from EV adoption across all sectors albeit to a lesser extent given some of those benefits are offset with the incremental DCFC investment. In turn, this investment helps facilitate faster EV adoption to help ensure the benefits from transportation electrification materialize and a minimum viable network of fast charging stations is widely dispersed for all to use throughout the Company's service area.

The E3 CBA studies how costs and benefits for program participants, ratepayers, and society could change considering the proposed public charging investment. Table 11 below provides an overview of the net benefits in the analysis and the E3 CBA is provided in detail in Attachment G. The Base Case Scenario analyzes the net benefits of transportation electrification without the effects of NSPW's EV programs, removing the potential effects

that the proposed programs could have on EV adoption. The Public Charging Scenario incorporates the impacts of the Company's public charging proposal. In the first instance, both scenarios assume all EV charging is unmanaged–no vehicles are on TOD rates–and consider the present value lifetime benefits and costs of all EVs adopted and NSPW EV programs from 2022 through 2030. While the net benefits for the Public Charging Scenario under the ratepayer and societal cost tests are below those estimated in the Base Case Scenario, the Company's investments would provide greater access to public charging, in turn supporting higher EV adoption, and advancing the Company's goal of electrifying 1.5 million EVs by 2030.

Table 11: Public Charging Program Cost Benefit Analysis (Personal LDVs Unmanaged)

Millions $	Participant Cost Test (PCT)	Ratepayer Cost Test (RIM)	Societal Cost Test (SCT)
Reference Case Scenario:			
Personal LDV (Unmanaged)	$28.4	$44.8	$10.4
Commercial LDV (Managed)	$12.9	$6.8	$34.2
Net Benefit/(Cost)	$41.3	$51.6	$44.6
Public Charging Scenario:			
Personal LDV (Unmanaged)	+$10.4	($11.4)	($8.8)
Commercial LDV (Managed)	+$6.3	($3.8)	+$5.4
Net Benefit/(Cost)	$58.0	$36.4	$41.2

E3 also evaluated the Reference Case Scenario and Public Charging Scenario under the condition that all EV charging is managed using the assumption that all EVs are on TOD rates. Results of the managed charging scenarios are shown in Table 12 below. The managed charging scenarios are best viewed as a bookend in comparison to the unmanaged scenarios summarized above in that they assume all EVs are on TOD rates. Both unmanaged and managed scenarios assume all commercial EVs are on TOD rates which are standard on most of NSPW's commercial tariffs. The results show a decline in ratepayer benefits resulting from managed charging when compared to unmanaged charging primarily due to the decreased utility revenues from personal LDV EVs due to more charging occurring during off-peak hours. The unmanaged scenario shows that EV drivers paying for electricity on non-TOD rates results in revenues to the utility that exceed the marginal cost of supplying energy. Rates are more properly aligned with cost of service for EV drivers when they charge on TOD rates which is a key reason all of the Company's residential and commercial EV programs require drivers participate in TOD rates. The reduction in benefits under the managed charging scenario does not imply that non-EV customers will bear higher costs, it simply means there will be less EV charging revenue for the Company to utilize for program investments due to TOD rates more properly aligning costs and revenues.

Table 12: Public Charging Program Cost Benefit Analysis (All Managed)

Millions $	Participant Cost Test (PCT)	Ratepayer Cost Test (RIM)	Societal Cost Test (SCT)
Reference Case Scenario:			
Personal LDV	$48.2	$34.9	$20.2
Commercial LDV	$12.9	$6.8	$34.2
Net Benefit/(Cost)	$61.1	$41.7	$54.4
Public Charging Scenario:			
Personal LDV	+$13.2	($12.6)	($7.2)
Commercial LDV	+$6.3	($3.8)	+$5.4
Net Benefit/(Cost)	$80.6	$25.3	$52.6

The Company's proposed investments provide other benefits as they can help level the playing field and expand access to affordable charging options where none may have previously existed for certain people or communities. Such equity benefits can be more difficult to quantify but are no less important as highlighted in the Governor's Task Force on Climate Change Report. Creating more public access to fast charging services can help supercharge EV adoption for people who live in denser urban environments where dedicated parking spaces with charging stations installed can be more challenging and for households in which installing home wiring and/or panel upgrades may be prohibitively expensive. Lastly, public charging in rural areas and at key destinations can help alleviate range anxiety and encourage EV adoption, rural economic development, and tourism.

6. Coordination with Federal IIJA Funding, Wisconsin VW Settlement Funds, and Other Future Sources of Public Funding

A coordinated approach will be essential to meeting public charging needs and doing so in a cost-effective way that promotes complementary actions rather than duplicative projects. A coordinated approach is essential between electric utilities; state and federal agencies administering IIJA funds, VW Settlement funds, or other new or existing sources of public funding to support charging infrastructure development; private companies offering charging hardware and software solutions; non-profits helping to raise awareness and advocate for charging infrastructure; and other interested consumer and industry groups. Strong coordination also helps ensure that there is widespread and equitable access to public fast charging – which is a key component to enabling widespread EV adoption.

While there are a variety of federal funding initiatives that may present an opportunity to support public charging infrastructure, there are two key components of the federal IIJA that are specifically targeted at supporting public EV charging. First, the National Electric Vehicle Infrastructure (NEVI) program provides funding, to be deployed almost entirely through allocations to individual states, to support public EV charging. The NEVI program establishes minimum requirements for the buildout of public EV charging along designated Alternative Fuel Corridors (AFCs). States are required to submit plans by August 1, 2022

regarding how they will use their allocation under the NEVI program and are required to use that funding to first satisfy the minimum requirements for AFCs before using their NEVI funding to support public EV charging along roads other than AFCs. In NSW's service territory, Wisconsin has multiple designated AFCs – primarily including highways I-94, I-90, and 53. WISDOT has been conducting significant stakeholder engagement leading up to submission of its NEVI plan on August 1, including identification of additional major travel corridors that would, in combination with AFCs, establish a minimum viable travel network throughout the state of Wisconsin. WISDOT's draft Wisconsin EV Infrastructure (WEVI) Plan was released for public comment on July 14, 2022 which identifies 61 preliminary charging station locations of which 14 may be in NSPW's service territory.[13] The Company commends WISDOT for its efforts and the holistic approach it is taking to leverage the federal funding allocated to the state of Wisconsin through the NEVI program, and the Company is excited to support the buildout of this baseline public charging corridor network in the years to come.

The second source of federal funding meant to compliment the NEVI Formula Funding efforts is a nationally competitive grant program that can support provision of alternative fuels, including but not limited to electricity. This competitive source of funding, the Charging and Fueling Infrastructure discretionary grant program (CFI) has the potential to fund EV charging in the community and along corridors other than AFCs, however, the details about the administration of this program are not yet known. The Company anticipates there to be significant competition nationally for this $2.5 billion in funding, and it is not clear what portion of it will be allocated to support EV charging, as it is also designated to support hydrogen fueling, propane fueling, and compressed natural gas vehicle fueling, or what portion of it will be allocated to projects serving the NSPW service territory.

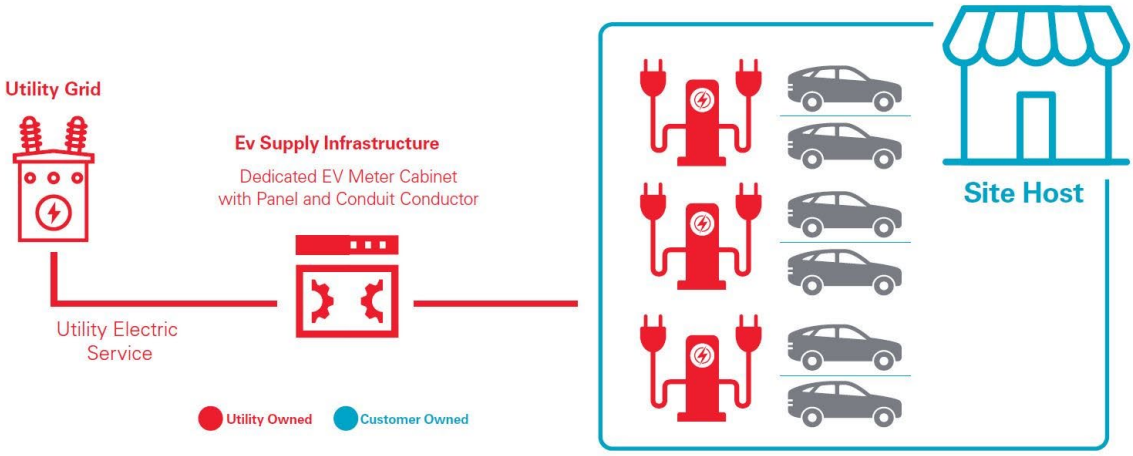
The Company plans to pursue federal funding, whether from the federal government through the CFI or from the state's NEVI formula allocation pursuant to implementation of its NEVI plan, if the Company believes projects will be competitive in light of the terms of any specific funding opportunity. The Company will consider these federal funding opportunities a great chance to strengthen relationships with customers, communities, state agencies and regulators, Tribal Nations, and other stakeholders.

7. Operating Plans

In the plan the Company is developing it expects to oversee all aspects of the operation of the charging stations from site host recruitment, site design, charging equipment and software vendor selection, customer experience and billing at the charging station as well as operation and maintenance of the stations. The section below outlines the Company's expected end-to-end operations plan for providing fast charging services and Figure 6 provides an overview of the public charging site infrastructure and ownership model.

[13] WI EV Infrastructure Plan: https://wisconsindot.gov/Documents/projects/WI-EV_DRAFT_22-0714.pdf

Figure 6: Public Charging Diagram



i. Site Host Engagement and Recruitment

The Company has defined three types of charging locations that it expects to prioritize in its charging network in an effort to serve a wide range of charging needs. Descriptions of these charging location types along with the charging needs the site types are meant to service and the assumed charger installations at each site are provided in Table 13 below. With these site designs in mind, the Company will identify locations that are both capable of hosting the desired charging site types and meeting a public charging need as defined in the siting analysis outlined above. NSP Community Service Managers and Account Managers will approach customers that are deemed to be good fits based on location, amenities, capacity availability, and space availability among other factors. Potential locations will be scored and prioritized based on their alignment with this criteria and potential site design and distribution upgrade costs. The Company will also approach customers (both public and private entities) with a large number of locations throughout its service territory capable of hosting company owned fast charging in an effort to promote program efficiency by minimizing contracting and site design lead times.

Participation requirements and benefits to being a site host for NSP owned public charging will be communicated to potential site hosts by NSP and program staff. Site hosts will be expected to provide land access for construction and maintenance of the charging and EVSI equipment as well as ensure that the EV chargers are accessible 24/7, the spaces are maintained and cleared of snow and debris, and that the spaces are used exclusively for EV charging and not general parking. In exchange, the site host will receive EV charging and supply infrastructure onsite at no cost to them. Site hosts will not be billed for electricity use at the public charging stations and will not be responsible for routine maintenance or repairs. They will receive the benefit of having EV fast charging located on their premises and the increased foot traffic and notoriety that it provides.

While the Company plans to proactively engage with potential site hosts to develop this public charging network, those potential site hosts, as well as any others, will need to submit an application for formal consideration of their sites. Applications will be scored based on the criteria outlined above. Site hosts with awarded projects will be asked to sign a land easement granting the Company rights to install, own and maintain the charging equipment and necessary supply infrastructure on their property. These easements will typically last 10 years to align with the anticipated useful life of a charging station with options for extensions and equipment replacement at the end of the contract. While the Company will attempt to standardize site design as much as possible as shown in the designs described in Table 13, a flexible approach will be used to ensure sites are designed and charging equipment provided according to a suitable location's space availability and needs. The Company plans to work with each site host to build out their locations, taking into account their preferences and any site-specific needs, using one of the Company's standard charging hub designs as a template.

ii. Site Design and Planning

In order to expedite site buildout while addressing a range of charging needs, the Company has identified 3 standardized site designs that it will use as templates for its public fast-charging sites. These site designs are described in Table 13 below.

Table 13: Public Charging Hub Designs

Site Type	Description	Charging Need	Site Configuration
Connector Charging Hub	● High speed charging along major highways ● Prioritizes charging speeds and convenience	● Enable long distance charging between major population centers	● 2-6 350 kW chargers design for LDV
Destination Charging Hub	● High speed charging in urban areas and key destinations ● Located at retail, restaurant, and other similar amenities ● Prioritizes space availability, charging experience, and areas of need	● Provide charging in areas of need in urban centers and key destinations ● Provide charging services for drivers that may lack access to charging at home	● 2-6 180 kW chargers design for LDV
Pull Through Charging Hub	● High speed charging along major highways at truck stops designed for MDV and HDV as well as LDV	● Enable long distance travel for all vehicle types ● Drive electrification of MD and HDV ● Support LDV with towing capabilities	● 2-6 350 kW chargers designed for MDV and HDV ● Designed to allow for pull through charging

The charging hub concepts were designed in an effort to provide simple, replicable design templates that program staff and its vendor partners can utilize while identifying and designing fast charging sites. While sites will be prioritized and designed using these specifications, the Company will be flexible to site host needs and will adjust site designs as needed, taking into account host preferences as well as spacing and capacity limitations. Site hosts can request layouts and charger quantities that differ from the configurations laid out in Table 13; however, the site must meet the minimum charging needs identified by the Company and provide the desired charging experience to EV drivers.

Additional design considerations, such as covered charging, will be implemented on an as needed basis according to site needs and budget availability. All medium and heavy-duty hubs will allow for pull-through charging, in contrast to the typical industry approach for fast charging today, which uses standard parking spots for light duty charging. All sites will be ADA compliant and will be equipped with adequate lighting and safety amenities.

Once a site has been identified as a potential host location, the Company's Distribution Design and EVSI teams will evaluate the site for charger readiness. The distribution team will analyze the location and provide an initial cost estimate for needed distribution upgrades based on capacity availability at the site, access to three-phase power, and other considerations. The EVSI team will analyze the site layout to confirm that there is sufficient access and land availability for all EVSI equipment and provide a high-level cost estimate. If the cost estimates are in line with expectations, a site visit will be scheduled with the distribution designer, a member of the EVSI team, and a member of the Company's EVSI contracting vendor. This group will walk the site with the site host, confirm assumptions, and identify any potential barriers to implementation. Once this data is collected, a site design and final cost will be generated, and construction can begin.

Prior to any construction taking place, any upgrades to the distribution system deemed necessary during site visits and design will be executed by the Company's distribution team and associated contractors according to current practices not outlined in this filing. Construction of the site will be conducted by the Company's EVSI vendor. They will install and commission all EVSI and EVSE equipment in conjunction with the Company's EVSE vendor (see section below for an overview of each vendor and their roles). The Company, site host, and relevant vendors will then test all EVSE equipment, install all agreed upon signage and branding, complete construction, and open the charging stations for public use.

iii. Service and Equipment Vendor Strategy

The Company will utilize a variety of vendor partners to build and maintain its public charging network. The services to be provided by third party vendors are listed below.

- EVSI design, equipment and construction and EVSE installation
- EVSE hardware and software supplier
- EVSE O&M provider
- Siting Analysis

Where applicable, the Company will utilize existing contractors. This will likely be the case for its siting analysis and EVSI contractors. Guidehouse is currently under contract conducting analysis across the Company's corporate-wide service territory to identify areas with public charging needs and has conducted the analysis provided with this filing. As with all vendor contracts, the Company will evaluate continued use of specific vendors in the normal course of business but intends to maintain the same methodology for siting analysis throughout implementation.

Third-party installation contractors have been and will continue to be competitively sourced through RFPs in the Company's normal course of business. This may include soliciting bids for this work in combination with other RFPs for third-party distribution system contractors and/or making adjustments to account for rapidly changing technologies including needed contract amendments or appropriate

additions consistent with previously conducted RFPs. Third-party contracts are currently in place to support EVSI and site design work. The Company will evaluate contractors' ability to scale with the scope of this project and their ability to meet the design requirements for the site types outlined in Table 13 and will continue to competitively source vendors for this and related work in the Company's normal course of business. Additional vendors for civil design work beyond what is currently provided by existing contracts may be necessary depending on the capabilities of the contractors.

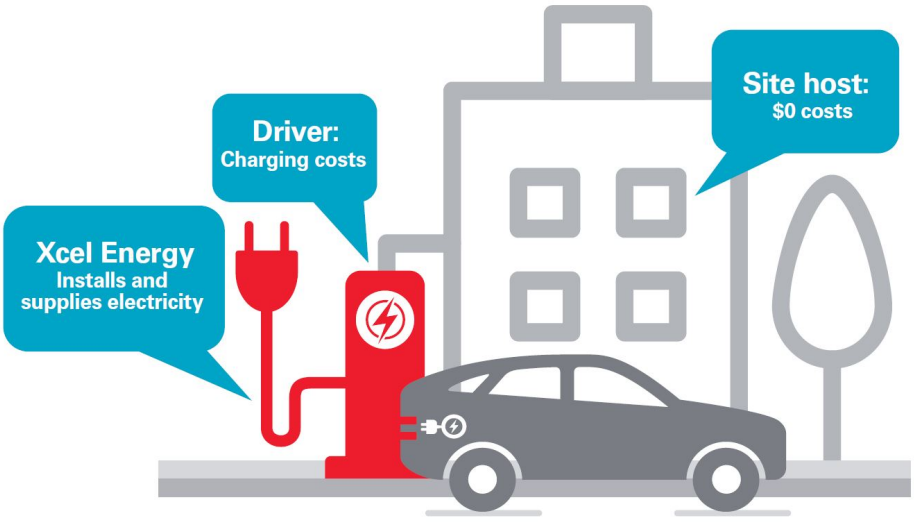
The Company recently completed an RFP for charging equipment to serve multiple Xcel Energy jurisdictions. Charging equipment vendors submitted bids for Xcel Energy to purchase Level 2 (L2) and Level 3 (DCFC) charging stations for the EV programs. However, in light of the significantly expanded scope of Company-owned DCFC charging equipment contemplated in this filing, the Company plans to conduct an additional competitive RFP for EVSE hardware, software, and O&M providers. These software and O&M services are often provided by charging station OEM's but are also available as individual services. The Company plans to release a single RFP for all these services (hardware, software, and O&M) needed to support the charging equipment for its public fast charging network while giving vendors the option to bid on all or only a portion of the services. This will give the Company a broad view of pricing and service options and not restrict participation by vendors who may specialize in a specific area of the public charging value stream. A high-level definition of each of these services and vendor expectations is provided below:

- EVSE Hardware Services – This vendor will provide the charging stations themselves. This can be a charging OEM or a distributor.
- EVSE Software Services – Software services for public charging will include but not be limited to backend monitoring of the stations for utilization and fault detection, pricing plan deployment and payment processing, and frontend customer interface such as mobile application development and charging network services. These services could be performed by a single vendor or multiple.
- EVSE O&M Services – Operation and maintenance services will include preventative maintenance and repairs of the charging equipment. The O&M services provider will not be responsible for site maintenance such as snow removal and vegetation control as these will be the responsibility of the site host. The O&M services provider and the Company will coordinate with site hosts as needed to ensure site access for all necessary maintenance.

iv. Site Operations and Billing

Each charging hub will receive its own dedicated meter to track demand and usage. The Company will be responsible for all electricity costs. EV drivers that utilize the charging stations will be charged a per kWh rate for the energy they consume as outlined in the Pricing section below. These revenues will be collected by the Company to offset program costs. Charger utilization and payment processing will be conducted through a platform provided by the EVSE software services provider. Figure 7 below summarizes the customer billing experience.

Figure 7: Public Charging Billing



As stated above, the Company and its vendors will be responsible for all maintenance and repairs of the EVSE and EVSI equipment located on a customer site while the customer will be responsible for ensuring that the EV charging parking spaces are kept clear and used exclusively for EV charging. Preventative maintenance will take place according to a schedule agreed upon between the Company and its EVSE O&M provider. This schedule will be clearly communicated with the site hosts and maintenance will be scheduled in a manner that will not interrupt operation of the site. Charging station repairs will be initiated by the Company if a station is deemed to be offline through its monitoring software. The site host will be notified that a repair request has been made and the Company's EVSE O&M service provider will contact the site host to schedule the repair. Site hosts will also be given a phone number to call to report charging station issues and request repairs. These calls will be routed through the Company's support team who will notify the O&M service provider to schedule a repair or replacement if necessary.

v. Driver Experience

EV drivers will be able to locate Company owned fast charging sites through the EVSE software services provider's mobile application. The Company will work with an EV charging network provider to build out a mobile experience that will allow customers to clearly identify which stations are owned by the Company to allow for informed charging decisions. Mobile application architecture and associated roaming agreements between the mobile application provider and other network providers will be determined based on the results of the RFP referenced above. The Company will build its platform to ensure that all EV drivers in its service territory will have fair and efficient access to its charging network and be able to make informed decisions about available fast charging, regardless of whether this is through vendor(s) platforms or through a platform operated by the Company.

Once at the EV charging station, customers will be given the option to pay via credit or debit card or through the same mobile application that was used to locate the charging station. The Company conducted customer research to understand payment preferences among both EV drivers and prospective EV drivers in its service territory. Ease of payment and speed of charging, both more so than the cost of charging, were referenced by customers as the most important factors considered when making public charging decisions. Customers indicated that they strongly prefer to pay by the kilowatt-hour versus other options currently offered such as a monthly subscription fee or by the time spent at the charging station. Customers also indicated that they would strongly prefer to pay by credit or debit card or through a mobile app at the charging station rather than through other payment methods. The Company plans to structure its driver experience and associated vendor strategy based on this feedback and continued discussions with both drivers and site hosts.

Company customers will be eligible for reduced rates of charging at all Company owned stations as outlined in the Pricing section below. Company customers will need to enroll with the Company prior to receiving the reduced rates. The Company will validate an EV driver's eligibility for decreased charging rates through an internal customer validation process and then provide its EVSE software services provider with a list of eligible drivers. Once their eligibility is confirmed, drivers can access the reduced charging rate by scanning a QR code or other validation method depending on the EVSE software provider's available payment methods. All drivers who are not Company customers will pay market rates as outlined in the Pricing section of this document through an approved payment method.

8. Public Charging Tariff

The Company is also previewing a proposed tariff for drivers charging at Company-owned public charging hubs. The Company expects to use the same three-part TOD rates for Company-owned public charging hubs as approved for the Company's residential EV program contained in the EVR-1 tariff. Customers must enroll through an online application and be verified as NSPW customers to pay the EVR-1 rate. In contrast, unverified customers or non-customer drivers would pay the same rate plus a market charge adder increasing the price to align with market pricing for public charging in Wisconsin. Table 14 below shows the proposed public charging pricing which is also outlined in the proposed Company Owned Public EV Charging (EVP-1) tariff contained in Attachment H.

Table 14: Proposed Public Charging Pricing[14]

Cents per kWh	**June - September**	**Other Months**
On-Peak[15]	21.15	13.50
Int.-Peak[16]	13.50	13.50
Off-Peak[17]	6.75	6.75
Market Charges	17.90	17.90

Utilizing the EVR-1 TOD pricing recognizes that the Company's EV customers are paying for public charging infrastructure investments through charging at their homes and businesses as described in the CBA section above. The CBA illustrates that residential and commercial EV drivers are paying for the proposed public charging investment through their general rates when they charge at their homes or businesses which produces broader benefits for all customers. Allowing drivers to pay the EVR-1 rates allows recovery of the public charging energy supply costs in a way that is simple for drivers to understand – they pay the same rate whether they charge at home or in a public charging setting – with the remainder of the public charging program costs recovered from the base rates paid by EV drivers.

The Company's standard tariffs require customers with electrical loads exceeding 25 kW to pay demand charges. In this setting there is not a single 'customer'. Multiple drivers are making individual transactions making the assessment of demand charges impossible. Additionally, residential customers, which will likely make up a majority of the public charging utilization, are not typically assessed demand charges due to their complexity and the inability of residential customers to control their peak demand.

The EVR-1 TOD rate provides a strong price signal for drivers to charge at their homes and businesses during overnight hours. In evaluating the options available to the Company to support large scale EV adoption, the Company has concluded that while it is important to send customers price signals to encourage the efficient use of the grid, truly supporting the transportation needs of our customers means also recognizing that it is not always possible for them to charge at their home or business. Importantly, the Company also notes that this significantly disadvantages customers living in multi-family dwellings that don't have access to a charger at home. The Company believes that all residential customers (whether in a single-family home or multi-family unit) should receive the same price signals that residential TOD rate structure provides, which strongly incentivizes charging overnight and provides a cost-based rate design appropriate for the Company's customers. Under this rate structure, customers will still be encouraged to do most charging at their homes and businesses, since the lowest charging cost is available at night, when a substantial portion of vehicles are most likely parked at home or in a fleet depot.

The Company's market data indicates that pricing at third-party public chargers averages about 31 cents per kWh in Wisconsin, though most other station operators do not charge

[14] EVP-1 tariffed rates are also subject to the Energy Cost Adjustment (ECA).
[15] On-Peak: 12:00 noon to 8:00pm, Monday through Friday, excluding holidays
[16] Intermediate Peak: 8:00am to 12:00 noon all days, 8:00pm to 12:00 midnight all days, and 12:00 noon to 8:00pm weekends and holidays
[17] Off-Peak: 12:00 midnight to 8:00am all days

EV drivers rates that vary across times of day.[18] The market charges adder is intended to reflect this market average when the EVR-1 rates plus the market charges added are applied to a typical public charging load profile so that the Company's chargers remain comparably prices to the broader market for public fast charging in Wisconsin. It is noteworthy that the Company based the market data from across Wisconsin, but the available public charging is extremely limited in the Company's service territory.

9. Accounting and Regulatory Treatment

Public charging revenue, capital—including distribution extension, EVSI, and EVSE—and O&M expense will be included in the Company's revenue requirement in future rate cases. Public Charging sales and revenues from EVs will be forecasted by class. Public Charging revenues will be allocated across rate classes in a manner that reflects users and the revenues from NSPW customers and non-customers would be tracked separately. Public Charging expense will also be allocated to class based on the class EV sales forecast. Public charging program capital will fall in the appropriate FERC accounts and distribution extension costs placed in the appropriate distribution FERC accounts. Public charging program O&M would be placed in the appropriate FERC accounts. As described in the CBA, the Company's revenue requirement in future rate cases will also contain revenues associated with broader EV adoption. Revenues from EVs will be recorded in their respective rate class under which they take service. Cost allocation will be fully addressed in the Company's next rate case filing. The Company welcomes Commission and stakeholder feedback on this accounting and regulatory treatment approach.

In the event the Company's next rate case resolves in a settlement agreement between parties, the Company proposed to include the EVP-1 tariff proposal in the settlement agreement. In prior dockets, the Commission has expressed interest in considering new customer offerings, such as this public charging program, in separate TE dockets. In addition to serving as an opportunity for Commission and stakeholder feedback, the public charging section of this Application serves to provide an opportunity for the Commission to opine on the Company's public charging proposal in the event it is necessary for the Company to include its proposal in rate case settlement agreement.

10. Reporting Requirements

The Company plans to provide reporting on a variety of metrics for stations across its charging network, primarily around utilization, charging revenues and charger uptime. The Company's EVSE software services provider will provide the Company with monitoring software that will allow program staff to track these metrics in real time. The Company will also install a dedicated meter at each charging hub. Usage will also be tracked at the charger level to track individual utilization and charge drivers based on the energy consumed. The Company suggests the following detailed reporting requirements that could be provided to the Commission in an annual report and is open to additional reporting requirements, subject to the availability of the information being requested:

- Number of unique charging sessions

[18] Based on EPRI research and data received by authors: https://www.mdpi.com/1996-1073/14/17/5240/htm.

- Charging session time, kWh by TOD period, payment amount
- Charging revenues by customer type (customer vs non-customer)
- Charger utilization (load factor or hours use) by hub location
- Charger uptime and availability of charging stations

It is important to note that the Company intends to meet all reporting requirements set forth in this proceeding and any additional reporting requirements. The Company does want to note that, due to the early stage of the market and rapidly changing technologies, additional reporting requirements may prove to be difficult to track and, due to technical constraints, some may not be possible to track.

11. Waivers

The Company acknowledges its public charging proposal may require the waiver of some PSC Administrative Rules. Since the Company is only previewing and requesting feedback on this proposal, it is not detailing any required waivers at this time. The Company plans to propose any needed waivers in its next rate case filing when approval is requested for the broader public charging program and recovery.

F. Advisory Services Preview

1. Background

In this Application, the Company is previewing the creation of a formal EV Advisory Services program following the approval of a limited advisory services budget in the Company's last rate case settlement agreement in Docket No. 4220-UR-125. The Commission authorized $100,000 in residential and commercial advisory services each year of the 2022 and 2023 rate case settlement agreement. In this Application, the Company is previewing an EV Advisory Service Program which will be formally introduced in the Company's next rate case filing or settlement agreement expected in the spring of 2023 for a 2024 test year. The Company's proposal includes residential and commercial advisory services that target their respective market segments and customer groups within those segments.

2. Residential EV Advisory Services

EV Advisory Services includes support for an EV Advisory Online Tool, Digital Media & Marketing, Public Events, and Trade Ally Support for Auto Dealers and Electricians.

i. EV Advisor Online Tool

The EV Advisor Online Tool provides personalized information on EVs and programs to help customers find the right option for their lifestyle and charging needs, and the Company has included funding to improve the online tools. Online tools currently provide the following customer resources:

- New and pre-owned EVs available in the market and options to compare models;

- Environmental impacts of EVs;
- Costs and benefits of EVs, including fuel and maintenance costs;
- Auto Dealers who are knowledgeable about EVs and current inventory at select dealer locations;
- Rates and managed charging program recommendations, including information encouraging customers to charge during off-peak periods

The Company will seek to improve the online and mobile experience by providing more self-service capabilities that provide customers with information needed to compare new charging program options, such as the BYOC option under the Residential EV Program.

ii. Digital Media & Marketing

The Company has developed several digital educational initiatives, including EV Awareness & Education advertising campaign that highlights EV benefits and helps customers realize switching to an electric car can be simple and beneficial. In addition to communicating EV benefits, the campaign includes ads to drive awareness of the Company's EV program and to answer consumers' questions about EV charging. The Company also seeks to drive engagement through search engine optimization and social media posts. All efforts direct customers to the Company's online website and resources such as the EV Advisor Online Tool.

iii. Public Events

To reach consumers where they are at in their communities, the Company strategically selects public events to engage customers throughout their EV journey. Notable events include community fairs, festivals, or local and regional auto shows. Attendees can learn more about EVs and charging by engaging with the Company's teams, print out materials, an EV "pillar" and at large-scale events, or the EV "garage." The pillar and garage are interactive displays that offer consumers hands-on experiences with EVs and home charging equipment. The Company also often coordinates with auto dealership partners to bring display vehicles and conduct ride & drives.

iv. Trade Ally Support for Auto Dealers and Electricians

The budget for Trade Allies includes non-labor costs associated with managing a network of local auto dealer partners to help provide a positive customer experience from point of sale to charging at home. The Company currently provides three local Wisconsin dealer partners with services that directly address barriers they face selling EVs, including EV training for personnel, and information, resources, and tools to be shared with mutual customers along with EV promotional opportunities with cooperative marketing and lead generation, and the Company anticipates this network will continue to grow over time. The Company is also planning to implement an incentive for sales managers and Finance & Insurance (F&I) managers

at dealer network partners who support managed charging program enrollments right at the dealership during the purchase/lease process.

These activities are all focused on advancing EV adoption by increasing awareness of EVs, their benefits, and the Company's charging programs. By establishing a trusted relationship with auto dealership partners and having a presence in their showrooms, the Company has created a seamless experience for customers by helping them feel confident in choosing an EV and making it easy to find the right charging solution during the buying/leasing stage of their journey.

3. Commercial EV Advisory Services

The Commercial EV Advisory Services budget includes funding for three major components of the Advisory program: Advisory and Assessments, Community Planning, and Workforce Training. The services deliver upfront education, outreach, and consultation via tailored, real-time support and tools that customers need to identify transportation electrification opportunities and to make informed decisions about their plans as they consider converting their fleet and, or, installing EV charging infrastructure.

i. Advisory and Assessments

This component of the program offers customers upfront education, outreach, and consultation for vehicle electrification and charging infrastructure installation through the Company's teams of customer care agents, EV Advisors, and an external vendor that provides information, data and technical assistance in building a robust and actionable electrification plan. The electrification plan will consist of a procurement plan for EVs, strategies for charging infrastructure buildout and guidelines for optimizing vehicle usage and charging economics. As part of this service, the Company will work with customers that operate fleets (public and private) and will leverage telematics data to monitor key vehicle performance indicators such as, but not limited to, fleet vehicles usage, miles traveled, dwell times, GPS routes, fuel efficiency and idling time. This data is analyzed to identify which vehicles in the customers' fleet are best suited to be replaced with an EV model, based on operational needs, financial benefits, greenhouse gas savings and other factors deemed necessary by decision makers.

ii. Community Planning

The Commercial Advisory budget includes support for more robust tools, data, and expertise to deliver electric vehicle planning services for communities that encompass multiple strategies to drive the growth of EVs in the marketplace as well as development of charging infrastructure, while integrating other Company offerings as appropriate. During the planning process, the Company and facilitators will seek to provide the guidance and framework to help develop a common vision and develop an organized plan to identify and achieve the communities' goals relating to EV's. Implementation services for these plans will be provided for up to 18 months to promote progress towards goals, provide necessary resources and

remove barriers. The implementation support for these will leverage the Company's EV offerings and will identify and incorporate additional resources as appropriate. These services are offered at no cost to participating communities.

iii. Workforce Training

A key barrier to most commercial customers is ensuring proper training of employees of customers that will be involved in the EV markets. This includes staff training on safety, maintenance, and day-to-day operations of EV and infrastructure. This would be applicable to site hosts, drivers, and mechanics. It can be challenging for customers to know what types of training they need and who is qualified to provide it. Xcel Energy is a trusted source of information and the Company can help connect customers to the right training programs. The Company plans to work with an outside vendor to create a standardized training program that all commercial customers would have access to, and the Company sees an opportunity to work with local entities on this front as well. This would include on-site training classes and webinars for commercial customers.

Table 15 below summarizes the enhancements to the Commercial EV Advisory Services based on current elements that are in place today.

Table 15: Commercial EV Advisory Service Elements

Advisory Service Element	Current State	Enhancements/Additions
Education/Outreach & Consultation	Informal education and outreach via marketing and traditional channels	Establish a formal "Pre-Electrification Consulting team" to support commercial customers
Fleet Assessments	Telematics and total cost of ownership (TCO) planning tool	Vehicle procurement planning to streamline steps and vehicle deliver after fleet assessments
Charging Infrastructure & Energy Assessment	Commercial EV Advisory team for infrastructure design planning upon receiving customer application	Establish a process to conduct preliminary technical infrastructure, energy, and rate assessments after consultancy and prior to the customer submitting their infrastructure application
Workforce Training	Not current offered	Create Workforce Training Program geared towards educating and training operators on how to use their new vehicles and charging systems provided through Company programs
EV Customer Care	Not currently offered	Establish a dedicated team of customer care agents to handle inquires from commercial EV customers
Community Advisory	Community EV Tool Kit available via Xcel Energy's Partners in Energy (PiE) program	Strong community engagement and promotion of the available PiE EV Toolkit

4. Budget

Table 16 below provides a forecast of proposed residential and commercial EV Advisory Services Program expenses.

Table 16: EV Advisory Services Program Forecast

	2022	2023	2024	2025	2026
Residential:					
Program Admin	$5,000	$32,000	$133,000	$153,000	$167,000
Dealer Network	$13,000	$11,000	$35,000	$39,000	$52,000
Other	$15,000	$19,000	$34,000	$32,000	$34,000
Total Residential	$33,000	$62,000	$202,000	$224,000	$253,000
Commercial:					
Program Admin	$45,000	$27,000	$96,000	$116,000	$137,000
Assessments	$9,000	$11,000	$2,000	$117,000	$233,000
Community Advisory	$0	$0	$168,000	$265,000	$269,000
Workforce Training	$0	$0	$24,000	$63,000	$139,000
Other	$13,000	$0	$74,000	$79,000	$84,000
Total Commercial	$67,000	$38,000	$364,000	$640,000	$862,000
Total Advisory Program	$100,000	$100,000	$566,000	$864,000	$1,115,000

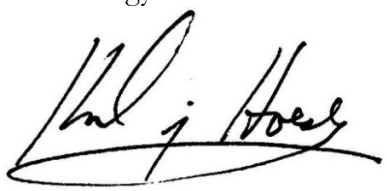
G. Conclusion:

The Company looks forward to the Commission's review of its proposal. The Company has discussed the Application with several stakeholders and community partiers prior to filing and submits Letters of Support in Attachment I. Because customer and generator participation in the proposed electric vehicle tariffs is voluntary, and this application does not request an increase in rates or a reduction in service for non-participating customers, the Company does not believe a contested case proceeding or hearing is required.

The Company respectfully requests that the Commission issue an Order approving the programs and provide feedback on the public charging plan by February 1, 2023 so that the modified and new programs can be made available to customers beginning in mid-2023 and the Company will have the final order in time to incorporate into its 2024 test year rate case.

Respectfully submitted this 2nd day of August 2022.

NORTHERN STATES POWER COMPANY
a Wisconsin corporation, and wholly owned subsidiary of
Xcel Energy Inc.



By: Karl J. Hoesly
Regional Vice President, Rates and Regulatory Affairs

RESIDENTIAL ELECTRIC VEHICLE HOME SERVICE PROGRAM

Availability: Available to residential customers taking service under the Residential Service (Rg-1) or Farm Service (Fg-1) to provide electric vehicle charging equipment to service electric vehicle loads including battery charging and accessory usage. Electric vehicle charging that occurs under this service will be charged according to this tariff. Customer's home energy usage will be billed based on Residential Service (Rg-1) or Farm Service (Fg-1). Customers taking service under Residential Time-of-Day Service (Rg-2) or Parallel Generation – Net Energy Billing Service (Pg-1) are not eligible for service under this tariff.

Bundled Service includes Company installed and provided charging equipment. Pre-Pay Service is available to customers electing to pay the Company for the installed cost of charging equipment prior to beginning service. Customer electing Pre-Pay Service are separately invoiced at the time of installation. Bring Your Own Service is available to customers electing to enroll their own eligible charging equipment prior to beginning service. The customer must complete Company-approved documentation verifying possession, through ownership or lease, of an electric vehicle. N N

Any customer choosing to be served on this rate schedule waives all rights to any billing adjustments arising from a claim that the bill for the customer's service would be cheaper on any alternative rate schedule for any period of time, including any rights under Wis. Adm. Code section PSC 113.0406(4).

Contract: Customers must contract for this service through an Electric Vehicle Service Customer Service Agreement with the Company. The contract period will be as long as the customer wishes to use the equipment. Customers choosing the bundled option and who have taken service for less than ten (10) years will be subject to a $200 removal fee if they terminate the agreement. Customers choosing the bundled option and who have taken service for more than ten (10) years will not be subject to a removal fee.

Character of Service: Single-phase 60-Hertz service at approximately 120 or 120/240 volts will be provided hereunder. Three-phase service or other service upgrade requests will be provided in accordance with Company service regulations.

Monthly Minimum Charge: The customer charge.

Definition of Peak Periods: On-peak hours shall be those listed below. On-peak hours shall begin at the same time for each of the on-peak days, which are Monday through Friday, inclusive (excluding holidays). Intermediate-Peak hours shall be those listed below. Intermediate-peak hours shall begin at the same time each day of the year including weekends and holidays and include 12:00 noon – 8:00 p.m. on Saturdays, Sundays, and Holidays. The holidays designated shall be New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas, on the day nationally designated to be celebrated as such. When a designated holiday occurs on Saturday, the preceding Friday shall not be considered an on-peak day. When a designated holiday occurs on Sunday, the following Monday shall not be considered an on-peak day.

RESIDENTIAL ELECTRIC VEHICLE HOME SERVICE PROGRAM (continued)

Peak Periods: All customers served on this rate schedule will have the following on-, intermediate-, and off-peak periods:

	Starting Time	Ending Time	Days
On-Peak	12:00 noon	8:00 p.m.	Mon.-Fri. Excluding Holidays
Intermediate-Peak	8:00 a.m.	12:00 noon	All Days
Intermediate-Peak	8:00 p.m.	12:00 midnight	All Days
Intermediate-Peak	12:00 noon	8:00 p.m.	Sat.-Sun. and Holidays
Off-Peak	12:00 midnight	8:00 a.m.	All Days

Rate:

Customer Charge per Month

Bundled Service	$17.00	
Pre-Pay Service (Closed)	$7.00	R
Bring Your Own Charger	$7.00	N

Delivery Charges per kWh

On-Peak	
June—September	6.400¢
October—May	3.9400¢
Intermediate-Peak	3.9400¢
Off-Peak	1.850¢

Energy Charges per kWh

On-Peak	
June—September	14.250¢
October—May	9.200¢
Intermediate-Peak	9.200¢
Off-Peak	4.500¢

Energy Cost Adjustment: Bills subject to the adjustment provided for in Energy Cost Adjustment. See Schedule X-1, Sheet No. E 63.

Late Payment Charge: A one percent (1%) per month late payment charge will be applied to outstanding charges unpaid 20 days after the date of billing.

RESIDENTIAL ELECTRIC VEHICLE HOME SERVICE PROGRAM (continued)

Pre-Pay Service: The Pre-Pay Service option Customer Charge per Month applies in place of the Bundled Customer Charge per Month to customers that have paid the installed cost of charging equipment to the Company. This option is closed to new customers. R

Bring Your Own Charger Service: The Bring Your Own Charger Service option Customer Charge per Month applies in place of the Bundled Customer Charge per Month to customers that have elected to enroll their own qualified charging equipment. N N N

Terms and Conditions of Service:

1. Electric Vehicle Home Service shall be served through wiring connected to customer's single meter provided for Residential Service. Consumption under this rate schedule will be subtracted from the main meter for purposes of billing customer's non-Electric Vehicle electricity usage.
2. In the event of an error in the charging equipment's ability to track electric vehicle charging consumption, such consumption will be billed at the Rg-1 or Fg-1 rate.
3. Over- or under-measurement of charging consumption will result in more or less consumption being billed on this rate and bill adjustments will not be made for charging equipment measurement inaccuracy.
4. Customer must rent or own and live in a single-family home, defined as a detached single-family home, townhome/row house, or duplex, provided that customers who are renting their dwelling must have a separately metered service and have the building owner's written consent to participate in the program.
5. Customer must have wireless internet ("Wi-Fi") service at Site.
6. The customer shall supply, at no expense to the Company, premises wiring and a suitable location for connection of charging and associated equipment.
7. Company may require customer to provide access for Company-owned equipment for the recording and wireless communication of energy usage.
8. The customer agrees to provide information allowing the Company to analyze their energy use, vehicle charging patterns, and reactions to vehicle charging load management activities.
9. Customer vehicle charging sessions will be subject to interruption and power reduction.
10. The rate contemplates that this service will utilize existing facilities with no additional major expenditures. Customer shall reimburse Company for any expenditure for facilities necessary to serve this load which would not otherwise be required to serve customer's load.
11. Customer must execute an Electric Vehicle Customer Service Agreement with the Company.
12. If a consumer alert or warning is issued indicating that charging an electric vehicle or use of charging equipment in a manner consistent with this tariff creates a safety issue for a customer, the Company may suspend this tariff in full or part until the safety issue is resolved. N N N

Rate Code:

B80	Electric Vehicle Home Service Bundled
B81	Electric Vehicle Home Service Prepay (Closed)
Bxx	Electric Vehicle Home Service BYOC N

VOLUNTARY ELECTRIC VEHICLE CHARGER SERVICE PROGRAM

Availability: Available to residential customers taking service under the Residential Time-of-Day Service (Rg-2) to provide electric vehicle charging equipment to service electric vehicle loads including battery charging and accessory usage. Electric vehicle charging that occurs under this service will be charged with the Customer's home energy usage which will both be billed based on Residential Time-of-Day Service (Rg-2). Customers taking service under Residential Service (Rg-1) or Farm Service (Fg-1) are not eligible for service under this tariff.

Bundled Service includes Company installed and provided charging equipment. Pre-Pay Service is available to customers electing to pay Company for the installed cost of charging equipment prior to beginning service. Customer electing Pre-Pay Service are separately invoiced at the time of installation. The customer must complete Company-approved documentation verifying possession, through ownership or lease, of an electric vehicle.

Any customer choosing to be served on this rate schedule waives all rights to any billing adjustments arising from a claim that the bill for the customer's service would be cheaper on any alternative rate schedule for any period of time, including any rights under Wis. Adm. Code section PSC 113.0406(4).

Contract: Customers must contract for this service through an Electric Vehicle Service Customer Service Agreement with the Company. The contract period will be as long as the customer wishes to use the equipment. Customers choosing the bundled option and who have taken service for less than ten (10) years will be subject to a $200 removal fee if they terminate the agreement. Customers choosing the bundled option and who have taken service for more than ten (10) years will not be subject to a removal fee.

Character of Service: Single-phase 60-Hertz service at approximately 120 or 120/240 volts will be provided hereunder. Three-phase service or other service upgrade requests will be provided in accordance with Company service regulations.

Rate:

Customer Charge per Month		
Bundled Service	$13.00	
Pre-Pay Service (Closed)	$3.00	R

Pre-Pay Service: The Pre-Pay Service option Customer Charge per Month applies in place of the Bundled Customer Charge per Month to customers that have paid the installed cost of charging equipment to the Company.

VOLUNTARY ELECTRIC VEHICLE CHARGER SERVICE PROGRAM (continued)

Terms and Conditions of Service:

1. Voluntary Electric Vehicle Charger Service shall be served through wiring connected to customer's single meter provided for Residential Time-of-Day Service.
2. Customer must rent or own and live in a single-family home, defined as a detached single-family home, townhome/row house, or duplex, provided that customers who are renting their dwelling must have a separately metered service and have the building owner's written consent to participate in the program. R R R R
3. Customer must have wireless internet ("Wi-Fi") service at Site.
4. The customer shall supply, at no expense to the Company, premises wiring and a suitable location for connection of charging and associated equipment.
5. Company may require customer to provide access for Company-owned equipment for the recording and wireless communication of energy usage.
6. The customer agrees to provide information allowing the Company to analyze their energy use, vehicle charging patterns, and reactions to vehicle charging load management activities.
7. Customer vehicle charging sessions will be subject to interruption and power reduction.
8. The rate contemplates that this service will utilize existing facilities with no additional major expenditures. Customer shall reimburse Company for any expenditure for facilities necessary to serve this load which would not otherwise be required to serve customer's load.
9. Customer must execute an Electric Vehicle Customer Service Agreement with the Company.
10. If a consumer alert or warning is issued indicating that charging an electric vehicle or use of charging equipment in a manner consistent with this tariff creates a safety issue for a customer, the Company may suspend this tariff in full or part until the safety issue is resolved. N N N

Rate Codes:

B76 Voluntary Electric Vehicle Charger Service Bundled
B77 Voluntary Electric Vehicle Charger Service Prepay (Closed)

Residential Electric Vehicle Home Service (EVR-1) - Charger Pricing

Pricing per Charger

Bundled Pricing Option		
Total Installed Cost	(A)	$780.00
Shipping	(B)	$0.00
Total Installed Cost with Tax	(C = A + B)	$780.00
LARR Percentage	(D)	15.82%
Annual Revenue Requirement of the Charger Investment	(E = C * D)	$123.41
Operations & Maintenance	(F)	$30.00
Program Administrative	(G)	$52.88
Revenue Requirement per Charger	(H = E + F + G)	$206.29
Months per Year	(I)	12
Price per Month	(J = H / I)	$17.19
Price per Month Rounded		$17.00
Pre-Pay Pricing Option (Closed to New Customers)		
Total Installed Cost	(A)	
Shipping	(B)	
Total Installed Cost with Tax	(C = A + B)	Upfront Payment
LARR Percentage	(D)	
Annual Revenue Requirement of the Charger Investment	(E = C * D)	
Operations & Maintenance	(F)	$30.00
Program Administrative	(G)	$52.88
Revenue Requirement per Charger	(H = E + F + G)	$82.88
Months per Year	(I)	12
Price per Month	(J = H / I)	$6.91
Price per Month Rounded		$7.00
BYOC Pricing Option (New)		
Total Installed Cost	(A)	
Shipping	(B)	
Total Installed Cost with Tax	(C = A + B)	Upfront Payment
LARR Percentage	(D)	
Annual Revenue Requirement of the Charger Investment	(E = C * D)	
Operations & Maintenance	(F)	$24.00
Program Administrative	(G)	$52.88
Revenue Requirement per Charger	(H = E + F + G)	$76.88
Months per Year	(I)	12
Price per Month	(J = H / I)	$6.41
Price per Month Rounded		$7.00

COMMERCIAL ELECTRIC VEHICLE SERVICE PROGRAM

Availability: The program is available to customers served under Rate schedules Cg-1, Cg-2, EVC-2, DS-1, Cg-7, Cp-3, Cg-9, or Cp-1 who meet the following availability criteria. In order to be eligible for this tariff, a customer must have a minimum of ~~four~~ two level 2 charging ports per site or one direct current fast charging port per site~~, or, in cases with less than four ports, a minimum of 50 kW of estimated incremental electric vehicle charging load~~. Customers may qualify for additional options if they meet at least one of the following criteria: R R R R R

1. In order to be eligible for the Revenue-Based Extensions Rules through this program, customers must be served through a Company-owned service and dedicated meter for the primary purpose of charging electric vehicles and the incremental load for charging electric vehicles shall be above Baseline Demand Levels from a single delivery point and must be served under Rate schedules EVC-2, DS-1, Cg-7, Cp-3, Cg-9, or Cp-1. R R
2. In order to be eligible for Optional Charger Service, customers need not be served through a dedicated meter, and the incremental load for charging electric vehicles need not be above the Baseline Demand Level.

This program is an experimental pilot program. This experimental pilot program has a maximum subscription limit of 30 MW of estimated incremental electric vehicle charging load.

Rate: Each customer will have unique Baseline Levels for demand usage as outlined in the Baseline Determination section of this program. A customer will be charged according to the applicable standard tariff rates for their usage up to and including their Baseline Levels. Distribution demand above Baseline Levels will be subject to the applicable standard tariff rates. The customer will receive a construction allowance per the Company's Extension Rules schedules or the Revenue-Based Extension Rules in this program, whichever is greater.

Optional Charger Service: Charging equipment may be supplied and installed either by customer or by the Company through an optional charger service. Optional charger service is available from the Company for a minimum of ~~four~~ two level 2 ports per site or one direct current fast charging port per site~~, or in cases with less than four ports, a minimum of 50 kW of estimated incremental load for charging electric vehicles~~. A dedicated meter is not required for optional charger service. Optional charger service by the Company is available as a Bundled Option that includes a monthly charge for the installed cost of charging equipment ~~or as a Pre-Pay Option to customers electing to pay the Company for the installed cost of charging equipment prior to beginning service with this tariff~~. ~~Customers electing the Pre-Pay Option are separately invoiced at the time of installation and are subject to the Pre-Pay Option service charge in place of the Bundled Option service charge.~~ R R R R R R R R

Service Charger per Month per Port	Group A	Group B	Group C
Bundled Option – Single Port	$39.00	$54.00	$69.00
Bundled Option – Dual Port	$34.00	$47.00	$56.00
~~Pre-Pay Option – Single Port~~	~~$12.00~~	~~$25.00~~	~~$33.00~~
~~Pre-Pay Option – Dual Port~~	~~$11.00~~	~~$21.00~~	~~$30.00~~

R R

Pricing for charging infrastructure for transit buses is determined on a per project basis.

COMMERCIAL ELECTRIC VEHICLE SERVICE PROGRAM (continued)

Revenue-Based Extension Rules: Customers eligible to receive a construction allowance under this program will receive the greater allowance between the Company's Extension Rules schedules and the Revenue-Based Extension Rules not to exceed the total cost of the extension. The Revenue-Based Extension Rules reduce the estimated cost of the extension by the following formula:

Allowance = ~~D~~R x 12 x L / I R

~~D~~R = ~~Customer Demand Charge~~ Allowance Rate outlined below ~~in the applicable standard tariff rates~~ R

L = Incremental customer demand above Baseline Levels

I = Annual average carrying charges for the Applicable Construction Allowance

N

Estimated Capacity	Allowance Rate
< 200 kW	$4.51 per kW
200 kW or Greater	$3.60 per kW

N

At the Company's discretion, both the existing Extension Rules and Revenue-Based Extension Rules may apply to costs associated with Company installed, owned, and maintained service panels, conduit, wiring, and equipment located on a Customer's premise which may be included as additional Items Included in Costing the Extension, as otherwise defined in the Company's Extension Rules schedules. The specific panels, conduit, wiring, and equipment on a Customer's premise are defined in the Annual Average Carrying Charges section below.

Annual Average Carrying Charges: Annual average carrying charges for the Applicable Construction Allowance vary by asset type and are derived from the Company's most recently approved Wisconsin Depreciation Filing. A weighted carrying charge will be used in the Revenue-Based Extension Rules based on the sum of each carrying charge for each asset type multiplied by the total cost of the related asset divided by the total cost of all assets considered in the extension. Carrying charges by asset type are listed as follows:

R

FERC	Description	Carrying Charge
364-367	Distribution	9.02%
369	EV Make-Ready Supply Infrastructure	15.53%

R

Additional asset type carrying charges may be added or removed from this tariff at the Company's discretion and with prior approval by the Public Service Commission of Wisconsin.

COMMERCIAL ELECTRIC VEHICLE SERVICE PROGRAM (continued)

Determination of Baseline Levels: A customer's Baseline Demand Level shall be based on a Baseline Period. The customer's Baseline Period represents a recent, historical 12-month time period. Historical Distribution Demand levels derived from the Baseline Period make up the Demand Baseline Level. The Demand Baseline Level will be contracted prior to beginning service under this program and will be applicable for the duration of the ten year Contract Period. The Baseline Customer Demand for new customers will be zero.

Adjustments to the strict historical consumption patterns may be made by the Company to eliminate data anomalies in the Baseline Period that are not expected to reoccur, or to accommodate unique production patterns as demonstrated in historical data from the last 24 months (e.g., if production is commonly reduced during a specific day of the week or for infrequent maintenance shutdown).

At the Company's discretion, adjustments to a customer's set Baseline Demand Level may be made at the customer's request to account for demand management initiatives.

~~Allowance Refund: If after two years of beginning service and receiving a construction allowance under the Revenue-Based Extension Rules a customer's actual incremental load is lower than the estimated incremental load by greater than 25 percent, the customer is required to refund a portion of the allowance to the Company equaling the total allowance given less the allowance that would have been provided to the customer based on the customer's actual incremental load.~~

Non-Firm Load Requirements: Customers subscribing to interruptible program schedules Cp-3 or Cp-1 for Baseline Levels usage are subject to the non-firm conditions of this program. Customers subscribing to the non-firm load option under this program will be subject to the curtailment or interruption terms, provisions and penalties outlined in the underlying Baseline interruptible program. Baseline Levels and program pricing, terms and conditions do not apply to any energy consumed during the curtailment or interruption event. Once a curtailment or interruption event is over, pricing, terms and conditions of delivery revert to those of this program.

COMMERCIAL ELECTRIC VEHICLE SERVICE PROGRAM (continued)

Terms and Conditions of Service:

1. Experimental EV Extension Program shall be served through wiring connected to customer's dedicated-meter.

2. Company may require customer to provide access for Company-owned equipment for the recording and wireless communication of energy usage.

3. The rate contemplates that this service will require the installation of new facilities to provide electric service to the electric vehicle charger.

4. Customer must execute a Commercial EV Service Agreement with the Company.

5. Customer must retain a minimum of ~~four~~ two level 2 charging ports per site or one direct current fast charging port per site~~, or, in cases with less than four ports, a minimum of 50 kW of charging capacity~~. R R R

6. The customer agrees to provide information allowing the Company to analyze their energy use, vehicle charging patterns, and reactions to vehicle charging load management activities. Customer vehicle charging sessions will be subject to interruption and power reduction.

7. Level 2 charging is defined as having a charging capacity equal to or less than 22 kW and direct current fast charging is defined as having a charging capacity greater than 22 kW. N N

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Attachment D
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Distribution Revenue-Based Extension Allowance Calculation

	Account	Distribution Functional Rev. Req.	kW	Distribution Cost per kW
1	Medium Demand and Energy Cg-7, Cp-3	$18,831,036	4,189,875	$4.49
2	Large Demand and Energy Cg-9, Cp-1-Secondary	$19,968,507	5,539,643	$3.60

MULTI-FAMILY HOUSING ELECTRIC VEHICLE SERVICE PILOT

Availability: Available to residential customers residing in multi-family housing taking service under the Residential Service (Rg-1) tariff or multi-family housing site hosts to provide electric vehicle charging equipment to service electric vehicle loads including battery charging and accessory usage. Electric vehicle charging that occurs under this service will be subject to this tariff and tariffs referenced herein. Residential customers taking service under Farm Service (Fg-1), Residential Time-of-Day Service (Rg-2) or Parallel Generation – Net Energy Billing Service (Pg-1) are not eligible for service under this tariff.

Any Customer choosing to be served on this rate schedule waives all rights to any billing adjustments arising from a claim that the bill for service would be cheaper on any alternative rate schedule for any period of time, including any rights under Wis. Adm. Code section PSC 113.0406(4).

Contract: Customers must contract for the service through a Multi-Family Housing Electric Vehicle Service Customer Service Agreement with the Company. For site hosts participating under the Shared Parking or Assigned Parking Options, the contract will be for ten (10) years. For residential customers residing in multi-family housing participating under the Assigned Parking Option the contract will be month-to-month.

Shared Parking Option: Charger Service that provides electric vehicle charging equipment for shared parking areas that can be utilized by multiple electric vehicle drivers residing in multi-family housing. The electric service for the charging equipment and charging consumption will be assessed to the site host through the applicable standard commercial tariff. Site hosts participating in the Shared Parking Option may enroll in Optional Charger Service, Revenue-Based Extension Rules, or both through the Commercial Electric Vehicle Service Program (EVC-1) subject to the availability requirements of that service.

Assigned Parking Option: Charger Service that provides electric vehicle charging equipment for parking areas that are assigned to a single multi-family housing tenant. Charging equipment and charging consumption will be assessed to the individual tenants under the Bundled Option in the Residential Electric Vehicle Home Service Program (EVR-1). The electric service including any residual unbilled volumes not billed to individual tenants will be billed to the site host through the Cg-2 tariff. Site hosts are also responsible for the customer charge on the applicable standard commercial tariff. Site hosts participating in the Assigned Parking Option must have a Company-owned service and dedicated meter, must enroll in Revenue-Based Extension Rules through the Commercial Electric Vehicle Service Program (EVC-1), and are subject to the availability requirements of that service.

(Continued)

MULTI-FAMILY HOUSING ELECTRIC VEHICLE SERVICE PILOT
(continued)

Terms and Conditions of Service:

1. Customers must adhere to the terms and conditions of the referenced tariffs. Where there is a discrepancy between referenced tariffs and this tariff, the EVC-2 tariff shall govern.
2. Multi-Family Housing Electric Vehicle Service customers selecting the Assigned Parking Option or selecting the Shared Parking Option and enrolling in Revenue-Based Extension Rules under the EVC-1 tariff shall be separately served and metered according to the EVC-1 tariff and must at no time be connected to facilities serving the site host's other loads.
3. Consumption under the Assigned Parking option will be measured by dedicated tenant charging equipment for each assigned parking spot and will be subtracted from the site host's dedicated meter for charging equipment. Site hosts will be responsible for meter usage not accounted for from assigned parking spot usage at the Cg-2 tariff.
4. The site host shall supply, at no expense to the Company, a suitable location for meters and associated equipment used for billing. Installations must conform to the Company's specifications.
5. Company may require site host to provide access for Company-owned equipment for the recording and wireless communication of energy usage.
6. Site host must have wireless internet ("Wi-Fi") service at site.
7. Customer must reside or site host must own or manage a multi-family home, including but not limited to apartment buildings, condominiums, and mixed-use buildings and excludes individually owned or rented detached single-family homes, townhomes, row houses, and duplexes.
8. Site host is defined as developer, owner, or operator of multi-family housing, including but not limited to property managers, building owners, and home-owners associations.
9. Participants must execute a Multi-Family Housing Electric Vehicle Service Customer Service Agreement with the Company.

Rate Codes:

Bxx Multi-Family Housing Electric Vehicle Service Pilot

Guidehouse

Memorandum

To: **Deborah Erwin, Jean Baptiste Jouve, Jason Peuquet, Benjamin Crist, Xcel Energy**

From: **Derek Jones, Alex Metz, Adam Green, Gavin Aiello, Guidehouse**

Date: **July 19, 2022**

Re: **Xcel Energy Electric Vehicle and Infrastructure Forecasting Methodology & Results – Wisconsin**

Introduction

Xcel Energy ("Company") engaged Guidehouse, Inc. ("Guidehouse") to assist in the preparation of its transportation electrification filings in Colorado, Minnesota, Wisconsin, and New Mexico. As part of this support, Guidehouse conducted a series of plug-in electric vehicle[1] ("PEV") modeling analyses leveraging its Vehicle Analytics & Simulation Tool ("VAST"). VAST is a systems dynamics model with three distinct modules that are modeled in sequential order:

- **Vehicle Adoption:** Forecast adoption of various powertrain, fuel, and vehicle class configurations in each census tract in each jurisdiction. By modeling vehicle adoption based on inputs specific to a particular jurisdiction, the forecast closely reflects local market conditions and have a stronger empirical basis when compared to similar national, state, or regional forecasts.
- **Charging Needs:** Forecast charging infrastructure required to support the above electric vehicle adoption, calculated though a dynamic market equilibrium model (the number of charging station ports required to supply a given number of vehicles).
- **Charging Station Siting:** Determines the latitude and longitude of public charging sites to inform distribution planning, electric vehicle supply equipment ("EVSE") siting, and other locationally sensitive analyses; uses a GIS network model to optimally site EV charging stations based on local vehicle populations and vehicle miles traveled for a specified street network.

Further details on VAST methodology are available in the "Vehicle Analytics & Simulation Tool Overview" document available from Guidehouse by request.

This memo presents an overview of Guidehouse's modeling methodology and associated results for:

1. **Vehicle Adoption** in the state of Wisconsin and Xcel service territory.
2. **Charging Needs** in the state of Wisconsin and Xcel Service territory.
3. **Charging Station Siting** in the state of Wisconsin and Xcel Service territory, including siting factors available for inclusion in an analysis and recommendations for use of the outputs.

[1] Includes battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV)

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Vehicle Adoption Modeling

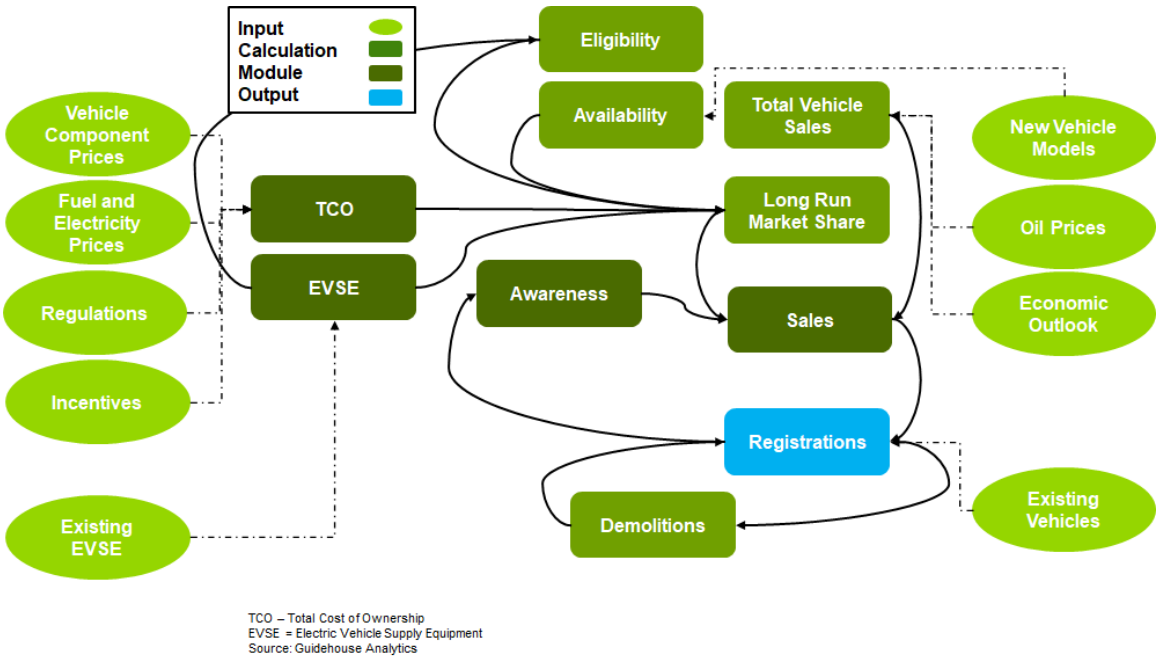
Guidehouse's Vehicle Analytics & Simulation Tool (VAST) uses a systems dynamics model[2] driven by enhanced Bass diffusion[3], conditioned on vehicle availability, customer ownership economics, and eligibility constraints. This means that the fundamental cause and effect relationships in the system are defined and calibrated.

Vehicle Adoption Methodology Summary

The VAST Adoption module explicitly accounts for supply-side dynamics driving vehicle production and availability as new models are rolled out preferentially to specific geographies in response to specific markets or policy drivers. If a vehicle is available, the economics of vehicle ownership, customer decision-making, and the impact of word-of-mouth effects and advertising all affect vehicle sales. This formulation is more accurate than strict autoregressive time-series forecast models like GARCH or ARIMA models and outperforms econometric models because the system is fundamentally bounded by stocks and flows and can account for non-linear dynamics that arise from positive and negative feedback, balancing effects, and reinforcing trends.

Figure 1 depicts a high-level diagram explaining the relationships between the major model routines.

Figure 1. VAST Vehicle Adoption Methodology



Source: Guidehouse

[2] Sterman, John D. Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin McGraw-Hill. 2000.
[3] Bass, Frank (1969). "A new product growth model for consumer durables." Management Science 15 (5): p 215-227

Vehicle Adoption Results

In Wisconsin, Guidehouse modeled vehicle adoption based on its default Scenario 2 assumptions. This scenario models more favorable EV adoption compared to Scenario 1, based on adjustments to inputs including fuel price forecasts, battery pack pricing, customer awareness and other related inputs. The forecasted electric vehicle adoption results in the Northern States Power Company, Wisconsin ("NSPW") service territory are shown in Table 1.

Table 1. NSPW Vehicle Adoption Results

Scenario / Vehicles	2022	2026	2030
Electric LDVs (#)	2,138	13,165	44,088
Electric MDVs (#)	3	203	904
Electric HDVs (#)	1	139	849
Electric LDVs (% of All LDVs)	1%	3%	8%
Electric MDVs (% of All MDVs)	0%	1%	5%
Electric HDVs (% of All HDVs)	0%	1%	5%

Source: Guidehouse

Charging Needs Modeling

Charging Needs Methodology Summary

The VAST Charging Needs module assumes changes in the vehicle population associated with a specific fuel drive infrastructure build-out. For example, as EVSE rollouts continue, the portion of the market that can consider purchasing a PEV increases and the economic disadvantage of PEV ownership decreases because PEVs can meet more consumer transportation needs. Economic disadvantage is formulated to reflect the vehicle's ability to satisfy all the driving requirements of its owner and is consequently modeled as a cost added to the total cost of ownership (TCO)[4]. Guidehouse refers to this cost as the consumer sacrifice penalty.

Fueling infrastructure and vehicle populations evolve together in VAST. More vehicles on the road with specific fuel requirements dictated by the powertrain stimulate infrastructure development for the relevant fuel. This is accomplished through the estimation of dynamic regional charger-per-vehicle

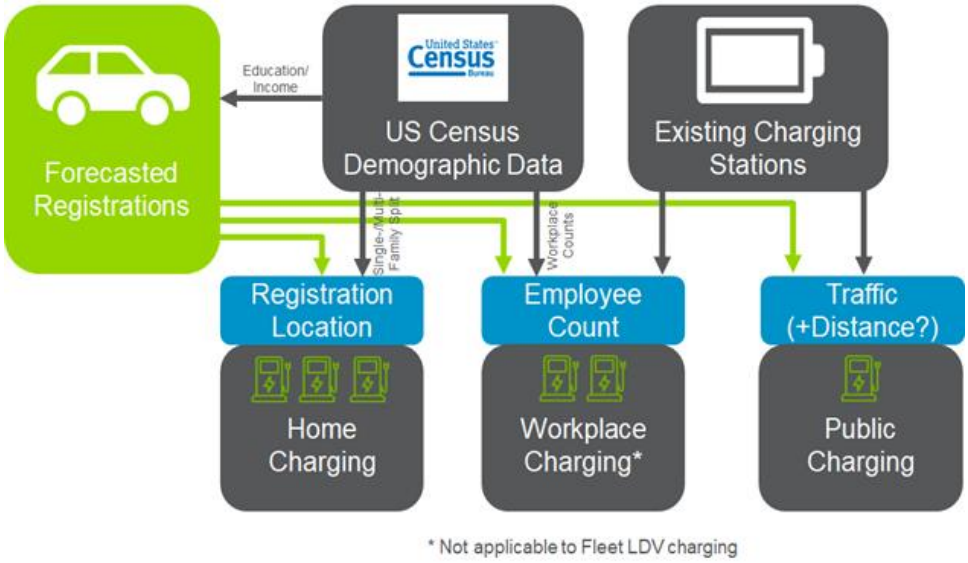
[4] There is no assumed infrastructure penalty associated with PHEVs, due to PHEVs ability to use gas and avoid the need for rental cars on long trips.

ratios. They are regional, reflecting local traffic and driving patterns, and dynamic, reflecting changing technology, range, and use case preferences among drivers. Charging levels (rated capacity) evolve over time in the model in response to vehicle range, penetration, and use case requirements.

The public charging requirements included in Guidehouse's charging needs assessment includes publicly accessible charging stations (e.g. accessible to all EV drivers) and existing semi-private, or proprietary charging stations (e.g. charging stations available only to certain EV drivers, such as Tesla or Rivian networks). Guidehouse's model discounts the port counts of these proprietary networks to account for the lack of accessibility to all drivers.

Figure 2 illustrates the VAST methodology for connecting charging stations with vehicle registrations.

Figure 2. VAST Charging Needs Methodology



Source: Guidehouse

Charging Needs Results

For the NSPW service territory, Guidehouse developed an infrastructure forecast, also developed as part of Scenario 2. Guidehouse's projections for infrastructure requirements show that by 2030, over 1,700 Level 2 ports and ~300 DCFC ports will be required for public usage in NSPW territory. Full results for infrastructure projections can be found in Table 2, which is inclusive of existing charging infrastructure available today.

Table 2. NSPW Charging Needs Results

	2022	2026	2030
Public Level 2 Charging (MW)	1	7	28

	2022	2026	2030
Public Level 2 Charging (Ports)	184	593	1,708
Public DCFC Charging (MW)	7	26	81
Public DCFC Charging (Ports)	91	168	333

Source: Guidehouse

Adoption & Charging Needs Modeling Factors

Future vehicle adoption and charging needs are driven by many market factors. Consideration of these factors is essential in developing robust and reliable forecasts. Table 3 lists key factors incorporated in Guidehouse's 2022 vehicle adoption and charging needs forecast.

Table 3. VAST Adoption and Charging Needs Factors

Adoption and Charging Needs Factor	Description
Regulatory Targets	Future PEV penetration targets established by regulatory bodies or government agencies
Awareness	Consumer's knowledge of the PEV market
Availability	Ability for the PEV market to meet the specific demand of a consumer,. e.g., if a consumer wants an electric minivan, can they purchase this vehicle
Customer Preference	Inherent non-economic drivers of customer powertrain purchase behavior such as perceived vehicle performance, style, and attractiveness.
Total Cost of Ownership (TCO)	The total cost to a consumer who purchases a PEV, incorporating capital expenses, operating expenses and existing incentives
Charger to Vehicle Ratio	The measurement of how charging infrastructure is required to meet the charging demand generated by PEV adoption

Source: Guidehouse

In Wisconsin, no regulatory guidance has been provided regarding expected PEV penetration. Maximizing PEV awareness, along with factors affecting total cost of ownership, such as historic

increases in gasoline prices due to recent geopolitical events[5] and incentives that keep initial capital expenses competitive with ICE vehicles, will drive higher levels of adoption.

Understanding the charging needs associated with increased PEV adoption is essential to inform effective and efficient charging site deployments to support and unlock PEV market demand. Charger-to-vehicle ratios must take into consideration developing charging behavior in EV owners, such as shifts from home charging to public market charging as public chargers become more available and as EV adoption increases beyond detached households with dedicated charging solutions. The evolution of technology, such as availability and affordability of DC fast chargers ("DCFC") and improved rated capacity on Level 2 ("L2") and DCFC chargers, will further define the capacity required to support the PEV market.

As the PEV market is still nascent, the inclusion of many factors is essential to support robust, reliable modeling. These factors will continue to develop in parallel with the PEV market and it is important to revisit and refresh underlying assumptions as increasingly reliable and relevant information becomes available.

Charging Station Siting

Fundamentally, while the volume of charging station ports is calculated though a dynamic market equilibrium model (the number of ports required to supply a given number of vehicles) the locations of these charging ports can be difficult to determine through the vehicle counts alone. The VAST Charging Station Siting module calculates the latitude and longitude of likely public charging sites to inform distribution planning, EVSE siting, and other locationally sensitive analyses.

Siting Methodology Summary

Guidehouse calculates the number of charging station ports required within the census tract to serve the forecasted charging load (Charging Needs module), based on the anticipated adoption of electric vehicles (Vehicle Adoption module). Guidehouse's siting analysis (Charging Station Siting module) then leverages prioritization criteria—or objective functions—along with various siting factors to determine the potential locations for charging station sites based on a hybrid approach using two objective functions as depicted in Figure 3.

Figure 3. A Hybrid Approach of Two Objective Functions

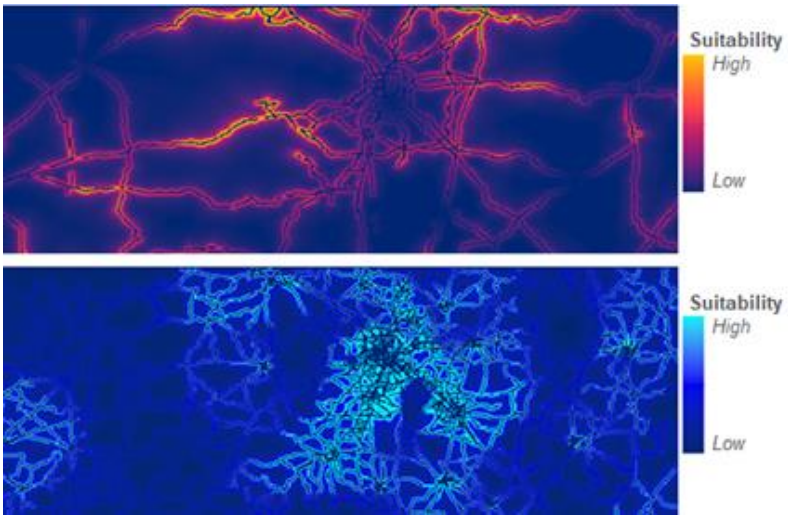
Source: Guidehouse

[5] Wall Street Journal, Why are Gas Prices So Expensive: https://www.wsj.com/articles/why-gas-prices-expensive-11646767172

As Figure 3 depicts, Guidehouse's model is designed to site:

- **Connector Stations** – Stations needed to connect major cities and provide intra-city commerce and tourism; and
- **Market Stations** – Stations needed to meet local market demand generated by inter-city traffic.

Figure 4. Illustrative Connector (Top) and Market (Bottom) Station Suitability



Source: Guidehouse

Key core features of the methodology include:

- Roads modeled as a network with explicit size, speed limits, navigation rules, travel times and traffic volume
- Stations sited on nodes in the modeled network
- Station locations determined discretely by network optimization to meet maximum demand for charging, subject to vehicle range and network constraints
- Stations assigned to an electric distribution service territory defined by a drive-time isochrone
- Station assignment based on total forecasted demand at a given location

Additional optional analysis considerations include:

- Electric distribution system costs
- Electric distribution system support
- Equity considerations to support disadvantaged communities

Notably, the analysis represents an approximate location of the charging station. The VAST Charging Station Siting module does not consider station installation considerations such as technical feasibility, make-ready costs, land costs, landowner willingness to participate, attraction colocation, visibility, accessibility, etc. For example, an analysis may identify an optimal location for placing the charging station, but the site may not have sufficient goods and services to attract drivers to the location. For this reason, the actual location of the installed charging station may differ from the modeled siting results.

Siting Factors Summary

The VAST Charging Station Siting module analyzes various factors to determine the optimal location for charging stations at the census tract-level. The sited charging station location varies depending on the factors selected for analysis. The overarching goals of the analysis guide factor selection. Table 4 details the various factors available in the VAST Charging Station Siting methodology and whether they were used in the Wisconsin analysis.

Table 4. VAST Charging Station Siting Factors List

Siting Factor	Description	Included in Analysis	Data Point & Source
Site Buffer, Connector	Proposed Connector sites cannot be sited within a certain distance from a built station	**No**	Distance (miles) from an existing charging station (Alternative Fuels Data Center)
Site Buffer, Market	Proposed Market sites cannot be sited within a certain distance from a built station	**No**	Distance (miles) from an existing charging station (Alternative Fuels Data Center)
Site Buffer, Proposed	Two proposed stations cannot be within a certain distance from one another	**Yes**	Two (2) miles from a proposed (connector or market) charging station (VAST Charging Station Siting module)
Utilization, High	Maximize utilization based on anticipated driver traffic	**No**	Average annual daily traffic (Federal Highway Administration)
Utilization, Low	Prioritize areas with lower utilization (underserved regions)	**Yes**	Average annual daily traffic (Federal Highway Administration) Existing charging stations (Alternative Fuels Data Center)
Low-Income[6]	Prioritize disadvantaged communities	**No**	Median household income (American Community Survey, 5-year Estimates) Federal Poverty Guidelines (Department of Health and Human Services)
Development Cost	Prioritize areas with excess grid capacity, reduce installation cost	**No**	Distribution Grid Capacity Study (Electric Distribution Network Operator)

[6] Low-income populations are households making up to 150% of the poverty level.

Siting Factor	Description	Included in Analysis	Data Point & Source
Grid Support	Prioritize sites with least headroom based on capacity and demand forecast	**No**	Distribution Grid Capacity Study (Electric Distribution Network Operator)

Source: Guidehouse

Siting Results

Table 4 depicts the 2026 siting results from Guidehouse's 2022 analysis of Xcel Energy service territories in NSPW.

Table 4. Public Direct Current Fast Charging Forecast Results (2026)

Entity	Scenario	Adopted EVs (2026 by duty)[7]	Charging Capacity Demand (MW)[8]	Sited Capacity (MW)[9]	NSP Planned Capacity (MW)
NSPW	GH Scenario 2	LD: 13,165 MHD: 342	26	15	12

Source: Guidehouse

Table 5 depicts the 2030 siting results from Guidehouse's 2022 analysis of Xcel Energy service territories in NSPW.

Table 5. Public Direct Current Fast Charging Forecast Results (2030)

Entity	Scenario	Adopted EVs (2030 by duty)[8]	Charging Capacity Demand (MW)[9]	Sited Capacity (MW)[10]
NSPW	GH Scenario 2	LD: 44,088 MHD: 1,753	81	49

Source: Guidehouse

Table 6 provides definitions for the terms used in Tables 4 and 5 as well as relevant concepts that are critical to interpreting the results. Additional terms and definitions are available in the Data Dictionary that accompanies the results workbook.

[7] Adoption values for NSPW are provided in the file titled "FINAL_EV_Adoption_Results_Xcel_WI_Scenario_2_500ft_Buffer.csv" under the field named "Population".
[8] Charging capacity demand for NSPW is provided in the file titled "FINAL_EVSE_Needs_Results_Xcel_WI_Scenario_2_500ft_Buffer.csv" under the field named "Charger Capacity (kW)".
[9] Sited capacity for NSPW is provided in the file titled "FINAL_WI_Scenario_2_500ft_Sites_2026_2030.xlsx" under the field named "Site Capacity (kW)".

Table 6. Siting Results Definitions

Term	Definition
Entity	Xcel Energy operating company service territory
Scenario	Set of assumptions specific to an Entity siting analysis
Siting Analysis	Given a calculated charging need (MWh) to serve forecasted EV adoption, approximate latitudinal / longitudinal location of individual charging stations determined through analysis of factors such as modeled road network, electric vehicle adoption, traffic patterns, existing charging stations, etc. as defined in the Methodology Overview section of this memo
Public Direct Current Fast Charging	Share of total charging needs in megawatts (MW) modeled for an Entity's designated jurisdiction for public charging (unrestricted access) through direct current fast charging (DCFC) stations. Does not include public charging needs for Level 2 stations or any private charging (restricted access) by DCFC or Level 2 stations
Target Percentage	Siting analysis requires many criteria to avoid returning one new station for every point along a road network. Target percentage reflects real-world resource constraints, e.g., capital, goods, services. A target percentage of 25%* aligns with historic roll out of charging station locations in high adoption regions.
Per Port Weighted Average Capacity (kW)	Rated capacity (kW) of DC port at optimal charging station site. Average value of 160 kW was used in 2026 across all sites; average value of 240 kW was used in 2030 across all sites.
Sited Capacity (kW)	Sum of installed capacity (kW) at optimal charging station site (port count * per port weighted average capacity)

* For a comparison of historical vs. simulated charging station installation density see Robinson, S. et al 2021 here and here

Source: Guidehouse

Figure 5. Siting Results for NSPW Service Area Based on GH Scenario 2 Adoption and Charging Needs Scenario (2026)

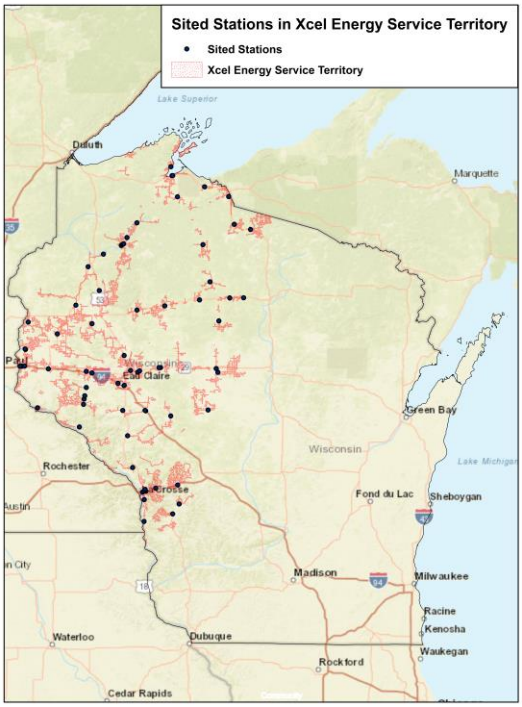


Figure 5 provides an overview of the siting results for the NSPW service area based on the scenario modeled, in 2026. Each dot shown in the Figure indicates one siting location – the number of ports per site varies depending on the demand at the site. The siting results in Figure 5 include all candidate charging station locations. In other words, this figure includes all charging station sites that would be required to support the vehicle adoption and charging needs developed in the scenario, excluding stations that exist today. The density of charging stations is largely proportional to population, as demonstrated by the large clustering of sites in the La Crosse and Eau Claire regions. To capture larger quantities of driving traffic, the majority of sites are located along major highways, including the I-94.

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Appendix A: Detailed Vehicle Adoption Results

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Wisconsin (State Level)									
Scenario 2 – Vehicles									
Individually-Owned BEV LDVs	23,357	39,288	61,652	94,213	144,016	202,336	271,248	355,278	452,197
Individually-Owned PHEV LDVs	10,449	15,254	22,707	34,438	52,650	80,630	114,490	148,081	181,815
Fleet-Owned BEV LDVs	1,894	3,152	4,921	7,143	9,772	12,898	16,619	21,175	26,477
Fleet-Owned PHEV LDVs	524	736	1,039	1,486	2,147	3,069	4,256	5,707	7,539
Electric MDVs	75	276	727	1,576	3,031	4,842	7,024	9,617	12,278
Electric HDVs	39	86	253	759	1,966	3,679	5,764	8,312	11,239
All Individually-Owned LDVs	5,158,709	5,299,150	5,449,787	5,610,836	5,780,940	5,958,021	6,141,579	6,331,357	6,525,524
All Fleet-Owned LDVs	328,158	336,581	345,614	355,271	365,468	376,083	387,085	398,459	410,095
All MDVs	150,406	157,262	164,311	171,444	178,567	185,599	192,471	199,120	205,500
All HDVs	159,444	167,186	175,247	183,532	191,956	200,443	208,920	217,318	225,577

	2022	2023	2024	2025	2026	2027	2028	2029	2030
NSPW (Territory Level)									
Scenario 2 – Vehicles									
Individually-Owned BEV LDVs	1,366	2,337	3,731	5,801	9,019	12,847	17,416	23,033	29,564
Individually-Owned PHEV LDVs	607	901	1,366	2,114	3,296	5,146	7,420	9,699	12,005
Fleet-Owned BEV LDVs	114	202	330	494	690	925	1,206	1,551	1,954
Fleet-Owned PHEV LDVs	48	62	82	114	160	227	315	425	566
Electric MDVs	3	15	43	101	203	336	499	698	904
Electric HDVs	1	2	12	48	139	270	430	625	849
All Individually-Owned LDVs	389,734	400,033	411,020	422,672	434,827	447,390	460,360	473,745	487,426
All Fleet-Owned LDVs	26,307	26,970	27,679	28,437	29,236	30,067	30,927	31,814	32,720
All MDVs	13,135	13,719	14,315	14,914	15,504	16,086	16,654	17,201	17,727
All HDVs	12,825	13,420	14,039	14,676	15,323	15,975	16,627	17,274	17,909

Source: Guidehouse

Appendix B: Detailed Charging Infrastructure Results

Wisconsin (State Level)									
Scenario 2 – PORTS	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Public Infrastructure									
Hub L2	0	0	0	0	0	0	0	0	0
Hub L3	1	3	8	20	45	77	116	161	211
Market L2	1,873	2,762	3,960	5,708	8,402	11,811	15,889	20,587	25,836
Market L3	630	847	1,072	1,364	1,817	2,329	2,953	3,750	4,697
Shared Single-Unit Dwelling L1	2	5	11	22	40	67	105	154	217
Shared Single-Unit Dwelling L2	59	144	299	574	1,058	1,785	2,792	4,113	5,775
Shared Single-Unit Dwelling L3	9	22	46	89	165	271	417	617	875

NSPW (Territory Level)									
Scenario 2 – PORTS	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Public Infrastructure									
Hub L2	0	0	0	0	0	0	0	0	0
Hub L3	0	0	0	1	3	6	9	12	16
Market L2	185	248	323	428	593	803	1,060	1,362	1,708
Market L3	91	113	128	142	165	186	216	260	317
Shared Single-Unit Dwelling L1	0	0	1	1	2	4	7	10	14
Shared Single-Unit Dwelling L2	3	8	18	34	64	110	175	260	369
Shared Single-Unit Dwelling L3	0	1	3	5	10	17	26	39	56

Source: Guidehouse

Wisconsin (State Level)									
Scenario 2 – MW	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Public Infrastructure									
Hub L2	0	0	0	0	0	0	0	0	0
Hub L3	0	0	1	4	9	17	28	41	56
Market L2	14	24	38	62	101	156	228	318	426
Market L3	50	80	118	177	277	405	579	821	1,136
Shared Single-Unit Dwelling L1	0	0	0	0	0	0	0	0	0
Shared Single-Unit Dwelling L2	0	1	2	5	11	21	36	57	87
Shared Single-Unit Dwelling L3	1	2	5	12	25	46	78	126	193

NSPW (Territory Level)									
Scenario 2 – MW	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Public Infrastructure									
Hub L2	0	0	0	0	0	0	0	0	0
Hub L3	0	0	0	0	1	1	2	3	4
Market L2	1	2	3	5	7	11	15	21	28
Market L3	7	11	14	18	25	32	42	57	77
Shared Single-Unit Dwelling L1	0	0	0	0	0	0	0	0	0
Shared Single-Unit Dwelling L2	0	0	0	0	1	1	2	4	6
Shared Single-Unit Dwelling L3	0	0	0	1	2	3	5	8	12

Source: Guidehouse

Attachment G

Cost-Benefit Analysis of Transportation Electrification in the Xcel Energy Wisconsin Service Territory

July 2022

Energy+Environmental Economics

Cost-Benefit Analysis of Transportation Electrification in the Xcel Energy Wisconsin Service Territory

July 2022

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Acronym Definitions

Acronym	Definition
BEV	Battery Electric Vehicle
CBA	Cost-Benefit Analysis
DCFC	Direct Current Fast Charger
DER	Distributed Energy Resource
EIA	Energy Information Administration
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
HDV	Heavy-Duty Vehicle
ICE	Internal Combustion Engine
LDV	Light-Duty Vehicle
MDV	Medium-Duty Vehicle
MFH	Multi-Family Housing
NPV	Net Present Value
O&M	Operations and Maintenance
PCT	Participant Cost Test
PEV	Plug-in Electric Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
RIM	Ratepayer Impact Measure
SCT	Societal Cost Test
TOU	Time-of-Use
V2G	Vehicle-to-Grid
VMT	Vehicle Miles Traveled
WACC	Weighted Average Cost of Capital

Executive Summary

Key Takeaways

1. Vehicle electrification offers net benefits to all NSPW customers in Wisconsin.

2. NSPW's proposed programs increase the benefits for drivers from electrifying vehicles in Xcel's Wisconsin service territory from 2022 to 2030. NSPW's proposed programs also increase societal benefits from vehicle electrification, with the exception of the School Bus Purchase Program.

3. While benefits to society and Xcel customers decrease with the implementation of Xcel's programs, net benefits remain positive and NSPW's programs accelerate EV adoption. Vehicle electrification with Xcel's programs also provides additional benefits not captured in the cost-benefit analysis such as improvements in air quality.

4. Personal LDVs are the largest contributor to vehicle electrification benefits in Xcel's Wisconsin service territory because they make up 90% of the vehicles adopted over the modeling horizon.

5. Managed charging results in an increase in driver benefits from utility bill savings but results in a decrease in customer net benefits since the reduction in driver utility bills is greater than the reduction in electric supply costs.

Study Aims and Methodology

This study evaluates the costs and benefits of electric vehicle (EV) adoption in Xcel Energy's Wisconsin service territory, operated by Xcel Energy's subsidiary Northern State Power of Wisconsin (NSPW), and examines the impact of proposed charging infrastructure programs to accelerate EV adoption in Wisconsin and support Xcel's goal to serve 1.5 million EVs across all its service territories by 2030. To achieve these aims, Energy and Environmental Economics, Inc. (E3) conducted cost-benefit study to evaluate the economic and electric grid impacts of EV adoption.

E3 employed its EVGrid model to capture key interactions between drivers, vehicles, chargers, utility costs, incentives, and gasoline costs. EVGrid includes a simulation of EV driving and charging behavior to capture the costs and benefits associated with hourly EV charging profiles.

In this study, we consider the impacts of EV adoption from 2022 to 2030. Costs and benefits are analyzed from driver, customer, and societal perspectives that are captured through three cost tests:

+ Participant Cost Test (PCT): the costs and benefits to the vehicle driver or fleet owner – is the total cost of EV ownership higher or lower than a similar Internal Combustion Engine (ICE) option?

- Ratepayer Impact Measure (RIM): the costs and benefits to utility customers[1] in Xcel Energy's Wisconsin service territory – will average utility rates increase or decrease?
- Societal Cost Test (SCT): the costs and benefits from a societal perspective for Wisconsin – do EVs provide net benefits to society?

Vehicle Types and Scenarios

The study explored how costs and benefits vary under different vehicle types, charge management, and utility program scenarios. Reference scenarios were developed for each vehicle type that represent an aggressive EV adoption forecast for Xcel's Wisconsin territory. Reference scenarios are used to assess the impacts of Xcel's proposed programs on costs and benefits from the driver, customer, and societal perspectives. E3 modeled Reference scenarios for personal LDVs, commercial LDVs, MDVs, commercial HDVs, and school buses. Xcel is proposing programs for owning public DCFC and funding residential, commercial fleet, workplace, and public L2 chargers, which change the cost and benefit streams from electrifying personal and commercial LDVs that have access to these types of chargers.

There are three types of charging modeled: unmanaged, managed, and Vehicle-to-Grid (V2G) charging. In unmanaged charging scenarios, drivers charge at different locations (home, workplace, public L2, and public DCFC) based on their driving patterns and charging access. With unmanaged charging scenario, drivers are not exposed to time-varying charging rates and charge their EV immediately upon arriving at a charging location. In this study, only personal LDVs are modeled to have unmanaged charging based on expectations for all other vehicle types to have most charging managed over the modeling horizon.

In managed charging scenarios, drivers are exposed to time-varying charging rates and manage their charging at each location to minimize their cost of charging. This means that drivers may not charge as soon as they arrive at a charging location but may instead wait until lower-priced hours to charge. Under managed charging, drivers still charge the amount needed to satisfy driving patterns. Managed charging is modeled for all vehicle types in the study.

In V2G charging scenarios, in addition to charging from the grid, vehicles can sell energy stored in their vehicle battery back to the grid. These cases assume that vehicles charge at the same rate as in managed charging for charging the vehicle but receive a separate rate for selling energy back to the grid. Only school buses are modeled under V2G charging as a sensitivity.

Results

Overall, this study finds that under the Reference scenario, vehicle electrification offers net benefits to customers in Wisconsin as well as society as a whole. Society as a whole can benefit between $59 million and $69 million from the electrification of personal and commercial LDVs, MDVs, commercial HDVs, and school buses in Xcel's Wisconsin territory depending on if personal LDVs have unmanaged or managed

[1] Throughout this study, 'customers' refer to all Xcel customers in the Wisconsin service territory, including both EV drivers and non-EV drivers.

charging.[2] Customers benefit between $161 million and $171 million from the net increase in utility revenues from EV charging. Personal and commercial LDV drivers and MDV drivers can benefit between $47 million and $67 million from vehicle electrification between 2022 and 2030. Commercial HDV and school bus owners, however, face net costs around $111 million and $9.2 million, respectively.

Xcel's proposed programs increase the benefits for drivers from electrifying vehicles in Xcel's Wisconsin service territory from 2022 to 2030. The NPV of LDV and MDV owner or driver net benefits increases by between $28 million and $33 million with the implementation of Xcel's programs since programs cover the costs of EV chargers that drivers would have otherwise had to pay. Commercial HDV and school bus net costs are unchanged since Xcel's proposed programs target charging infrastructure for LDV and MDV. An increase in net benefits for LDV and MDV drivers indicate that the programs will improve the economic proposition for drivers to adopt an EV. By increasing benefits achieved by electrifying a vehicle, Xcel is helping to accelerate EV adoption in its Wisconsin service territory and support Xcel's EV adoption goals.

Societal net benefits decrease by between $0.5 million and $3.5 million but net benefits remain positive, at between $56 million and $68 million in net benefits. This result indicates that Xcel can improve the economic proposition for drivers to electrify their vehicles and still provide net benefits to its Wisconsin territory at the cost of cutting back the total net benefits that society as a whole receives.

Customer net benefits also decrease with the implementation of Xcel's programs between $20 million and $23 million but remain positive and vehicle electrification offers customers in Xcel's Wisconsin territory between $138 million and $151 million in net benefits. Therefore, Xcel's programs can offer additional incentives for drivers to electrify their vehicles and benefit the state as whole while still not incurring additional costs on customers.

Table ES.1, Table ES.2, and Table ES.3 summarize the total NPV of benefits from each cost test perspective evaluated for a Reference scenario and scenario with Xcel's programs. The totals shown sum net benefits across all vehicle types modeled.

Table ES.1 shows the net benefits from the driver or fleet owner perspective. All scenarios have net benefits for drivers and fleet owners except commercial HDVs and school buses.

[2] Societal benefits are $59 million if personal LDVs have unmanaged charging and $69 million if personal LDVs have managed charging. Ranges provided in subsequent results reflect the difference in benefits from each perspective (societal, customer, or participant) hinging on whether charging is managed for personal LDVs. Drivers and society see greater benefits from managed charging, meaning that managed personal LDV charging represents the higher value of the range of results, while customers have reduced benefits from managed charging, meaning that managed personal LDV charging represents the lower value of the range of results.

Table ES.1. Summary of PCT net benefit results ($M)

Case	Reference Scenario		Xcel Programs	
Personal LDV	$28.4 (all vehicles unmanaged)	$48.2 (all vehicles managed)	$46.6 (all vehicles unmanaged)	$72.0 (all vehicles managed)
Commercial LDV	$12.9		$22.2	
MDV	$5.7		$5.7	
Commercial HDV	-$111.0		-$111.0	
School Bus	-$9.2		-$9.2	
Total	**-$73.2**	**-$53.4**	**-$45.7**	**-$20.3**

Personal and commercial LDVs and MDVs have net benefits that are largely driven by vehicle gasoline and O&M savings. These savings outweigh incremental upfront costs, utility bills for charging, and charger costs. For commercial HDV and school buses, however, the large incremental upfront costs of these vehicle types outweigh the savings from avoided diesel and O&M, resulting in net costs for vehicles adopted between 2022 and 2030.

As can be seen in Table ES.1, moving from unmanaged to managed charging offers drivers opportunities to further increase their net benefits due to reductions in utility bills from managing charging. Xcel programs scenarios are applied separately to scenarios that assume all vehicles are unmanaged and that assume all vehicles are managed.

Xcel's proposed programs increase the net benefits for personal and commercial LDVs due to the reductions in charging infrastructure costs that drivers must pay when adopting an EV.

From the customer perspective, all Reference scenarios have net benefits, but the addition of Xcel's programs reduces the net benefits for all vehicle types modeled, as shown in Table ES.2. Although there is a reduction in customer net benefits from the implementation of Xcel's programs, net benefits remain positive, and customers still benefit between $138 million and $151 million from the electrification of vehicles in Xcel's Wisconsin service territory over the modeling horizon.

Table ES.2. Summary of RIM net benefit results ($M)

Case	Reference		Xcel Programs	
Personal LDV	$44.8 (all vehicles unmanaged)	$34.9 (all vehicles managed)	$31.6 (all vehicles unmanaged)	$19.1 (all vehicles managed)
Commercial LDV	$6.8		-$0.2	
MDV	$6.9		$6.9	
Commercial HDV	$109.8		$109.8	
School Bus	$2.8		$2.8	
Total	**$171.1**	**$161.3**	**$151**	**$138.4**

When viewed in isolation, commercial LDVs have net costs for customers since the increase in utility bills earned from the additional EVs adopted, particularly given the managed charging, does not outweigh the program costs for charging infrastructure that are added in program scenarios. When electrification across all vehicle types is considered in aggregation, including the MDV, commercial HDV, and school buses that do not have program costs, customers have net benefits.

Moving from unmanaged to managed charging for personal LDVs reduces customer benefits since reductions in utility bills are larger than reductions in electricity supply costs. This indicates that Xcel's current TOU rates offered to drivers in Wisconsin may provide greater incentives than are reflective of the reductions in electricity supply costs that can be achieved through managed charging.

Table ES.3 shows the net benefits from a societal perspective. Apart from school buses, EV adoption for all vehicle types and scenarios has net benefits for society. School buses have net costs to society, primarily due to high incremental upfront costs. When viewed in aggregation across all vehicle types, electrification has positive net benefits for society.

Table ES.3. Summary of SCT net benefit results ($M)

Case	Reference		Xcel Programs	
Personal LDV	$10.4 (all vehicles unmanaged)	$20.2 (all vehicles managed)	$0.6 (all vehicles unmanaged)	$13.4 (all vehicles managed)
Commercial LDV	$34.2		$40.5	
MDV	$14.2		$14.2	
Commercial HDV	$6.5		$6.5	
School Bus	-$6.3		-$6.3	
Total	**$59.0**	**$68.6**	**$55.5**	**$68.4**

Xcel's proposed programs reduce societal net benefits for personal LDVs and increase net benefits for commercial LDVs. The higher mileage of commercial LDVs allows for higher avoided gasoline and O&M savings to outweigh the program costs of additional charging infrastructure. Personal LDVs, which have lower annual miles traveled than commercial LDVs, do not achieve enough avoided gasoline and O&M savings to outweigh the program costs.

In addition to sensitivities that include Xcel's proposed programs, the study also modeled a sensitivity for school buses that included V2G charging. V2G charging offers buses opportunities to reduce their utility bills by selling energy back to the grid. V2G charging reduces net costs to drivers, as shown in Table ES.4. V2G charging does not significantly impact societal net costs and reduces customer net benefits; although both utility bills and total energy supply costs are reduced in the V2G scenario, the reduction in utility bills for drivers is larger than the decrease in electricity supply costs.

Table ES.4. Summary of school bus net benefit results ($M)

Case	Reference	**V2G**
PCT	-$9.2	-$8.6
RIM	$2.8	$2.3
PCT	-$6.3	-$6.3

In addition to providing direct economic benefits, vehicle electrification in Xcel's Wisconsin service territory reduces emissions. With either managed or unmanaged charging in the Reference scenario, vehicle electrification across all vehicle types reduces emissions by 0.82 million metric tons CO_2 over the lifetime of all vehicles adopted between 2022 and 2030. Vehicle electrification also reduces NO_x by 340 metric tons and PM_{10} by 70 metric tons.

Xcel's proposed programs can help increase this number by facilitating the adoption of more EVs due to Xcel ownership and funding of charging infrastructure. The emissions savings in the scenario with Xcel's programs increases to 0.96 million metric tons CO_2, 400 metric tons NO_x, and 80 metric tons PM_{10} over the vehicles' lifetimes.

1 Study Aims

This study evaluates the costs and benefits of electric vehicle (EV)[3] adoption in Xcel Energy's Wisconsin service territory and examines the impact of proposed charging infrastructure programs to meet Xcel's EV adoption goals. This study aims to support Xcel Energy, policymakers, and other stakeholders in understanding:

- the costs and benefits of EV adoption, from a driver, non-participating customer, and broader societal perspective,
- the cost and benefits of Xcel's proposed EV programs,
- potential greenhouse gas emissions impacts of electrified transportation, and
- potential impacts of electric vehicles on utility planning, specifically electricity consumption and planning loads.

The cost-benefit methodology seeks to evaluate direct impacts of transportation electrification through the lens of regulatory cost test frameworks.

Xcel is proposing several programs to accelerate EV adoption in its Wisconsin territory and support Xcel's EV adoption goals. Proposed programs include ownership of public DCFC, funding for residential, commercial, workplace, and public L2 chargers. The purpose of this study is to evaluate the impacts of the proposed programs for each of the perspectives evaluated in the regulatory cost test framework. An analysis of costs and benefits from the driver perspective evaluates if the programs will improve the economic proposition for drivers to electrify their vehicle. A cost-benefit analysis from a societal perspective will demonstrate if programs improve the overall benefits achieved by society from vehicle electrification. Lastly, an analysis of costs and benefits from a customer perspective will evaluate if Xcel's revenues from vehicle electrification are larger than costs to supply electricity for EV charging and program costs; a net cost from the customer perspective would indicate that Xcel would need to raise electric rates at some point in the future to collect sufficient revenue to cover the costs of the proposed programs.

[3] The terms "electric vehicle" (EV) and "plug-in electric vehicle" (PEV) are used interchangeably in this report and encompass both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs).

2 Methodology

2.1 Cost-Benefit Overview

To perform a Cost-Benefit Analysis (CBA) of transportation electrification in Xcel Energy's Wisconsin service territory, E3 compared the costs and benefits accrued over the lifetime of each EV adopted against an equivalent Internal Combustion Engine (ICE) vehicle. Defining a particular value stream as a cost or benefit depends on the perspective taken. E3 performed CBA from the perspective of EV owners and drivers, other utility customers (i.e., non-participating customers), and Wisconsin state. Each perspective offers distinct insights that help describe the overall impact of EV adoption in Xcel Energy's Wisconsin service territory and inform the development of policies and programs. The three perspectives are as follows:

- Participant Cost Test (PCT): the costs and benefits to the vehicle driver or fleet owner – is the total cost of EV ownership higher or lower than a similar ICE option?
- Ratepayer Impact Measure (RIM): the costs and benefits to all utility customers in Xcel Energy's Wisconsin service territory – will average utility rates increase or decrease?
- Societal Cost Test (SCT): the costs and benefits from a societal perspective for Wisconsin – do EVs provide net benefits to society?

The cost and benefit components that constitute each perspective were originally defined in the standard practices of cost-effectiveness for California (CALMAC, 2002). These methods are well established and used to evaluate other nationwide distributed energy resource (DER) programs (EPA, 2008), with input data and calculations of cost and benefits updated based on the context of the program.

The PCT measures benefits and costs to participating customers, which are customers who own and drive EVs. Benefits include reduced gasoline or diesel costs, operations and maintenance (O&M) savings, and upfront incentives, while costs include the incremental upfront cost of an EV compared to an ICE vehicle, costs of charging an EV, and charging infrastructure costs paid by drivers.

The RIM compares utility electricity supply costs and transmission and distribution upgrades with revenues associated with EV charging loads. In scenarios that include utility programs, costs also include investments in charging stations and vehicle costs paid by the utility.

The SCT measures the net costs of a program to customers, the utility, and the broader society, including the effects of environmental externalities, within a defined region, in this case the state of Wisconsin. Environmental externalities in this study refer primarily to the avoided CO2 emissions, which receive a monetary value based on an average societal cost of carbon of $33.67/metric ton CO_2. Transfers of costs and benefits within Wisconsin, such as electricity bills which are a cost to participants and a benefit to the utility, cancel out from a societal perspective. This study assumes that total energy supply costs, incremental EV costs, and infrastructure costs associated with charging are all societal costs, while avoided vehicle gasoline or diesel costs, O&M savings, and emissions reductions are societal benefits.

Table 2.1 provides an overview of the various costs and benefits analyzed under each perspective.[4]

Table 2.1. Cost and benefits associated with each cost test perspective

Cost/Benefit Component	PCT	RIM	SCT
Incremental EV cost	Cost	Cost*	Cost
Federal EV tax credit	Benefit		
EV O&M savings	Benefit		Benefit
Avoided gasoline/diesel costs	Benefit		Benefit
Electricity supply costs for EV charging		Cost	Cost
Charging infrastructure cost	Cost	Cost*	Cost
Electricity bill for EV charging	Cost	Benefit	
Emissions savings			Benefit

* Costs and benefits apply only to scenarios with utility programs

The costs tests consider the Net Present Value (NPV) of costs and benefits over the lifetime of the vehicle. For this analysis, Xcel Energy's Weighted Average Cost of Capital (WACC) for their Wisconsin service territory is used to discount cost and benefit streams for all three cost tests.[5]

The study performs a cost-benefit analysis for five different vehicle types:

- **Personal LDVs:** Personal LDVs are used for personal (non-commercial) purposes and have access to a combination of residential, workplace, and public charging (see Modeling Methodology section for additional details on how a representative personal LDV is constructed).
- **Commercial LDVs:** Commercial LDVs are used for commercial purposes, including commercial fleet vehicles and personally-owned vehicles used for ride-sharing services. Commercial vehicles include those owned by companies and used for commercial operations as well as personal vehicles used for ridesharing services. All commercial fleet vehicles are assumed to have access to depot charging and a portion of vehicles used for ridesharing are assumed to have access to residential charging. All commercial LDVs are assumed to have access to public charging.
- **MDVs:** MDVs are Class 3 vehicles such as parcel trucks that are used for commercial purposes. MDVs are assumed to only charge at fleet depots.

[4] For more information on how cost and benefit components are assigned, please refer to the Environmental Protection Agency (EPA) best practice manual for cost effectiveness (EPA, 2008).

[5] Some cost-benefit studies assume a higher discount rate for the PCT (e.g., 9%) and a lower discount rate for the SCT (e.g., 3%). Since transportation electrification net-benefits tend to grow over time, using these distinct discount rates would result in lower participant net-benefits and higher societal net-benefits.

- **Commercial HDVs:** Commercial HDVs are Class 4-8 vehicles used for commercial purposes. Load profiles are based on transit bus driving patterns and are scaled to represent total expected heavy-duty EV adoption. HDVs are also assumed to only charge at fleet depots.
- **School Buses:** School buses are modeled separately from commercial HDVs given their unique driving patterns characterized by limited use on weekends and lower total miles travelled per year. School buses are assumed to only charge at depots.

2.2 Modeling Methodology

E3's EVGrid model uses various input streams, described in detail in the

Inputs and Assumptions section, and performs a CBA from each of the perspectives described above. The model calculates the NPV of EV adoption relative to ICE vehicles in Xcel's Wisconsin service territory. Accurate forecasting of electricity supply costs and electricity bills depends strongly on the hourly load shape from EV charging. Charging load shapes vary substantially across the driver population and depend on several factors such as vehicle type, charging access, cost of charging, and many others.

To model charging behavior, E3 has developed a bottom-up modeling approach that simulates the driving and charging behavior of thousands of EV drivers. Driving behavior is captured using travel survey data and converted to 15-minute driving patterns though a Markov-Chain Monte Carlo (MCMC) method[6]. The driving population is characterized by drivers' access to charging, spanning a combination of residential, workplace, and public charging access. The driving population is also characterized by EV type, which includes short- and long-range battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) for LDVs. For personal LDV cases, there are four EV types and six combinations of workplace, home, and public charging access, resulting in 24 combinations of customer types (see details in Sections 3.2.1 and 3.2.2). Normalized load shapes for each customer type are generated through linear optimization subject to various constraints. Load shapes are then scaled by the portion of drivers representing that customer type. The final load shape therefore captures the diversity of driving behavior, charging access, and EV adoption across the driving population.

There are three types of charging that can be simulated: unmanaged, managed, and Vehicle-to-Grid (V2G). In unmanaged charging scenarios, drivers charge at different locations (home, workplace, public L2, and public DCFC) based on their driving patterns and charging access. If possible given driving requirements, drivers can also select charging locations based on the cost of charging at each location. For example, public charging is typically more expensive than home or workplace charging, and this price comparison is incorporated into unmanaged drivers' decisions on where to charge if given the choice based on their driving patterns. Under an unmanaged charging scenario, drivers are not exposed to time-varying charging rates and charge immediately upon arrival at a charging location. In this study, only personal LDVs are modeled to have unmanaged charging based on expectations for all other vehicle types to have most charging managed over the modeling horizon.

[6] A basic introduction to MCMC is available can be found here: https://link.springer.com/article/10.3758/s13423-016-1015-8

In managed charging scenarios, in addition to charging based on driving patterns, charging access, and relative prices across charging locations, drivers are exposed to time-varying charging rates and manage their charging at each location to minimize their cost of charging. This means that drivers may not charge as soon as they arrive at a charging location but may instead wait until lower-priced hours to charge. Under managed charging, drivers still charge the amount needed to satisfy driving patterns. Managed charging is modeled for all vehicle types in the study.

In V2G charging scenarios, in addition to charging from the grid, vehicles can sell energy stored in their vehicle battery back to the grid. These cases assume that vehicles charge at the same rate as in managed charging for charging the vehicle but receive a separate rate for selling energy back to the grid. Only school buses are modeled under V2G charging as a sensitivity.

2.3 Modeling Scenarios

The study calculates the costs and benefits of personal and commercial LDVs, MDVs, HDVs, and school buses adopted between 2022-2030. A Reference scenario is modeled for each vehicle type which assumes that has an aggressive EV adoption forecast for Xcel's Wisconsin territory and assumes that Xcel does not implement any new EV programs. Xcel is proposing several EV programs for its Wisconsin service territory to support EV adoption goals, which are modeled as sensitivities and compared to Reference scenarios. The programs proposed by Xcel include funding, and for some charger types, ownership and operation of charging infrastructure in Xcel's Wisconsin service territory to be utilized by personal and commercial LDVs. Comparisons of scenarios with the proposed Xcel programs to the Reference scenarios allows for assessments of how the proposed programs impact EV lifetime costs and benefits from a driver, customer, and societal perspective. The Xcel proposed programs are described below:

- **Public DCFC Program**: Xcel will install and own new public DCFC stations in its Wisconsin service territory. Chargers are available for use by all personal and commercial LDVs, with preferential charging rates given to Xcel customers. Fifty percent of public DCFC stations installed as part of the program are considered incremental to the Reference forecast of DCFC stations in Xcel's Wisconsin service territory. The number of DCFC stations installed as part of the Public DCFC Program is shown in Table 2.2.

Table 2.2. Installation schedule for Xcel-owned public DCFC ports

	2024	2025	2026
Number of DCFC ports installed	8	12	60

- **L2 Charging Program**: Xcel will provide funding for the installation of Level 2 make-ready charging infrastructure at commercial fleet, multi-family housing (MFH), workplace, and public locations. The number of each charger type installed as part of the L2 Charging Program is shown in Table 2.3. For the purposes of the proposed program, workplace and public chargers are grouped together. This study assumes that 25% of the combined workplace and public chargers would be in workplace locations with the remaining 75% being in public locations.

Table 2.3. Installation schedule for Xcel-funded commercial, MFH, workplace, and public chargers

	2024	2025	2026
Number of commercial fleet ports installed	0	16	32
Number of MFH ports installed	261	410	772
Number of workplace ports installed	3	6	19
Number of public ports installed	10	19	58

The scenarios modeled are described below:

- **Personal LDV – Unmanaged Charging:** Personal LDVs are modeled to have unmanaged charging with a flat Xcel rate at residential and workplace locations.
  - Reference **scenario**
  - **Public DCFC + L2 Charging Programs scenario:** Personal LDVs have access to Xcel-owned public DCFC and Xcel-funded public L2 chargers. A portion of personal LDVs also have access to Xcel-funded MFH chargers. The induced effect of the increased number of chargers available to personal LDVs is represented in the personal LDV adoption forecast used for this scenario.
- **Personal LDV – Managed Charging:** Personal LDVs are modeled to have managed charging against Xcel's time-of-use rates for residential and workplace charging.
  - Reference **scenario**
  - **Public DCFC + L2 Charging Programs scenario:** similar to the Personal LDV Unmanaged Charging scenario
- **Commercial LDV – Managed Charging:** Commercial LDVs are modeled with managed charging against Xcel's time-of-use rates for all charging locations.
  - Reference **scenario**
  - **Public DCFC + L2 Charging Programs:** Commercial LDVs have access to Xcel-owned public DCFC and Xcel-funded commercial fleet and public L2 chargers. The induced effect of the increased number of chargers available to commercial LDVs is represented in the commercial LDV adoption forecast used for this scenario.
- **MDV – Managed Charging:** MDVs are modeled to have managed charging against Xcel's time-of-use rates for charging at depots.
  - Reference **scenario**

- **Commercial HDV – Managed Charging:** Commercial HDVs are modeled to have managed charging against Xcel's time-of-use rates for charging at depots.
    - Reference **scenario**
- **School Buses – Managed Charging:** School buses are modeled to have managed charging against Xcel's time-of-use rates for charging at depots.
    - Reference **scenario**
    - **V2G Charging:** All school buses adopted in the Reference scenario have the ability for V2G charging.

An overview of all modeled scenarios is shown in Table 2.4.

Table 2.4. Summary of vehicle types and charging management considered in Reference and Xcel Programs modeling scenarios

Vehicle Type	Reference Scenario	Xcel Programs Scenario
Personal LDV	Unmanaged	Unmanaged *Public DCFC + L2 Charging*
	Managed	Managed *Public DCFC + L2 Charging*
Commercial LDV	Managed	Managed *Public DCFC + L2 Charging*
MDV	Managed	n/a
HDV	Managed	n/a
School Bus	Managed	Managed
		V2G

3 Inputs and Assumptions

3.1 Driving and Charging Behavior

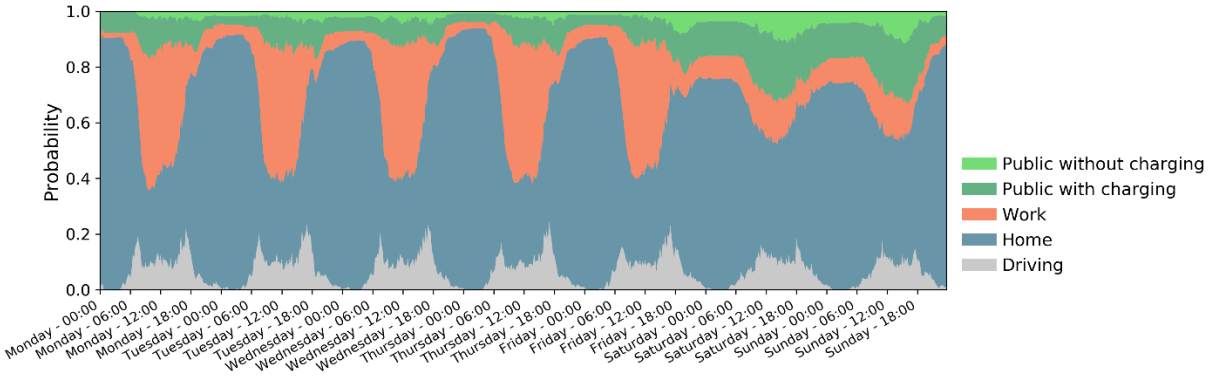
To simulate EV driving and charging behavior, thousands of vehicle trips from detailed trip datasets are utilized. For personal LDVs, trip data was extracted from the 2017 National Household Travel Survey (NHTS) (Federal Highway Administration, 2017). For commercial LDVs, the City of Chicago's survey of Transportation Network Company trip data was used (City of Chicago, 2022). For MDVs, commercial HDVs, and school buses, the NREL Fleet DNA database (NREL, 2019) and the national transit database (Federal Transit Administration, 2019) are used. Each dataset was cleaned, filtered for the specific vehicle type of interest, and where possible, filtered for Wisconsin trips only. Values for MDVs are aligned with data on parcel trucks, and values for commercial HDVs are aligned with data on transit buses. The origin and destination locations are categorized, and the mileage is adjusted slightly to align with Wisconsin-specific annual vehicle miles traveled (VMT) sources as shown in Table 3.1.

Table 3.1. Annual VMT for each vehicle class

Vehicle Type	Annual VMT
Personal LDV	11,124
Commercial LDV	40,545
MDV	14,175
Commercial HDV	42,500
School Bus	12,792

A statistical process using a Markov-Chain Monte Carlo algorithm is used to simulate driving profiles from vehicle trip data. This process simulates the probability that a driver is parked at possible destinations (home, work, public location) or is driving between two of the locations based on the vehicle trip data. The Markov-Chain Monte Carlo algorithm selects 500 sample drivers to balance computational time and sample diversity. Driving datasets collected over the past several years are assumed to be representative of driving profiles over the modeling horizon. An example weekly driving pattern for a group of drivers is shown in Figure 3.1.

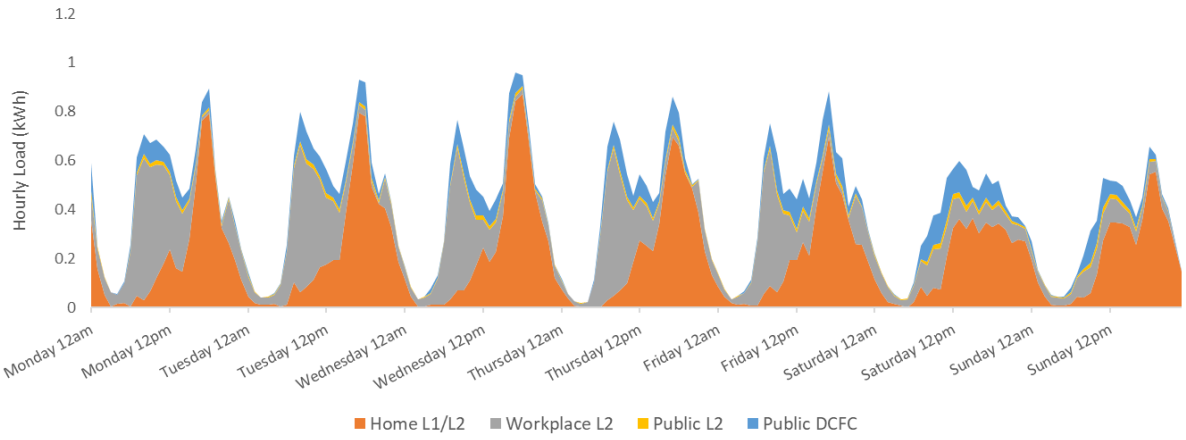
Figure 3.1. Sample one-week driving profile for personal LDVs



Drivers who had travel days that could not be completed using the EV and charging access options assigned to them are deemed to have "unserved driving energy" and are dropped from the sample to generate the final aggregated charging loads. This implies that drivers with driving patterns where they cannot complete their travel day with the EV and charging access options assigned to them would not purchase this EV type and would not therefore contribute to the final load. A minimum dwell time of 15 minutes was set for charging; if the driver was parked at a destination for less time than this time, no charging was assumed to occur.

Due to the computational intensity of simulating driving and charging behavior, only a representative winter and summer week in 2025 was simulated. The resulting load shapes are scaled based on EV adoption forecasts between 2022 and 2030. A sample week of unmanaged personal LDV charging is shown in Figure 3.2 below. The charging profile shown reflects a per vehicle average across the entire personal LDV population and is used with the EV adoption forecast to create a population-level charging profile.

Figure 3.2. Sample charging profile for one week for an unmanaged personal LDV



3.2 EV Adoption

In a separate study, Xcel engaged Guidehouse to forecast EV adoption in its Minnesota service territory under a scenario that reflects the state of Minnesota's goal of having 20% of all light-duty vehicles on the road be electric by 2030. Reference scenario EV adoption is determined based on the assumption that Xcel programs are responsible for a share of EVs adopted in the Guidehouse adoption forecast through the induced effects of increased charger availability. Based on a Cornell University Study, every 10% increase in L2 or DCFC ports on average resulted in an 8.4% increase in EV adoption (Li, Tong, Xing, & Zhou, 2016). The Guidehouse adoption forecasts are adjusted downward to produce a Reference EV adoption forecast that has removed the induced effects of the chargers added in the Xcel programs. The cumulative EV adoption in 2022,2025, and 2030 for each vehicle class and scenario is shown in Table 3.2.

Table 3.2. Cumulative EV adoption in 2022, 2025, and 2030 for each vehicle class and scenario

Vehicle Class	Scenario	2022	2026	2030
Personal LDVs	Reference	1,973	11,125	32,017
Personal LDVs	Xcel Programs	1,973	12,315	41,569
Commercial LDVs	Reference	162	806	2,063
Commercial LDVs	Xcel Programs	162	850	2,520
MDVs	Reference	3	203	904
Commercial HDVs	Reference	1	139	849
School Buses	Reference	0	13	53

3.2.1 Charging Access

To model charging behavior, the driving population is segmented by EV type and the locations that each vehicle type has access to charging. For personal LDVs, six charging access types are used based on a combination of access to home and/or workplace charging. All personal LDVs are assumed to have access to public charging. Information on population and housing type from the American Community Survey (ACS) is used to estimate the number of households by housing type (detached, house, attached house, apartment building), the percentage of each household type that owns a car, and the percentage of car owners that drive to work (U.S. Census Bureau, 2016). A report from University of California, Davis is used to estimate the availability of home charging at each type of housing and the percentage of vehicles that would charge at home, at work, and on public chargers (Nicholas & Tal, 2017).

Commercial LDVs are modeled as having access to depot charging and public chargers. MDVs, commercial HDVs, and school buses are assumed to have charging access limited to depots.

3.2.2 EV Types

The driving population was also segmented by the type of EV driven. Four EV types are modeled for personal LDVs: short- and long-range BEVs and PHEVs. The split between BEVs and PHEVs in the personal LDV population is based on the Bloomberg New Energy Finance EV outlook for 2025 (BNEF, 2019). The split between short- and long-range EV types is based on forecasts from NREL (Kontou, Melaina, & Brooker, 2018). The percentage of the vehicle population represented by each vehicle type in the model is shown in Table 3.3.

Table 3.3. Vehicle and charger parameters of personal LDVs

Vehicle Type	Electric Range (miles)	Battery Size (kWh)	Max AC Charging Power (kW)	Max DC Charging Power (kW)	Percent of Modeled Population - 2025
Long-range BEV	400	135	20	150	43%
Short-range BEV	150	51	20	50	32%
Long-range PHEV	60	20	3.6	0	6%
Commercial LDV	25	8	3.6	0	19%

The normalized charging profiles determined for 2025 are scaled using the relative proportion of each of the four personal LDV types in each year from 2022-2030 to give a representative charging profile based on the shift in BEV and PHEV ranges and populations over time.

Two types of commercial HDVs are modeled: a short- and long-range transit bus. MDVs and school buses only model one type of EV. Vehicle parameters for each MDV and HDV type modeled are shown in Table 3.4.

Table 3.4. Vehicle and charger parameters of MDVs and HDVs

Vehicle Type	Electric Range (miles)	Battery Size (kWh)	Max DC Charging Power (kW)	Max AC Charging Power (kW)	Percent of Modeled Population - 2025
MDV	149	100	20	50	100%
Short-range Transit Bus	289	500	100	100	75%
Long-range Transit Bus	578	1000	200	200	25%
School Bus	110	200	20	20	100%

3.3 Vehicle Parameters

LDV, MDV, and Commercial HDV are assumed to have a 12-year lifetime based on 2022 findings from S&P Global . School buses are assumed to have a 15-year lifetime .

Personal and commercial LDVs are modeled to have a minimum state of charge of 25% and a maximum state of charge of 95%. MDVs, commercial HDVs, and school buses are assumed to have a minimum state of charge of 0% and maximum state of charge of 100%. If school buses have V2G charging, then a minimum state of charge of 20% and maximum state of charge of 95% is assumed.

3.3.1 Vehicle Efficiency

Short-range BEVs and short- and long-range PHEVs are expected to have a nameplate efficiency of 0.219 kWh/mile while long-range BEVs are expected to have a nameplate efficiency of 0.224 kWh/mile (U.S. Department of Energy, 2020; Auto Alliance, 2020). In reality, EV efficiency is dependent on ambient temperature. During the development of load shapes, temperature data for Wisconsin is used to adjust vehicle efficiency. Empirical data is used to determine the relationship between temperature and vehicle efficiency (GeoTab). Once the effects of temperature are taken into effect, short-range BEVs and short- and long-range PHEVs have an average efficiency of 0.300 kWh/mile and long-range BEVs have an average efficiency of 0.307 kWh/mile.

MDVs are assumed to have a nameplate vehicle efficiency of 0.67 kWh/mile based on a study from Eudy & Jeffers (Eudy & Jeffers, 2018). With temperature effects, the MDV average efficiency is 0.92 kWh/mile. Commercial HDVs are modeled to have a nameplate of efficiency of 1.73 kWh/mile based on current nameplate transit bus efficiencies and E3 projections on technology improvements over time. With temperature effects, commercial HDV efficiency is an average of 2.37 kWh/mile. School buses are assumed to have a nameplate efficiency of 1.81 kWh/mile, which becomes 2.07 kWh/mile once temperature effects are incorporated (Eudy & Jeffers, 2018).

3.3.2 Incremental Vehicle Costs

EVs currently have higher upfront purchase costs than similar ICE vehicles, primarily due to EV battery costs. The incremental upfront purchase price of EVs relative to similar ICE vehicles is expected to decline over time and get close to reaching cost parity with ICE vehicles by 2030. E3 used upfront cost projections from the ICCT for both EV and ICE personal LDVs in the U.S. to determine incremental upfront costs of both BEV and PHEVs for each year in the modeling horizon (ICCT, 2019). An average of each vehicle type's upfront costs weighted by the portion of each vehicle type in the personal LDV population was used in comparison with ICE vehicle costs.

MDV incremental upfront vehicle costs are derived from 2019 upfront costs for electric and ICE parcel trucks and forecasts of 2030 costs from Ricardo Strategic Consulting (Kuhn, 2013). For MDVs and HDVs including school buses, all electric vehicles are expected to be battery electric vehicles.

Electric commercial HDV upfront costs are derived from Bloomberg New Energy Finance (NEF) forecasts of electric transit bus costs and are adjusted for higher costs expected for HDVs with larger batteries than represented in the Bloomberg study. Battery cost adjustments come from ICCT estimates of $/kWh battery costs (ICCT, 2019). Transit buses are also expected to need battery replacements because of high annual mileage. E3 estimated a frequency for battery replacements in transit buses of four years, compared to ICE vehicle replacements of 12 years.

Electric school bus costs are based on an analysis of manufacturing data of the Vermont Energy Investment Corporation (VEIC, 2020) and research by the University of Delaware (Noel & McCormack, 2014).

Incremental upfront vehicle costs for each vehicle type are given in Table 3.5.

Table 3.5. Incremental upfront vehicle costs (2022$)

Vehicle Type	2022	2026	2030
Personal and Commercial LDV (BEV)	$14,535	$8,081	$1,848
Personal and Commercial LDV (PHEV)	$7,694	$6,864	$2,793
MDV	$24,182	$13,091	$2,000
Commercial HDV	$206,214	$161,835	$125,820
School Bus	$214,750	$217,023	$219,295

3.3.3 Tax Credits

Personal LDV drivers in Wisconsin are assumed to have access to a federal tax credit. A federal tax credit of $7,500 is assumed for BEVs. PHEVs are eligible for a lower tax credit. Based on data of tax credits received by current PHEV models, an average tax credit of $5,985 was assumed to be available to PHEVs. Tax credits phase out once over 200,000 vehicles have been sold by a given automaker. E3 assumes that tax credits will phase out on average by 2023 (Internal Revenue Services, 2020).

3.4 Charger Parameters

3.4.1 Charger Types

Load shape modeling uses assumptions on the power level and efficiency of chargers used by each vehicle class. For personal LDVs, residential chargers represented in load shapes are L2 chargers with 6.6 kW charger levels (i.e., no L1 chargers are represented in load shapes). Personal LDVs also have access to 6.6 kW chargers at workplace and public locations. In addition, personal LDVs have access to public DCFC with 150 kW charger levels. Some personal LDV types may be constrained by charging power limits based on the LDV type and may not be able to access the full charger power. For example, PHEVs can charge with AC chargers at a maximum of 3.6 kW, so cannot access the full charging power of home, workplace, and public L2 AC chargers. Table 3.6 summarizes the charger power assumed for each vehicle class and charger type.

Table 3.6. Charger power level for each vehicle class and charger type (kW)

Charger Type	Personal LDV	Commercial LDV	MDV	Commercial HDV	School Bus
Residential L2	6.6	6.6	n/a	n/a	n/a
Workplace L2	6.6	n/a	n/a	n/a	n/a
Public L2	6.6	6.6	n/a	n/a	n/a
Public DCFC	150	150	n/a	n/a	n/a
Depot	n/a	6.6	7.2	150	50

3.4.2 Charger Network Density

To capture EV access to each charger type given charger availability and congestion, EV to EV charger ratios are an input for the load shape modeling. For Reference scenario personal LDV access to home charging, a ratio of 1.34 EVs for every charger is assumed. For Reference scenario workplace, public L2, and public DCFC, E3 used the Xcel charger forecasts derived from NREL's EVI-Pro Lite model, which provides a state-specific estimation of the number of each type of charger required to support a given EV adoption forecast (NREL, 2018). EV to EV charger ratios for each vehicle class are summarized in Table 3.7.

Table 3.7. Reference scenario EV to EV charger ratios by vehicle class and charger type

Charger Type	Personal LDV	Commercial LDV	MDV	Commercial HDV	School Bus
Residential L2	1.34	1	n/a	n/a	n/a
Workplace L2	20	n/a	n/a	n/a	n/a
Public L2	21	21	n/a	n/a	n/a
Public DCFC	97	97	n/a	n/a	n/a
Depot	n/a	1	2	2	5

The proposed Xcel programs add public DCFC, residential, workplace, commercial fleet, and public L2 chargers. As a result of the additional chargers and the induced effect of the additional EV chargers on EV adoption, there is a shift in the EV to charger ratios for the Xcel Programs scenarios. EV to charger ratios for each vehicle class in the Xcel Programs scenarios are summarized in Table 3.8.

Table 3.8. Xcel Programs Scenario EV to charger ratios by vehicle class and charger type

Charger Type	Personal LDV	Commercial LDV	MDV	Commercial HDV	School Bus
Residential L2	1.25	0.99	n/a	n/a	n/a
Workplace L2	19	n/a	n/a	n/a	n/a
Public L2	19	19	n/a	n/a	n/a
Public DCFC	86	86	n/a	n/a	n/a
Depot	n/a	1	2	2	5

The additional chargers outpace the increased adoption that is assumed in the Xcel Programs scenario, resulting in lower EV to charger ratios for Personal and Commercial LDVs.

3.4.3 Charger Costs

Charging infrastructure costs in this analysis are based on three components: Electric Vehicle Supply Equipment (EVSE) hardware costs, costs associated with the electrical infrastructure ("make-ready" costs), and the O&M costs for continued operation of the charger over its lifetime.

The costs of charging infrastructure are outlined in Table 3.9. These costs are based on Xcel data and assumptions. MFH residential chargers typically have higher electrical infrastructure costs than single-family home (SFH) costs. Residential L2 costs used in modeling represent an average of SFH and MFH charger costs weighted by the number of vehicles adopted in each home type. Residential L2 costs are weighted with Residential L1 charger costs based on the assumption that 50% of residential chargers will be L2 and 50% will be L1. Residential L1 chargers are assumed to incur negligible charging infrastructure costs.

Table 3.9. Charger costs (2022$)

Charger Type	EVSE Cost ($)	Make-ready Cost ($)	O&M Cost ($)
Residential*	$625	$603	$31
Workplace L2	$4,000	$8,000	$320
Public L2	$4,000	$8,000	$320
Public DCFC	$68,000	$27,000	$7,610
Depot – Commercial LDV	$750	$7,850	$251
Depot – MDV	$750	$7,850	$251
Depot – Commercial HDV	$68,000	$27,000	$7,610
Depot – School Bus	$45,000	$12,500	$4,875

*Residential charger costs represent a weighted average between L1 and L2 charger costs and between SFH and MFH charger costs

3.4.4 *Distribution Upgrade Costs*

Increased load from EV charging is assumed to incur distribution upgrade requirements. The costs of these distribution upgrades are calculated as a per vehicle cost based on the total cost of distribution upgrades and an assumption for the number of vehicles adopted per distribution upgrade required. Distribution upgrades are expected to be required for each vehicle type.

The distribution upgrade costs are paid for in Xcel's revenue requirement (i.e., not as one-time upfront costs but instead as annual payments over the lifetime of the distribution system). Distribution systems have longer lifetimes than those for the vehicles adopted in the modeling horizon; therefore, only revenue

requirement payments made during the lifetime of vehicles in the modeling horizon are included in this study. A NPV of revenue requirement payments over the lifetime of vehicles in the modeling horizon is used to represent distribution upgrade costs for each charger type. Distribution upgrade costs are outlined in Table 3.10.

Table 3.10. Distribution upgrade costs

Charger Type	Charge Management	Distribution Upgrade Cost (2022$/vehicle)
Residential L2	Unmanaged	$842
	Managed	$716
Workplace L2	Both	$3,959
Public L2	Both	$3,959
Public DCFC (LDV)	Both	$36,600
Depot L2 – Commercial LDV	Managed	$3,959
Depot L2 – MDV	Managed	$3,959
Depot – Commercial HDV	Managed	$36,600
Depot – School Bus	Managed	$12,960

3.4.5 Avoided Fuel Costs

For avoided fuel costs, the amount of fuel an ICE vehicle would have used under the same circumstances over the lifetime of the vehicle is calculated. This fuel consumption is multiplied by the costs of fuel in each year to determine avoided fuel costs. The average annual fuel consumption avoided per EV per year is assumed to decrease over time according to the relative improvement in ICE vehicle fuel efficiency projected by NREL in their Light-Duty Vehicle Attribute Projections prepared for the California Energy Commission (Kontou, Melaina, & Brooker, 2018). Fuel economy data for other vehicle types was taken from the Transportation Energy Efficiency tables of EIA's Annual Energy Outlook for 2020 (U.S. Energy Information Administration, 2020). The assumed fuel efficiencies per vehicle category are shown in Table 3.11.

Table 3.11. Fuel economy assumptions in miles per gallon (mpg)

Year	Personal and Commercial LDV	MDV	Commercial HDV and School Buses
2022	34.5	10.5	7.5
2025	36.5	11.0	7.8
2030	37.4	11.6	8.2

Gasoline and diesel forecasted prices are derived from the EIA Short-Term Energy Outlook and Annual Energy Outlook 2020 and include an inflation rate of 2% per year to convert them to nominal dollars. The EIA's current Short-Term Energy Outlook considers price impacts of COVID-19 in 2022 and 2023 (U.S.

Energy Information Administration, 2020). Table 3.12 shows the projected fuel costs for both gasoline and diesel for several modeled years (U.S. Energy Information Administration, 2020).

Table 3.12. Fuel price forecast (nominal $)

Year	Gasoline ($/gallon)	Diesel ($/gallon)
2022	$3.17	$3.68
2025	$2.75	$3.29
2030	$3.32	$3.96
2035	$3.87	$4.53
2040	$4.53	$5.18

3.4.6 Avoided O&M Costs

To calculate avoided O&M costs, E3 multiplied the annual mileage for different vehicle types by an estimation of the per mile difference between maintenance costs for ICE and electric vehicles. To inform these estimates for LDVs, E3 used data provided by the International Council on Clean Transportation, estimating conventional vehicle maintenance costs for LDVs at $0.074 per mile versus $0.031 per mile for their electric counterparts (ICCT, 2019).

For commercial HDVs, using electric transit buses as a focus, maintenance costs are considered significantly less expensive due to the relatively simple drive system compared to diesel buses. E3 assumed maintenance costs of $0.47 per mile for battery buses and $0.72 per mile for diesel buses, averaged from multiple sources of data. Electric bus maintenance costs are derived from an NREL study finding a maintenance cost of $0.39 per mile (NREL, 2018b) and from a recent study on 16 electric buses assuming $0.55 per mile (Frontier Group, US Pirg Education Fund, 2019). For diesel buses, NREL estimated $0.44 per mile (NREL, 2018b), while the Bus Lifecycle Cost Model developed by the US Department of Transportation estimated the maintenance costs of conventional diesel transit buses at a relatively conservative estimate of $1.00 per mile (US DOT Volpe Center, 2019).

3.5 Rates and Utility Costs

3.5.1 Utility Tariffs and Charging Costs

Different rates are used for unmanaged versus managed charging scenarios and where the implementation of Xcel's programs would impact rates. For the unmanaged charging scenarios, residential charging locations are assigned Xcel Energy's standard residential Rg-1 rate. Workplace and public charging locations are assigned the general service time-of-day (TOD) rate Cg-7 (energy-only). For the managed charging scenario, the residential EV time-of-use (TOU) rate EVR-1 is applied to charging at residential locations. The energy-only Cg-7 rate is again applied at workplace locations and a demand-inclusive Cg-7 is applied to charging at public and depot locations for the site hosts (Northern State Power Company, 2020). Twenty-five percent of personal LDV drivers are assumed to have access to free charging

at workplaces, meaning that the workplace rather than the driver pays the energy-only Cg-7 rate to the utility.

All EV chargers are assumed to be separately metered and therefore building loads are not included when calculating demand charges for the commercial rate since the intention is to measure the impact of EV charging on utility bills versus a counterfactual where an ICE vehicle is owned. Energy and demand charges are assumed to grow at the inflation rate of 2% per year.

For personal vehicles, the rates paid by the drivers are distinguished from the electricity bills paid by charging station site hosts for public locations. Charging prices for public L2 chargers and DCFCs were assigned to drivers based on Electrify America rates provided by Xcel, reflecting the charging costs EV drivers pay at public locations. These rates are often much higher than the commercial rate paid by charging station site hosts or owners. This difference is reflected in the cost of charging to drivers in the PCT and the utility revenue for customers in the RIM.

For school buses with V2G charging, buses are assumed to charge at the same rates as used in the scenario with one-directional charging, or V1G. Under the V2G scenario, school buses are also able to discharge energy stored in the vehicle battery back to the grid and receive compensation for the energy discharged. There is not currently a rate that exists for vehicles that discharge energy to the grid. Therefore, a proxy was used that combines Xcel's A-25 rate used for imports and the marginal costs of capacity. The illustrative rate used for V2G discharging is shown in Table 3.13.

Table 3.13. Illustrative Rate Used for School Bus V2G Discharge (nominal $/kWh)

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
2	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
3	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
4	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
5	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00
6	$ 0.00	$ 0.00	$ 0.01	$ 0.02	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.01	$ 0.02	$ 0.00	$ 0.00
7	$ 0.00	$ 0.00	$ 0.02	$ 0.09	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.02	$ 0.08	$ 0.00	$ 0.00
8	$ 0.00	$ 0.00	$ 0.03	$ 0.15	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.03	$ 0.15	$ 0.00	$ 0.00
9	$ 0.00	$ 0.00	$ 0.04	$ 0.18	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.04	$ 0.18	$ 0.00	$ 0.00
10	$ 0.16	$ 0.16	$ 0.18	$ 0.28	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.18	$ 0.27	$ 0.16	$ 0.16
11	$ 0.16	$ 0.16	$ 0.17	$ 0.20	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.17	$ 0.20	$ 0.16	$ 0.16
12	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16
13	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.17	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16
14	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.17	$ 0.17	$ 0.16	$ 0.16	$ 0.16	$ 0.16
15	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.18	$ 0.18	$ 0.17	$ 0.16	$ 0.16	$ 0.16
16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.19	$ 0.18	$ 0.17	$ 0.16	$ 0.16	$ 0.16
17	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.16	$ 0.19	$ 0.19	$ 0.17	$ 0.16	$ 0.16	$ 0.16
18	$ 0.16	$ 0.16	$ 0.16	$ 0.18	$ 0.16	$ 0.16	$ 0.18	$ 0.18	$ 0.16	$ 0.18	$ 0.16	$ 0.16
19	$ 0.16	$ 0.16	$ 0.17	$ 0.25	$ 0.16	$ 0.16	$ 0.17	$ 0.17	$ 0.17	$ 0.25	$ 0.16	$ 0.16
20	$ 0.16	$ 0.16	$ 0.18	$ 0.31	$ 0.17	$ 0.16	$ 0.17	$ 0.17	$ 0.18	$ 0.31	$ 0.17	$ 0.16
21	$ 0.16	$ 0.16	$ 0.18	$ 0.34	$ 0.17	$ 0.16	$ 0.16	$ 0.16	$ 0.19	$ 0.34	$ 0.17	$ 0.16
22	$ 0.00	$ 0.00	$ 0.02	$ 0.13	$ 0.01	$ 0.00	$ 0.00	$ 0.00	$ 0.02	$ 0.13	$ 0.01	$ 0.00
23	$ 0.00	$ 0.00	$ 0.00	$ 0.04	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.04	$ 0.00	$ 0.00
24	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00

3.5.2 Electricity Supply Costs

Utility electricity supply costs are calculated by multiplying the hourly marginal electricity supply costs with hourly electric EV charging load. Recall that this study focuses only on adoption between 2022 and

2030, but to account for costs and benefits over each EV's lifetime, electric supply costs are calculated for charging load out to 2042 for vehicle types with a 12-year lifetime and 2045 for vehicles with a 15-year lifetime, when it is assumed that all EVs adopted by 2030 will have been retired.

The marginal electricity supply cost used in this analysis is comprised of four components. Xcel Energy provided marginal energy costs ($/MWh), marginal capacity costs ($/MWh), avoided distribution costs ($/kW-year), and avoided transmission costs ($/kW-year) from 2022 to 2045.

To allocate the kW-year generation and transmission capacity costs to hourly values in $/kWh, the PCAF (Peak Capacity Allocation Factor) methodology was used.[7] Using the hourly net system load from 2022 to 2045, a threshold (MW) corresponding to the top 250 net load hours was selected. In hours where the net load exceeds the threshold, the exceeded load is divided by the total exceeded load for the 250 hours to create an hourly PCAF allocation factor that sums to one over the year. For years beyond 2035, the team used the 2035 PCAF shape.

$$Exceeded\ load_t = min\ (0,\ load_t - the\ 250^{th}\ top\ load\ in\ a\ year)$$

$$PCAF_t\ (\%) = Exceeded\ load_t\ /\ total\ exceeded\ load\ in\ a\ year$$

$$Capacity\ value_t\ (\$/kWh) = PCAF_t\ (\%) * capacity\ value\ (\$/kW\text{-}year)$$

This same methodology is applied to allocate the distribution capacity value using a typical 2019 residential distribution load provided by Xcel Energy.

3.6 Avoided Emissions

Avoided carbon emissions are calculated based on the difference between electric vehicle emissions from charging load and gasoline or diesel combustion. E3 calculated avoided carbon emissions for ICE vehicles based on 0.0085 metric tons/gallon of gasoline and 0.01098 metric tons/gallon of diesel emissions intensities. Emissions from electric vehicles are calculated based on hourly emissions provided by Xcel and hourly charging load shapes. EV emissions are expected to decrease over time following the growth of renewables in Xcel Energy's generation mix. For this study, E3 looked at average hourly electricity emissions provided by Xcel Energy between 2019 and 2042 which decline by more than 70% over this period.

To convert avoided emissions to costs, E3 calculated an average societal cost of carbon of $33.67/metric ton CO_2. The societal cost of carbon was a weighted average of vehicle population andthe Wisconsin Public Service Commission's adopted CO_2 environmental and regulatory cost values for each year.

[7] The methodology was first developed by PG&E in 1993 (California Public Utilities Commission, 2016) and has since been used in various regulatory reports

4 Results

The first results section describes the total impacts for all EVs adopted in Xcel Energy's Wisconsin service territory between 2022 and 2030 for the Reference and Xcel program scenarios. Program impacts are evaluated through the net benefits resulting from the lifetime costs and benefits of EVs adopted over the modeling horizon. Each scenario and its contributing costs and benefits are explored in greater detail in subsequent sections. Cost-benefit results are shown on both a total NPV and an average per vehicle adopted basis. The total value results show the magnitude of costs and benefits from all EVs adopted in Xcel's Wisconsin service territory. The average value per vehicle results depict the costs and benefits that an average individual driver will face.

4.1 Total Transportation Electrification Results

The total results for all EVs adopted in Xcel's Wisconsin service territory show that transportation electrification can generate significant benefits to customers and society. The study finds that in the Reference scenario, society, which for the purposes of this study is the state of Wisconsin, could receive net benefits between $59 million and $69 million for electrifying personal and commercial LDVs, MDVs, commercial HDVs, and school buses depending on if personal LDVs have unmanaged or managed charging.[8] Xcel customers in Wisconsin could benefit between $161 million and $171 million from the net increase in utility revenues from EV charging.

Drivers and fleet owners would incur net costs between $53 million and $73 million. In considering the aggregate net costs from the driver perspective, it is important to note that Commercial HDVs are a large contributor to the high net costs for drivers. Personal and Commercial LDVs and MDVs have positive net benefits for drivers. While school buses also have net costs, it is the large magnitude of the Commercial HDV net costs that drives the total net costs for vehicle electrification from the driver perspective. The large net costs for Commercial HDVs are due to high incremental upfront costs relative to ICE counterparts and high electric rates that contribute to large utility bills, as shown in Sections 4.5 and 4.6.

Customer and societal benefits decrease with the implementation of Xcel's programs but remain positive, thereby continuing to offer customers and society net benefits from vehicle electrification in Xcel's Wisconsin service territory. Customer net benefits decrease by between $20 million and $23 million, and societal net benefits decrease by between $0.5 million and $3.5 million. However, customers still benefit between $138 million and $151 million, and society benefits between $56 million and $68 million. Driver net benefits increase by between $28 million and $33 million but remain negative with the addition of Xcel's programs.

[8] Societal benefits are $59 million if personal LDVs have unmanaged charging and $69 million if personal LDVs have managed charging. Ranges provided in subsequent results reflect the difference in benefits from each perspective (societal, customer, or participant) hinging on whether charging is managed for personal LDVs. Drivers and society see greater benefits from managed charging, meaning that managed personal LDV charging represents the higher value of the range of results, while customers have reduced benefits from managed charging, meaning that managed personal LDV charging represents the lower value of the range of results.

Table 4.1, Table 4.2, and Table 4.3 summarize the total NPV of benefits from each cost test perspective evaluated for all scenarios. The totals shown sum net benefits across all vehicle types modeled, representing the total costs and benefits of these transportation electrification scenarios across Xcel's WI service territory.

Table 4.1 shows the net benefits from the driver or fleet owner perspective. As discussed previously, the total net costs are largely due to the large magnitude of Commercial HDV net costs. Results show that a personal LDV driver can increase their net benefits by moving from unmanaged to managed charging. This is largely due to the bill savings from shifting charging to off-peak rate periods under managed charging. Xcel programs increase the net benefits for personal and commercial LDVs due to the reductions in charging infrastructure costs that drivers must pay when adopting an EV.

Table 4.1. Summary of PCT net benefit results ($M)

Case	Reference Scenario		Xcel Programs	
Personal LDV	$28.4 (unmanaged)	$48.2 (managed)	$46.6 (unmanaged)	$72.0 (managed)
Commercial LDV	$12.9		$22.2	
MDV	$5.7		$5.7	
Commercial HDV	-$111.0		-$111.0	
School Bus	-$9.2		-$9.2	
Total	**-$73.2**	**-$53.4**	**-$45.7**	**-$20.3**

Table 4.2 shows net benefits from the customer perspective. All Reference scenarios from the customer perspective have net benefits. Managed charging reduces the net benefits for personal LDVs since the utility bill reductions that drivers can unlock from TOU rates and shifting their charging is greater than the utility savings in energy supply costs.

The Xcel programs reduce customer net benefits for personal and commercial LDVs. Net benefits for unmanaged personal LDVs decrease from $44.8 million in the Reference scenario to $31.6 million in the Xcel programs scenario. For commercial LDVs, customers have net costs with the implementation of Xcel's programs. Net benefits for managed personal LDVs decrease from $34.9 million in the Reference scenario to $19.1 million in the Xcel programs scenario, and net benefits for commercial LDVs decrease from $6.8 million in the Reference scenario to -$0.2 million in the Xcel programs scenario. This reduction in net benefits for cases with the Xcel programs occurs because charging infrastructure costs incurred as part of the program are greater than the customer benefits that result from increased EV adoption. Customer net benefits remain positive when considered across all vehicle types.

Table 4.2. Summary of RIM net benefit results ($M)

Case	Reference		Xcel Programs	
Personal LDV	$44.8 (unmanaged)	$34.9 (managed)	$31.6 (unmanaged)	$19.1 (managed)
Commercial LDV	$6.8		-$0.2	
MDV	$6.9		$6.9	
Commercial HDV	$109.8		$109.8	
School Bus	$2.8		$2.8	
Total	**$171.1**	**$161.3**	**$151**	**$138.4**

Table 4.3 shows the net benefits from a societal perspective. Apart from school buses, EV adoption for all vehicle types and scenarios has net benefits for society. Managed charging achieves higher societal net benefits for both the Reference and the Xcel Programs scenarios since the benefits for each EV adopted, such as avoided vehicle gasoline and O&M savings, outweigh costs for each EV, including charging infrastructure and energy supply costs. A breakdown of the benefits and costs that contribute to societal net benefits is shown in greater detail for each vehicle type in the following sections.

School buses have net costs to society primarily due to high incremental upfront costs. While both commercial HDV and school buses have net costs from the driver perspective, commercial HDVs have net benefits in the societal perspective. Commercial HDV avoided gasoline and O&M savings do not outweigh the utility bills in the driver perspective but exceed the energy supply costs that are included in the societal perspective.

Table 4.3. Summary of SCT net benefit results ($M)

Case	Reference		Xcel Programs	
Personal LDV	$10.4 (unmanaged)	$20.2 (managed)	$0.6 (unmanaged)	$13.4 (managed)
Commercial LDV	$34.2		$40.5	
MDV	$14.2		$14.2	
Commercial HDV	$6.5		$6.5	
School Bus	-$6.3		-$6.3	
Total	**$59.0**	**$68.6**	**$55.5**	**$68.4**

In addition to providing direct economic benefits, vehicle electrification in Xcel's Wisconsin service territory reduces emissions. With either managed or unmanaged charging in the Reference scenario,

vehicle electrification across all vehicle types reduces emissions by 0.82 million metric tons CO_2 over the lifetime of all vehicles adopted between 2022 and 2030. Vehicle electrification also reduces NO_x by 340 metric tons and PM_{10} by 70 metric tons.

Xcel's proposed programs can help increase this number by facilitating the adoption of more EVs due to Xcel ownership and funding of charging infrastructure. The emissions savings in the scenario with Xcel's programs increases to 0.96 million metric tons CO_2, 400 metric tons NO_x, and 80 metric tons PM_{10} over the vehicles' lifetimes.

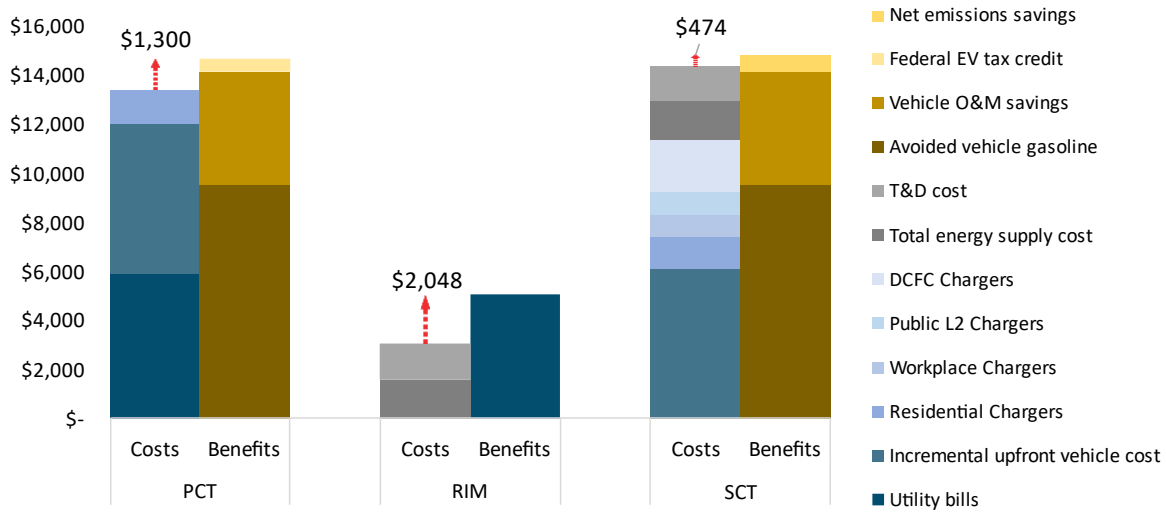
4.2 Personal LDVs

Personal LDVs are the largest contributor to vehicle electrification benefits in Xcel's Wisconsin service territory because they make up 90% of the vehicles adopted over the modeling horizon. Personal LDVs are modeled under a Reference scenario and a scenario with the Public DCFC and L2 Charging programs for both unmanaged and managed charging. The managed and unmanaged cases represent two extreme scenarios, where in reality, the population of personal LDVs in Xcel's Minnesota service territory is likely to have a split of unmanaged and managed charging; therefore, the observed net benefits will likely be between the 100% unmanaged charging and 100% managed charging scenarios.

4.2.1 Reference Scenario

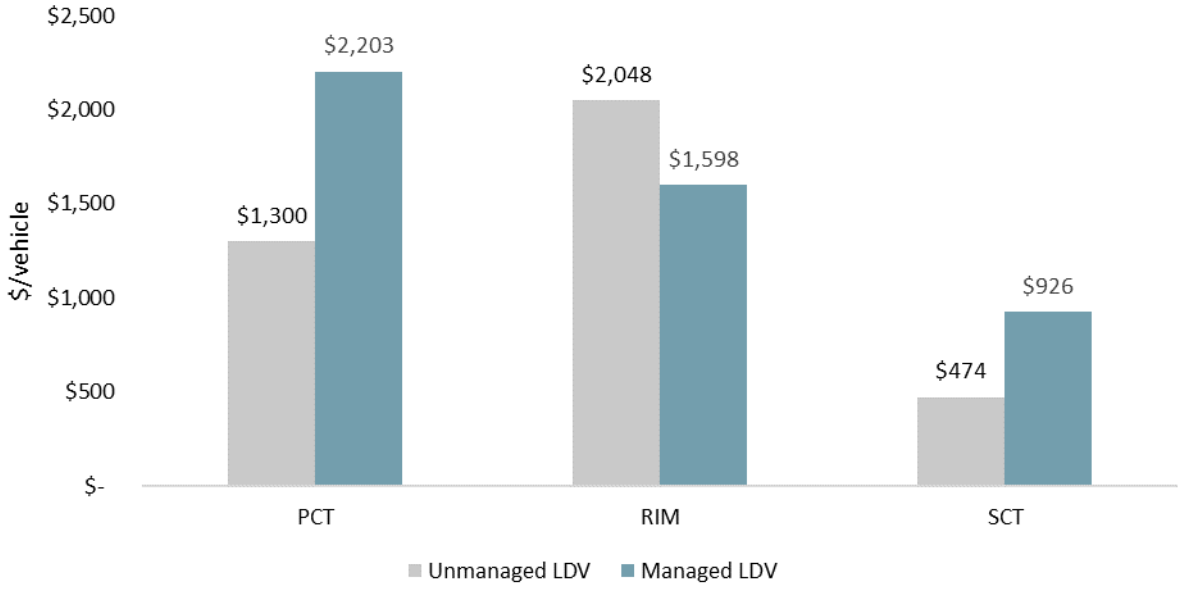
Personal LDV drivers with unmanaged charging achieve NPV net benefits of $1,300 per vehicle over the vehicle lifetime. As shown in Figure 4.1, net benefits are driven largely by avoided gasoline costs and vehicle O&M savings; these benefits are larger than the costs of utility bills for EV charging, incremental upfront vehicle costs, and charging infrastructure costs. The customer net benefit is $2,048 per vehicle over the vehicle lifetime. The societal net benefit is $474 per vehicle, which includes a social cost of carbon on the net avoided CO2 of 20 metric tons over the vehicle lifetime. Costs and benefits for each cost test perspective are shown in Figure 4.1.

Figure 4.1. Average costs and benefits of unmanaged personal LDV electrification per vehicle adopted from 2022-2030 (Reference scenario)



Comparing the unmanaged and managed charging scenarios, managed charging increases driver net benefits from electrifying a personal LDV by 69% over the vehicle lifetime, or a net present value of $903 over the vehicle lifetime, as seen in Figure 4.2. Managed charging also increases societal benefits by 95% but decreases customer benefits by 22% over an average vehicle's lifetime.

Figure 4.2. Per vehicle net benefit comparison of personal LDV unmanaged vs. managed charging (Reference scenario)



Moving from unmanaged to managed charging alters the hourly charging load shape, which primarily affects utility bills and electric supply costs. With managed charging, drivers save on utility bills by shifting

their charging to off-peak TOU periods, which offers savings relative to charging on flat rates in the unmanaged charging scenario. An average personal LDV driver in Wisconsin reduces their utility bill by 15%, or $904 over the vehicle lifetime, by moving from unmanaged to managed charging.

Managed charging also increases societal net benefits relative to unmanaged charging from charging at times with lower electric supply costs. Electric supply costs decrease by 21%, or $329 over the vehicle lifetime, when a driver moves from unmanaged to managed charging. In addition, fewer distribution upgrades are required if all personal LDVs have managed charging instead of unmanaged charging, which lowers societal costs. Based on existing and forecasted trends in each charging scenario's contribution to peak load, Xcel assumes that a distribution upgrade will be required for every 17 unmanaged LDVs adopted and every 20 managed LDVs adopted. Personal LDV total per vehicle transmission and distribution costs decrease by 9%, or $123, under managed charging relative to unmanaged charging.

Managed charging results in a decrease in customer net benefits since the reduction in driver utility bills is greater than the reduction in electric supply costs. The relationship between volumetric rates and avoided utility costs, as well as the timing of charging, will affect whether customers see an increase or decrease in net benefits charging managed by TOU rates. It is important to note, however, that the modeling of TOU rates used in this analysis has limitations; this analysis uses the current peak and off-peak periods and rates, which are designed to align with today's loads and electric supply costs. The loads, including additional loads from EVs, and electric supply costs of the future may not be as well-aligned with today's TOU rates. Finally, there are more sophisticated methods to manage charging which are not modeled in this analysis, such as direct charging management by aggregators or utilities and other demand response techniques. The managed charging results discussed here reflect only a single, relatively simple, strategy for charging management.

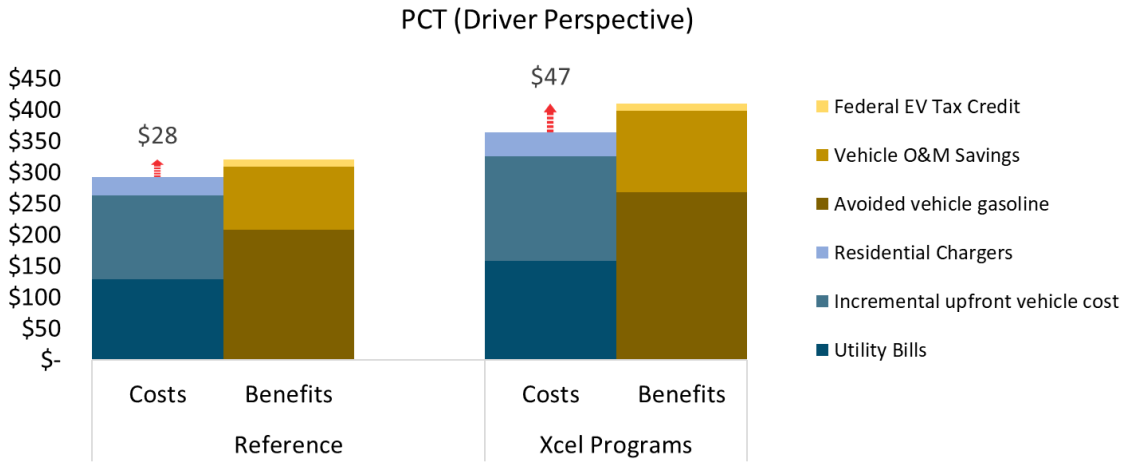
Personal LDVs with managed charging have nearly identical lifetime emissions reductions as those with unmanaged charging.

4.2.2 Xcel Programs Scenario

In the Xcel programs scenario, personal LDVs have access to Xcel-owned public DCFC and Xcel-funded MFH, workplace, and public L2 chargers. The total Xcel program costs for public DCFC and public L2 chargers are split between personal and commercial LDVs based on the number of each vehicle type; 93% of electric LDVs adopted over the modeling horizon are personal LDVs and therefore 93% of the public DCFC and public L2 program costs are allocated to the personal LDV Xcel programs scenario.

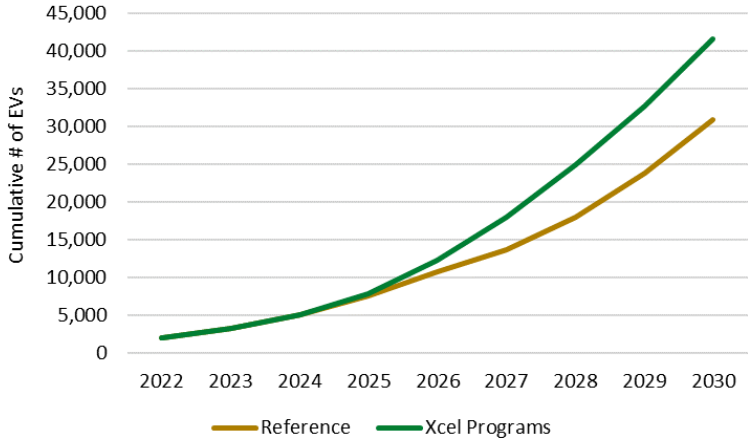
Unmanaged personal LDV drivers' net benefits increase from $28 million in the Reference scenario to $47 million in the Xcel programs scenario, a $19 million increase in net benefits, as shown in Figure 4.3.

Figure 4.3. Driver costs and benefits comparison of unmanaged personal LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030 ($M)



Drivers receive higher net benefits in the Xcel programs scenario since some residential charger costs are shifted from the driver to the utility from the Xcel programs. This stems from the make-ready support for customers provided through the multi-dwelling unit program. Therefore, drivers have lower charging infrastructure costs in the scenario with the Xcel programs. In addition, in the Xcel programs scenario, a greater portion of vehicles are adopted towards the end of the modeling horizon due to the induced effect of the additional EV chargers installed from the programs, as shown in Figure 4.4.

Figure 4.4. Electric personal LDV adoption forecast in Reference and Xcel programs scenarios

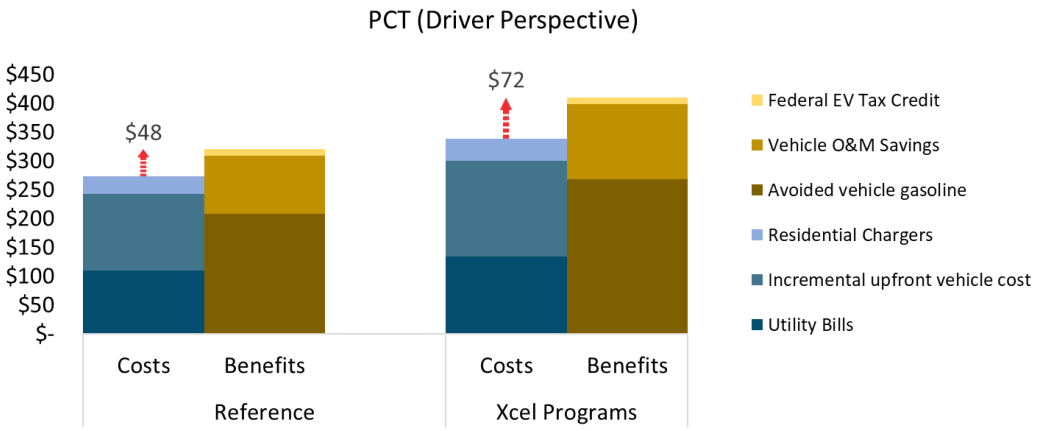


Higher adoption in later years in the Xcel programs scenario results in several shifts in costs and benefits streams. Incremental upfront costs decline over time and therefore an adoption forecast with a higher portion of EVs adopted in later years results in a lower average incremental upfront cost in the Xcel programs scenario. Similarly, gasoline costs are higher in later years, so later EV adoption in the Xcel programs scenario results in greater average avoided gasoline benefits. Discounting benefits that occur in

later years results in a lower NPV compared to discounting benefits that occur in earlier years, so this dampens the effect of greater average benefits captured from later adoption.

When compared to unmanaged charging, personal LDVs with managed charging follow a similar trend between the Reference and Xcel programs scenarios. Personal LDVs with managed charging have an increase in net benefits from $48 million in the Reference scenario to $72 million in the Xcel programs scenario, or a $24 million increase in net benefits, as shown in Figure 4.5. Like unmanaged charging, managed charging has an increase in net benefits in moving from the Reference scenario to Xcel programs scenario because of the reduction in residential charger costs, which stems from make-ready support for multi-unit dwelling units added as part of the Xcel programs.

Figure 4.5. Driver costs and benefits comparison of managed personal LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030 ($M)



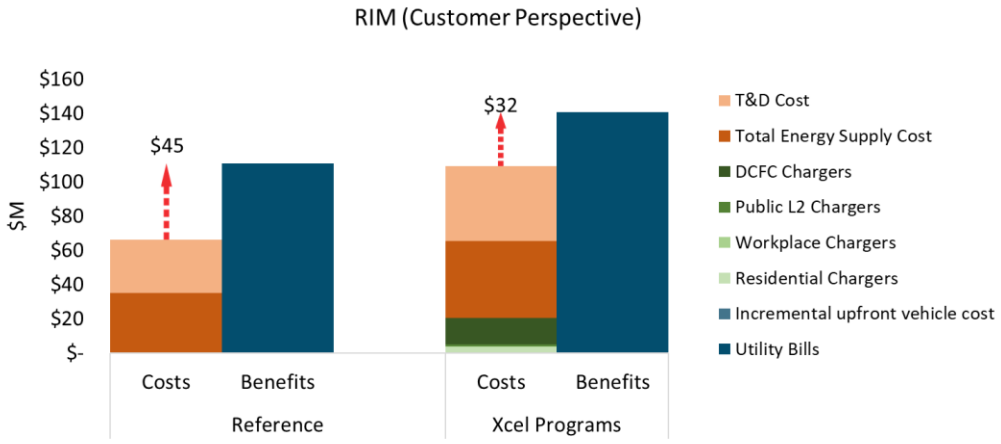
As shown in Table 4.4, the net benefits in both the Reference and Xcel programs scenarios are higher for personal LDVs with managed charging. Benefits such as avoided gasoline and O&M savings remain constant between unmanaged and managed charging scenarios since vehicles travel the same number of miles per year regardless of their charge management. Reductions in utility bills lead to lower costs in the managed charging scenarios.

Table 4.4. Driver costs and benefits comparison between unmanaged and managed personal LDV electrification scenarios for all vehicles adopted 2022-2030 ($M)

Charge Management	Result	Reference Scenario	Xcel Programs Scenario
Unmanaged	Costs	$292.3	$363.8
	Benefits	$320.7	$410.4
	Net Benefits	**$28.4**	**$46.6**
Managed	Costs	$273	$338
	Benefits	$321	$410
	Net Benefits	**$48**	**$72**

Customers see a decrease in net benefits from $45 million in the Reference scenario to $32 million in the Xcel programs scenario for unmanaged personal LDVs, as shown in Figure 4.6.

Figure 4.6. Customer costs and benefits comparison of unmanaged personal LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030



In the Xcel programs scenario, customers have additional costs from the increased utility spending on charging infrastructure. Net benefits remain positive in the Xcel programs scenario, which indicates that customers still benefit from the EV adoption that will occur in Xcel's Wisconsin service territory, even with the increased charging infrastructure costs.

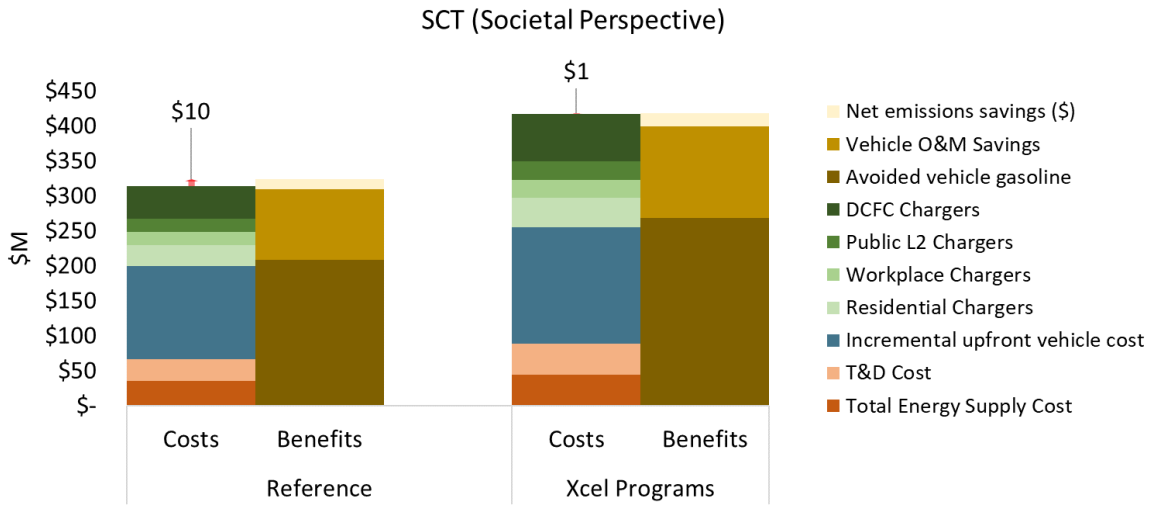
For personal LDVs with managed charging, customers have a decrease in net benefits from $35 million in the Reference scenario to $19 million in the Xcel programs scenario. Results for unmanaged and managed personal LDVs are shown in Table 4.5. As discussed previously, moving from unmanaged to managed charging decreases the net benefits for customers since the utility bill reductions from managing charging are greater than the decrease in electric supply costs to serve EV charging.

Table 4.5. Customer costs and benefits comparison between unmanaged and managed personal LDV electrification scenarios for all vehicles adopted 2022-2030 ($M)

Charge Management	Result	Reference Scenario	Xcel Programs Scenario
Unmanaged	Costs	$66	$109
	Benefits	$111	$141
	Net Benefits	**$45**	**$32**
Managed	Costs	$56	$96
	Benefits	$91	$115
	Net Benefits	**$35**	**$19**

From a societal perspective, there is a decrease in net benefits for unmanaged personal LDVs in moving from the Reference scenario to the Xcel programs scenario. Net benefits decrease from $10 million in the Reference scenario to $0.6 million in the Xcel programs scenario, as shown in Figure 4.7. Societal benefits are driven by avoided gasoline and O&M savings. In this instance, the additional costs of more residential, workplace, and public DCFC and L2 chargers being built in the Xcel programs scenario relative to the Reference scenario exceed the savings in avoided gasoline and O&M expenses from additional EV adoption.

Figure 4.7. Societal costs and benefits comparison of unmanaged personal LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030



For personal LDVs with managed charging, the societal net benefit decreases from $20 million in the Reference scenario to $13 million in the Xcel programs scenario. DCFC charger costs are a main

contributor to Xcel Programs scenario costs. DCFC incur significant EVSE, electrical infrastructure, and O&M costs. Compared to other studies, Xcel's Wisconsin territory also has a low EV to DCFC ratio, which is favorable for increasing EVs' access to DCFC in Wisconsin but yields societal per vehicle and total NPV costs.

Results for unmanaged and managed personal LDVs are shown in Table 4.6. As discussed previously, the increase in societal net benefits from the unmanaged to managed charging scenarios is driven by reductions in electric supply costs to serve EV charging loads as well as reductions in distribution upgrade costs. Like unmanaged personal LDVs, managed personal LDVs show a decrease in net benefits in the Xcel programs scenario because avoided gasoline and O&M savings for the additional EVs adopted is not able to match the costs of additional charging infrastructure built in the programs.

Table 4.6. Societal costs and benefits comparison between unmanaged and managed personal LDV electrification scenarios for all vehicles adopted 2022-2030 ($M)

Charge Management	Result	Reference Scenario	Xcel Programs Scenario
Unmanaged	Costs	$313.4	$417
	Benefits	$323.8	$417.5
	Net Benefits	**$10.4**	**$0.6**
Managed	Costs	$303.5	$404.1
	Benefits	$323.8	$417.5
	Net Benefits	**$20.3**	**$13.4**

In summary, the results for personal LDVs indicate that while the Xcel proposed programs will lead to positive net benefits for the drivers and support Xcel's EV adoption goals, the programs decrease the net benefits of EV adoption for customers and society as a whole. This reduction in net benefits in the Xcel programs scenario is a function of both the charger infrastructure costs and electricity supply costs in Xcel's Wisconsin service territory and the high amount of charging infrastructure relative to the number of EVs.

Separate from the implementation of the Xcel programs, managed charging presents an opportunity for increasing both participant and societal net benefits. These benefits come from reductions in participant utility bills and electric supply costs, though customers bear some of the participant savings as a net cost. Each of these impacts are amplified in the Xcel programs scenario, though not enough to make the programs result in a net societal benefit relative to Reference.

4.2.3 Individual Xcel Programs

Net benefit results for the Public DCFC Charging Program and L2 Charging Program can be broken out and assessed separately, shown in Table 4.7. L2 Charging Program results are further broken out into subprograms for each charger type: residential, commercial, and workplace/public chargers. The L2

Charging Program – Residential subprogram refers to make-ready support for L2 chargers at multi-unit dwellings.

These scenarios include only the costs for that specific program or subprogram. The induced EV adoption effect from the increase in EV chargers was allocated to each individual program or subprogram based on the portion of chargers added in that program or subprogram since the induced EV effect assumes an 8.4% increase in EV adoption for every 10% increase in EV chargers (Li, Tong, Xing, & Zhou, 2016).

Table 4.7. Net benefits for personal LDV electrification programs with unmanaged charging for all vehicles adopted 2022-2030 ($M)

Program Scenario	PCT (Participant)	RIM (Customer)	SCT (Societal)
Reference Case	$28.4	$44.8	$10.4
Public DCFC Program	$38.8	$33.4	$1.6
L2 Charging Program - Residential	$30.9	$43.1	$7.8
L2 Charging Program - Commercial	*N/A*	*N/A*	*N/A*
L2 Charging Program - Workplace/Public	$36.0	$45.1	$11.9
All Programs	$46.6	$31.6	$0.6

Results in Table 4.7 indicate that each individual program or subprogram for unmanaged personal LDVs has net benefits for participants, customers, and society. Table 4.8 shows net benefits for all programs and each individual program/subprogram compared to the net benefits in the Reference scenario for each cost test perspective.

Table 4.8. Net benefits comparison between personal LDV electrification programs with unmanaged charging for all vehicles adopted 2022-2030 ($M)

Program Scenario	PCT (Participant)	RIM (Customer)	SCT (Societal)
Reference Case	$28.4	$44.8	$10.4
Public DCFC Program	↑$10.4	↓$11.4	↓$8.8
L2 Charging Program – Residential	↑$2.5	↓$1.7	↓$2.6
L2 Charging Program – Commercial	*N/A*	*N/A*	*N/A*
L2 Charging Program – Workplace/Public	↑$7.6	↑$0.3	↑$1.5
All Programs	↑$18.2	↓$13.2	↓$9.8

Results in Table 4.8 show that each individual program or subprogram increases net benefits relative to the Reference scenario for personal LDV drivers with unmanaged charging. Increases in net benefits in the L2 Charging Program – Residential subprogram from the driver perspective are driven by Xcel make-ready support. Personal LDV drivers do not pay for DCFC, workplace L2, or public L2 charging infrastructure in the Reference scenario but drivers still see increases in net benefits in the Public DCFC Program and L2 Charging Program – Workplace/Public subprogram due to the increased EV Adoption from the induced effect of the chargers added in each program. The increase in EV adoption amplifies the net benefits that are observed with the Reference scenario EV adoption forecast.

Table 4.8 also shows that as with the trend for all programs considered in aggregate, each individual program or subprogram for personal LDVs reduces net benefits for society except for the L2 Charging Program – Workplace/Public L2 subprogram, which increases net benefits for society. The reductions in net benefits are lower for the Public DCFC Program and L2 Charging Program – Residential since the DCFC and MFH chargers added in these programs have higher costs than the increased benefits of avoided gasoline and O&M savings from higher EV adoption. The L2 Charging Program – Workplace/Public subprogram, however, has charger costs that are low relative to the added savings in avoided gasoline and O&M that result from the induced EV adoption.

Customer net benefits decrease for the Public DCFC Program since DCFC have high charging infrastructure costs that get incurred by society, both from the program costs and from the need for additional DCFC from increased EV adoption. Net benefits also decrease when considering the residential L2 Charging subprogram for unmanaged personal LDVs since the added costs of charging infrastructure for residential, workplace, and public L2 chargers is lower than the benefit of higher utility bills from the additional EVs. The workplace L2 Charging Program results in an approximately neutral shift in net benefits because the utility bills paid by the workplace rather than participants increase by enough to compensate for higher energy supply and infrastructure costs.

Table 4.9 and Table 4.10 show a similar set of results but for managed personal LDVs.

Table 4.9. Net benefits comparison between personal LDV electrification programs with managed charging for all vehicles adopted 2022-2030 ($M)

Managed Program Scenario	Participant	Customer	Societal
Reference Case	$48.2	$34.9	$20.2
Public DCFC Program	$61.4	$22.3	$13.0
L2 Charging Program – Residential	$52.1	$32.6	$18.4
L2 Charging Program – Commercial	*N/A*	*N/A*	*N/A*
L2 Charging Program – Workplace/Public	$57.1	$34.7	$22.5
All Programs	$72.0	$19.1	$13.4

Table 4.10. Net benefits comparison between personal LDV electrification programs with managed charging for all vehicles adopted 2022-2030 ($M)

Program Scenario	PCT (Participant)	RIM (Customer)	SCT (Societal)
Reference Case	$48.2	$34.9	$20.2
Public DCFC Program	↑$13.2	↓$12.6	↓$7.2
L2 Charging Program – Residential	↑$3.9	↓$2.3	↓$1.8
L2 Charging Program – Commercial	*N/A*	*N/A*	*N/A*
L2 Charging Program – Workplace/Public	↑$8.9	↓$0.2	↑$2.3
All Programs	↑$23.8	↓$15.8	↓$6.8

Trends in net benefits for each program or subprogram relative to the Reference scenario shown in Table 4.10 are similar for managed personal LDVs as seen for unmanaged vehicles in Table 4.8.

Assessing each program or subprogram individually offers insights into how each component of the package of Xcel proposed programs contributes to the change in costs and benefits from the programs. As can be seen from the results for unmanaged and managed personal LDVs, each individual program or

subprogram increases net benefits for drivers. Therefore, each program or subprogram would help improve the economic proposition for EV adoption and support Xcel's EV adoption goals. Most programs when considered individually reduce net benefits for society and customers. These reductions in net benefits are driven by charging infrastructure costs that do not outweigh added benefits from avoided gasoline and O&M savings for society or from increased utility bills from the customer perspective. Although reduced, net benefits do still remain positive for society and customers for all individual program/subprograms, which indicates that society and customers will still benefit from vehicle electrification with Xcel's programs implemented.

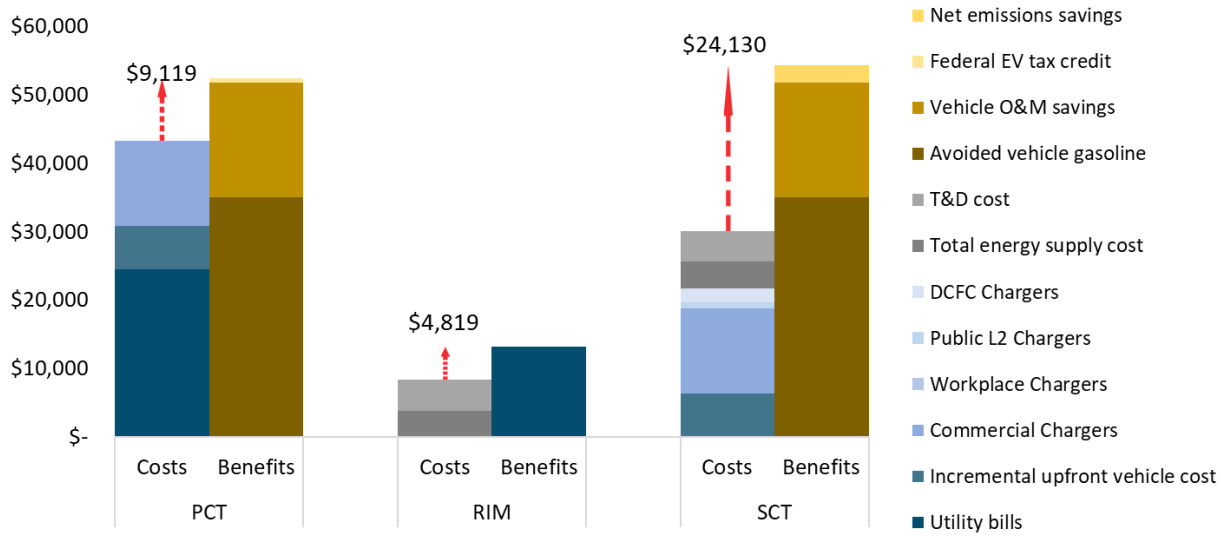
4.3 Commercial LDVs

Commercial LDVs represent LDVs that are driven primarily for commercial purposes, such as in commercial fleets or for ridesharing. All commercial LDVs modeled are assumed to have access to depot charging and a portion are assumed to have access to residential charging to represent personal vehicles used for ridesharing services. Commercial LDVs are a smaller portion of the total EV population in Xcel's Wisconsin service territory relative to personal LDVs and make up 6.2% of the forecasted EV adoption over the modeling horizon. However, due to a higher average VMT, they account for 15% of the estimated load. Commercial LDVs are assumed to have fully managed charging against Xcel's Cg-7 rate based on the anticipated fleet management for these vehicle types.

4.3.1 Reference Scenario

Commercial LDVs have net benefits for all cost test perspectives, as shown in Figure 4.8. Commercial LDV drivers have an average net benefit of $9,119 per vehicle over the lifetime of their vehicle. Society benefits on average by $24,130 per vehicle adopted over the modeling horizon. Customers have a smaller net benefit of $4,819 per vehicle due to low utility bills relative to the electric supply costs to serve commercial LDV charging. Low utility bills result from lower rates that many commercial LDVs are assumed to have access to at depot charging locations.

Figure 4.8. Average costs and benefits of commercial LDV electrification per vehicle adopted from 2022-2030 (Reference scenario)



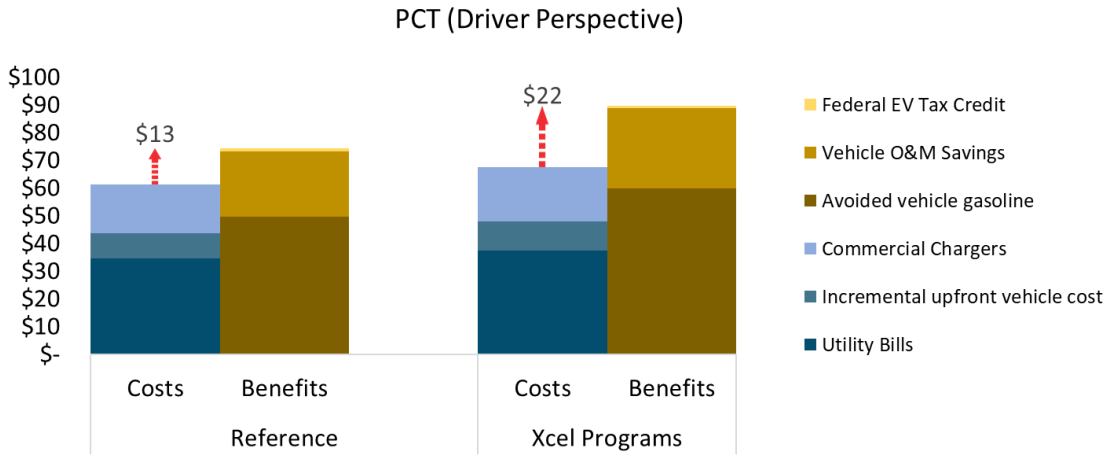
Like personal LDVs, net benefits for commercial LDVs are driven primarily by avoided gasoline costs and vehicle O&M savings. These benefits scale with the number of miles driven and therefore are even larger for commercial LDVs compared to personal LDVs due to higher vehicle mileage (40,545 miles driven per year for commercial LDVs compared to 11,124 miles driven per year for personal LDVs). Commercial LDVs avoid 75 metric tons of CO_2 over the vehicle lifetime.

4.3.2 Xcel Programs Scenario

In the Xcel programs scenario, commercial LDVs have access to Xcel-owned public DCFC and Xcel-funded commercial fleet and public L2 chargers. The total Xcel program costs for public DCFC and public L2 chargers are split between personal and commercial LDVs based on the number of each vehicle type; 7% of each program's costs are allocated to commercial LDVs.

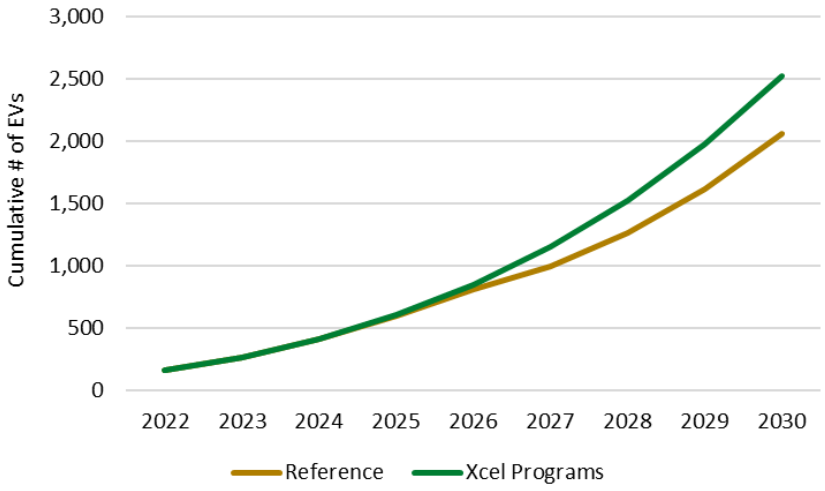
Commercial LDV drivers' net benefits increase from $13 million in the Reference scenario to $22 million in the Xcel programs scenario, a $9 million increase in net benefits, as shown in Figure 4.9.

Figure 4.9. Driver costs and benefits comparison of commercial LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030



Commercial LDV drivers have higher net benefits in the Xcel programs scenario since the programs cover some of the charging infrastructure costs that would have otherwise been paid for by commercial LDV drivers. In the Xcel programs scenario, a greater portion of vehicles are adopted towards the end of the modeling horizon due to the induced effect of the additional EV chargers installed from the programs, as shown in Figure 4.10.

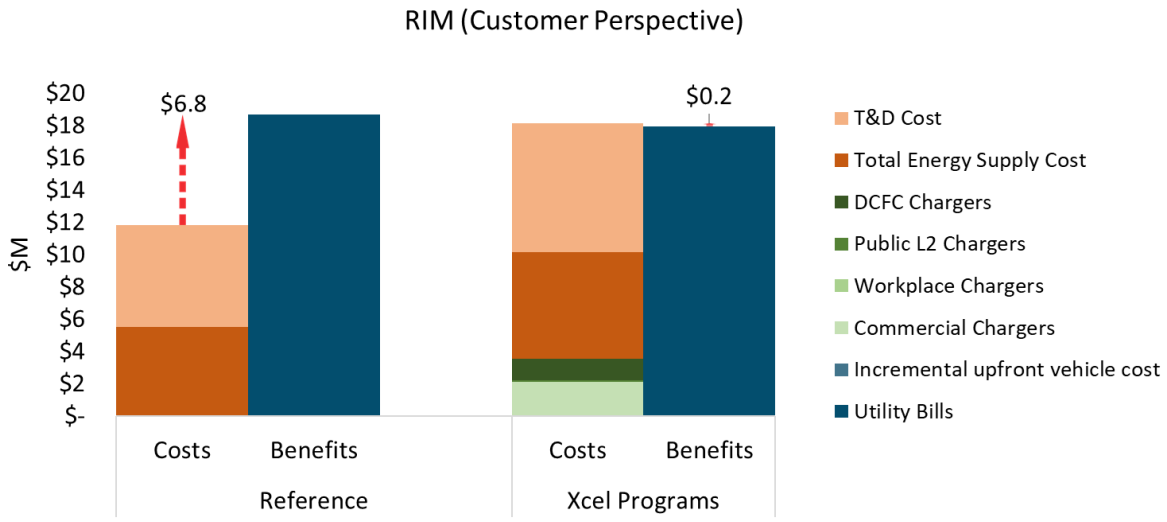
Figure 4.10. Electric commercial LDV adoption forecast in Reference and Xcel programs scenarios



Like the effects seen for personal LDVs, higher commercial LDV adoption in later years in the Xcel programs scenario shifts the portion of vehicles with lower incremental upfront costs and higher avoided gasoline costs to later years, resulting in greater average benefits for vehicles adopted over the modeling horizon. Additionally, the discounting of benefits that occur in later years dampens the impacts of higher average benefits from later adoption.

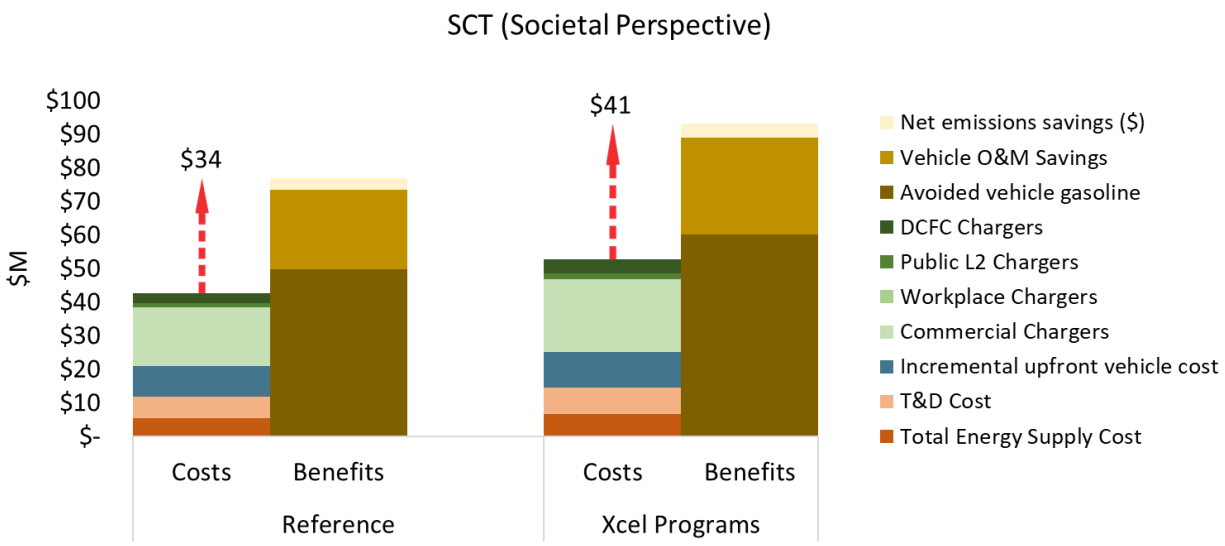
Customers have a net benefit of $6.8 million in the Reference scenario. This becomes a net cost of $0.2 million in the Xcel programs scenario due to the increased charging infrastructure costs from program chargers, as shown in Figure 4.11. When viewed in isolation, commercial LDVs pose a net cost but when considered in aggregation with all vehicle types that are electrified in Xcel's Wisconsin territory, customers have net benefits of $117 million, as shown in Table 4.2.

Figure 4.11. Customer costs and benefits comparison of commercial LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030



From a societal perspective, commercial LDVs have an increase in net benefits in the Xcel programs scenario relative to the Reference scenario. Net benefits increase from $34 million in the Reference scenario to $41 million in the Xcel programs scenario, as shown in Figure 4.12. Societal net benefits increase since the higher charging infrastructure costs from the Xcel program are lower than the savings from avoided gasoline and O&M resulting from higher EV adoption.

Figure 4.12. Societal costs and benefits comparison of commercial LDV electrification in Reference and Xcel programs scenarios for all vehicles adopted 2022-2030



In summary, the results for commercial LDVs indicate that the Xcel proposed programs will increase net benefits from the driver and societal perspectives relative to the Reference scenario. However, the Xcel proposed programs lead to net costs for customers. Despite the net costs of commercial LDVs, the Xcel programs across all vehicle types still lead to a positive net benefit for customers of $117 million. Positive net benefits for drivers and society indicate that the Xcel programs would be beneficial for supporting EV adoption and Wisconsin's EV goals.

4.3.3 Individual Xcel Programs

The impacts of the Public DCFC Program and L2 Charging Program with each of its subprograms can also be assessed separately for commercial LDVs. Table 4.11 displays the net benefits of each scenario, including only the specific costs of that program or subprogram and benefits from induced EV adoption attributable to that program or subprogram.

Table 4.11. Net benefits comparison between commercial LDV electrification programs with managed charging for all vehicles adopted 2022-2030 ($M)

Managed Program Scenario	Participant	Customer	Societal
Reference Case	$12.9	$6.8	$34.2
Public DCFC Program	$19.2	$3.0	$39.6
L2 Charging Program - Residential	*N/A*	*N/A*	*N/A*
L2 Charging Program - Commercial	$13.2	$4.3	$32.6
L2 Charging Program - Workplace/Public	$15.4	$5.8	$36.8
All Programs	$22.2	-$0.2	$40.5

Results in Table 4.11 indicate that all individual program or subprogram for commercial LDVs have net benefits for participants, customers, and society. The only exception is $0.2 million in net costs for all programs in aggregate. Each individual program or subprogram reduces the net benefits for customers in the Reference scenario and only when all of the reductions in net benefits are summed in the All Programs scenario do the net benefits become net costs.

Table 4.12 shows net benefits for all programs and each individual program/subprogram compared to the net benefits in the Reference scenario for each cost test perspective.

Table 4.12. Net benefits comparison for commercial LDV electrification programs for all vehicles adopted 2022-2030 ($M)

Program Scenario	PCT (Participant)	RIM (Customer)	SCT (Societal)
Reference Case	$12.9	$6.8	$34.2
Public DCFC Program	↑$6.3	↓$3.8	↑$5.4
L2 Charging Program – Residential	*N/A*	*N/A*	*N/A*
L2 Charging Program – Commercial	↑$0.3	↓$2.5	↓$1.6
L2 Charging Program – Workplace/Public	↑$2.5	↓$1.0	↑$2.5
All Programs	↑$9.3	↓$7.0	↑$6.3

Results in Table 4.12 indicate that commercial LDV drivers receive increased net benefits for all individual programs or subprograms relative to the Reference scenario. In the Reference scenario, drivers are responsible for commercial charger costs but not DCFC or workplace/public charger costs. The L2 Charging Program – Commercial subprogram reduces some of the commercial charger costs paid for by drivers. The increase in net benefits for the L2 Charging Program – Commercial is small though, with an increase of only $0.3 million in net benefits, because the number of commercial chargers funded by the program is small relative to the total number of chargers that support commercial LDVs. The small number in increased chargers in the commercial subprogram also leads to a smaller portion of the induced EV adoption assumed from the Xcel programs and therefore less significant increases in benefits. There is a large increase in net benefits for drivers from the Public DCFC Program even though the program costs do not translate to charging infrastructure cost savings for drivers (since drivers do not pay for DCFC charging infrastructure)_since the largest portion of the induced EV adoption effect from adding the Xcel programs, 84% of the induced EV effect, is attributed to the Public DCFC Program.

Societal net benefits increase for the Public DCFC Program and L2 Charging Program – Workplace/Public relative to the Reference scenario. This result indicates that the charging infrastructure costs incurred as part of the programs are lower than the net benefits that result from increased EV adoption. The L2 Charging Program – Commercial subprogram incurs net costs for society since the cost of the charging infrastructure added as part of the subprogram do not outpace the increased benefits from the limited EV adoption increases that result from the added commercial chargers. Because commercial LDVs share the public DCFC chargers added in the Public DCFC Program with personal LDVs, the program charging infrastructure costs get spread among many more vehicles and fewer costs are allocated to commercial LDVs. On the contrary, for commercial chargers in the L2 Charging Program – Commercial subprogram, all program costs are allocated to commercial LDVs since personal LDVs do not have access to these types of chargers.

Customer net benefits decrease for all individual programs and subprograms. The increase in utility bills from the induced EV adoption in each program/subprogram are not large enough to outweigh the program costs, resulting in lower net benefits.

These results indicate that drivers have increased benefits from each of Xcel's proposed programs and in most scenarios, programs also increase benefits for society. Although they experience a decrease in net benefits from the implementation of each individual program or subprogram, customers still see positive net benefits with each of the programs considered individually. It is only once all programs and their costs are considered in aggregate that customers see net costs due to the stacking of multiple decreases in net benefits seen for each individual program/subprogram. The net cost to customers is small, $0.2 million, which suggests that customer benefits or costs are highly sensitive to inputs such as utility rates and electricity supply costs.

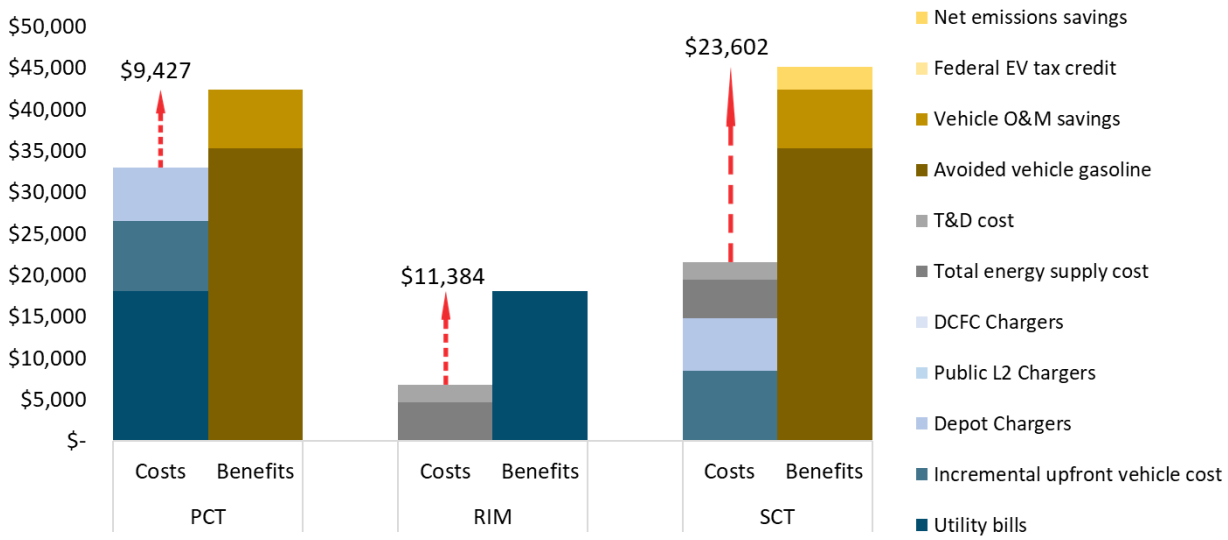
4.4 MDVs

For this study, MDVs are represented through the charging load shape and cost characteristics of parcel trucks. MDVs make up 2.1% of the forecasted EV adoption in Xcel's Wisconsin service territory from 2022 to 2030 and 3.5% of the total charging load. MDVs are assumed to have fully managed charging against Xcel's Cg-7 rate based on anticipated fleet owner management of MDV charging.

4.4.1 Reference Scenario

MDVs have net benefits for all cost test perspectives, as shown in Figure 4.13. MDV drivers have an average net benefit of $9,427 over the lifetime of their vehicle and society benefits by an average of $23,602 per MDV. Customers benefit by an average of $11,384 per MDV for MDVs adopted from 2022 to 2030.

Figure 4.13. Average costs and benefits of MDV electrification per electrified MDV adopted from 2022-2030 (Reference scenario)



MDV net benefits are driven by avoided vehicle gasoline and O&M savings. Although annual VMT for MDVs are similar to personal LDVs (14,175 miles per year for MDVs compared to 11,124 miles per year for personal LDVs), the net benefits for MDVs are much higher than for personal LDVs primarily due to lower utility bills resulting from lower electric rates for EV charging. The lower utility bills still provide enough utility revenue relative to the electric supply costs to result in net benefits for customers. MDVs avoid 83 metric tons of CO_2 over the vehicle lifetime.

Although it is possible that MDVs have access to some of the public DCFC and L2 chargers installed as part of Xcel's programs, this study assumed that MDV benefits and costs will not change significantly as a result of Xcel's proposed programs. A separate scenario for MDVs with the Xcel programs is not modeled in this study.

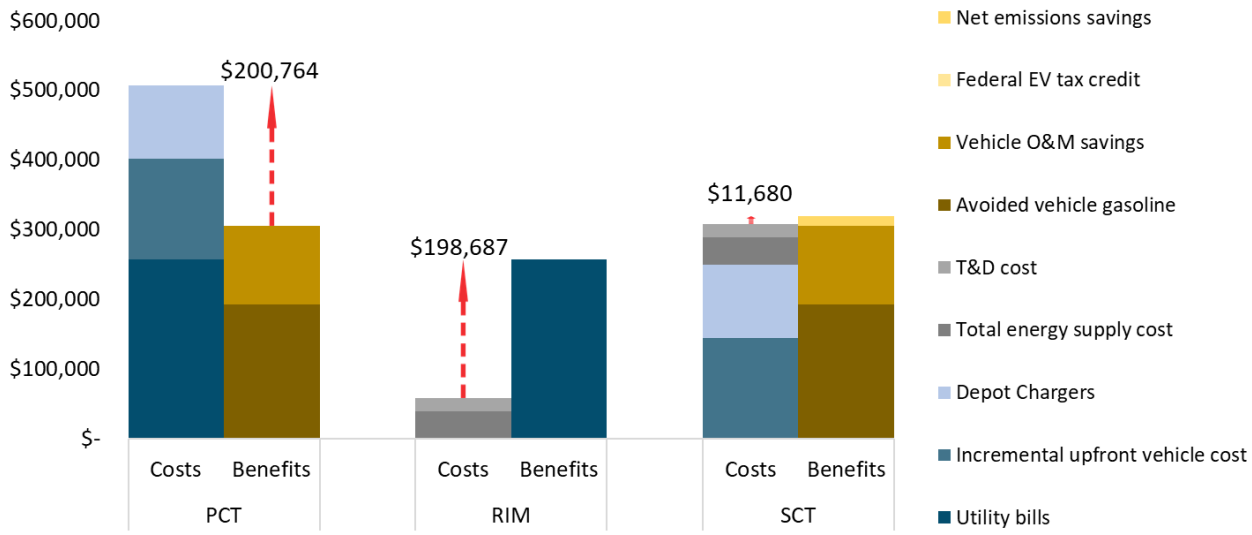
4.5 Commercial HDVs

Commercial HDVs are represented by the charging load shapes and vehicle and cost characteristics of transit buses. Commercial HDVs make up 1.8% of forecasted EV adoption in Xcel's Wisconsin territory from 2022 to 2030 and 22.9% of the total charging load. Commercial HDVs are assumed to be fully managed against Xcel's demand-inclusive Cg-9 rate.

4.5.1 Reference Scenario

Commercial HDVs have net costs for drivers and net benefits for customers and society, as shown in Figure 4.14. Customers and society have average net benefits of $198,687 per vehicle and $11,680 per vehicle, respectively, for commercial HDVs adopted from 2022 to 2030. Drivers have net costs of $200,764 per vehicle.

Figure 4.14. Average costs and benefits per electrified commercial HDV adopted from 2022-2030 (Reference scenario)



Commercial HDV net costs for drivers are largely driven by high incremental upfront costs forecasted for commercial HDVs over the modeling horizon. Commercial HDVs are assumed to use high-powered chargers (150 kW), which have higher charger and O&M costs. Commercial HDV chargers are assumed to have an annual O&M cost that is 10% of the EVSE cost and 3% of the electrical infrastructure cost. The avoided vehicle gasoline and O&M savings, which scale up per mile, are large for commercial HDVs given the high average mileage of 42,500 miles per year but are still lower than the costs of utility bills, high-level chargers, and incremental upfront purchase costs. Commercial HDVs avoid on average 409 metric tons of CO_2 over the vehicle lifetime. Emissions savings are much higher than seen for other vehicle types because electric commercial HDVs replace diesel HDVs, and diesel has a higher emissions intensity than gasoline. In addition, commercial HDVs have high mileage, which increases opportunity to reduce fossil fuel miles.

Similar to MDVs, it is assumed that commercial HDVs will not significantly benefit from the proposed Xcel programs and therefore separate scenarios are not modeled for this study.

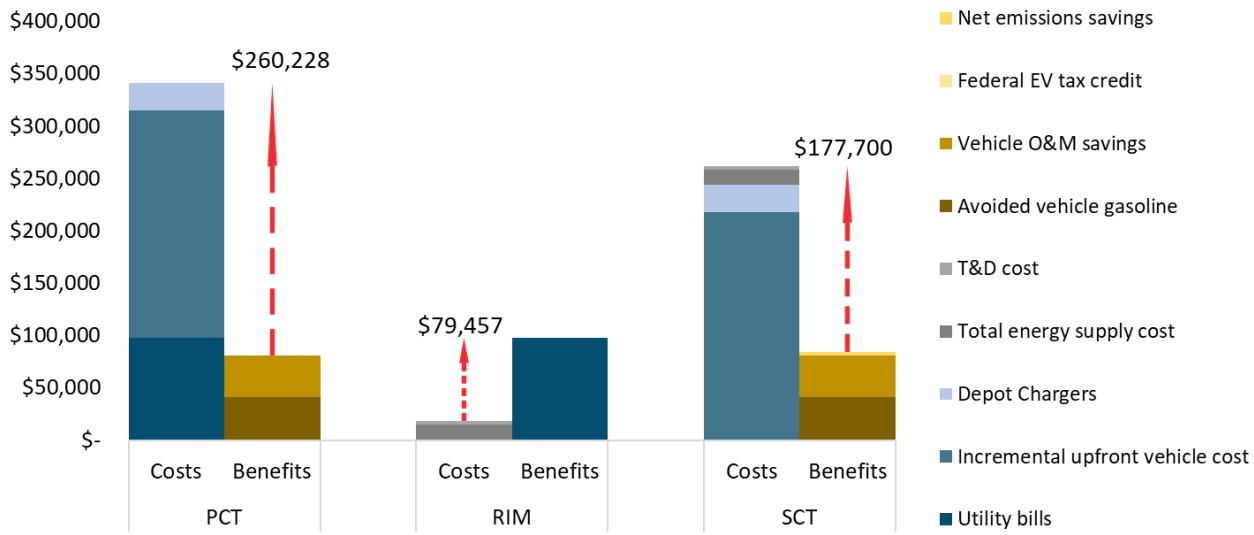
4.6 School Buses

School buses are broken out separately from commercial HDVs and have their own load shape and vehicle and cost characteristics represented in the modeling.

4.6.1 Reference Scenario

School buses have net costs for drivers and society but net benefits for customers, as shown in Figure 4.15. School bus drivers on average have net costs of $260,228 per vehicle and society on average has net costs of $177,700 per vehicle. Customers have on average net benefits of $79,457 per vehicle.

Figure 4.15. Average costs and benefits of commercial LDV electrification per vehicle adopted from 2022-2030 (Reference scenario)



School bus net costs in the PCT and SCT are driven largely by high incremental upfront costs for electric school buses. Savings from avoided vehicle gasoline and O&M are not as large as seen for commercial HDVs since the average mileage for school buses is much lower (12,792 miles per year for school buses compared to 42,500 miles per year for commercial HDVs); this results in significantly lower benefits for school buses. There are net benefits from the customer perspective since the utility bills from school bus charging are higher than the electric supply cost to serve the school bus charging load.

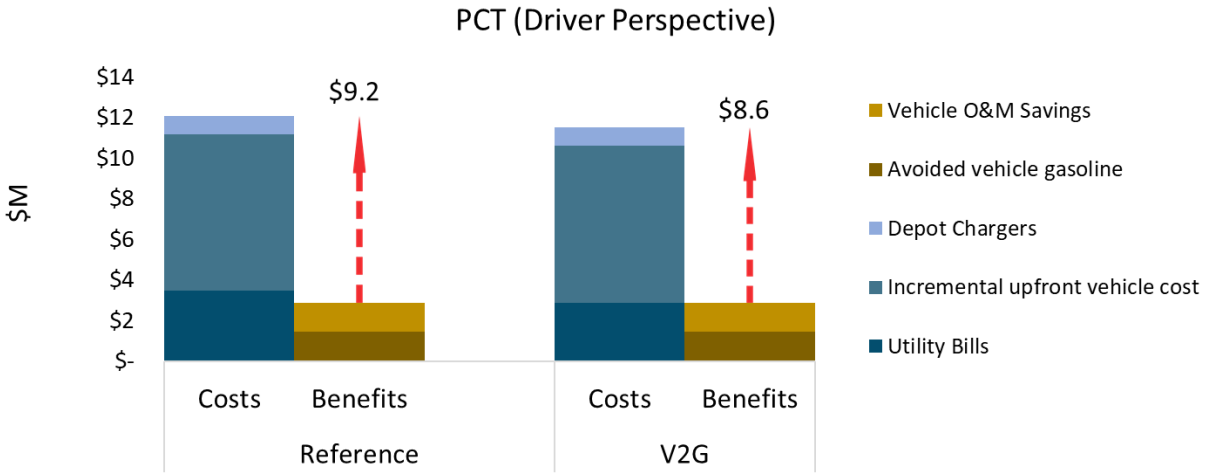
Electric school buses avoid 91 metric tons of CO_2 over the vehicle lifetime.

4.6.2 Reference Scenario with V2G

School buses are assumed to not receive significant benefits from the proposed Xcel programs and therefore a separate Xcel programs scenario was not modeled for school buses. A sensitivity for the Reference scenario models all school buses with V2G charging. With V2G charging, school buses must still meet charging requirements to satisfy the same driving patterns. If school buses have sufficient time in their driving schedules, the buses can charge, discharge energy stored in their battery back to the grid, and charge again to meet driving requirements. Charging is managed against the Xcel Cg-9 rate and discharging is managed against a rate based on Xcel Wisconsin's marginal generation costs and the Xcel Cg-9 rate. These rates also determine the amount the school bus pays and receives for charging and discharging, respectively.

In the Xcel Reference scenario, electrified school buses have a net cost of $9.2 million. This net cost is reduced to $8.6 million with V2G charging, as shown in Figure 4.16.

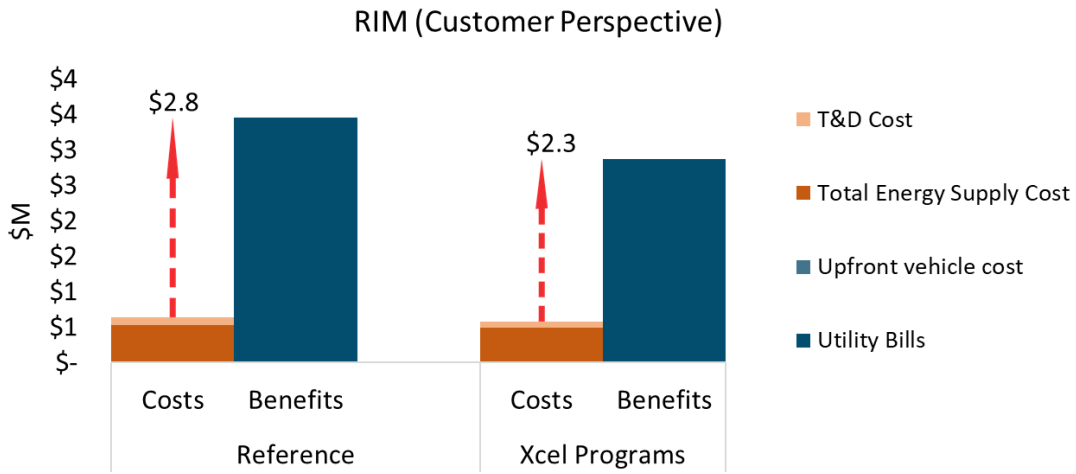
Figure 4.16. Driver costs and benefits comparison of school bus electrification in Xcel programs with and without V2G for all vehicles adopted 2022-2030



Net costs are reduced in the scenario with V2G because V2G charging offers opportunities for reductions in utility bills. Although vehicles must still charge the same amount with V2G charging, discharging back to the grid offers opportunities to earn money and reduce the net utility bill.

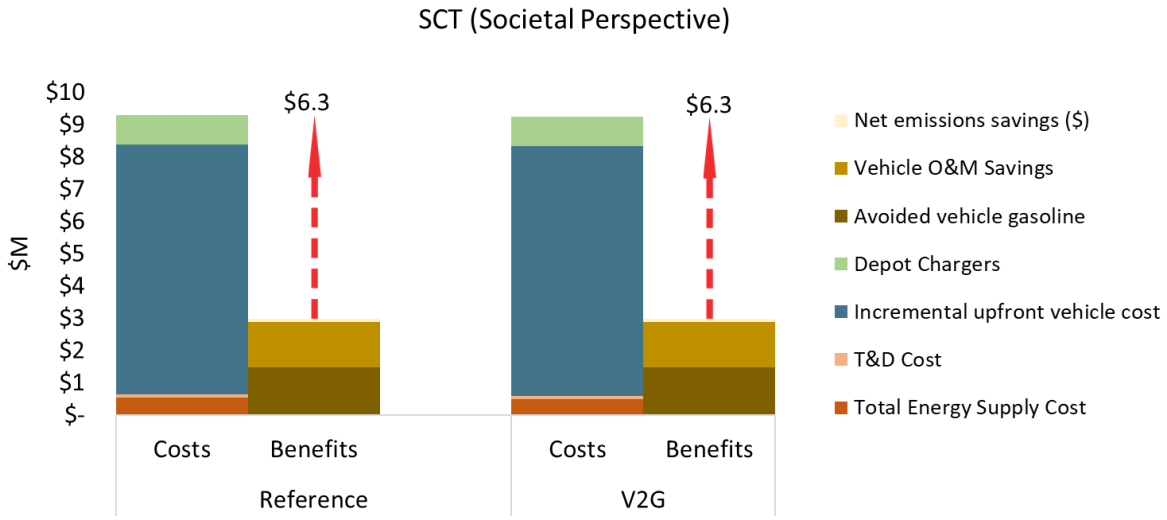
Customer net benefits decrease from $2.8 million to $2.3 million when school buses have V2G charging, as shown in Figure 4.17. This decrease in net benefits is due to utility bill reductions from V2G charging that are larger than reductions in electric supply costs from V2G charging.

Figure 4.17. Customer costs and benefits comparison of school bus electrification in Xcel programs with and without V2G for all vehicles adopted 2022-2030



From a societal perspective, net costs remain at $6.3 million with or without V2G charging, as shown in Figure 4.18.

Figure 4.18. Societal costs and benefits comparison of school bus electrification in Xcel programs with and without V2G for all vehicles adopted 2022-2030



This result from the societal perspective indicates that V2G charging does not achieve substantial reductions in electric supply costs.

In summary, school buses pose net costs to drivers and society due to large incremental upfront costs. School buses do offer net benefits to customers when electrified since utility revenues are larger than the electric supply costs to serve school bus charging. V2G charging slightly improves the economics for driver adoption of electric school buses. V2G charging does not offer improvements to customers or society based on the results from this study; customer net benefits decrease slightly and societal net benefits remain the same. V2G may offer benefits not captured in this study particularly at times of peak electric supply costs, which might not be captured in the electricity supply costs used for this study. At these peak supply cost times, V2G charging may offer valuable opportunities to discharge back to the grid and reduce the need to generate additional high-cost electricity.

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Attachment H

COMPANY OWNED PUBLIC ELECTRIC VEHICLE CHARGING

Availability: Available while this Public Charging is in effect to customers purchasing electricity used to recharge a battery that powers an electric vehicle from Company-owned and operated public charging stations.

Determination of Customer's Charges: Customers who elect to use Company-owned and operated public charging stations will be charged for electricity provided by the charging stations. Customer's charges shall reflect energy charges (if applicable) based on customer's kWh usage. Two rate tiers will be available to customers utilizing Company-owned and operated public charging stations. Delivery Charges, Energy Charges, and Market Charges will be assessed to all customers who use the public charging stations who are not NSPW ratepayers. Market Charges will not be assessed to customers who are NSPW ratepayers with a residential or commercial account and complete the enrollment process specified by the Company to validate their ratepayer status. Validated customers will be given the means to access public charging reflecting only the Delivery Charges and Energy Charges at all Company-owned public charging stations.

Details regarding the specific charges applicable to this service are listed below.

Definition of Peak Periods: On-peak hours shall be those listed below. On-peak hours shall begin at the same time for each of the on-peak days, which are Monday through Friday, inclusive (excluding holidays). Intermediate-Peak hours shall be those listed below. Intermediate-peak hours shall begin at the same time each day of the year including weekends and holidays and include 12:00 noon – 8:00 p.m. on Saturdays, Sundays, and Holidays. The holidays designated shall be New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas, on the day nationally designated to be celebrated as such. When a designated holiday occurs on Saturday, the preceding Friday shall not be considered an on-peak day. When a designated holiday occurs on Sunday, the following Monday shall not be considered an on-peak day.

Peak Periods: All customers served on this rate schedule will have the following on-, intermediate-, and off-peak periods:

	Starting Time	Ending Time	Days
On-Peak	12:00 noon	8:00 p.m.	Mon.-Fri. Excluding Holidays
Intermediate-Peak	8:00 a.m.	12:00 noon	All Days
Intermediate-Peak	8:00 p.m.	12:00 midnight	All Days
Intermediate-Peak	12:00 noon	8:00 p.m.	Sat.-Sun. and Holidays
Off-Peak	12:00 midnight	8:00 a.m.	All Days

(Continued)

COMPANY OWNED PUBLIC ELECTRIC VEHICLE CHARGING

(continued)

Rate:

Delivery Charges per kWh	
On-Peak	
June—September	6.900¢
October—May	4.300¢
Intermediate-Peak	4.300¢
Off-Peak	2.250¢
Energy Charges per kWh	
On-Peak	
June—September	14.250¢
October—May	9.200¢
Intermediate-Peak	9.200¢
Off-Peak	4.500¢
Market Charges per kWh	17.900¢

Energy Cost Adjustment: Rates are subject to the adjustment provided for in Energy Cost Adjustment. See Schedule X-1, Sheet No. E 63.

(Continued)

COMPANY OWNED PUBLIC ELECTRIC VEHICLE CHARGING

(continued)

Terms and Conditions:

1. Company Owned Public Electric Vehicle Charging service shall be served through wiring connected to dedicated meter.

2. Company has access to Company-owned equipment for the recording and wireless communication of energy usage.

3. The rate contemplates that this service will require the installation of new facilities to provide electric service to public electric vehicle chargers.

4. Customers must adhere to all Company instructions regarding the safe and efficient use of the public charging stations displayed on or near the station and must follow all recommendations, guidelines, and requirements published by the manufacturer of customer's electric vehicle regarding the charging of the electric vehicle, including the compatibility of the public charging station with the customer's electric vehicle.

5. Customer's use of the public charging station will be unsupervised, and customer's use of the public charging station is at Customer's own risk.

6. The Company has the right to control the use of the public charging station and may suspend or refuse access to public charging station at any time, for any reason.

7. The Company will use reasonable efforts to maintain the operability of the public charging stations and keep the public charging stations in working order, but the Company does not guarantee, and is under no obligation to ensure the availability, compatibility with customer's electric vehicle or performance of any public charging station.

8. Customer data may be collected by the Company in connection with Customer's use of a public charging station, and the Company will maintain any such information in accordance with and subject to the Company's then current Privacy Policy.

Rate Codes:

Bxx Optional Commercial Electric Vehicle Charging

CITY OF EAU CLAIRE

Office of the City Manager
Phone: (715) 839-4902
Fax: (715) 839-6177

July 12, 2022

Cru Stubley
Secretary to the Commission
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Dear Secretary Stubley:

The City of Eau Claire sees a marketplace need for more utility leadership and standardization for electric vehicle (EV) charging infrastructure. To meet our State and local carbon reduction goals, electric transportation provides both environmental benefits and the opportunity for lower fossil fuel and maintenance costs for EV drivers.

We own and have developed several of our own stations to grow the industry, but the fact remains that lack of public charging infrastructure is a primary barrier to EV adoption, and especially in rural areas. As we have experienced, fast EV charging infrastructure projects can be complicated, confusing to users with being highly individualized, and they come at a high upfront cost. Sources other than municipal funding, such as grants and utility programs, are frequently needed to support these installations. Rural areas are often overlooked, too, so there needs to be more equitable access.

We have utilized Xcel's commercial EV program, have partnered on a shared Energy Future Collaborative vision on EV transformation, and developed an EV Roadmap with a goal of at least 8,000 registered EVs in Eau Claire by 2030. Analysis concluded we need 160 public stations (1/50 EVs) by 2030. The City is not capable of meeting this need, nor interested in owning and operating all these stations. For example, we could be site host partner to strategically locate fast-charging hubs.

Achieving future goals will require significant effort from many interested parties, and as an electric infrastructure provider, we believe Xcel Energy is well positioned to build, own, operate and maintain charging infrastructure to meet a wide variety of needs. These include

- enhancements to its already successful "EV Accelerate at Home" program, to provide an easier and streamlined experience for those EV drivers who have the ability to charge at their homes;

- updates to its commercial program to make EV charging more cost effective, available and accessible at multi-family, workplace, visitor and destination locations and
- a detailed plan to build and operate a convenient and robust fast charging network throughout its service territory in northwestern Wisconsin to ensure that its customers can confidently embrace EVs for their transportation needs.

We encourage support of these future program changes and are looking forward to working with Xcel to identify locations for its future public fast-charging hubs so that all Wisconsinites can travel anywhere throughout the state in an EV with confidence.

Sincerely,

Stephanie A. Hirsch
City Manager

PLANNING, DEVELOPMENT AND ASSESSMENT

400 LA CROSSE STREET | LA CROSSE, WI 54601 | P: (608) 789-7512

June 30, 2022

Cru Stubley
Secretary to the Commission
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

The City of La Crosse sees a strong need for additional utility support for electric vehicle (EV) charging infrastructure. Electric transportation provides both environmental benefits and the opportunity for lower fuel and maintenance costs for EV drivers. We know that a lack of public charging availability is a primary barrier to EV adoption. However, EV charging infrastructure comes at a high upfront cost, and other sources of funding (such as grants and utility programs) are frequently needed to support these installations.

We support Xcel Energy's efforts to establish a strong vision to support transportation electrification and reduce the upfront costs of EV charging infrastructure. We have been actively engaged with Xcel Energy on the development of electric vehicle projects over the past few years and have used the company's current programs to advance our EV goals.

Achieving future goals will require significant effort from many interested parties and as an infrastructure provider, we believe Xcel Energy is well positioned to build, operate and maintain charging infrastructure to meet a wide variety of needs. This includes:

- Enhancements to its already successful "EV Accelerate at Home" program, to provide an easier and streamlined experience for those EV drivers who have the ability to charge at their homes.
- Updates to its commercial program to make EV charging more cost effective, available and accessible at multi-family, workplace, visitor and destination locations.
- A detailed plan to build and operate a convenient and robust fast charging network throughout its service territory in northwestern Wisconsin to ensure that its customers can confidently embrace EVs for their transportation needs.

We encourage support of these future program changes and are looking forward to working with Xcel Energy to identify locations for its future public fast charging hubs so that all Wisconsinites can travel anywhere throughout the state in an EV with confidence.

Sincerely,

Lewis Kuhlman, Environmental Planner
City of La Crosse

above expectations

BAYFIELD COUNTY

Tourism Department

Mary D. Motiff, *Director*

June 30, 2022

Attn: Secretary of the Public Service Commission of Wisconsin

The Bayfield County Tourism department sees a strong need for additional utility support for electric vehicle (EV) charging infrastructure. Electric transportation provides both environmental benefits and the opportunity for lower fuel and maintenance costs for EV drivers. We know that a lack of public charging availability is a primary barrier to EV adoption; however, EV charging infrastructure comes at a high upfront cost, and other sources of funding (such as grants and utility programs) are frequently needed to support these installations.

We support Xcel Energy's efforts to establish a strong vision to support transportation electrification and reduce the upfront costs of EV charging infrastructure. We have been actively engaged with Xcel Energy on the development of electric vehicle projects over the past few years and have used the company's current programs to advance our EV goals.

Achieving future goals will require significant effort from many interested parties and as an infrastructure provider, we believe Xcel Energy is well positioned to build, operate and maintain charging infrastructure to meet a wide variety of needs. This includes:

- Enhancements to its already successful "EV Accelerate At Home" program, to provide an easier and streamlined experience for those EV drivers who have the ability to charge at their homes.
- Updates to its commercial program to make EV charging more cost effective, available and accessible at multi-family, workplace, visitor and destination locations.
- A detailed plan to build and operate a convenient and robust fast charging network throughout its service territory in northwestern Wisconsin to ensure that its customers can confidently embrace EVs for their transportation needs.

We encourage support of these future program changes and are looking forward to working with Xcel Energy to identify locations for its future public fast charging hubs so that all Wisconsinites (and visitors from other states) can travel anywhere throughout the state in an EV with confidence.

Sincerely,

Mary D Motiff

DOLLAR TREE | FAMILY DOLLAR

7 /8 /2022

Attn: Secretary of the Public Service Commission of Wisconsin

Dollar Tree / Family Dollar sees a strong need for additional utility support for electric vehicle (EV) charging infrastructure. Electric transportation provides both environmental benefits and the opportunity for lower fuel and maintenance costs for EV drivers. We know that a lack of public charging availability is a primary barrier to EV adoption, however, EV charging infrastructure comes at a high upfront cost, and other sources of funding (such as grants and utility programs) are frequently needed to support these installations.

We support Xcel Energy's efforts to establish a strong vision and specific plans to support transportation electrification. We have been actively engaged with Xcel Energy on the development of electric vehicle projects, and we have been excited to support Xcel Energy's pilots and programs to advance the transportation electrification of our communities. While we have all been working hard together to bring forward the charging infrastructure needed to support the decarbonization of our transportation system, we recognize things are not moving as quickly as we would like.

We are excited to see Xcel Energy taking a proactive approach to reducing the upfront costs of EV charging infrastructure. Achieving meaningful transportation electrification in our communities will require significant effort from many interested parties. As an infrastructure provider, we believe Xcel Energy is well positioned to build, operate and maintain charging infrastructure to meet a wide variety of needs.

Xcel Energy's plan to build and operate a convenient and robust public fast charging network throughout its service territory will ensure that its customers can confidently embrace electric vehicles for their transportation needs. We are looking forward to working closely with Xcel Energy to identify locations suitable for its public fast charging network and hope that Dollar Tree and Family Dollar can serve as a host for some of Xcel Energy's public fast charging hubs.

We thank Xcel Energy for its leadership on electric transportation, and hope that other utilities and electric providers in the state follow suit, so that Wisconsinites can travel throughout the state in an electric vehicle with confidence. We look forward to providing further comments on Xcel Energy's proposals throughout the Commission's review process.

Sincerely,

Menno Enters
VP Property Management, RPM
Dollar Tree / Family Dollar
STORE SUPPORT CENTER
500 Volvo Parkway | Chesapeake, Virginia 23320 | Tel 757-321-5000 | www.dollartree.com