August 22, 2025

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
Lansing, MI 48909

Via E-File

RE: MPSC Case No. U-21860

Dear Ms. Felice:

Attached please find the enclosed documents for filing:

- Direct Testimony and Exhibits of Graham Woolley on behalf of Michigan Environmental Council, Natural Resources Defense Council, Sierra Club, and Citizens Utility Board of Michigan (CUB-19 through CUB-27); and
- Proof of Service.

Thank you for your assistance in this matter. If you have any questions, please feel free to contact me.

Sincerely,

Digitally signed by Holly Hillyer
Date: 2025.08.22 13:26:33 -04'00'

Holly L. Hillyer
holly@tropospherelegal.com

CC: Parties to Case No. U-21860

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the application of **DTE ENERGY COMPANY** for authority to increase its rates for the generation and distribution of electricity and for other relief.	U-21860

DIRECT TESTIMONY OF GRAHAM G WOOLLEY

ON BEHALF OF

**MICHIGAN ENVIRONMENTAL COUNCIL,
NATURAL RESOURCES DEFENSE COUNCIL, SIERRA CLUB, AND
CITIZENS UTILITY BOARD OF MICHIGAN**

August 22, 2025

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DIRECT TESTIMONY OF GRAHAM WOOLLEY ON BEHALF OF MNSC
CASE NO. U-21860

I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, position, and business address.

A. My name is Graham G Woolley. I am a Consultant at 5 Lakes Energy, located at PO Box 869, Northport MI, 49670.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Michigan Environmental Council (MEC), Natural Resources Defense Council (NRDC), Sierra Club (SC), and Citizens Utility Board of Michigan (CUB), as noted below.

Q. Please summarize your experience in the field of utility regulation.

A. I have worked for 5 Lakes Energy since December 2022. In this role, I have developed data pipelines and modeling tools to analyze projects, policies, and plans aiming to advance clean energy. My modeling work includes tools to assess the economics of DC fast charging networks, to calculate the multifaceted values of electrification projects, to report on utility performance, and to analyze transformer aging under real-world conditions. My work experience is summarized in my resume, provided in Exhibit CUB-19.

Q. Have you testified before this Commission or as an expert in any other proceeding?

A. I have previously testified before the Michigan Public Service Commission (Commission) in the following cases:

- Case U-21534 (DTE Electric Company 2025 Electric Rate Case).

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

Exhibit CUB-19:	Resume of Graham Woolley
Exhibit CUB-20:	Responses to MNSCDE-6.31a, b and STDE-11.1
Exhibit CUB-21:	Smart Charge Schedule Overrides
Exhibit CUB-22:	Smart Charge Fleet Load Profile
Exhibit CUB-23:	Smart Charge Pilot Financial Impacts
Exhibit CUB-24:	Transformer Network Effective Capacity Utilization with Current Load
Exhibit CUB-25:	Transformer Network Effective Capacity Utilization 20-50 Electrification Scenario
Exhibit CUB-26:	Supporting Data for Smart-Charge Analysis
Exhibit CUB-27:	Supporting Data for Transformer Analysis

Exhibit CUB-26 and Exhibit CUB-27 correspond to more detailed workpapers—Workpaper GGW-1 Smart Charge and Workpaper GGW-2 Transformer, respectively. These exhibits cite and summarize the essential data sources and methodologies underpinning my analysis that would otherwise not be part of the public record.

II. SUMMARY

Q. What topics are you addressing in your testimony?

A. On behalf of Sierra Club and NRDC, I am addressing the following topics, mostly related to implementation of the Company's Transportation Electrification Plan (TEP):

1) Contributions in Aid of Construction (CIAC) for EV charging infrastructure
2) The Company's Benefit-Cost Analysis for the TEP
3) The Company's Smart Charge Pilot
4) The Company's Charging Hubs Initiative

On behalf of MEC, NRDC, and CUB, I am addressing the following topic:

5) Transformer Network Capacity

Q. Please summarize your general conclusions regarding the Company's TEP implementation.

A. I believe the Company's TEP is largely reasonable and prudent, and I find cost recovery for most of its proposed elements to be appropriate. However, I recommend a few modifications to improve the plan's effectiveness and alignment with customer and system needs. These recommendations are described in more detail throughout my testimony.

Q. Please summarize your analysis and recommendations related to the Company's transformer network capacity.

A. My analysis indicates that the Company's distribution transformer fleet is, in aggregate, overbuilt and underutilized. Even with significant building and vehicle electrification, average transformer loading will not drive meaningful loss of life. This suggests that broad, programmatic spending on distribution system upgrades is not yet "used and useful", and that targeted, data-driven approaches can defer or avoid major capital outlays. I therefore recommend that the Commission require the Company to submit circuit- and substation-level loading and thermal headroom analyses (similar to the one I present at the network-level), modeled under multiple electrification scenarios and tied to clear upgrade triggers, in support of any grid plan or capacity project that it seeks to justify on the basis of system loading.

Q. Which Company witnesses' testimony do you discuss in your testimony?

A. I discuss the testimony of Company witnesses Neal T. Foley and Aaron Willis.

III. CIAC FOR EV INFRASTRUCTURE (On behalf of Sierra Club and NRDC)

Q. Please summarize the Company's proposal regarding residential customer CIACs for EV infrastructure.

A. As described by Company witness Aaron Willis[1], the Company was directed to "establish a limited waiver for CIAC which may arise from residential EV charger installation." Willis quotes new proposed language in Section C6.1 of the Company's rate book that grants a CIAC waiver for residential customers whose EV charging load does not exceed 9.6 kW and whose non-EV load does not exceed 10 kW. Loads in excess of these limits may be subject to additional charges.

Q. Do you agree that CIACs for EV infrastructure should be waived?

A. Yes. Increasing the number of EVs in the Company's service territory should be a high priority, both to meet statewide decarbonization goals and to scale grid-supporting distributed energy assets to improve energy security and affordability. Moreover, since circuit-level distribution system upgrades consist of infrequent, bulky costs, requiring customer CIACs would result in disproportionate costs being assigned to the customer who happens to trigger an upgrade, even though that upgrade may create capacity for many future customers. For both these reasons, the limits described in the waiver strike me as reasonable short-term requirements for residential customers. However, as EV adoption increases, I believe this waiver alone will not be sufficient to minimize system upgrade costs.

[1] Direct testimony of Aaron Willis, AW-30, lines 7 through 21.

Q. Please elaborate on your concerns regarding the Company's CIAC waiver for EV charging infrastructure.

A. Many families have two cars, and it is reasonable to expect that an increasing number of families will opt to own two EVs, both of which will need to access home charging. A family may decide to install a second charger, and the Company may lack visibility into this decision, in which case the family could easily exceed the 9.6 kW waiver threshold and incur significant charges. Such charges would hinder EV adoption. I propose that the Company should step in to preempt these decisions and avoid most customers exceeding the waiver's limits.

Q. Please describe how the Company should act proactively to keep most or all customers within the waiver's limits.

A. First, the Company should identify which residential customers have EVs. With the help of existing EV detection tools[2], the Company can use customer metering data to identify customers that charge EVs at home, even if the EV purchase and/or the installation of home charging infrastructure occurred without the Company's knowledge. Second, the Company should target these customers with additional outreach efforts that explain the terms of the waiver and give the customer options for how to avoid breaching the waiver's limits. The Company would specifically explain that it expects two-EV households to either coordinate their charging or to install a current-sharing device that keeps the overall EV load within

[2] For example, Eaton's Center for Intelligent Power offers a tool for EV detection, https://www.eaton.com/sg/en-us/digital/center-for-intelligent-power/ev-detection-tool.html (last checked August 20, 2025)

the waiver's limits. This is a reasonable and practical step to ask of a customer to avoid the need for CIACs, and most customers will likely opt to stay within the prescribed limits.

Q. Please explain why the Company should be required to engage in this targeted outreach.

A. The proposed actions can be implemented in a highly automated way and with minimal incremental cost. EV detection tools already exist and can operate using data already in the Company's possession, and outreach could be automated via existing communication channels. These small upfront costs are outweighed by the long-term savings from avoiding premature or unnecessary distribution system upgrades that would otherwise be funded by all ratepayers. Maximizing the waiver's benefits depends on customers understanding how their charging decisions affect the system—knowledge the Company is best positioned to provide through targeted outreach.

Q. How would you respond to potential privacy concerns stemming from using metering data to identify customers with EVs?

A. The Company already collects metering data for all customers, and the proposed use would be limited to identifying load patterns consistent with EV ownership. This type of data analysis is already used widely in utility programs nationwide, such as targeted marketing for demand response or managed charging measures. No personally identifiable information need be disclosed outside the Company, and the analysis would be used solely for the purpose of helping customers avoid unnecessary costs.

IV. BENEFIT-COST ANALYSIS FOR THE TEP (On behalf of Sierra Club and NRDC)

Q. Please summarize the Company's benefit-cost analysis (BCA) for its TEP.

A. According to Section 7.2 of the Company's TEP[3], the Company's BCA for its TEP evaluates the net-present value (NPV) of the program's revenue requirement, testing whether the incremental costs of rebates, UMR investments, and serving additional EV load are outweighed by the additional revenues those loads generate. The analysis considers load only from rebated chargers, accounting for roughly 10% of overall EV load through 2030. It uses conservative assumptions, like constant utilization rates, and applies standard utility finance parameters. The BCA predicts short-term rate pressure, but projects $56 million in total ratepayer benefits over its lifetime, with relief beginning in 2033.

Q. Do you have any concerns regarding this BCA?

A. Yes. The BCA is too narrow and conservative, which inflates near-term rate pressure and delays ratepayer benefits until 2033. Specifically, it front-loads rebate costs with a 5-year amortization, counts only 10% of projected EV load (ignoring network effects), omits societal benefits, and consequently risks associating the TEP with Michigan's growing affordability concerns, potentially fueling political opposition to EVs.

Q. Why is the 5-year amortization schedule for rebates problematic?

A. Amortizing rebates over only 5 years front-loads costs and creates apparent short-term rate pressure, particularly during a period of growing affordability concerns. Extending the amortization period would smooth costs and bring forward the point at which customers see ratepayer benefits. I recommend that the Commission direct the Company to extend its

[3] See Exhibit A-29, Schedule S1, Pages 44-47.

rebate amortization schedule to 10 years. A 10-year period better matches the useful life of the underlying charging infrastructure investments. This approach balances timely cost recovery needs with the goal of minimizing near-term bill impacts for customers.

Q. How should the BCA account for network effects, and what impact would this have?

A. The BCA should account for the network effects of charger deployment by including the gross margin from *all* EV charging, not just the incremental load from rebated chargers. The presence of TEP-supported infrastructure encourages broader EV adoption, which in turn drives significant additional charging load beyond the 10% currently accounted for in the analysis. Including the gross margin from this additional load would more accurately reflect the full revenue impact of the TEP, significantly reduce apparent near-term rate pressure, and better demonstrate the program's ability to deliver ratepayer benefits while maintaining cost neutrality for non-EV customers.

Q. Why should societal benefits be included in the BCA?

A. Societal benefits accrue to the same people who pay utility bills; separating ratepayer benefits from societal benefits is a false distinction: nearly all members of society are also ratepayers, and these benefits directly improve their wellbeing. The Company's TEP BCA suffers from a very narrow accounting framework that fails to consider the full range of benefits offered by the TEP, such as avoided health costs from reduced pollution, avoided greenhouse gas costs from reduced fuel combustion, avoided gasoline costs for EV drivers, increased potential for grid support and VPP capacity, increased economic development activity, and increased energy resilience benefits. Excluding societal benefits from the

BCA systematically undervalues the program's total impact and risks underinvestment in climate solutions that deliver broad and lasting value.

Q. What actions should the Commission take regarding the Company's TEP BCA?

A. First, when the Commission-directed BCA collaborative tool becomes available, the Company should be required to use it in its next TEP.[4] Second, the Commission should require the Company to amend its rebate amortization schedule over a longer period to reduce short-term rate pressure and bring forward the onset of ratepayer benefits.

V. SMART CHARGE PILOT (On behalf of Sierra Club and NRDC)

Q. What did the Company's witnesses say about the Smart Charge Pilot within the TEP in this case?

A. Company Witness Foley testified that "the Company is also proposing to extend its managed charging pilot, known as the 'Smart Charge' pilot. Company Witness Leuker is sponsoring this proposal as part of the Company's Demand Response (DR) portfolio."[5] However, Witness Leuker testified that "the Company decided not to convert [the Smart Charge pilot] into a program at this time. The Company intends to keep the Smart Charge a pilot while additional value streams are analyzed."[6] While both witnesses agree that the pilot will be extended, Witness Leuker made clear that the Company does not plan to convert the pilot into a permanent program.

[4] Case No. U-20898, Commission's docket to consider issues related to the implementation of effective new technologies and business models.

[5] See direct testimony of Company Witness Foley, Page NTF-10, lines 1-3.

[6] See direct testimony of Company Witness Leujer, Page MBL-60, lines 1-9.

For clarity, in my testimony I will refer to the Smart Charge Pilot as the "Pilot" or as "Smart Charge" interchangeably, but not as the "program", since the Company has not proposed to convert it into a formal program within its DR portfolio.

Q. What benefit is the Smart Charge Pilot designed to provide to the Company and its customers?

A. Typical EV owner behavior would suggest that, upon arriving home in the evening on a workday, drivers plug in their cars immediately and forget about it until morning. Because many EV owners use Level 2 chargers that draw between 5-9 kW, this habit can nearly double a household's peak load, coincident with system peak hours. Scaled across a distribution circuit, unmanaged charging of this kind would produce untenable evening peaks, requiring costly new resource adequacy requirements, circuit upgrades, and transformer replacements. Those costs would place upward pressure on customer rates and could hinder EV adoption.

By contrast, most household cars are parked for more than 12 hours overnight, while the average daily charging need is only a few hours. From the customer's perspective, the timing of charging generally makes no difference so long as the vehicle is ready by morning. This creates an opportunity for the utility to shift charging to off-peak hours, improving utilization of existing grid assets and providing potential ratepayer benefits rather than rate pressure. This is exactly the goal of the Smart Charge Pilot: the Company provides incentives for customers to allow managed charging, turning EVs into a flexible grid asset rather than a strain on the system.

Q. What data did the Company provide related to the Smart Charge Pilot?

A. Upon request, the Company provided datasets on customer enrollment, charging events, zip codes for enrollees, finances, and vehicle information. I relied on these data to conduct my analysis, and the complete files are included in Workpaper GGW-1.

Q. What were the key findings of your analysis of the Company's Smart Charge data?

A. My analysis produced three key sets of findings: (1) customer participation and behavior, (2) fleet-level system impacts, and (3) financial impacts. I will address each in turn.

Q. What did you find about customer participation in the Smart Charge Pilot?

A. The Company enrolled 2193 customers between August 2023 and December 2024. Customers participated through one of two managed charging service providers—ChargeScape[7] or Weavegrid[8] (collectively, the "Providers"). Of the total, 1,283 enrollments were made through ChargeScape, and 910 enrollments through Weavegrid. The timing of enrollments is shown in Figure GGW-1.

[7] Visit the ChargeScape website: https://chargescape.com/ (last visited August 20, 2025).

[8] Visit the Weavegrid website: https://www.weavegrid.com/ (last visited August 20, 2025).

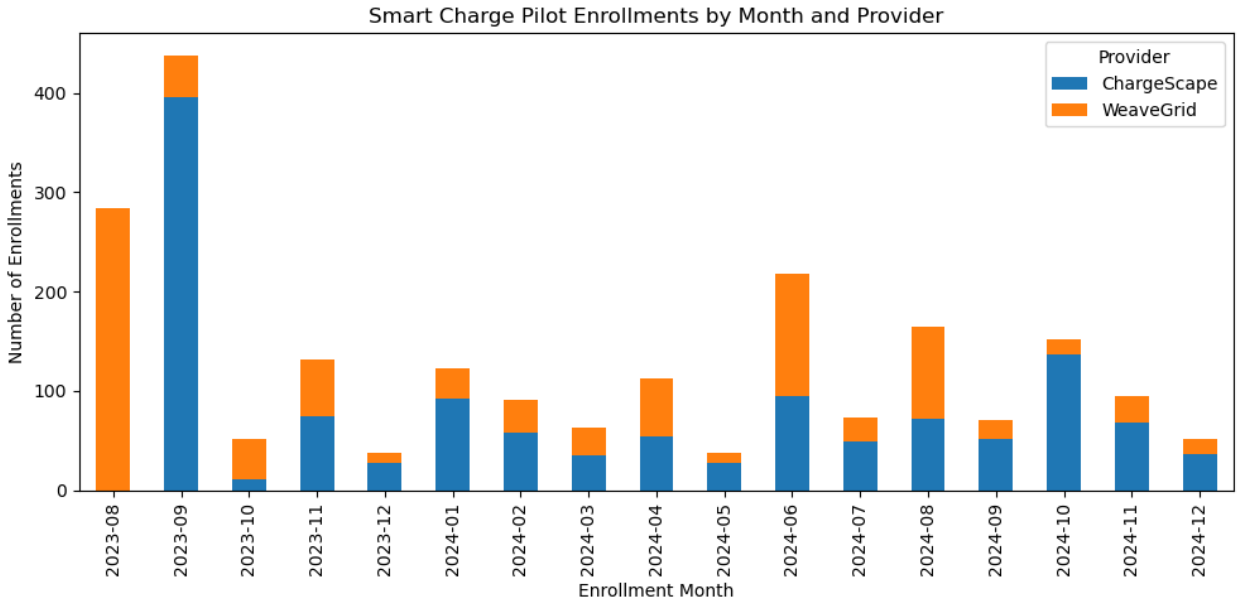

Figure GGW-1: Smart Charge Enrollments by Provider.

The enrollments cover a large geographic area and are concentrated largely outside Detroit, as shown in Figure GGW-2.

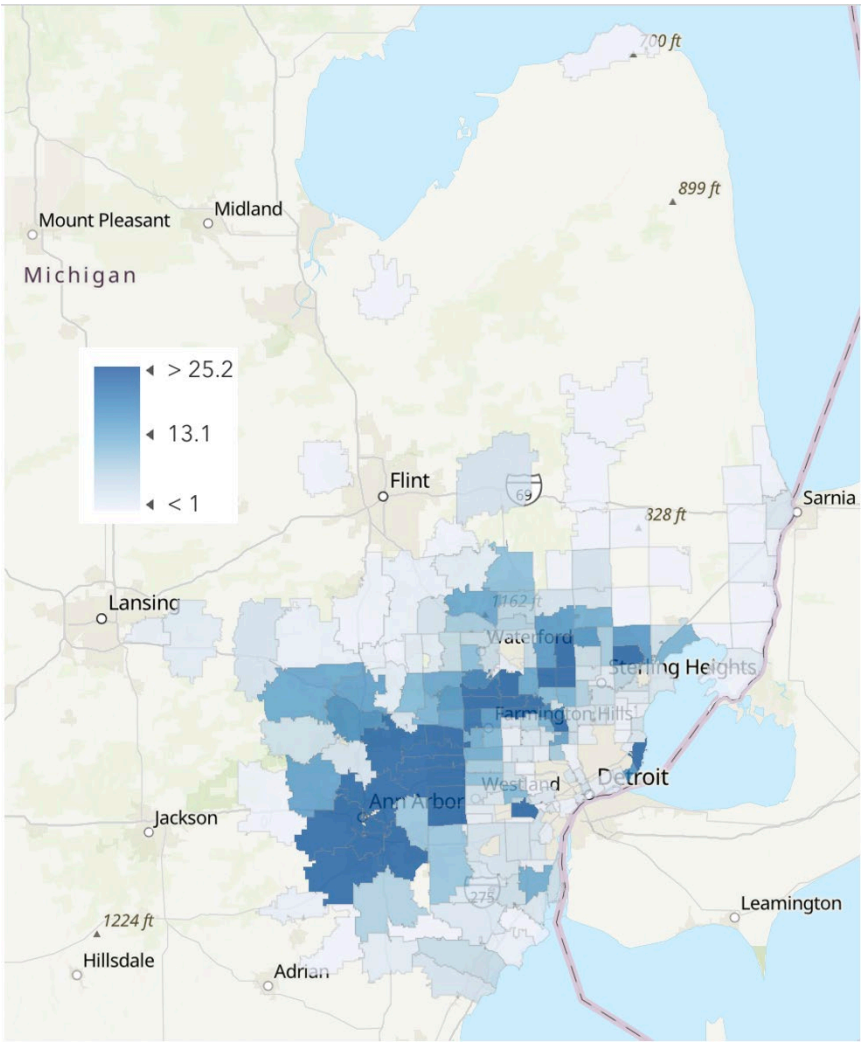

Figure GGW-2: Smart Charge Enrollment Counts by Zip Code

Q. What do the data show about customer charging behavior and compliance with managed charging schedules?

A. The data confirm that EV owners plug in mostly during the evening hours, as shown in Figure GGW-3.

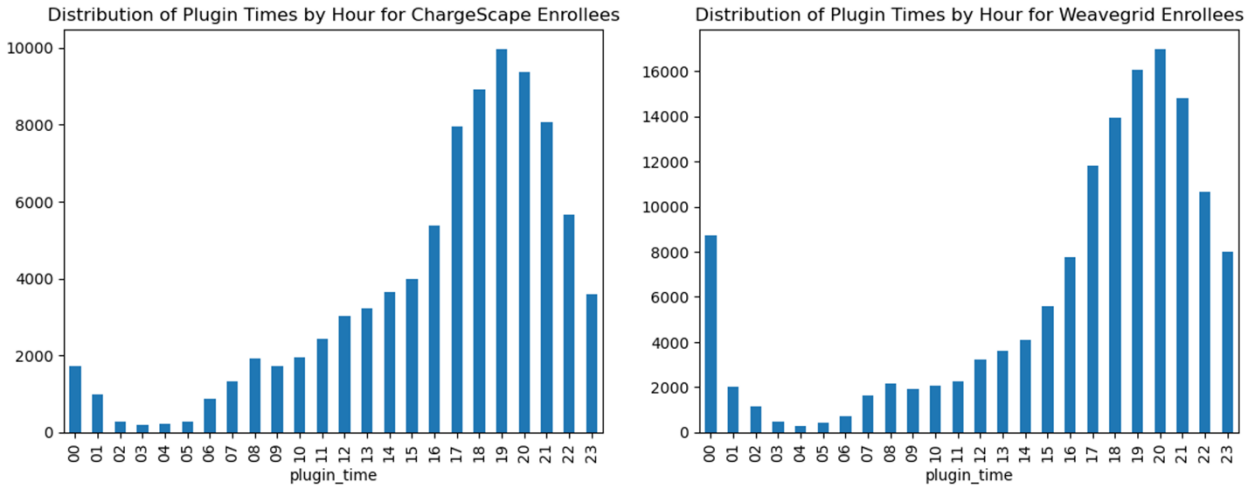

Figure GGW-3: Plugin Times for Smart Charge Charging Events

The charging data provided for the ChargeScape enrollees included a flag indicating when customers overrode the managed charging schedule. Across more than 85,000 charging events from 1085 labeled enrollees, only about 0.26% of events were overridden, and just 1.84% of customers had at least one override, as illustrated in Table GGW-4, provided as Exhibit CUB-21.[9]

[9] Exhibit CUB-21, Smart Charge Schedule Overrides.

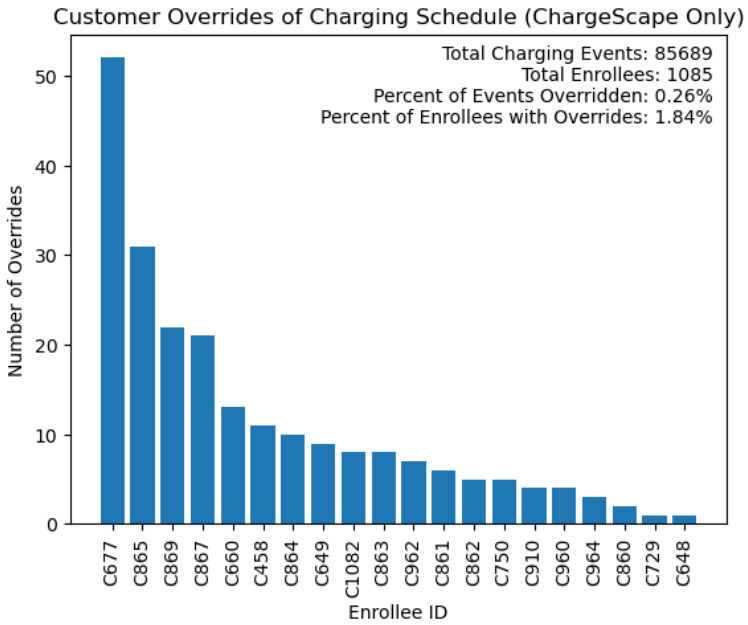

Figure GGW-4: Charging Schedule Override Counts by Customer

No comparable override data were available for Weavegrid enrollees, but the ChargeScape results demonstrate that customers were overwhelmingly compliant with the Company's managed charging schedules. Moreover, a small number of customers accounted for most of the rare overrides. These findings support the conclusion that drivers are generally indifferent to when charging occurs, provided their vehicle is ready by morning.

Q. What did your analysis show about how the Smart Charge Pilot affected system peak demand?

A. The results are illustrated in Figure GGW-5 and provided as Exhibit CUB-22.[10]

[10] Exhibit CUB-22, Smart Charge Fleet Load Profile.

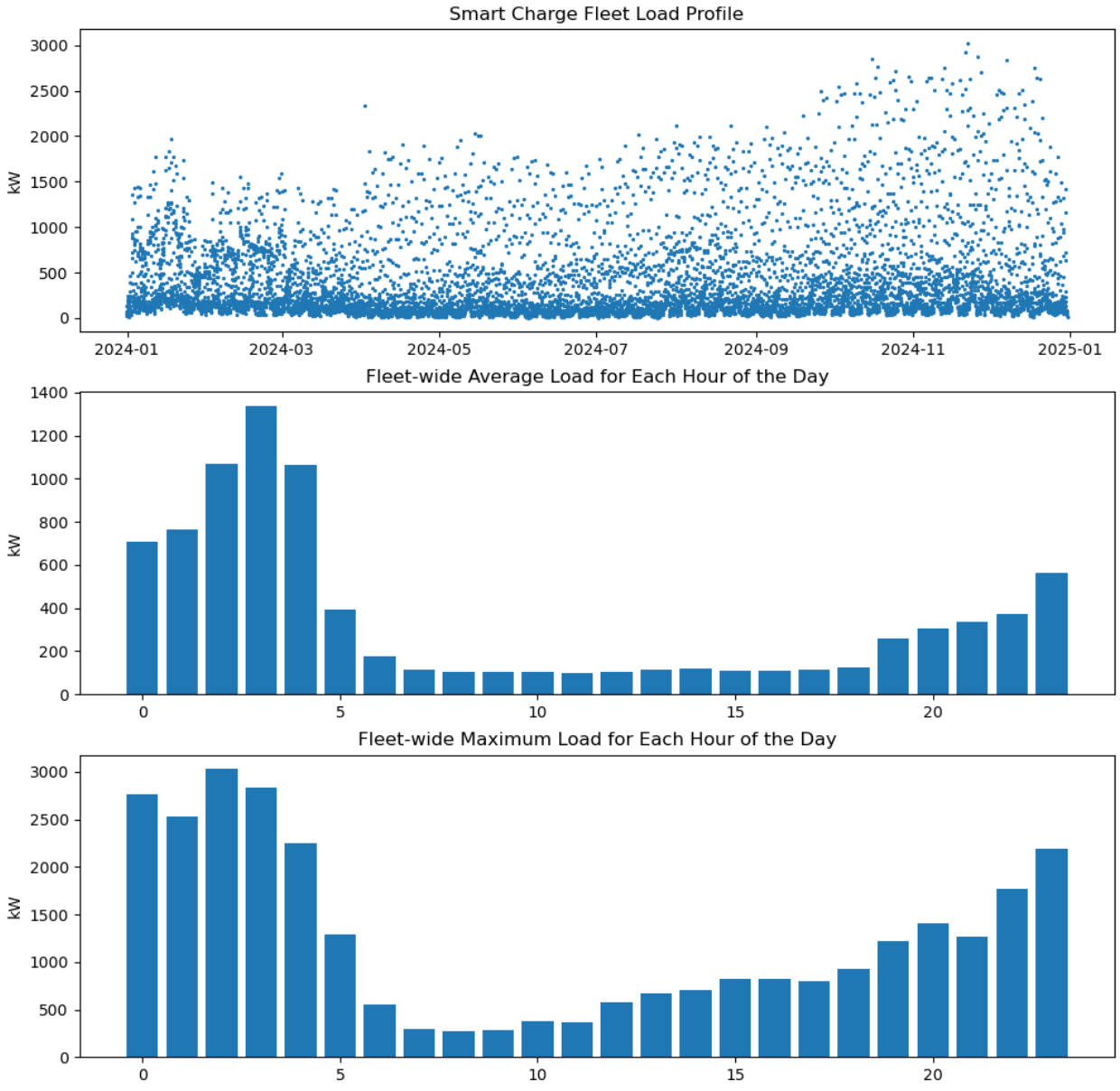

Figure GGW-5: Fleet-level Load Profile for Smart Charge, 2024

The increase in aggregate load over the year reflects the growing number of enrolled customers. On an average day, the fleet contributed less than 200 kW during the 3-7pm peak window, with the overwhelming majority of charging shifted to off-peak hours. Even at maximum observed fleet load, the Pilot never added more than 1000 kW during the 3-7pm peak window.

Q. What did you find about the Smart Charge Pilot's impact on the Company's capacity costs and incremental revenue?

A. Using MISO's standard methodology[11], I estimated that the Smart Charge fleet added approximately $4,762 in incremental capacity costs in 2024. In the same period, the Pilot generated over 3.7 GWh in electricity sales, mostly off-peak, producing gross margin revenue[12] exceeding $332,000. (Exhibit CUB-23).[13]

Q. Did charging mostly occur during a customer's off-peak hours as defined by their rate schedules?

A. Yes. Enrollees participated under one of five different rate schedules, each with distinct peak periods. As shown in Figure GGW-6, charging for nearly all schedules occurred primarily during off-peak hours, meaning Smart Charge often reduced customers' bills relative to unmanaged charging. The one exception was a single enrollee on Rate D1.7, whose irregular charging pattern does not alter this overall conclusion.

[11] The methodology for this calculation is illustrated in the supporting Workpaper GGW-1. The supporting data for the calculation originates with the MPSC-funded Michigan Building Efficiency and Electrification Cost-Benefit Analysis Toolkit, which has a module to calculate the capacity costs of added load. https://5lakesenergy-lceid-toolkit.vercel.app/ (last visited August 20, 2025). I adapted the calculation methodology to determine the capacity costs of EV load for our purposes here.

[12] I calculated the gross margin by taking the distribution component of the volumetric rate, which is 8.907 cents per kWh across all rate schedules included in the Smart Charge Pilot.

[13] Exhibit CUB-23, Smart Charge Pilot Financial Impacts.

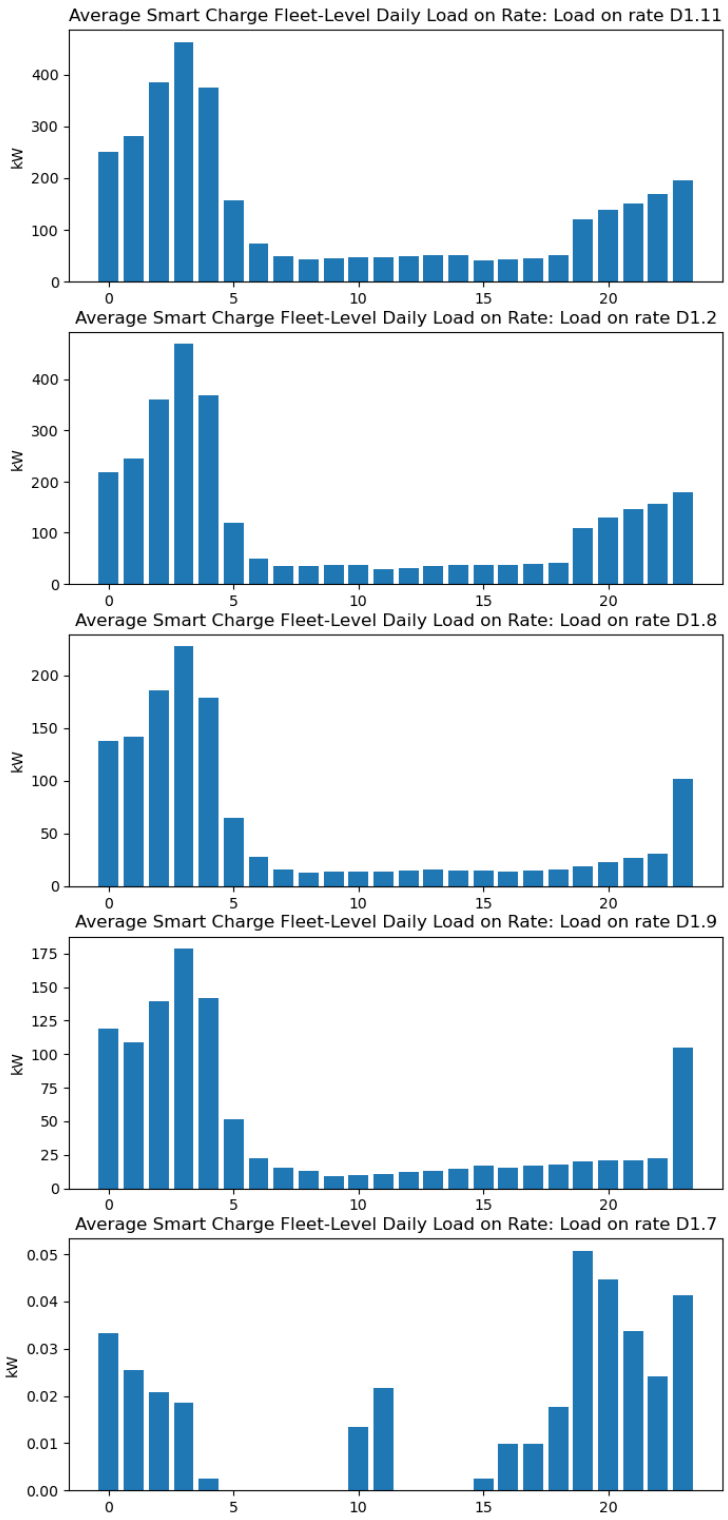

Figure GGW-6: Smart Charge Average Daily Load by Rate Schedule

Q. What financial impacts did you calculate from the Smart Charge Pilot?

A. As summarized in Exhibit CUB-23, I estimated that in 2024 the Pilot produced $327,277 in net distribution revenue after accounting for incremental capacity costs. Using the Company's administrative cost assumptions, the Pilot's costs were roughly $222,405, including customer incentives. On a net basis, Smart Charge yielded $104,872 in 2024, or about $47.82 per participating vehicle.

Q. What did your analysis suggest about the scalability of these benefits?

A. Based on the 2024 results of $47.82 per enrollee, and assuming roughly 32,000 EVs in the Company's service territory, I estimate that Smart Charge could provide roughly $1.5 million in annual net revenue. This estimate is conservative because my calculation may overstate costs—the Company may have already accounted for capacity costs in its $12,000 capital expense assumption—and because administrative costs per enrollee are likely to decline as enrollment grows. With EV adoption expected to increase in Michigan, the potential benefits will only expand over time.

Q. How does the value of Smart Charge compare to the counterfactual of unmanaged charging?

A. My per-vehicle estimate compared managed charging of 2193 vehicles to no incremental load. In reality, the counterfactual is 2193 vehicles with unmanaged charging, which would add substantial on-peak load, as shown in Figure GGW-3. Relative to unmanaged charging, the benefits of managed charging are significantly greater than my $47.82 estimate, as it avoids costly new peak demand and associated system upgrades. At scale, managed charging offers a powerful opportunity to improve grid utilization and lower costs.

Q. Based on these findings, what actions do you recommend the Commission take?

A. My analysis shows that customers can participate in Smart Charge without changing their behavior, while the Pilot delivers substantial grid benefits—significant electricity sales with minimal incremental capacity costs. Compared to unmanaged charging, Smart Charge offers clear system savings and customer bill reductions. For these reasons, the Company should integrate Smart Charge into its Demand Response portfolio as a permanent program and scale enrollment to match the current scale of and projected growth in EV adoption. Every year the Company delays expansion leaves cost savings on the table and exposes customers to avoidable grid costs. I therefore recommend that the Commission direct the Company to convert Smart Charge into a permanent program and invest in scaling it aggressively.

VI. CHARGING HUBS INITIATIVE (On behalf of Sierra Club and NRDC)

Q. Please summarize the Company's proposals regarding its Charging Hubs Initiative.

A. According to the direct testimony of Company Witness Foley, site work on the proposed Redford, MI charging hub was expected to begin by mid-year 2025.[14] The Company is proposing recovery of $1.5 million in capital investment through 2025 in support of this first Charging Hub, and no second charging hub is proposed.

Q. What did the Company's responses provided in discovery suggest about the Charging Hubs Initiative and the proposed Redford, MI site?

A. As shown in Exhibit CUB-20, Witness Foley made clear that construction has still not yet begun on the Redford, MI charging hub, and that "the Company has exited the referenced

[14] See direct testimony of witness Foley, NTF-30, lines 19-20.

Charging Hub initiative.[15] As such, it does not believe the Charging Hub in Redford, MI will ever become operational."

Q. Given the Company's statements regarding the Charging Hubs Initiative, what actions do you recommend the Commission take?

A. Because the Redford hub will not enter service, the Commission should find that associated assets are not used and useful and should not be included in rate base. Consequently, recovery of capital expenditures associated with the Charging Hubs initiative should be disallowed as follows[16]:

- $96,000 for the 12 months ending 12/31/2023
- $1,503,000 for the 24-month bridge period ending 12/31/2025.

All associated spend-to-date should be written off to shareholders, with any salvage value credited to customers.

VII. TRANSFORMER NETWORK CAPACITY (On behalf of MEC, NRDC, and CUB)

Q. What is the basis for transformer ratings?

A. Transformer ratings are typically expressed as "nameplate" or nominal ratings, which indicate the maximum load a transformer can carry continuously under standardized ambient temperature and equipment cooling conditions. These ratings are designed to protect against excessive heating that can degrade insulation and shorten equipment life. While useful as a benchmark, nominal ratings do not reflect the real operating environment

[15] Exhibit CUB-20, Responses to MNSCDE-6.31a, b and STDE-11.1.

[16] U-21860 Exhibit A-12, B5.9, line 5.

of a transformer, where ambient temperature, load fluctuations, and cooling conditions all affect its actual capacity.

Q. Why are transformer nominal ratings not sufficient to characterize transformer capacity?

A. Nominal ratings assume fixed operating conditions, but transformers operate in environments that very by season and by hour. What ultimately drives replacement is thermal aging of a transformer's insulation, which depends not just on load level but also on load duration and ambient temperature. A transformer can carry loads above its nominal rating, though doing so accelerates insulation aging. Because cold temperatures dissipate heat more effectively, transformers can sustain higher loads in winter than in summer without shortening their life. The IEEE has developed heuristics[17] to capture this effect, adjusting effective capacity upward in colder weather and downward in hotter weather. While imperfect, this illustrated that nominal ratings alone understate the load transformers can accommodate during colder times of the year.

Q. What analysis did you conduct on the Company's transformer network?

A. Using Company data as well as data from NREL tools including ResStock, ComStock, and EVI-Pro Lite, I modeled transformer network-level load profiles under a range of building and vehicle electrification scenarios. This allowed me to compare projected system loads against the Company's existing transformer network capacity, considering the effect of seasonal temperature on effective ratings. The analysis illustrates how much electrification

[17] IEEE Std C57.91-2011, *IEEE Guide for Loading Mineral-Oil-Immersed Transformers and Step-Voltage Regulators,* Section 6.4, Table 3.

the system can accommodate before winter peaks emerge and when, if at all, transformer upgrades would become necessary.

Q. What data did you use for your analysis of the Company's transformer network?

A. I requested the Company's aggregate residential, non-residential, and system-level load profiles. I also obtained transformer counts, aggregate kVA ratings, and customer counts for the Company's residential transformer network, commercial transformer network, and substation transformers. These data allowed me to align load growth scenarios with the specific transformer networks that would carry the load.

Q. How did you model building electrification?

A. I used ResStock and ComStock end-use load profiles from NREL to isolate fossil fuel energy demand for residential and commercial buildings. I then modeled electrification at various percentages by converting the corresponding share of fossil demand to electricity, applying standard efficiency and coefficient-of-performance assumptions and accounting for the weather-sensitivity of air-source heat pumps. To make the results specific to the Company's territory, I scaled statewide demand data to reflect the Company's share of Michigan customers.

Q. How did you model vehicle electrification?

A. I used NREL's EVI-Pro Lite tool to generate a managed charging load profile for an average EV in the Detroit metro area. I assumed a theoretical maximum of two million EVs in the Company's service territory and scaled the per-vehicle profile to represent different adoption levels. EVI-Pro Lite disaggregates vehicle load into home, workplace,

and public charging; I classified home charging as residential load and workplace/public charging as commercial load.

Q. How did you integrate these scenarios with the Company's transformer network?

A. For each scenario, I added the projected building and vehicle loads to the corresponding Company load profile—residential loads to the residential profile, commercial loads to the commercial profile, and both to the system-level profile. I then scaled these to reflect only the customers in each transformer network, excluding mixed-class transformers. Finally, I converted the resulting profiles into "per-unit effective load" using the IEEE heuristic, which adjusts capacity upward in cold weather and downward in hot weather. This produced a picture of effective capacity utilization for the Company's transformers in aggregate while allowing me to examine the separate and combined impacts of residential and commercial electrification.

Q. What did your analysis show about the Company's current transformer network utilization?

A. My analysis indicates that the Company is currently using only a fraction of its available transformer network capacity. As shown in Figure GGW-7, which is included as Exhibit CUB-24, the Company has room to accommodate substantial additional load from electrification.[18] On average, residential line transformers peak at just under 40% of their effective ratings, commercial line transformers peak at just under 15%, and substation transformers peak at roughly 48%.

[18] Exhibit CUB-24, Transformer Network Effective Capacity Utilization with Current Load.

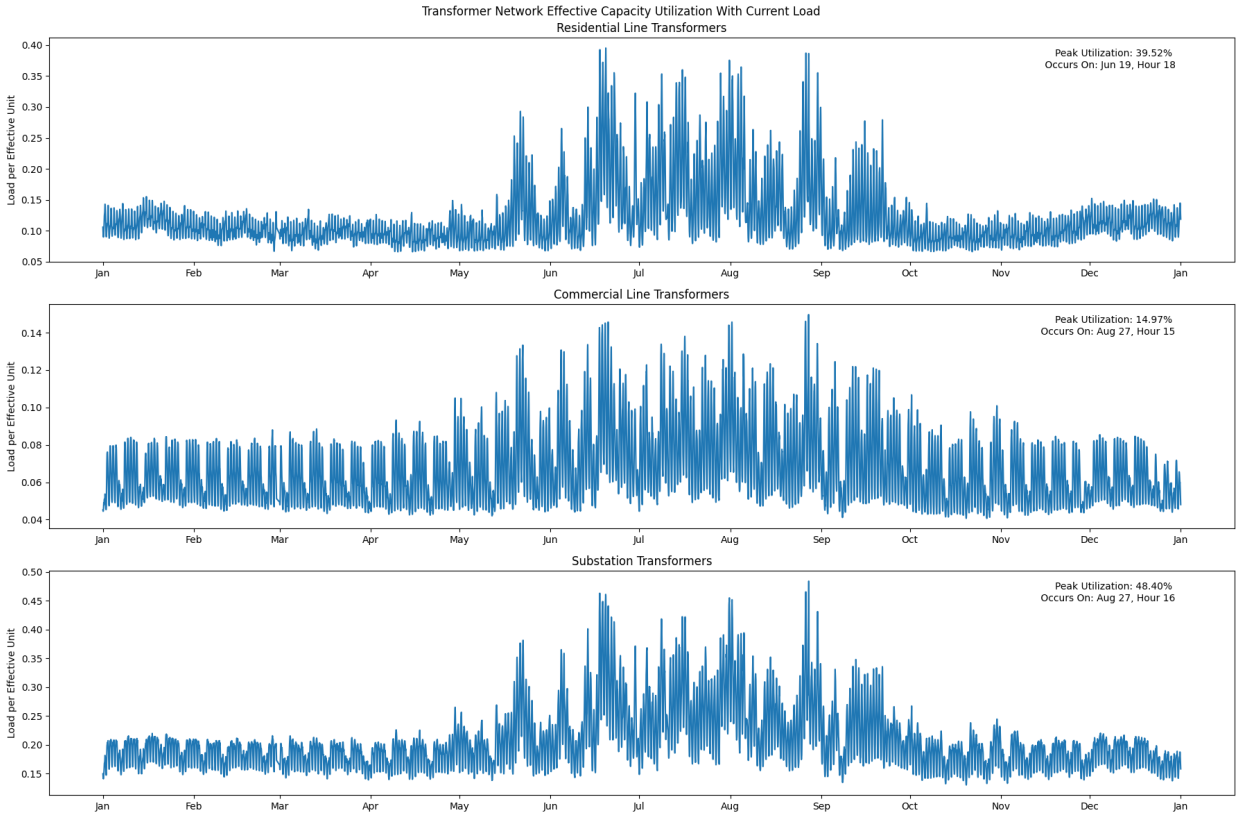

Figure GGW-7: Transformer Network Effective Capacity Utilization With Current Load.

Q. How much electrification can occur before winter peaks emerge on the Company's transformer network?

A. My analysis shows that the Company can accommodate substantial electrification before winter peaks begin to materialize. Specifically, the system could reach about 50% vehicle electrification and 20% building electrification before winter peaks exceed summer peaks. This indicates that even with significant electrification, the transformer network has ample effective capacity to manage additional load without triggering immediate upgrades. This is shown clearly in Figure GGW-8, included as Exhibit CUB-25.[19]

[19] Exhibit CUB-25, Transformer Network Effective Capacity Utilization 20-50 Electrification Scenario.

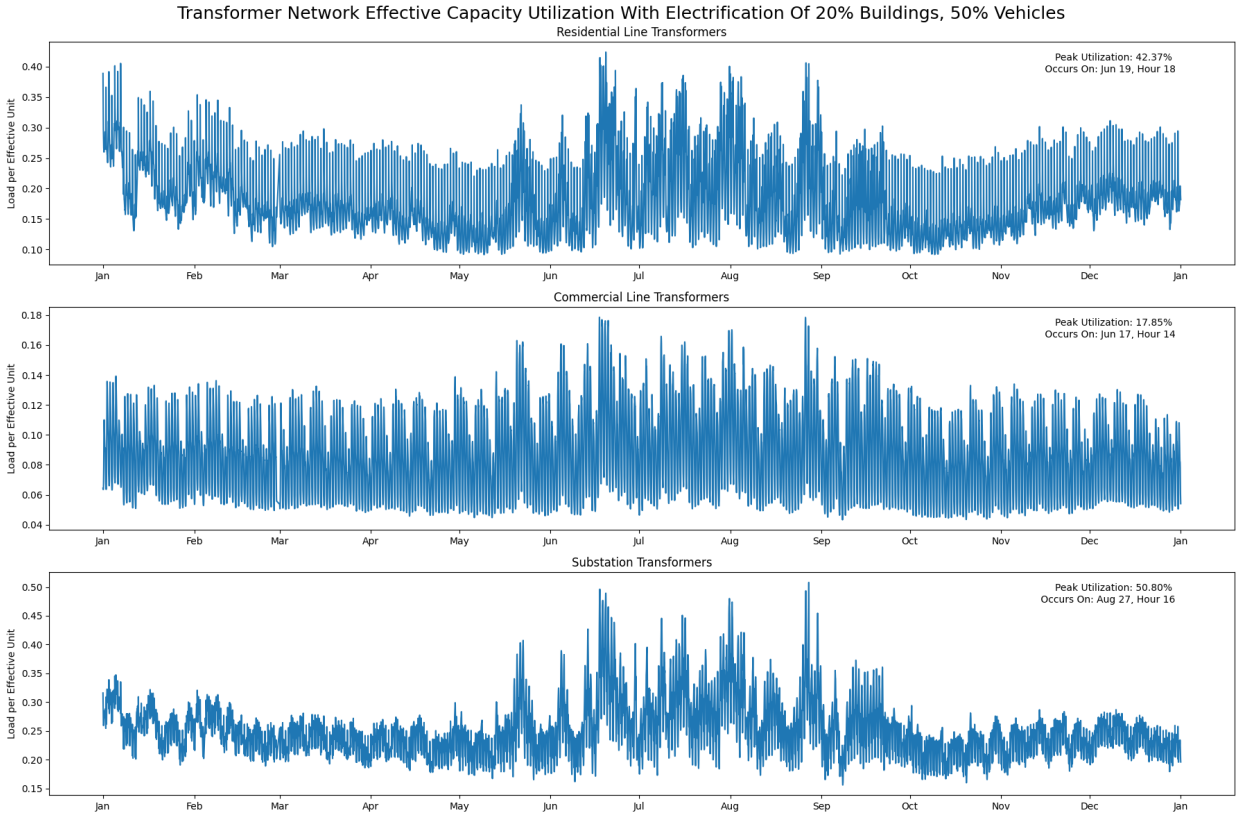

Figure GGW-8: Transformer Network Effective Capacity Utilization With Electrification of 20% Buildings, 50% Vehicles

Q. Why does your analysis assume 50% vehicle electrification while only assuming 20% building electrification?

A. Gasoline is relatively expensive compared to electricity, so switching to EVs often saves customers money immediately. By contrast, natural gas remains very cheap in Michigan, so the economics of replacing furnaces and water heaters are less compelling. In addition, persistent reliability issues in Michigan also carry higher stakes for electric heating during cold snaps than for vehicle charging, so homeowners are likely to be more cautious about electrifying buildings than vehicles. Combined with workforce challenges in equipment

installation, these factors suggest that vehicle electrification will likely advance more quickly than building electrification in Michigan.

Q. Does this analysis apply to specific circuits in the Company's distribution or to the transformer network in aggregate?

A. This analysis applies to the transformer network in aggregate, not to any specific circuits. The Company did not provide circuit-level transformer data; instead, it produced aggregate residential, commercial, and system-level load profiles. I translated those profiles into representative loading on the "average" residential line transformer, commercial line transformer, and substation transformer in the network. My intention is to demonstrate a trend in the transformer network as a whole. It should be the Company's responsibility to perform circuit-level and substation-specific analyses when seeking approval for investments justified on the basis of expected electrification.

Q. Please comment on the Company's transformer network capacity in the context of this analysis.

A. In summary, the Company's transformer network appears to have substantial effective capacity headroom under realistic near-term electrification. When I translate loads into per-unit effective load (applying the IEEE temperature heuristic), utilization remains well below unity for most hours of the year, even after adding significant EV and building load in the scenarios I modeled. Two implications follow: first, seasonal headroom allows the system to accommodate materially more winter load before reaching the same thermal stress seen in summer. Second, system-wide transformer upgrades are not imminent. Even once winter peaks emerge, the modeled per-unit effective loads indicate a long runway

before widespread transformer upgrades are necessary. (Exhibit CUB-25). This analysis supports the conclusion that all Company requests for distribution system investments justified on the basis of future electrification should be backed up by a circuit-specific analysis reflecting vehicle and building electrification scenarios and their impacts on transformer aging.

VIII. RECOMMENDATIONS

Q. Please summarize your conclusions and recommendations to the Commission.

A. On behalf of Sierra Club and NRDC, I recommend that the Commission:

(1) Approve the Company's proposed residential CIAC waiver for EV infrastructure as a reasonable short-term measure but require the Company to proactively identify EV-owning households and conduct targeted outreach.

(2) Direct the Company to inform customers of waiver limits and explain practical steps for staying within those limits.

(3) Instruct the Company to use the Commission-directed collaborative BCA tool in its next TEP.

(4) Require that the Company extend the rebate amortization period in its TEP to 10 years to reduce rate pressure.

(5) Direct the Company to convert Smart Charge from a pilot to a permanent Demand Response program and aggressively scale enrollments.

(6) Disallow cost recovery for the Redford charging hub, which the Company admits will never become operational. Specifically, disallow $96,000 for 2023 and $1,503,000 for the 2024-2025 bridge period, with any salvage value credited back to customers.

And on behalf of MEC, NRDC, and CUB, I recommend the Commission:

(7) Require the Company to submit circuit- and substation-level loading and thermal headroom analyses (similar to the one I present at the network-level), modeled under multiple electrification scenarios and tied to clear upgrade triggers, in support of any grid plan or capacity project that it seeks to justify on the basis of system loading.

My silence in regard to any position taken by the Company in its application or direct testimony in this proceeding does not indicate endorsement of that position.

Q. Does that complete your testimony?

A. Yes.

Graham Woolley

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SKILLS

- **Policy:** Modeling and analysis of physical and economic systems to evaluate clean energy initiatives
- **Programming**: Python | Numpy | Pandas | SciPy | Matplotlib | Object-oriented Python | Machine Learning | Requests (HTTP & API integration) | FastAPI | Web scraping | SQL | Tableau visualization | API interactions
- **Web development**: HTML | CSS | Javascript | React.js (with a Treehouse Techdegree Certificate)
- **Physics:** Advanced calculus & linear algebra | Statistics | First-principles reasoning | Laser cooling and optical systems | Analytical problem solving | Physics-based modeling (thermodynamics, power systems)

EDUCATION

B.A. in Physics — **University of California, Berkeley** — **08/2017-12/2019**

- Relevant Physics Coursework: Statistical and Thermal Physics, Electrodynamics, Analytic Mechanics, Particle Physics, Quantum Field Theory, and Instrumentation & Experimentation Labs.
- Other Relevant Coursework: Electric Power Systems, Climate Change Mitigation, Climate Change Economics, Environmental Engineering, Python Programming

PROFESSIONAL EXPERIENCE

Consultant — **5 Lakes Energy** — **12/2022-Present**

- Wrote a transportation electrification plan for a Michigan utility compliant with state regulatory requirements. Built models assessing the economics of DC Fast Charging sites to support the development of this plan.
- Designed and built a cost/benefit analysis toolkit to assess the impacts of building electrification and energy efficiency projects. Deployed this toolkit on the web using a Microsoft Azure Function App.
- Built data pipelines (in Python) and a Tableau workbook to underpin the analytical narrative of the Michigan Citizens' Utility Board annual Utility Performance Report.
- Developed a physics-based, weather-dependent transformer thermal aging model to analyze distribution system costs. Used this model to testify in utility regulatory cases before the Michigan Public Service Commission.
- Modeled the environmental and economic impacts of proposed climate legislation in Michigan, which was later signed into law by Governor Whitmer. Streamlined the energy policy modeling process by automating workflows using Python and Jupyter notebooks.

Founding Fellow — **Climatebase** — **02/2022-04/2022**

- Wrote a Python script to automatically collect grid data from the California Independent System Operator.
- Created visualizations to analyze this data using Numpy, Pandas, and Matplotlib.
- Continued mentoring fellows in subsequent cohorts to help with their climate career transitions.

STEM Teacher — **ARISE High School** — **08/2020-06/2022**

- Built and taught online and in-person engineering/physics courses for an underserved population of students. We focused on the thermodynamics of climate change, principles of design, critical thinking and 21st-century skills.
- Led students through a rigorous online curriculum in front-end web development using HTML, CSS and Javascript while developing the same skills myself.
- Designed a computer science course for underserved students focusing on problem solving and python programming.

Data Analytics Intern — **New Sun Road P.B.C.** — **01/2020-05/2020**

- Developed Python script for acquiring microgrid performance and usage data from microgrid operator APIs.
- Analyzed the data using Python (Numpy, Pandas, Matplotlib), specifically in projects involving anomaly detection, for example in detecting degrading batteries.
- Produced an algorithm that identifies grids experiencing unmetered power anomalies and lists likely causes.

RESEARCH

Undergraduate Researcher — **Berkeley Center for Theoretical Physics** — **01/2019-06/2019**

- Compared existing astrophysical data to the predictions of several candidate models for Dark Matter, placed numerical constraints on each, and produced results that inform the future experiments in Dark Matter detection.

Undergraduate Researcher — **UC Berkeley Department of Nuclear Engineering** — **01/2018-01/2019**

- Monitored ion sources and system parameters for experiments in geochronology and nuclear reaction cross section measurements at the High Flux Neutron Generator (HFNG).
- Machined a sample holder that carries increased samples inside the HFNG, resulting in better statistics.
- Used high purity germanium detectors to collect cross section data on irradiated samples.
- Performed data analysis with Python, revealing a previously unknown property of the Nickel-58 nucleus.

MPSC Case No: U-21860

Requester: MNSC

Question No.: MNSCDE-6.31a

Respondent: N. Foley

Page: 1 of 1

Question: 31. Refer to Testimony by Company Witness Foley, pages NTF-29 and NTF-30. Please clarify: a. Has site work begun at the proposed Charging Hub in Redford, MI?

Answer: Assuming “site work” means construction on the proposed site, then no.

Also, see response to STDE-11.1 which highlights that the Company has exited the referenced Charging Hub initiative.

Attachment: *None*

MPSC Case No: U-21860

Requester: MNSC

Question No.: MNSCDE-6.31b

Respondent: N. Foley

Page: 1 of 1

Question: 31. Refer to Testimony by Company Witness Foley, pages NTF-29 and NTF-30. Please clarify: b. When will the Charging Hub in Redford, MI become operational?

Answer: See response to STDE-11.1 which highlights that the Company has exited the referenced Charging Hub initiative. As such, it does not believe the Charging Hub in Redford, MI will ever become operational.

Attachment: *None*

MPSC Case No: U-21860

Requester: Staff

Question No.: STDE-11.1

Respondent: N. Foley

Page: 1 of 1

Question: Please confirm if plans have changed for Charging Hub/Truck Stop of the Future project. Please provide all impacts to revenue, expenses, rate base and the revenue deficiency for any projected changes for the projected test year.

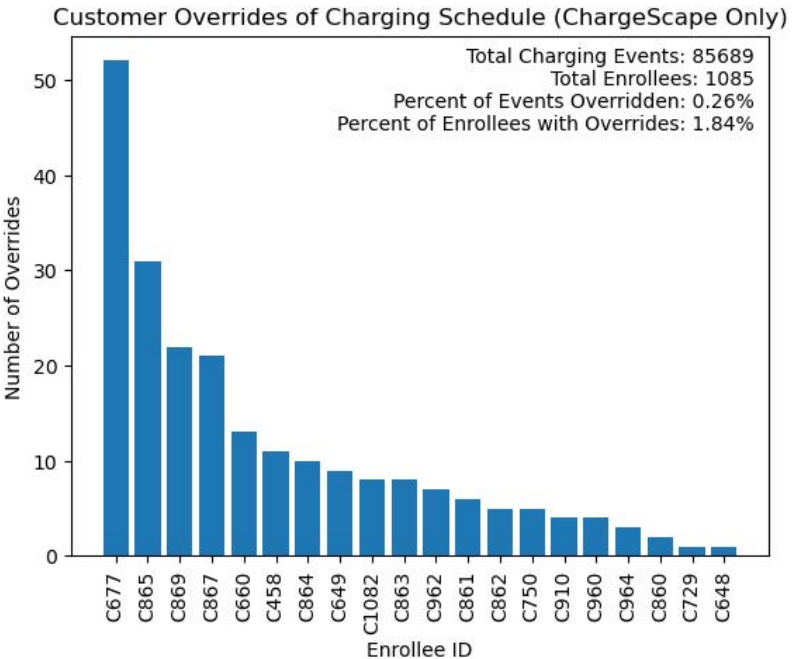
Answer: Yes, the Company's plans have changed for the Charging Hub/Truck Stop of the Future project. As discussed in my direct testimony starting on page 29, the Company and the other project partners were waiting for disbursement of the RAISE grant funds awarded to the State of Michigan (SOM). However, in late May 2025, the Company was informed that the United States Department of Transportation (USDOT) was requesting that EV Chargers be removed from the scope of the Truck Stop of the Future Initiative.

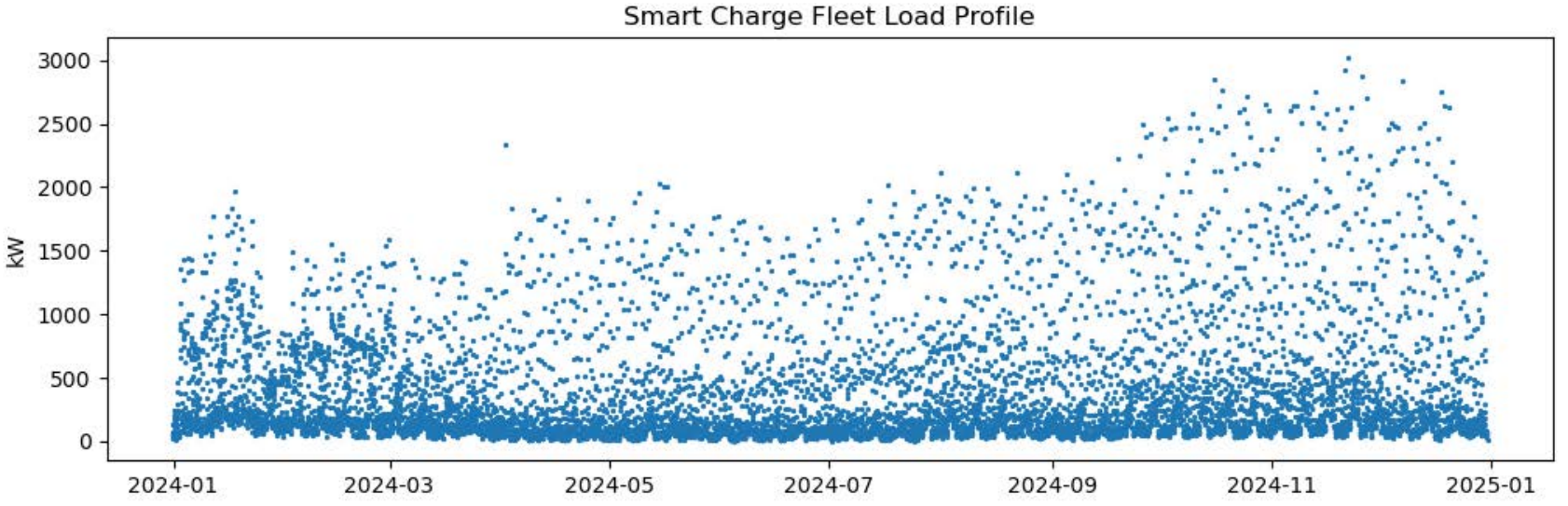
Given this requested change in scope, the Company made the decision to exit the initiative since its primary interest was testing innovative EV charging for medium/heavy-duty trucking.

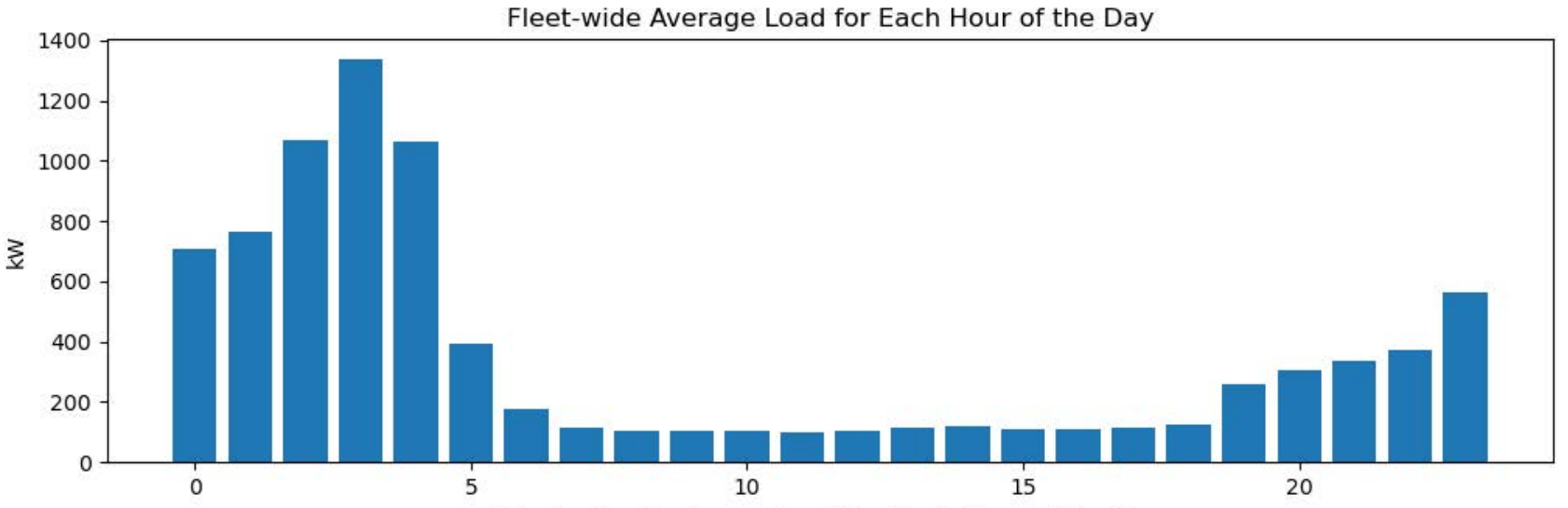
In the instant case, the Company has requested recovery of $1.5 million of capital in 2025 that it had planned on investing in support of the project (Exhibit A-12, Schedule B5.9, Line 5). It no longer expects to invest this capital.

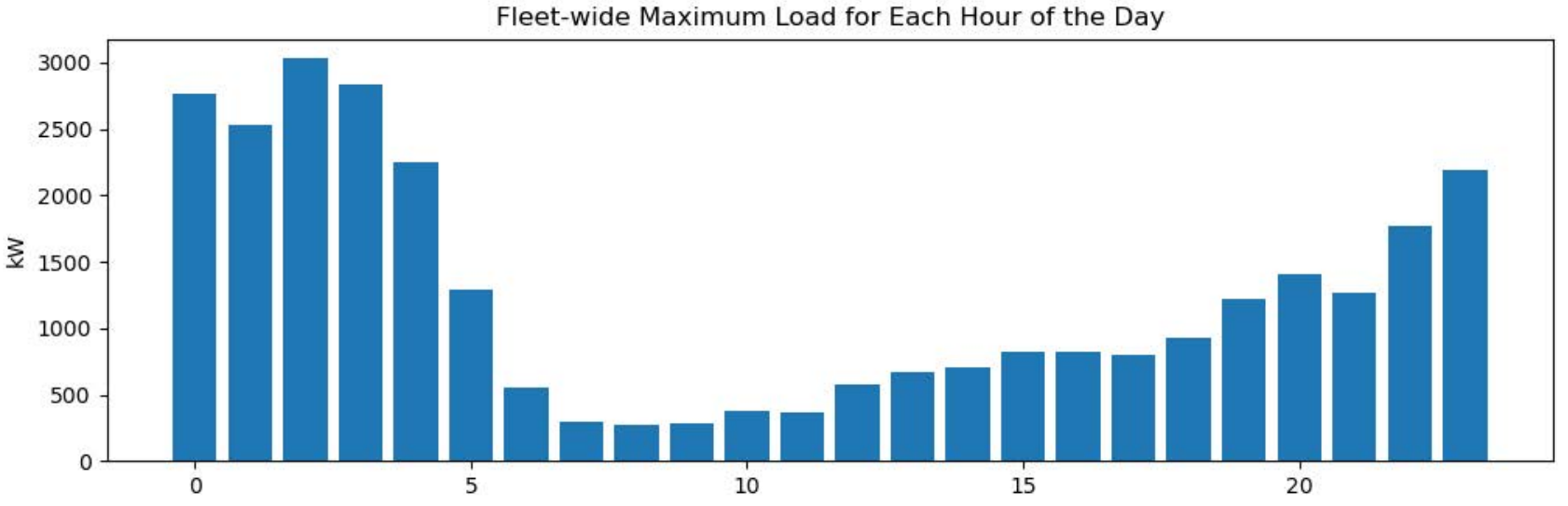
The Company is also requesting recovery of $99 thousand of capital that it had invested in 2023 and 2024. For example, these investments supported Project Management Office (PMO) resources and a third-party engineering study in anticipation of site work. These investments were reasonable and prudent at the time they were spent given there was no indication that the scope of the project would change and the MPSC had approved the Company's participation in the project.

Attachment: *None*


Customer Overrides of Charging Schedule (ChargeScape Only)
Total Charging Events: 85689
Total Enrollees: 1085
Percent of Events Overridden: 0.26%
Percent of Enrollees with Overrides: 1.84%
Number of Overrides
0
10
20
30
40
50
C677
C865
C869
C867
C660
C458
C864
C649
C1082
C863
C962
C861
C862
C750
C910
C960
C964
C860
C729
C648
Enrollee ID


Smart Charge Fleet Load Profile
kW
3000
2500
2000
1500
1000
500
0
2024-01
2024-03
2024-05
2024-07
2024-09
2024-11
2025-01


Fleet-wide Average Load for Each Hour of the Day
kW
1400
1200
1000
800
600
400
200
0
0
5
10
15
20


Fleet-wide Maximum Load for Each Hour of the Day
kW
3000
2500
2000
1500
1000
500
0
0
5
10
15
20

Smart Charge Pilot Financial Impacts

Data Sources:

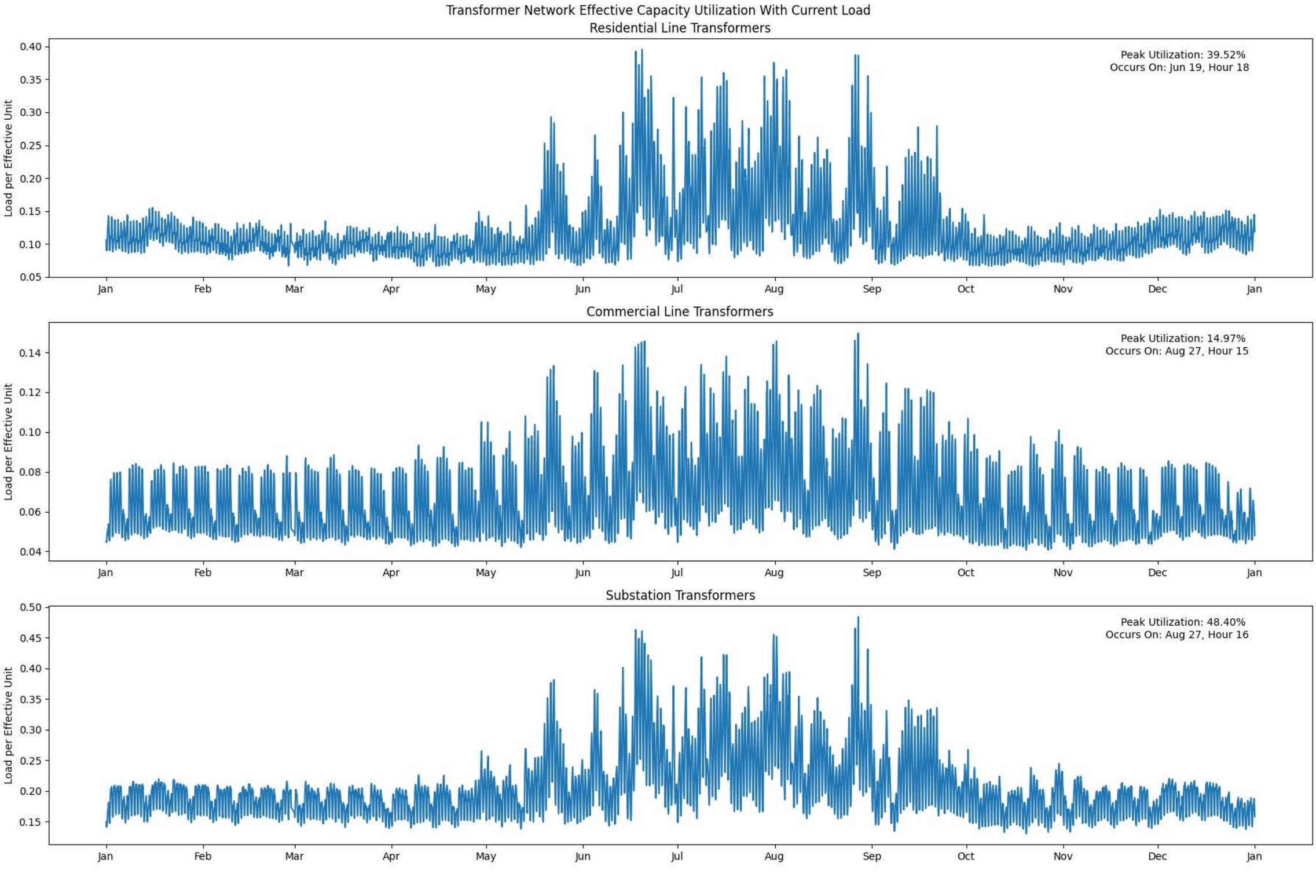
- Company Discovery response U-21860 MNSCDE-6.32a Smart Charge_2024 Enrollment Dates.xlsx
- Company Discovery response U-21860 MNSCDE-6.32d-01 Smart Charge_2024 EV Hourly Data_ChargeScape.xlsx
- Company Discovery response U-21860 MNSCDE-6.32d-02 Smart Charge_2024 EV Hourly Data_WeaveGrid.xlsx
- Company Discovery response U-21860 MNSCDE-6.33 DR Cost Effectiveness - Smart Charge RFP.xlsx
- Atlas EV Hub Cumulative EV Sales by State (MI)
- EIA Form 861 Customer Count Data

Analysis by Witness Woolley.

Data sources and supporting analysis are included in Workpaper GGW-1. Data Sources are summarized in Exhibit CUB-26 (GGW-8).

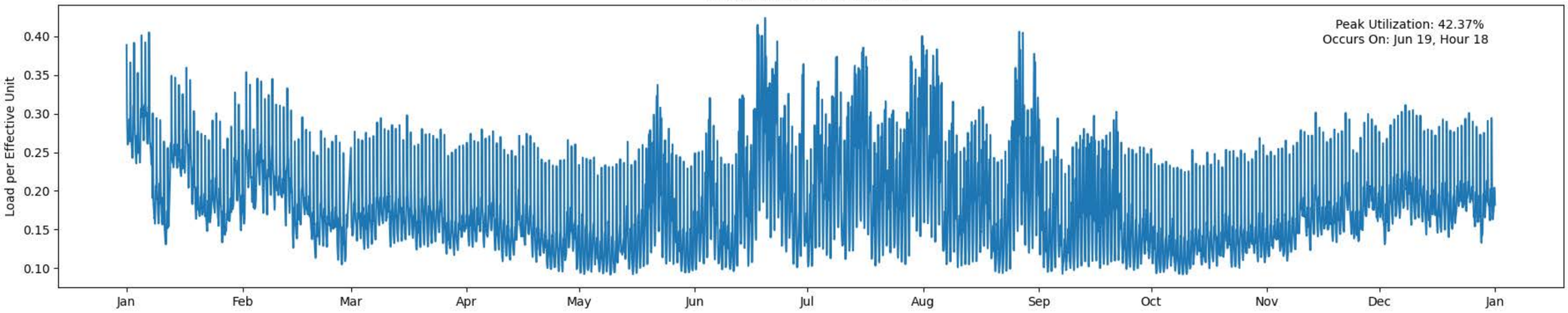
Results:

Item	Number of Enrollees	2193 customers
1	Fleet-level Capacity Costs in 2024	$4762
2	Distribution Rate for Smart Charge Enrollees	0.08907 cents per kWh
3	Fleet-level Sales of Electricity in 2024	3,727,840 kWh
4	Distribution Revenue (Gross Margin) on Smart Charge Electricity Sales	$332,039
5	Fleet-level Net Revenue (gross margin less capacity costs)	$327,277
6	Annual Customer Incentive	$85 per customer enrollment
7	Annual Miscellaneous O&M Costs	$24,000
8	Annual Miscellaneous Capital Costs	$12,000
9	Program Costs per Customer Enrollment	$101.42
10	Total 2024 Administrative Costs	$222,405
11	Net Incremental Revenue from Smart Charge	$104,872
12	Net Incremental Revenue per Vehicle	$47.82
13	Estimated EV Count in Michigan, 2025	71,561 vehicles
14	Estimated EV Count in DTE Territory, 2025	32,044 vehicles
15	Potential Net Incremental Revenue (if all EVs enrolled), 2025	$1,532,385

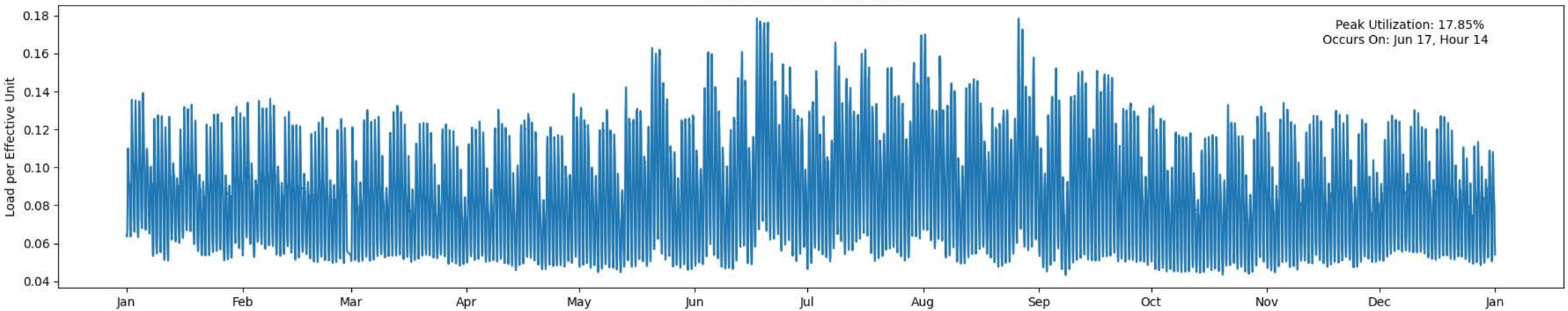

Transformer Network Effective Capacity Utilization With Current Load
Residential Line Transformers
Peak Utilization: 39.52%
Occurs On: Jun 19, Hour 18
Load per Effective Unit
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Commercial Line Transformers
Peak Utilization: 14.97%
Occurs On: Aug 27, Hour 15
Load per Effective Unit
0.14
0.12
0.10
0.08
0.06
0.04
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Substation Transformers
Peak Utilization: 48.40%
Occurs On: Aug 27, Hour 16
Load per Effective Unit
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan

Transformer Network Effective Capacity Utilization With Electrification Of 20% Buildings, 50% Vehicles

Residential Line Transformers



Commercial Line Transformers



Substation Transformers

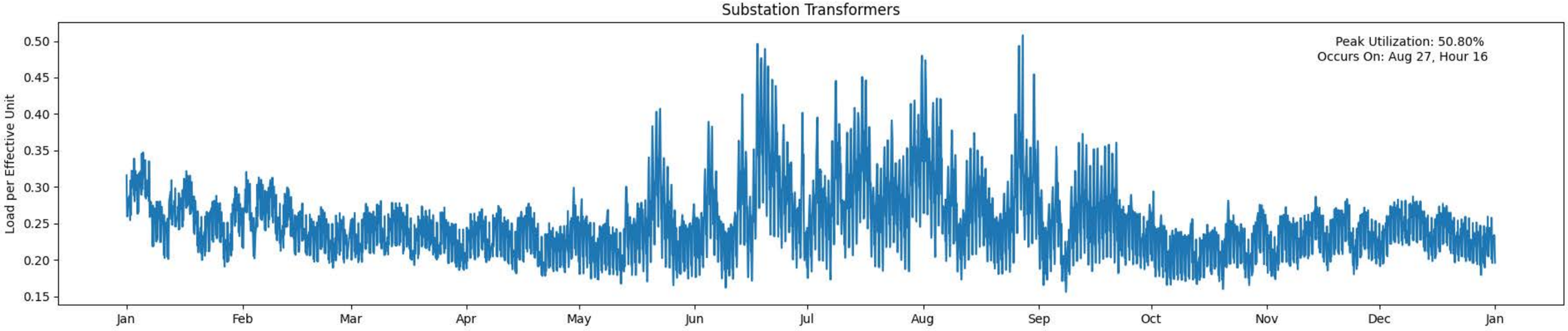


EXHIBIT CUB-26 IS AN EXCEL FILE

You can find CUB-26 at the link below:

CUB-26. Supporting Data for Smart-Charge Analysis

(link expires September 20th)

EXHIBIT CUB-27 IS AN EXCEL FILE

You can find CUB-27 at the link below:

CUB-27. Supporting Data for Transformer Analysis

(link expires September 20th)

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of **DTE ELECTRIC COMPANY** for authority to increase its rates, amend its rate schedules and rules governing the distribution and supply of electric energy, and for miscellaneous accounting authority	Case No. U-21860

Proof of Service

On the date below, an electronic copy of **Direct Testimony and Exhibits of Graham Woolley on behalf of Michigan Environmental Council, Natural Resources Defense Council, Sierra Club, and Citizens Utility Board of Michigan (CUB-19 through CUB-27)**; was served on the following:

Name/Party	E-mail Address
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Michigan Cable Telecommunications Association Sean P. Gallagher Jon Austin	 sgallagher@fraserlawfirm.com jaustin@fraserlawfirm.com
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Michigan Municipal Association for Utility Issues (MI-MAUI) and Michigan Coalition To Protect Public Rights-Of-Way (PROTEC) Michael J. Watza Nathan Inks	mike.watza@kitch.com nathan@bloomsluggett.com

The statements above are true to the best of my knowledge, information and belief.

Troposphere Legal, PLC
Counsel for MNSC

Date: August 22, 2025

By: Natasha J. Fowles
Digitally signed by Natasha Fowles
Date: 2025.08.22 13:27:11 -04'00'

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Traverse City, MI 49686
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Email: natasha@tropospherelegal.com