DNV

MASSACHUSETTS PHASE 1 EV CHARGING STATION PROGRAM EVALUATION

Program Year 3 Evaluation Report

National Grid

April 28, 2022

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1 EXECUTIVE SUMMARY

This report presents the DNV (formerly ERS) Team's evaluation results and findings for Program Year 3 (PY3) for National Grid Massachusetts's Electric Vehicle (EV) Charging Station program (Charging Program or program), a program designed to facilitate development of Level 2 charging stations and Direct Current Fast Charging (DCFC) stations throughout National Grid's service territory in Massachusetts.

The PY3 evaluation in this report covers program activity from January 1, 2021, through December 31, 2021. The DNV Team's evaluation activities for PY3 included the following:

- Review and analyze all program data and materials, including general program information and program tracking spreadsheets that monitor charging station progress and costs.
- Analyze charging station utilization data provided by six EV supply equipment (EVSE) vendors covering 684 program-supported charging stations across 246 site host facilities (sites).

From these evaluation activities, the DNV Team developed the following PY3 program findings, recommendations, and considerations, grouped into program achievements and process improvement opportunities. These are summarized below.

1.1 Program Achievements

Finding #1: The Charging Program has exceeded its goals. The Charging Program has activated a cumulative total of 836 stations through December 31, 2021, far surpassing the overall target goal of 680 stations and almost reaching the exemplary goal of 850 activated stations. Broken out by station type, the Charging Program has activated 823 Level 2 stations and 13 DCFC stations to date. In PY3 alone, the program activated 378 Level 2 Stations and 11 DCFC stations, almost doubling the number of stations activated in PY1 and PY2.

Finding #2: Station utilization continues to increase across all segments. While an overall increase in utilization would be expected given the increase in activated stations, utilization also increased significantly in PY3 compared to PY2 when normalized by station and time in operation. Compared to PY2, station utilization, average kWh charged per station, and the average number of charging sessions per week have all increased in PY3 for stations in all segments.

Finding #3: Continued success in activating stations in Environmental Justice (EJ) communities. Of the 864 activated and in-flight stations through PY3, 52% are located in EJ communities meeting at least one EJ criteria (defined in detail in Section 4.1.2), and 26% are located in communities meeting two or more EJ criteria and are therefore eligible for additional program funding. DNV's verification process used to verify these stations in EJCs is discussed in greater detail in section 4.1.2. Compared to PY2, the number of stations that are eligible for this additional funding and meet at least one EJ criteria showed a 5% increase in PY3.

Finding #4: Strong site host pipeline. The Charging Program continues to have a strong pipeline of site hosts that are interested in the program. As of December 31, 2021, the Charging Program had not only activated 836 stations, but has an additional 487 stations in the pipeline from site hosts that are interested in installing L2 and/or DCFC stations.

Finding #5: Growth in DCFC station activation. The Charging Program saw significant growth in DCFC stations between PY2 and PY3, with 11 activated DCFC stations in PY3. The program also has a strong pipeline of 95 DCFC stations.

Finding #6: Multi-unit dwelling (MUD) segment growth. Between PY2 and PY3, MUD stations saw the most growth in the Charging Program compared to the other program segments, which is important because charging at MUD facilities is a necessity to allow for future EV adoption and charging accessibility. While MUD stations are not as widespread as public and workplace stations are in the program, since PY2 the Charging Program more than tripled its activated MUD stations. There are also a total of 56 Level 2 MUD stations in the pipeline for the program (17% of the projects in the program

pipeline), with some in EJ communities, suggesting additional future opportunities in the segment. Utilization at participating MUD stations more than doubled from PY2 to PY3, with sessions and kWh per station increasing even more when normalized by station and time in operation, signifying an increased usage for EV chargers at multi-unit dwellings.

Recommendation #1: Continue to encourage MUD station development. The more than 100% increase in utilization showcases increasing demand. While MUD station development may be hindered by a lack of interest from site developers or a lack of funding, demonstrated demand should be seen as motivation for development of new and expansion of existing MUD sites.

1.2 Process Improvement Opportunities

Finding #7: The process for EVSE data management and tracking still does not capture all Charging Program station usage data. The Charging Program requires that EVSE suppliers provide National Grid with charging data, adhering to a required data format, for all stations funded by the program for a period of five years from the installation date. However, National Grid does not have a process to verify that data for each station complies with the data standard. Mapping EVSE data to individual stations is a manual process and continues to result in frequent inconsistencies between tracking data and utilization data. During the PY3 evaluation, DNV coordinated with National Grid and the EVSE suppliers but 11% of the charging stations providing utilization data could not be mapped to activated stations. While the overall data coverage increased from PY2, the process in PY3 was equally challenging and many stations that were previously mapped during prior year evaluations needed to be re-mapped, largely due to EVSE vendor data management changes.

- **Recommendation #2**: Standardize the station ID tracking process and conduct upfront and ongoing quality control for each EVSE vendor and each activated station providing utilization data. Ongoing quality control could be facilitated by establishing quarterly check-ins between National Grid and each participating EVSE supplier to review recent charging data submissions for data format consistency and to cross-compare the IDs of actively-reporting stations to identify mismatches or tracking gaps resulting from changed station IDs or other factors. This will help to mitigate mapping issues and provide additional opportunities to incorporate any changes to supplier data tracking and mapping into the official program dataset of record. DNV is aware that National Grid is working to develop an improved data management system to better map individual station data and identify data inconsistencies.

Finding #8: Supplier diversity. While National Grid promotes all approved EVSE providers, there is little supplier diversity in activated stations. One EVSE provider continues to provide the overwhelming majority of Charging Program stations and utilization, representing 79% of all activated stations. For the stations actively reporting utilization data, this EVSE provider represents 89% of stations and 92% of reported kWh charged program-wide.

Finding #9: **Consistent with previous evaluation efforts, insights from the charging station utilization analysis can help National Grid target market research and refine program offerings** to identify early utilization trends, increase – and shape – charger utilization in key segments, and pilot advanced load management technologies and strategies. The key observations and corresponding program considerations include:

- The MUD, workplace, and public Level 2 segments exhibit relatively high rates of late night and overnight charging. While hospitals and hotels represent a sizable portion of the workplace and public sites with the highest levels of overnight (9 p.m.–5 a.m.) charging, several offices, parking facilities, and municipal facilities also exhibit high levels of overnight charging. This level of nighttime charging is higher than would be expected for these types of facilities,

suggesting some EV drivers – potentially those without access to charging at home – consistently access these stations for convenient or free overnight refueling.[1]

  - **Consideration A**: The prevalence of overnight charging across multiple segments presents an opportunity for National Grid to gather insights into the types of drivers using these stations, their motivations for charging where and when they do, and their preferences around and receptiveness to managed charging at these facilities.
- Several segments – including public DCFC and public and workplace Level 2 – show high levels of morning and midday charging as well as weekday vs. weekend variability. The public and workplace Level 2 segments both exhibit a morning ramp that appears to be driven by drivers plugging in after their commute, though the majority of charging is conducted off-peak. Charging in the public DCFC segment, however, occurs mostly on-peak and is intermittent, as expected.
- Concentration of utilization at a relatively small number of charging sites continued in PY3, with no more than 35% of sites being responsible for 70% of kWh charged in any given segment (between public, workplace, and MUD). Of the 30 most utilized sites (by kWh per station per week), 80% are in the public segment and 93% are Level 2 chargers. Of the total activated stations, 72% are in the public segment and 92% are Level 2. However, given the multitude of diverse factors that determine the utilization of the charging network, it is currently not possible to draw clear and consistent conclusions about why the observed levels of concentration exist and what impact they may have on the long-term robustness of the charging network.

The remainder of this report presents a summary of the EV Charging Station Program, the DNV Team's evaluation methodology, and the results of evaluation research and analyses.

[1] As discussed in the next finding bullet, these segments also exhibit pronounced mid-morning ramps in charging load and consistent midday charging. These statements are not contradictory. The morning and midday charging behavior are to be expected for the public and workplace segments, which support charging for commuters, employees, customers, and others who access EV chargers throughout the day. The level of late night and overnight charging – particularly on weekends – was unexpected for these segments because the majority of facilities in these segments (especially workplaces) do not operate overnight and tend to be closed on weekends. These segments are not expected to support significant charging for tenants/residents, the majority of which occurs overnight.

2 INTRODUCTION

This section describes National Grid's EV Charging Station Program (Charging Program or program) in Massachusetts and the evaluation approach and objectives for Program Year 3 (PY3), running from January 1, 2021, to December 31, 2021.

2.1 Electric Vehicle Charging Station Program Overview

National Grid's EV Charging Program seeks to increase the deployment of Level 2 and Direct Current Fast Charging (DCFC) stations throughout Massachusetts. For approved projects, National Grid funds 100% of the cost of electric service upgrades and distribution equipment needed to power and install the charging stations. The program also provides rebates for the cost of the electric vehicle supply equipment (EVSE). Rebates for Level 2 station equipment costs vary depending on the targeted charging segment, covering 50% of the cost of Level 2 stations at workplace facilities, 75% of the cost at public/municipal facilities, and 100% at facilities located in environmental justice (EJ) communities meeting two or more criteria. Equipment costs for DCFC stations are not eligible for rebates from National Grid because, at the time the program was filed, National Grid believed public and private subsidies for DCFC stations from non-utility ratepayer sources, such as the Volkswagen settlement funding, would be available to site hosts.

The program requires network and station monitoring for a minimum of five years after installation for all participants.

Roles and Responsibilities

There are five primary market actors engaged in National Grid's Charging Program:

- **Product growth team:** This group was responsible for developing the Charging Program strategy, focusing on program design and budgets. They also worked on regulatory filings in support of the program. Once the program was running, the implementation team took on responsibility for the program.
- **Implementation team:** This group's primary focus is on delivering the Charging Program. They are responsible for the day-to-day operations including evaluating and approving site host projects and determining the strategic direction of the program. They also develop and maintain relationships with manufacturers, vendors, and other program stakeholders.
- **Sales team:** The National Grid sales team works closely with the implementation team to deliver the Charging Program. The primary role of the sales team is to generate leads for the program from assigned customers. However, unlike the implementation team, the sales team is responsible for bringing all National Grid offerings to their customers, including energy efficiency and demand response (DR) programs.
- **Installation vendors**: The Charging Program encourages potential site hosts to work with installation vendors familiar with their facilities. In the event the site host does not have a vendor, National Grid will provide a list of experienced EVSE installers. At the program's onset, there were a limited number of installation vendors familiar with EVSE installation. National Grid has since provided EVSE information and workshops to vendors, including its energy efficiency vendors ("ProjectExpediters"), to encourage them to enter this new business. Most site hosts choose to work with these vendors to facilitate project installation given the relationships established from delivering energy efficiency projects. In addition to generating leads and projects, the installation vendors perform site assessments for potential site hosts to provide price quotes, station location recommendations, and additional information about the charging stations and program. The installation vendors typically manage scheduling electricians, ordering EVSE equipment and managing delivery, completing the program application, and delivering invoices and proof of station activation.
  - As of Q1 2020, National Grid launched a team of qualified EVSE installation vendors, EV Charging Station Installers (CSIs), similar to ProjectExpediters who have worked with customers to identify energy efficiency projects. The EV CSIs sell the projects and then manage the installations and program paperwork.

- **EVSE vendors/suppliers:** EVSE suppliers provide the charging hardware for the projects. National Grid maintains a list of qualified EVSE models for Level 2 and DCFC stations. The EVSE vendors typically work closely with installation vendors in station siting, and some EVSE vendors assist in lead generation.

2.2 Evaluation Objectives

The overall objectives of this evaluation are to measure the technical impacts of the Charging Program, including progress against charging station development goals, costs of installed stations, and station utilization. Additional objectives include assessing consumer awareness, attitudes, and behaviors toward EVs and understanding the characteristics and experiences of site hosts participating in the program.

The PY3 evaluation objectives are to:

- Assess progress against charging station development goals.
- Measure technical impacts such as station utilization and development costs.
- Develop recommendations to enhance the Charging Program.

3 EVALUATION APPROACH AND METHODOLOGY

To evaluate National Grid's EV Charging Station Program, the DNV Team developed an evaluation approach in coordination with National Grid. This overall evaluation approach is organized into four discrete tasks:

1. **Task 1:** Residential customer surveys. The DNV Team conducted a general population survey during PY1 to collect perspectives on EVs and EV charging from a simple random sample of National Grid residential customers.
2. **Task 2:** EV owner, employee, and resident surveys. The DNV Team designed these surveys to capture perspectives from EV owners as well as non-EV owners who are likely to have the opportunity to use the charging stations installed through the program. During PY1, the evaluators conducted a baseline survey of existing EV owners and for three communities that recently installed EV charging stations through the program. During PY2, the evaluators conducted follow-up EV owner and community surveys, as well as additional surveys of employees at workplaces installing charging stations.
3. **Task 3:** Participant, prospective participant, and nonparticipant site host interviews. The DNV Team completed in-depth interviews with site host decision-makers installing charging stations, considering participation, and comparable decision-makers at locations that are not participating in the Charging Program. The DNV Team conducted five interviews with DCFC site hosts in PY1, and 24 site host interviews in PY2.
4. **Task 4:** Program data analysis. The DNV Team analyzed program progress against its goals, reviewing and analyzing program data, tracking spreadsheets, and charging station utilization data. This activity will be repeated during each of the three program years.

The DNV Team completed the following activities during PY3 of this evaluation:

- Program information review – The DNV Team reviewed program materials for the Charging Program to inform the survey design, analysis approach, and our understanding of the program components and progress. Materials included program information, tracking spreadsheets, and other materials.
- Data analysis – The DNV Team conducted data analysis to understand progress against program goals, assess charging station utilization and greenhouse gas (GHG) emission reduction impacts, and develop charging station load profiles.
  - **Tracking data review/analysis**. We analyzed program tracking data provided by National Grid to assess progress against program goals and identify trends in station costs. This data included a Project Tracking spreadsheet that contained site host information for stations at each milestone from in-development to committed, installed, and activated. Data collection and analysis of program progress reflects activity from January 1, 2019, through December 31, 2021.
  - **Station ID mapping.** The DNV Team mapped the station IDs contained in the provided charging data to individual records in the program tracking spreadsheet, working closely with National Grid staff and EVSE provider representatives. This mapping exercise was necessary to link the analyzed utilization data – which consists of charge session counts, charging kWh totals, load profiles, and other measures of charging activity – to program tracking records indicating each station's charger type, station use, segment, EJ status, location, and more. In this round of evaluation, the DNV and National Grid teams successfully mapped 89% of the charging station data to be used in the analysis. The remaining 11% of charging station data could not be successfully mapped to records in the project tracking spreadsheet and were excluded from the utilization analysis.
  - **Charging station data analysis.** The DNV Team analyzed charging session data from 684 charging stations – 679 Level 2 and 5 DCFC – from five different EVSE vendors in PY3. Data sets were provided to National Grid and included continuous program charging activity covering all program charging from January 1, 2019, through December 31, 2021.

- The DNV Team performed quality control (QC) checks to ensure that blank, invalid, and inaccurate data were flagged for removal from the analysis. Through QC, the evaluators flagged blank or negative charging data (kWh and max kW) and charging sessions that lasted less than one minute or that recorded 0 kWh. These short sessions were assumed to be "false starts" and would not have contributed meaningfully to station utilization because of their short duration and low energy consumption. In total, 97% of the charging station data received passed all QC checks, suggesting that overall data quality is sound.
- Charging station utilization metrics include the number of unique charging sessions, total energy consumption (kWh), and total duration of charging (hours). The DNV Team also assessed the GHG emissions reduction impacts, using a methodology that accounted for avoided tailpipe emissions from the enablement of electric driving and increased grid load from charging. This methodology is described in Appendix A.
- The DNV Team developed charging station load profiles for initial assessment of potential future opportunities for DR and load management through EV charging stations. In developing these profiles, the DNV Team accounted for time periods during which the station was not in use (zero-charging intervals), which ensures that the load profiles accurately reflect average charging activity. Data points that failed QC checks were removed from the analysis prior to this step.

Table 3-1. Charging data disposition summary

Disposition	Station count
Activated stations through PY3	836
Stations with EVSE-provided data	764
Failed QC – could not map to tracking data	59
Failed QC - data does not pass QC checks	21
Stations with PY2 data, but no PY3 data	14
Stations with valid utilization data for PY3	670
Total stations with valid utilization data	**684**

4 RESULTS AND FINDINGS

This section presents the evaluation results of National Grid's Charging Program for PY3, including charging station and utilization results, along with cumulative program results from January 1, 2019 through December 31, 2021.

4.1 Charging Station Development Results

In PY3, National Grid continued to make great progress toward the installations of Level 2 stations, most notably in public areas (72% of activated Level 2 stations) and workplaces (18% of activated Level 2 stations). During PY3, there were 378 Level 2 stations and 11 DCFC stations activated through the Charging Program. To date, the program has activated and paid a cumulative total of 836 stations (see Table 4-1), which represents 123% of the program target goal of 680 stations (see Table 4-2).

Table 4-1. Charging Program paid stations by Program Year

Program Year	Paid station count
PY1	74
PY2	321
PY3	441
Total	**836**

Table 4-2. Charging Program activated stations by station type

Charging level	Program activation station goal	PY1 activated station count	PY2 activated station count	PY3 activated station count	Total activated stations through PY3	Progress toward goal (%)[2]
Level 2	600	107	338	378	823	137%
DCFC	80	1	1	11	13	16%
Total	**680**	**108**	**339**	**389**	**836**	**123%**

National Grid has a strong pipeline of projects at various stages of development. For the purposes of this evaluation, the DNV Team, in conjunction with National Grid, has grouped the site statuses in the Charging Program tracking worksheet as follows:

- **Activated** status indicates sites that are complete and operational. They have tracking worksheet statuses of "paid."
- Project pipeline stages track project development from lead generation through construction as defined below.
  - **In-flight** status indicates sites that have been approved by National Grid but are not yet complete and activated. This includes the tracking worksheet status of "under construction."
  - **Committed** status indicates sites that National Grid has reviewed and approved for funding, including sending a letter of commitment to the customer with the committed rebate amounts. These projects may or may not have begun construction. This includes the tracking worksheet status of "application approved" or "committed."
  - **Application submitted** status indicates sites that have submitted an application to the program and are awaiting formal approval to receive program incentives. This includes the tracking worksheet status of "application submitted" or "on hold".

[2] National Grid's activation goal was 510 stations by end of 2021. National Grid has two additional years to activate any stations from RY1 – RY3.

  - **Lead generation** status indicates sites that have expressed interest in the program but have not yet submitted an application. This includes the tracking worksheet status of "project opportunity."

- There are additional statuses in the tracking data representing projects that are not actively moving forward, including "cancelled," "duplicate," and "not approved." These stations are not included in this analysis. Table 4-3 shows program progress by status for both activated stations and the project pipeline.

Table 4-3. Charging Program project disposition as of 12/31/21

Roll-up status (ordered from most to least developed)	Site count	Station count
Activated	301	836
In-flight	9	28
Committed	52	153
Application submitted	114	268
Lead generation	13	38
Total	**489**	**1,323**

Consistent with previous program years, the Charging Program has made significant progress with Level 2 public and workplace stations and continues to experience lower than anticipated participation from DCFC stations. Between PY2 and PY3, MUD stations saw the most growth in participation in the program compared to the other program segments. While MUD stations are not nearly as widespread as public and workplace stations are in the program, since PY2, the program more than tripled its MUD station development. There are also a total of 56 Level 2 MUD stations in the pipeline for the program — suggesting even further future progress in the segment. The program also continues to see DCFC development lower than anticipated, however, between PY2 and PY3, the program also saw significant growth with 11 new DCFC stations and has a strong pipeline of 95 stations.

Table 4-4 shows the program progress through PY3 for both Level 2 and DCFC stations in each market segment. Note that MUD sites are not identified as locations intended for DCFC station deployment and are thus excluded.

Table 4-4. Charging Program progress - station counts through PY3

Station use	Lead generation	Application submitted	Committed	In Flight	Activated
Level 2					
MUD	21	16	19	0	86
Public	17	97	90	27	589
Workplace	0	74	30	1	148
Total Level 2	**38**	**187**	**139**	**28**	**823**
DCFC					
Public	0	77	14	0	11
Workplace	0	4	0	0	2
Total DCFC	**0**	**81**	**14**	**0**	**13**
Total	**38**	**268**	**153**	**28**	**836**

Figure 4-1 and Figure 4-2 show activated sites by program year, and Figure 4-3 shows activated and in flight sites through the end of PY3, highlighting the growth of EV stations over the first 3 years of the Charging Program. The figures are overlaid with National Grid's electric service territory.

Figure 4-1. Level 2 and DCFC sites in Massachusetts activated and in flight during PY1

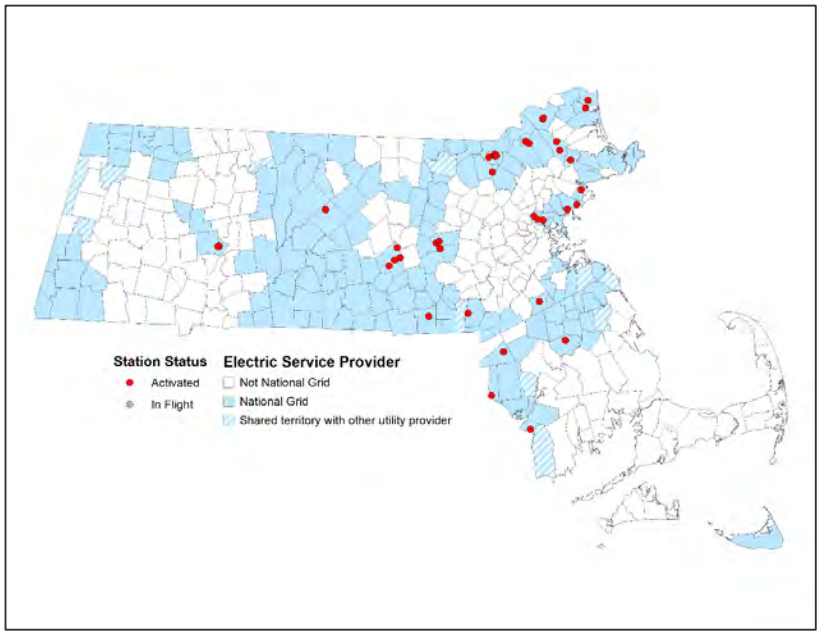


Figure 4-2. Level 2 and DCFC sites in Massachusetts activated and in flight through PY2

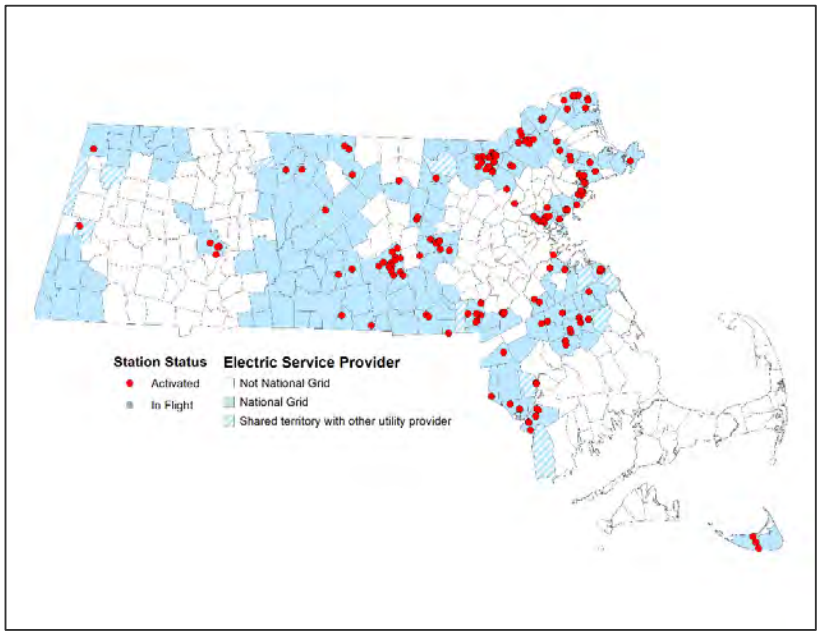
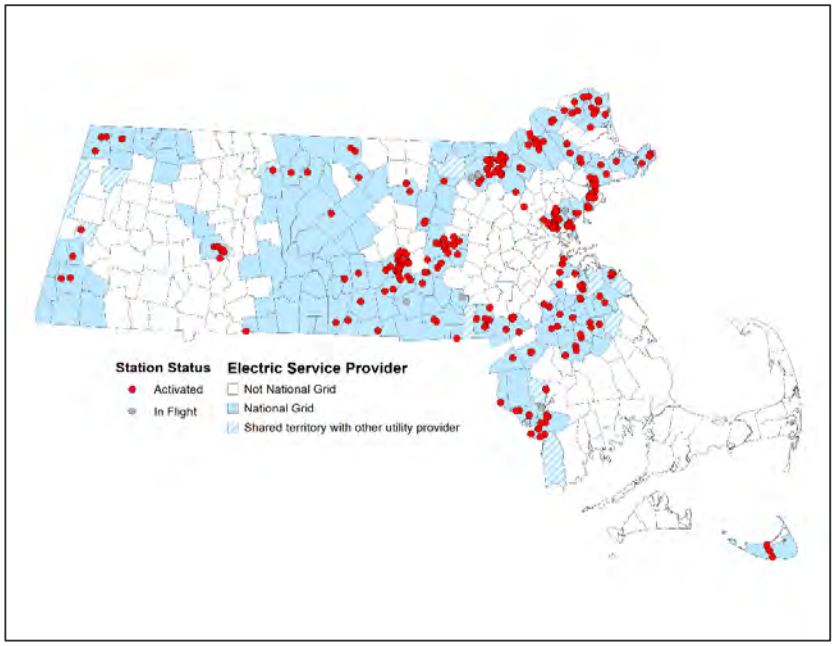


Figure 4-3. Level 2 and DCFC sites in Massachusetts activated and in flight through PY3



4.1.1 Charging Program Station Development Cost Analysis

The Charging Program funds 100% of the costs of electric service upgrades needed for Level 2 and DCFC stations. These "infrastructure costs" include all utility infrastructure necessary for the station installation, but do not include costs for signs, painting, aesthetics, or other in-house work performed at the sites.

The program also provides rebates for the EVSE costs for Level 2 stations. These EVSE rebates range from 50% to 100%, based on the targeted charging segment for Level 2 stations. The program covers 50% of the EVSE costs of Level 2 stations at workplace and MUD facilities, 75% of the EVSE costs at public/municipal facilities, and 100% of the EVSE costs at facilities located in communities meeting two or more EJ criteria. The equipment costs for DCFC stations are not eligible for rebates from National Grid.

The DNV Team analyzed the infrastructure and EVSE costs for PY3 to summarize the "invoiced costs," which include all costs listed in project invoices, and the "paid costs," which reflect only the portion of the invoiced costs that are eligible for rebates through the program. Note that similar to PY2, the DNV Team analyzed the actual program costs. Total paid and invoiced costs are presented in Table 4-6 and Table 4-8 respectively, while Table 4-7 and Table 4-9 present average per-station paid and invoiced costs. This analysis is based on the 836 activated stations included in National Grid's program tracking spreadsheet.

The 823 Level 2 stations reporting data span three segments: MUD, publicly accessible, and workplace stations. The average total per-station invoiced cost (including installation and EVSE costs) was $10,664.51, and the infrastructure costs represented 53% of overall project costs. Table 4-5 below, compares the projected program costs costs in the original DPU 17-13 order to the actual costs to-date through PY3; the costs incurred are lower than the projection, reflecting the lack of activated DCFC stations.

Table 4-5. Program filing cost comparison to program costs spent to-date

	Total filing costs from DPU Filing- PY1 - PY3[3]	Program cost spent
Total program costs	$12,731,482	$12,388,385
Number of stations	680	836
Total costs per station	**$18,723**	**$14,819**

Table 4-6. Charging Program paid costs (total) through PY3

Charging Level	Segment	Number of Stations	Company-Owned Infrastructure Costs (Total)	Total Rebate Costs Paid by National Grid		
				Electrical Infrastructure Rebates (Total)	EVSE Rebates (Total)	Charging Program Costs (Total)
Level 2	MUD	86	$3,727	$777,542	$353,577	$1,131,118
	Public	589	$438,640	$5,742,730	$3,054,872	$8,797,602
	Workplace	148	$13,719	$1,454,952	$565,094	$2,020,046
Total Level 2		**823**	**$456,086**	**$7,975,224**	**$3,973,543**	**$11,948,766**
DCFC	Public	11	$98,785	$460,225	$24,000	$484,225
	Workplace	2	$93,940	$71,500	$4,000	$75,500
Total DCFC		**13**	**$192,725**	**$531,725**	**$28,000**	**$559,725**
All		**836**	**$648,811**	**$8,506,949**	**$4,001,543**	**$12,508,491**

Table 4-7. Charging Program paid costs (per station) through PY3

Charging Level	Segment	Number of stations	Per station paid (rebate) costs		
			Electrical infrastructure rebates (per station)	EVSE rebates (per station)	Charging Program rebates (per station)
Level 2	MUD	86	$9,041	$4,111	$13,153
	Public	589	$9,750	$5,187	$14,811
	Workplace	148	$9,831	$3,818	$13,338
Total Level 2		**823**	**$9,690**	**$3,922**	**$14,373**
DCFC	Public	11	$41,839	$2,182	$44,020
	Workplace	2	$35,750	$2,000	$37,750
Total DCFC		**13**	**$40,902**	**$2,154**	**$43,056**

[3] 17-13 Exhibit KAB/BJC-4, page 4, line 20-22. https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/9800474

Table 4-8. Charging Program invoiced project costs (total) – through PY3

Charging level	Segment	Number of stations	Total invoiced costs			
			Company-owned infrastructure costs (total)	Invoiced electrical infrastructure costs (total)	Invoiced EVSE costs (total)	Invoiced charging program costs (total)
Level 2	MUD	86	$3,727	$749,901	$531,327	$1,281,228
	Public	589	$438,640	$3,164,025	$2,997,932	$6,161,958
	Workplace	148	$13,719	$753,120	$580,588	$1,333,709
Total Level 2		**823**	**$456,086**	**$4,667,047**	**$4,109,847**	**$8,776,894**
DCFC	Public	11	$98,785	$509,869	$339,088	$848,957
	Workplace	2	$93,940	$141,250	$53,564	$194,814
Total DCFC		**13**	**$192,725**	**$651,119**	**$392,651**	**$1,043,770**
All		**836**	**$648,811**	**$5,318,166**	**$4,502,499**	**$9,820,664**

Table 4-9. Charging Program invoiced project costs (per station) – through PY3

Charging level	Segment	Number of stations	Per station invoiced (project) costs		
			Reported electrical infrastructure costs (per station)	Reported EVSE costs (per station)	Reported charging program costs (per station)
Level 2	MUD	86	$8,720	$6,178	$14,898
	Public	589	$5,372	$5,090	$10,462
	Workplace	148	$5,089	$3,923	$9,012
Total Level 2		**823**	**$5,671**	**$4,994**	**$10,665**
DCFC	Public	11	$46,352	$30,826	$77,178
	Workplace	2	$70,625	$26,782	$97,407
Total DCFC		**13**	**$50,086**	**$30,204**	**$80,290**

4.1.2 Environmental Justice Communities

In addition to paying for infrastructure and service upgrades, National Grid provides rebates for 100% of the EVSE costs for Level 2 charging stations located in EJ communities. EJ communities are defined as locations that meet at least one of the criteria below. To be eligible for enhanced funding opportunities through the Charging Program, locations must meet two or more of the following criteria:

1. Annual median household income is less than or equal to 65% of the state-wide median
2. 25% or more of the residents identify as a race other than white
3. 25% or more of the households in the community have no one over the age of 14 who speaks fluent English

The DNV Team verified the tracked EJ community status for the activated and in-flight charging stations using a combination of geolocation tools to convert the provided station addresses to the best possible latitude and longitude coordinates. These results were used to place the stations into a geographic analysis software suite (ArcGIS) to identify which stations are located inside a geographic area identified as an EJ community (for EJC communities both current and under the prior 2010-

2020 cycle).[4] This EJC data is the same US Census Block Group files that are available on the Massachusetts online mapping platform. DNV's analysis separately verified the tracked EJ community statuses in the Project Tracking spreadsheet and identified slight differences from National Grid's tracking, shown below in Table 4-10.

This analysis identified that 217 activated and 3 in-flight stations (64 activated and 1 in-flight sites) are located in an EJ community. As of December 31, 2021, 22% of the activated sites – and 26% of the stations – are eligible for enhanced funding since they meet at least two of the EJ criteria. In total, 46% of the program's activated and in-flight sites (and 52% of stations) that have been verified by DNV are located in communities that meet at least one of the EJ criteria. This exceeds National Grid's program goal of developing 10% of Level 2 sites in EJ communities. Note that this analysis only covered activated and in-flight stations, and those which have complete address information (to facilitate the EJ map-based verification process) and are the most developed projects.

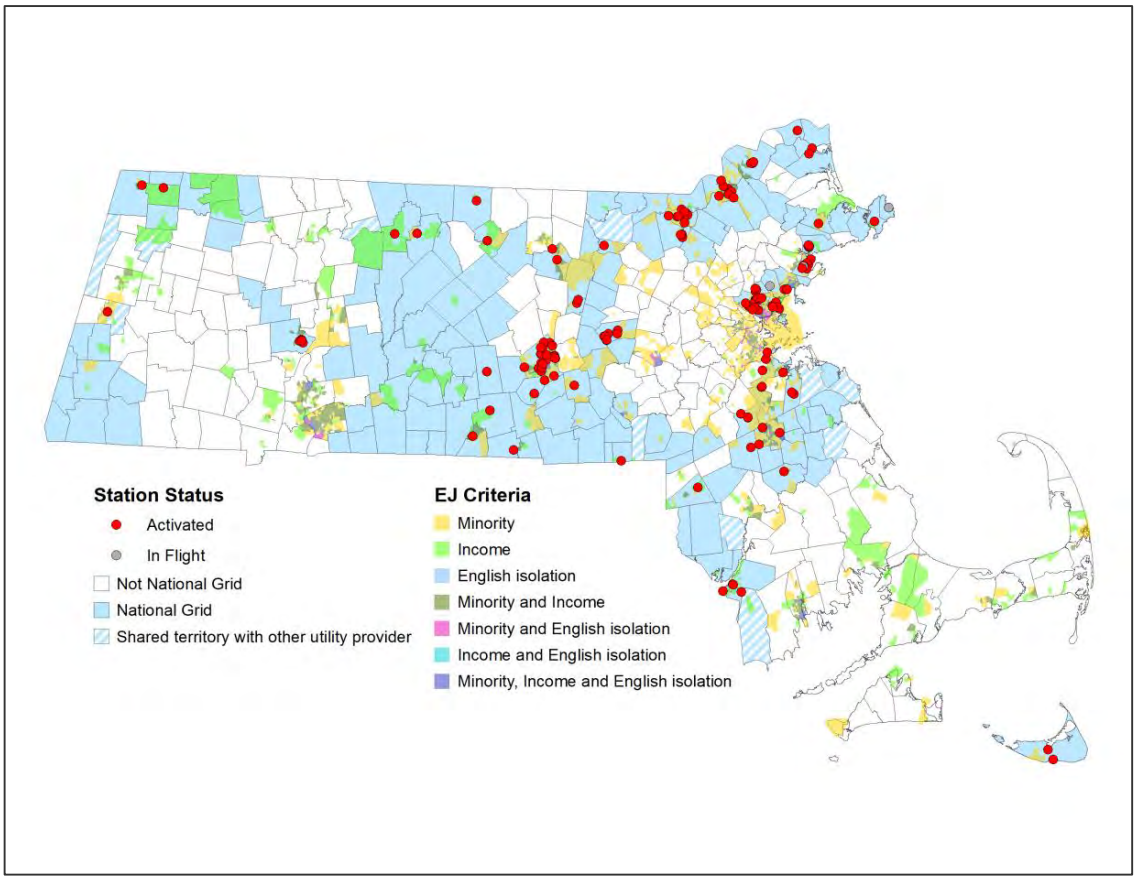
Table 4-10. Results of DNV Environmental Justice Community status verification

EJ community status	Station count: tracking	Station count: verified	Station count: percent of total (verified)	Site count: tracking	Site count: verified	Site count: percent of total (verified)
No	518	406	49%	193	160	54%
One criterion	174	210	25%	64	74	25%
2+ criteria	172	220	26%	53	65	22%
Total	**864**	**836**	**100%**	**310**	**299**	**100%**

Figure 4-4 presents the geographic distribution of charging stations in EJ communities. The stations mapped meet *at least one* of the criteria defined above. Most of the EJ community charging stations within National Grid territory are concentrated in a handful of localities, including Lawrence, Worcester, Lowell, and communities north of Boston.

[4] The new method for DNV verification of EJ community statuses resulted in 79 sites with different EJ criteria than specified in previous program years. 21 sites identified in non-EJ communities in PY2 are now classified as inside EJ communities. 13 sites identified in EJ communities in PY2 are now classified as in non-EJ communities. 45 sites were found to have a different number of EJ criteria than in PY2, though both years showed EJ communities. All EJ classifications presented in this report are based on the new method.

Figure 4-4. Massachusetts Environmental Justice Community EV charging stations



4.2 Charging Station Utilization Analysis

The Charging Program requires a minimum of five years of network monitoring for each station installed through the program. Charging data are reported to National Grid by the EVSE suppliers. The DNV Team analyzed charging data from 679 Level 2 stations and 5 DCFC station (1317 ports in total) in PY3 to help National Grid understand station utilization in Massachusetts. The actively-reporting stations were all activated between January 2019 and December 2021; charging data were available from January 2019 through December 2021.

It should be noted that, while charging station utilization is a valuable metric to track, it should not be seen as the only indicator of a successful installation. Charging stations deployed throughout National Grid's service territory (as illustrated in Figure 4-3) can help improve the awareness of EVs and the availability of charging infrastructure for drivers who currently drive gas-powered vehicles while providing reassurance for EV drivers with range anxiety. Tracking station utilization provides insight into how often, how long, and when charging stations are used; this information can then be used to inform future station deployment and charging infrastructure programs, support new rate designs, and develop marketing materials for prospective program participants.

4.2.1 Charging Station Data

Data from participating stations was provided to the DNV Team by the EVSEs via National Grid. For each charging session, the charging data includes, but is not limited to, the following fields:

- Charging session starting and ending timestamp
- Unique station identification code (Station ID)
- Unique charging session identification code (Session ID)
- The total charged energy per plug-in event (kWh)

Six vendors initially provided charging data for the PY3 evaluation, but only data from five vendors are included in the PY3 analysis. One of the vendors was excluded from the analysis because their provided data included inconsistent station identifiers that could not mapped to existing stations in the program. The DNV Team observed that the quality and type of data provided varied across vendors, though all vendors that delivered data provided all of the fields listed above.

Data quality and mapping challenges. Mapping the station IDs contained in the provided charging data to individual records in the program tracking spreadsheet is a difficult, critical, and manual process. This process is necessary to link the analyzed utilization data – which consists of charge session counts, charging kWh totals, load profiles, and measures of charging activity per week or month – to a program tracking record indicating the station's charger type, station use, segment, EJ status, location, and more. This mapping provides critical context to our analysis, allowing us to draw valuable conclusions beyond calculating the simple volume and timing of EV charging. The manual nature of this process, however, results in frequent inconsistencies between tracking and charging data and makes it difficult to efficiently derive insights from the charging data. Issues encountered in PY3 included typos in the tracked IDs, swapped or updated IDs not being accurately communicated to National Grid by EVSE suppliers, and the tracked IDs not aligning with the ID formats contained in the charging data. This results in challenges ensuring that the Charging Program is receiving data from all activated stations. The DNV Team worked closely with National Grid and the EVSE suppliers to resolve station ID mapping issues. In this round of evaluation, station IDs from 80 stations could not be successfully mapped to a record in the project tracking spreadsheet; this represents 11% of the charging stations received through PY3. Additionally, there were 14 stations where the EVSE vendor provided data in PY2, but not in PY3. DNV also recognizes that EVSE charging data is typically not available for several weeks following a station's final installation.

4.2.2 Utilization Results

Table 4-11 provides an overview of the charging data analyzed in PY3. Overall, 99% of charging sessions and 98% of the total charged energy (kWh) came from Level 2 stations. Note that this utilization analysis does not include all "activated" stations in the Project Tracking spreadsheet; charging data was only provided for 670 stations in PY3 (overall, a total of 836 stations have been activated), and the analysis is therefore limited to only those stations for which data sets were available. There is typically a time lag between a station's activation and when charging data is available. Further, all of the analysis results in this section are based on charging data from chargers that could be matched to a project in the tracker and that passed quality control checks designed to flag invalid or inaccurate data.

Table 4-11. PY3 charging station utilization data overview

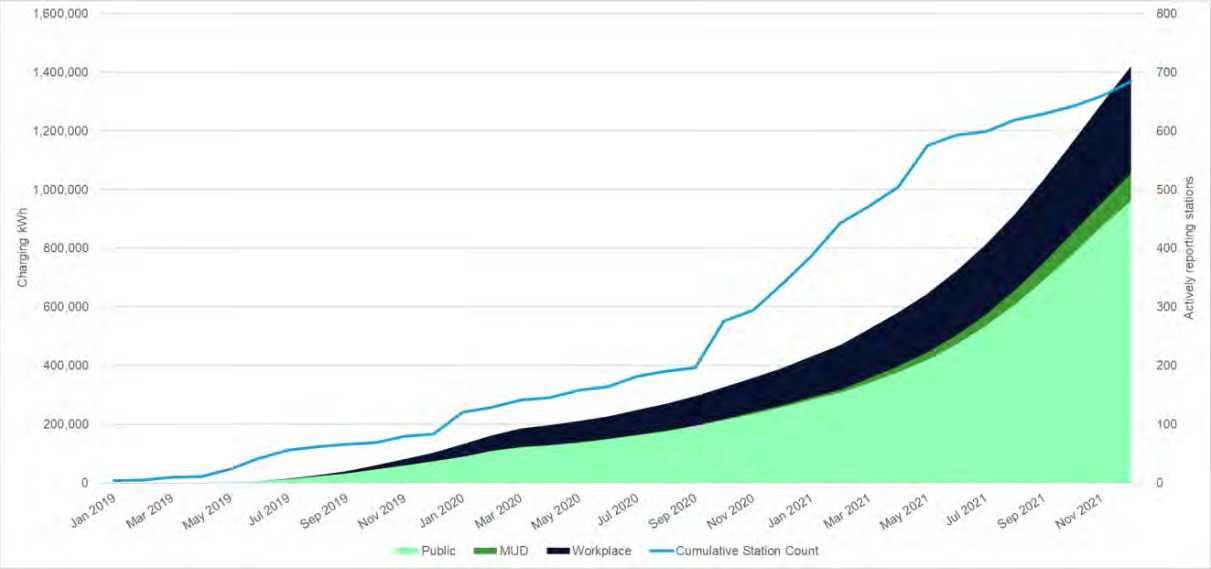
Metric	Level 2	DCFC	Total
Number of stations	679	5	684
Number of ports	1,312	5	1,317
Number of charging sessions	100,745	1,444	102,189
Charging energy consumed (kWh)	1,388,946	32,028	1,420,974

Metric	Level 2	DCFC	Total
GHG savings (kg)	847,528	19,543	867,071
Average charging energy per station (kWh)	2,046	6,406	2,077
Average charging energy per session (kWh)	14	22	14

Overall, the charging utilization dataset increased significantly in PY3, likely a result of program growth and the accelerating pace of station activation from the last quarter of 2020 and first half of 2021 as observed on the "Cumulative Station Count" line in Figure 4-5. The EVSE vendors in aggregate doubled the number of stations reporting valid data and the amount of charging kWh in PY3 more than tripled the PY2 data, an increase of over 1,000,000 kWh.

The 684 charging stations that reported data through PY3 are located at a total of 246 facilities, with several facilities containing multiple stations. Consistent with prior analyses, because drivers tend to choose whichever port or station is available when they arrive at a charging location with multiple stations/ports, we have considered co-located stations as a single station-location; this approach also streamlines the utilization analysis. A full summary of charging station utilization across all activated projects is included in Appendix B.

Figure 4-5. Growth in station reporting and charging activity through PY3



Station utilization by segment

Table 4-12 presents the utilization data received through PY3 by segment. Consistent with PY2, MUD and workplace charging station see the most kWh per session. This aligns with expectations that these stations are more likely to support consistent, long-duration charging, while public stations are more likely used for shorter-duration convenience charging to address range anxiety.

Table 4-12. Charging station utilization by segment through PY3

Charging level	Segment	Station count	Charge session count	Sessions per station	Total kWh	kWh per session	kWh per station	Percent of stations	Percent of charging
Level 2	Public	478	74,691	156	929,303	12	1,944	70%	67%
	MUD	69	4,951	72	94,138	19	1,364	10%	7%
	Workplace	132	21,103	160	365,505	17	2,769	19%	26%
Level 2		**679**	**100,745**	**148**	**1,388,946**	**14**	**2,046**	**100%**	**100%**
DCFC	Public	5	1,444	289	32,028	22	6,406		
Total		**684**	**102,189**	**149**	**1,420,974**	**14**	**2,077**		

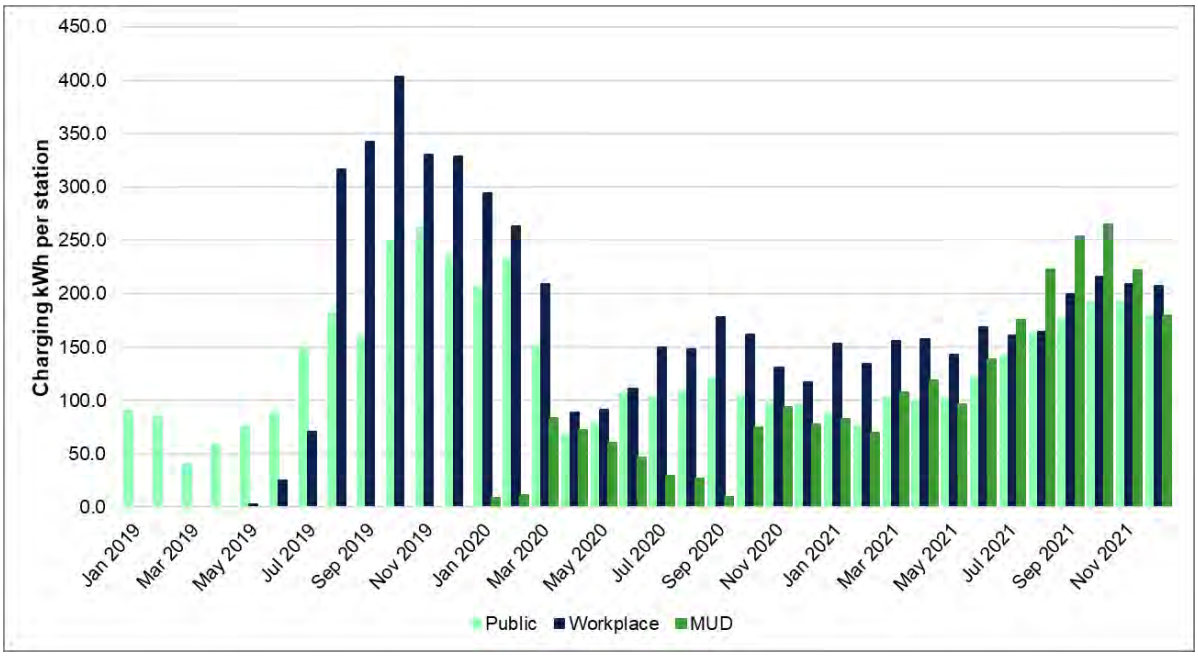
While the quantity of utilization data provided increased substantially in PY3, largely as a function of the increased number of activated stations, average utilization at program stations also increased on both a per-session and per-kWh basis as shown in Table 4-13. While increases were observed across all segments, the largest growth was in MUD stations, where the average number of sessions per week increased by 129% and the kWh per station per week increased by 168%. While some of this increase is likely due to limited MUD station activation and EV owner awareness in PY2, this growth highlights a strong demand for MUD charging stations and a potential opportunity for future program development.

Table 4-13. Charging growth from PY2 to PY3, normalized by time in operation

Segment	Number of sites		Number of stations		Average of sessions per station per week			Average of kWh per station per week		
	PY2	PY3	PY2	PY3	PY2	PY3	Percentage increase	PY2	PY3	Percentage increase
MUD	11	22	20	68	0.9	2.1	129%	15	41	168%
Public	104	173	240	473	2.4	2.6	7%	27	34	25%
Workplace	31	45	79	129	2.2	2.4	9%	38	42	10%
Total	**146**	**240**	**339**	**670**	**2.3**	**2.5**	10%	29.2	36.5	25%

Figure 4-6 below, shows the monthly per-station utilization of the activated charging stations providing data by segment from the first charging provided in January 2019 through December 2021. As noted in the PY2 report, there was a significant drop in charging at the start of the COVID-19 pandemic in March 2020, observable for public and workplace segments. Throughout the remainder of 2020 and all of 2021, this figure shows a moderate bounce back of charging activity and ongoing fluctuations, though kWh per station for the public and workplace segments through December 2021 remains lower than observations prior to the COVID-19 pandemic. Some of this trend may be due to the increased number of stations and thus opportunities for charging. An additional observation from Figure 4-6 is the growth in MUD charging, particularly during the second half of 2021. This aligns with the prior observation regarding the increase in MUD charging, suggesting that this is a segment with high charging demand.

Figure 4-6. Normalized charging station utilization by month and use – kWh per activated station



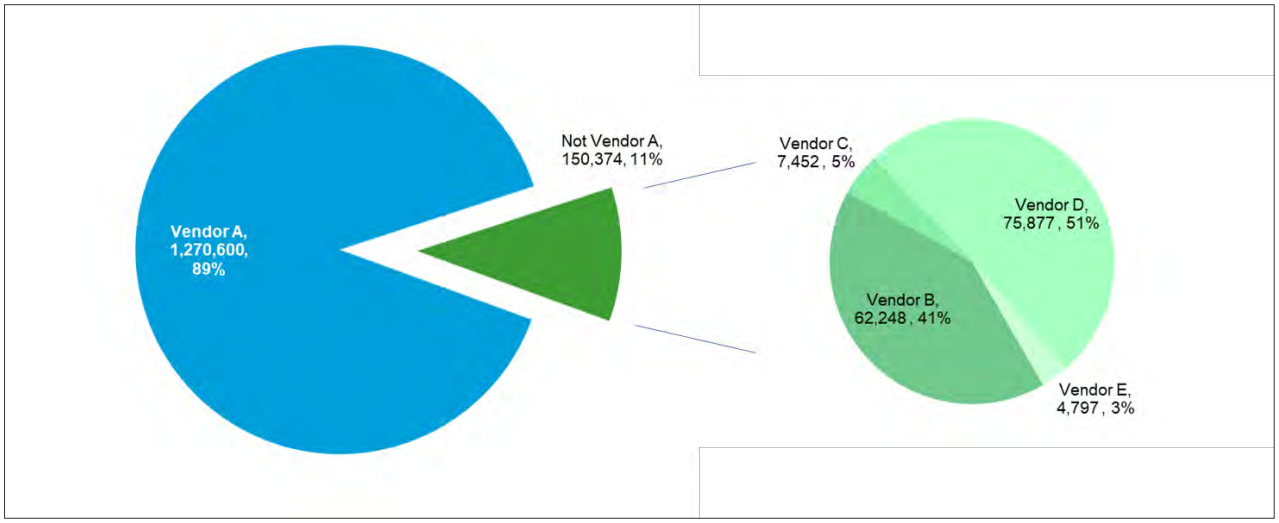
Station utilization by EVSE Supplier

Table 4-14 and Figure 4-7 summarize the distribution of charging across the five EVSE vendors that provided valid data for analysis through PY3. Consistent with prior years, one EVSE vendor is responsible for the overwhelming majority of program activity, comprising 92% of activated stations and 89% of charging activity.

Table 4-14. Number of stations and kWh charged by vendor

Mapped vendor name	Charged kWh	Percent of total kWh	Stations	Percent of stations
Vendor A	1,270,600	89%	630	92%
Vendor B	62,248	4%	30	4%
Vendor C	7,452	1%	2	0%
Vendor D	75,877	5%	14	2%
Vendor E	4,797	0%	8	1%
Total	**1,420,974**	**100%**	**684**	**100%**

Figure 4-7. Charging kWh by EVSE vendor



GHG emissions reduction impacts

As part of the utilization analysis, the DNV Team assessed the GHG emissions reduction impact of the charging stations incentivized by the program. The analysis assumes that the electric-driven miles enabled by the program-incentivized charging stations would have otherwise been driven with internal combustion engine vehicles (ICEVs). Savings are calculated as the difference between offset tailpipe emissions and the added grid load from EV charging. The methodology for this analysis was developed by DNV and National Grid and is outlined in Appendix A. Please note the following regarding this analysis:

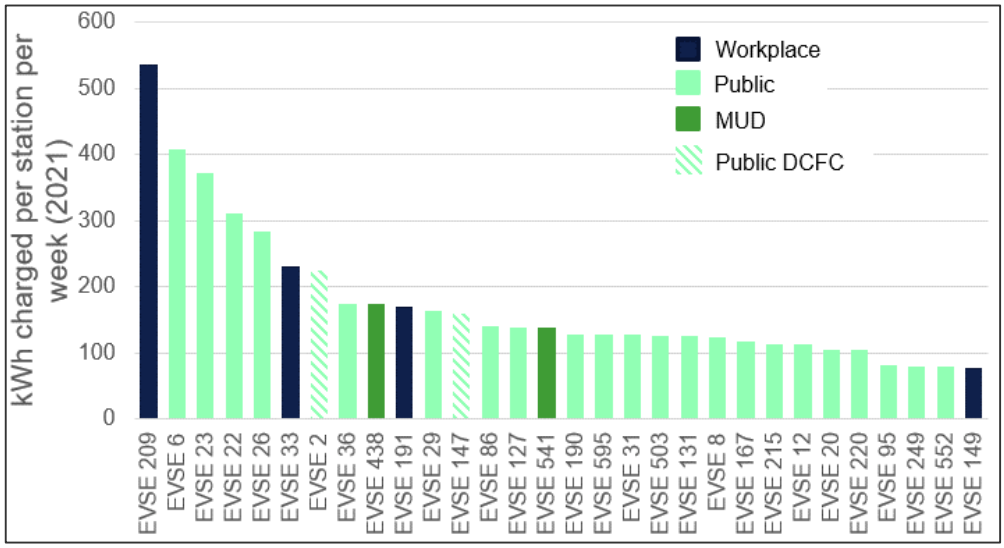
- The DNV Team does not attempt to attribute GHG emissions savings to the program; that is, DNV does not imply that any National Grid customers purchased EVs (and drove electric miles) as a direct result of program activity.
- One aim of the program is to support increased EV adoption through the development of a publicly available EV charging network. As EV adoption increases, we expect to see an associated increase in grid load and GHG emissions. The DNV Team did not assess any incremental EV adoption impacts the program may have had.
- In the absence of the program, it is possible that some fraction of the charging now occurring at program-funded stations would have occurred elsewhere, such as at privately developed public stations, EV drivers' home chargers, or stations funded by other utilities. This portion of charging may not be new to the grid but is now associated with National Grid activities relative to the baseline condition (fewer charging stations and less program-enabled charging).
- To measure any GHG emissions savings associated with the program, it is necessary to consider the amount of program-enabled charging relative to a baseline scenario in which all driving is done with ICEVs. The DNV Team's analysis is based on this approach.
- This analysis considered CO2 impacts alone and did not consider other criteria pollutants, such as SOx and NOx.

Table B-1 in Appendix B contains the station-level GHG emissions reduction analysis results. In total, the GHG emissions reduction through PY3 is 867,701 kg.

Most utilized charging stations

Similar to PY2, the DNV Team conducted an analysis of the most utilized charging stations through the end of PY3, examining overall utilization as well as utilization by segment. This analysis allowed us to identify commonalities between highly utilized stations and to quantify the concentration of utilization by segment. Figure 4-8, below, provides a high-level look at the 30 most utilized stations across all segments in PY3, with utilization defined as the kWh charged per station per week of operation in PY3.

Figure 4-8. Top 30 most utilized stations (kWh charged per station week) in PY3



This analysis reveals the following takeaways about the program's 30 most utilized stations:

- The majority of stations (24, or 80%) are in the public segment, while 4 (13%) are classified as workplace and 2 (7%) are classified as MUD
- Just 2 (7%) of the stations are DCFC, with the remainder (93%) Level 2
- The average weekly per-station charging activity was 175 kWh/station-week, while the maximum utilization was 536 kWh/station-week

Ranking sites by utilization level and segment allows us to assess the concentration of utilization to determine whether a small number of sites drive the utilization figures for a given segment or whether utilization is more evenly spread across a greater number of stations. To assess the concentration of station utilization, DNV determined the proportion of sites in a given segment that supported 70% of that segment's kWh; the results of this analysis are shown below.

- **Workplace.** The 10 sites with the greatest per-week utilization, out of a total of 44 sites (23%), supplied 70% of the workplace segment's kWh
- **Public.** The 46 sites with the greatest per-week utilization, out of a total of 177 sites (25%), supplied 70% of the public segment's kWh
- **MUD.** The 8 sites with the greatest per-week utilization, out of a total of 23 sites (35%), supplied 68% of the MUD segment's kWh

This analysis indicates that a relatively small proportion of sites provided the majority of kWh in each segment, though this trend may evolve as EV adoption increases in Massachusetts and the EVSE network continues to expand.

Figure 4-9, Figure 4-10, and Figure 4-11 also show the extent of the concentration of station utilization across the workplace and public segments, respectively. They show the site-level station utilization, ranked by kWh charged per week, and include only sites with at least 10 kWh charged per week.

Figure 4-9. Workplace segment utilization ranked by kWh charged per station per week

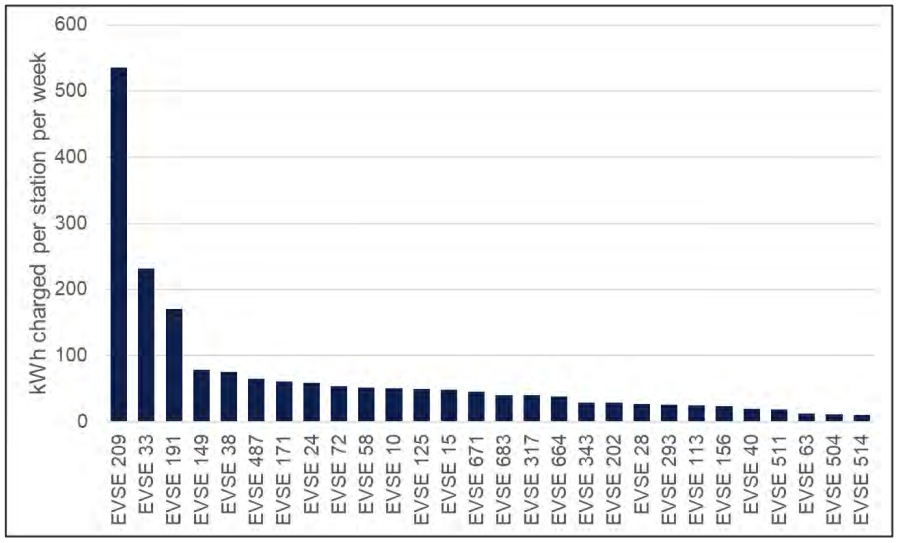


Figure 4-10. Public segment utilization ranked by kWh charged per station per week

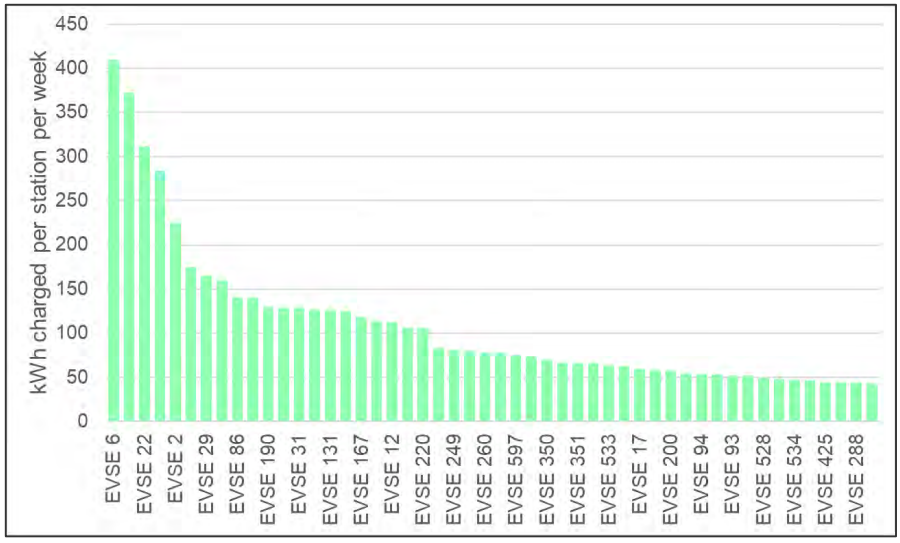
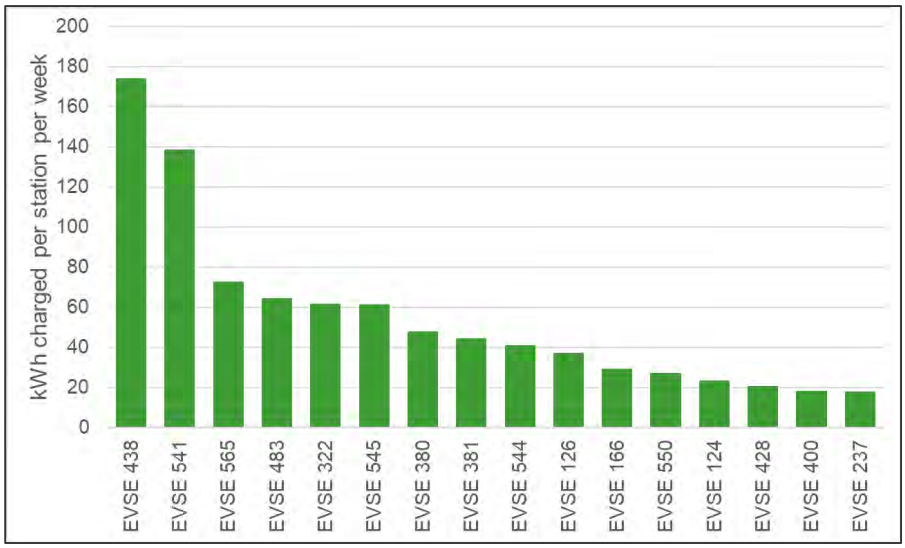


Figure 4-11. MUD segment utilization ranked by kWh charged per station per week



While these figures clearly depict some concentration of utilization, it is difficult to draw clear and consistent conclusions about why this concentration exists and what impact it may have on the utilization of the network as a whole. For example, seven of the eight most utilized (kWh/station-week) public sites were installed prior to September 2019, while the eighth was installed in March 2021, making it difficult to establish a relationship between the length of time since charger deployment and the level of sustained utilization. Similarly, six of the eight (all Level 2) are installed in municipal parking garages, while the remaining two are DCFC stations located near interstates, complicating attempts to draw conclusions about high levels of utilization based on facility type, charger type, or location.

There are a multitude of factors that determine the utilization of a given station, including its location, visibility, proximity to EV drivers or pockets of high EV adoption, and potentially proximity to other EV chargers. Additional factors, such as cost of charging and availability of chargers during peak times, likely also play a role in the observed level of utilization over time. As the charging station network and EV adoption continue to grow and more charging data is collected, National Grid should consider establishing criteria by which the evolution of utilization concentration can be measured as well as steps to be taken if utilization is determined to be growing beyond an acceptable level of concentration over time.

Station Utilization in EJ Communities

The DNV team assessed station utilization for all segments by EJ status as defined in Section 4.1.2. Table 4-15 shows the distribution by segment and by the number of EJ criteria met for each station. Charging is fairly evenly distributed throughout both EJ and non-EJ communities; this is an increase from PY2 when only 11% of charging occurred in communities meeting two or more EJ criteria. As stated earlier in this report, assessing utilization based solely on the number of charging sessions over the total kWh charged may not always indicate a successful installation, as stations that may seem underutilized by these metrics still contribute to a robust EV charging network, can increase the visibility of EV infrastructure, and may address range anxiety concerns.

Table 4-15. Charging station utilization by station use and EJ status through PY3 (Level 2 and DCFC)

Segment	EJ status	Station count	Charge session count	Total kWh	Percent kWh (by station Use)	Sessions per station	kWh per session	kWh per station
Public	No	213	32,247	370,783	39%	151	11	1,741
	One criterion	131	18,481	262,921	27%	141	14	2,007
	2+ criteria	139	25,407	327,627	34%	183	13	2,357
Total Public		**483**	**76,135**	**961,331**	**100%**	**158**	**13**	**1,990**
MUD	No	32	2,055	34,348	36%	64	17	1,073
	One criterion	14	816	23,948	25%	58	29	1,711
	2+ criteria	23	2,080	35,843	38%	90	17	1,558
Total MUD		**69**	**4,951**	**94,138**	**100%**	**72**	**19**	**1,364**
Workplace	No	61	6,657	123,229	34%	109	19	2,020
	One criterion	35	7,306	116,709	32%	209	16	3,335
	2+ criteria	36	7,140	125,567	34%	198	18	3,488
Total Workplace		**132**	**21,103**	**365,505**	**100%**	**160**	**17**	**2,769**
Total		**684**	**102,189**	**1,420,974**		**149**	**14**	**2,077**

4.2.3 Load profile analysis

In PY3, DNV developed 24-hour average charging load profiles (kW) for each of the actively reporting charging stations, capturing all days in operation since the station's first recorded charge session (through December 31, 2021). Only data that passed QC was included in the analysis.

The team analyzed these load profiles to develop segment-wide average charging load shapes that captured weekday and weekend charging behavior separately. We also assessed the coincidence of on-peak charging by segment (public, workplace, and MUD), charger type (Level 2 or DCFC), and day type (weekday or weekend), using a 1 p.m. to 9 p.m. window on all days as the "peak period" definition.[5] This analysis allowed us to compare the different segments on a consistent basis and facilitate a discussion regarding how segment-specific characteristics may impact a charging station's utilization and load shape.

The profiles included in this discussion include all data that passed QC for each station's data reporting period (from the first recorded charge session through the end of PY3). Only stations that exceeded a segment-specific rate of utilization (in kWh charged per day) were included in that segment's analysis, which minimized the likelihood of diluting the load shape by including stations that had not yet achieved a sustained level of utilization; for most segments, this threshold utilization rate was selected to capture approximately 90% of the segment's total kWh charged.

In each of the figures below, the light blue and green lines represent the weekday and weekend average charging load, respectively, and the blue box indicates the on-peak hours of 1 p.m. to 9 p.m. For charging locations with multiple stations/ports, the average load profile (kW) includes charging data from all stations/ports that provided data and exceeded the segment-specific threshold utilization rate.

[5] Note that the 1-9 p.m. window is not a defined peak period under any National Grid electric rate; it was selected to align with the peak period definition for National Grid's Off-Peak Charging Program (also known as the SmartCharge Massachusetts, or SCMA, Program). This program is an EV managed charging program designed to shift EV charging off-peak. All references to the "peak period" (including the use of the phrases "on-peak" and "off-peak") in this section refer to this 1-9 p.m. window.

Workplace Level 2 Load Profile Observations

The load profile presented in Figure 4-12, below, represents the average workplace Level 2 station charging load shape over all months of the program (spanning PY1 through PY3). It includes data from 61 individual stations located at 19 sites where the per-day charger utilization exceeded 4 kWh/day; this represents 54% of the stations and 90% of the kWh charged in the workplace segment.

Figure 4-12. 24-hour average charging load profile – Workplace Segment, All Level 2

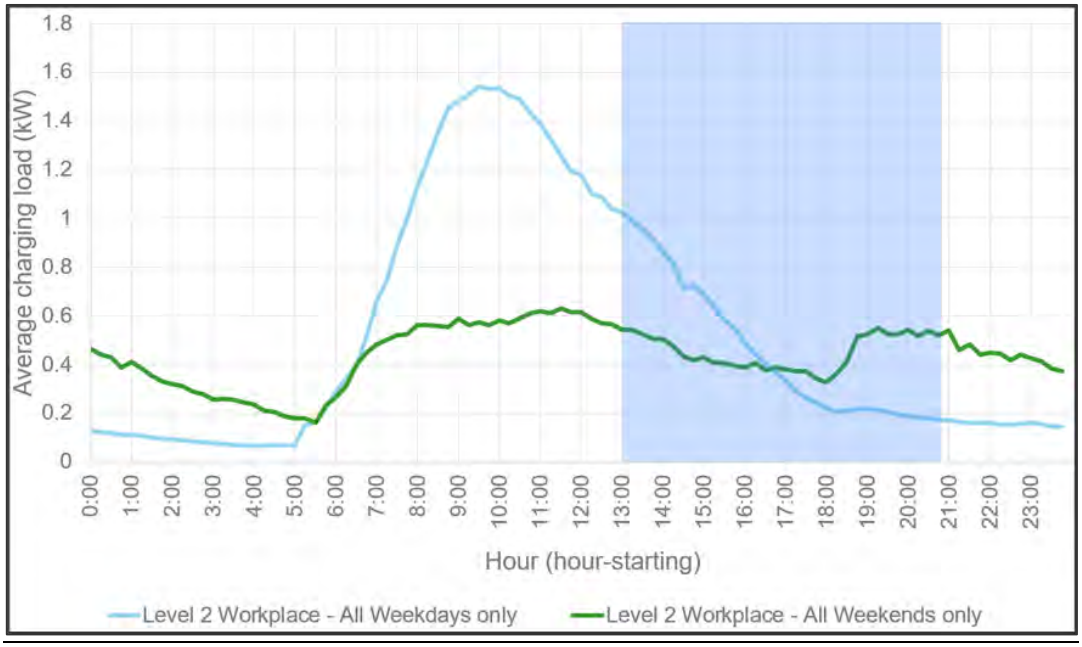


Figure 4-12 shows that on weekdays, the charging load begins to climb at 5 a.m., peaks at approximately 1.5 kW between 9 and 10 a.m., and then falls consistently throughout the afternoon and evening to approximately 0.2 kW, where it remains until midnight before tapering off slightly over the early morning hours. The weekday charging load shape is strongly linked to typical working and commuting hours. On weekends, the load shape begins to climb between 5 and 6 a.m., peaks at approximately 0.6 kW between the hours of 10 a.m. and noon (40% of the weekday average peak and about two hours after the weekday peak), and falls consistently until 6 p.m. before ramping up slightly between the hours of 7 and 9 p.m. The weekend charging load also tapers off overnight and into the early morning, though it remains notably higher than the weekday charge rate.

Unsurprisingly, there is about 21% more weekday charging (12.7 kWh per day) than weekend charging (10.5 kWh per day). Notably, evening and overnight charging is more prevalent in this segment on weekends, though the analysis shows that overnight charging also occurs consistently on weekdays.[6] This overnight charging is driven by two hospital sites with a total of 11 charging stations and may stem from overnight employees charging their vehicles. However, several non-hospital facilities also showed higher than expected levels of overnight charging. This suggests that some EV drivers are utilizing workplace chargers – likely those near their homes – to charge overnight, with a preference for weekend charging that may be due to schedule differences or convenience. It is also possible that these stations are available to the public outside of business hours, or that the drivers charging overnight at workplace chargers have access to publicly-available charging elsewhere during the week and utilize workplace chargers near their homes on the weekend.

[6] Overnight charging in this analysis is defined as occurring between the hours of 9 p.m. and 5 a.m. the following day.

Through PY3, approximately 29% of weekday and 35% of weekend charging in this segment occurred on-peak, while the average on-peak load was roughly equivalent on weekdays and weekends, at approximately 0.45 kW. The weekday on-peak charge rate drops over the course of the peak period, from approximately 1 kW at 1 p.m. to 0.2 kW from 6 until 9 p.m., while the weekend on-peak charge rate is more consistent over the peak period, varying between 0.4 and 0.6 kW throughout the 8-hr peak window.

Public Level 2 Load Profile Observations

The load profile presented in Figure 4-13, below, represents the average public Level 2 station charging load shape over all months of the program (spanning PY1 through PY3). It includes data from 237 individual stations located at 92 sites where the per-day charger utilization exceeded 2.5 kWh/day; this represents 52% of the stations and 90% of the kWh charged in the public segment.

Figure 4-13. 24-hour average charging load profile – Public Segment, All Level 2

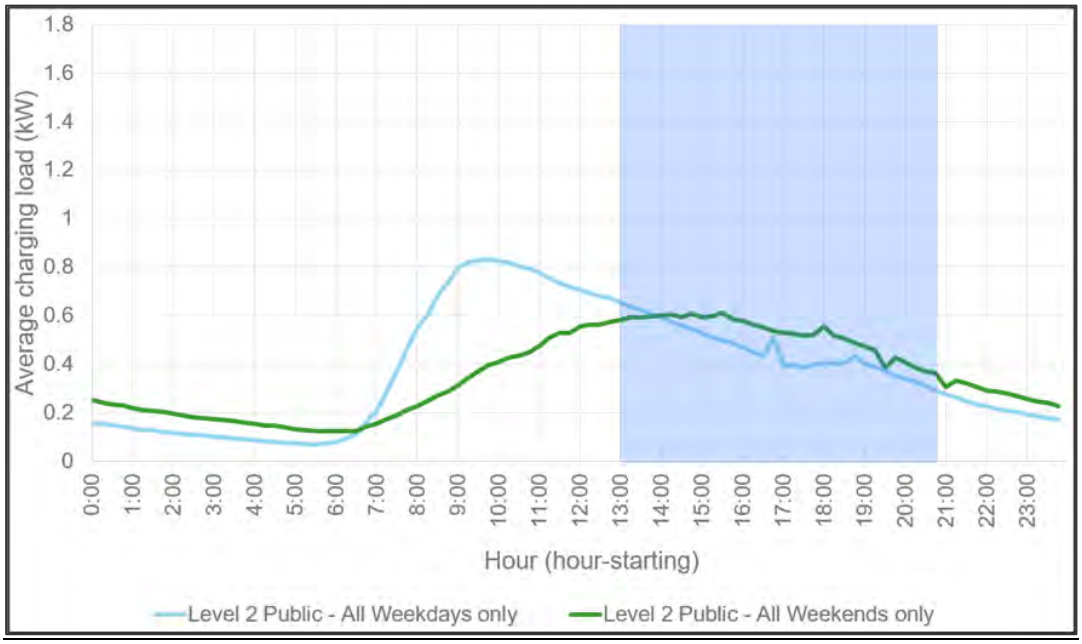


Figure 4-13 shows that the weekday charging load begins to climb from 0.1 kW between 6 and 7 a.m., peaks at approximately 0.8 kW between 9 and 10 a.m., and falls consistently throughout the rest of the day. The weekday public charging load shape resembles the weekday workplace load shape in terms of when the load ramps up, when it peaks, and how it behaves post-peak; however, the peak load is 45% lower than the workplace segment's peak load. On weekends, the load shape ramps slowly from 7 a.m. (about 0.1 kW) until 3 p.m. (0.6 kW) before falling again. The load drops off consistently and smoothly throughout the late afternoon, evening, and late-night hours, with the weekend charging load during these hours remaining consistently but only slightly higher than the weekday charging load.

There is slightly more (6%) weekday charging (9.1 kWh per day) than weekend charging (8.6 kWh per day) in the public segment. This more equitable distribution between weekday and weekend charging load makes sense for the public segment, which contains a diverse array of charging stations located at multiple facility types, including parking garages, government facilities, and retail locations; some of these locations may support long-duration charging sessions during the workday, while others may be accessed more often on the weekends, such as shopping areas or other destinations. This diverse set of facilities can support multiple EV charging needs, including both long- and short-duration charging and

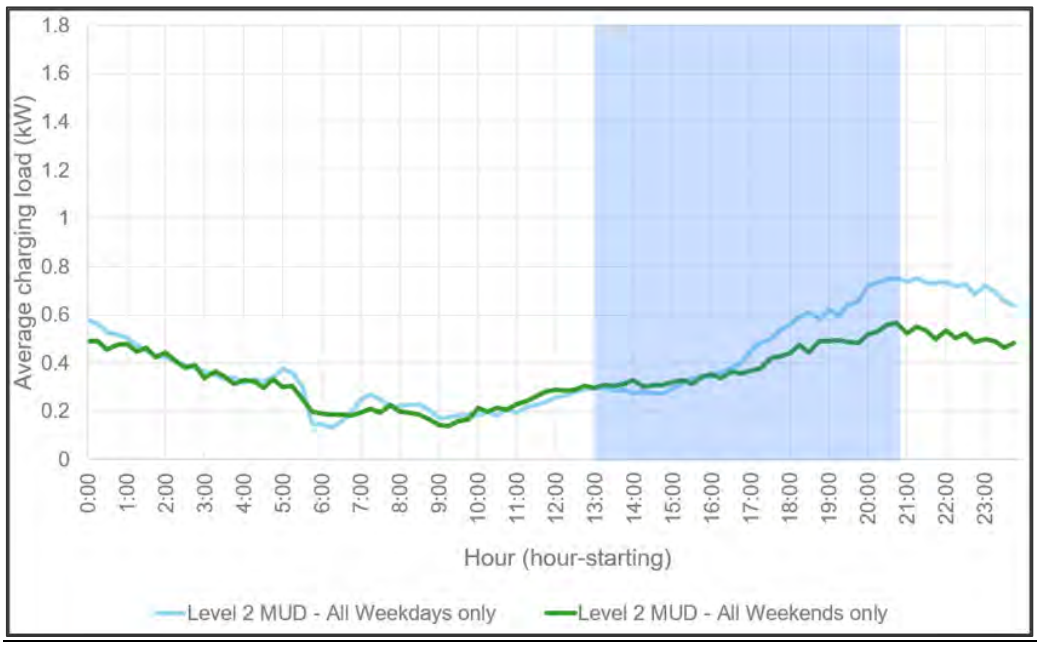
"convenience" charging, where drivers plug in to top up their batteries over the course of running errands or completing other daily activities. It is worth noting that evening and overnight charging is relatively prevalent in this segment throughout the week, with no major difference between weekdays and weekends. Several hotel facilities exhibit high rates of overnight charging, which is to be expected as more hotels offer EV charging as an amenity. However, there are also other facility types – including offices and parking and municipal sites – that support high levels of overnight charging. As with the workplace segment, this indicates that some EV drivers may be utilizing public chargers (likely near their homes) to charge overnight, potentially because they are free or more convenient than other charging options.

Through PY3, approximately 40% of weekday and 49% of weekend charging in this segment occurred on-peak, while the average on-peak load was slightly higher on weekends (approximately 0.53 kW vs. 0.46 kW). Similar to the workplace segment, the weekday on-peak charge rate drops over the course of the peak period, from approximately 0.65 kW at 1 p.m. to 0.3 kW at 9 p.m., while the weekend on-peak charge rate ranges from 0.6 kW at the start of the peak period to 0.4 kW at the end.

MUD Level 2 Load profile Observations

The load profile presented in Figure 4-14, below, represents the average MUD Level 2 station charging load shape over all months of the program (spanning PY1 through PY3). It includes data from 29 individual stations located at 9 sites where the per-week charger utilization exceeded 2.9 kWh/day; this represents 49% of the stations and 89% of the kWh charged in the MUD segment.

Figure 4-14. 24-hour average charging load profile – MUD Segment, All Level 2



The MUD weekday and weekend charging profiles are the most similar of all segments. The two profiles closely mirror each other throughout the day until the middle of the on-peak period; for both day types, the charging load begins to climb from 0.2 kW at around 9 a.m., ramps up slowly throughout the day, and peaks at approximately 9 p.m. before tapering off overnight. The weekday peak is approximately 0.75 kW and the weekend peak is approximately 0.6 kW. The weekday load begins to deviate from the weekend load at around 4:30 p.m., and the two load shapes come together again at around 1 a.m. as vehicles that were plugged in reach a full charge.

There is slightly more (15%) weekday charging (9.7 kWh per day) than weekend charging (8.5 kWh per day) in the MUD segment. This distribution is more evenly distributed than the workplace segment but less so than the public segment; the greater prevalence of weekday charging may align with when schedules, driven by work and commuting, are most consistent. The afternoon-into-evening ramp, which is greater during the week, is consistent with drivers returning from work. It is also worth noting that the MUD segment shows the highest levels of charging in the early morning hours, from midnight until approximately 4 a.m., of any segment (excluding the Public DCFC segment), which is consistent with the frequent overnight home charging one would expect to see in a residential segment.

Through PY3, approximately 38% of both weekday and weekend charging in this segment occurred on-peak, while the average on-peak load was slightly higher on weekdays (0.46 kW vs. 0.4 kW). The end-of-peak (9 p.m.) load is higher than at start-of-peak (1 p.m.) on both weekdays and weekends; the only other Level 2 segment that exhibits this behavior is the workplace weekend charging load.

Public DCFC Load Profile Observations

For Public DCFC stations, robust utilization data was available for 3 individual stations located at 2 sites; the per-week charger utilization exceeded 24 kWh/day at each station included in the analysis. There are an additional two DCFC stations co-located at a third site that came online in January 2021 and provided negligible charging during PY3 (each of these chargers recorded only one charging session during the reporting period). These two stations were excluded from this analysis. Due to the intermittent nature of DCFC charging and the small population of actively utilized DCFC stations in the program, DNV did not aggregate average profiles but instead developed individual weekday vs. weekend load shapes for each DCFC station. Figure 4-15, Figure 4-16, and Figure 4-17 depict these profiles.

Figure 4-15. 24-hr average load profile for DCFC charging station EVSE 2

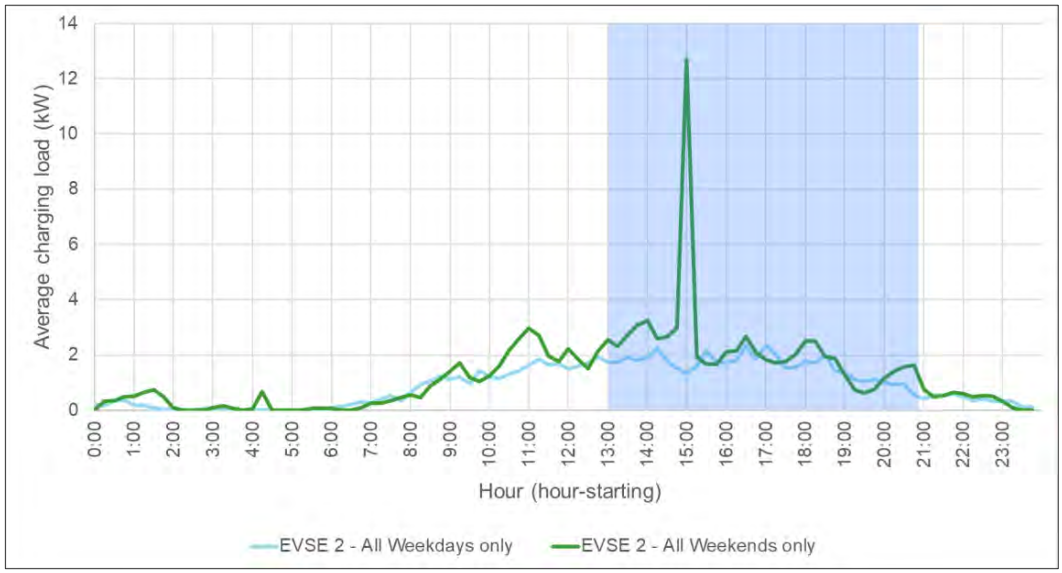


Figure 4-16. 24-hr average load profile for DCFC charging station EVSE 147 #1

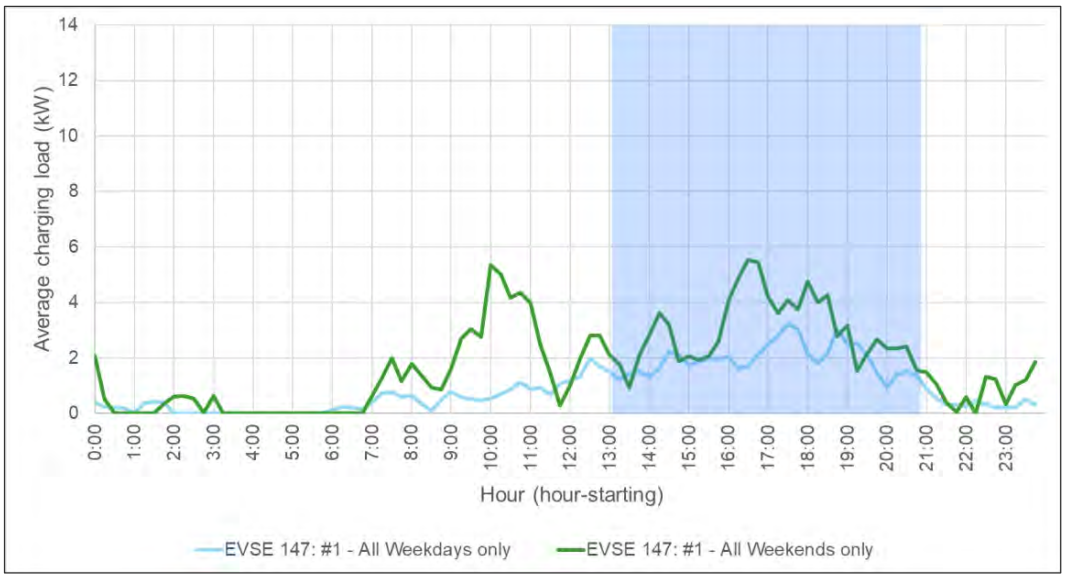
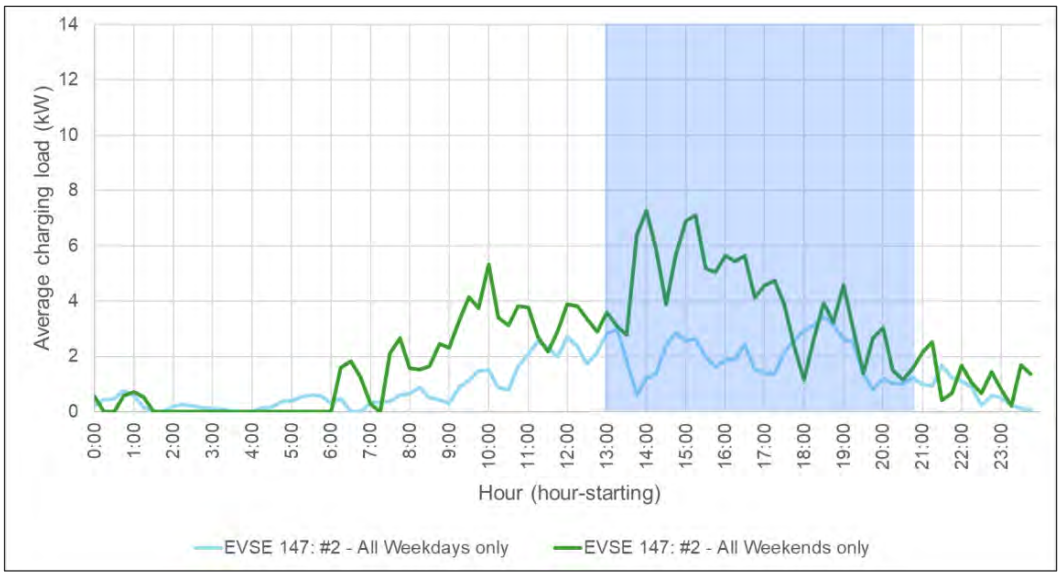


Figure 4-17. 24-hr average load profile for DCFC charging station EVSE 147 #2



While the public DCFC weekday and weekend charging profiles vary by station, they are consistent in that weekend charging is greater than weekday charging, and the peaks typically occur during the on-peak period. At the individual station level, it is easy to observe the quick increases and decreases in activity driven by quicker charging capabilities of the DCFC stations. This uneven distribution of charging activity is not surprising, as DCFC charging is intended to address range anxiety and support quick refueling on longer trips. As additional DCFC station data becomes available, additional assessment and aggregation of DCFC profiles could help to better understand charging trends. Additionally, this is an area where targeted market research could leverage EVSE vendor networks to learn more about the motivations and typical use cases for DCFC station users.

Load profile summary and program opportunities

Table 4-16, below, summarizes several high-level metrics stemming from the segment-wise load profile analysis, including the weekday and weekend on-peak coincidence and the ratio of the daily energy charged on the average weekday versus the average weekend day.

Table 4-16. Load profile summary statistics by segment and charger type

Segment	Percent of kWh charged on-peak		Ratio of weekday to weekend charging (kWh)	Daily average kWh		Average on-peak kW	
	Weekday	Weekend		Weekday	Weekend	Weekday	Weekend
Level 2 Public	40%	49%	106%	9.1	8.6	0.46	0.53
Level 2 MUD	38%	38%	115%	9.7	8.5	0.46	0.40
Level 2 Workplace	29%	35%	121%	12.7	10.5	0.46	0.45
DCFC Public	62%	59%	57%	23.9	42.0	1.86	3.12

Program Opportunities Identified Through Load Profile Analysis

As discussed throughout the preceding subsections, utilization across each of the four segments – Workplace Level 2, Public Level 2, MUD Level 2, and Public DCFC – can vary significantly across charger type, day type, and time of day. There are several potential market research and program design opportunities for National Grid to consider that follow from the above analysis, which are described in greater detail below.

- **Customer market research to gain further insights into charging behavior.** There are several opportunities to learn more about the charging behavior, needs, and preferences of the EV drivers currently utilizing the program-funded EVSE network – to assess the "who" and the "why" behind the observed charging behavior – and to begin to probe how those behaviors, needs, and preferences might change over time. As such, National Grid should consider fielding a comprehensive survey-based market research effort to develop deeper insights into charging station utilization and better inform future program design. This research could be fielded via the EVSE vendors to their user bases and could potentially be strengthened by leveraging the results of this utilization analysis to reflect relevant utilization findings back to respondents. Several specific research opportunities could include:
  - Collecting insights into why EV drivers charge when and where they do, with a particular focus on probing the observed overnight utilization at workplace and public chargers and segment-dependent differences in weekday and weekend charging load.
  - Measuring drivers' receptiveness to various managed charging and/or demand response approaches, including how that receptiveness depends on the segment (e.g., workplace vs. MUD), day type, season, time of day, and other factors.
  - Probing whether MUD tenants would be receptive to more advanced forms of managed charging, such as intelligent charge scheduling. This research could also support the future deployment of time-of-use rate structures.
- **Targeted site host market research to explore DER and colocation opportunities.** Similar to the above customer-focused research, National Grid should consider fielding additional market research directed at Site Hosts to better understand their receptiveness to further DER deployment and involvement in demand response or managed charging programs. Current Site Hosts can be viewed as "early adopters" who have shown a willingness to adopt a new technology in support of National Grid's transportation electrification efforts; additional research can assess the extent

to which they may also be good candidates for additional efforts or measures designed to support National Grid's load flexibility, peak load management, and resilience objectives.

- **Consider expanding managed charging.** Given the observed prevalence of late night and overnight charging, including in the workplace and public segments, National Grid should consider expanding its managed charging efforts to reach drivers charging overnight in these segments. This effort would be aided by the customer market research consideration above and account for customer responses relating to why they charge where and when they do as well as their openness to delaying or scheduling charging at these locations.
- **Co-location of distributed energy resources.** Given the observed prevalence of morning and midday charging in the workplace (Level 2) and public (both Level 2 and DCFC) segments, National Grid should consider strategies for increasing the co-location of DERS, including solar and energy storage systems, at EV charging Site Hosts. This effort would follow the Site Host market research recommendation described above, taking into account Site Host receptiveness to adopting additional DERs as well as the barriers and drivers behind that decision-making process.
  - This effort could be paired with a proactive Site Host inventory and utility data review intended to quantify the potential renewable energy generation or bill savings that would result from adopting solar and/or storage.
  - DNV acknowledges that National Grid's Phase III program filing already includes a proposed $2M in incentives for innovative co-located energy storage and DCFC projects in grid-constrained areas.

APPENDIX A. METHODOLOGY FOR CALCULATING CO_2 SAVINGS

This appendix presents the methodology for calculating CO_2 savings for the charging session data reported by the EVSE suppliers. The figure below shows the formula used to calculate CO_2 savings, and the table shows formula assumptions and their sources.

Figure A-1. Formula for Calculating GHG Impact (CO2) for Charging Program

$$Gasoline\ miles = electric\ miles = \ EV\ efficiency\ x\ Charging\ kWh$$

$$CO_2\ savings = \left(\frac{Gas\ miles}{Average\ mpg}\ x\ Gas\ carbon\ intensity\right) - \ (Charging\ kWh\ x\ Grid\ carbon\ intensity)$$

Table A-1. GHG impact assumptions and sources

Metric	Value	Units	Source
Gas miles	N/A	Miles	Calculated
Electric miles	N/A	Miles	Calculated
EV efficiency	3.5	Miles per kWh	National Grid
CO2 savings	N/A	kg of CO2	Calculated
Gas carbon intensity	8.67	kg CO2 per gallon of gasoline	National Grid
Grid carbon intensity	0.31	kg CO2 per kWh	ISO-NE Electric Generator Air Emissions Report, 2017
Average mpg	33	Miles per gallon	National Grid
Charging kWh	N/A	kWh	Charging station vendor data

APPENDIX B. STATION UTILIZATION BY PROJECT

Table B-1 summarizes the utilization of the co-located chargers for PY3 across multiple metrics; the anonymized stations are ranked by the total amount of charging (kWh) they have provided through PY3.

Table B-1. Charging Station Utilization by Station

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 33	Workplace	Level 2	4	3,932	75,477	19	29	553	46,055	05/21/2019
EVSE 131	Public	Level 2	10	6,313	65,980	10	68	714	40,261	03/25/2020
EVSE 12	Public	Level 2	4	3,269	46,774	14	21	299	28,541	01/02/2019
EVSE 6	Public	Level 2	1	2,044	45,358	22	14	315	27,677	03/29/2019
EVSE 209	Workplace	Level 2	1	1,777	44,263	25	18	438	27,009	01/24/2020
EVSE 38	Workplace	Level 2	4	3,198	44,110	14	25	348	26,916	07/29/2019
EVSE 191	Workplace	Level 2	2	2,146	36,444	17	19	330	22,238	11/21/2019
EVSE 22	Public	Level 2	1	2,765	35,934	13	22	288	21,927	08/13/2019
EVSE 36	Public	Level 2	2	3,205	34,075	11	24	250	20,792	05/23/2019
EVSE 26	Public	Level 2	1	2,273	32,606	14	16	231	19,896	04/17/2019
EVSE 29	Public	Level 2	2	2,521	31,113	12	19	239	18,985	07/05/2019
EVSE 23	Public	Level 2	1	4,332	30,629	7	35	244	18,689	08/08/2019
EVSE 190	Public	Level 2	2	1,696	24,062	14	17	236	14,683	01/18/2020
EVSE 683	Workplace	Level 2	16	1,256	22,587	18	36	645	13,783	05/01/2021
EVSE 2	Public	DCFC	1	824	18,291	22	6	143	11,161	07/23/2019
EVSE 127	Public	Level 2	2	1,215	17,973	15	12	181	10,967	02/05/2020

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 72	Workplace	Level 2	5	1,282	17,655	14	12	169	10,773	01/02/2020
EVSE 487	Workplace	Level 2	5	718	17,081	24	14	324	10,422	12/28/2020
EVSE 236	Public	Level 2	6	1,161	16,821	14	22	323	10,264	01/01/2021
EVSE 35	Public	Level 2	2	837	15,152	18	6	113	9,245	06/06/2019
EVSE 565	MUD	Level 2	6	893	14,573	16	27	434	8,892	05/11/2021
EVSE 322	MUD	Level 2	5	506	14,427	29	11	307	8,803	02/06/2021
EVSE 15	Workplace	Level 2	4	822	14,343	17	7	119	8,752	09/10/2019
EVSE 147	Public	DCFC	2	618	13,729	22	14	319	8,377	03/06/2021
EVSE 512	Public	Level 2	4	736	13,708	19	11	211	8,364	10/03/2020
EVSE 503	Public	Level 2	2	467	13,624	29	5	158	8,313	05/06/2020
EVSE 171	Workplace	Level 2	2	715	13,603	19	7	124	8,300	11/27/2019
EVSE 215	Public	Level 2	2	833	12,834	15	13	200	7,831	10/08/2020
EVSE 13	Public	Level 2	4	1,139	12,787	11	8	95	7,802	05/30/2019
EVSE 90	Public	Level 2	8	640	12,701	20	10	196	7,750	10/05/2020
EVSE 17	Public	Level 2	1	1,143	12,037	11	9	92	7,345	06/26/2019
EVSE 348	Public	Level 2	10	831	11,847	14	26	374	7,229	05/24/2021
EVSE 288	Public	Level 2	5	1,216	11,382	9	23	218	6,945	01/01/2021
EVSE 545	MUD	Level 2	3	817	11,370	14	13	175	6,938	10/03/2020
EVSE 528	Public	Level 2	5	912	10,816	12	20	240	6,600	02/19/2021

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 30	Public	Level 2	2	1,003	10,795	11	8	82	6,587	06/26/2019
EVSE 89	Public	Level 2	4	468	10,417	22	7	161	6,356	10/06/2020
EVSE 86	Public	Level 2	1	466	10,117	22	6	124	6,173	06/10/2020
EVSE 167	Public	Level 2	1	574	10,075	18	5	91	6,148	11/20/2019
EVSE 1	Public	Level 2	5	1,057	9,998	9	8	78	6,101	07/18/2019
EVSE 37	Public	Level 2	4	1,578	9,897	6	12	74	6,039	06/14/2019
EVSE 31	Public	Level 2	1	732	9,769	13	6	74	5,961	06/27/2019
EVSE 51	Public	Level 2	10	852	9,526	11	10	113	5,812	05/19/2020
EVSE 11	Public	Level 2	4	765	9,174	12	6	68	5,598	06/02/2019
EVSE 20	Public	Level 2	1	1,004	9,093	9	7	67	5,549	05/30/2019
EVSE 438	MUD	Level 2	1	248	8,965	36	5	174	5,470	01/05/2021
EVSE 95	Public	Level 2	2	678	8,771	13	11	145	5,352	11/03/2020
EVSE 202	Workplace	Level 2	4	506	8,659	17	5	81	5,284	12/11/2019
EVSE 7	Public	Level 2	3	655	8,462	13	5	59	5,163	03/29/2019
EVSE 260	Public	Level 2	2	349	8,294	24	6	131	5,061	10/16/2020
EVSE 541	MUD	Level 2	1	469	8,174	17	8	133	4,988	10/28/2020
EVSE 8	Public	Level 2	1	511	7,934	16	4	59	4,842	05/30/2019
EVSE 435	Public	Level 2	5	530	7,656	14	13	191	4,672	03/27/2021
EVSE 343	Workplace	Level 2	5	465	7,610	16	8	138	4,643	12/10/2020

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 344	Public	Level 2	4	505	7,524	15	8	125	4,591	11/06/2020
EVSE 192	Public	Level 2	2	2,710	7,452	3	26	71	4,547	01/01/2020
EVSE 530	Public	Level 2	3	722	7,409	10	14	142	4,521	01/01/2021
EVSE 28	Workplace	Level 2	1	261	7,261	28	2	62	4,431	10/07/2019
EVSE 498	Public	Level 2	4	251	6,976	28	3	90	4,257	07/09/2020
EVSE 230	Public	Level 2	2	680	6,953	10	11	115	4,243	11/05/2020
EVSE 251	Public	Level 2	5	288	6,795	24	11	256	4,146	06/29/2021
EVSE 58	Workplace	Level 2	2	374	6,794	18	6	105	4,145	10/05/2020
EVSE 533	Public	Level 2	2	325	6,547	20	6	121	3,995	12/18/2020
EVSE 10	Workplace	Level 2	1	337	6,414	19	3	48	3,914	06/07/2019
EVSE 423	Public	Level 2	4	371	6,380	17	8	141	3,893	02/19/2021
EVSE 552	Public	Level 2	1	253	6,377	25	3	77	3,891	06/04/2020
EVSE 249	Public	Level 2	3	377	6,167	16	15	240	3,763	07/05/2021
EVSE 233	Public	Level 2	2	214	5,983	28	4	108	3,651	12/08/2020
EVSE 220	Public	Level 2	1	755	5,886	8	12	91	3,592	10/03/2020
EVSE 125	Workplace	Level 2	2	578	5,841	10	9	90	3,564	10/05/2020
EVSE 483	MUD	Level 2	2	316	5,815	18	7	128	3,548	02/17/2021
EVSE 93	Public	Level 2	2	383	5,708	15	6	93	3,483	10/29/2020
EVSE 94	Public	Level 2	2	400	5,627	14	7	92	3,434	10/31/2020

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 424	Public	Level 2	4	283	5,470	19	6	123	3,338	02/23/2021
EVSE 428	MUD	Level 2	5	437	5,062	12	9	101	3,089	01/15/2021
EVSE 126	MUD	Level 2	3	147	5,040	34	3	111	3,075	02/16/2021
EVSE 63	Workplace	Level 2	4	272	4,938	18	3	51	3,013	02/27/2020
EVSE 544	MUD	Level 2	2	139	4,802	35	2	75	2,930	10/08/2020
EVSE 18	Public	Level 2	2	624	4,674	7	5	36	2,852	07/02/2019
EVSE 104	Public	Level 2	2	329	4,644	14	5	72	2,834	10/05/2020
EVSE 347	Public	Level 2	5	179	4,550	25	3	83	2,777	12/14/2020
EVSE 595	Public	Level 2	2	280	4,511	16	16	257	2,752	08/31/2021
EVSE 486	Public	Level 2	4	233	4,468	19	4	86	2,727	01/02/2021
EVSE 521	Public	Level 2	2	300	4,140	14	5	64	2,526	10/08/2020
EVSE 255	Public	Level 2	2	186	4,136	22	7	156	2,524	06/29/2021
EVSE 96	Public	Level 2	2	333	3,909	12	5	64	2,385	11/02/2020
EVSE 124	MUD	Level 2	2	251	3,700	15	2	37	2,258	01/24/2020
EVSE 237	MUD	Level 2	4	100	3,678	37	2	70	2,245	12/30/2020
EVSE 262	Public	Level 2	3	357	3,637	10	6	58	2,219	10/19/2020
EVSE 135	Public	Level 2	2	236	3,588	15	4	55	2,189	10/05/2020
EVSE 200	Public	Level 2	2	302	3,552	12	10	113	2,167	05/26/2021
EVSE 515	Public	Level 2	6	365	3,542	10	5	48	2,161	07/28/2020

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 522	Public	Level 2	2	189	3,541	19	5	92	2,161	04/06/2021
EVSE 349	Public	Level 2	5	150	3,291	22	4	95	2,008	05/04/2021
EVSE 440	Public	Level 2	3	264	3,207	12	6	72	1,957	02/23/2021
EVSE 149	Workplace	Level 2	1	127	3,169	25	3	78	1,934	03/24/2021
EVSE 351	Public	Level 2	2	198	3,136	16	8	131	1,914	07/17/2021
EVSE 21	Public	Level 2	1	383	3,104	8	3	23	1,894	05/22/2019
EVSE 166	MUD	Level 2	2	117	3,090	26	1	39	1,885	06/22/2020
EVSE 378	Public	Level 2	3	185	3,014	16	5	87	1,839	05/03/2021
EVSE 68	Public	Level 2	2	408	2,977	7	6	46	1,817	10/07/2020
EVSE 510	Public	Level 2	8	146	2,825	19	3	58	1,724	01/26/2021
EVSE 40	Workplace	Level 2	2	342	2,811	8	3	27	1,715	01/02/2020
EVSE 442	Public	Level 2	2	168	2,792	17	3	47	1,704	11/08/2020
EVSE 261	Public	Level 2	3	308	2,791	9	5	44	1,703	10/16/2020
EVSE 159	Public	Level 2	2	145	2,783	19	2	31	1,698	04/18/2020
EVSE 436	Public	Level 2	5	137	2,761	20	3	63	1,685	02/26/2021
EVSE 382	Public	Level 2	5	164	2,691	16	3	54	1,642	01/18/2021
EVSE 245	Public	Level 2	5	185	2,661	14	7	100	1,624	06/28/2021
EVSE 439	Public	Level 2	3	145	2,635	18	7	126	1,608	08/08/2021
EVSE 453	Public	Level 2	3	150	2,627	18	4	70	1,603	04/12/2021

Station Identifier	Station Use	Charging Level	Number of Stations (Tracking)	Charging Session Count	Energy Charged (kWh)	kWh per Session	Charging Sessions per Week	kWh per Week	GHG Savings (kg)	First Charge Date
EVSE 443	Public	Level 2	3	172	2,613	15	4	68	1,595	04/06/2021
EVSE 244	Public	Level 2	5	212	2,548	12	12	138	1,555	08/25/2021
EVSE 575	Public	Level 2	2	136	2,523	19	7	123	1,539	08/10/2021
EVSE 437	Workplace	Level 2	5	245	2,430	10	4	40	1,483	10/29/2020
EVSE 42	Workplace	Level 2	1	146	2,397	16	2	37	1,463	10/03/2020
EVSE 113	Workplace	Level 2	1	97	2,380	25	1	23	1,453	01/04/2020
EVSE 164	Public	Level 2	2	350	2,374	7	6	39	1,449	11/06/2020
EVSE 446	Public	Level 2	3	122	2,364	19	3	63	1,443	04/15/2021
EVSE 235	Public	Level 2	2	130	2,358	18	2	34	1,439	08/27/2020
EVSE 5	Public	Level 2	1	207	2,327	11	2	19	1,420	08/05/2019
EVSE 434	Public	Level 2	5	169	2,315	14	4	61	1,413	04/09/2021
EVSE 111	Public	Level 2	1	237	2,301	10	3	26	1,404	04/19/2020
EVSE 401	Public	Level 2	4	303	2,263	7	7	54	1,381	03/12/2021
EVSE 156	Workplace	Level 2	1	160	2,247	14	2	22	1,371	01/03/2020
EVSE 534	Public	Level 2	1	286	2,236	8	6	47	1,364	02/02/2021
EVSE 271	Public	Level 2	1	284	2,192	8	4	34	1,337	10/05/2020
EVSE 425	Public	Level 2	1	186	2,181	12	4	44	1,331	01/18/2021
EVSE 369	Workplace	Level 2	10	198	2,146	11	4	46	1,310	02/11/2021
EVSE 49	Public	Level 2	2	308	2,110	7	5	32	1,287	10/03/2020

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EVSE 550	MUD	Level 2	1	193	2,091	11	2	22	1,276	03/03/2020
EVSE 136	Public	Level 2	2	87	2,088	24	1	21	1,274	01/29/2020
EVSE 168	Public	Level 2	2	186	2,064	11	4	40	1,259	01/03/2021
EVSE 511	Workplace	Level 2	2	105	1,969	19	2	34	1,201	11/16/2020
EVSE 152	Public	Level 2	2	165	1,879	11	2	19	1,146	02/17/2020
EVSE 19	Public	Level 2	1	214	1,863	9	2	14	1,137	06/20/2019
EVSE 350	Public	Level 2	1	165	1,666	10	7	69	1,017	07/17/2021
EVSE 397	Public	Level 2	4	102	1,582	16	3	41	965	04/09/2021
EVSE 138	Workplace	Level 2	4	107	1,563	15	1	14	954	11/07/2019
EVSE 597	Public	Level 2	1	104	1,547	15	5	75	944	08/09/2021
EVSE 485	Public	Level 2	4	100	1,494	15	2	32	912	02/12/2021
EVSE 315	Public	Level 2	4	59	1,473	25	5	126	899	10/11/2021
EVSE 594	Public	Level 2	1	140	1,456	10	7	72	888	08/13/2021
EVSE 455	Public	Level 2	5	63	1,410	22	1	25	860	12/02/2020
EVSE 77	Public	Level 2	1	26	1,367	53	0	21	834	10/10/2020
EVSE 671	Workplace	Level 2	1	96	1,365	14	3	45	833	06/04/2021
EVSE 148	Public	Level 2	1	103	1,353	13	1	14	825	03/12/2020
EVSE 317	Workplace	Level 2	1	58	1,330	23	2	40	812	05/14/2021
EVSE 452	Public	Level 2	3	109	1,243	11	2	23	759	12/25/2020

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EVSE 504	Workplace	Level 2	2	66	1,208	18	1	18	737	09/26/2020
EVSE 97	Public	Level 2	2	53	1,205	23	1	17	735	08/18/2020
EVSE 84	Public	Level 2	1	87	1,201	14	1	12	733	01/14/2020
EVSE 41	Workplace	Level 2	2	129	1,194	9	1	12	729	01/06/2020
EVSE 16	Public	Level 2	1	90	1,130	13	1	8	690	03/02/2019
EVSE 479	Public	Level 2	3	142	1,116	8	4	30	681	04/14/2021
EVSE 259	Public	Level 2	2	81	1,095	14	2	28	668	03/31/2021
EVSE 293	Workplace	Level 2	5	107	1,055	10	13	127	644	11/04/2021
EVSE 9	Public	Level 2	2	119	1,050	9	1	8	641	06/05/2019
EVSE 24	Workplace	Level 2	1	85	1,043	12	5	59	636	08/31/2021
EVSE 459	Public	Level 2	1	67	1,030	15	2	27	629	04/05/2021
EVSE 154	Public	Level 2	2	72	1,030	14	1	16	629	10/16/2020
EVSE 419	Public	Level 2	3	60	1,026	17	1	19	626	12/15/2020
EVSE 161	Public	Level 2	2	92	984	11	1	9	600	11/13/2019
EVSE 27	Public	Level 2	1	121	947	8	1	6	578	02/05/2019
EVSE 427	Workplace	Level 2	5	100	906	9	2	16	553	12/11/2020
EVSE 529	Public	Level 2	5	56	872	16	1	19	532	02/20/2021
EVSE 62	Public	Level 2	2	126	862	7	2	12	526	08/25/2020
EVSE 400	MUD	Level 2	1	162	849	5	3	18	518	02/03/2021

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EVSE 404	Public	Level 2	2	80	815	10	5	46	497	08/31/2021
EVSE 444	Public	Level 2	1	65	810	12	2	20	495	03/20/2021
EVSE 14	Public	Level 2	2	154	796	5	1	7	485	10/03/2019
EVSE 450	Public	Level 2	2	59	753	13	1	16	460	02/07/2021
EVSE 497	Public	Level 2	3	84	716	9	1	10	437	07/28/2020
EVSE 429	MUD	Level 2	2	31	710	23	1	14	433	01/22/2021
EVSE 514	Workplace	Level 2	1	100	696	7	2	11	425	10/05/2020
EVSE 141	Workplace	Level 2	1	43	693	16	0	7	423	01/11/2020
EVSE 596	Public	Level 2	1	36	687	19	2	34	419	08/13/2021
EVSE 4	Public	Level 2	1	94	672	7	1	5	410	08/25/2019
EVSE 70	Public	Level 2	1	113	669	6	2	10	408	10/06/2020
EVSE 146	Public	Level 2	1	59	647	11	1	8	395	06/24/2020
EVSE 445	Public	Level 2	3	143	610	4	4	16	372	04/07/2021
EVSE 664	Workplace	Level 2	2	48	586	12	6	77	358	11/09/2021
EVSE 527	Public	Level 2	2	58	582	10	1	13	355	02/14/2021
EVSE 381	MUD	Level 2	4	10	578	58	3	176	353	12/09/2021
EVSE 312	Public	Level 2	4	38	575	15	4	63	351	10/29/2021
EVSE 543	MUD	Level 2	1	27	566	21	0	9	345	10/04/2020
EVSE 494	Public	Level 2	3	33	560	17	1	9	342	10/09/2020

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EVSE 474	Public	Level 2	1	32	522	16	1	8	318	10/20/2020
EVSE 91	Public	Level 2	5	44	500	11	1	8	305	10/18/2020
EVSE 535	Public	Level 2	1	67	494	7	1	9	302	12/23/2020
EVSE 499	Public	Level 2	2	127	482	4	1	4	294	08/06/2019
EVSE 508	Public	Level 2	2	40	477	12	1	8	291	10/19/2020
EVSE 532	Workplace	Level 2	1	46	468	10	1	8	286	11/05/2020
EVSE 83	Public	Level 2	6	29	450	16	0	4	275	01/03/2020
EVSE 229	Public	Level 2	2	54	449	8	1	12	274	04/09/2021
EVSE 69	Public	Level 2	1	72	444	6	1	7	271	10/03/2020
EVSE 39	Public	Level 2	2	104	438	4	1	4	267	01/09/2020
EVSE 516	Public	Level 2	1	53	434	8	1	7	265	10/22/2020
EVSE 546	MUD	Level 2	2	35	412	12	1	6	251	10/04/2020
EVSE 256	Public	Level 2	1	76	398	5	1	4	243	04/14/2020
EVSE 257	Public	Level 2	1	45	396	9	1	5	241	05/07/2020
EVSE 61	Public	Level 2	2	18	355	20	0	5	216	09/17/2020
EVSE 422	Public	Level 2	18	20	353	18	1	10	215	05/08/2021
EVSE 324	Public	Level 2	3	72	339	5	2	11	207	05/26/2021
EVSE 460	Public	Level 2	3	50	335	7	2	10	204	05/20/2021
EVSE 210	Public	Level 2	2	32	324	10	0	5	198	08/25/2020

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EVSE 170	Workplace	Level 2	2	19	322	17	0	3	197	01/27/2020
EVSE 466	Public	Level 2	2	87	307	4	2	8	187	04/13/2021
EVSE 418	Public	Level 2	5	45	297	7	2	10	181	06/10/2021
EVSE 352	Workplace	Level 2	2	19	268	14	1	13	163	08/14/2021
EVSE 234	Public	Level 2	2	58	258	4	1	5	157	12/15/2020
EVSE 162	Public	Level 2	2	29	235	8	0	2	143	01/08/2020
EVSE 280	Public	Level 2	2	25	197	8	0	3	120	11/18/2020
EVSE 465	Public	Level 2	2	27	180	7	1	4	110	03/03/2021
EVSE 493	Public	Level 2	2	29	173	6	1	5	105	04/23/2021
EVSE 648	Public	Level 2	1	27	153	6	4	24	93	11/17/2021
EVSE 500	Public	Level 2	1	11	136	12	0	2	83	10/10/2020
EVSE 457	Public	Level 2	1	29	135	5	1	3	82	03/06/2021
EVSE 526	Public	Level 2	1	23	133	6	0	2	81	09/09/2020
EVSE 430	Public	Level 2	5	24	116	5	2	8	71	09/21/2021
EVSE 405	Workplace	Level 2	5	7	115	16	0	3	70	03/17/2021
EVSE 380	MUD	Level 2	1	3	109	36	1	48	67	12/16/2021
EVSE 520	MUD	Level 2	1	21	91	4	0	1	56	06/05/2020
EVSE 502	Public	Level 2	5	16	87	5	0	1	53	07/07/2020
EVSE 258	Public	Level 2	2	23	85	4	0	2	52	01/09/2021

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EVSE 456	Public	Level 2	2	14	66	5	0	2	40	05/21/2021
EVSE 313	Public	Level 2	4	5	55	11	1	6	34	11/02/2021
EVSE 463	Public	Level 2	4	8	46	6	0	1	28	03/30/2021
EVSE 531	Public	Level 2	1	3	41	14	0	1	25	08/14/2020
EVSE 600	Public	Level 2	2	4	40	10	1	6	25	11/16/2021
EVSE 43	Workplace	Level 2	1	2	33	17	0	1	20	05/25/2021
EVSE 305	Public	Level 2	5	5	33	7	1	4	20	10/30/2021
EVSE 458	Public	Level 2	2	7	28	4	1	4	17	11/12/2021
EVSE 243	Public	Level 2	2	7	25	4	1	4	15	11/19/2021
EVSE 525	Public	Level 2	1	6	20	3	0	0	12	03/08/2021
EVSE 65	MUD	Level 2	1	4	18	5	0	0	11	01/15/2020
EVSE 169	Workplace	Level 2	2	3	14	5	0	0	9	01/15/2020
EVSE 690	MUD	Level 2	14	14	11	1	10	7	6	12/22/2021
EVSE 413	MUD	Level 2	5	11	8	1	5	4	5	12/16/2021
EVSE 470	Public	DCFC	2	2	7	4	0	0	5	01/11/2021
EVSE 71	Workplace	Level 2	1	1	5	5	0	0	3	09/05/2021
EVSE 403	Workplace	Level 2	2	4	4	1	0	0	2	01/04/2021
EVSE 109	Public	Level 2	1	1	3	3	0	0	2	12/31/2020
EVSE 64	Workplace	Level 2	4	1	3	3	0	0	2	09/08/2021

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EVSE 420	Workplace	Level 2	1	2	3	1	0	0	2	12/15/2020
EVSE 25	Workplace	Level 2	1	1	1	1	0	0	1	03/09/2021

About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.