ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

1407 W. North Temple, Suite 330
Salt Lake City, UT 84116

April 1, 2025

VIA ELECTRONIC FILING

Public Service Commission of Utah
Heber M. Wells Building, 4th Floor
160 East 300 South
Salt Lake City, UT 84114

Attention: Gary Widerburg
Commission Administrator

Re: **Docket No. 25-035-23**
Rocky Mountain Power's Electric Vehicle Infrastructure Program Report for Calendar Year 2024

PacifiCorp d. b. a Rocky Mountain Power ("the Company") hereby submits its annual report for the Electric Vehicle Infrastructure Program ("EVIP") to the Public Service Commission of Utah ("Commission"). This report is submitted in accordance with the November 17, 2021 Settlement Stipulation ("Settlement Stipulation") and June 15, 2022 Commission Order Approving Proposed Report in Docket No. 20-035-34.

Attachment A provides the accounting information for EVIP activities for calendar year 2024 the prior year, by month, showing all detail of the balancing account including. Attachment B contains a written status update, divided into sections for each component of the EVIP. The EVIP report also contains two confidential appendices and six non-confidential appendices. Confidential information will be uploaded to the Commission's SFTP site and provided in accordance with Commission Rule R746-1-601 and -602.

The Company also notes that it intends to file for an EVIP program review as described in paragraph 41 of the Settlement Stipulation no later than July 31, 2025. Prior to filing the program review, the Company may host one or more workshops with interested stakeholders and invites any party who wishes to participate to contact the Company by emailing Max Backlund, Manager of State Regulatory Affairs, at max.backlund@pacificorp.com.

All formal correspondence and data requests regarding this filing should be addressed as follows:

By E-mail (preferred): datarequest@pacificorp.com
max.backlund@pacificorp.com

By regular mail: Data Request Response Center
PacifiCorp
825 NE Multnomah, Suite 2000
Portland, OR 97232

Informal inquiries may be directed to Max Backlund, Manager, State Regulatory Affairs, at (801) 220-3121.

Sincerely,

Joelle Steward
Senior Vice President, Regulation

Enclosures

CC: Service List

CERTIFICATE OF SERVICE

Docket No. 25-035-23

I hereby certify that on April 1, 2025, a true and correct copy of the foregoing was served by electronic mail to the following:

Utah Office of Consumer Services

Michele Beck	mbeck@utah.gov
	ocs@utah.gov

Division of Public Utilities

dpudatarequest@utah.gov

Assistant Attorney General

Patricia Schmid	pschmid@agutah.gov
Robert Moore	rmoore@agutah.gov
Patrick Grecu	pgrecu@agutah.gov

Rocky Mountain Power

Data Request Response Center	datarequest@pacificorp.com
Jana Saba	jana.saba@pacificorp.com
	utahdockets@pacificorp.com
Max Backlund	max.backlund@pacificorp.com

Rick Loy
Coordinator, Regulatory Operations

Attachment A

EVIP Accounting
(calendar year 2024)

Beginning Balance (3,879,770.67)
Ending Balance (3,958,412.64)

		Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	CY 2024 Total
Revenue														
	Schedule 198	(492,883.75)	(459,346.50)	(438,465.88)	(417,988.92)	(407,349.05)	(511,803.38)	(703,541.56)	(875,902.71)	(709,132.67)	(570,205.76)	(506,712.62)	(556,497.84)	(6,649,830.64)
	Schedule 60 - 67% *	-	-	-	-	-	-	-	-	-	(25,848.10) **	(17,709.31)	(18,452.38)	(62,009.79)
Total Revenue		(492,883.75)	(459,346.50)	(438,465.88)	(417,988.92)	(407,349.05)	(511,803.38)	(703,541.56)	(875,902.71)	(709,132.67)	(596,053.86)	(524,421.93)	(574,950.22)	(6,711,840.43)
Expenses														
RMP Chargers														
	Program Management	15,133.50	10,601.00	11,390.00	13,162.00	12,166.00	10,368.00	10,391.59	10,802.00	8,119.00	11,869.22	9,639.72	6,359.23	130,001.26
	Marketing	-	-	-	-	-	-	6,692.98	-	19,460.00	-	-	-	26,152.98
	Incentive Admin.	46,900.00	8,500.00	39,213.64	52,482.80	113,250.00	6,600.00	15,200.00	32,600.00	30,350.00	17,200.00	2,741.75	16,456.98	381,495.17
	O&M	-	-	-	-	-	-	-	-	-	-	-	-	-
	Warranty	-	78,249.82	-	-	-	136,556.97	-	-	-	-	-	-	214,806.79
	Network Services	1,152.04	93,810.40	7,365.88	-	-	-	60,582.00	-	-	-	2,693.60	-	165,603.92
	Property Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Expense RMP Chargers		63,185.54	191,161.22	57,969.52	65,644.80	125,416.00	153,524.97	92,866.57	43,402.00	57,929.00	29,069.22	15,075.07	22,816.21	918,060.12
Make Ready														
	Charger Incentives	$438,524.00	$131,174.12	$154,614.00	$112,136.00	$-	$467,829.10	$-	$167,280.44	$31,185.35	$179,000.00	$ 154,738.00	$ 66,649.25	
Total Expense RMP Chargers		$438,524.00	$131,174.12	$154,614.00	$112,136.00	$-	$467,829.10	$-	$167,280.44	$31,185.35	$179,000.00	$154,738.00	$66,649.25	$1,903,130.26
Capital Spend														
RMP Chargers														
	Chargers	6,313.34	1,021,810.95	6,268.66	(497,772.12)	15,243.36	178,295.03	1,746,105.85	560,749.87	-	109,110.82	92,045.26	15,137.89	3,253,308.91
	Warranty	-	-	-	-	-	-	-	-	-	-	-	-	-
	Infrastructure	15,113.03	67,622.99	17,227.32	(192,540.64)	(383,162.71)	667,636.73	30,453.56	4,007.51	483,154.99	136,761.39	23,309.13	29,376.32	898,959.62
Total Expense RMP Chargers		21,426.37	1,089,433.94	23,495.98	(690,312.76)	(367,919.35)	845,931.76	1,776,559.41	564,757.38	483,154.99	245,872.21	115,354.39	44,514.21	4,152,268.53
Make Ready														
	Infrastructure													
Total Expenses		**523,135.91**	**1,411,769.28**	**236,079.50**	**(512,531.96)**	**(242,503.35)**	**1,467,285.83**	**1,869,425.98**	**775,439.82**	**572,269.34**	**453,941.43**	**285,167.46**	**133,979.67**	**6,973,458.91**
Balance Before Carrying Charge		(3,849,518.51)	(2,926,048.36)	(3,153,923.34)	(4,107,314.25)	(4,784,451.70)	(3,862,378.53)	(2,729,011.59)	(2,854,289.27)	(3,012,159.67)	(3,176,325.53)	(3,439,174.23)	(3,905,808.32)	(3,934,271.45)
Carrying charge		(28,952.63)	(25,488.60)	(22,870.04)	(27,285.05)	(33,409.28)	(32,517.47)	(24,814.80)	(21,007.07)	(22,053.43)	(23,594.23)	(25,663.54)	(28,463.12)	(316,119.25)
Total Balancing Account		(3,878,471.14)	(2,951,536.96)	(3,176,793.37)	(4,134,599.30)	(4,817,860.98)	(3,894,896.01)	(2,753,826.38)	(2,875,296.34)	(3,034,213.10)	(3,199,919.76)	(3,464,837.78)	(3,934,271.45)	(3,934,271.45)

* Schedule 60 - 67% of charging revenue is allocated to the the EVIP account, 33% is allocated to the EBA account. For the months of October, November, and December 2024, amounts of $12,731.15, $8,722.50, and $9,088.48 respectively were allocated to the EBA account for charging activities.

** First charging revenue payment includes charging activity for June - August 2024.

Attachment B

Section 1a - Company Owned Charging Stations

Summary of previous years activity and status.

Rocky Mountain Power made significant strides in expanding the network of Company owned electric vehicle fast charging throughout 2024 with the installation and operation of its initial sites. In 2024, four sites Vernal, Moab, Millcreek and Kimball Junction became operational, with 6 additional sites selected and under development. The additional 6 sites are Ivie Creek, Layton, Ogden, Orem, Coalville, and Draper, and are expected to be operational in 2025. The Vernal, Millcreek and Kimball Junction sites came online in June and the Moab site became operational in early July. The Moab site, which is a designated NEVI site, was the sixth NEVI location to be constructed and the first near a National Park in the United States. Figure 1 is a photograph of the Moab ribbon cutting event attended by officials from the Federal Highway Administration, Utah Department of Transportation, National Park Service, and Moab City.

Figure 1. Moab Ribbon Cutting Event

Status of Company Owned Charging Stations

In addition to the four sites constructed in 2024 (Vernal, Moab, Millcreek, and Kimball Junction) the Company began developing 6 additional sites in 2024. Two of these sites, Layton and Ivie Creek Rest Area, became operational in the 1st quarter of 2025. Currently, there are two sites under construction (Ogden and Orem) and two sites (Coalville and Draper) in engineering design and all four remaining sites are expected to be operational by the end of 2025. For a list and status of planned stations see Table 1.

Table 1. List of Locations Planned with Charger Type

Location	Status	Type	# of Ports
Ogden	Under Construction	DCFC:350KW-shared w/2	8
Layton	*Operational**	DCFC:350KW-shared w/2	6
Farmington	Planned	DCFC:350KW-shared w/2	6
Woods Cross	Planned	DCFC:350KW-shared w/2	6
Kimball Junction	Operational	DCFC:350KW-shared w/2	4
Salt Lake City	Planned	DCFC:350KW-shared w/2	6
Millcreek City	Operational	DCFC:350KW-shared w/2	4
West Valley City	Planned	DCFC:350KW-shared w/2	6
Midvale	Planned	DCFC:350KW-shared w/2	6
Draper	Engineering Design	DCFC:350KW-shared w/2	6
American Fork	Planned	DCFC:350KW-shared w/2	6
Orem	Under Construction	DCFC:350KW-shared w/2	8
Coalville	Under Construction	DCFC:350KW-shared w/2	4
Vernal	Operational	DCFC:350KW-shared w/2	6
Cove Fort	Planned	DCFC:350KW-shared w/2	4
Tie Fork Rest Area	Planned	DCFC:350KW-shared w/2	4
Ivie Creek Rest Area	*Operational**	DCFC:350KW-shared w/2	4
Moab	Operational	DCFC:350KW-shared w/2	8
Bluff	Planned	DCFC:350KW-shared w/2	4
La Verkin	Planned	DCFC:350KW-shared w/2	4

*Became operational in the 1st Qrt 2025

Utilization Evaluation

The Company installed 22 charging ports across its 4 sites in 2024: (6) Vernal, (8) Moab, (4) Millcreek, and (4) Kimball Junction. The charging stations came on line in June and July and operated for roughly 6 months. The charging port availability for customer use with total outage time was calculated over the 2024 period and can be found in Table 2. The average charger availability across all sites was 97.52%.

Table 2. Charging Port Availability

Location	Station ID	Total OCPI Outage (minutes)	Period (minutes)	Availability (%)
Vernal	701141-01	3,058.1	302,399	98.99%
Vernal	701141-02	3,658.3	302,399	98.79%
Vernal	701141-03	3,764.1	302,399	98.76%
Vernal	701141-04	3,978.8	302,399	98.68%
Vernal	701141-05	1,061.8	302,399	99.65%
Vernal	701141-06	2,550.0	302,399	99.16%
Moab	701142-01	12,539.8	252,000	95.02%
Moab	701142-02	5,290.1	252,000	97.90%
Moab	701142-03	4,977.4	252,000	98.02%
Moab	701142-04	3,932.5	252,000	98.44%
Moab	701142-05	10,942.0	252,000	95.66%
Moab	701142-06	11,117.8	252,000	95.59%
Moab	701142-07	4,222.1	252,000	98.32%
Moab	701142-08	23,558.9	252,000	90.65%
Millcreek	701143-01	3,406.0	280,799	98.79%
Millcreek	701143-02	6,543.9	280,799	97.67%
Millcreek	701143-03	1,713.7	280,799	99.39%
Millcreek	701143-04	16,504.5	280,799	94.12%
Kimball Junction	701144-01	7,004.5	279,359	97.49%
Kimball Junction	701144-02	6,297.9	279,359	97.75%
Kimball Junction	701144-03	3,375.1	279,359	98.79%
Kimball Junction	701144-04	5,936.2	279,359	97.88%

For a more detailed review of the charging port availability and the outage occurrences see Confidential Appendix 1-2024_RMP_Availaibility and Outage.xls.

An evaluation of the charger usage at each site was conducted. Table 3 shows the load factor, percentage of customer discount use, percentage of off-peak usage, and revenue for each location.

Table 3. Comparison of Load Factor, Peak Usage, Customer Discount and Revenue per site

Sites	Load Factor	Customer Discount	Off-Peak Usage	Revenue
Vernal	7%	13%	79%	$ 12,985
Moab	6%	5%	74%	$ 27,247
Millcreek	15%	12%	72%	$ 56,440
Kimball Junction	13%	9%	71%	$ 58,031
All Sites	10%	9%	73%	$ 154,703

The total revenue from charging in 2024 was $154,703, in which 33% was deposited into the Utah Energy Balancing Account and 67% deposited into the EVIP Balancing Account. As to be expected, Millcreek and Kimball junction had the most use due to its proximity to Interstates and population centers. Almost ¾ of the energy associated with charging across all sites occurred during off-peak hours. The utilization of the RMP customer discount was only 9% across all sites. To access the chargers, consumers have two[1] pathways to make a payment: 1) through a credit card reader located on the charging station 2) downloading the Electrify America app, supplying a credit card, selecting a plan and managing the transaction through the app. Inside the Electrify America app there are multiple plans users can select, including Electrify America's +plan (discount plan at all Electrify America's charging stations across the country), OEM bundle programs (For Example, this is when a consumer purchases a new car and the OEM offers free 1000 kwh of fast charging), and lastly the Rocky Mountain Power

[1] A third mechanism is available called plug and pay, where one plugs into the charger and the transaction occurs between the vehicle and charger. Only a few automotive OEMs have this capability with Electrify America but it is expected to increase over time.

Discount plan. The Rocky Mountain Power Discount plan eligibility includes customers with active Rocky Mountain Power accounts, residents who don't have their own accounts but live at properties with active Rocky Mountain Power accounts, and employees of Rocky Mountain Power business customers who are using an electric vehicle for that business. The highest use of the Rocky Mountain Power discount occurred at the Millcreek site, which is the only site along the Wasatch front. For a detailed review of the revenue and payment type see Confidential Appendix 2, 2024 RMP Revenue Summary.xls.

Lastly, the Company conducted a preliminary power utilization and charging behavior analysis of the four sites from operational data throughout 2024. The analysis, performed by Electric Power Engineers LLC, evaluated peak usage patterns, site load factors and power sharing events.   The load factors were calculated by dividing the average power dispensed at each site by the maximum power available at each site. The average load factor was 10%; that is, the average power used was only 10% of what was capable of being used. The implications of the analysis are significant as it may impact how the Company designs future sites, particularly sites with constrained circuits. To review the report on the analysis in its entirety please see Appendix 3 RMP DCFC Analysis. Since, the analysis only covers 6 months of operational data, the Company intends to conduct an additional analysis once an entire year of operational data is available to take into account any seasonal effects.

Section 1b – Make Ready Infrastructure and Charger Rebates

The Company offers two incentives for customers; rebates for chargers and incentives for infrastructure. Eligible non-residential customers may choose between applying for the rebates or the infrastructure incentives but they are not allowed both. The rebates are a prescriptive incentive after the purchase and installation of the charger; whereas, the infrastructure incentives require an application prior to the project. Rebates are available to all eligible customers. Infrastructure incentives are prioritized to projects that are demonstrated to be viable with a strong commitment by the applicant, projects that are expected to increase EV adoption or reduce transportation emissions, and projects that are in the public interest and prudent as outlined in section 54-4-41(4) and (7) of the Utah Code. Residential customers are only eligible for rebates.

There has been an increase in the number of applications in 2024. Infrastructure projects are taking a significant amount of time to complete which reflects a nationwide industry challenge. These projects are rarely completed in the year the applications were submitted. The following are key highlights for the program:

- The number of Make Ready applications doubled from 2023 numbers (48 vs 101)
- Over half of the Make Ready applications came from property managers looking to install 50 kW DC Fast Chargers at their properties. The applications were completed by the same EV charging developer.
- $5.87 million in funding was awarded to non-residential applicants. In 2023, $5.8 million in funding was awarded for non-residential applications.
- $2.25 million in funding was paid to non-residential customers. Some of these payments were for applications submitted and approved in 2022 and 2023.
- 186 AC Level 2 Charger residential applications were approved, totaling $37,166 paid.

The following tables summarizes the types of applications for 2024.

Table 3. Total 2024 Applications

2023 Application Summary	Make Ready Incentives	DCFC Rebates	AC Level 2 Rebates	Residential Rebates	Total for 2024
# of applications	101	6	47	241	395
# of applications-approved	56	5	47	186	294
Amount Requested	$20,036,977	$265,494	$360,386	$46,600	$20,709,458
Amount Awarded	$5,352,474	$186,592	$327,202	$37,166	$5,903,434
Amount Paid in 2024	$1,903,130	$152,037	$152,037	$37,166	$2,284,625

Table 4. Awarded Projects by Charger Type, # of Ports

	Make Ready Incentives	DCFC Rebates	AC Level 2 Rebates	Total for 2024
AC Level 2 Charger Count	243		322	565
AC Level 2 Port Count	257		357	614
DCFC Charger Count	192	5		197
DCFC Port Count	194	9		203

Table 5. Awarded Projects by Customer Category, 2024

Category	AC Level 2 Charger Count	AC Level 2 Port Count	DC Fast Charger Count	DC Fast Charger Port Count
Commercial	16	16	4	4
Dealership	34	42	6	11
Fleet	15	15	30	31
Lodging	18	18	4	4
Multi Family	288	301	4	4
Public	36	41	94	94
School	8	20	0	0
Transit	1	1	51	51
Workplace	122	160	4	4

Table 6. Awarded Projects by Location, 2024

Location	AC Level 2 Charger Count	AC Level 2 Port Count	DC Fast Charger Count	DC Fast Charger Port Count
American Fork	18	18	8	8
Bountiful	3	6	0	0
Circleville	1	1	0	0
Clearfield	7	7	12	12
Draper	16	28	0	0
Green River	0	0	16	16
Heber	2	2	0	0
Herriman	60	60	2	2
Hill AFB	2	2	0	0
Holladay	4	4	0	0
Ivins	45	45	0	0
Layton	0	0	10	10
Lindon	2	2	3	5
Logan	17	17	2	2
Marriot Slaterville	4	8	0	0
Midvale	4	4	0	0
Millcreek	60	60	2	2
Moab	2	2	0	0
North Logan	0	0	2	2
Ogden	47	52	10	12
Orem	8	8	0	0
Park City	12	12	3	3
Plain City	2	2	0	0
Richfield	3	3	0	0
Riverdale	4	8	0	0
Riverton	1	1	0	0
Salt Lake City	152	159	59	60
Sandy	37	44	4	4
South Jordan	6	6	0	0
South Salt Lake	16	21	22	23
Springdale	5	5	0	0
Taylorsville	2	4	0	0
Tooele	0	0	4	4
Tremonton	0	0	4	4
West Jordan	10	10	4	4
West Valley City	8	8	28	28
Woods Cross	5	5	2	2

Section 1c – Innovation and Partnerships

The Company continued engaging key partners in 2024 and participates on the Electrification of Transportation Infrastructure Steering Committee. Established by the Utah Legislature in 2023, the Steering Committee is tasked to create a strategic plan for a fully electric transportation system in Utah. Chaired by the Utah Department of Transportation, the Committee's efforts to develop the plan are supported by the ASPIRE Center, which is designated to staff the committee. Other members of the steering committee include the Governor's Office of Economic Opportunity, the Governor's Office of Energy Development, Utah Department of Environmental Quality, and the Utah Transit Authority. The Steering committee meets quarterly and discusses strategies of how to expand transportation electrification in the state including within the Utah Inland Port Authority and The Point Development.

In 2024, the Company developed three innovative projects that will utilize EVIP funds. First, the Company developed the project, Reliable Electric Vehicle Infrastructure through Versatile and Equitable Managed Charging (REVIVE). The REVIVE project is designed to implement comprehensive solutions that prioritize EV charging based on grid health, EV charging demand times, and customer preferences while adjusting charging rates dynamically in response to fluctuating grid conditions. The project will include end-to-end specifications of charging hardware, grid communication requirements, and standards enabling the scalability and reliability of managed charging solutions to facilitate future EV charging implementations. The project was developed with Utah State University, Utah Transit Authority, and the National Renewable Energy Laboratory (NREL) as key partners. The project was submitted in July 2024 to the U.S. Department of Energy (DOE) Funding Opportunity Announcement DE-FOA-0003214, Communities Taking Charge Accelerator. See Appendix 4, REVIVE Technical Volume, for a detailed description of the project. The project was conditionally selected for negotiation of an award, DOE Award number DE-EE0011921. James Campbell, PacifiCorp, is the project lead, and $1,000,000 in EVIP funds are budgeted which can be used as cost share for DE-EE0011921. As a note, the project is currently paused as the DOE reviews recent Executive Orders to ensure that the agency complies with Administrative directives.

The second project is SuperCharge: Sustainable Utilization of Power Infrastructure Enabling Rapid and Replicable MHDVs Charging. SuperCharge will develop and demonstrate utility integration of megawatt-scale charging with on-site battery energy storage to support Utah local and regional freight movement. The project includes a field demonstration and evaluation at the Utah Inland Port site in Salt Lake City. The technologies developed and demonstrated will inform the utility, site operators, charging providers, and fleet owners and operators on best practices for deploying and operating infrastructure and electrifying medium and heavy-duty vehicles (MHDVs). The key partners of the project are ASPIRE Center, Utah State University, and Utah Inland Port. For an in depth description of the project see Appendix 5. SuperCharge Project Description. The project was selected for a DOE award, award number DE-EE0011921. The award was part of a DOE Funding Opportunity Announcement DE-FOA-0003344. The project is being led by Dr. Regan Zane, ASPIRE Center and Utah State University, with $1,000,000 of EVIP funds allocated. The Company is a partner and subrecipient on the DOE award DE-EE0011921, and can use the EVIP funds to meet its cost share requirements.

The third project is the Intelligent Integration of Electric Vehicles and Buildings for a Campus with Innovative Cyber Security and Data Privacy Solutions, referred as, “Intelligent Integration”.

The Intelligent Integration project will design the architecture necessary to monitor and control the available EV charging infrastructure integrated with distributed energy resources (DERs) and autonomous electric vehicles (AEVs) at university and commercial campuses to provide services to the power grid. In addition, the project will develop comprehensive and practical solutions that ensures security against cyber threats and ensures the privacy of data for stakeholders involved. The project will be focused initially at the University of Utah with the insights translated to The Point Development. The key partners of the project are Grid Elevated, University of Utah and The Point. For an in depth description see Appendix 6, Intelligent Integration Project Description. This project expands upon the Company's DOE Connected Communities award, award number DE-EE0011921, DOE Funding Opportunity Announcement DE-FOA-0003344. The Intelligent Integration project is being led by Dr. Masood Pavarnia, Grid Elevated and University of Utah, with $2,100,000. Both Grid Elevated and the University of Utah are participants in the Company's Connected Communities project, DE-EE0011921 and the EVIP funds can used to meet the cost share requirements.

Section 1d – Educational Outreach/Marketing

The Company conducted outreach and education throughout 2024. The initial outreach was centered around the launch of the new charging stations in June 2024. During these launch events, the Company leveraged both earned and paid media to promote the new sites. In addition to promoting the new sites, the Company's messaging highlighted the importance of charging during off-peak hours. For example, at the Millcreek launch event, Fox 13 The Place did live on air segments, during these live segments Company representatives stressed the importance of off-peak charging Figure 2 was displayed during live air segments.

Figure 2. TOU charts

The Company ran a second campaign in September to highlight National Drive Electric Week. As part of the campaign, the Company utilized paid social media to highlight that discounts were available for EV users that charged off-peak. The Company also had paid spots on KUER 90.1 NPR during the 3 weeks before the national event and the typical spot said the following:

> "Support for NPR comes from Rocky Mountain Power, helping EV drivers with information on the best time to charge vehicles like overnight, when energy demand is low more at rocky mountain power net, slash, EV"

The campaign culminated on October 1st when the Company hosted an EV car show as part of the National Drive Electric Week, where it invited members of the community to bring an EV and/or just attend the event and learn about EVs. There was a focus on time-of-use charging where a tent was set up and manned by Utah State University students and researchers where they described the grid and explained about the importance of time-of-use charging to the event attendees. The event attracted hundreds of people from the community. Fox 13 The Place also did live spots from the event highlighting the importance of off-peak charging.

The Company also engaged in educational outreach and participated in STEM FEST at the Mountain American Expo Center. During STEM Fest 10,000 K-12 students came and learned about careers in STEM from various businesses in the state. The Company had information about EV charging including on the importance of charging off-peak, Figure 3 illustrates an employee sharing that information with students.

Figure 3. RMP participation at STEM Fest

In 2024, the Company spent $46,849 on marketing, outreach and education.

Plan for 2025 EVIP and TOU Outreach

In 2025 the Company will continue to market the program and highlight new Company Owned EV sites along with informing customers in how to take advantage of discounts that are available at these locations. However, a primary focus will be on time of charging or time of use. In 2023, Embold Research surveyed 647 Rocky Mountain Power customers, followed by 10 follow-up in-depth interviews of current and future electric vehicle owners, to understand customers' awareness of and willingness to participate in time-of-use programs. This research found that customers have low awareness of on-peak and off-peak hours, but show moderate willingness to participate in time-of-use programs. Motivation to enroll in time-of-use programs increases at the prospect of significant cost savings and the ability to help the grid. Moreover, current and future electric vehicle owners show particular interest in time-of-use programs both in and out of the home, but the use of solar panels and net metering is a prominent obstacle in participating in at-home electric vehicle time-of-use programs.

Based on these findings the Company will develop specific approaches to time of use customer education. The Company will pursue two approaches; first, a Company Driven track and second, a stakeholder driven track with the Office of Consumer Services and the Governor's Office of Energy Development that will be cobranded with all parties. The two tracks are meant to be complementary and to amplify the messaging so that customers can hear the message from different sources and potentially different trusted entities therefore enhancing the effectiveness. A description of the approach can be found in Appendix 7, TOU Education 2025. The 2025 budget for the customer TOU education is $20,000 for Track 1 and $20,000 for Track 2, for a total of $40,000.

Section 1e – Summary

Attachment A includes the expenditures of the EVIP for last year along with the ongoing net balance of the Balancing Account. The Balancing Account only reflects actual payments and actual revenue (Sch 198 and Sch 60) it doesn't include commitments. The development of EV projects (particularly the high powered sites) can take 1-2 years from decision to move forward to construction and operation. In some cases, it can take longer due to long lead times on equipment, permit applications, utility interconnections, and agreements with property owners. When the Company identifies funding commitments like Company Owned sites or customer Make-Ready incentives, those funds are put to the side and considered allocated even though they are not included in the Balancing Account. See Table 7 for the allocation of program funds. The workpapers for Table 7 can be found in Appendix 8.

Table 7. Allocated Funds

Category	Total	%
Total Company owned	$ 15,159,143	45%
Total Customer Incentive Awards	$ 15,397,944	46%
Total Innovation Projects	$ 3,100,000	9%
Total	$ 33,657,087	100%

APPENDIXES 1 AND 2 ARE CONFIDENTIAL

IN THEIR ENTIRETY

AND ARE PROVIDED UNDER SEPARATE COVER

Appendix 3

Rocky Mountain Power DC Fast Charger Power Utilization Analysis

Report Presented to:

EXECUTIVE SUMMARY

This report analyzes charging behavior and power utilization patterns at four Electrify America DC fast charging (DCFC) sites in Utah: Kimball Junction, Olympus Cove, Moab, and Vernal, providing insights into current operational performance and future readiness. A more detailed summary of the analysis is in Section 1. Comprehensive analysis details are in Sections 2 and 3.

DATA PROCESSING

- **Charging Sessions:** Data from May to December of 2024 was used to facilitate the analysis of over 10,000 sessions.
- **Charging Profile Simulation:** Simulations were conducted using a constant-current constant-voltage (CC-CV) model, reflecting dynamic DCFC load shapes and accounting for power-sharing behavior.

POWER UTILIZATION

- **Site-level analysis:** Site-level analyses reveal consistent daily patterns across all four locations, characterized by lower demand in the mornings and significantly higher demand during afternoon and evening hours with maximum loading occurring in the Fall or Winter given the current data.
- **Load Factor:** The average load factor of approximately 10% across all sites indicates substantial headroom to accommodate increasing EV adoption and future growth in charging demand.
- **Power Sharing:** Cabinet-level power sharing (as explained in Section 2.3.1) was observed in just 1% of sessions, with an average curtailment event duration of 13 minutes and energy curtailment averaging 2.58 kWh, suggesting minimal impact on charging performance given current EV adoption rates.

FUTURE WORK

This preliminary analysis has opened further avenues for research. After consistent data collection for a year, further analyses will include a deeper investigation of peak usage events, public DCFC charging time correlation analysis with transit bus charging at relevant sites, and further data validation.

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1 NARRATIVE

Understanding public direct-current fast charging (DCFC) infrastructure is crucial for managing the electrification transition. As DCFC systems can produce substantial, localized power demand spikes, assessing their impact on grid stability is critical. This report examines operational data from four Electrify America (EA) DCFC sites in Utah (Kimball Junction, Olympus Cove, Moab, and Vernal), analyzing charging behavior and power utilization patterns to inform future infrastructure planning and grid integration strategies.

Analysis of charging session data from the Electrify America Nucleus Portal reveals several insights:

- **Peak Usage Patterns:**

  Figure 1 shows the maximum and mean power profile aggregated across all days at an hourly resolution. The Y-axis is scaled to the site capacity to show relative site utilization. In peak loading scenarios the sizeable difference between mean load and maximum load should be noted.

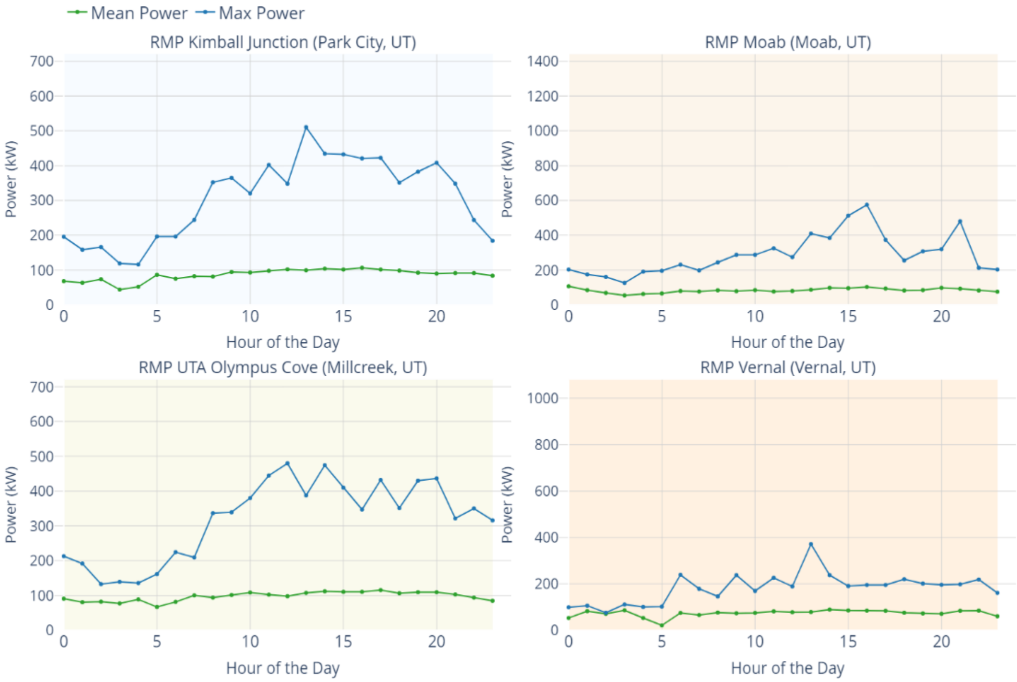


Figure 1. 1-Hour Resolution Site-Level Power Profile for All Four Stations

Figure 2 provides more insight into maximum loading scenarios. By plotting the contiguous maximum power duration against the maximum power level and showing the correlated energy usage as the shaded area, this plot communicates the grid impact of the maximum load event at each site. **Maximum power events occur between 1:00 PM and 4:35 PM in the Fall or Winter seasons** across all sites. The data shows an upward trend of usage since the start of data collection, suggesting that these insights may change as data is collected under regularized site usage.

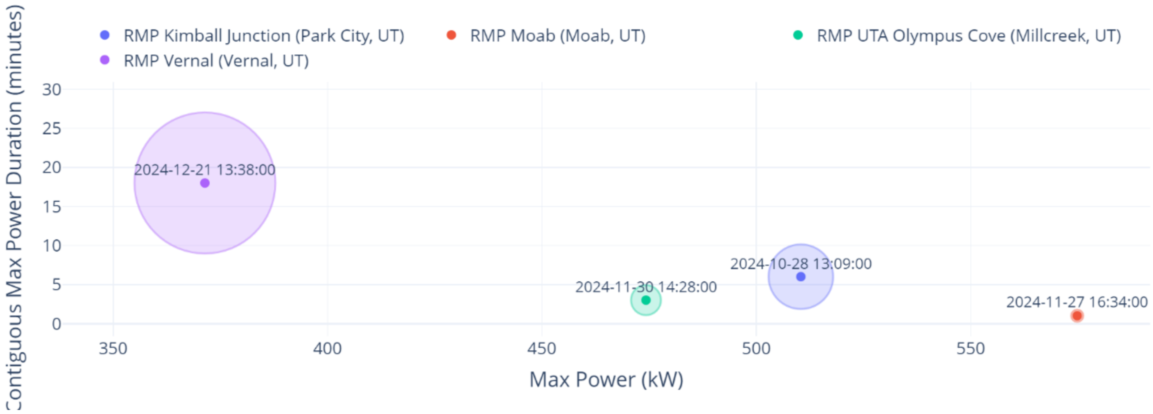


Figure 2. Site-Level Maximum Power Duration vs. Maximum Power Level

Figure 2 shows that while the peak demand in Moab is high (574.8 kW), the duration of that peak demand is only for one minute so the energy impact to the grid is low. Conversely, the peak demand realized at Vernal is lower (371.4 kW), but the duration of the peak demand lasts for ~18 minutes making creating a great energy impact for the grid.

- **Load Factor:**
  In this analysis load factor (LF) is considered as:

$$LF = \frac{Average\ Power}{Maximum\ Power},$$

where

$$Maximum\ Power = Cabinet\ Capacity * N_{Cabinets}.$$

Maximum power is analogous to the site's power capacity considering grid connectivity through power cabinets. Power cabinet connectivity is explained in Section 2.3.1. Comparing the average one-minute simulated power to the site's capacity (maximum power) shows how typical site utilization compares to the site's potential utilization. The average load factor across the four sites is approximately **10%** based on simulated load profiles, indicating substantial unused capacity and suggesting readiness for future EV growth.

Table 1. Site-Level Load Factor Estimates

Site	Load Factor
Kimball Junction	0.1342
Moab	0.0605
UTA Olympus Cove	0.1451
Vernal	0.0730
AVERAGE	**0.1032**

- **Limited Power Sharing Events:**

  Due to low average utilization, **power-sharing events at the charger level remain infrequent, occurring only in 1% of recorded sessions**. Drivers currently tend to avoid parking next to occupied chargers, minimizing sharing-related power reductions. However, as charger usage grows, educating drivers about power-sharing impacts on charging performance could help maintain positive user experiences and efficient utilization of charging infrastructure. Power sharing is explained in Section 2.3.1.

1.1 REPORT SCOPE & METHODOLOGY

Detailed explanations of data processing methods, charging profile simulations (using a constant-current constant-voltage model), and analytical approaches employed at site, cabinet, and individual charger levels are provided in the Section 2. Additionally, this section outlines the methods used for evaluating peak usage patterns and power-sharing dynamics.

The insights derived from this analysis can guide future strategic decisions around DCFC site deployment, infrastructure sizing, customer engagement strategies, and control automation. Continued data sharing from Electrify America, combined with ongoing monitoring of power utilization patterns, will enhance understanding of DCFC effects on grid stability, ultimately supporting a smoother electrification transition in Utah.

2 METHODOLOGY

2.1 DATA PREPROCESSING

The purpose of the data preprocessing task is to prepare the dataset collected from four EV charging sites in Utah—Kimball Junction, Millcreek, Moab, and Vernal—for further analysis. The dataset contains session-level details, including session start and end times, duration, idle duration, energy usage, payment method, and subscription plan type. EPE has employed a data-driven preprocessing and feature engineering approach to provide the data for further analysis. Preprocessing steps focused on addressing missing values, standardizing datetime formats, and removing redundant data to streamline the dataset. Additionally, data inconsistencies were corrected, and outlier detection was applied to remove unrealistic session records, such as those with no power usage (i.e., from testing and commissioning).

The raw data includes the information of 12,024 session samples. The clean data includes 10,189 sessions, accounting for 84.4% of the original data. The data spans from the earliest session on May 30, 2024, to the latest session on December 31, 2024.

2.2 FEATURE ENGINEERING

Figure 3 illustrates the distribution of sessions and chargers across the different sites. Session power profiles are aggregated to the charger and site levels to produce the power plots in this report. The data reveal that 37.3%, 36.6%, 18.4%, and 7.7% of sessions correspond to the Kimball, Millcreek, Moab, and Vernal sites, respectively. Notably, 14 of the 22 chargers are located at the Moab and Vernal sites, resulting in the observation that 64% of the charging infrastructure is responsible for facilitating only 26% of the sessions to date.

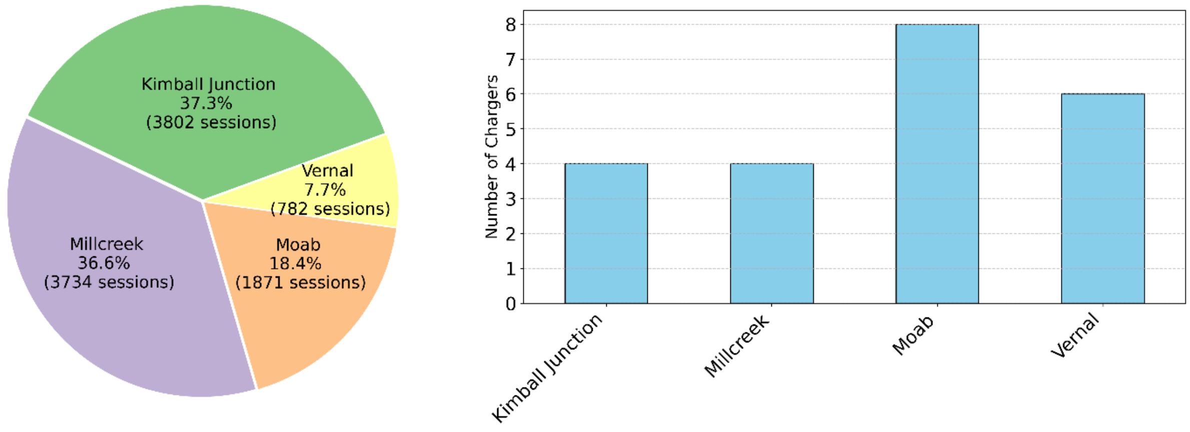


Figure 3. Chargers and Session Distribution

2.3 PROFILE SIMULATION

From the provided data, profile simulations leverage total energy usage, start time, and stop time to meet analysis objectives. Maximum session power, session-start state-of-charge (SOC) and session-end SOC were not always recorded. These values were randomly filled from within their column's respective distributions to provide the needed context to the simulator.

The simulation result of a one-minute resolution power profile is constrained to last for the entire session period (start time to end time – idle time) and match the recorded total energy usage while following a constant-current constant-voltage (CC-CV) profile. The CC-CV profile entails a threshold (set at 80%) where the charger switches priorities from maintaining a constant current (providing maximum available power) to maintaining a constant voltage to roughly mimic real-world charging profiles. After the CV threshold is reached the exponentially decaying power is modeled as:

$$P = Available\ Power * e^{(-k*SOC_{Ratio})},$$

where

$$SOC_{ratio} = \frac{SOC - CV_{threshold}}{100 - CV_{threshold}}.$$

While these are rough estimates that do not consider effects such as thermal throttling, or battery chemistry, it does provide a foundation for estimating DCFC power utilization behaviors. Figure 4 shows the result of these simulations with the median profile in yellow, showing that the typical session's maximum power (90 kW) is 25% of the charger's capacity.

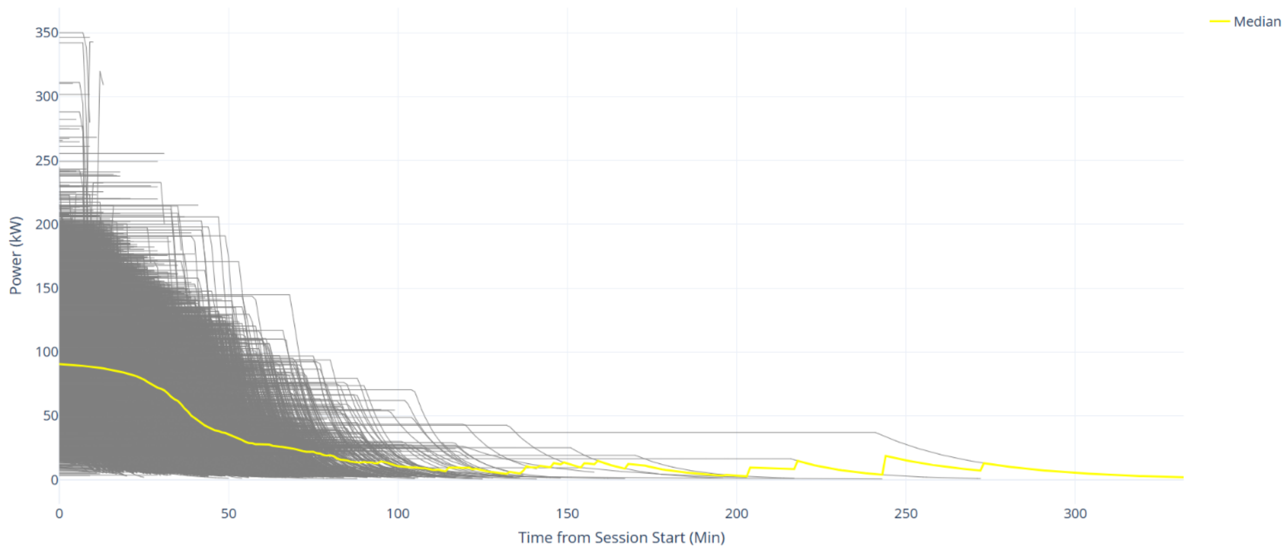


Figure 4. Simulated Charging Power Profiles with Median Power

Figure 5 shows all session data and the interquartile range (the energy usage (kWh) range for the most typical sessions on a given day), communicating that the typical session uses between 25 and 50 kWh of energy. This plot also validates notable simulated power profiles such as those drawing around 150 kW of power for over an hour. Figure 5 shows this is feasible given several sessions near, and above, 150 kWh of energy usage.

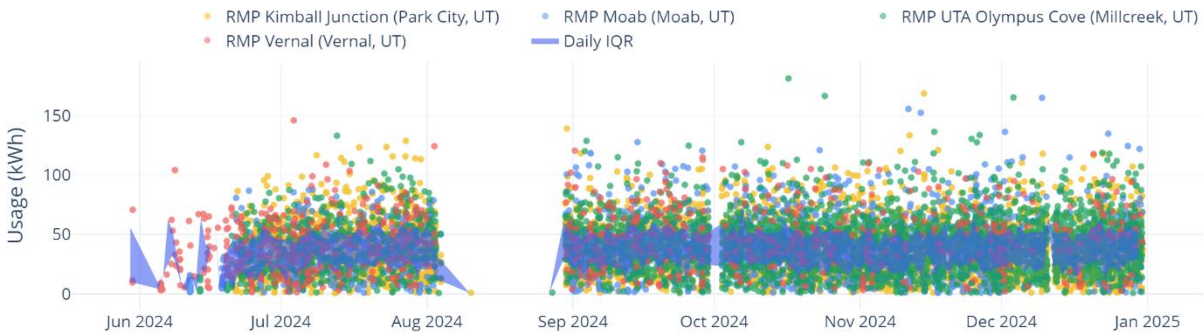


Figure 5. Session Energy Usage

2.3.1 POWER SHARING

The DCFC sites analyzed in this project are connected to the grid, sharing a 360-kW cabinet with a neighboring charger. Cabinet neighbors are determined by device ID where Device XXX-01 and Device XXX-02 share one cabinet while Device XXX-03 and Device XXX-04 would share another. This results in the maximum charger capacity being reduced to 180 kW when both chargers on a shared cabinet are coincidently charging a vehicle. We handle this nuance in profile simulation with a second pass over the profiles once they have been simulated, assuming no power sharing. If there is an overlap at the cabinet level, the profiles are adjusted to adhere to the curtailed available power. Curtailed power is considered as the difference in power level due to power sharing. 99% of recorded sessions were successfully simulated within 1 kWh of the total energy usage. Figure 6 provides an example of this situation and depicts what is considered as curtailed power in this analysis.

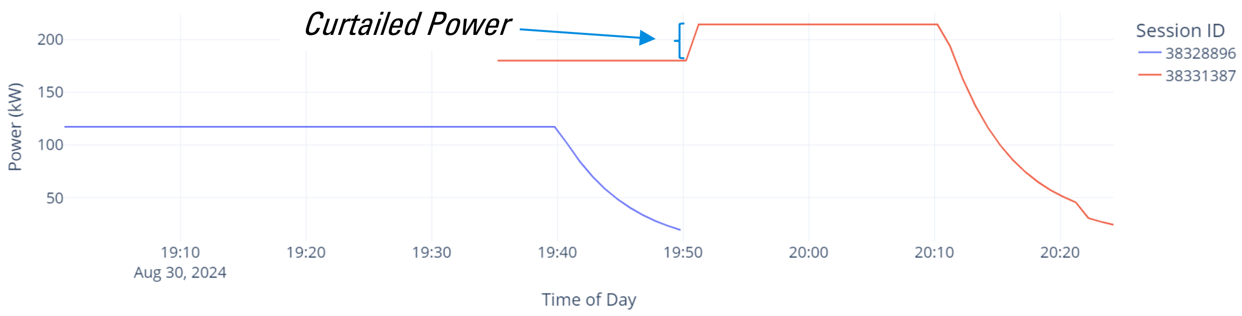


Figure 6. Power Sharing Example

Analyzing power sharing events across all sessions in this analysis, results show that power sharing is estimated to only have occurred at two stations (Kimball Junction and Olympus Cove). Kimball Junction and Olympus Cove have higher utilization and only four chargers at each site whereas Moab and Vernal are more remote with lower utilization.

Figure 7 shows the sum of curtailed power at each minute every day of the week across the entire period of the collected data, uncovering that the highest power sharing event happened on a Tuesday at the Olympus Cove site around 3 PM, curtailing 170 kW of power for two minutes. Overall, the frequency, and location, of power sharing events coincides with the power utilization analysis outlined in the next section.

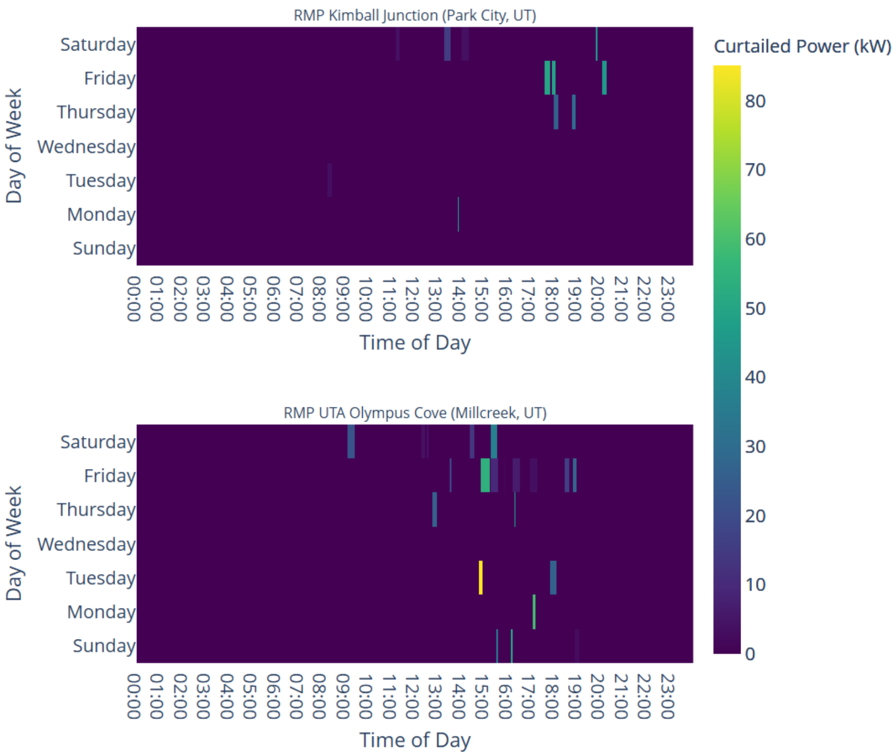


Figure 7. Total Power Curtailment

3 POWER UTILIZATION

This section beings with data aggregated to the site level, analyzing hourly and 15-minute resolution mean and maximum power profiles in Section 3.1. Section 3.2 reduces the level of aggregation to analyze power profiles at the cabinet level. Section 3.3 shows session profiles aggregated to the charger level.

3.1 SITE-LEVEL POWER PROFILE

EPE has conducted detailed site-level power profile analysis. Profile samples reflect one-minute resolution data for power utilization over time, enabling granular insights into charging behavior. Furthermore, the analysis distinguishes between weekdays and weekends to account for variations in power usage patterns based on temporal differences. Figure 8 shows a representative

24-hour site-level power profile with 15-minute resolution, providing a detailed depiction of the power usage pattern observed across all days. This figure highlights the general trend of lower morning power loads and higher maximum loads throughout the afternoon and evening across all sites. The area between the maximum load line and the average load line shows how representative the maximum load line is of charger usage. If there is a large gap between the two lines, this communicates that the maximum load line is not a likely representation of what the charger will experience at that time of day (assuming a sufficient sample size for that timestep). If the lines are close, this means that there are several values recorded near the maximum value, making the maximum value more representative of likely loads.

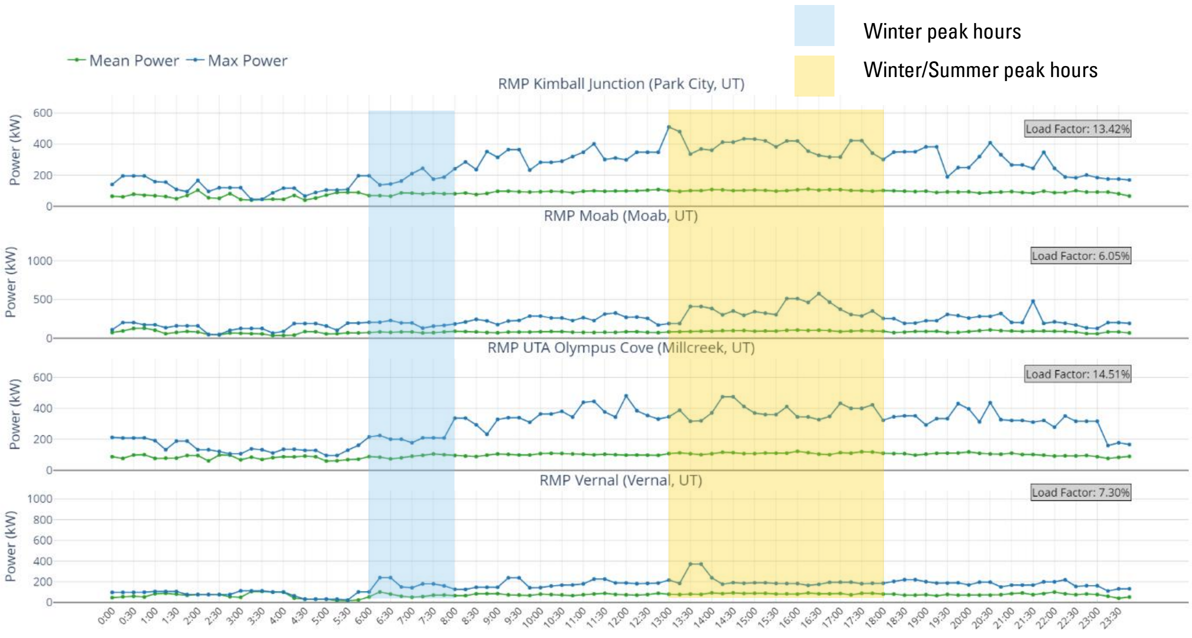


Figure 8. 15-Minute Mean & Max Power Profiles (All Stations, All Days) with TOU Overlay

TOU peak-demand pricing windows are highlighted in blue, for winter peak hours, and yellow for summer/winter peak hours. 33% of sessions occurred in the morning winter peak time, accounting for 29% of total power usage. 25% of sessions occurred in the winter/summer evening peak accounting for 23% of total power usage. Figure 9 represents the utilization of each site based on the site maximum load, showing maximum power utilization below 70% across the four sites.

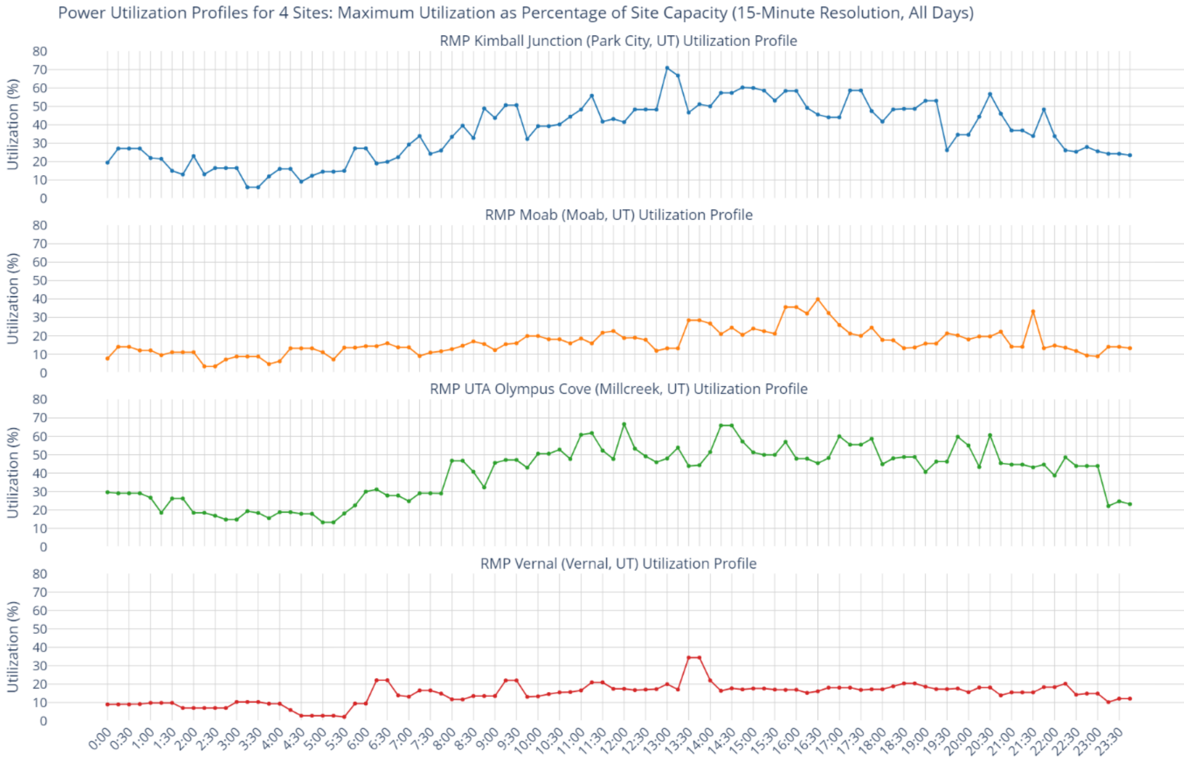


Figure 9. Power Utilization Profile for 4 Sites: Max. Utilization as % of Site Capacity (All Days)

3.1.1 WEEKDAY/WEEKEND COMPARISONS

The following plots break out aggregation into weekdays and weekends to observe site-level trends in each scenario. Notable changes in charging behavior include the ~200 kW increase of maximum power on weekends at the Vernal site and ~200 kW increase of maximum power on weekdays at the Moab site. Average power trends tend to stay around 100 kW regardless of the time of week except for Vernal experiencing longer periods of time on weekend mornings without any sessions.

3.1.1.1 WEEKDAY/WEEKEND HOURLY RESOLUTION PLOTS

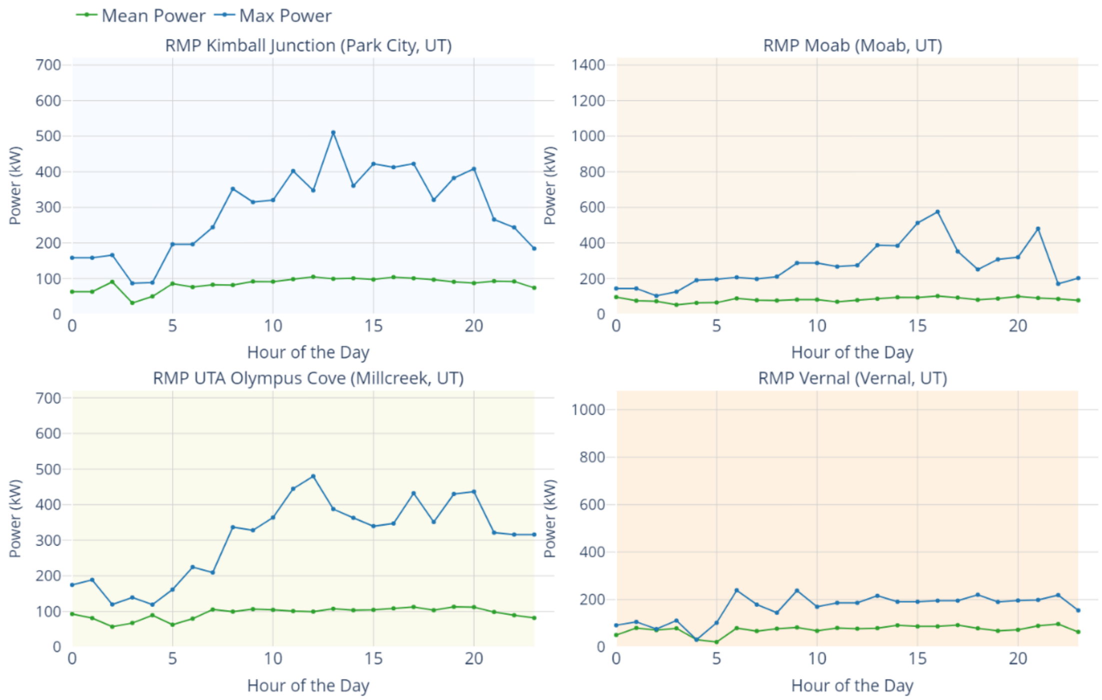


Figure 10. Weekday Power Profiles

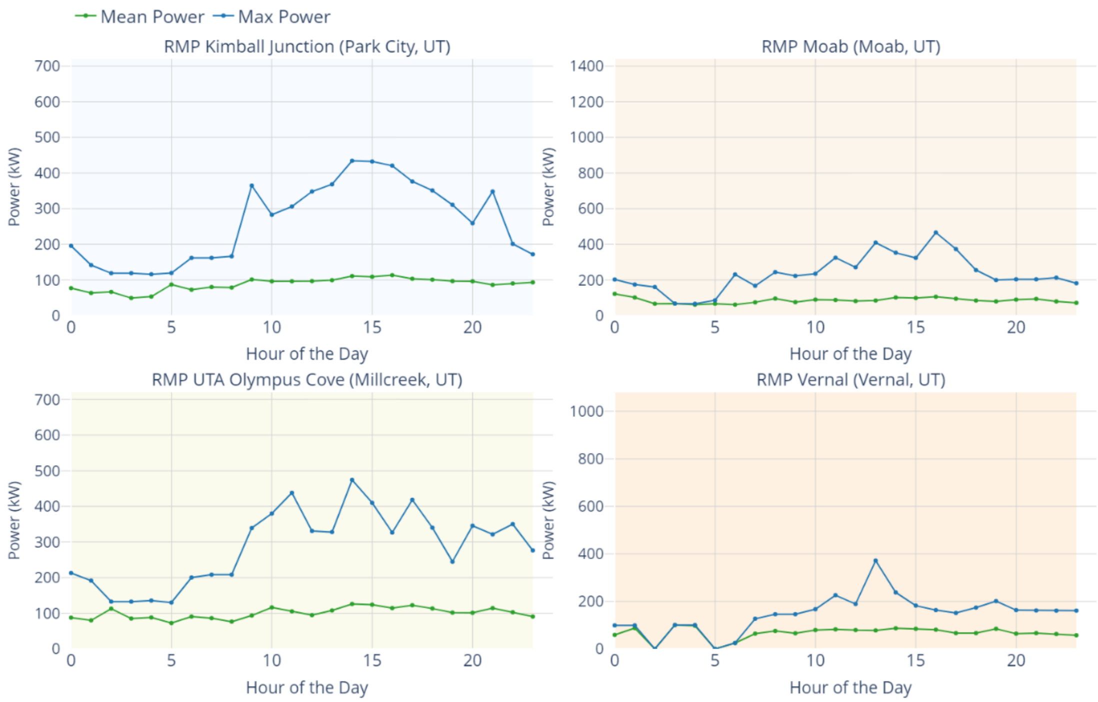


Figure 11. Weekend Power Profiles

3.1.1.2 WEEKDAY/WEEKEND 15-MINUTE RESOLUTION PLOTS

Increasing the time resolution provides further insights into when peak loading occurs. For instance, the previously mentioned Vernal weekend peak is estimated to hold for 30 minutes, and power levels at the Moab site around the weekday maximum are higher, suggesting more potential energy usage from 3:30 PM to 5 PM during the weekdays than the weekends. Kimbal Junction also shows higher consistent utilization on weekend afternoons, highlighted by the increased time resolution.

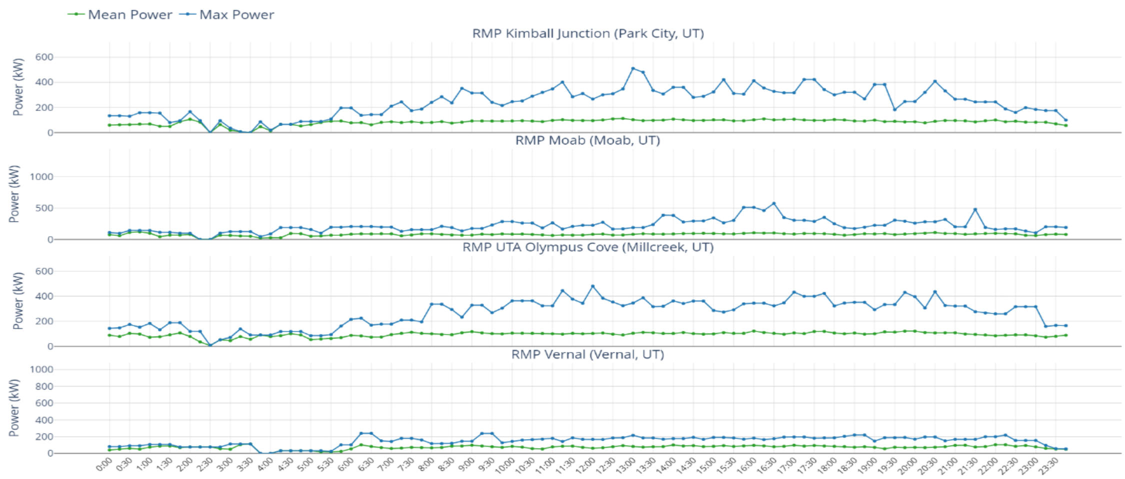


Figure 12. Weekday 15-Minute Resolution Mean and Maximum Power Profiles

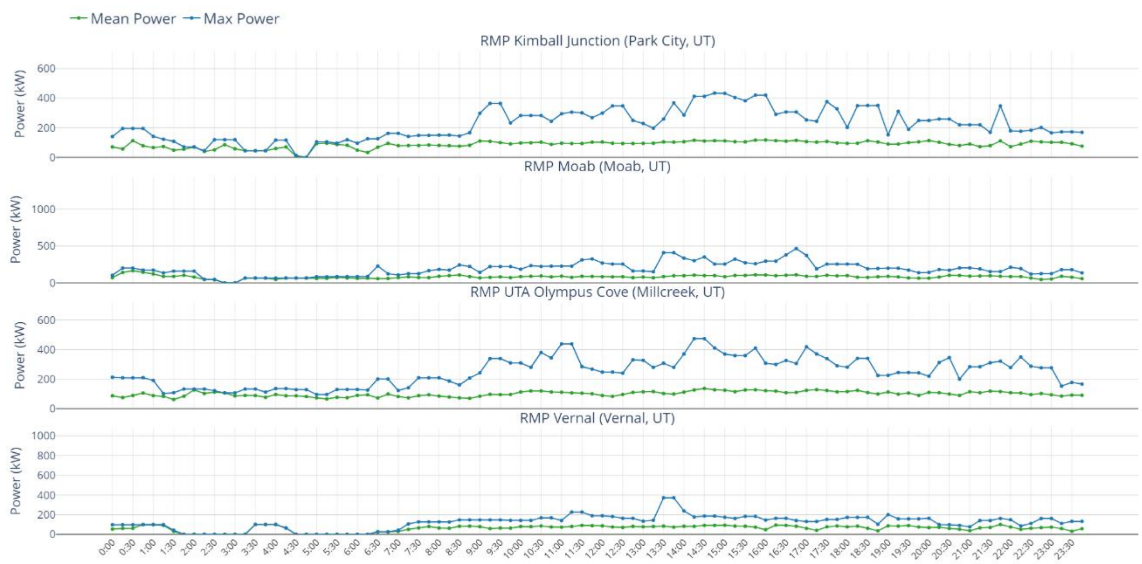


Figure 13. Weekend 15-Minute Resolution Mean and Max Power Profiles

3.2 CABINET-LEVEL POWER UTILIZATION

Reducing the level of aggregation by one step, this section analyzes power utilization from the perspective of the cabinet. As previously mentioned, each pair of chargers is connected to a 360-kW cabinet, setting each of their capacities at 180 kW if both neighboring chargers are in use. Like site level analyses, this study observes cabinet-level power utilization behavior at hourly and 15-minute time resolutions.

3.2.1 HOURLY RESOLUTION PLOTS

Three perspectives are provided for each cabinet at each station. The plot furthest to the left shows mean and max power profiles for all days. The middle plot shows these profiles for weekends and the plot furthest to the right shows power profiles for weekdays.

At the cabinet level, the overall trend shows very rare occurrences of the maximum load at a given cabinet approaching the cabinet's 360 kW capacity. Power utilization approaches maximum capacity on Cabinet 2 at Kimball Junction, and Cabinet 1 at Olympus Cove during the weekends.

3.2.1.1 RMP KIMBALL JUNCTION (PARK CITY, UT)

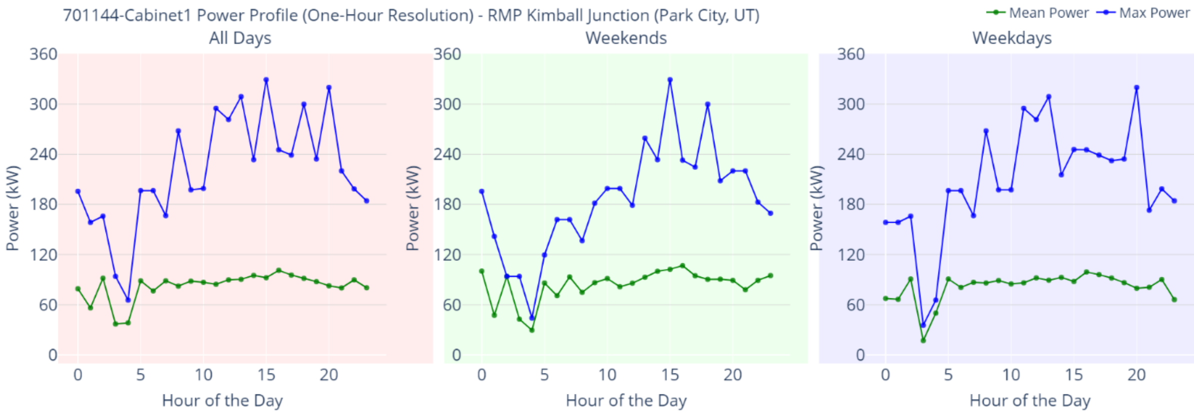


Figure 14. 1-Hour Resolution Power Profile for Chargers 701144-01 and 701144-02 (Cabinet 1)

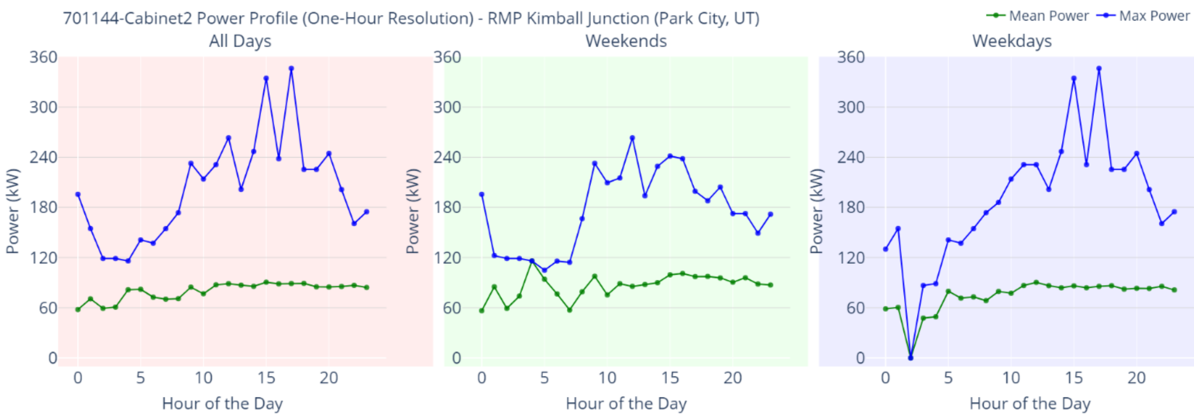


Figure 15. 1-Hour Resolution Power Profile for Chargers 701144-03 and 701144-04 (Cabinet 2)

3.2.1.2 RMP MOAB (MOAB, UT)

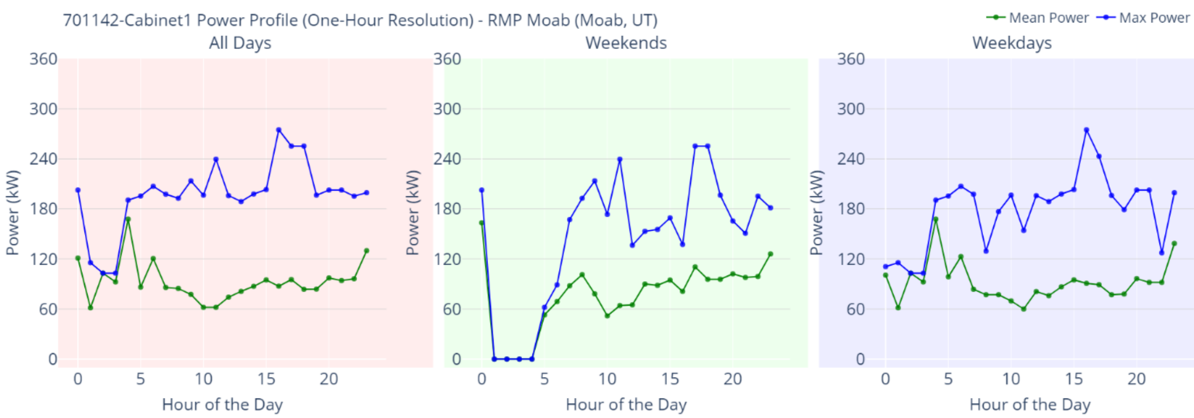


Figure 16. 1-Hour Resolution Power Profile for Chargers 701142-01 and 701142-02 (Cabinet 1)

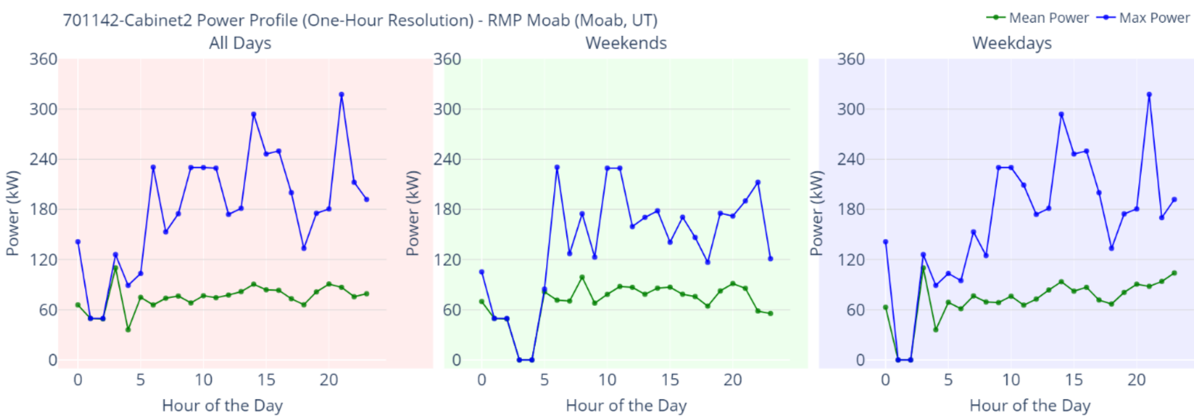


Figure 17. 1-Hour Resolution Power Profile for Chargers 701142-03 and 701142-04 (Cabinet 2)

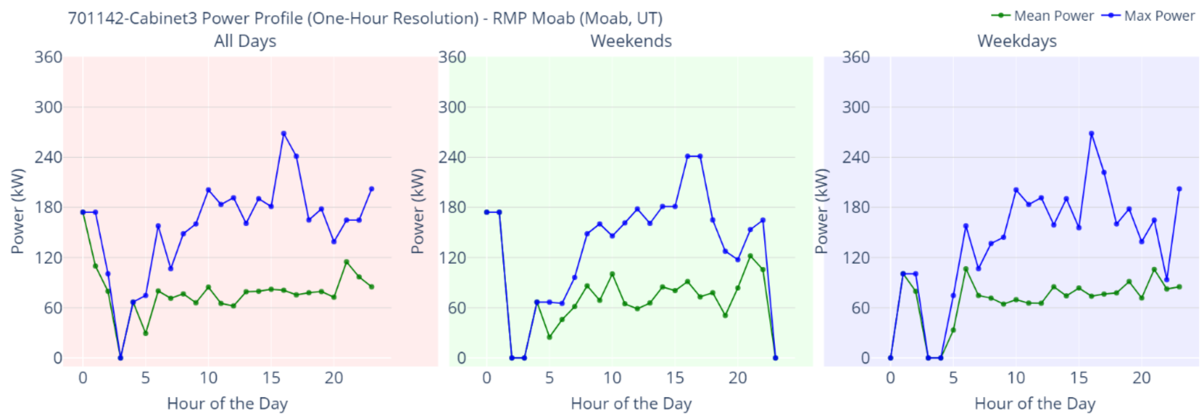


Figure 18. 1-Hour Resolution Power Profile for Chargers 701142-05 and 701142-06 (Cabinet 3)

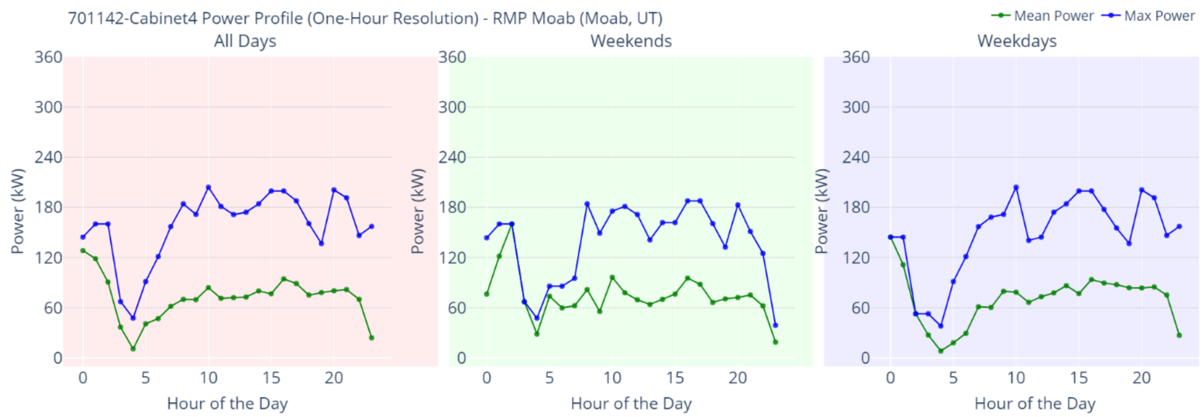


Figure 19. 1-Hour Resolution Power Profile for Chargers 701142-07 and 701142-08 (Cabinet 4)

3.2.1.3 RMP UTA OLYMPUS COVE (MILLCREEK, UT)

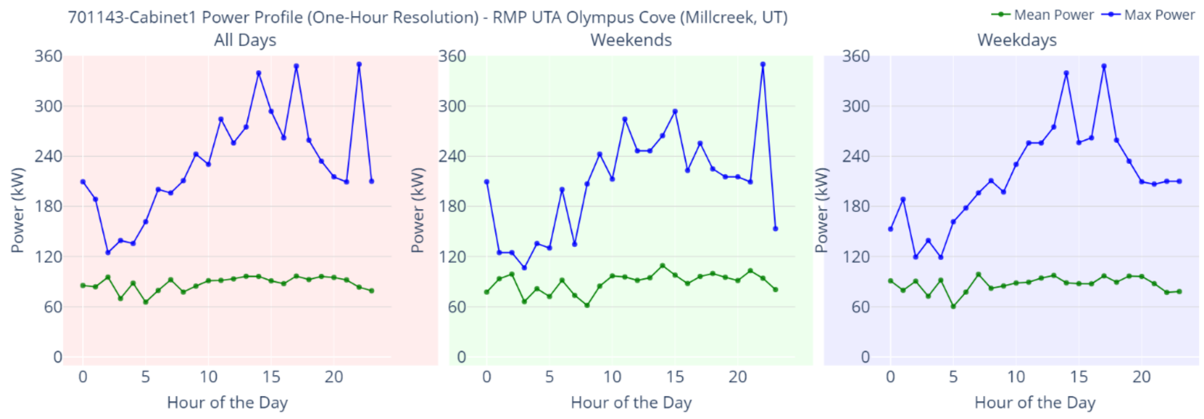


Figure 20. 1-Hour Resolution Power Profile for Chargers 701143-01 and 701143-02 (Cabinet 1)

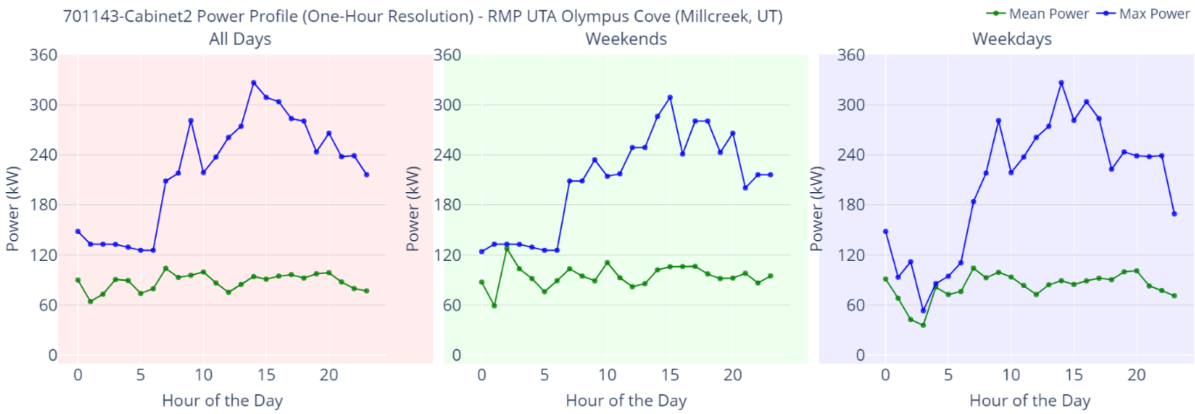


Figure 21. 1-Hour Resolution Power Profile for Chargers 701143-03 and 701143-04 (Cabinet 2)

3.2.1.4 RMP VERNAL (VERNAL, UT)

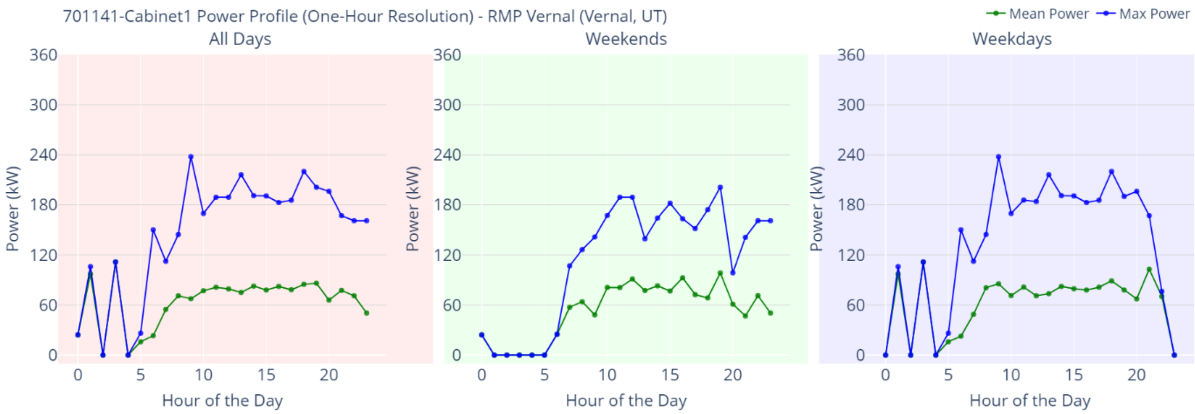


Figure 22. 1-Hour Resolution Power Profile for Chargers 701141-01 and 701141-02 (Cabinet 1)

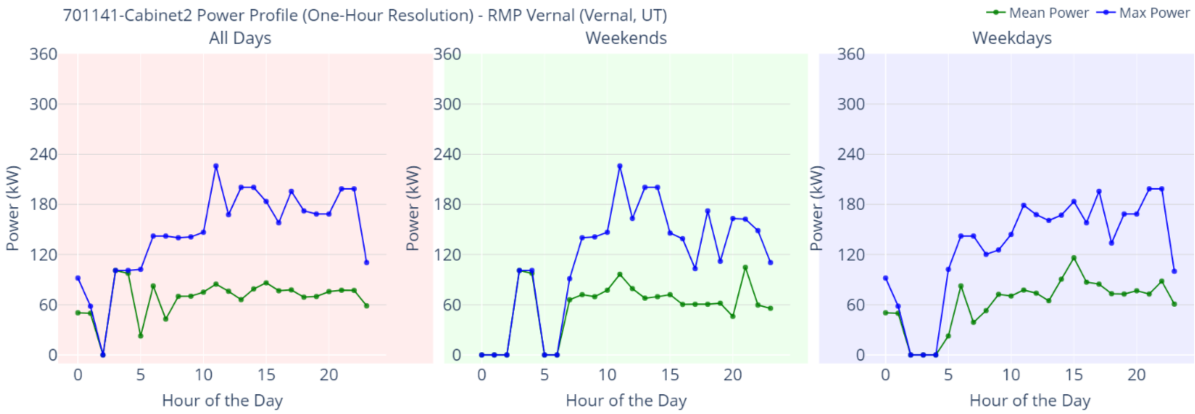


Figure 23. 1-Hour Resolution Power Profile for Chargers 701141-03 and 701141-04 (Cabinet 2)

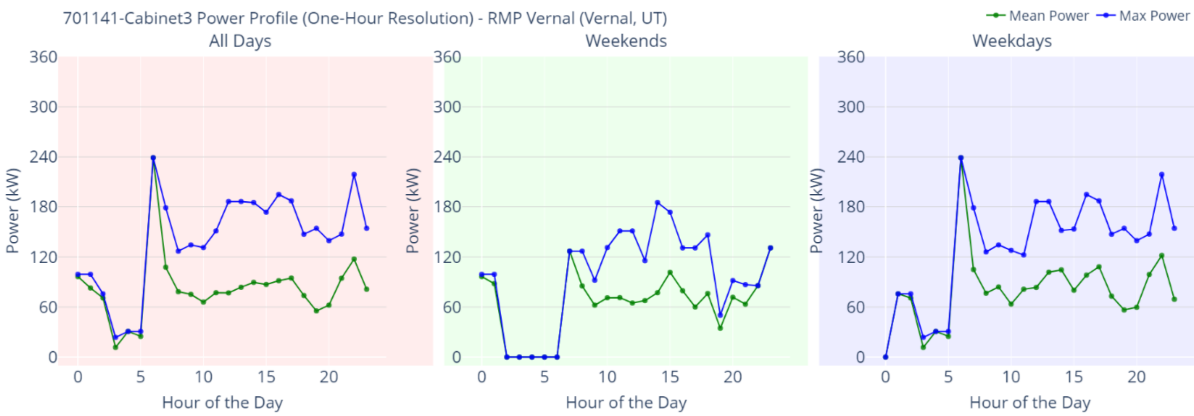


Figure 24. 1-Hour Resolution Power Profile for Chargers 701141-05 and 701141-06 (Cabinet 3)

3.2.2 15-MINUTE RESOLUTION CABINET-LEVEL POWER UTILIZATION

3.2.2.1 RMP KIMBALL JUNCTION (PARK CITY, UT)

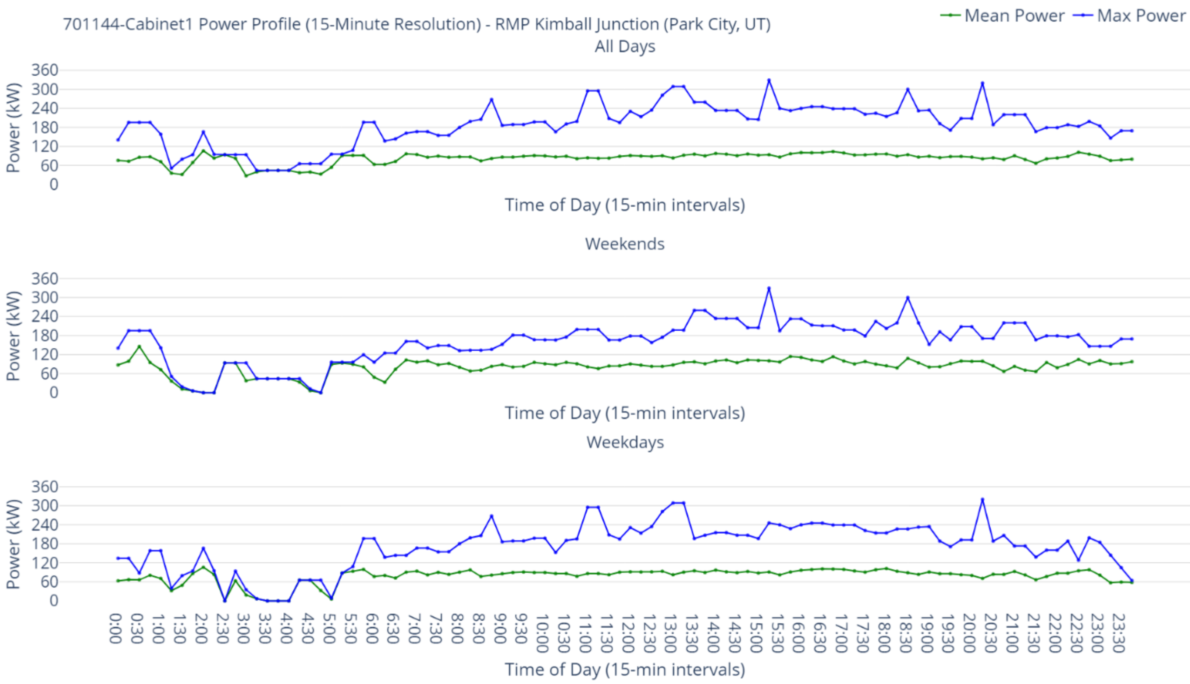


Figure 25. 15-Minute Resolution Power Profile for Chargers 701144-01 and 701144-02 (Cabinet 1)

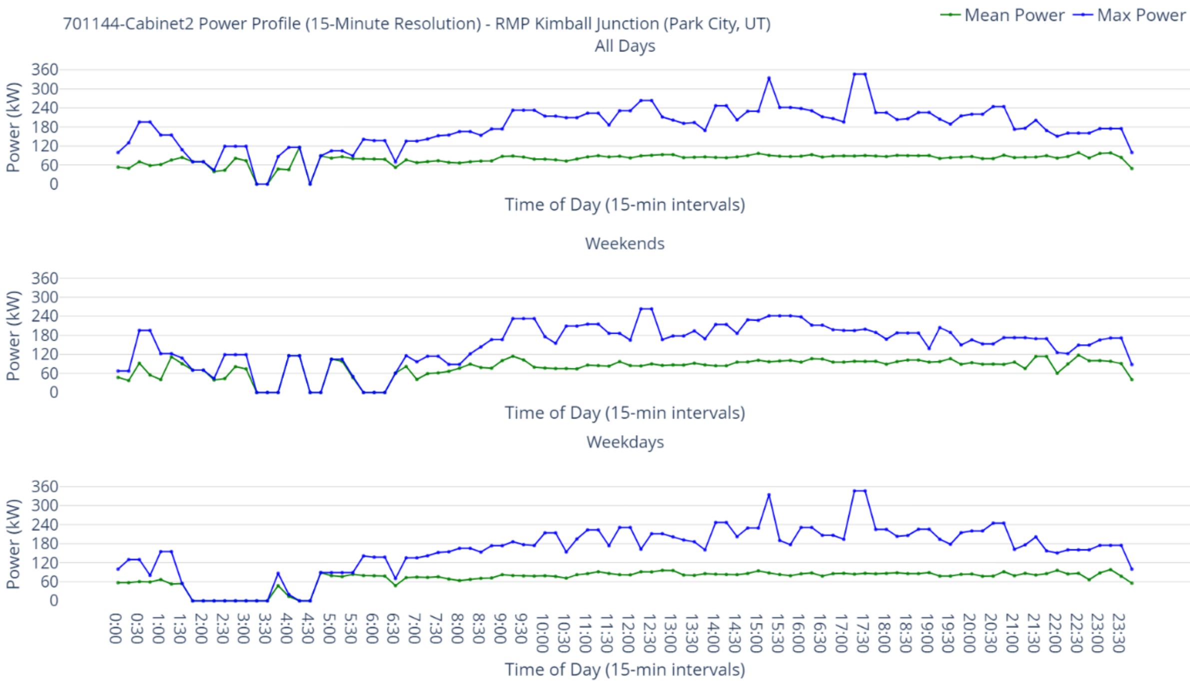


Figure 26. 15-Minute Resolution Power Profile for Chargers 701144-03 and 701144-04 (Cabinet 2)

3.2.2.2 RMP MOAB (MOAB, UT)

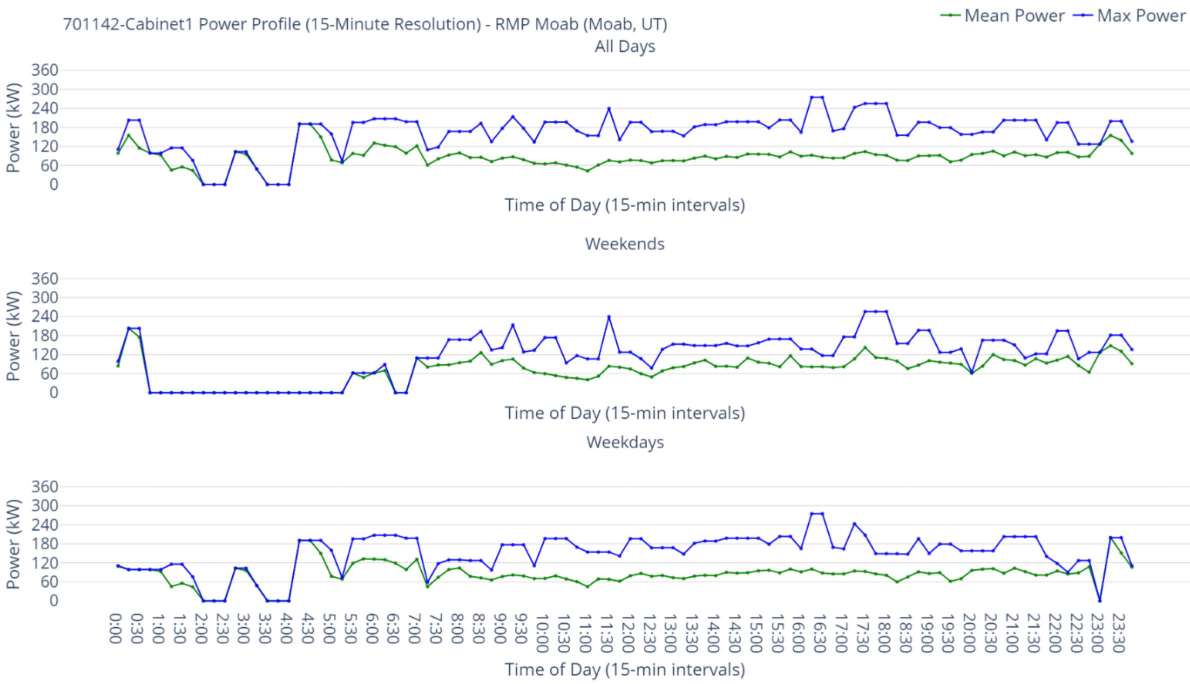


Figure 27. 15-Minute Resolution Power Profile for Chargers 701142-01 and 701142-02 (Cabinet 1)

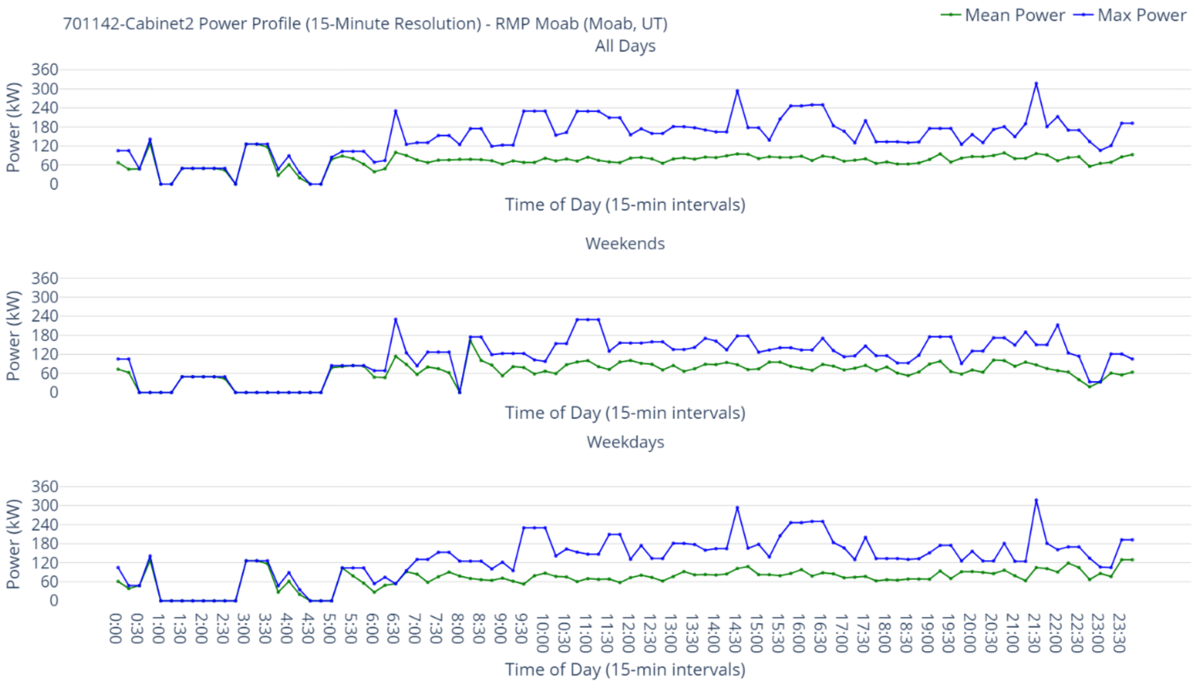


Figure 28. 15-Minute Resolution Power Profile for Chargers 701142-03 and 701142-04 (Cabinet 2)

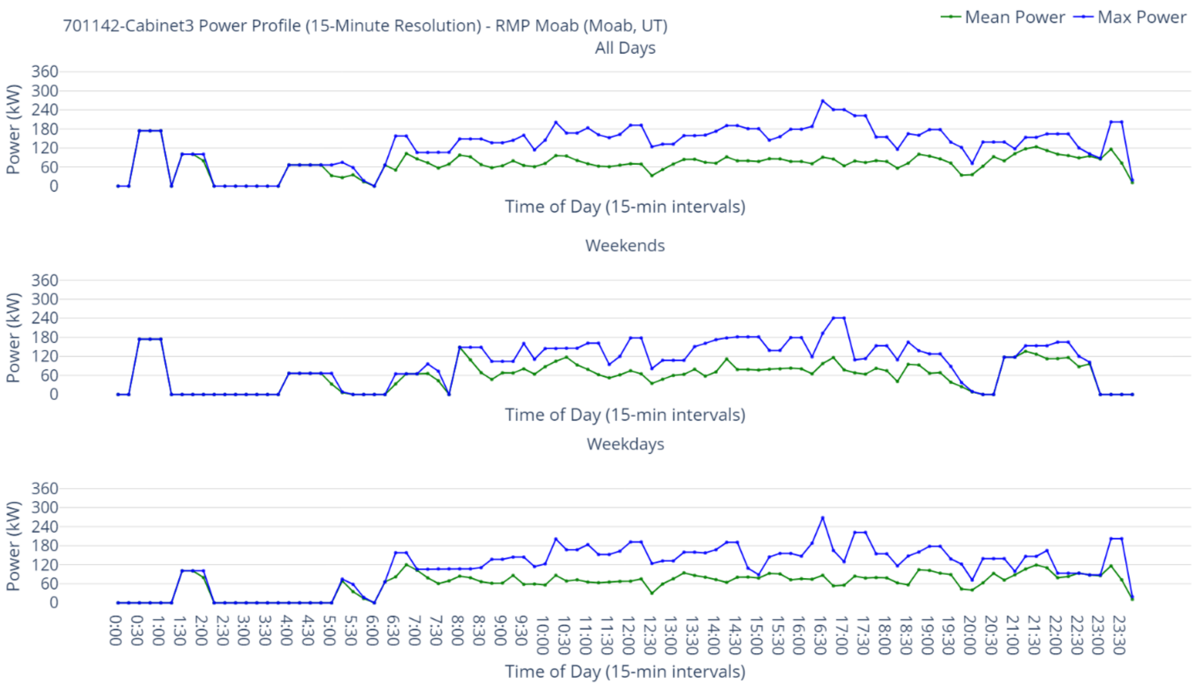


Figure 29. 15-Minute Resolution Power Profile for Chargers 701142-05 and 701142-06 (Cabinet 3)

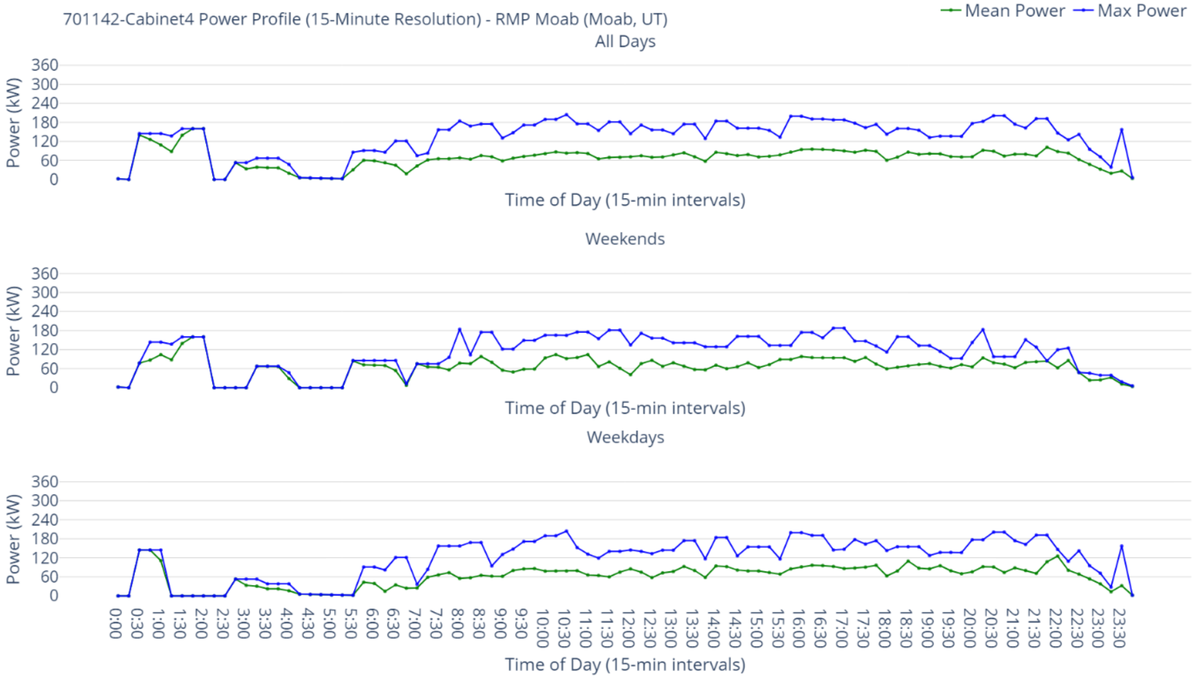


Figure 30. 15-Minute Resolution Power Profile for Chargers 701142-07 and 701142-08 (Cabinet 4)

3.2.2.3 RMP UTA OLYMPUS COVE (MILLCREEK, UT)

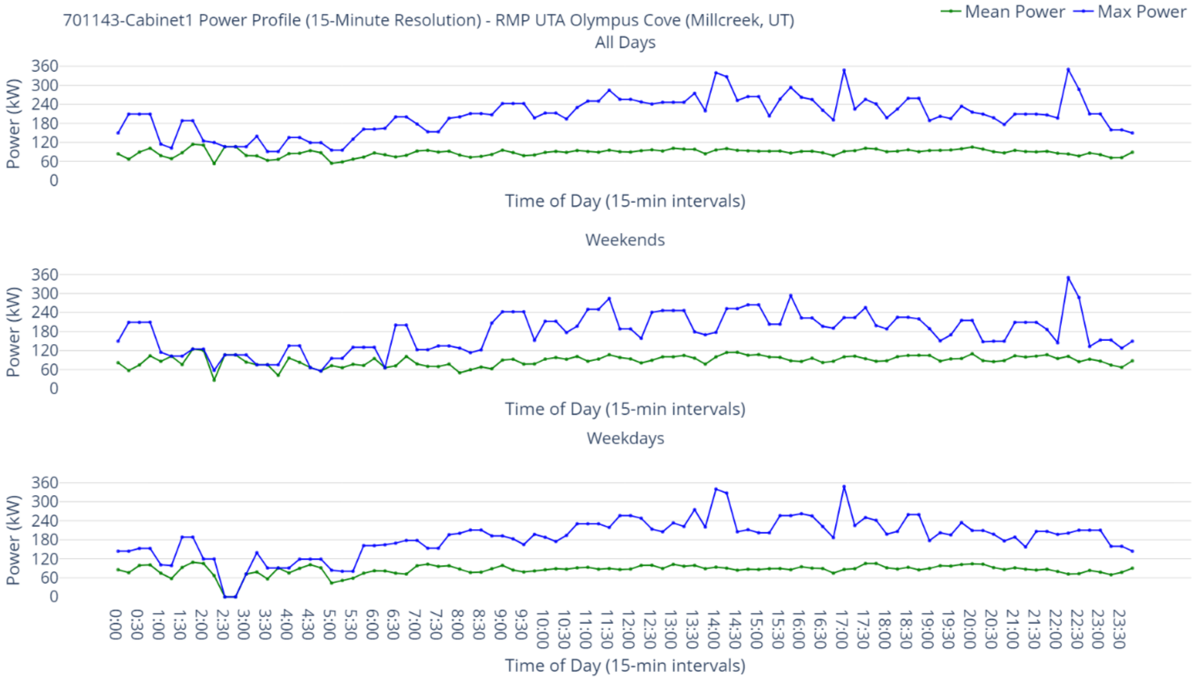


Figure 31. 15-Minute Resolution Power Profile for Chargers 701143-01 and 701143-02 (Cabinet 1)

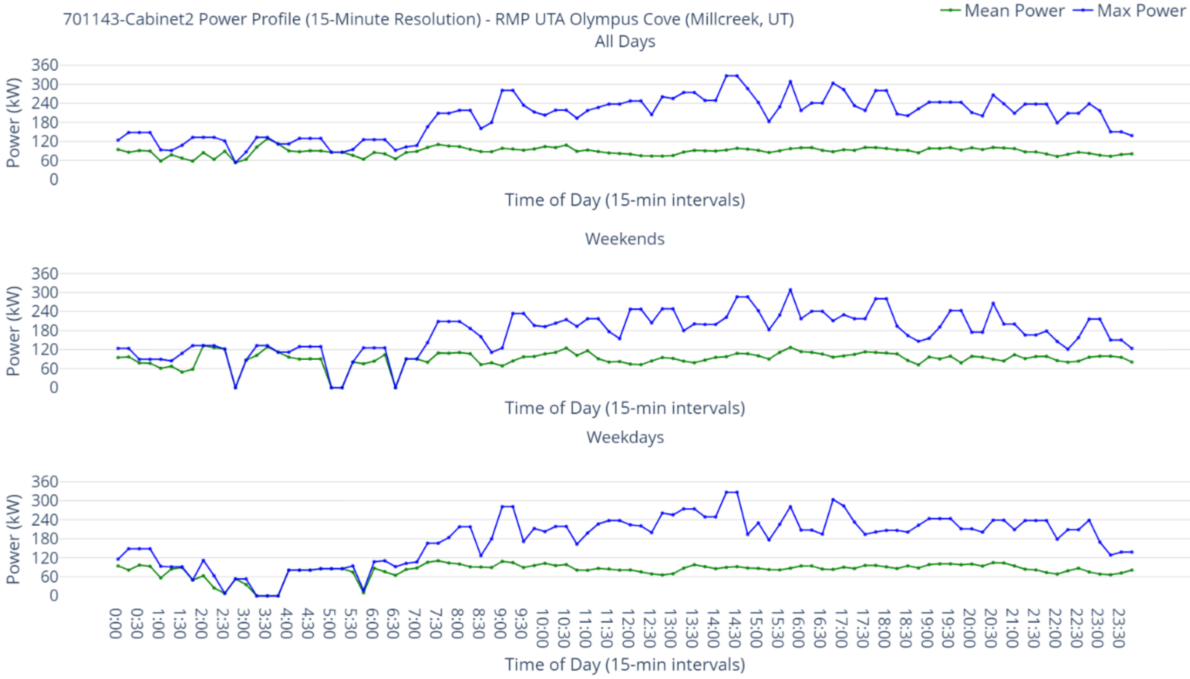


Figure 32. 15-Minute Resolution Power Profile for Chargers 701143-03 and 701143-04 (Cabinet 2)

3.2.2.4 RMP VERNAL (VERNAL, UT)

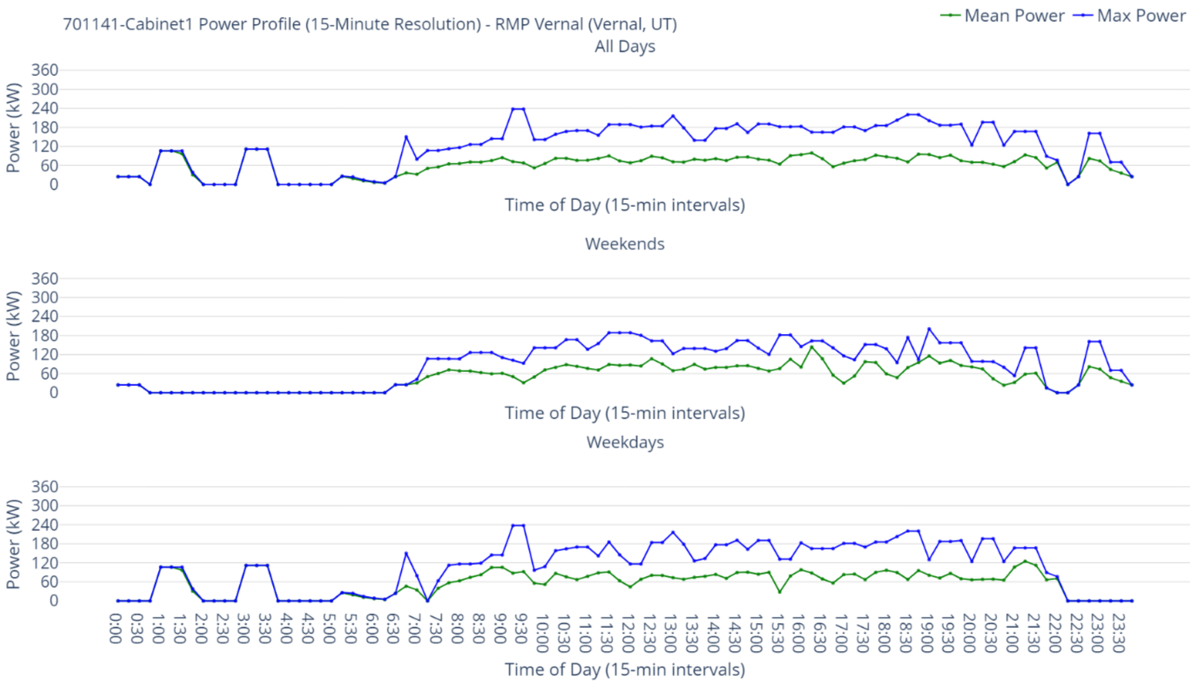


Figure 33. 15-Minute Resolution Power Profile for Chargers 701141-01 and 701141-02 (Cabinet 1)

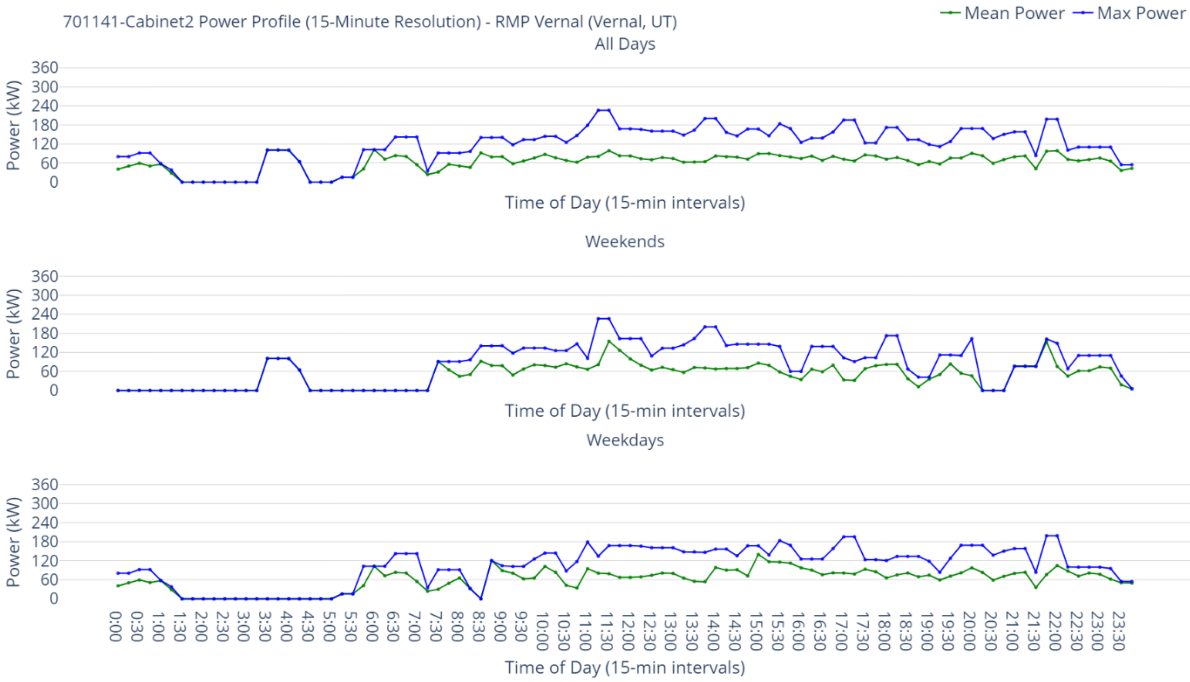


Figure 34. 15-Minute Resolution Power Profile for Chargers 701141-03 and 701141-04 (Cabinet 2)

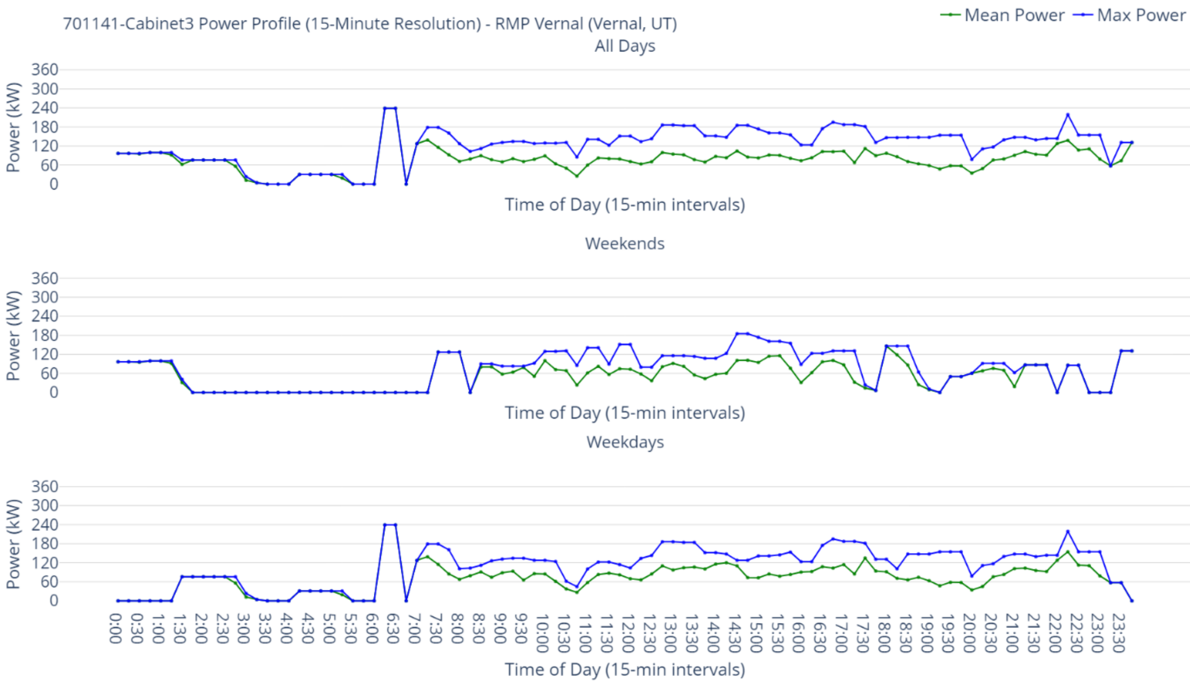


Figure 35. 15-Minute Resolution Power Profile for Chargers 701141-05 and 701141-06 (Cabinet 3)

3.3 INDIVIDUAL CHARGER POWER PROFILE

EPE has provided the daily power profile for each charger. Detailed power profiles are segmented into all days, weekends, and weekdays. These profiles are presented at both one-hour and 15-minute resolutions. The inclusion of the 15-minute resolution offers a more granular understanding of power demand fluctuations, enabling a detailed analysis of peak power usage and patterns. This finer resolution is particularly valuable for identifying short-term demand spikes, optimizing load management, and informing pricing strategies based on time-of-use behaviors.

3.3.1 ONE-HOUR RESOLUTION CHARGER-LEVEL POWER PROFILES

3.3.1.1 RMP KIMBALL JUNCTION (PARK CITY, UT)

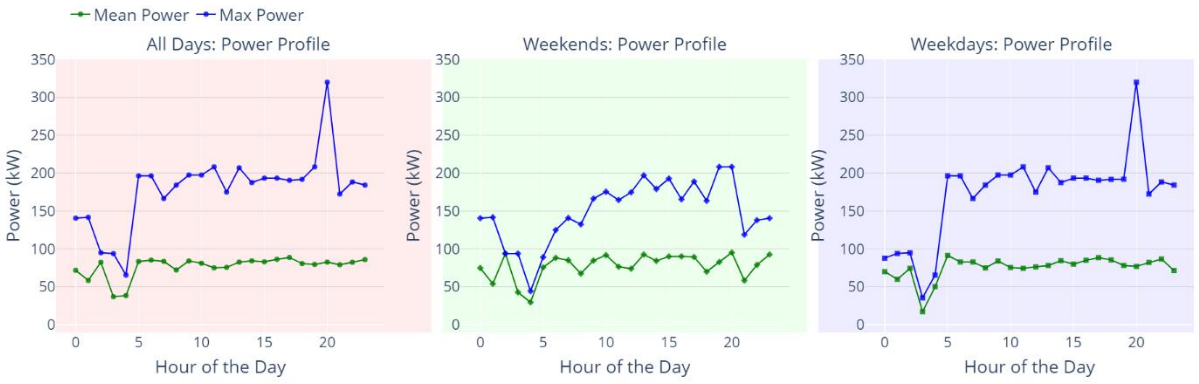


Figure 36. 1-Hour Resolution Power Profile for Charger 701144-01

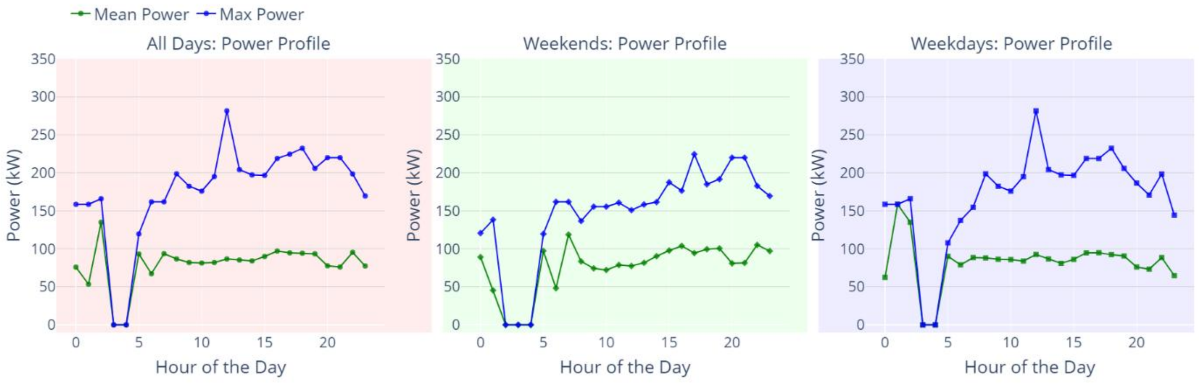


Figure 37. 1-Hour Resolution Power Profile for Charger 701144-02

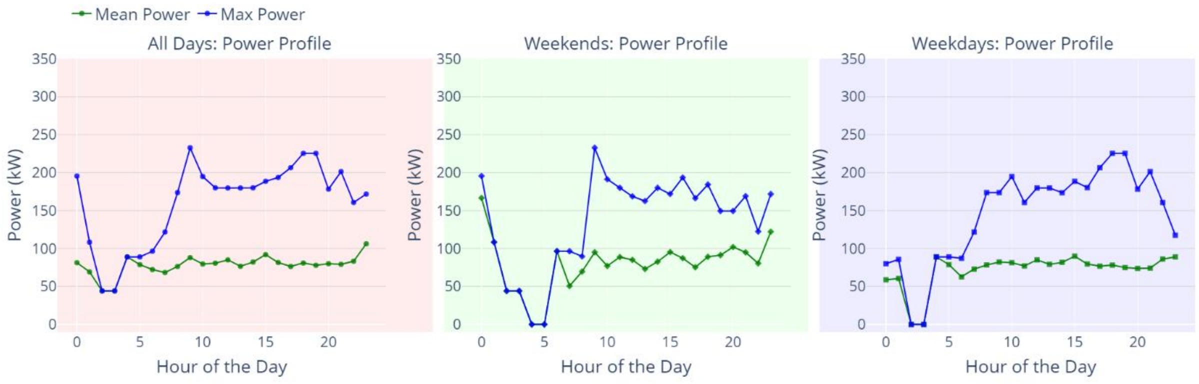


Figure 38. 1-Hour Resolution Power Profile for Charger 701144-03

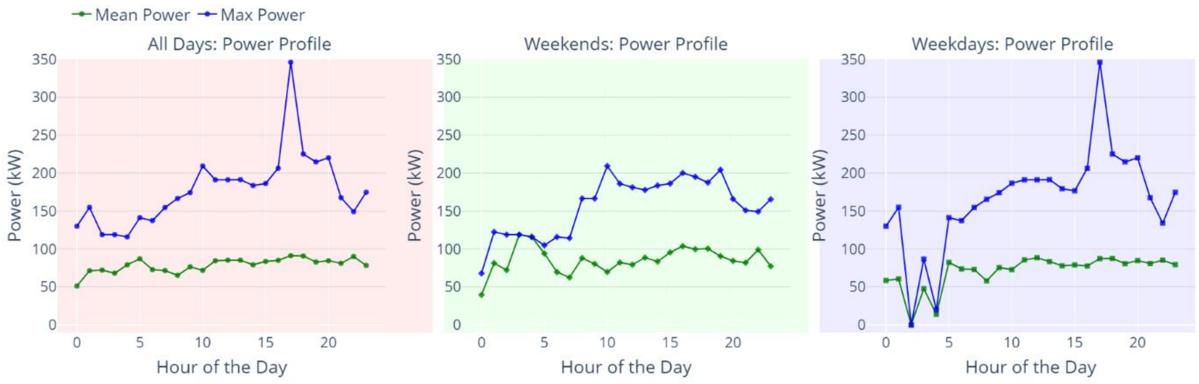


Figure 39. 1-Hour Resolution Power Profile for Charger 701144-04

3.3.1.2 RMP MOAB (MOAB, UT)

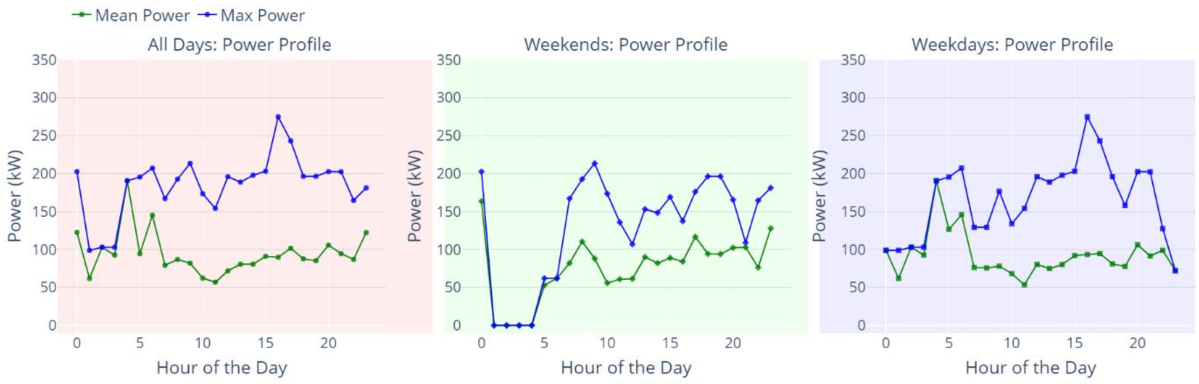


Figure 40. 1-Hour Resolution Power Profile for Charger 701142-01

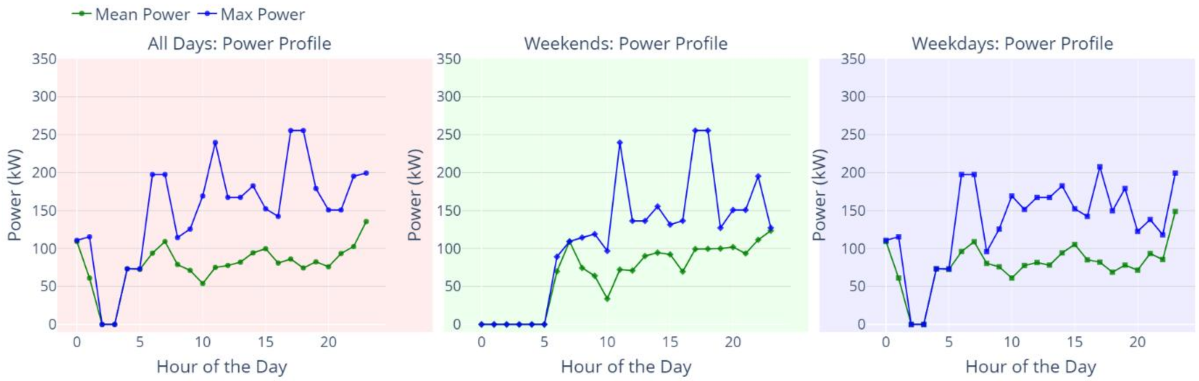


Figure 41. 1-Hour Resolution Power Profile for Charger 701142-02

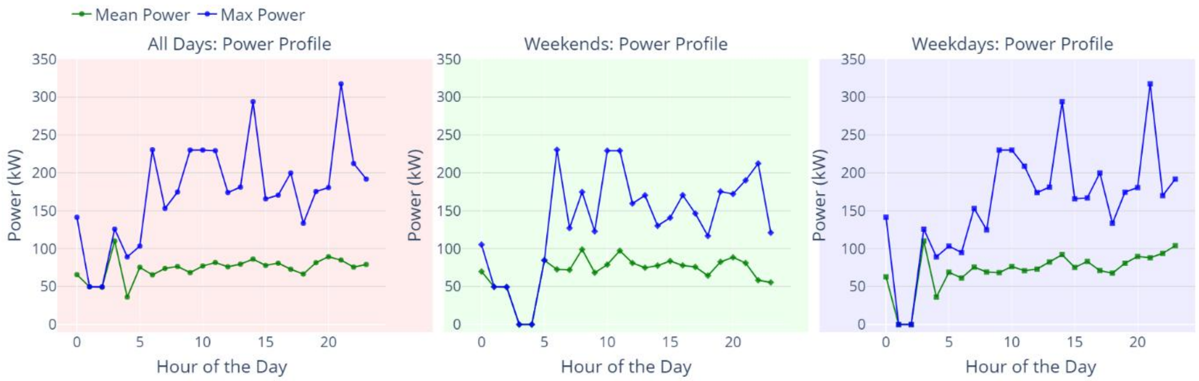


Figure 42. 1-Hour Resolution Power Profile for Charger 701142-03

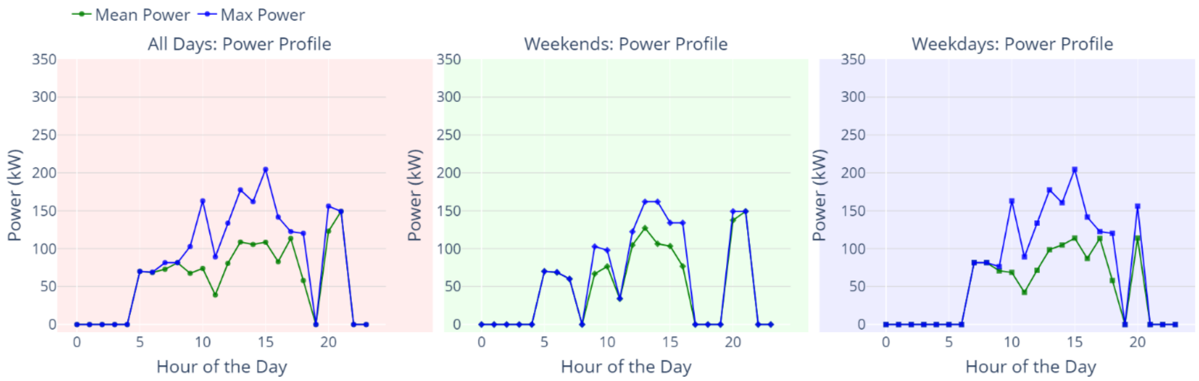


Figure 43. 1-Hour Resolution Power Profile for Charger 701142-04

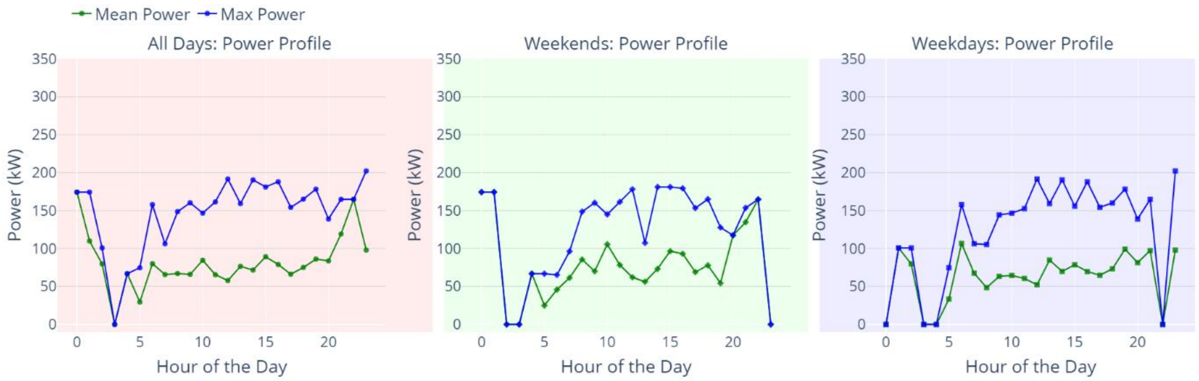


Figure 44. 1-Hour Resolution Power Profile for Charger 701142-05

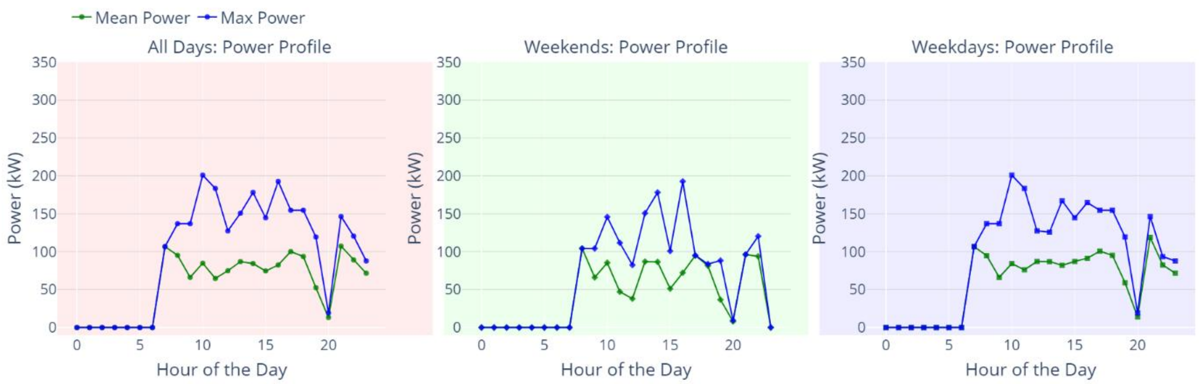


Figure 45. 1-Hour Resolution Power Profile for Charger 701142-06

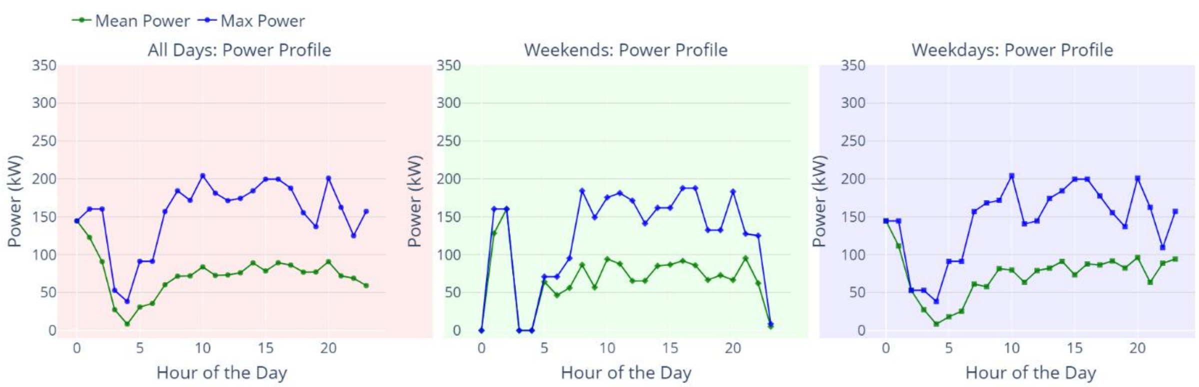


Figure 46. 1-Hour Resolution Power Profile for Charger 701142-07

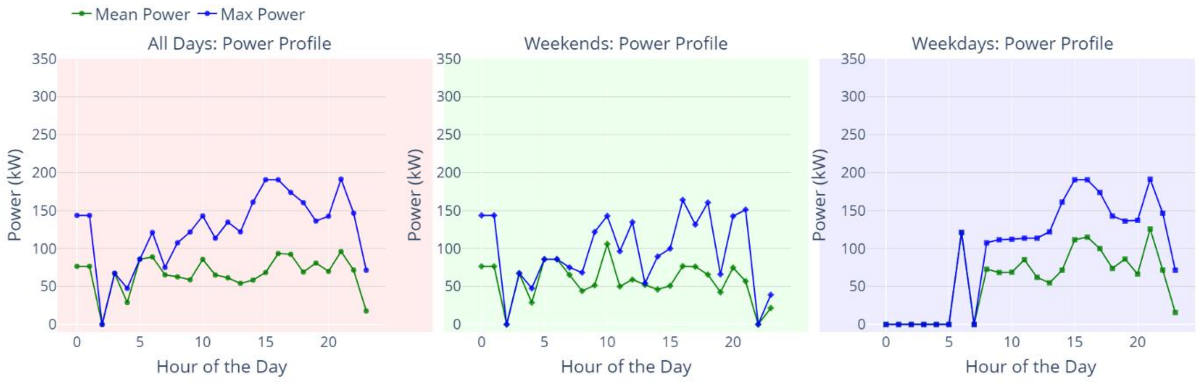


Figure 47. 1-Hour Resolution Power Profile for Charger 701142-08

3.3.1.3 RMP UTA OLYMPUS COVE (MILLCREEK, UT)

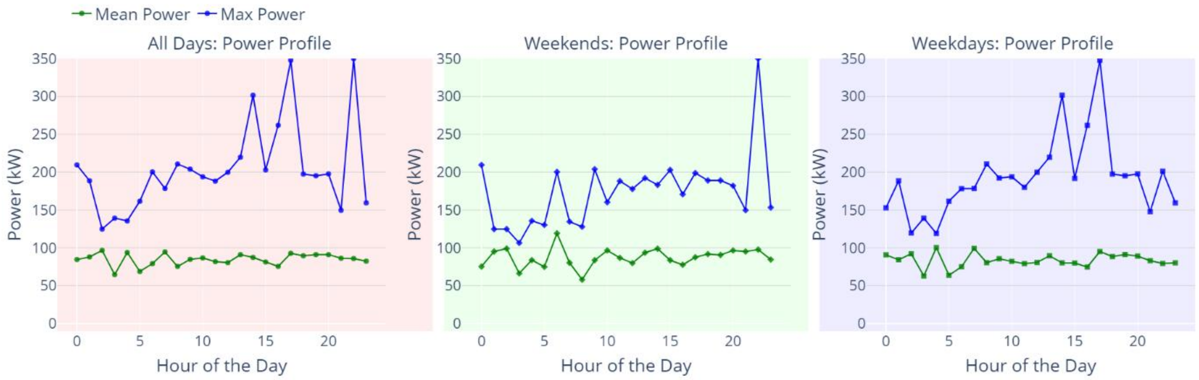


Figure 48. 1-Hour Resolution Power Profile for Charger 701143-01

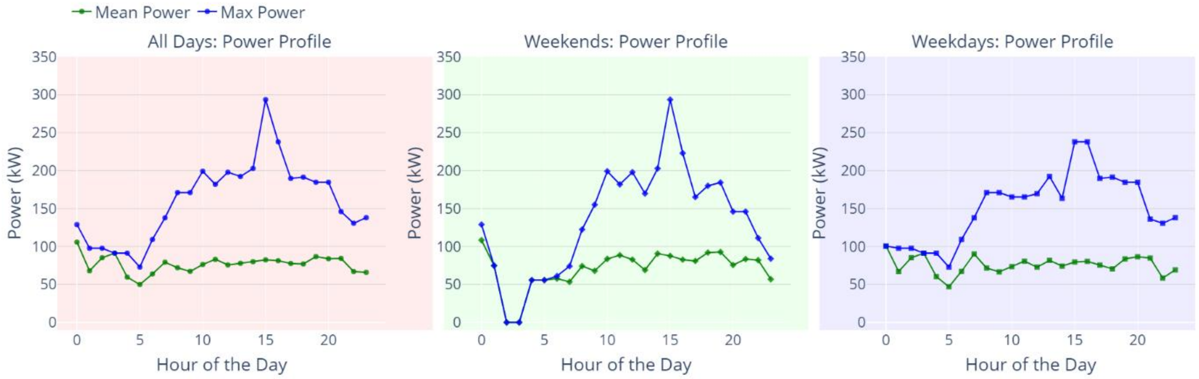


Figure 49. 1-Hour Resolution Power Profile for Charger 701143-02

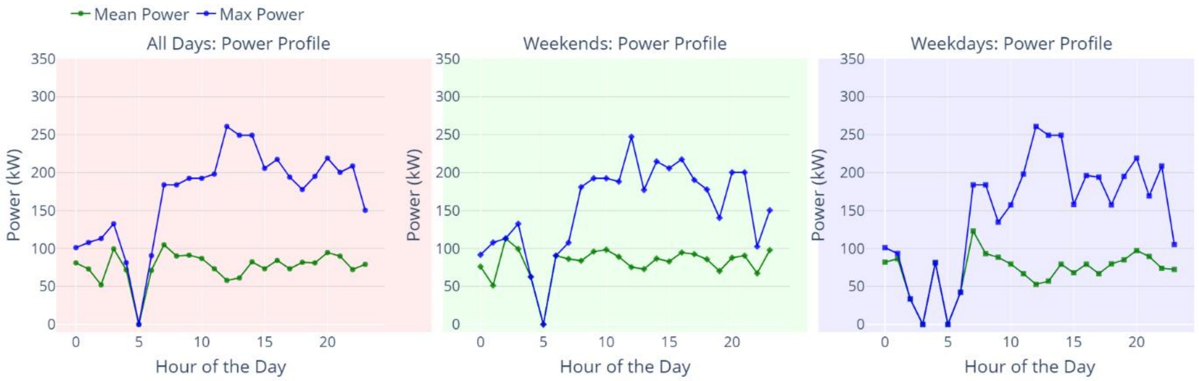


Figure 50. 1-Hour Resolution Power Profile for Charger 701143-03

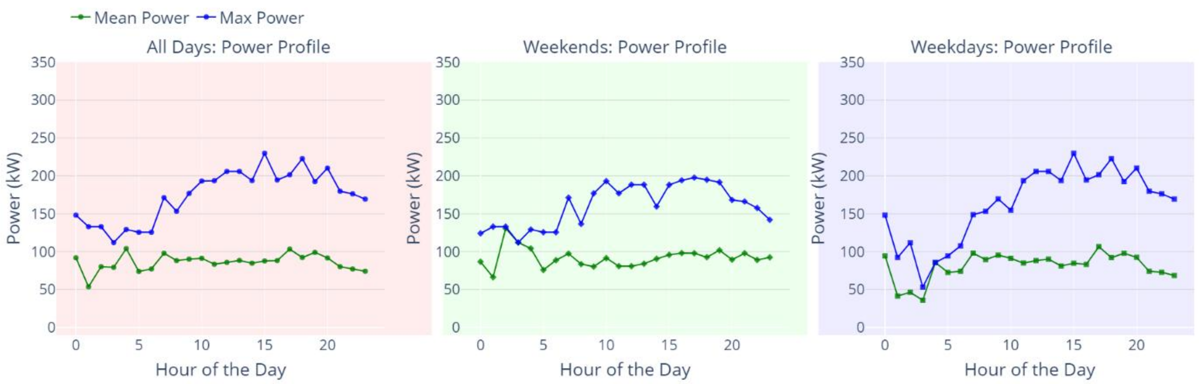


Figure 51. 1-Hour Resolution Power Profile for Charger 701143-04

3.3.1.4 RMP VERNAL (VERNAL, UT)

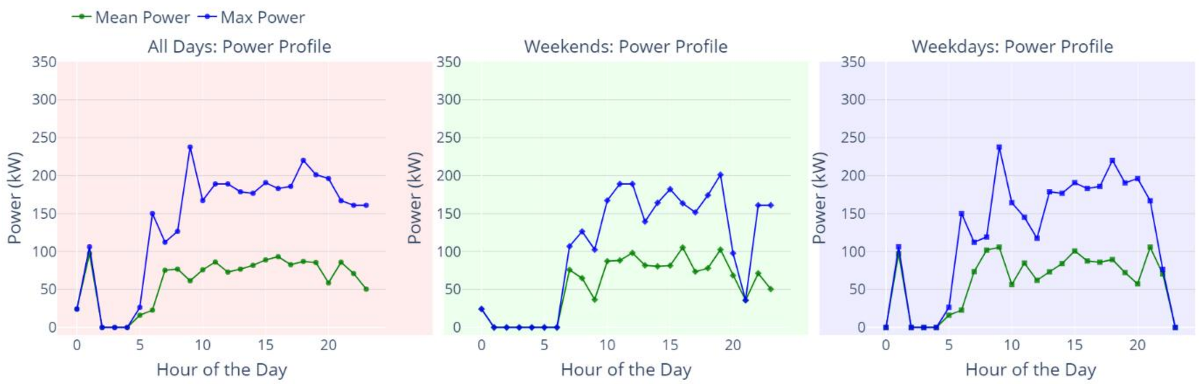


Figure 52. 1-Hour Resolution Power Profile for Charger 701141-01

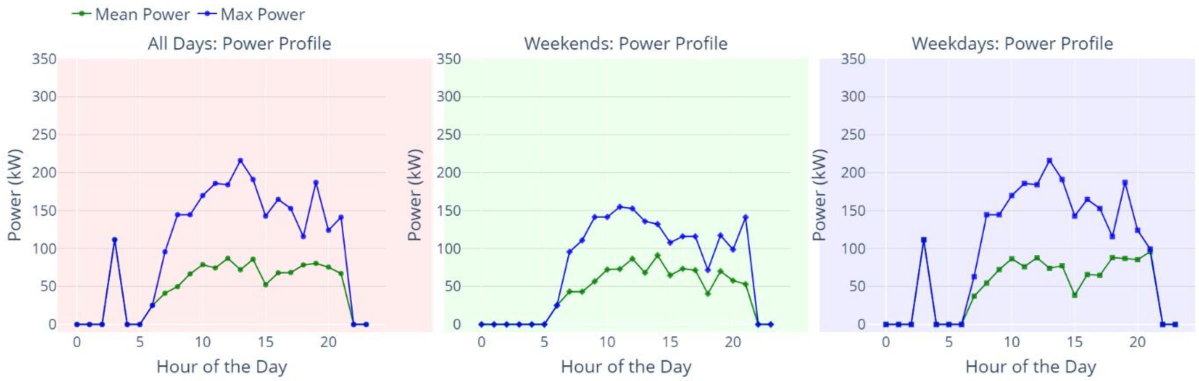


Figure 53. 1-Hour Resolution Power Profile for Charger 701141-02

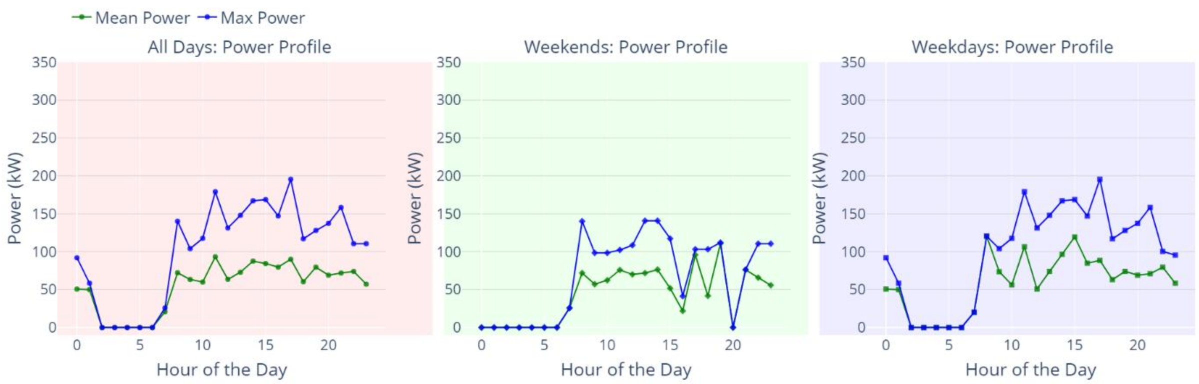


Figure 54. 1-Hour Resolution Power Profile for Charger 701141-03

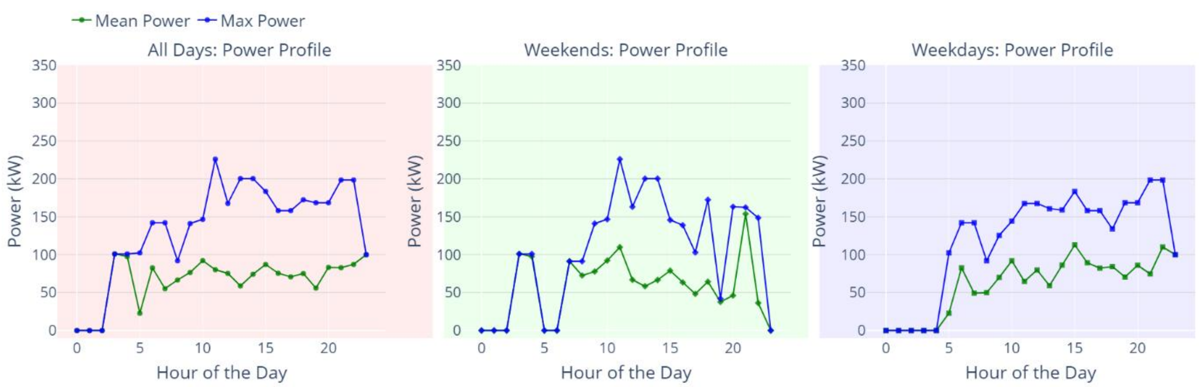


Figure 55. 1-Hour Resolution Power Profile for Charger 701141-04

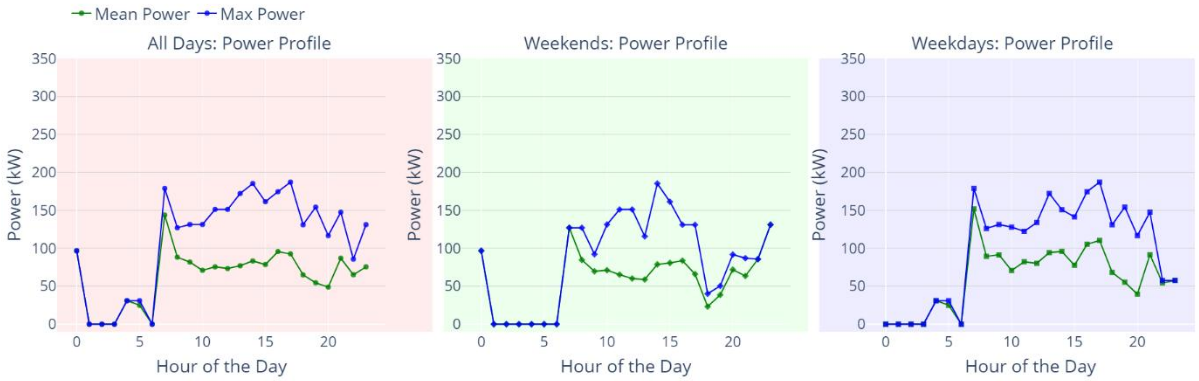


Figure 56. 1-Hour Resolution Power Profile for Charger 701141-05

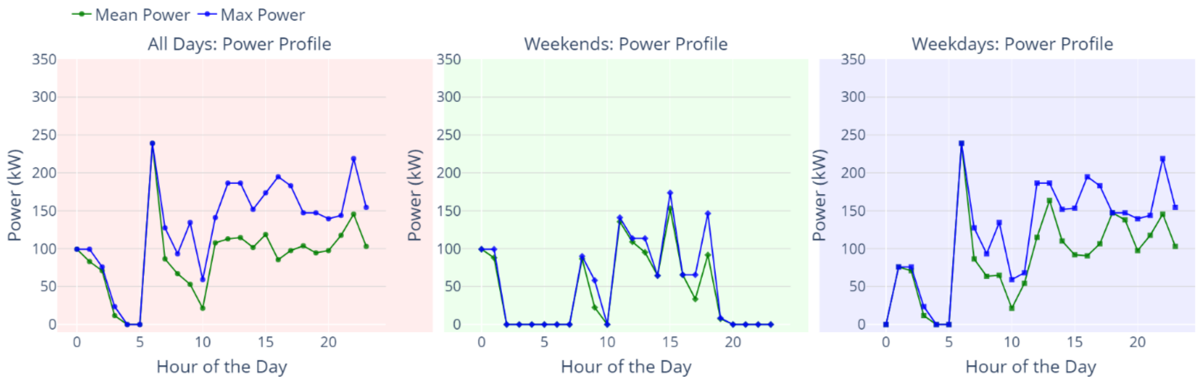


Figure 57. 1-Hour Resolution Power Profile for Charger 701141-06

3.3.2 15-MINUTE RESOLUTION CHARGER-LEVEL POWER UTILIZATION

3.3.2.1 RMP KIMBALL JUNCTION (PARK CITY, UT)

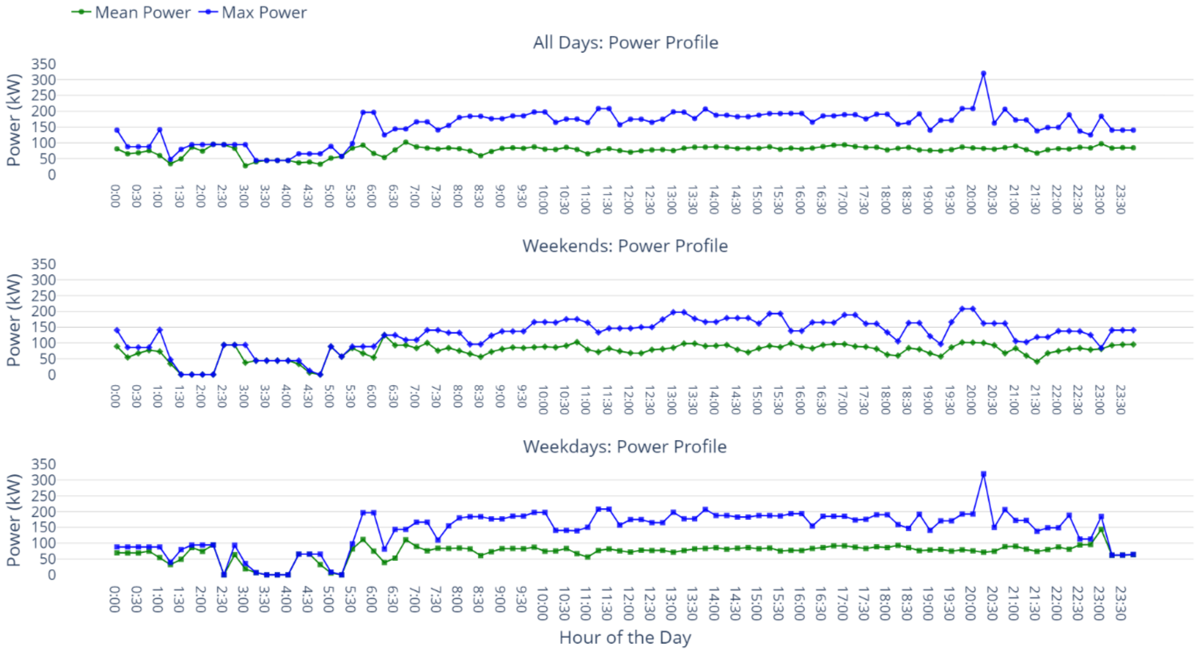


Figure 58. 15-Minute Resolution Power Profile for Charger 701144-01

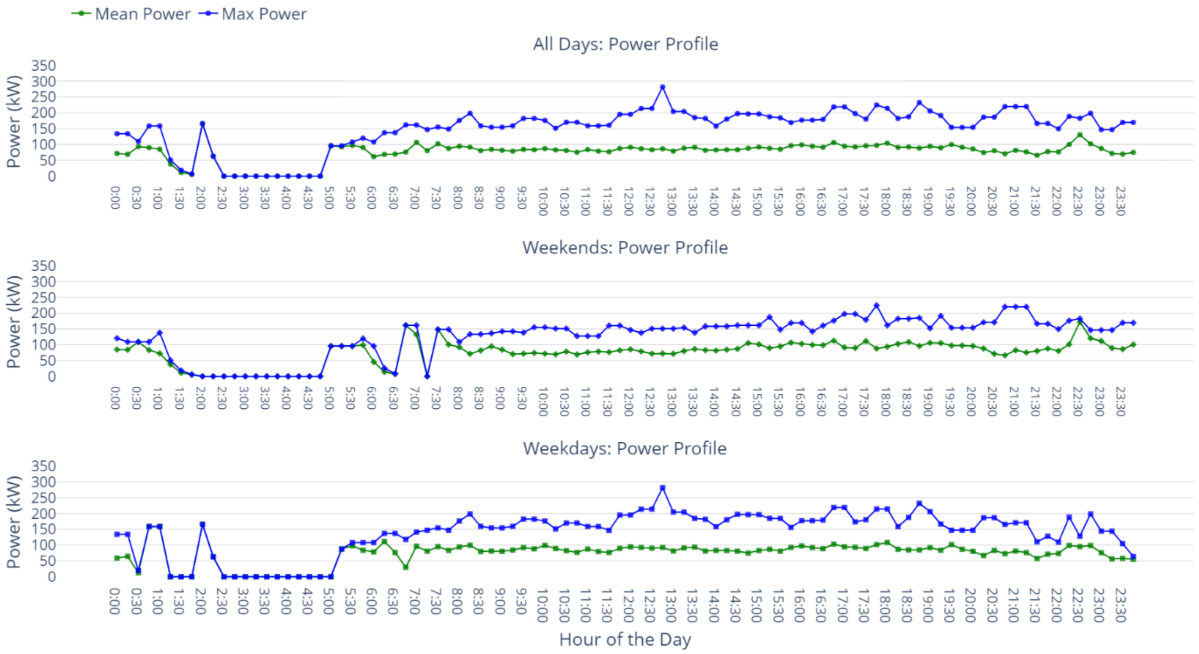


Figure 59. 1-Hour Resolution Power Profile for Charger 701144-02

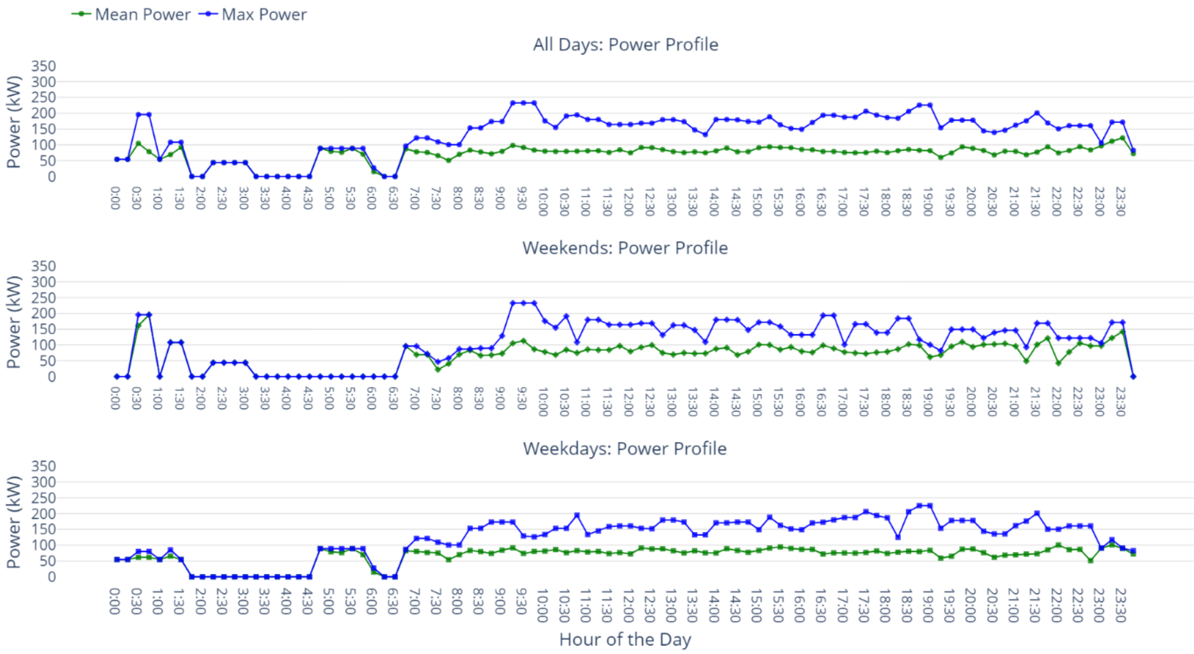


Figure 60. 1-Hour Resolution Power Profile for Charger 701144-03

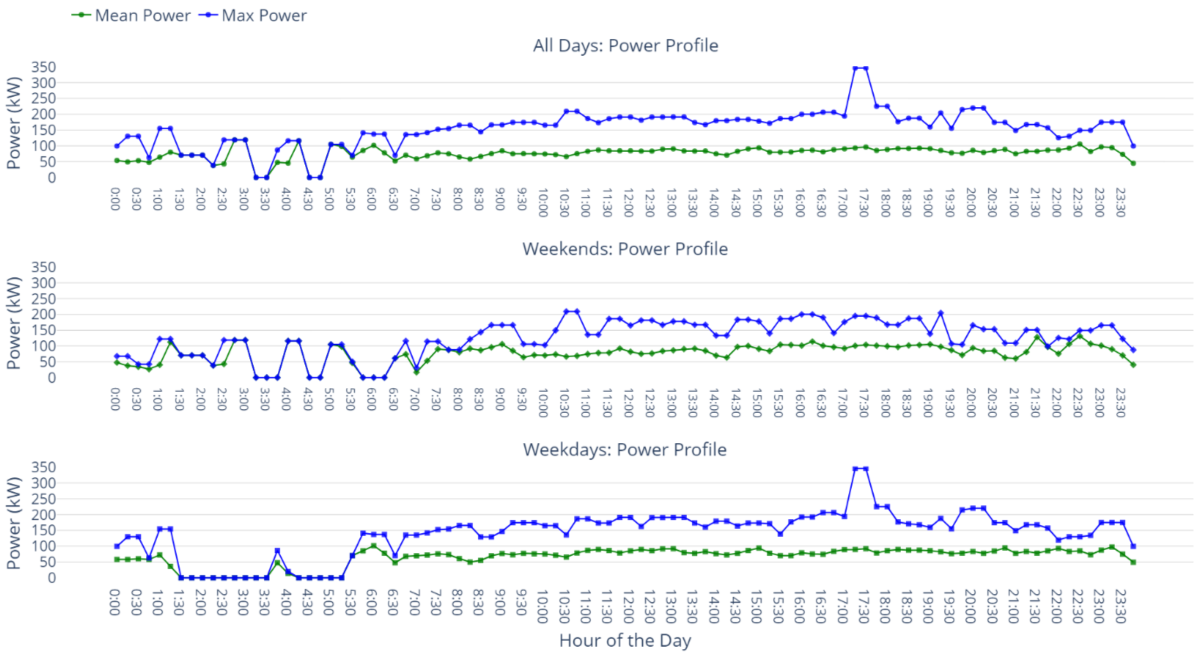


Figure 61. 1-Hour Resolution Power Profile for Charger701144-04

3.3.2.2 RMP MOAB (MOAB, UT)

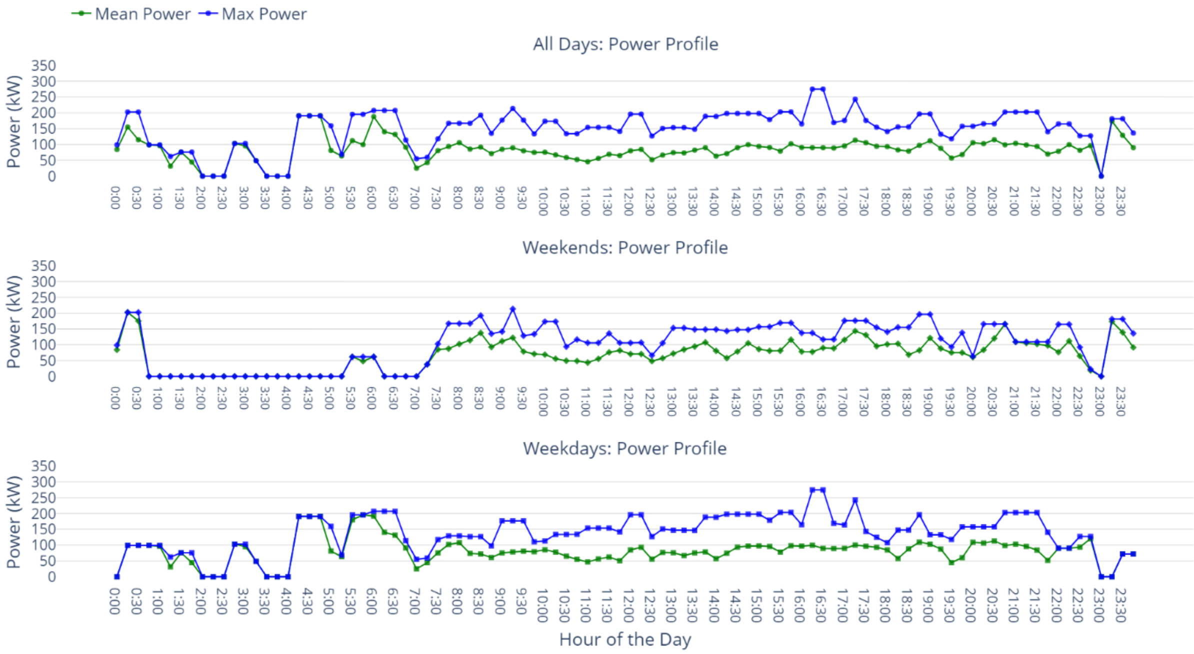


Figure 62. 15-Minute Resolution Power Profile for Charger 701142-01

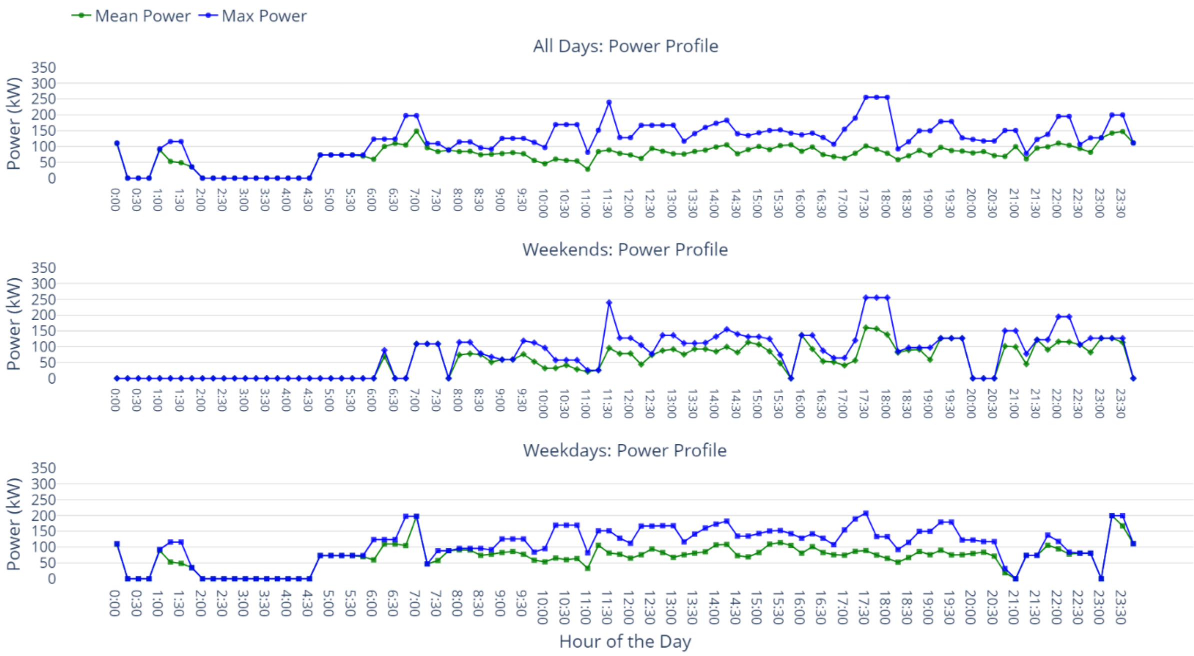


Figure 63. 15-Minute Resolution Power Profile for Charger 701142-02

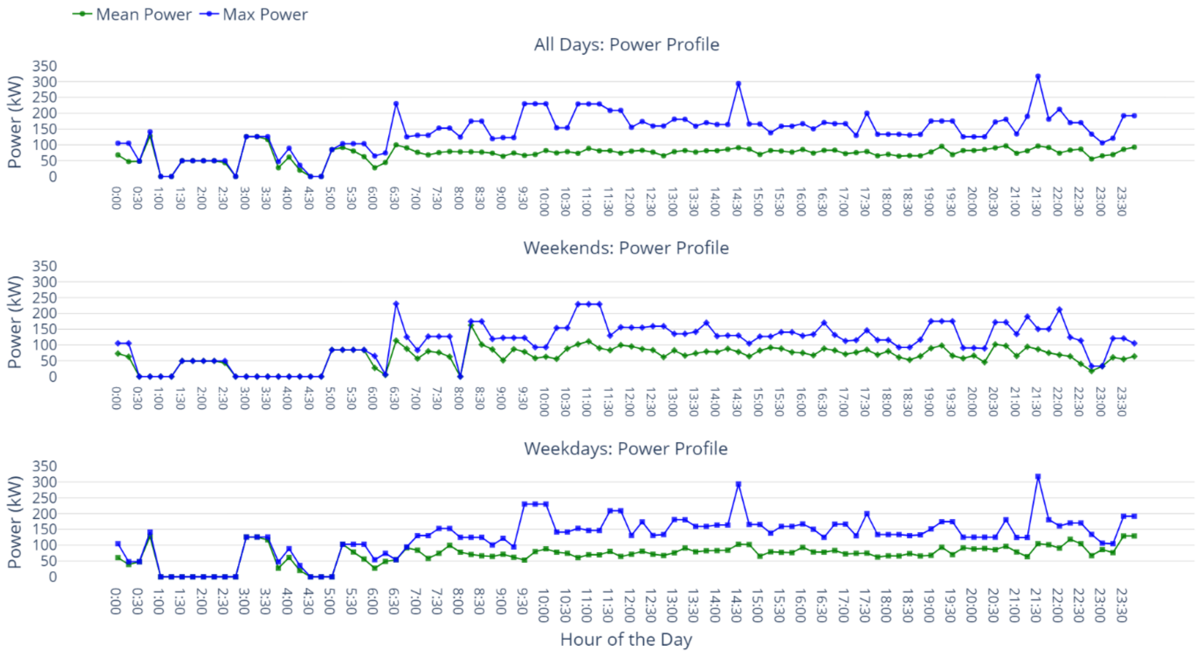


Figure 64. 15-Minute Resolution Power Profile for Charger 701142-03

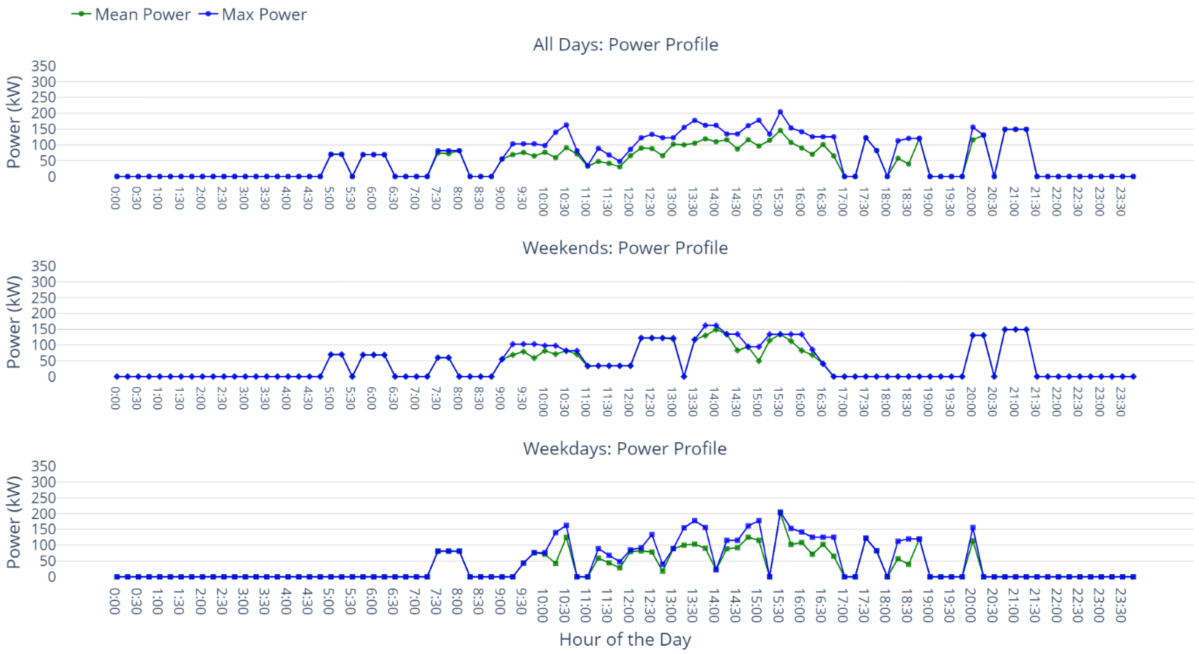


Figure 65. 15-Minute Resolution Power Profile for Charger 701142-04

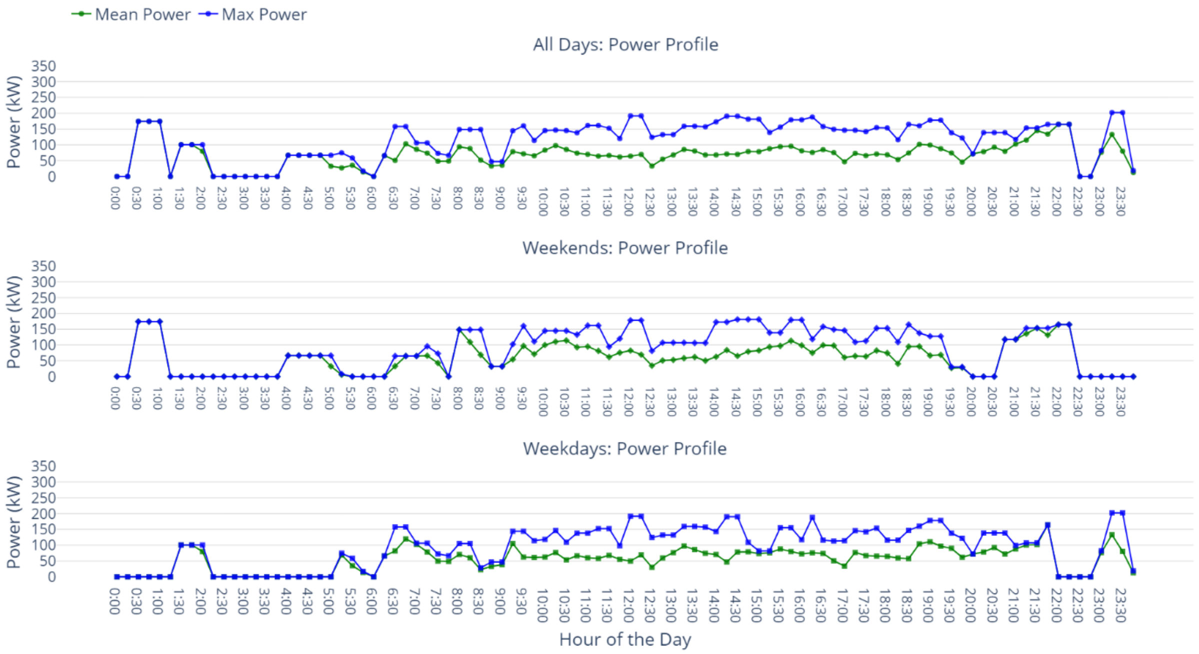


Figure 66. 15-Minute Resolution Power Profile for Charger 701142-05

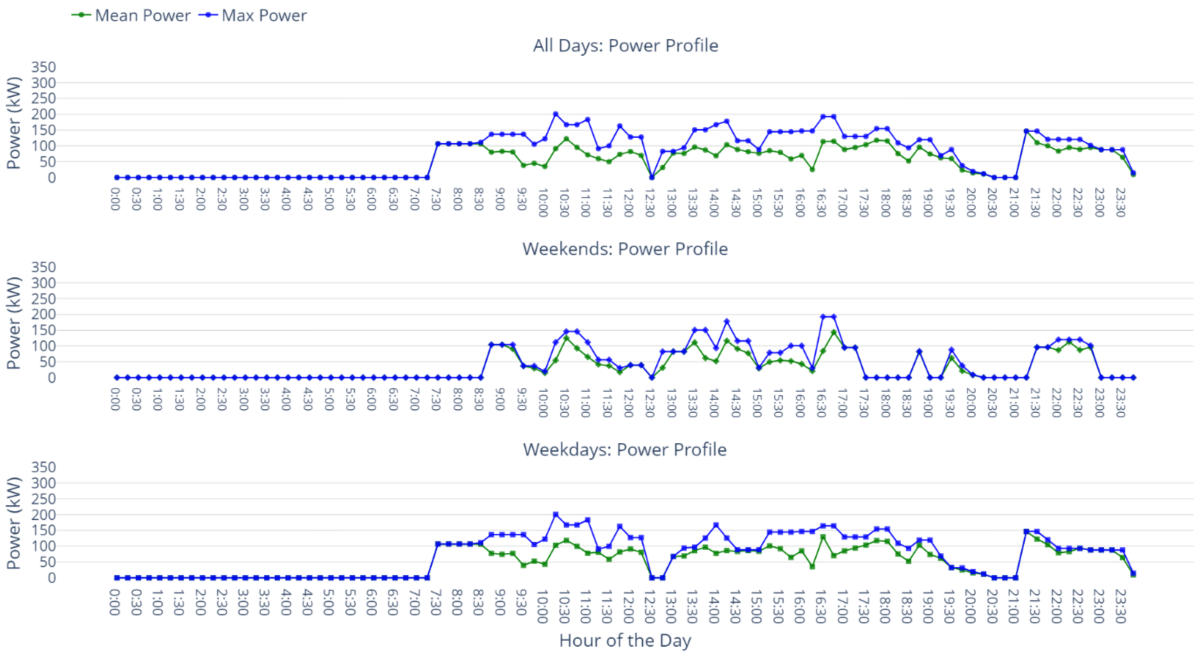


Figure 67. 15-Minute Resolution Power Profile for Charger 701142-06

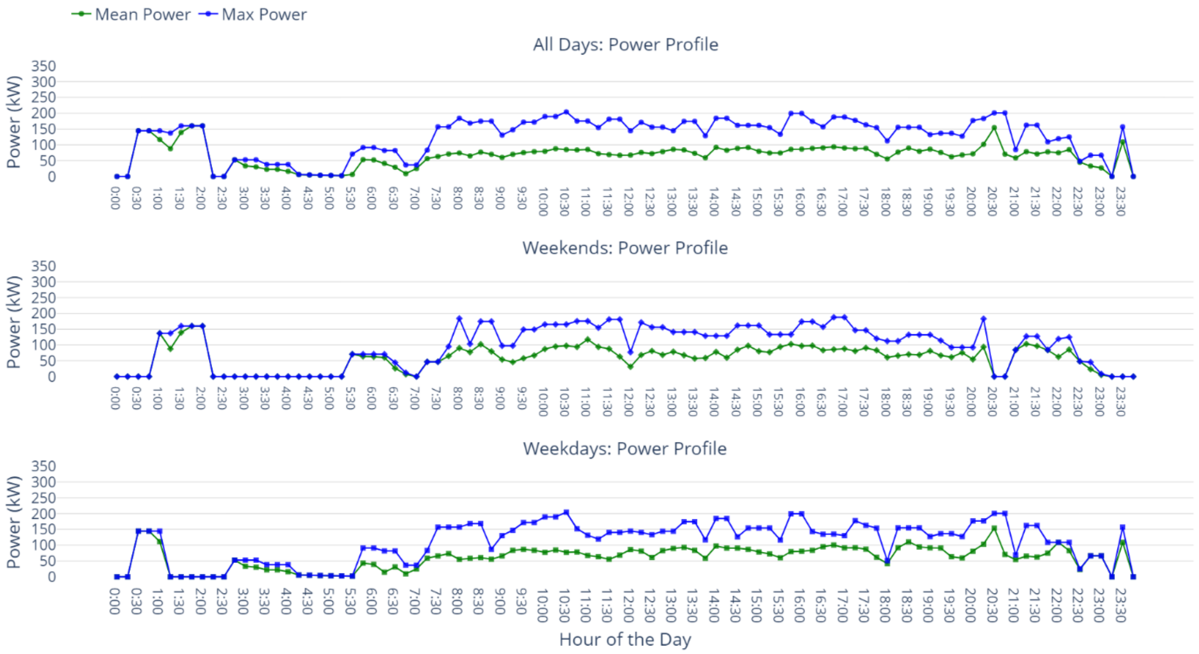


Figure 68. 15-Minute Resolution Power Profile for Charger 701142-07

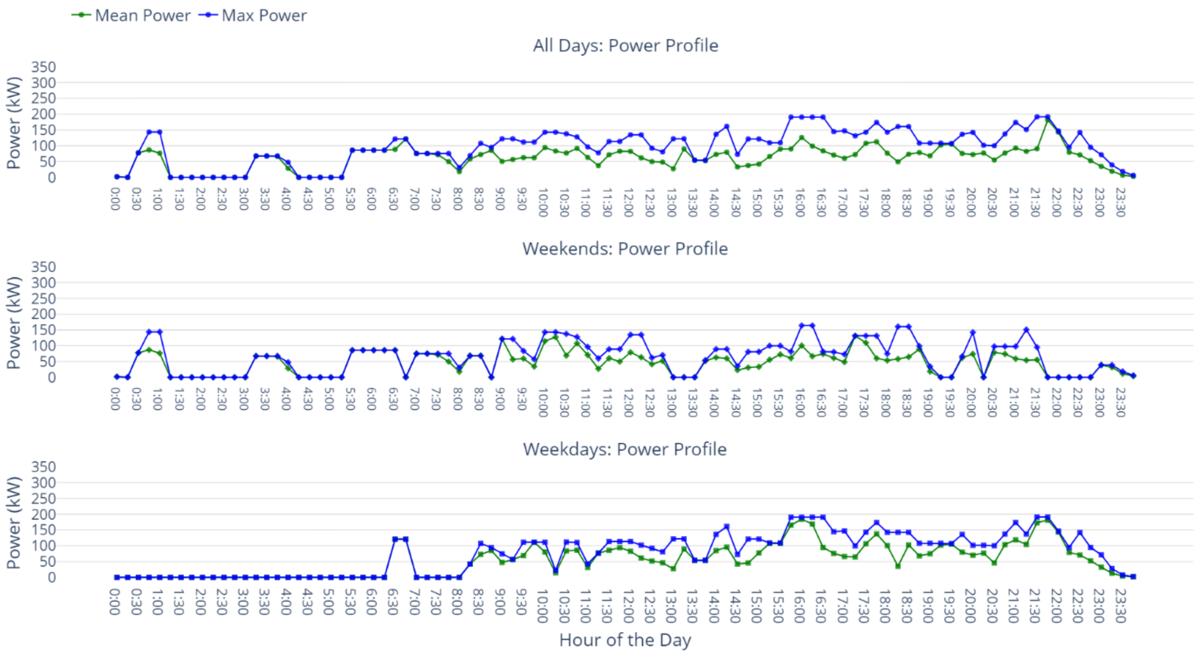


Figure 69. 15-Minute Resolution Power Profile for Charger 701142-08

3.3.2.3 RMP UTA OLYMPUS COVE (MILLCREEK, UT)

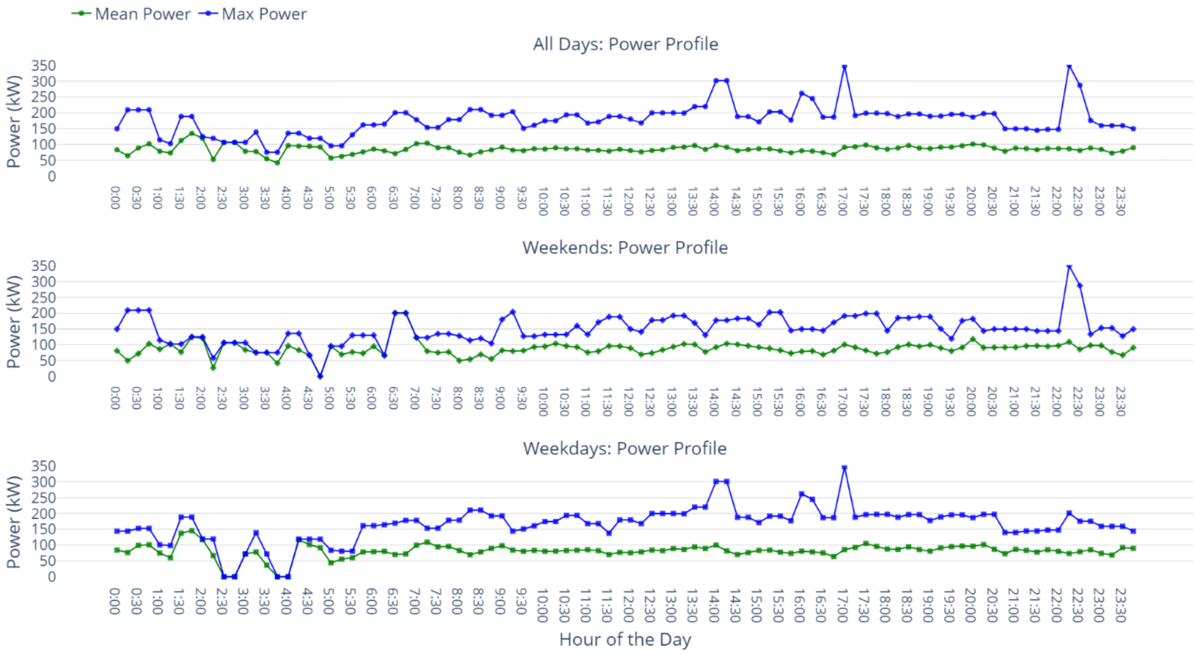


Figure 70. 15-Minute Resolution Power Profile for Charger 701143-01

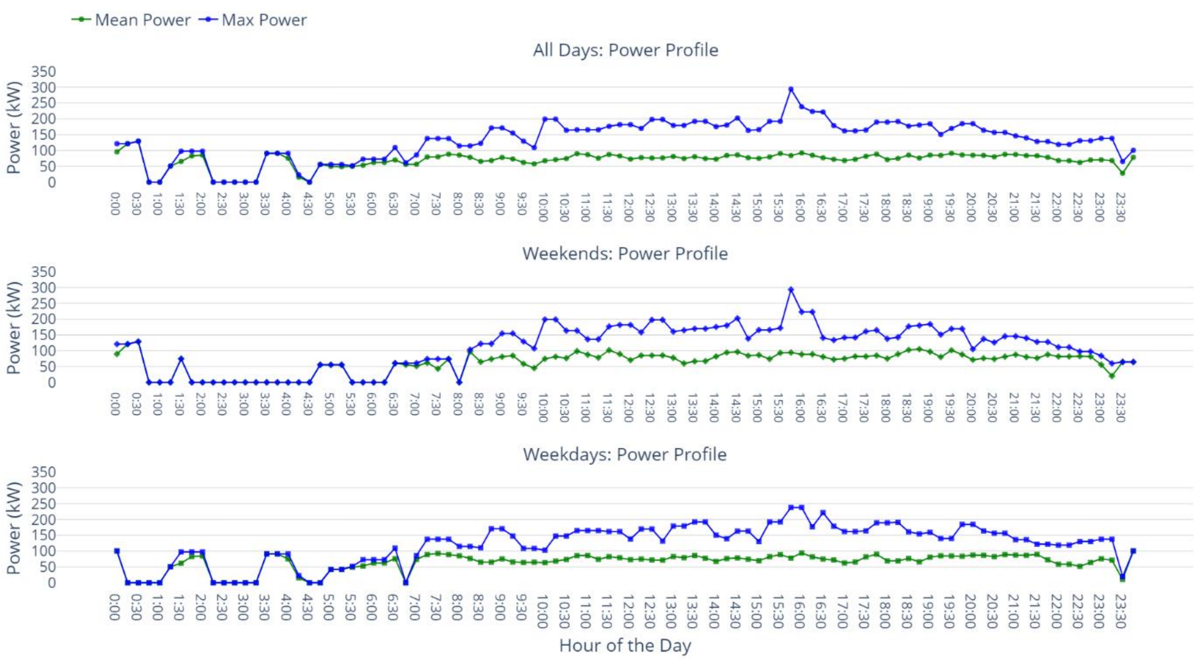


Figure 71. 15-Minute Resolution Power Profile for Charger 701143-02

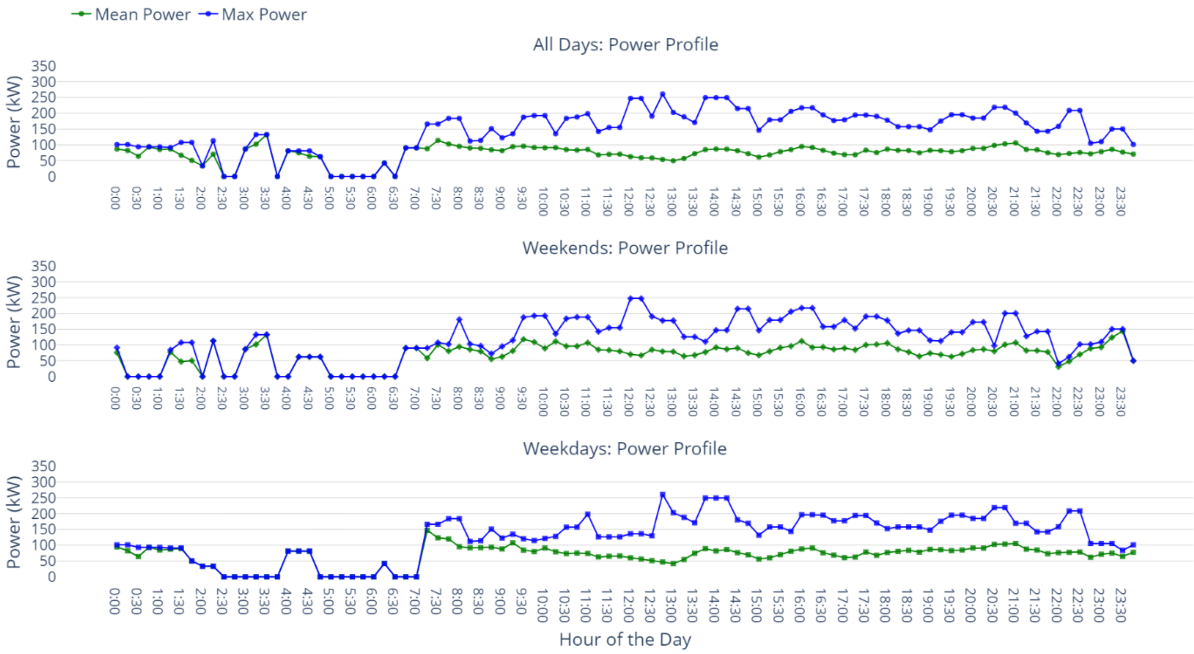


Figure 72. 15-Minute Resolution Power Profile for Charger 701143-03

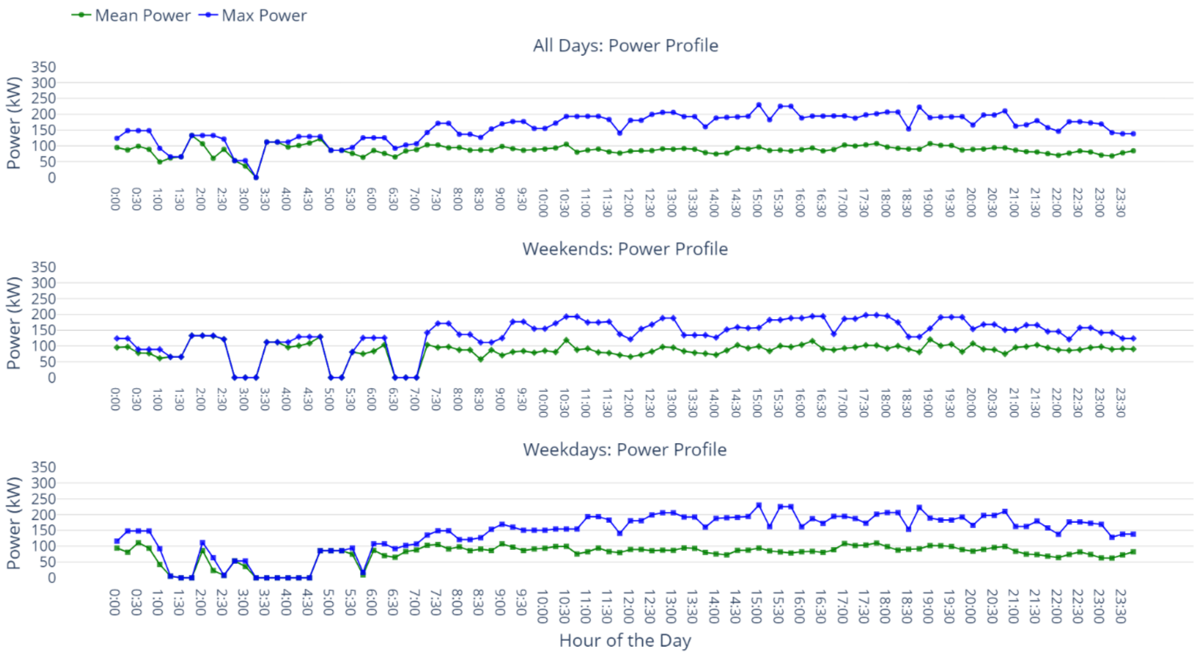


Figure 73. 15-Minute Resolution Power Profile for Charger 701143-04

3.3.2.4 RMP VERNAL (VERNAL, UT)

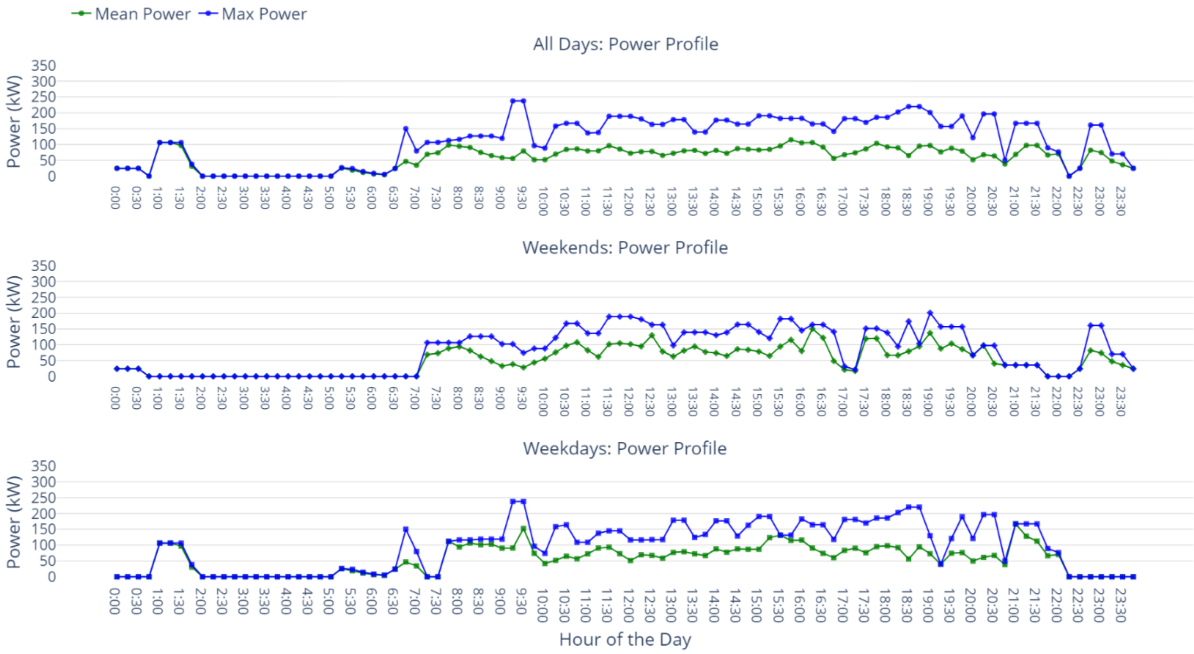


Figure 74. 15-Minute Resolution Power Profile for Charger 701141-01

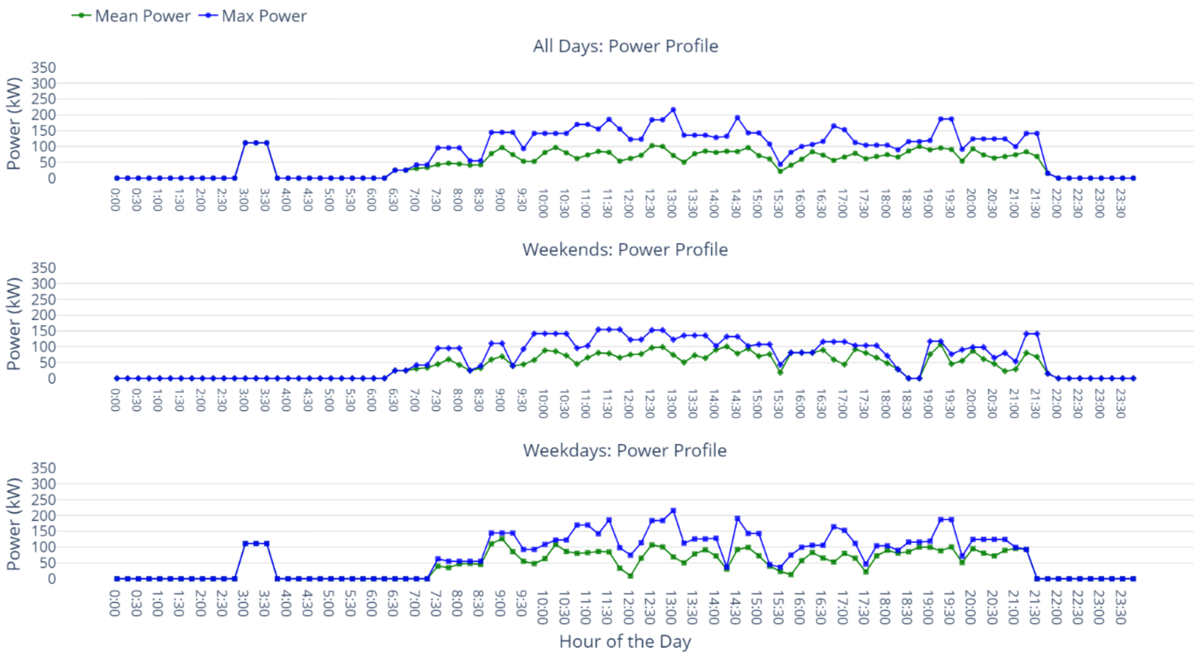


Figure 75. 15-Minute Resolution Power Profile for Charger 701141-02

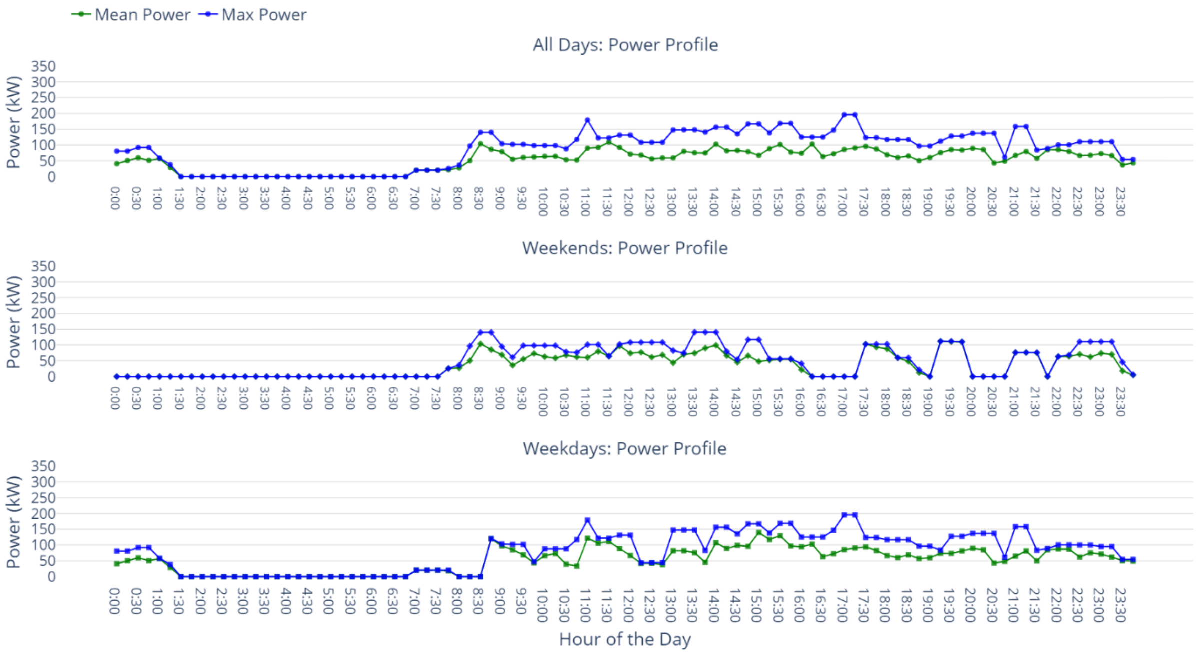


Figure 76. 15-Minute Resolution Power Profile for Charger 701141-03

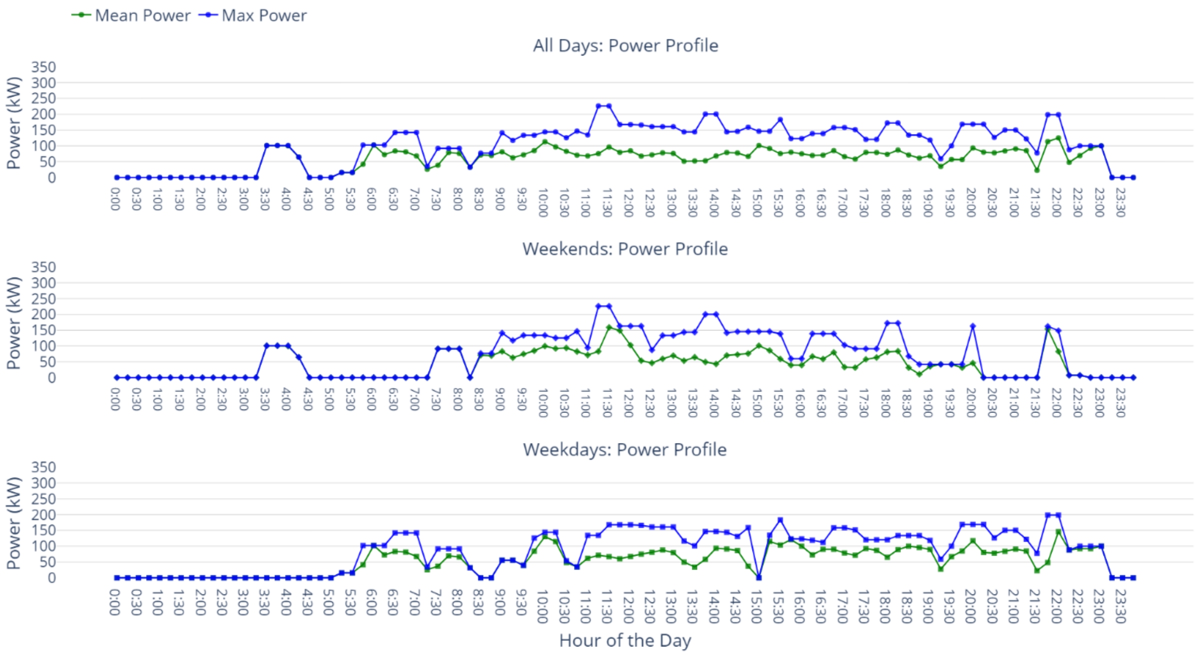


Figure 77. 15-Minute Resolution Power Profile for Charger 701141-04

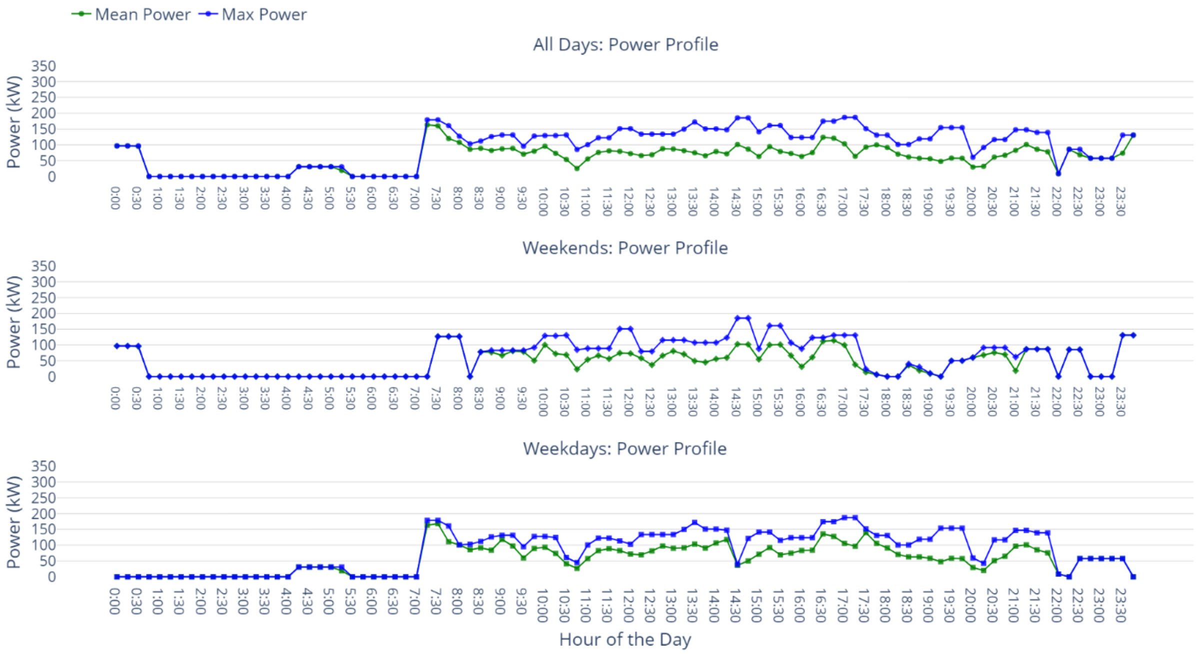


Figure 78. 15-Minute Resolution Power Profile for Charger 701141-05

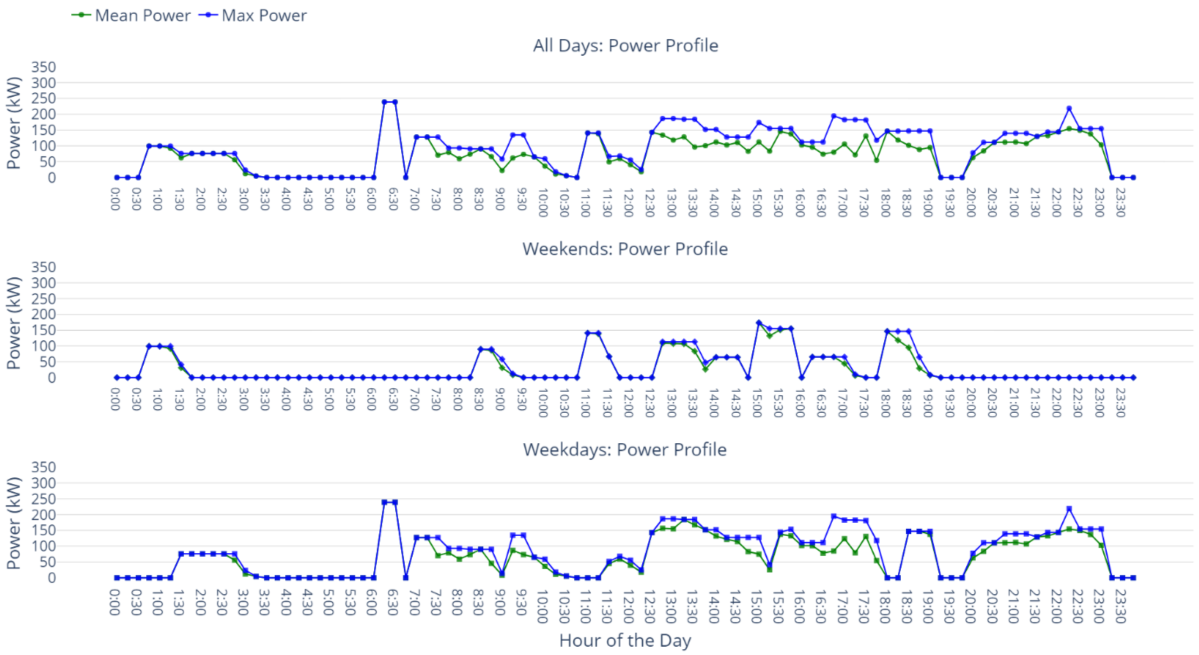


Figure 79. 15-Minute Resolution Power Profile for Charger 701141-06

4 CONCLUSION

The analysis of charging session data from Rocky Mountain Power's DCFC sites provides valuable insights into charging behavior and power utilization patterns. There were over 10,000 charging sessions offering robust evidence of consistent daily patterns, highlighting peak demand in afternoon and evening hours, with an overall low average load factor of 10%. The low occurrence of power sharing events indicates current capacity adequately meets user demand but also suggests an opportunity for future educational initiatives or smart charging automation needs as site usage grows. Additionally, as the dataset grows, significant enhancements can be made to future analyses. Ultimately, better driver awareness, data transparency, and proactive site management strategies will be essential as EV adoption continues to rise.

Future analyses will include:

- Validation with AMI/SCADA data
- Higher dimensional analysis surrounding peak loading events
  - Identification of the largest contiguous energy consumption event at each site
  - Site-level comparison of upper-quartile energy consumption events
- Transit bus charging and public DCFC time correlation analysis at Kimball Junction and Olympus Cove
- Seasonality analysis
  - Power usage trends by season
  - Impact of temperature on charging performance
- Forecasting with load management analysis

In summary, future analyses are planned to incorporate validation with AMI/SCADA data, along with a higher-dimensional examination of peak loading events. This will include identifying the largest contiguous energy consumption event at each site and conducting a site-level comparison of upper-quartile energy consumption events. In addition, transit bus charging and public DCFC time correlation analysis at Kimball Junction and Olympus Cove are anticipated, as well as a seasonality analysis to explore power usage trends by season and assess the impact of temperature on charging performance. Forecasting and load management analysis will also be explored.

Appendix 4

Reliable Electric Vehicle Infrastructure through Versatile and Equitable Managed Charging (REVIVE)

Control No.: 3214-1868

Technical Volume

Submitted to the Department of Energy (DOE) in response to DE-FOA-0003214
Joint Office of Energy and Transportation:
Communities Taking Charge Accelerator

Topic Area 3: Managed Charging for Clean Reliable Energy

Project Lead / Entity Type:
PacifiCorp/Utility

Technical Point of Contact:
James Campbell
Email: james.campbell@pacificorp.com

Business Point of Contact:
Jeff Howcroft
Email: jeff.howcroft@pacificorp.com

Team Member Organizations and Senior/Key Personnel:

Organization	Senior/Key Personnel
PacifiCorp	James Campbell
Utah State University (USU)	Dustin Maughan
Electric Power Engineers (EPE)	Sarah Chatterjee
Merge Fleet Solutions (Merge)	David Eckels
National Renewable Energy Laboratory (NREL)	Kenneth Kelly

Project Location:
Salt Lake City (UT), Logan (UT), Millcreek (UT), West Valley (UT), Portland (OR)

Confidentiality Statement:
No sections or data included in this document are confidential.

1. Project Overview

1.1. Project Summary

Project Relevance:

The rapidly growing adoption of electric vehicles (EVs) necessitates maximizing the existing charging infrastructure through smart charge management solutions to provide reliable and equitable energy supply to a wide range of consumers. Employing robust managed charging systems plays a crucial role in optimizing the cost, operation, and maintenance of EV infrastructure. Coordinated and optimized EV charging ensures the most efficient use of infrastructure while sustaining the health of the electrical grid. For this proposal, the REVIVE project brings together a comprehensive team with a notable background in developing and testing EV managed charging systems.

The REVIVE team is uniquely equipped with infrastructure access and advanced managed charging algorithms developed for numerous level 2 and direct current fast charging (DCFC) networks exploring session scheduling, charge allocation based on grid conditions and fleet operations, and dynamically adjusted EV charging prices. During this project, the REVIVE team will focus on optimizing, reinforcing, and standardizing a deployment-ready managed charging system. The project will further contribute to the landscape through open-source software distribution, standardized ecosystem reliability and maintenance protocols, and a defined roadmap for integrating privately and commercially owned infrastructure in the future.

Project Approach and Outcomes:

The REVIVE project will implement comprehensive solutions that prioritize EV charging based on grid health, EV charging demand times, and customer preferences while adjusting charging rates dynamically in response to fluctuating grid conditions. The project will include end-to-end specifications of charging hardware, cybersecurity, grid communication requirements, and standards enabling the scalability and reliability of managed charging solutions to facilitate future EV charging implementations. The overall project outcomes are summarized through the following key contributions:

1) Establishing an ecosystem data management platform and undertaking full-scale managed charging optimization by leveraging data provided by the project partners on:
   a. EV supply equipment (EVSE) supporting fleet charging in the city of Portland.
   b. Public transit routes and charging requirements across the state of Utah.
   c. The utilization, reliability, and performance of widescale EVSE infrastructure.
   d. The reliability and performance of transportation fleets.
   e. Charging requirements for a wide range of fleets and light-duty vehicles.
   f. Grid health requirements, limitations, and DER integration plans.
   g. Existing grid optimization models for the charging of electric bus fleets (leveraging results from the existing eMosaic DOE project).

h. Grid health optimization by curtailing loads in buildings (leveraging results from the existing Connected Communities DOE project).

2) Developing the REVIVE Managed Charging (REVIVE-MC) software, which will provide wide-scale robust control over multifamily, fleet, and utility-owned public EV charging infrastructure deployed across the state of Utah.
3) Addressing and reinforcing the reliability and robustness of the entire managed charging ecosystem from grid to vehicle.
4) Creating a roadmap for integrating privately and commercially owned charging infrastructure into the managed charging ecosystem in the future.
5) Contributing to wide-scale managed charging implementations through open-source distribution.
6) Demonstrations and deployments at distributed sites to test and collect data on the performance and integrity of the REVIVE-MC Software.

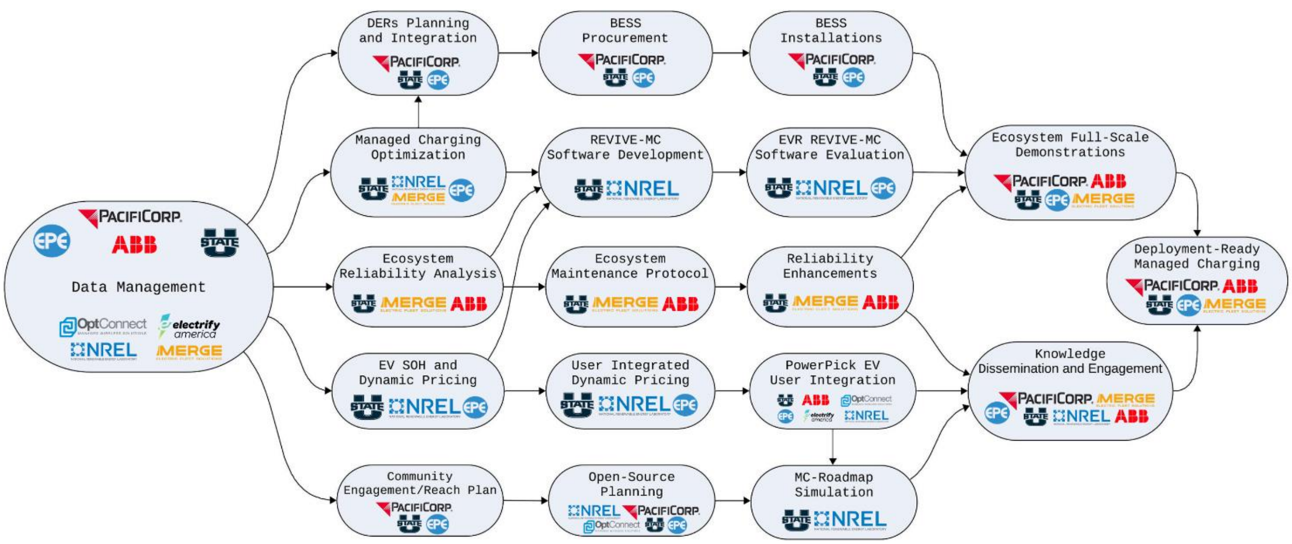


Figure 1 Project Approach

Project Outputs:

1) The MC Optimizer, which will produce charge allocation priorities, a blueprint for integrating the end user preferences, dynamic pricing models, and DERs planning.
2) The REVIVE-MC Software, which will provide a wide-scale robust control over multi-family, fleet, and utility-owned public charging infrastructure deployed across the state of Utah.
3) Developed protocols to standardize the reliability, robustness, and maintenance of the managed charging ecosystem.
4) A software simulation serving as a roadmap for integrating privately and commercially owned charging infrastructure into the managed charging ecosystem as the end goal.
5) An open-source software tool to accelerate a wide-scale implementation of managed charging systems.

Project Impacts:
With access to multiple EV infrastructure locations, data models from multifamily and commercial spaces, and a well-established communication platform, the REVIVE team is uniquely positioned to implement significant advancements surrounding optimized smart charge management to ensure reliable and equitable access to EV infrastructure. Results from the planned development, demonstrations, and deployments will contribute to accelerating the deployment of robust, reliable, and interoperable charging solutions through open-source distribution. DOE Funding for this project will enable technological advancement and guidelines for the deployment of robust and equitable infrastructure that can deliver valuable grid services based on optimized data models for energy allocation. The funding enables collaboration across the key EV ecosystem stakeholders, creating a common objective of standardizing an optimized managed ecosystem.

Community Benefits:
The REVIVE project will amplify meaningful community engagement and labor partnerships, create quality jobs to attract and retain skilled workers, promote equitable access to wealth-building opportunities, and meet Justice40 objectives. Through systematic investment in and deployment of state-of-the-art hardware and software for managed EV charging at different geographic locations, the REVIVE project anticipates the formation of trusted partnerships between community stakeholders including, but not limited to, technology end-users, technology vendors, labor organizations, and the PacifiCorp.

Climate Strategy and Increased Renewable Penetration:
An integral part of the project is the use of the project distributed energy resources to support the long-term goal of increasing the capacity to interconnect larger volumes of renewable energy generation. The REVIVE project will demonstrate this by aligning EV charging and battery energy storage system (BESS) charging with time of renewable overproduction from the local grid and the surrounding energy markets as a whole (i.e., leveraging the overgeneration of renewable energy from California). The managed charging software developed during the course of this project will integrate EVSEs and BESSs to, not only support the local site needs and congestion relief, but to also ensure that the charge/discharge cycles are such that they offer maximum benefit to the grid and maximum renewable energy utilization. The grid benefits include:

1. **Oversupply mitigation and Increased Capacity for Renewables:** Oversupply is when electricity generation surpasses demand. The issue of oversupply is becoming more prominent as more and more renewable energy resources such as solar and wind generation are getting integrated into the grid. The impact of this issue is more visible in California where the so-called duck curve is deepening resulting in a threat of under investments in renewable generation. Scheduling BESS charge cycles, in this project, to match the times of overproduction can result in diminishing worries surrounding renewable integration into the grid because to threats to system stability due to oversupply since BESSs can absorb the additional generation.

2. **Utilization of Cheap Electricity:** During times of oversupply, electricity wholesale rates can potentially go negative where the grid operator offers credits to an end user to consume electricity. BESS implementation can benefit from this opportunity by replenishing the depleted BESS charge at a lower cost, and consequently by offering charging service to EV users at reduced prices.
3. **Improved Climate Resilience:** The BESS implementation will also result in an improvement in resilience against extreme weather events that can potentially lead to power outages. During such events, the energy stored in BESSs can be utilized to charge EVs.

1.2. Project Team and Qualifications

The REVIVE team is strongly positioned to execute the proposed project plan. The team has access to over 170 level-2 networked EV chargers that are integrated into an Open Charge Point Protocol (OCPP) server, in addition to multiple locations with integrated DCFC networks across the state of Utah. These EV chargers support a wide range of consumers including multifamily mixed-income, workplace, light industrial, transit, and public charging facilities. The charging networks are also integrated with other distributed energy resources (DERs) like distributed renewable generation, BESS, and grid-interactive efficient buildings.

PacifiCorp is the utility provider and project lead. PacifiCorp's extensive experience with utility backend systems, software integration, EV infrastructure, smart charge management, customer engagement, and cybersecurity expertise. PacifiCorp will leverage utility-owned and operated EV infrastructure and support additional EV and DER interconnected needed for the project. PacifiCorp is providing fleet make ready services to many customers within the City of Portland and will provide the network service and technology platform for EVSE stations planned to scale electric vehicles within Portland. **EPE** brings its expertise with grid integration of DERs, demand flexibility, energy efficiency, power systems engineering and grid modelling, data analytics, and deployment experience. **Merge** brings deep experience with EV fleet solutions, charge management, EVSE deployment, OCPP/telematics data analysis, and customer centric EV solution designs. **USU/ASPIRE** supports the team with extensive experience leading, supporting, and deploying several EV infrastructure and integration programs funded through DOE. The ASPIRE Center brings depth of experience across the entire EV ecosystem and will leverage existing partnerships with vehicle manufacturers, charging infrastructure, and other DER devices to deliver on the objectives of REVIVE. **NREL's** research focuses on developing advanced hardware and control solutions to integrate EVs with the grid, including a focus on charge management and grid integration. NREL will leverage fleets and light-duty databases to extrapolate findings and determine the broader applicability of this technology nationally. **UTA** site locations combine multiple modes of electric transit converging at one location, including electric tram service, electric buses, and public charging. **ABB** brings forward its experience in manufacturing, installation, and maintenance of level-2 and DCFC EVSE.

2. Project Approach and Impact

2.1. Project Approach and Impact Description

While EVs hold the promise of revolutionizing travel by reducing reliance on fossil fuels and cutting greenhouse gas emissions, the EV adoption landscape has faced some barriers including range anxiety, high costs, lack of reliable charging infrastructure, and consumer awareness. EV sales in the United States are hitting new heights with 1.4 million sales in 2023 and 1.7 million sales in the first half of 2024 alone. If this trend were to continue, vehicle CO_2 emissions by 2030 can be aligned with the federal Net Zero Emissions goals by 2050, and it is crucial that the charging infrastructure is in place to support these goals. The availability, reliability, scalability, and cost of EV charging infrastructure are some of the most critical factors that might impact and slow down the EV adoption landscape[1].

During this project, the robust project team will develop, deploy, and disseminate knowledge on robust managed charging systems, which will play a significant role in optimizing the cost, operation, and maintenance of charging infrastructure. The proposed REVIVE approach is built upon the following key areas:

1) Data management for EV charging ecosystems

Data on grid infrastructure health, along with the utilization and performance of EVs and EVSE, is crucial in determining the optimal solution for managed charging algorithms.

As highlighted earlier, the project team will work on defining the design criteria for optimized managed charging by leveraging data provided by **a) Merge** on their EVSEs supporting commercial and multifamily charging (170 Level 2); **b) UTA** on public transit routes and their charging requirements from EV bus manufacturers; **c) ABB** on the utilization, reliability, and performance of widescale EVSE infrastructure; **d) NREL** on charging requirements and profiles for a wide range of light-duty vehicles; **e) PacifiCorp** on grid health requirements, limitations, and DER integration; **f) USU** on existing grid optimization models for the charging of electric bus fleets (leveraging results from the eMosaic DOE project); and **g) EPE** on grid health optimization for curtailing loads in buildings (leveraging results from the Connected Communities and eMosaic DOE projects).

A data management platform will be evaluated and developed based on the following criteria:

a) **Data collection and organization capabilities:** The data management platform will aggregate and organize historical or real-time data from the project team or any additional vendors and opportunities in the future.
b) **Data security:** the data management plan needs to conform with all laws and regulations employed by the United State federal government, such as U.S. Privacy Act of 1974, HIPAA, COPPA, and the Gramm-Leach-Bliley Act.
c) **Data analysis and storage:** the data management platform needs to provide adequate storage and analysis capability enabling the team to normalize, demonstrate, and collaborate on the project data.

[1] https://www.iea.org/energy-system/transport/electric-vehicles

2) Optimization for managed charging

The crux of the present challenge for managed charging systems involves the resilience and optimization of multiple competing objectives including utilizing EVSE infrastructure, tending to grid health, and providing a reliable and equitable charging experience for customers. A technology-based approach to intelligent managed charging would employ distributed sensing, communication, computing for optimization, and real-time control of charging. Past works from the REVIVE team in grid optimization for charging of electric bus fleets (eMosaic project) and grid health optimization by curtailing loads in buildings and (Connected Communities) have the team fully prepared to tackle this new challenge.

REVIVE intends to utilize historical and real-time data to create a hierarchal approach to charging optimization. The managed charging optimizer (MC Optimizer) will have a top layer to continuously update a plan that spatially matches bulk customer charging needs with grid resources, respects the current use and limits of distribution grids, and minimizes peak loading. Scheduling charging sessions over time will be performed at a lower layer where specific user/charger associations are solved, accounting for users' individual needs and ensuring fair access. This hierarchal separation of tasks decomposes a large, complex optimization problem into simpler, decoupled subproblems that may be solved in parallel for efficiency. The proposed work is thus a natural extension of prior work that has been demonstrated in small-scale, control experiments to improve grid health while maintaining user constraints (e.g. bus routes) and user experience (e.g. curtailment of thermal loads with no perceptible user impact).

The MC optimizer will further study the impacts of battery storage systems supporting constrained grid circuits, which would require active and reliable charge management for EV loads. This will encompass several key operational aspects of BESS, including strategic timing for charging and discharging, as well as maintaining optimal states of charge (SOC) throughout the day.

Charging/Discharging Phase Management: The MC optimizer will schedule BESS charging during periods of low grid demand or when renewable energy generation (like solar or wind) is at its peak. This ensures that the storage system is charged in the most efficient and cost-effective manner while reducing reliance on non-renewable energy sources. To alleviate stress on the grid during peak demand hours, the BESS will discharge stored energy. This not only provides necessary support to the grid but also ensures a stable power supply to critical infrastructure, including EV charging stations.

Optimizing State of Charge (SOC): The system will continuously monitor the SOC of the BESS to optimize its performance and longevity. By dynamically adjusting SOC levels based on real-time grid and demand data, the optimizer can enhance the operational efficiency of the BESS. For instance, keeping the SOC at a level that balances depth of discharge with the need for immediate power availability and longevity. The system will align BESS operations with EV and electric bus charging schedules to ensure that the charging sessions are completed, and if possible, do not coincide with grid peak periods.

Adaptive Learning Algorithms: Utilizing machine learning algorithms, the MC Optimizer can predict and adapt to changing patterns in EV charging behavior. These predictive capabilities will allow the BESS to preemptively adjust its charging and discharging strategies to maintain grid stability and optimize energy usage.

BESS Integration with EV Charging: To effectively manage the charging operations for electric buses and EVs, the MC optimizer will employ a hierarchy of charging priorities and power distribution controls. The MC Optimizer will consider the needs of the electric buses and public EV charging, and strategies will be developed and deployed to meet the designated priority, considering EV driver preference via the PowerPick solution. In situations where the combined charging demand from the electric buses and EVs approaches or exceeds the capacity of the local grid infrastructure, the MC optimizer will implement a BESS dispatch strategy and smart charge management to control reduction in power allocation to onsite EV chargers.

By integrating advanced algorithms, the MC optimizer will predict daily charging demands and adjust strategies accordingly. It will optimize the SOC of the BESS throughout the day, ensuring it can supply power when most needed, particularly during peak usage or when grid supply is constrained. The goal is to achieve a balance between operational demands of the EV and electric buses and the available grid and storage resources, thus enhancing grid stability and reducing operational costs associated with energy consumption.

3) Feasibility analysis and design for dynamic pricing models

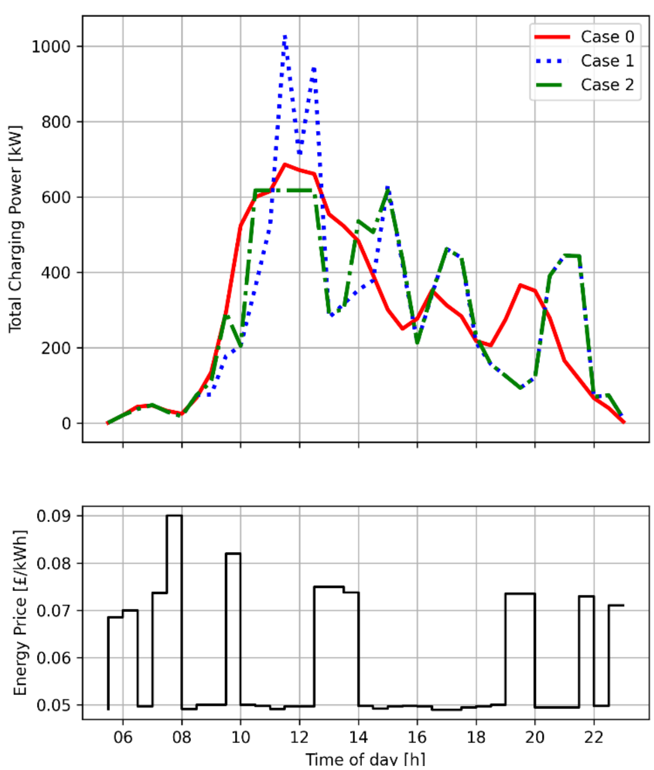


Figure 2 Pricing Use Cases

Dynamic pricing represents a form of time-of-use pricing in which customers pay a time-varying price for energy that depends on the availability of renewable energy, transmission congestion, and other factors. This pricing framework allows EV users or charging station operators to schedule charging for the periods when energy is the cheapest. Dynamic operating envelopes refer to a time-varying limit on a customer's power consumption, which is informed by real-time grid conditions, including line congestion and node voltages. Working together, dynamic pricing and dynamic operating envelopes can be used to reduce both energy costs and grid capacity costs by using the cheapest, cleanest power when it is available and using distribution capacity at underutilized times.

The team has shown this method to be effective in simulation. The Figure 2 shows three cases. Case 0 represents business-as-usual charging, where a vehicle charges at maximum power until it is full and then idles. Case 1 optimizes energy costs, charging at low times but resulting in a much higher peak demand than before. Case 2 optimizes energy while keeping peak demand 10% lower than the base case, demonstrating that these methods can be used to reduce both energy costs and grid capacity needs while ensuring all vehicles receive their requested charging power. Vehicles with longer dwell times at chargers and smaller energy needs are relatively more flexible and see the greatest cost savings by being charged in this way. This speaks to the applicability of these methods to level 2 charging for both commercial and residential charging. Additionally, the dynamic operating envelopes can be applied to mixed charging stations, in which DCFC can be prioritized for light- to heavy-duty vehicles, with the longer-duration Level 2 charging sessions sharing the fast chargers' grid capacity and only charging when the fast chargers are underutilized.

During this project, the team will investigate the feasibility of implementing a higher level of dynamic pricing to incorporate the end user preferences into the dynamic pricing algorithms. The dynamic pricing model will interact with an end-user interface, which shall be called the PowerPick interface. PowerPick will provide the EV end-user with control over the energy, duration, and cost of the charging session. In addition to equitable energy access, the project team will further study the impact and benefits of the PowerPick fluid charging sessions on the longevity of the EV state of health. Existing dynamic pricing models will be analyzed and upgraded to incorporate guidelines and inputs from the MC optimizer and the PowerPick interface. The feasibility of implementing this approach will be tested and surveyed through a publicly accessible software simulation demo, referenced as the MC-Roadmap demo in this document.

4) Enhancing the reliability and connectivity of the charging ecosystem

The operational efficiency of the electric bus fleet is currently facing significant challenges related to charging reliability. These issues are not necessarily due to the availability of charging stations but stem from frequent charging failures that impact the overall functionality of the fleet.

REVIVE will support collaboration between EVSEs and vehicles to reinforce and ensure standardized reliable connectivity for vehicle-to-grid communication platforms. This involves collecting and analyzing detailed data on charging cycles, error logs, and failures to assess system reliability and develop maintenance schedules. It will evaluate the impact of charger outages on operational efficiency, define diagnostic protocols, and implement regular checks to enhance system reliability. Additionally, Root Cause and Fault Tree analyses will identify underlying issues, while

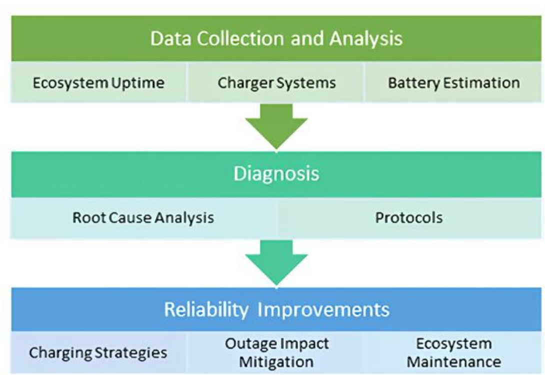


Figure 3 Development of Charging Ecosystem

preventative maintenance, and sensor-based monitoring, will be developed to improve the overall performance of the UTA charging ecosystem. The process will involve installing cameras on buses and pantograph chargers to monitor alignment and identify misalignment issues, estimating thermal loads using data from ABB EVSE portal and Viricity systems to detect overheating, and tracking OCPP connection logs to identify persistent charger-side issues. Additionally, telematics data will be analyzed to pinpoint areas with poor connectivity, power usage patterns, and critical chargers. By addressing these challenges, we aim to significantly reduce the error rate per charging attempt, enhance the reliability of the UTA electric bus fleet, reduce operational costs, and improve overall service quality.

Key Objectives and Specifications

a) **Data Collection and Analysis**
Detailed data on charging cycles, including duration, energy transferred, communications, and any interruptions, will be collected. Error logs and failure reports will be analyzed to categorize and quantify incidents. Correlation and trend analysis will be conducted to understand the relationship between core data over time and the likelihood of failure.

b) **Reliability, Availability, Maintainability, and Safety Analysis**
The analysis will focus on the percentage of time the system is operational and available for use, power delivered before downtime, charge sessions started before downtime, and other diagnostic data (temperature, service logs, etc.). This includes an assessment of the ease and speed with which the system can be restored to operational status after a failure. Improvements in reliability will be tracked over time using statistical modeling tools to ensure the system meets specified reliability targets.

c) **Charger Outage Impact**
The impact of charger outages on operational efficiency metrics such as power usage by each charger, vehicle miles driven, and power delivered will be evaluated. Historical data will be used to assess the frequency and duration of outages and their effects on bus availability and operational costs. This analysis will guide the prioritization of maintenance and upgrades to improve network reliability.

d) **Charger outage testing and maintenance protocol development**
A protocol will be defined for diagnosing and repairing faults within the charging infrastructure, aimed at reducing downtime and enhancing reliability. The protocol includes checks such as Depot Box Online Check, Power Cabinet Online Box Check, Pantograph Arm Motion Test, Residual Current Device (RCD) Test, Charge Session Start Test, and communication assessments. Regular implementation of these tests through both software and hardware evaluations will decrease repair time and enhance system reliability. Root Cause Analysis will be conducted to identify underlying root causes, and Fault Tree Analysis will systematically chart the paths leading to errors. Correlation analysis with ABB backend logging service will be pursued to understand when buses fail to connect or charge.

e) **Ecosystem Maintenance Recommendations**

Preventative maintenance for the charging ecosystem will be identified. A gap analysis of maintenance recommendations between OEMs (buses and EVSEs) will be conducted. Sensor-based monitoring will be implemented to track the condition of key components, and machine-learning algorithms will be used to estimate failures based on historical and real-time data. Design elements will be reviewed and modified based on reliability data to improve performance. Failure Mode and Effects Analysis (FMEA) will be conducted to assess and mitigate risks associated with the charging process.

5) Software development for managed charging (REVIVE-MC Software)

The team will develop testing capabilities for OCPP 2.0.1 to automatically identify the supported sub-routines of various OCPP-compliant devices. Although many EV charging equipment vendors support OCPP, the extent of this support varies. Site-management level software (REVIVE-MC) will be developed based on the MC optimizer output and a simplified dynamic pricing model. The REVIVE-MC software will further enhance multi-charger control at distributed sites, ensuring compliance with CFR 680. The REVIVE-MC software will manage charging infrastructure across site-wide locations using an open automated demand response (OpenADR) EV aggregator network. The EV aggregator network will investigate upgrades to additional open standards like OpenADR 3.0 or IEEE 2030.5 during the length of this project.

6) Open-source contributions and community engagement

The PowerPick Interface: PowerPick User Interface Model will be developed during the course of this project to provide the EV end-user with equitable and fair access to charge opportunities. Designed to interface seamlessly with the Managed Charging (MC) Optimizer, PowerPick ensures that users' charging needs are efficiently captured and met. This approach will support scalability and enhance long-term grid stability. PowerPick will provide EV users with control over the energy, duration, and cost of their charging sessions, leveraging advanced dynamic pricing logic. The feasibility of implementing this approach will be tested and surveyed through the MC-Roadmap simulation. The PowerPick software interface will be made available for open-source access.

The MC-Roadmap Open-Access Simulation: The MC-Roadmap open-access simulation will be launched to enable feedback-driven community engagement. The MC-Roadmap will survey the performance of the REVIVE-MC software and increase community awareness by providing an outlook into the future of their electrified transportation. The software simulation will include real scenarios where the user can select a specified location, time of day, starting SOC, vehicle information, and desired charging session option through the PowerPick interface. The MC-Roadmap simulation will additionally provide the user with different driving cycle simulation options to simulate real-case scenarios of where and how the user would get the charge.

Open Managed Charging Standards: OpenADR represents a non-proprietary standardized demand response interface that allows electricity providers to communicate signals directly to customers using a common language and existing communications. The REVIVE team has long supported the adoption of this technology by implementing EV aggregators across the state of Utah using OpenADR. The team will further sustain that goal by evaluating an upgrade to EV aggregator interfaces to OpenADR 3.0 or other open standards like IEEE 2030.5.

7) Demonstrations and deployments of the proposed technology

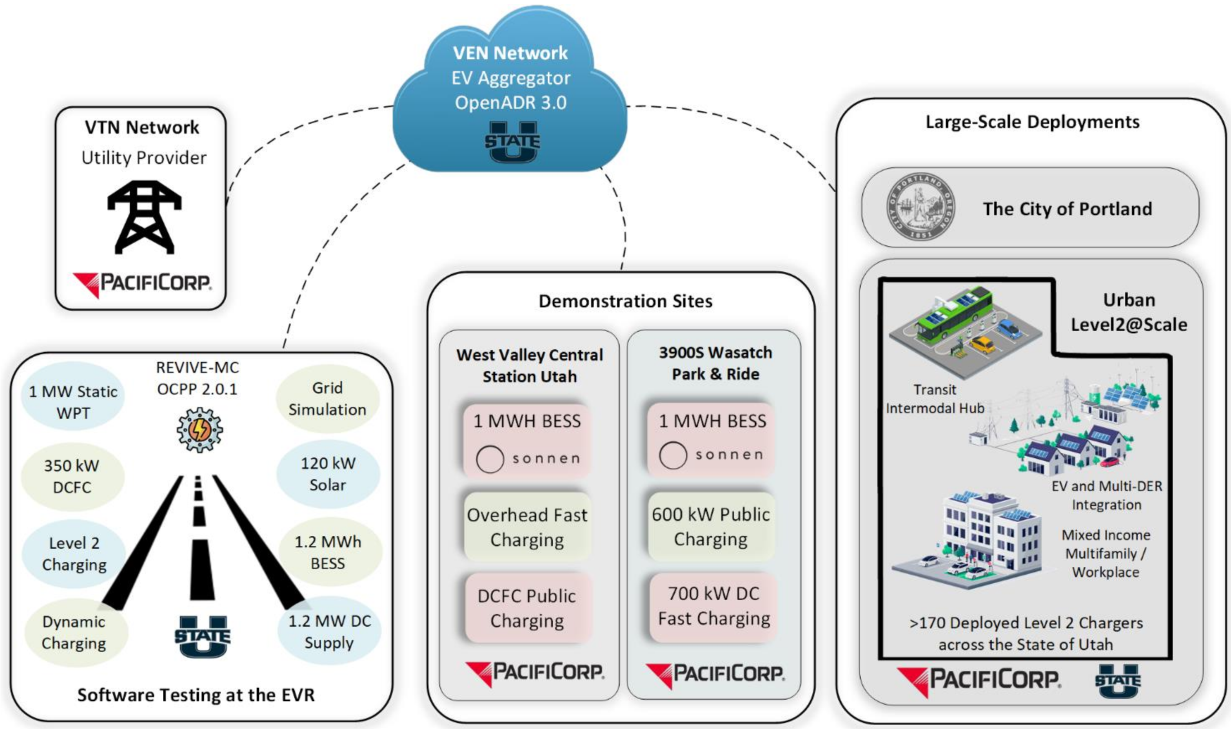


Figure 4 Demonstration and Deployments Overview

Early stages of testing and validation will be conducted at USU's EVR facility. The team will test and evaluate the REVIVE-MC software as well as the option to migrate to OCPP 2.0.1 for upgraded communications. The evaluation will be conducted according to specific key performance indicators complying with industry standards. The project team will test and evaluate the enhanced multi-charger communication control developed in compliance with CFR680.

Two full-scale demonstrations will be launched in the state of Utah in the following locations:

a) The Wasatch Park & Ride
b) West Valley Central Station

The proposed demonstration sites will allow access to a wide range of charging technologies, integrated with battery storage systems, and supplied from constrained grid circuits, which would require active and reliable charge management for EV loads.

Informed by the demonstrations, the team will conduct a large-scale deployment of the developed charge management system across multiple locations including:

a) Urban Level2@Scale locations housing over 170 level-2 chargers across residential and commercial spaces

b) Fleet Operations sites within the City of Portland that participate in PacifiCorp's fleet make ready pilot program.

2.2. Market Transformation Plan

Sustaining and Expanding Project Activities

To ensure sustainability and scalability beyond the project period, the REVIVE project will leverage lessons learned from pilot demonstrations to refine and optimize the approach. Learnings and innovation developed during the project will be considered for production integration through work with partner EV manufacturers and network providers. Continuous engagement with stakeholders will help maintain momentum and support. Strategic partnerships with industry leaders, local governments, and ASPIRE members may facilitate broader adoption. The project's activities will be designed to scale, enabling other communities and technology providers to replicate the successes demonstrated during the project. Additionally, the project will develop an open-source model known as PowerPick, which interfaces with customers through a user-friendly interface to capture their charging preferences. This information will be integrated into the smart charging algorithm, ensuring personalized and efficient charging solutions.

Replication and Dissemination

The success and insights from the REVIVE project will be widely disseminated to support replication in other communities. Detailed project reports and findings will be shared through industry publications and at relevant conferences. Webinars and workshops will be conducted to educate and engage a broader audience, ensuring that the knowledge gained is accessible and actionable. Collaboration with national laboratories and academic institutions will help validate and promote the project's outcomes, further supporting widespread adoption. By developing and promoting the PowerPick open-source model and integrating it with established standards, the project aims to build a foundation for industry-wide interoperability and scalability.

Addressing market barriers and demonstrating effective solutions, the REVIVE project aims to create a sustainable, replicable model for managed EV charging systems. The innovative smart charge management technology developed during the project will optimize charging based on real-time grid conditions, user preferences, and dynamic pricing models. This technical advancement will not only enhance the efficiency and reliability of EV charging but also significantly impact the market by providing a scalable solution that can be adopted broadly. This Market Transformation Plan provides a clear pathway for transforming the market, ensuring that the advancements made during the project are scalable and sustainable, leading to long-term benefits for urban and regional communities, municipal authorities, electric utilities, and local businesses.

3. Workplan

3.1. Overall Project Management and Planning

The recipient will perform project management activities to include project planning and control, subcontractor control, financial management, data management, management of supplies and/or equipment, risk management, and reporting as required to successfully achieve the overall objectives of the project.

3.2. Project Summary by Budget Period

Budget Period 1: Planning

Summary: In this budget period, the REVIVE team will undertake the planning and development for managed charging optimization, universal dynamic pricing models, ecosystem reliability, managed charging software, and open-source distribution planning.

Budget Period 2: Demonstration

Summary: In this budget period, the REVIVE team will conduct the testing, demonstration, and deployment of the optimized REVIVE-MC software. The team will also launch the open-access MC-Roadmap software simulation to define future advancement in charge management and integrate universal dynamic pricing into the eco-system. The REVIVE project will include some limited construction, deploying two BESS devices and bus chargers at project site locations for integration with other DCFCs to deliver grid services. The REVIVE project will be compliant with Buy America requirements. Finally, the team will launch an open-source platform to accelerate the advancement of charge management technology.

3.3. Project Schedule

WBS	Task Name	Duration	Start Date	Finish Date
1	**REVIVE: Reliable Electric Vehicle Infrastructure through Versatile and Equitable Managed Charging**	**0 days**	**Wed 1/1/25**	**Wed 1/1/25**
1.1	Contract award	0 days	Wed 1/1/25	Wed 1/1/25
1.2	Subcontract award	0 days	Wed 1/1/25	Wed 1/1/25
1.3	Project Management Plan	0 days	Wed 1/1/25	Wed 1/1/25
1.4	Project Kickoff	0 days	Wed 1/1/25	Wed 1/1/25
M1.1	Project Management Plan (PMP) Submission	0 days	Wed 1/1/25	Wed 1/1/25
M1.2	Kickoff Meeting Summary Report	0 days	Wed 1/1/25	Wed 1/1/25
2	**Budget Period 1 - REVIVE Planning and Development**	**261 days**	**Wed 1/1/25**	**Wed 12/31/25**
2.1	**Data Management and Managed Charging Optimization**	**129 days**	**Wed 1/1/25**	**Mon 6/30/25**
2.1.1	Establish a data management platform for the MC optimizer	20 days	Wed 1/1/25	Tue 1/28/25
2.1.2	Compile and analyze EVSE fleet charging data	20 days	Wed 1/15/25	Tue 2/11/25
2.1.3	Compile and analyze public transit routes data	20 days	Wed 1/15/25	Tue 2/11/25
2.1.4	Compile and analyze EVSE reliability, utilization, and performance data	20 days	Wed 1/15/25	Tue 2/11/25
2.1.5	Compile and analyze reliability data from transportation fleets	20 days	Wed 1/15/25	Tue 2/11/25
2.1.6	Compile and analyze charging data for light-duty applications	20 days	Wed 1/15/25	Tue 2/11/25
2.1.7	Compile and analyze data on grid health, capacity, and DERs	20 days	Wed 1/15/25	Tue 2/11/25
2.1.8	Evaluate existing optimization models for grid health	20 days	Wed 1/15/25	Tue 2/11/25

2.1.9	Develop the managed charging optimizer (MC Optimizer)	90 days	Wed 2/12/25	Tue 6/17/25
2.1.10	Managed charging with DERs integration planning	20 days	Wed 5/21/25	Tue 6/17/25
M2.1	Data Management Platform Development	0 days	Mon 3/31/25	Mon 3/31/25
M2.2	Data Compilation and Analysis Report	0 days	Mon 3/31/25	Mon 3/31/25
M2.3	Managed Charging Optimizer Development	0 days	Mon 6/30/25	Mon 6/30/25
M2.4	Battery Energy Storage Systems Installation Report	0 days	Mon 6/30/25	Mon 6/30/25
2.2	**Universal Dynamic Pricing Feasibility Study**	**90 days**	**Wed 1/29/25**	**Tue 6/3/25**
2.2.1	EV state-of-health analysis for long-term fluid charging	30 days	Wed 1/29/25	Tue 3/11/25
2.2.2	Analyze and develop the PowerPick interface model	30 days	Wed 3/12/25	Tue 4/22/25
2.2.3	Analyze and develop the universal dynamic pricing model	60 days	Wed 3/12/25	Tue 6/3/25
M2.5	Dynamic Pricing Model Development	0 days	Mon 6/30/25	Mon 6/30/25
2.3	**Reinforcing Ecosystem Reliability and Connectivity**	**215 days**	**Wed 1/29/25**	**Tue 11/25/25**
2.3.1	Data collection and analysis on chargers outage	40 days	Wed 1/29/25	Tue 3/25/25
2.3.2	Reliability, availability, maintainability, and safety Analysis	40 days	Wed 3/26/25	Tue 5/20/25
2.3.3	EV chargers outage Impact analysis on transportation fleets	20 days	Wed 5/21/25	Tue 6/17/25
2.3.4	Charger outage testing and maintenance protocol development	75 days	Wed 6/18/25	Tue 9/30/25
2.3.5	Ecosystem maintenance recommendations	40 days	Wed 10/1/25	Tue 11/25/25
M2.6	Ecosystem Reliability Protocol Development	0 days	Tue 9/30/25	Tue 9/30/25
2.4	**Optimized Managed Charging Software Development (REVIVE-MC)**	**141 days**	**Wed 6/18/25**	**Wed 12/31/25**
2.4.1	Upgrade communication platforms	40 days	Wed 10/1/25	Tue 11/25/25
2.4.2	Upgrade testing and demonstration platforms to OCPP 2.0.1	60 days	Wed 10/1/25	Tue 12/23/25
2.4.3	Multi-charger control enhancement for CFR680 compliance	40 days	Wed 10/1/25	Tue 11/25/25
2.4.4	Final software development with simplified dynamic pricing	70 days	Wed 6/18/25	Tue 9/23/25
2.5	**Open-Source Planning**	**140 days**	**Wed 6/4/25**	**Tue 12/16/25**
2.5.1	Planning open-source contributions in dynamic pricing	20 days	Wed 6/4/25	Tue 7/1/25
2.5.2	Planning for open-source contributions in managed charging	20 days	Wed 9/24/25	Tue 10/21/25
2.5.3	Identifying standards for open-source distribution	20 days	Wed 9/24/25	Tue 10/21/25
2.5.4	Software development for open distribution	30 days	Wed 10/22/25	Tue 12/2/25
2.5.5	MC-Roadmap open-access simulation development	60 days	Wed 9/24/25	Tue 12/16/25
M2.7	Consensus Report on Open-Source Standard	0 days	Wed 12/31/25	Wed 12/31/25
M2.8	MC Development and Connectivity Testing	0 days	Wed 12/31/25	Wed 12/31/25
3	**Budget Period II: REVIVE Demonstration and Deployment**	**260 days**	**Thu 1/1/26**	**Wed 12/30/26**
3.1	**REVIVE-MC Pre-Demonstration Testing and Surveying**	**129 days**	**Thu 1/1/26**	**Tue 6/30/26**
3.1.1	Testing the upgraded communication platform	60 days	Thu 1/1/26	Wed 3/25/26

3.1.2	Testing the optimized REVIVE-MC software at the EVR	60 days	Thu 1/1/26	Wed 3/25/26
3.1.3	Launching the MC-Roadmap open-access simulation	129 days	Thu 1/1/26	Tue 6/30/26
M3.1	Test Reporting on the REVIVE-MC software at the EVR	0 days	Tue 3/31/26	Tue 3/31/26
M3.2	MC-Roadmap Open-Access Simulation Report	0 days	Tue 6/30/26	Tue 6/30/26
3.2	**REVIVE-MC Full System Demonstrations**	**140 days**	**Thu 3/26/26**	**Wed 10/7/26**
3.2.1	REVIVE-MC system implementation at demonstration sites	20 days	Thu 3/26/26	Wed 4/22/26
3.2.2	REVIVE-MC testing and demonstrations	60 days	Thu 4/23/26	Wed 7/15/26
3.2.3	Data review from demonstration sites	20 days	Thu 7/16/26	Wed 8/12/26
3.2.4	Evaluate the performance of reliability enhancements	40 days	Thu 8/13/26	Wed 10/7/26
3.2.5	Compile demonstration results and corrective measures	20 days	Wed 7/1/26	Tue 7/28/26
3.2.6	REVIVE-MC software updates based on demonstration results	40 days	Wed 7/29/26	Tue 9/22/26
M3.3	Comprehensive Testing and Demonstrations Report	0 days	Wed 9/30/26	Wed 9/30/26
3.3	**Open-Source Plan Execution**	**66 days**	**Wed 7/1/26**	**Wed 9/30/26**
3.3.1	Identify open-source platform of distribution	20 days	Wed 7/1/26	Tue 7/28/26
3.3.2	Knowledge transfer on the PowerPick Interface	40 days	Wed 7/29/26	Tue 9/22/26
3.3.3	Knowledge transfer on dynamic pricing	40 days	Wed 7/29/26	Tue 9/22/26
3.3.4	Knowledge dissemination on ecosystem maintenance recommendations	40 days	Wed 7/29/26	Tue 9/22/26
M3.4	Models and Protocols Transfer Report	0 days	Wed 9/30/26	Wed 9/30/26
M3.5	Dissemination and Engagement Report	0 days	Wed 9/30/26	Wed 9/30/26
3.4	**REVIVE Managed Charging Deployments**	**71 days**	**Wed 9/23/26**	**Wed 12/30/26**
3.4.1	Final REVIVE-MC software implementation and testing	20 days	Thu 10/8/26	Wed 11/4/26
3.4.2	Wide-scale deployments of REVIVE-MC in Urban Level2@Scale locations	30 days	Wed 9/23/26	Tue 11/3/26
3.4.3	Wide-scale deployments of REVIVE-MC in the City of Portland	40 days	Thu 11/5/26	Wed 12/30/26
M3.6	**Go/No:** End of Project Goal: Deployment Readiness	0 days	Wed 12/30/26	Wed 12/30/26

3.4. Work Breakdown Structure

Task 1: Contract Initiation

Summary: The recipient will perform project management activities to include project planning and control, subcontractor control, financial management, data management, management of supplies and/or equipment, risk management, and reporting as required to successfully achieve the overall objectives of the project.

Task 1.1- Contract Award: The Recipient will receive notification of grant award from the DOE.
Task 1.2- Subcontract Award: The Recipient will notify all sub-recipients of the grant award and work through negotiations and contracting for each sub-recipient and issue notices to proceed.

Task 1.3- Project Management and Planning: The Recipient shall develop and maintain the Project Management Plan (PMP). The content, organization, and requirements for revision of the PMP are identified in the Federal Assistance Reporting Checklist and Instructions. The Recipient shall manage and implement the project in accordance with the PMP.
Task 1.4- Kick-Off Meeting: The Recipient will participate in a project kickoff meeting with the DOE within 30 days of project initiation.

Task 2: BP1 – REVIVE Planning and Development

Summary: In this budget period, the REVIVE team will undertake the planning and development for managed charging optimization, universal dynamic pricing models, ecosystem reliability, managed charging software, and open-source distribution planning.

Task 2.1: Data Management and Managed Charging Optimization
Details: For this task, the project team will specify and launch a data management platform for the project partners to share their data models and collaborate on managed charging optimization. As aforementioned, the data leveraged by REVIVE will encapsulate the performance, reliability, and optimal requirements for the entire charging ecosystem. The team will also investigate the performance of existing grid health optimization models to identify key limitations and improvements. Using the compiled database, the managed charging optimizer will be developed. The MC optimizer output will identify charge allocation priorities based on grid conditions, forecasted loads, fleet operations, and end-user preferences. Furthermore, the optimizer will provide guidelines for dynamic pricing logic and DERs planning across the deployment sites. The project team will procure and install battery energy storage systems in constrained locations based on the DERs planning output from the MC optimizer.
Subtask 2.1.1: Establish a data management platform for the MC optimizer
Subtask 2.1.2: Compile and analyze EVSE fleet charging data
Subtask 2.1.3: Compile and analyze public transit routes data
Subtask 2.1.4: Compile and analyze EVSE reliability, utilization, and performance data
Subtask 2.1.5: Compile and analyze reliability data from transportation fleets
Subtask 2.1.6: Compile and analyze charging data for light-duty applications
Subtask 2.1.7: Compile and analyze data on grid health, capacity, and DERs
Subtask 2.1.8: Evaluate existing optimization models for grid health
Subtask 2.1.9: Develop the managed charging optimizer (MC Optimizer)
Subtask 2.1.10: Managed charging with DERs integration planning

Task 2.2: **Universal Dynamic Pricing Feasibility Study**
Details: The purpose of this task is to investigate and study the feasibility of implementing a higher level of dynamic pricing that is universal across all charging infrastructure connected to the same utility provider to ensure equitable energy access. The universal dynamic pricing model will interact with the PowerPick end-user interface. The PowerPick interface will provide the EV end-user with control over the energy, duration, and cost of the charging session. In addition to

equitable energy access, the project team will further study the impact and benefits of the PowerPick fluid charging sessions on the longevity of the EV state of health. Existing dynamic pricing models will be analyzed and upgraded to incorporate guidelines and inputs from the MC optimizer and the PowerPick interface. Overall, the universal dynamic pricing model will use instantaneous loads, forecasted loads, grid health conditions, and user interface to ensure reliable and equitable energy access to all utility-connected consumers.

Subtask 2.2.1: EV state-of-health analysis for long-term fluid charging

Subtask 2.2.2: Analyze and develop the PowerPick interface model

Subtask 2.2.3: Analyze and develop the universal dynamic pricing model

Task 2.3: Reinforcing Ecosystem Reliability and Connectivity

Details: The purpose of this task is to identify and mitigate the root causes of charging failures observed across the charging ecosystem, thereby improving the overall reliability and serviceability of light-duty and fleet operations. The project team will use electric bus fleets as a model to address this issue. The team will collect detailed data on charging cycles including duration, energy transfer, communications, and any interruptions. The team will analyze error logs and failure reports to categorize and quantify incidents. Correlation and trend analysis will be conducted between core data over time and the likelihood of failure. For EVSEs, the team will provide a base analysis on the percentage of system operation, the power delivered before downtime, charge sessions started before downtime, and other diagnostic data that can be collected. For transportation fleets, the team will evaluate the impact of charger outages, focusing on operational efficiency metrics such as power usage, vehicle miles driven, and power delivered. Using historical data to assess the frequency and duration of outages and their effects on bus availability and operational costs, this analysis will guide the prioritization of maintenance of chargers to improve network reliability. Finally, the team will define a protocol for diagnosing and repairing faults within the charging infrastructure, aimed at reducing downtime and enhancing reliability. The protocol includes checks such as Depot Box Online Check to verify the status of the primary power supply, Power Cabinet Online Box Check for secondary power units, Pantograph Arm Motion Test to ensure operational integrity, Residual Current Device (RCD) Test for electrical safety, Charge Session Start Test for the stability of charge sessions, and communication assessments to ensure error-free data exchange and operational commands. The project team will identify preventative maintenance for the charging ecosystem. Gap analysis of maintenance recommendations between OEMs (buses and EVSEs). Sensor-based monitoring will be implemented to track the condition of key components of the charging infrastructure. Machine learning algorithms will be utilized to estimate failures based on historical and real-time data.

Subtask 2.3.1: Data collection and analysis on charger outages

Subtask 2.3.2: Reliability, availability, maintainability, and safety analysis

Subtask 2.3.3: EV chargers outage Impact analysis on transportation fleets

Subtask 2.3.4: Charger outage testing and maintenance protocol development

Subtask 2.3.5: Ecosystem maintenance recommendations

Task 2.4: Optimized Managed Charging Software Development (REVIVE-MC Software)
Details: The project team will upgrade EVSEs to OEMs communication platforms based on the reliability analysis and maintenance protocol established during the length of this project. The team will develop testing capabilities for the Open Charge Point Protocol (OCPP) 2.0.1 to automatically identify the supported sub-routines of various OCPP-compliant devices. Although many EVSE vendors support OCPP, the extent of this support varies. Additional software requirements will be developed to enhance multi-charger control at distributed sites ensuring compliance with CFR 680. The project team will develop the final MC software based on the MC optimizer output, a simplified dynamic pricing model, and upgraded communication platforms. The MC software will manage EVSEs across state-wide locations using new open-source energy management logic for Level 2 EVSE clusters.
Subtask 2.4.1: Upgrade communication platforms based on the reliability study
Subtask 2.4.2: Upgrade Testing and Demonstration Platforms to OCPP 2.0.1
Subtask 2.4.3: Multi-charger control enhancement for CFR680 compliance
Subtask 2.4.4: Final software development with simplified dynamic pricing logic

Task 2.5: Open-Source Planning
Details: The project team will work on identifying appropriate measures for the open-source distribution of software developed during the length of this project. An open-source software platform shall be identified and developed during this task. Additionally, the project team will develop and launch an open-source simulation of the optimized REVIVE-MC software integrated with the universal dynamic pricing model. The MC-Roadmap simulation will serve as a blueprint for further ecosystem advancements. The simulation will be utilized by a large sample of the general public surveying the performance of the MC software and the dynamic pricing model. from the MC system.
Subtask 2.5.1: Planning for open-source contributions in dynamic pricing models
Subtask 2.5.2: Planning for open-source contributions in managed charging algorithms
Subtask 2.5.3: Identifying standards for open-source distribution
Subtask 2.5.4: Software development for open distribution
Subtask 2.5.5: MC-Roadmap open-access simulation development

Task 3: BP2 - REVIVE Demonstration and Deployment

Summary: In this budget period, the REVIVE team will conduct the testing, demonstration, and deployment of the optimized REVIVE-MC software. The team will also launch the open-access MC-Roadmap software simulation to define future advancement in charge management and integrate universal dynamic pricing into the eco-system. Finally, the team will launch an open-source platform to accelerate the advancement of charge management technology.

Task 3.1: REVIVE-MC Pre-Demonstration Testing and Surveying
Details: The project team will test and evaluate the OCPP 2.0.1 communication platform according to specific key performance indicators complying with industry standards. The project

team will test and evaluate the enhanced multi-charger communication platforms developed in compliance with CFR680. The project team will test and evaluate the implementation of managed charging algorithms at USU's EVR facility. Additionally, the MC-Roadmap open-access software will be launched to survey the performance of the REVIVE-MC software. The software simulation will include real scenarios where the user can select their location, time of day, starting SoC, vehicle information, and desired charging session option through the PowerPick interface. The simulation will present the user with a real-time response.
Subtask 3.1.1: Testing the upgraded communication platform
Subtask 3.1.2: Testing the optimized REVIVE-MC software at the EVR
Subtask 3.1.3: Launching the MC-Roadmap open-access simulation

Task 3.2: REVIVE-MC Full System Demonstrations
Details: The project team will implement the optimized managed charging system and run a 3-month demonstration for the managed charging system at the demonstration sites. The project team will report on test data from the demonstration sites in accordance with the data management plan. Software updates will be finalized for the REVIVE-MC software based on the demonstration results.
Subtask 3.2.1: REVIVE-MC system implementation at demonstration sites
Subtask 3.2.2: REVIVE-MC testing and demonstrations
Subtask 3.2.3: Data review from demonstration sites
Subtask 3.2.4: Evaluate the performance of reliability enhancements
Subtask 3.2.5: Compile demonstrations results and corrective measures
Subtask 3.2.6: REVIVE-MC software updates based on demonstration results

Task 3.3: Open-Source Plan Execution
Details: During this task, the project team will finalize and launch the open-source platform in accordance with the open-source distribution plan. The team will transfer knowledge and specify the managed charging optimization model. Software will be distributed in accordance with the open-source distribution plan. Knowledge transfer processes for the ecosystem maintenance recommendations will be developed and made available.
Subtask 3.3.1: Identify open-source platform of distribution
Subtask 3.3.2: Software distribution for the PowerPick interface
Subtask 3.3.3: Knowledge dissemination on dynamic pricing recommendations
Subtask 3.3.4: Knowledge dissemination on ecosystem maintenance recommendations

Task 3.4: REVIVE-MC Managed Charging Deployments
Details: For the final task, the team will conduct the final software implementation and testing for the REVIVE-MC software. Wide-scale deployments will take place in Urban Level2@Scale locations housing over 170 level-2 chargers across residential and commercial spaces and at fleet operations sites within the City of Portland that participate in PacifiCorp's fleet make ready pilot program.

<u>Subtask 3.4.1</u>: Final REVIVE-MC software implementation and testing
<u>Subtask 3.4.2</u>: Wide-scale deployments of REVIVE-MC in Urban Level2@Scale locations
<u>Subtask 3.4.3</u>: Wide-scale deployments of REVIVE-MC in the City of Portland

3.5. Milestone Summary

Milestone Title	Task	Type	Description	Q
Project Management Plan (PMP) Submission	M1.1	Technical	Submission of the Project Management Plan detailing scope, schedule, budget, and risk management.	Q1
Kickoff Meeting Summary Report	M1.2	Technical	Summary report of the kickoff meeting with DOE, outlining key decisions and next steps.	Q1
Data Management Platform Development	M2.1	Technical	Launch of the data management platform for project partners.	Q1
Data Compilation and Analysis Report	M2.2	Technical	Report on EVSE fleet charging, public transit routes, and grid health data.	Q1
Managed Charging Optimizer Development	M2.3	Technical	Development of the final optimized model for charge management.	Q2
Battery Energy Storage Systems Installation Report	M2.4	Technical	Report on the installation of battery energy storage systems.	Q2
Dynamic Pricing Model Development	M2.5	Technical	Report on upgraded dynamic pricing models.	Q2
Ecosystem Reliability Protocol Development	M2.6	Technical	Deliver a standardized protocol for maintaining the connectivity and reliability of the charging ecosystem	Q3
Consensus Report on Open-Source Standard	M2.7	Technical	Consensus report on the chosen open-source protocol.	Q4
Managed Charging Software Development and Connectivity Testing	M2.8	Go/No Go	Report on the development and updates of the managed charging software and connectivity demonstration.	Q4
Test Reporting on the REVIVE-MC software at the EVR	M3.1	Technical	Consolidated report on the testing of communication platforms and managed at the EVR during the early stages of testing.	Q5
MC-Roadmap Open-Access Simulation Report	M3.2	Technical	Report on the development and updates of the managed charging software and open-source platform launch.	Q6
Model and Protocol Transfer Report	M3.3	Technical	Report on the transfer of optimization models and maintenance protocols to open-source software.	Q7

Dissemination and Engagement Report	M3.4	Technical	Comprehensive plan and execution report on disseminating project findings and engaging with key stakeholders.	Q7
Comprehensive Testing and Demonstrations Report	M3.5	Technical	Consolidated report on the testing of communication platforms and managed at the demonstration sites.	Q7
End of Project Goal: Deployment Readiness	M3.6	Go/No Go	Assessment of the system's readiness for wide-scale deployment, based on efficiency, stability improvements, and interoperability with open-source standards. Required metrics: 90% operational efficiency and demonstrated improvements in grid stability.	Q8

3.6. Go/No-Go Decision Points

Go/No-Go	Budget Period	Description
Managed Charging Software Development and Connectivity Testing	Year 1	Completion of planning tasks. Metrics: 90% of EVSE data collected, dynamic pricing models developed, and 80% battery energy storage systems deployed.
End of Project Goal: Deployment Readiness	Year 2	Assessment of the system's readiness for wide-scale deployment, based on efficiency, stability improvements, and interoperability with open-source standards. Required metrics: 90% operational efficiency and demonstrated improvements in grid stability.

3.7. End of Project Goal

End of Project Goal	Type	Description
End of Project Goal: Deployment Readiness	Go/No Go	Assessment of system's readiness for wide-scale deployment, based on efficiency, stability improvements, and interoperability with open-source standards. Required metrics: 90% operational efficiency and demonstrated improvements in grid stability.

3.8. Project Data

Collected Data: At the beginning of the project, data will be compiled on grid infrastructure health, the utilization and performance of light-duty and transportation electric vehicles, the utilization and performance of electric vehicle supply equipment, and the performance of existing grid optimization models. During the length of the project, data will be collected from the same sources to evaluate the success of the proposed work.

Data Management: A data management platform will be evaluated and developed based on the following criteria: collection and organization capabilities, data security, and analysis and storage bandwidth.

Data Sharing: Data sharing among the project partners will be conducted using the developed platform. External data sharing will be conducted in accordance with DOE Requirements and Guidance for Digital Research Data Management.

3.9. Project Management and Controls

PacifiCorp is the applicant and Principal Investigator and will be responsible for overall technical direction, project management, and successful completion of all milestones and end-of-project goals. The project team is organized into three core groups: A, B, and C. Partners within the core groups are responsible for their respective tasks according to the SOPO, with the leads indicated for each partner. As shown in the project management architecture figure, there will be active collaboration between the core groups to ensure the successful completion of tasks and interdependencies and hand-offs between the groups.

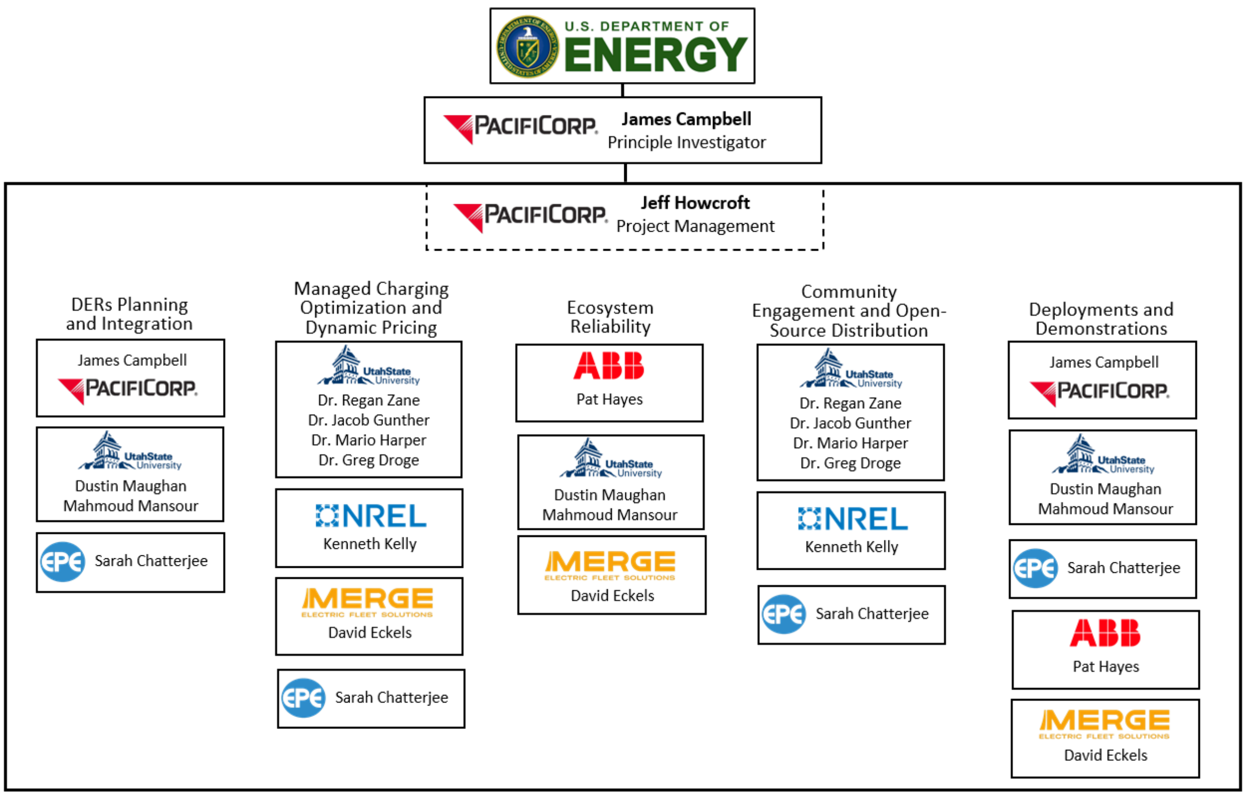


Figure 5 Project Management Architecture

3.10. Project Resources

1. **Testing Facilities**: EVR. The Electric Vehicle and Roadway research facility and test track includes a 23,000 sq ft systems integration lab with a quarter mile test track. The EVR is an ideal facility for testing the technologies to be deployed in this project. By 2025, the EVR will

be home to a megawatt stationary wireless charger, 1+ MWh battery energy storage, 1.2 MW DC supply capability, nine level-2 chargers, a 350 kW ABB Terra HP charger, and multiple dynamic charging installations from commercial partners.

2. **Demonstration Sites**: The West Valley Central Station and Millcreek Park & Ride will serve as the two demonstration sites.
3. **Deployment Sites**: Urban Level2@Scale provides access to over 170 level-2 networked EV chargers that are installed in a variety of customer locations including multifamily mixed-income, workplace, light industrial, transit, and public charging facilities. Sites within Portland that have participated in the PacifiCorp Fleet Make Ready Program.

3.11. Buy America Requirements for Infrastructure Projects

The REVIVE project will comply with the Buy America requirements if the DOE Program Manager determines that it is necessary.

Additionally, it is anticipated that the Battery Energy Storage Systems purchased during the length of this project will comply with the Buy America requirements.

4. Project Team and Qualifications

PacifiCorp

PacifiCorp has more than 100 years of experience in the energy transport business and the unique opportunity to provide service to customers in six states, which requires constant coordination with multiple stakeholders. By working across a large geographical area, the company is able to take best practices from one area and deploy the benefit of that knowledge to all customers it services. For example, the company recently led the successful WestSmart EV: Western Smart Plug-in Electric Vehicle Community Partnership (Award: DE-EE0007997), in which charging infrastructure and smart mobility were expanded in the region including the first full electrification of the I-15 corridor through Utah and a growth rate of EV adoption of 400% and more recently with the WestSmart@Scale: Western Smart Regional EV Adoption and Infrastructure at Scale (Award DE-EE0009224).

PacifiCorp can also evaluate and establish technology transition criteria for various geographic areas. When the company was evaluating the integration of advanced meters, there were two different technology platforms to evaluate automated meter reading (AMR) or advanced metering infrastructure (AMI), respectively. The company established test criteria to identify the optimum platform and determined that a customer density of 150-300 customers per square mile with a minimum customer base of 250,000 customers drove company decision makers to an AMR solution due to the large back-office cost of installing an AMI solution. Once 300 customers per square mile was surpassed, an AMI solution yielded greater benefit if a minimum population of 500,000 customers could be achieved. The Wasatch Front in Utah (Salt Lake City and surrounding areas within approximately 75 miles north and south) has 410,000 customers with a customer density of 218 customers per square mile. In contrast, the entire state of Wyoming has 315,000 customers with a density of 19 customers per square mile. By establishing these test criteria, the company provided its customers with the greatest benefit at the lowest cost.

These lessons learned from previous work in the region, including the instances of developing electric transportation advancements as well as test criteria and screening models, speak directly to the company's experience with region-specific challenges similar to the proposal's expansion and scaling of the regional electric vehicle ecosystem. PacifiCorp recognizes the importance of this project to its impact to EV infrastructure growth. Consequently, the company's President/CEO has directed that the Innovation and Sustainability Policy Director dedicate sufficient time and resources to serve as the principal investigator (PI) for the project. Further, the PI will be assisted in the task within the company by a Senior Engineering and Director of Engineering Standards who will spend between 5-10% of their time to make the project successful.

Utah State University and ASPIRE (Advancing Sustainability through Powered Infrastructure for Roadway Electrification)

USU's ASPIRE NSF Research Center has extensive experience leading, supporting, and deploying several EV infrastructure and integration programs funded through DOE. ASPIRE is led by Dr. Regan Zane, a senior professor/endowed chair in electrical engineering and the founding Director of the ASPIRE ERC, a center focused on charging infrastructure for EVs, funded by a $50M grant by NSF, and headquartered at USU with nine universities, more than 60 industry and innovation partners, and more than 250 participants. The center includes faculty across electrical, civil, and mechanical engineering as well as economics, marketing, and policy, all with research experience in sustainability and transportation related projects. Significant research projects currently in the ASPIRE portfolio relevant to the proposed project include a collaborative project with PacifiCorp and Utah Transit Authority to develop the machine learning based UTA Intermodal Hub charging management system as well as two currently DOE funded projects developing .5MW and full MW wireless power transfer for freight and port operations.

Unique Qualifications:

- **Experience and Resources:** The ASPIRE Center brings depth of experience across the entire EV ecosystem and will leverage existing partnerships with vehicle manufacturers, charging infrastructure, and other DER devices to deliver on the objectives of REVIVE. Key personnel on this project include ASPIRE's center director, a lead engineer, and four tenured professors with substantial experience in data management, machine learning and optimization, and software development.
- **Facility Access:** The Electric Vehicle and Roadway research facility and test track is a 22,000 sq ft systems integration facility with a quarter mile test track. The EVR is an ideal facility for testing the technologies to be deployed in this project. By 2025, the EVR will be home to a MW stationary wireless charger, 1 MWh Sonnen BESS, 1.2 MW DC supply capability, nine level-2 chargers, a 350 kW ABB Terra HP charger, and multiple dynamic charging installations from commercial partners. ASPIRE also has several pilot project deployments planned with the Utah Inland Port Authority (UIPA) which is being used as a testbed for electrified transportation technologies in Utah. UIPA is a state corporation dedicated to long-term economic growth and environmental benefits from improved freight logistics. The Utah Inland Port Authority (UIPA)'s jurisdictional area covers roughly 28,000 acres of land at Salt Lake

City's Western Edge. The area's location has prime access to highways (I-80, I-215), an international airport (Salt Lake City International Airport), and an extensive rail network (connecting to all West Coast seaports), with additional proximity to Salt Lake City's downtown, industrial, and manufacturing hubs. UIPA is partnered with USU/ASPIRE and PacifiCorp to develop electrification plans for the site, including partnership on the $20M Freight Logistics Electrification Demonstration (F-LED) project recently funded by the state.

National Renewable Energy Laboratory

NREL's in-use vehicle data tools include NREL's Transportation Secure Data Center (TSDC) and Fleet DNA: NREL data experts and engineers analyze large sets of complex transportation data. Housed at NREL, the Transportation Secure Data Center serves as a centralized repository of detailed transportation data from travel surveys and studies conducted across the nation. TSDC provides additional features such as linked reference layers, data filtering, road grade and road network matching, summary statistics, and data set comparisons. Fleet DNA database provides a comprehensive repository of commercial fleet transportation data. This tool assists in understanding duty cycles, energy demands, and travel patterns specific to M/HD vehicles, ensuring that charging networks are tailored to real-world operational needs.

NREL's unique capabilities in EV grid integration include a focus on Charge Management and Grid Integration. NREL's research focuses on developing advanced hardware and control solutions to integrate EVs with the grid. This includes:

- Accelerating EV integration into the utility grid
- Implementing resilient EV charging infrastructure for transportation decarbonization
- Validating EV integration solutions at NREL facilities
- Informing advanced vehicle and charging demonstrations to advance EV adoption at scale
- Identifying grid impacts of EV charging and developing new smart control solutions.

NREL's EVI-X modeling suite informs the planning and development of large-scale electric vehicle (EV) charging infrastructure deployments—from the regional, state, and national levels to site and facility operations.

NREL's high-performance computing resources, exemplified by the "Kestrel" HPC system, enable sophisticated data analysis and simulation. This capability is critical for optimizing vehicle performance and infrastructure planning. NREL applies powerful data mining techniques to evaluate on-road vehicle performance statistics from millions of miles of vehicle data combined with geographic information systems (GIS) data. This analysis informs infrastructure planning by identifying optimal locations and configurations for charging stations. High-performance simulations allow NREL to model complex interactions between vehicles, charging infrastructure, and the grid, ensuring that planned systems are robust, efficient, and future proof.

Electrify America
Electrify America is the leader in electric vehicle charging infrastructure, Electrify America brings unparalleled experience and expertise to the EV space. With over 3,650 DC fast chargers installed at 833 locations across 46 states and the District of Columbia, they operate the nation's largest open network of DCFCs. Their commitment to high-speed charging is evident, with 89% of our stations meeting NEVI standards for high-capacity chargers.

Electrify America has been recognized for its reliability, winning the "EV Charging Infrastructure Best-in-Test" awards from umlaut in both 2020 and 2021. Their Gen 4 equipment boasts an average uptime of 98%, ensuring dependable service for customers. Founded by Volkswagen Group of America, Electrify America is investing $2 billion over ten years in Zero Emission Vehicle (ZEV) infrastructure and education. This initiative supports the mission to promote widespread EV adoption through robust infrastructure and strategic partnerships.

Unique Value:

- Extensive Experience: Leading the industry with over 3,650 DC fast chargers deployed nationwide.
- Commitment to Reliability: Consistently high uptime rates, averaging 98% for Gen 4 equipment.
- Industry Recognition: Awarded "EV Charging Infrastructure Best-in-Test" in 2020 and 2021.
- Strong Mission: Established by Volkswagen to invest $2 billion in ZEV infrastructure, driving EV adoption and innovation.
- Widespread Coverage: Operating in 46 states and the District of Columbia, providing broad access to high-speed charging.

Electrify America is dedicated to supporting the growth of electric vehicles by providing reliable, high-speed charging solutions that meet the needs of today's EV drivers.

Electric Power Engineers
EPE is a prominent consulting firm established in 1968 and a pioneer in electricity network planning. EPE places particular emphasis on being an industry leader in providing a holistic approach to enable a clean energy transition and build the grid of the future. With over 250 team members, EPE has extensive experience in distribution system planning, electrification, demand flexibility, customer program design and implementation, DER integration and interconnection studies and analysis, power system modeling, distribution automation, electrification, grid modernization, advanced software solutions for energy intelligence focused on enhancing smarter grid planning and operations, and power system design. Our expertise is extensive in the ERCOT, SPP, WECC, MISO, CAISO, PJM, ISO-NE, NYISO, and Southeast markets. For more than 50 years, EPE has delivered engineering services solutions to a diverse range of clients including Municipalities, IOUs, and Cooperatives across the US. Recognizing the significance of technological advancements, EPE is committed to facilitating the energy transition.

Unique Value:

- Our team boasts of a combined 50+ years of experience in this field, with each member bringing a unique skill set and knowledge.
- Our team consists of expert power systems engineers, data scientists, researchers, leading cloud-based software architects, designers, and coders, specializing in power system planning studies and analysis, distribution system modeling, DER integration and interconnection studies, reliability studies and analysis, distribution system program design and implementation, protection and control studies, transient and dynamic studies, and distribution system design.
- EPE can capitalize on its extensive team of **250+** system planning engineers and subject matter experts, ensuring continuous support. This positions us strategically to assist with future growth plans and to adapt to changes in the energy system planning industry, particularly those tied to the local landscape.
- In the past five years, EPE has executed more than 15,000 engineering services projects.
- EPE currently serves numerous ISO/RTOs, investor-owned utilities, municipalities, and cooperatives across North America.
- EPE is deeply committed to fostering equity, diversity and inclusion, which are core policy principles that are reflected in our business. EPE is committed to operating in accordance with all applicable human right legislation and providing equal opportunity without discrimination.
- EPEs hiring practices seek a diverse range of talents and perspectives, as can be demonstrated in the makeup of our staff, representing a rich tapestry of backgrounds and experiences. We believe that a diverse workforce fosters innovative thinking and reflects the varied needs of the communities we serve.
- EPE is also a member of several organizations supporting the advancement of diverse groups in the energy industry, such as the Association of Women in Energy (AWE) and Women of Renewable Industries and Sustainable Energy (WRISE).

Merge Fleet Solutions

As a team with over 60 years of combined experience designing and deploying solutions in the electric vehicle space, and 100 years of combined experience in the energy and utility sectors, Merge is uniquely qualified to perform this work at the highest level of quality. Our team is comprised of EV experts, data specialists, and infrastructure professionals who have planned and deployed some of the largest networks of DC fast charging and Level 2 charging equipment in the US. In our experience, fleet electrification is a complex process for most agencies and organizations. We believe the Merge team's extensive real-world experience in planning, deployment, and operations, when applied together with detailed data analytics, results in comprehensive and executable implementation plans adaptive to contingencies which other providers may overlook.

Merge's team comprises long-tenured experts in vehicle electrification who have spent the last 15 years assessing, planning and implementing some of the largest projects in the EV space. No other provider is as experienced or knowledgeable when it comes to electric vehicles, electric vehicle charging technology, and charging infrastructure deployment and operations.

Our team is well known and respected in the EV industry for our collaboration with companies and agencies on their electrification efforts. In addition, we have key partners supporting our work, including Sawatch Labs, the industry leader in telematics analytics, and 3Degrees, a specialized provider of climate-related services to utilities and organizations across the United States and internationally.

Unique Value:

- A highly experienced team 100% dedicated to fleet electrification
- Access to a full spectrum of services including fleet assessments, replacement vehicle identification, infrastructure assessments and gap analysis, cost development, master planning, implementation and financing
- Established relationships with leading partner organizations and subcontractors that allow our clients to have the highest level of success
- Dedicated resources on our team, allowing for maximum responsiveness and flexibility our client's unique needs
- Client service excellence and a partnership approach to electrification planning projects
- Over 1,500 charging sites planned, installed, and operated across the U.S.
- Deployment and operations in 40 states on both public sector and privately funded EV projects
- State-of-the-art, high-power DC fast charging station site design and installation around the country
- Extensive testing of each EV and charging platform we deploy for customers
- EV master planning, program design, and operational turnarounds

ABB

ABB is a global electrification and automation leader and has been developing electrification technology for 138 years, including over a decade of EV infrastructure deployment experience managed by our ABB E-mobility group. The E-mobility group within ABB has 1800+ employees globally and 250 here in the US. ABB recently expanded its US manufacturing footprint with investment in a new EV charger facility in South Carolina.

Unique Value:

- For already a decade ABB has led the global development of high-power charging technology for cars, buses and trucks, with 50,000 DC charging systems installed across 85 countries. For US transit agencies, ABB's installed base has >80MW combined capacity of power, 700 charging points installed across 60+ transit US transit agencies.
- Collaboration with vehicle makers, networks, software technologists, utilities and transit authorities for highest interoperability and best user experience is a core tenet of ABB's e-mobility mission.
- As a power electronics pioneer and grid systems innovator, ABB offers the most dependable, redundant and safe power conversion and electrification technology;

- ABB has Service organization that provide programs of training, spare parts, warranty services, annual preventive maintenance and Service Level agreements to provide the highest operational uptime to meet customer requirements.
- ABB has rigorous company-wide mandates for manufacturing excellence, environmental stewardship, responsible sourcing, occupational health and safety as well as a culture of integrity.

Appendix 5

Project Description: SuperCharge

Introduction

The purpose of this innovation project is to develop and demonstrate utility integration of megawatt-scale charging with on-site battery energy storage to support Utah local and regional freight movement. The project includes a field demonstration and evaluation at the Utah Inland Port (UIP) site in Salt Lake City. The site will be further expanded post-project through additional federal funding into a commercial multi-megawatt charging service site for drayage and short and regional haul freight that operates near the port. The technologies developed and demonstrated will inform the utility, site operators, charging providers, and fleet owners and operators on best practices for deploying and operating infrastructure and electrifying medium- and heavy-duty vehicles (MHDVs).

The expanded demonstration plan for the site by 2030 includes a max concurrent charging capability of approximately nine megawatts (MWs) and a total installed EV charger equipment of 12 MW, while drawing less than 4.5 MW from the grid. This will be realized using an innovative architecture that cost effectively combines existing AC charging and distribution infrastructure with emerging solid-state DC distribution, distributed energy resources (DERs), and MW-class charging. The site will be the first to demonstrate standards-based interoperability among suppliers and vehicle OEMs for CharIN compatible MW-class plug-in charging and SAE J2954-2 compatible MW-class static wireless charging. The site will include charge management system aimed to optimize energy usage, reduce peak demand and provide grid services, manage scheduling, and enhance the overall efficiency of truck charging infrastructure.

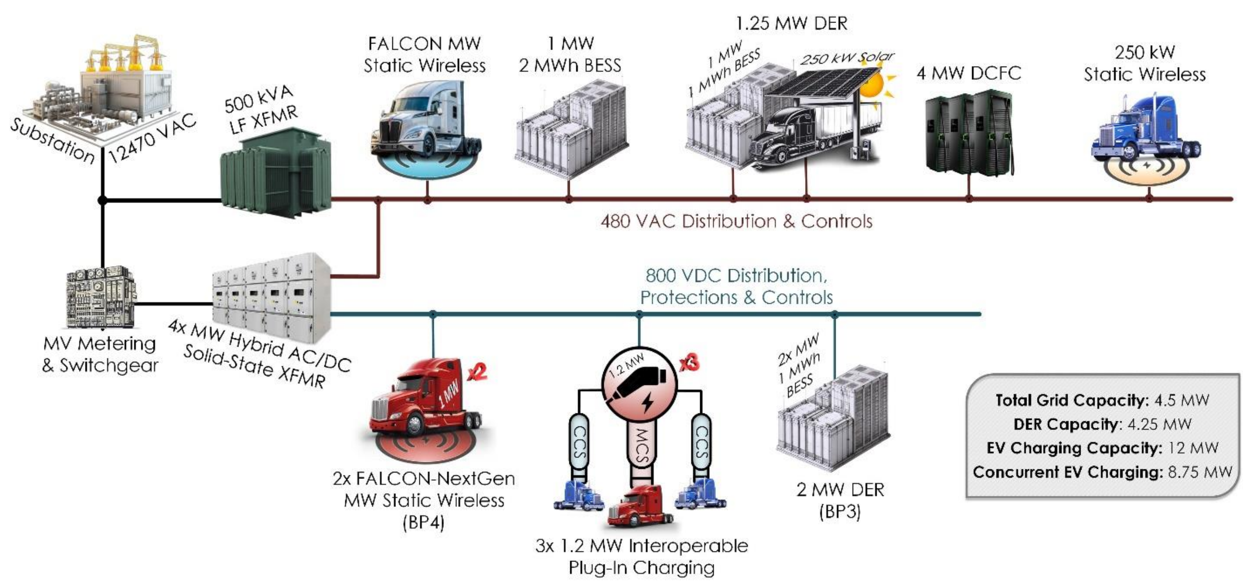


Figure 1. Expanded plans for a multi-MW commercial deployment at the UIP site

This project will focus on developing, deploying and evaluating a scaled version of the expanded system at the site to help inform plans for the expanded site. The scaled system will include a 1 MW wireless charger for an all-electric Class-8 truck, a stationary 2 MWh, 1 MW battery, and an intelligent on-site energy management system. The first-in-the-world demonstration of wireless charging at MW-scale will significantly improve the operational logistics for fleet operators and support accelerated adoption of electrified systems. The integration of local energy storage and intelligent grid communications and control will enhance the system's ability to accommodate high-power charging demands without overloading the grid. The project aims to develop scalable charging solutions that can be replicated at sites throughout the state.

Project Justification and Background

The transition to battery-electric MHDVs requires innovative charging solutions that address the challenges of high-power demand, grid limitations, and operational efficiency. The UIP site will address critical challenges posed by high-power charging requirements and limited grid capacity as traditional grid upgrades can be costly and time-consuming, creating a significant barrier to the widespread deployment of electric truck fleets. The integration of an advanced charge management system would offer an essential intermediate solution to optimize energy use and defer substantial infrastructure investments.

A key innovation of this project is the MW wireless charger, which will enable efficient, high-power charging while improving operational flexibility for fleet operators. Coupled with a 1 MW / 2 MWh stationary battery system, the site will demonstrate how local energy storage can mitigate peak demand and enhance grid stability for constrained circuits.

A successful charge management demonstration of the MW wireless charger will not only support the immediate needs of electric truck fleets but also serve as a steppingstone for the expanded charging services development and constrained sites throughout the state, further underscoring the value of intelligent charge management to the future of utility managed sites supporting zero-emission freight transportation.

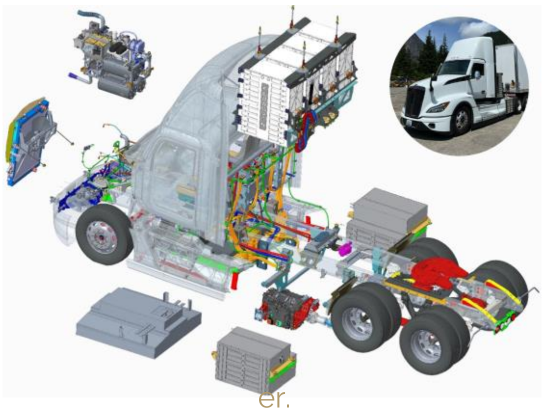
Technology Summary

The development of a megawatt-class (MW) wireless charging system is pivotal for advancing the electrification of heavy-duty transportation, particularly for Class 6-8 trucks engaged in rigorous freight operations. This project aims to demonstrate the practicality of battery-electric tractor-trailers in daily commercial operations, achieving 400 miles per day across two shifts, encompassing both intercity and regional freight hauling. A critical component of this initiative is the deployment of two 1-megawatt (MW) wireless charging systems, designed to seamlessly integrate into normal delivery operations without causing significant disruptions.

MW-Wireless Charger Subsystems and Deliverables

- **Prototype HD-BEV Tractor:** Development and demonstration of a heavy-duty battery-electric vehicle (HD-BEV) tractor with a minimum range of 170 miles per charge.
- **1-Megawatt Wireless Charging Systems:** Implementation and testing of two 1-MW wireless charging stations to evaluate their effectiveness in real-world freight operations.

- **Operational Integration:** Ensuring that the deployment of these charging systems supports normal delivery operations through a pilot demonstration period, thereby validating the feasibility of integrating high-power wireless charging into existing logistics frameworks.



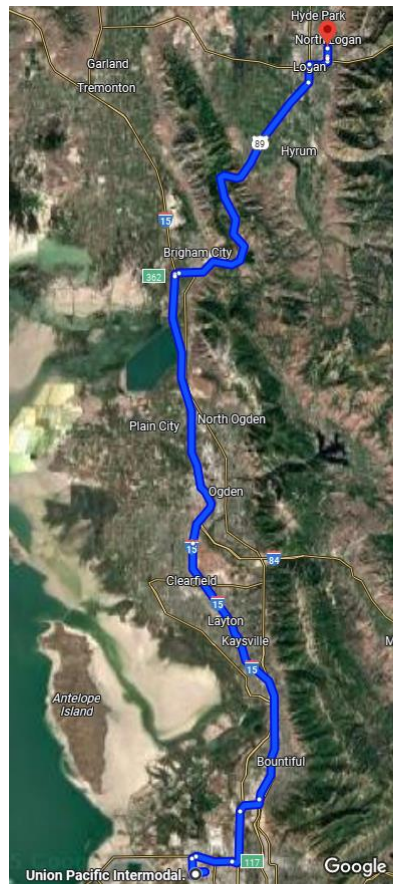
er.

Technical Challenges and Innovations for the MW Wireless Charger

1. **High-Power Delivery and Thermal Management:** Transmitting power at the megawatt level necessitates advanced thermal management strategies to dissipate heat effectively and maintain system reliability.
2. **Safety and Electromagnetic Field Exposure:** Limiting leakage fields to less than 15 µTrms is vital to ensure safety and compliance with health standards. This requires careful

electromagnetic field management to protect both operators and nearby electronic equipment from potential interference or exposure. The system must comply with stringent EMC standards to prevent such interference. The ANSI/AAMI/ISO 14117 standard provides comprehensive test methodologies for evaluating the electromagnetic compatibility of active implantable medical devices. While this standard is primarily focused on medical devices, its rigorous EMC protocols can inform the development of wireless charging systems to ensure they do not interfere with sensitive equipment.

3. **Efficiency and Power Conversion:** Achieving an efficiency greater than 90% is critical to minimize energy losses during the wireless power transfer process. This involves optimizing power electronics and coil designs to reduce resistive losses and enhance coupling efficiency.
4. **Alignment and Air Gap Management:** Maintaining a magnetic gap of 22.5 cm and an air gap of 18 cm between the charging pad and the vehicle's receiver coil is essential for efficient power transfer. Precision in vehicle positioning and robust coil design are necessary to accommodate these parameters without compromising performance.



Pilot Demonstration and Site Specifications

This project will further progress demonstration capabilities with two MW Wireless chargers to be installed at the Salt Lake City Utah In-land Port (UIP) and the Electric Vehicle and Roadway (EVR) facility at Utah State University in Logan as shown in Figure X. The two charger locations will serve multiple daily routes with significant elevation change and cold climates including:

- SLC to Logan, UT (193 miles)
- SLC to Orem, UT (187 miles)

The EVR is a 22,000 sq ft systems integration facility with a quarter mile test track. During the MW pilot demonstration period, the EVR will house the MW stationary wireless charger, 1.25 MW battery energy storage systems, 1.2 MW DC supply capability, nine level-2 chargers, a 350 kW ABB Terra HP charger, and multiple dynamic charging installations from commercial entities.

The UIP site location has prime access to highways (I-80, I-215), an international airport (Salt Lake City International Airport), and an extensive rail network (connecting to all West Coast seaports), with additional proximity to Salt Lake City's downtown, industrial, and manufacturing hubs. During the MW pilot demonstration period, the UIP will house the MW stationary wireless charger and a 2-MWh 1-MW battery energy storage system (BESS) supported by a 500-kW grid interconnection.

Demonstrating this technology in a real-world configuration with a constrained grid circuit is critical to validating its feasibility and scalability. The UIP's grid limitations and combination of high-power battery and charging loads create an ideal testbed for evaluating system performance, grid protections, and operational efficiencies under practical conditions. By leveraging a battery system with greater power capabilities than the grid interconnection, this project will assess the effectiveness of energy buffering, peak load management, and system reliability for MW-scale charging. The findings from this demonstration will provide a blueprint for deploying BESS solutions statewide, particularly in areas facing grid constraints, ensuring scalable and resilient infrastructure for future zero-emission freight corridors.

Energy Management and Grid Integration

One of the primary objectives for this innovation proposal is to develop and implement an advanced charge management system for truck charging at the Multi-Megawatt site at UIP. This system will optimize energy usage and ensure security for high-performance truck charging.

The implemented charge management system will include the following key specifications and capabilities:

Integration with Fleet and Grid Services

- Facility-wide energy management tools linked with fleet management systems and utility-operated grid services.
- Coordination of distributed energy resources (DERs) to schedule fleet charging based on operational demands and grid constraints.
- Utilization of localized demand response and regional virtual power plant (VPP) capabilities for load balancing.

Standardized Communication Protocols

- Open Charge Point Protocol (OCPP 2.0.1) for seamless communication between charging stations and the central management system.
- Utility aggregator interfaces supporting OpenADR 3.0 and IEEE 2030.5 for grid service compatibility and dynamic load balancing.

Multi-Charger Control and Power Distribution

- Compliance with CFR680 standards for multi-charger control.
- Real-time peak load modeling and adaptive demand management for optimized power distribution.
- Site-level control algorithms supporting both existing commercial technologies and new technology solutions, enabling phased deployment for the expanded commercial site.

Data Protection for Reliable Communication & Session Management

- System audits and advanced security controls for data protection and operational reliability.

- Reliable communication and tracking system for vehicle monitoring and session scheduling.
- Vehicle communication capabilities within a 2-mile radius, enabling real-time instructions for efficient traffic control and reduced wait times.

Project development

The development of the MW charger demonstration and the charge management for truck charging system will be conducted in a series of structured phases:

Phase 1: MW Charger and EMS Development

- Charger Design & Engineering:
  - Finalize MW wireless charging system assembly, including power electronics and wireless charging pads
  - Rigorous testing to efficient and thermally stable operations as well as compliance with ANSI 14117 standards for electromagnetic field safety.
- Energy Management System (EMS) Development:
  - Design an advanced EMS capable of real-time load balancing, predictive analytics, and dynamic charge scheduling.
  - Implement interoperability with Open Charge Point Protocol (OCPP 2.0.1), OpenADR 3.0, and IEEE 2030.5 for seamless grid integration.
- Grid and Power Flow Analysis:
  - Assess the grid capacity at deployment sites and conduct impact studies for high-power wireless charging.
  - Define strategies for coordinating distributed energy resources (DERs) and optimizing battery energy storage (BESS) utilization.

Phase 2: Site Deployment and System Integration

- Infrastructure Preparation & Installation:
  - Deploy MW wireless chargers at the Utah Inland Port (UIP) and the Electric Vehicle and Roadway (EVR) facility.
  - Install BESS solutions (2 MWh at UIP, 1.25 MWh at EVR) to buffer grid limitations and enhance charging reliability.
- System Integration & Testing:
  - Validate EMS functionality with multi-charger control, fleet coordination, and real-time grid response.
  - Conduct interoperability testing with Class 8 battery-electric trucks and assess power transfer efficiency, alignment accuracy, and safety measures.

Phase 3: Pilot Demonstration & Performance Validation

- Real-World Freight Operations Testing:
  - Execute the pilot demonstration across designated freight routes, evaluating daily charging cycles and operational feasibility.
  - Monitor system performance under elevation changes, cold weather conditions, and high-frequency usage scenarios.
- Grid and Energy Optimization Analysis:
  - Measure the effectiveness of BESS in managing peak loads and reducing grid impact.
  - Analyze EMS performance in dynamically optimizing charge schedules and energy allocation.
- Data Collection & System Refinement:
  - Assess key performance metrics such as charging efficiency, energy throughput, cost-effectiveness, and vehicle turnaround times.
  - Implement refinements and optimizations based on real-world data before scaling deployment across additional freight corridors.

Project Schedule

MILESTONE	START	FINISH
Grid capacity and connection evaluation, design, and optimization for the UIP Site	06/05/25	08/19/25
Finalize the two MW wireless charging system assemblies	06/05/25	09/18/25
Early Pilot Demonstration (3-Months)	09/18/25	12/18/25
Upgrade testing and demonstration platforms to OCPP 2.0.1 and test at the EVR	01/05/26	07/21/26
Ensure multi-charger control for CFR680 compliance and test protocol at the EVR	08/24/26	11/18/26
Upgrade utility aggregator interface to OpenADR 3.0 or IEEE 2030.5	08/21/26	01/30/27
Implement hardware and software upgrades for fleet management & scheduling	02/05/27	05/25/27
Test the upgraded communication platforms	06/28/27	08/19/27
Model peak load scenarios based on projected usage patterns	08/28/27	09/18/27
Develop algorithms to manage demand across multiple charging stations	09/20/27	11/26/27
Evaluate interoperability with smart grids to allow dynamic load balancing	11/29/27	1/14/27

Perform Final HiL testing and demonstration at the USU EVR facility	1/17/28	2/25/28
Monitor system load continuously and optimize demand management	2/28/28	03/24/28
Finalize and implement site energy management algorithms	03/27/28	04/05/28
Installation of the final charge management system at UIP	04/07/28	04/18/28
Onsite commissioning and testing of the final charge management system at UIP	04/19/28	04/26/28
On-site demonstration of the charge management system	05/02/28	05/07/28
Data collection and operations evaluation	05/10/28	06/09/28
Final report and analysis	06/10/28	06/17/28

Appendix 6

Project Description: Intelligent Integration of Electric Vehicles and Buildings for a Campus with Innovative Cyber Security and Data Privacy Solutions

1.0 Introduction

Background: Electrification is recognized as a key solution to reduce air pollution from the transportation and buildings sectors. Several modes of transportation, including public, passenger, trucking and ride-hailing systems, have been transitioning to electric. Sustainable growth in electric vehicles (EV) adoption, however, requires robust EV charging infrastructure that not only meets current EV charging demand, but also motivates growth in adoption. Many argue that the lack of ubiquitous EV charging infrastructure and the range anxiety that it may cause remains a primary barrier to EV adoption. In addition, recent advancements in long-range battery electric bus (BEB) technologies and development of associated charging infrastructure has made electrification of public transit systems a reality in urban areas. Further, adoption of self-driving functions in EVs would enable the utilization of autonomous electric vehicles (AEVs), with various applications such as ride-hailing systems. In this paradigm, while autonomous electric ride-hailing systems (AERS) will oversee routing the vehicles to serve the transit demand, they would need to rely on the power distribution systems to charge AEV batteries and ensure the availability of charge to serve the customers.

Turning Challenge into Opportunity: A reliable and resilient charging infrastructure for electric transportation requires access to reliable electricity service from the power grid. While the power grid in many areas is designed to provide the capacity required for even higher levels of adoption, the general load growth has made the efficient and intelligent utilization of power grid infrastructure a priority for utility companies and end users. This has sparked a wave of new technologies and solutions to make the end-users or “grid edge” more intelligent and responsive to the grid conditions. In this paradigm, the emerging loads, such as charging infrastructure, is not only not seen as a challenge for the grid, but as an opportunity and additional sources of flexibility to balance the fluctuations and provide grid services through intelligent control. In smaller power grid setups, such as campuses (e.g., university campuses, industrial campuses, large mixed-zone developments), the concept of “connected communities” has emerged as a viable solution to intelligently manage the load to balance the generation to avoid costly over-designed infrastructure and potential upgrades. Connected communities refer to a group of grid-interactive efficient buildings (GEBs) with diverse, flexible end-use equipment and other distributed energy resources (DERs) that collectively work to maximize building, community, and grid efficiency while meeting the community's comfort and needs. While this is a promising concept, practical technological solutions that would deliver the intended results for the grid remains a challenge and gap to address. In addition, as EV charging technology continues to progress, it is imperative for utility companies stay current with the latest advances in vehicle and charging technologies, such as charging infrastructure supported by energy storage systems, smart charging, bidirectional charging and vehicle to grid (V2G) technologies, as well as charging requirements of autonomous vehicles.

Cyber security and data privacy issues: While smart charging solutions and management of connected communities provide benefits to the grid, they need to ensure data privacy of the stakeholders and avoid becoming a security loophole for the grid. A comprehensive and practical solution for EV charging management needs to ensure security against cyber threats and ensure the privacy of data for stakeholders involved. Innovative approaches such as Differential Privacy (DP) provides rigorous, mathematically provable privacy assurances. DP ensures, for a prescribed accuracy, that the inclusion or exclusion of any single individual's data in a dataset has a bounded probability of being detected by an adversary. By carefully introducing random noise into data or model updates prior to aggregation, DP defines a privacy-utility trade-off for algorithms operating on private data. That is higher privacy can be achieved by adding more noise which thus reduces accuracy. Furthermore, this approach prevents adversaries from confidently attributing data points or behaviors to specific individuals, thereby adding a robust additional layer of privacy protection to intelligent management algorithms.

1.1 Objectives and Scope

This innovation project will design the architecture necessary to monitor and control the available EV charging infrastructure integrated with DERs and AEVs in university and commercial campuses to provide services to the power grid. As shown in Fig. 1, the proposed architecture consists of a suite of systems and modules that leverage the available data from different devices, which is collected using secure communications. Deep packet inspection algorithms are then integrated to analyze the collected data to detect and mitigate potential malicious data manipulations. Additionally, data privacy mechanisms will be developed using federated learning-inspired techniques, enabling algorithms to process information directly on local devices when feasible. In these federated scenarios, differential privacy techniques will further safeguard sensitive information by providing provable guarantees against inference attacks. When local processing is impractical, centralized algorithms with integrated differential privacy methods will be employed to ensure robust privacy protection.

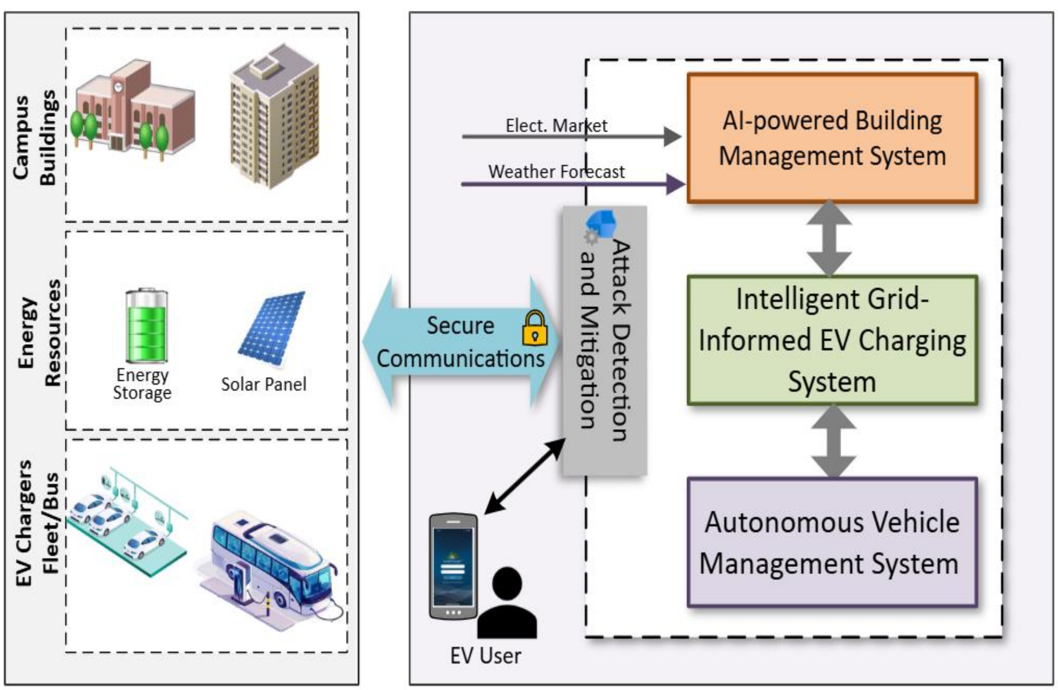


Figure 1. The architecture for secure integration of intelligent EV charging, building energy management, and autonomous vehicles management in university/commercial

2.0 Project Tasks

This project involves seven tasks that are described next.

Task 1. Intelligent Grid-Informed Charging of Electric Vehicles

This task starts with reviewing use cases of electric vehicle (EV) charging in university and commercial campuses, which includes workplace (office) charging, residential charging, fleet charging, and electric bus charging. This task will then design solutions for intelligent and grid-informed charging of EVs (e.g., charging control for circuits with limited capacity) for one-directional and bi-directional (e.g., vehicle-to-grid) modes of charging. In addition, this task will evaluate the current state of autonomous electric transportation technologies and the associated charging infrastructure, identify the gaps and limitations, and develop solutions and recommendations for charging of autonomous electric transportation modes.

Task 1.1. Assessment of the EV charging infrastructure on the university/commercial campus: This task will review the different characteristics, requirements, regulations, and challenges of the various types of EV charging infrastructure and users typically available on university campuses. The project team will focus on: i) workplace charging, which refers to the EV chargers located in office buildings or parking lots, ii) residential charging that consists of the EV chargers specifically available on dorms and university owned residential buildings, iii) fleet charging, which refers to EV chargers serving vehicles normally used for maintenance in the campus, and iv) electric bus charging, v) and autonomous electric vehicles (AEVs). The assessment will analyze the different circuits characteristics (e.g., conduit capacities, transformers ratings), determine optimal locations for massive EV charging infrastructure adoption, and determine the specific constraints that should be included in the intelligent EV charging system to minimize the installation costs.

Task 1.2. Design of the Intelligent Grid-Informed EV Charging System: The intelligent Grid-informed EV charging system will be designed to orchestrate the charging of the different types of vehicles to guarantee the user's needs are satisfied while minimizing the total cost of electricity in the campus. Each type of EV requires specific constraints. For instance, individual EV users may have more flexibility in their vehicle charging and not need to be fully charged quickly. However, fleets and buses may require to be constantly charged to keep operating. All these requirements are included in the EV charging system as well as specific spatio-temporal constraints related to bus routes and fleet schedules. Furthermore, the characteristics identified in Task 1.1 will be integrated to provide load sharing among EV chargers to maintain the limits of the lines and transformers.

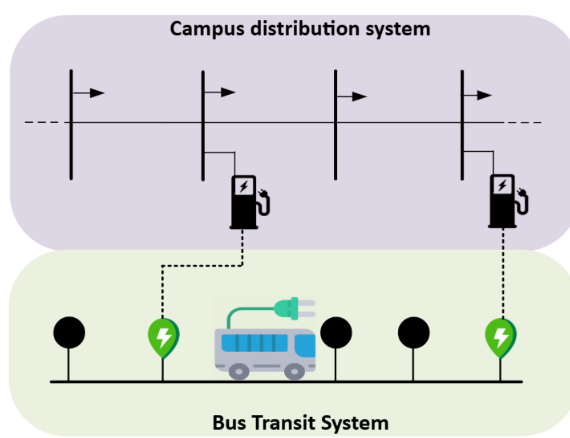


Figure 2: interdependence of electric bus charging system with power distribution system

Task 1.3. Integrate EV charging management system and autonomous electric transportation technologies: Recent advancements in the technology of self-driving EVs, also known as autonomous electric vehicles (AEVs), offer opportunities for coordinated bus or fleet dispatch that would mitigate spurious vehicle trips and provide a higher quality of services. Moreover, high penetration of AEVs enables mitigating human error and it is anticipated to reduce the operation cost of a vehicle by two to four times. Specifically for autonomous electric transportation providing services on campus, it is necessary to coordinate the AEVs operation to make sure routes are covered while some buses are charging. In addition, robust operation of AEV fleet or bus system is achieved by a meticulous vehicle charging and routing strategy. However, the AEVs charging requirement may cause congestion in power distribution lines and increase the line losses and bus voltage swings if proper coordination is not adopted. In this task, the EV charging system will be integrated with the autonomous vehicle management system to co-optimize the bus or fleet operation and charging simultaneously. More specifically, the spatio-temporal transit system components (i.e., roads, bus stations, electric buses, schedules) will be integrated into the intelligent grid-aware EV charging model to provide charging optimization while constraining their impact on the distribution network.

Task 2. Intelligent Management of Flexibility Resources to Provide Grid Services:
This task will design an intelligent system to manage the flexibility of resources in a campus, such as EV charging, DER (e.g. energy storage, solar) and grid-interactive buildings, to provide grid services (e.g., EIM, frequency regulation).

Task 2.1. Modeling the Interaction of EV charging Infrastructure, Distributed Energy Resources, and the Campus Distribution Network: This task will define a model that characterizes the intrinsic spatio-temporal interactions of the power grid when integrating EV charging infrastructure and DERs. The model will include the uncertainty induced by individual EV users and the weather dependence of some DERs using stochastic models. For instance, EV charging is a function of several parameters, all of which are stochastic in nature, such as the vehicle's daily travelled distance, charging start time, and the required energy. To account for uncertainty in the parameters, a stochastic model would be designed to simulate realistic vehicle arrival rates. The model will produce estimates of EV arrival patterns for both local and passing traffic, that could help inform the intelligent resource management system. In addition, the model will be designed to interact with the intelligent grid-informed EV charging system developed in Task 1 and enable the coordination of DERs, EVs, and AEVs.

Task 2.2. Intelligent Resource Management: This task will formulate the optimization problem to manage DERs along with EV chargers using the model defined in Task 2.1. The intelligent resource management will be designed to work in tandem with the grid-aware EV charging management system to provide services to the grid such as frequency regulation, peak load shaving, arbitrage, black start support, among others. The problem will also include topology reconfiguration, fault isolation, and potentially grid-forming/grid-following interactions to enable some areas of the campus to operate isolated from the power grid. Given the stochastic nature of the problem and the need to perform quick computations to address the changing environment (e.g., faults or attacks), a hybrid solution that integrates deep reinforcement learning (DRL) and optimization will be designed. One or more DRL agents are trained to control energy storage, EV charging/discharging, and other dispatchable resources while a reduced order optimization problem verifies the feasibility of the solution and reconfigure the distribution network (i.e., manage protection devices and tie switches) to respond to faults and even cyber-attacks. In this way it is possible to harness the benefits from both worlds, the speed of DRL with the mathematical rigor of optimization.

Task 3. Cybersecurity and Resilience: This task will identify the vulnerabilities of the EV charging and DER control infrastructure at the university and industrial campus used to provide grid services that could create grid instability, increase electricity prices, or even damage equipment. Along with the standard encryption and control flow techniques, autonomous software solutions using deep-packet inspection will be developed to detect and mitigate attacks in real-time. The architecture of the cybersecurity solution is shown in Fig. 3.

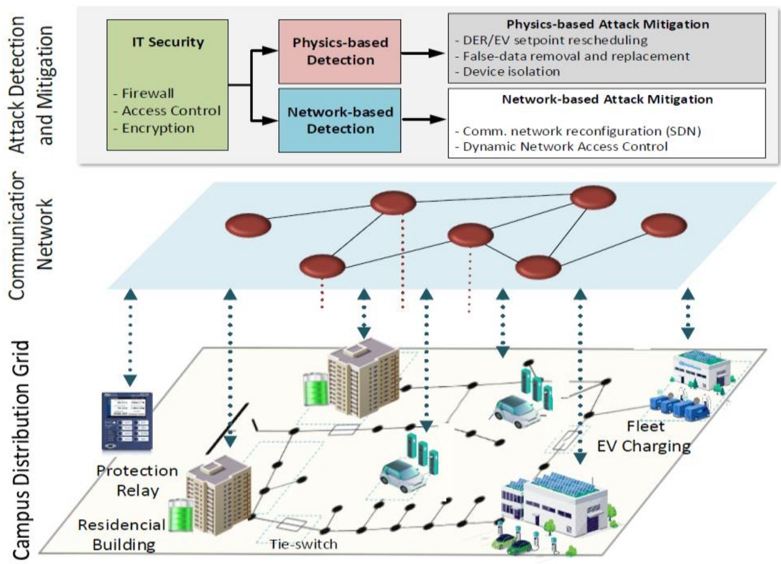


Figure 3: The architecture of the cyber-security solution

Task 3.1. Vulnerability Assessment Framework: This task involves a detailed characterization of the existing and future network infrastructure necessary to handle EV charging and energy flexibility, including the protocols that are mostly used in industry such as Modbus, DNP3, and OCPP. A vulnerability assessment will then identify the most common vulnerabilities in these protocols and the entire network architecture. Based on the assessment, the location of software-defined networking switches (SDN) will be defined to strengthen the network architecture and enable network-based attack mitigation strategies.

Task 3.2. AI-Powered Network-based Attack Detection and Mitigation: In this task, the project team will design novel algorithms that leverage the unique characteristics of the power system and EV charging network infrastructure. To this end, the data traffic will be analyzed using industrial tools such as Snort and Suricata to establish fundamental rules for the network traffic. Moreover, novel tools based on AI and machine learning will det ermine the presence of malicious agents that have gained access to the network and potentially manipulated some of the packets. These tools will leverage LSTM and other time-dependent machine learning tools to analyze the network patterns taking into consideration the intrinsic time-dependency of power systems. Attack mitigation strategies will be designed to modify aspects of the network using software-defined switches and dynamic network access control.

Task 3.3. AI-Powered Physics-based Attack Detection and Mitigation: Powerful attackers may be able to tailor their attack vector to avoid network-based detection. For this reason, physics-based attack detection will leverage our knowledge about the physical behavior of the power grid (e.g., Kirchoff laws that cannot be altered) to determine data manipulation. We will integrate these physical properties with machine learning algorithms to design physics-informed neural networks that can handle large amounts of data and detect cyber-attacks. Attack mitigation strategies will intend to isolate compromised devices and reschedule DERs and EV charging to mitigate the impact of these attacks.

Task 4 Integrating Data Privacy: Given the large amount of sensitive data required for effective grid services, the first step is to evaluate and define appropriate flows of information from data owners to the services. These information flows will be defined so that an individual's sensitive data is minimally disclosed while still offering effective grid-services (Task 4.1). Additionally, a data sharing pipeline will be developed to ensure provable privacy guarantees for sensitive information (Task 4.2). A key component of this pipeline is the design and implementation of algorithms that ensure almost all sensitive data and statistics are kept on device (Task 4.1) while providing privacy/utility guarantees for all shared information (Task 4.2).

Task 4.1 Data locality and device side computation: One strategy for enhancing data privacy is through data locality, where data remains exclusively on edge devices instead of being centralized. In this vein, unless strictly required by the nature of the algorithm, the previously developed algorithms will be evaluated for adaptation to a decentralized/federated setting. In such a setup, edge devices share only model parameters or derived data representations (such as embeddings) rather than raw local data. In the standard federated learning regime, each edge device updates a local model using its own data. These local models are then aggregated, via an aggregation server or consensus protocol, and the combined parameters are shared back with all devices. This approach means that the sensitive data never leaves the device which inherently provides some level of privacy.

Task 4.2 Differential Privacy: Relying solely on data locality in a federated environment is insufficient for guaranteeing privacy. It has been shown that federated algorithms are vulnerable to model inversion attacks, as parameters shared during aggregation can inadvertently reveal information about underlying local datasets used for training. To mitigate this vulnerability, differential privacy will be systematically incorporated into all previously developed algorithms. Differential privacy involves adding carefully calibrated noise to data or model parameters before they are shared or released, ensuring that an adversary cannot reliably infer whether any specific individual's data contributed to the aggregated information. When algorithms are deployed in federated settings, this privacy protection can be further enhanced, as the noise addition can be specifically tailored to the parameter space of the models, rather than the data, thus providing a superior privacy-utility trade off. See Figure 4 for a demonstration of how this might work in the context of EV charging.

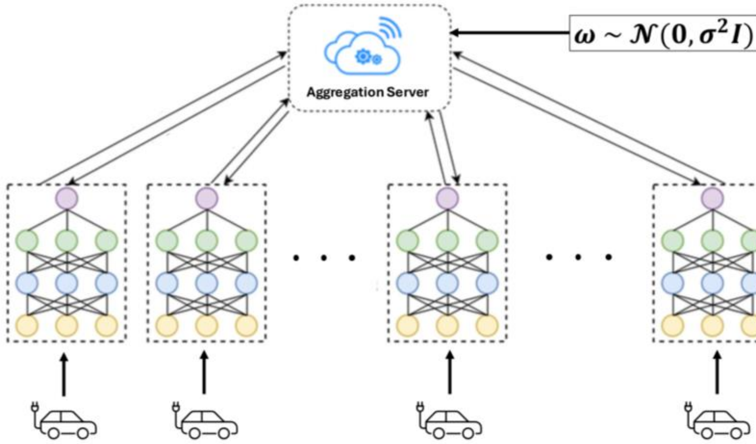


Figure 4: A demonstration of how a federated and Differentially Private algorithm might work in the case of EV charging. Each device/EV has its own model which is trained on local data. Then each device shares its model with an aggregation server which combines all the models and adds zero mean gaussian noise to satisfy the Differential Privacy guarantee prior sharing the new model with all devices.

Task 5 Implementation on University Campus Model: This task will simulate, test and verify the technologies and evaluate the impact on the select feeders University of Utah campus power distribution system model. This task will integrate the software solutions developed by Grid Elevated, as part of providing and integrating smart charging infrastructure in the campus.

Task 6 Evaluate and Inform Potential Infrastructure Investments at The Point: Using the models and assessment of the impacts of the technology at the University of Utah campus, the team will gather the lessons learned and will evaluate and inform the potential infrastructure investments for transportation electrification at The Point, an industrial/mixed-use campus.

Task 7 Project Management and Reporting: The project involves tracking progress and managing the successful completion of 6 major tasks that require project management and coordination between team members. This task involves managing the project and reporting the project progress to PacifiCorp.

3.0 Project Timeline

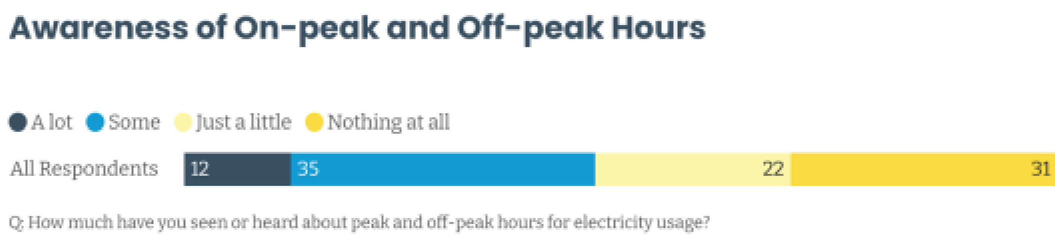
This is a 2-year project,

	Project Year	Year 1				Year 2			
	Task	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
1	**Intelligent Grid-Informed Charging of EV**								
1.1	Assessment of the EV charging infrastructure on the university campus:								
1.2	Design of the Intelligent Grid-Informed EV Charging System:								
1.3	Integrate EV charging management system and autonomous electric transportation technologies								
2	**Intelligent Management of Flexibility Resources to Provide Grid Services**								
2.1	Modeling the Interaction of EV charging Infrastructure, Distributed Energy Resources, and the Campus Distribution Network								
2.2	Intelligent Resource Management								
3	**Cybersecurity and Resilience**								
3.1	Vulnerability Assessment Framework								
3.2	AI-Powered Network-based Attack Detection and Mitigation								
3.3	AI-Powered Physics-based Attack Detection and Mitigation								
4	**Integrating Data Privacy**								
4.1	Data locality and device-side computation								
4.2	Differential privacy								
5	**Implementation on University of Utah Campus Model**								
6	**Evaluation at The Point**								
7	**Project Management and Reporting**			**D1**		**D2**		**D3**	**D4**

Appendix 7

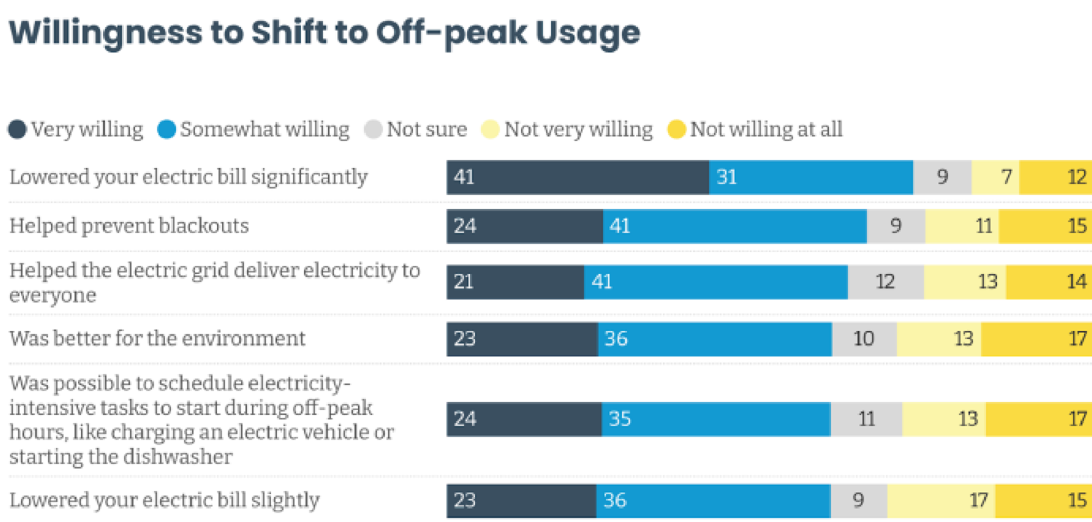
Project Summary

Utah residents are largely unaware of the benefits associated with Time of Use (TOU) and how to sign up for the rate. A recent study conducted by Elevate Strategies indicates 53% of customers have just a little or no awareness of on-peak and off-peak hours.



Additionally, customers while generally understand what “on-peak” and “off-peak” times mean, they do not make the connection to savings on their energy bill nor do they know when on-peak and off-peak hours occur.

Customers demonstrated a willingness to shift to off-peak usage, citing cost savings as the primary driver for behavior change:



This campaign is designed to increase awareness and drive interest to learn more. The TOU campaign will use a multi-channel strategy to engage customers and encourage them to learn more. Email and digital ads will point to a unique landing page on the Rocky Mountain Power website. The campaign will also utilize the established Wattsmart Wednesday partnership with Fox13 to extend the reach of the content.

Target Audience

The audience is limited to Utah Rocky Mountain Power residential customers.

Key Messaging

Key messaging will focus on cost savings and community benefits. From the research, these two topics stood out as the biggest drivers to switch to a Time of Use rate.

In addition, this campaign should help us answer:

- What is Time of Use?
- What are the benefits?
- How do I sign up?

Sample messaging

Price focused

The energy efficient habits you have now can help you save on your monthly bill. When you switch to the Time of Use program, you are charged a lower rate during off-peak times. Switch today and save. Visit RockyMountainPower.net to learn more.

It’s 6 p.m. – do you know if your dishwasher is running? If you decided to wait to run it until later, you could be saving money. Switch to the Time of Use program and enjoy a lower rate during off-peak hours. Visit RockyMountainPower.net to learn more.

Pay *less* to charge your EV at home! When you switch to the Time of Use program, you can charge your EV overnight at a lower rate. Visit RockyMountainPower.net to learn more.

Community focused

A simple switch can make a difference. When you reduce your energy consumption during peak usage times, you help keep prices among the nation’s lowest. Learn more about the Time of Use program at RockyMountainPower.net

Wait until eight! Utahns use the most energy during the hours of 4 to 8 p.m. When you wait to charge your EV, you reduce demand and help ensure that safe, reliable power is delivered to our entire community.

Timeline

Track 1-Company Driven

Phase One: Three months

- Content development
- Calendar planning
- Unique landing page on the Rocky Mountain Power website

Phase Two: Media placement

- Four weeks
    - Google Ads
    - Paid social

  Within the four-week run

  - Wattsmart Wednesday
    Wattsmart Wednesday is a media partnership with Fox13. Wattsmart messaging is the focus of the Fox13now.com website, along with in-content ads. A guest appearance on the midday show, The Place, will feature the Time of Use program, highlighting the benefits of the TOU program. In addition to the resources from Fox13, the company will
      - Email
        Email all Utah residential customers highlighting the TOU program.
      - The Place social media: The Place will highlight the TV appearance and drive customers to the unique landing page. Rocky Mountain Power pays for the content to be boosted, extending the reach of the content.
      - Organic: Rocky Mountain Power social media will repost from The Place, extending the content reach.

Track 2-Stakeholder Driven with Co-Branding

Phase One: Three months

- Stakeholder meeting to decide approach
- Content development
- Calendar planning
- Unique landing page on an independent website

Phase Two: Depends on Stakeholder approach

APPENDIX 8 WORKPAPERS WILL BE PROVIDED IN EXCEL FORMAT ONLY