MEMORANDUM

To: Professor Heather Hill
From: Group 6
Date: June 6, 2024
Subject: Final Evaluation for The National Electric Vehicle Infrastructure Formula Program

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PROGRAM BACKGROUND

On November 15, 2021, President Biden enacted the Bipartisan Infrastructure Act (BIL) to enhance U.S. electric vehicle (EV) charging infrastructure. The National Electric Vehicle Infrastructure (NEVI) Formula Program was launched under the BIL to expand Federal Highway Administration's (FHWA) comprehensive national network of EV charging stations. Specifically, the U.S. Department of Transportation (DOT) would distribute $5 billion (about $15 per person in the US) earmarked for the NEVI program to U.S states and territory stakeholders. The program would cover up to 80% of the costs associated with the hardware and installation of EV chargers[1].

By providing funding for fiscal years 2022 through 2026, states would develop the collection, accessibility, reliability of station data across the country, and deploy Alternative Fueling Corridors (AFC) / EV charging infrastructure. To actively receive funding, each state must submit an annual plan outlining its goals for systematic and strategic infrastructure expansion. However, if a state's highway corridors are fully developed, the state could propose alternative public locations for station installation[2].

Creating these outputs for expanded EV usage and accessible transition, the NEVI Formula Program outcomes would reduce transportation related greenhouse gas emissions. Additionally,

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[1] Federal Highway Administration. (n. d.) National Electric Vehicle Infrastructure (NEVI) Program. Retrieved May 25, 2024, from https://www.fhwa.dot.gov/environment/nevi/
[2] Alternative Fuels Data Center. (n.d.) National Electric Vehicle Infrastructure (NEVI) Formula Program. Retrieved May 25, 2024, from https://afdc.energy.gov/laws/12744

this program would produce positive economic externalities to secondary industries through employment opportunities in maintenance services and technology integration sectors. For example, positioning charging stations near shopping centers would boost a shopping center's foot traffic, subsequentially creating revenue opportunities for local businesses.[3]

With a target population of current and potential electric vehicle owners across the United States, the NEVI Program has not had an evaluation on its program. This is a consequence of its recent and ongoing implementations. However, two related studies have been conducted. One study conducted in Lafayette, Indiana after receiving a $100 million investment for EV charging network development, analyzed EV driver behavior, charging time, and usage at two public EV stations.[4] A separate study evaluated how EV charging infrastructure interacts with road networks and power grids.[5] Along with the program's recent enactment and lack of evaluation, related studies demonstrate ample interest and opportunity to evaluate the NEVI Formula Program.

EVALUATION PLAN

We are performing a combined implementation and outcome evaluation on the NEVI Formula Program. To guide our evaluation, we have formulated five research questions based on the program's theory and context:

Implementation Evaluation Research Questions:

1) What is the average number of charging stations built along designated AFCs within each state since 2018?

[3] The scope of our evaluation will not include these industries. However, it must be acknowledged that the NEVI Formula Program will impact the overall effect of secondary industries.

[4] Mahlberg, J. A., Desai, J., & Bullock, D. M. (2023). Evaluation of electric vehicle charging usage and driver activity. *World Electric Vehicle Journal*, 14(11), 308. https://doi.org/10.3390/wevj14110308

[5] He, L. et al. (2022). Comprehensive evaluation of electric vehicle charging network under the coupling of traffic network and power grid. *Plos One*, 17(9), e0275231. https://doi.org/10.1371/journal.pone.02752312024;58(1):90-99. doi:10.1017/S0030605322001648

2) What is the average distance between charging stations along designated AFCs by state?

Outcome Evaluation Research Questions:

1) How has the number of passenger EV registrations changed by state since 2018?
2) By state, how does number of registered EVs change with average distance between charging stations as of 2023?
3) As of 2024, does the level of concern about charge influence the decision to buy an electric vehicle?

We aim to assess each state's compliance with their proposed funding plans and assess the distances between charging stations in each state in our implementation evaluation. This approach will enable us to collect comprehensive data on the distribution of charging stations across the U.S. We will compare data from 2018 to the present day to determine the average number of charging stations constructed along designated AFCs and the average distance between each AFC in each state.

In our outcome evaluation, we will analyze EV registrations from 2018 to the present day to compare data from the pre-program and post-program periods across all states. This analysis will help us track changes in the number of registered EVs and assess whether EV usage is trending upwards, downwards, or remaining consistent. Additionally, we will conduct surveys at various auto dealerships across the United States. This will help us understand potential vehicle buyers' interest in purchasing EVs and if they have potential concerns about charging accessibility.

DATA COLLECTION PLAN

Our implementation and outcome research questions will utilize publicly available U.S. government administrative data sources. In addition, our third outcome evaluation questions will use survey data to verify if potential buyers have concerns with range availability for EVs.

Administrative Data

The predominant source of information to answer our research questions is derived from administrative data. The data needed to determine the number of charging stations built along designated AFCs, the number of EV registrations by state, the average distance between charging stations along AFCs, and the relationship between EV registrations and distance between charging stations are all publicly available and easy to assess.

U.S. Department of Energy Alternative Fuels Data Center Vehicle Registration Counts by State[6]

We will use the U.S. Department of Energy's Alternative Fuels Data Center's (AFDC) already gathered data on numbers of EV's registered, by state, since 2018. This will allow us to focus on two critical time frames: pre- and post-NEVI's implementation in 2022. Using this will allow us to track EV ownership trends, if the number of EV's registered in a state is analogous to number of EV's owned.

The AFDC aggregates data from the National Renewable Energy Laboratory (NREL) and Experian Information Solutions into an approximate count of light-duty vehicles (cars, pickups, and vans) in each state. Using Vehicle Identification Numbers, the data is further broken down into fuel types and rounded to the nearest one hundred vehicles. This data is available from the years 2016 through 2022, with the assumption that it will continue to be compiled through the end of the NEVI program in 2026. As this data is updated annually, we

[6] *Alternative Fuels Data Center: Vehicle registration counts by state*. (n.d.). https://afdc.energy.gov/vehicle-registration

will concurrently update our findings. This data source is publicly available and free to access, with no personally identifiable information (PII) attached.

U.S. Department of Energy Alternative Fuels Data Center Station Data for Alternative Fuel Corridors[7]

This database is a joint venture between the U.S. Departments of Energy and Transportation that provides a list of EV charging stations that are AFC eligible by state. Stations annually verified and the database shows when each charging station was opened and when its information was last verified to be updated. This data source is publicly available and free to access, with no PII attached.

We will use this database to determine the average number of charging stations built along AFCs by state from 2018 to 2023 by using the number of stations opened by the end of each successive year to build a cumulative tally. Then, through the designated end of the NEVI program in 2026, we will add newly built stations after each consecutive year to this tally. This will allow us to create a trend of AFC charging station growth prior to the program's creation and following program implementation. There is a potential for missing data using this source because it does not track charging stations that may have been open but were subsequently permanently closed. However, it remains a strong repository of data regarding AFC eligible EV charging stations.

Furthermore, this data will allow us to determine the distance between AFC eligible charging stations in each state. We will then be able to take this data and divide it by the number of stations to find the average distance between stations in each state.

[7] *Alternative Fuels Data Center: electric vehicle charging station locations*. (n.d.). https://afdc.energy.gov/fuels/electricity-locations#/corridors

We can also use this data in combination with EV registration data to determine how the number of EV's registered changes with average distance between charging stations in each state. This can be accomplished by finding a ratio of registered EVs in each state to average distance between AFC charging stations in each state, year over year from 2018 to 2026. This will allow us to track this ratio from prior to program implementation to the start of the program in 2022 and continue to track it through program completion in 2026.

Survey Data

Survey Conducted at New Car Dealerships

We will reach out to the National Automobile Dealers Association, a national organization that represents over 16,000 franchised new car dealerships across the United States, to coordinate performing brief surveys in their member dealerships. A small table will be set up near the entrance of participating dealerships where we will provide a QR code linking to an electronic survey generated using SurveyMonkey. We will also have tablet devices with the survey preloaded for ease of use.

Using an electronic format for the survey allows for easy translation of survey questions that can then be displayed in the respondents' preferred language via the default language of their web browser. The brief survey (see Figure 2) will ask respondents if they are considering buying an EV and ask them to rate their level of concern about ability to charge an EV on a Likert scale. We will also ask for their state of residence.

We will break the United States up into the following 8 regions: the West Coast (Washington, Oregon, Alaska, Hawaii, and California), the Mountain West (Idaho, Montana, Wyoming, and Colorado), the Southwest (Arizona, Utah, New Mexico, Texas, and Nevada), the Plains Midwest (North Dakota, South Dakota, Nebraska, Iowa, Kansas, Oklahoma, and

Missouri), the Great Lakes Midwest (Minnesota, Wisconsin, Illinois, Michigan, Indiana, and Ohio), the Gulf Coast South (Arkansas, Louisiana, Mississippi, Alabama, and Florida), the Mid-Atlantic South (Kentucky, Tennessee, South Carolina, North Carolina, Virginia, the District of Columbia, and West Virginia), and the Northeast (Maryland, Delaware, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine). We will then seek to perform ten survey days in dealerships in each region, making sure to collect data in at least three different states within each. We will seek to get at least ten responses at each site. This will ensure our sample encompasses a broad geographic cross-section of the United States with the hope that we can obtain a representative, non-probability sample of car buyers.

STAKEHOLDER INVOLVEMENT

Our program engages with several groups pivotal to decision-making and impact. However, our evaluations will focus specifically on three key stakeholders: state governments, EV owners and users, and EV dealerships and manufacturers. We analyze each stakeholders' level of interest and power to understand how to involve them in the evaluation process. We identify stakeholder interest by analyzing their vested stake in the program along with analyzing stakeholder's level of influence to understand the power they wield. For the comprehensive list of stakeholders' interest and influence in the program, see Table 1 of the appendix.

- *State Governments* play a vital role in grant-making, program implementation, and driving the program's broader adoption. Their goals include promoting economic development, reducing environmental impact, enhancing transportation infrastructure, and fostering innovation in the electric vehicle sector. As stakeholders and evaluators, they participate in data collection, monitoring program performance, and ensuring effective fund allocation.

They have a vested interest in assessing whether the program meets its objectives of increasing accessibility to EV charging infrastructure and subsequent overall adoption of electric vehicles. Furthermore, State Governments are responsible for applying for this grant determining the degree of program implementation in their state. State Government involvement in evaluation decision-making is limited, focusing more on providing data and insights for program improvement. However, we will work with State Governments and report evaluation findings to affirm the effectiveness of their applications and improve program implementation as needed.

- *EV Owners and Users* are important stakeholders who influence state decisions. Additionally, their relationship with automotive dealers and manufacturers makes them the key drivers of demand for EV infrastructure. EV owners typically have high interest, but low influence and we aim to increase the power and influence consumers currently have in the process by making the evaluation process more participatory. By obtaining EV owner insights, we seek to ensure their voices are heard and their insights are incorporated, enhancing the overall effectiveness of the program. Although we have already formulated our research questions and survey instruments, we intend to conduct focus groups with EV owners to assess and modify our current list of tools. These sessions will refine our questions and develop surveys for dealerships, enabling a comprehensive evaluation of the program's implementation.
- *EV Dealerships* are pivotal stakeholders in our evaluation of the NEVI Formula Program. Dealerships serve as direct points of contact for consumers, offering valuable information on purchasing decisions, preferred models, and charging needs. By working with dealerships to obtain data and insights into consumer behavior, evaluators can further understand the

dynamics of EV adoption. We will work with dealerships to leverage their expertise and data to assess the program's efficacy and identify areas for improvement to drive further EV adoption.

- *Manufacturers* contribute insights into market trends, technological advancements, and consumer preferences, shaping the overall landscape of electric vehicle adoption. While their interests may not directly guide the evaluation process, collaborating to obtain their insight will provide depth and accuracy of our analysis during and after the program.

ETHICS AND EQUITY

To provide external accountability as evaluators, we will take precautions to ensure ethical treatment and acknowledge inequities potentially arising from our evaluation. Data received for the evaluation will be respected by ensuring identifiable information is redacted. We additionally acknowledge and address the cultural context of our evaluation and its potential effects on equity.

Ethics

We acknowledge power dynamics inherent in evaluating this program and will have an open dialogue with stakeholders to ensure our evaluation maximizes the benefits relative to potential corresponding, see Stakeholder Involvement. Additionally, we will treat survey participants with respect and only utilize information from voluntary participants who have provided informed consent. Any personal identifiable information, such as specific addresses, of survey participants will be redacted. Identifiable building location information from government agencies, AFCs, and car dealerships will be redacted to prevent potential nongovernmental/private property conflict.

Equity

Geography and power impediments are exceptions to building AFCs within a 50-mile range. As a result, areas with a flat, less dense landscape have greater access to construct and sustain power for AFCs compared to mountainous and dense land. Our analysis will cluster administrative and survey information by state instead of assessing the program's overall federal outcome to address this issue.

Some of our evaluative data is obtained from current and prospective EV owners survey responses. We acknowledge that this information comes from individuals with higher disposable income and excludes data from individuals who cannot purchase a vehicle/prefer not to purchase vehicles. However, our evaluative focus on EV ownership and range anxiety necessitates a treatment, the ability to purchase a vehicle, on the treated analysis. We recommend future evaluations include researching this program's access/impact on income inequality.

Appendix

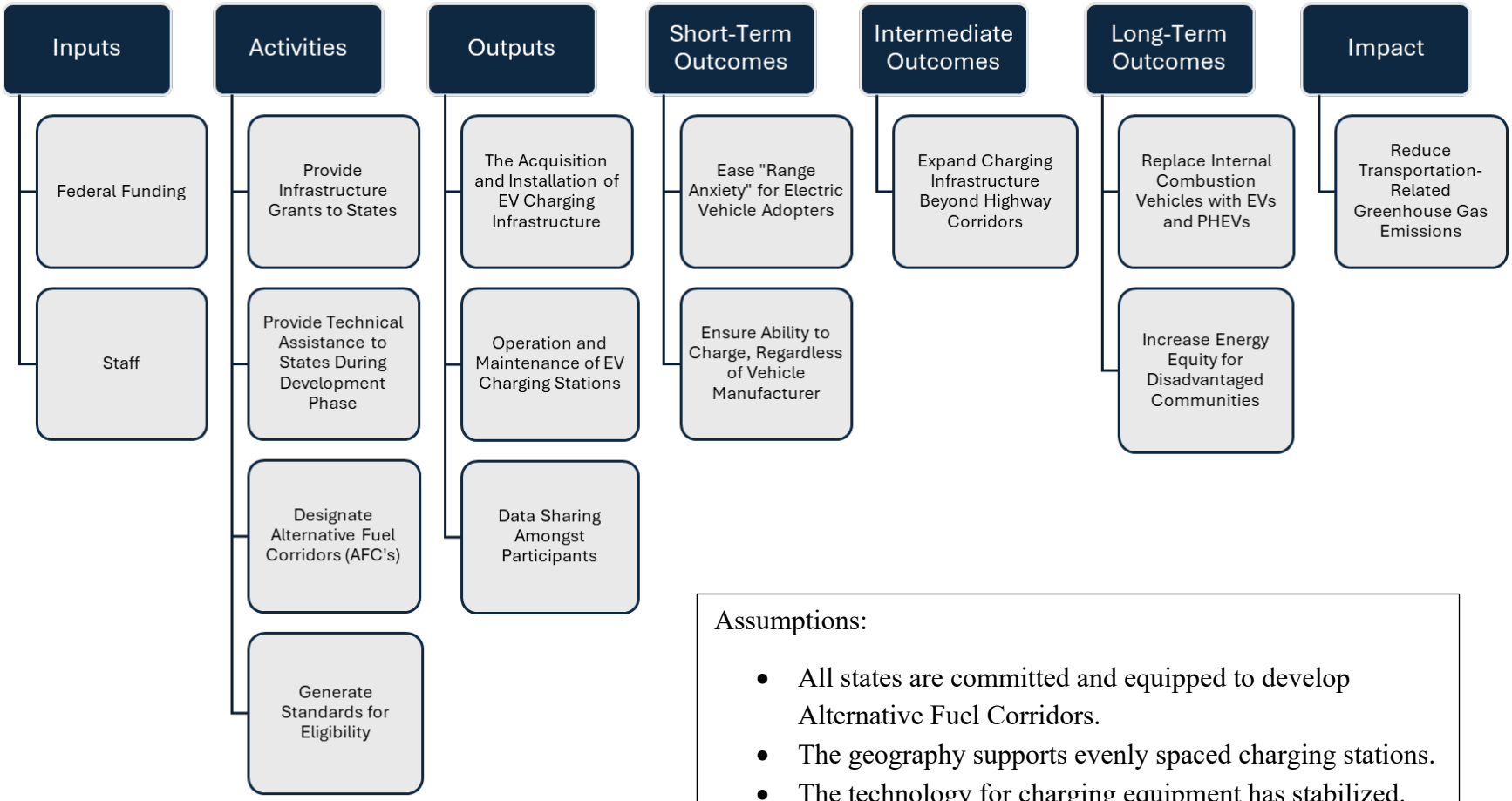
Table 1: Stakeholder Analysis

Stakeholder	Role	Interest	Power
Government Agency	Federal, state, and local authorities responsible for transportation, energy, and environmental policies. They would be the primary drivers and overseers of the program.	High	High
EV Manufacturers & Dealerships	Likely to provide input on standards, requirements, and locations for charging stations.	High	Medium
Charging Infrastructure Providers	Essential stakeholders in terms of implementing the infrastructure and ensuring its accessibility and functionality.	High	High
Utility providers	Collaborate with the program to ensure grid reliability and capacity planning to support the increased demand for electricity.	High	Low
EV Owners (future and potential)	Vehicle and AFC utilizers are the key consumers of the service and will be responsible for driving the demand of not just the AFC charging stations but the overall EV market.	High	Low
Environmental Advocacy Groups	Aligns with goals to reduce greenhouse gas emissions and dependence on fossil fuels.	Medium	Low
Financial Institutions	Interest in financing or investing in projects related to electric vehicle infrastructure development.	Medium	Low

Table 2: National Electric Vehicle Infrastructure Outcome Evaluation Data Collection Plan

	Research Questions	Data sources	Timing	Measures
1	What is the average number of charging stations built along designated AFCs within each state since 2018?	Administrative Data from U.S. Department of Energy Alternative Fuels Data Center Station Data for Alternative Fuel Corridors	2018-2026 (End of evaluation)	Use data compiled by Alternative Fuels Data Center to create a count of AFC eligible charging stations by year.
2	What is the average distance between charging stations along designated AFCs by state?	Administrative Data from U.S. Department of Energy Alternative Fuels Data Center Station Data for Alternative Fuel Corridors	2018-2026 (End of evaluation)	Use data compiled by Alternative Fuels Data Center to plot distance between AFC eligible charging stations in each state. Then divide by number of counted stations to determine average distance by state.
3	How has the number of passenger EV registrations changed by state since 2018?	Administrative Data from U.S. Department of Energy Alternative Fuels Data Center Vehicle Registration Counts by State	2018-2026 (End of evaluation)	Use data compiled by Alternative Fuels Data Center to count EV's by state by year to develop a trend analysis of EV purchases.
4	By state, how does number of registered EVs change with average distance between charging stations as of 2023?	Administrative Data from U.S. Department of Energy Alternative Fuels Data Center Station Data for Alternative Fuel Corridors and	2018-2026 (End of evaluation)	Calculate a ratio of registered EVs in each state to average distance between AFC charging stations in each state, year over year from 2018 to 2026.
5	As of 2024, does the level of concern about charge influence the decision to buy an electric vehicle?	Survey (conducted by third party in car dealerships across the USA) (non-probability sample)	Within 1 year of evaluation implementation	Measure correlation of willingness to buy an EV with level of concern over ability to charge vehicle on a long trip (measured by Likert scale of 1-10).

Figure 1: *National Electric Vehicle Infrastructure Formula Program Logic Model*



Assumptions:

- All states are committed and equipped to develop Alternative Fuel Corridors.
- The geography supports evenly spaced charging stations.
- The technology for charging equipment has stabilized.
- Building charging infrastructure will spur the growth of related industries.

Figure 2: Survey Data Collection Instrument