Improving Our Understanding of Transport Electrification Benefits for Disadvantaged Communities

January 2022

A Research Report from the National Center for Sustainable Transportation

Kristen M. Bush, University of California, Davis
Mark T. Lozano, University of California, Davis
Deb Niemeier, University of Maryland
Alissa Kendall, University of California, Davis

National Center for Sustainable Transportation
ITS UCDAVIS INSTITUTE OF TRANSPORTATION STUDIES

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NCST-UCD-RR-22-01	**2. Government Accession No.** N/A	**3. Recipient's Catalog No.** N/A
4. Title and Subtitle Improving Our Understanding of Transport Electrification Benefits for Disadvantaged Communities		**5. Report Date** January 2022 **6. Performing Organization Code** N/A
7. Author(s) Kristen M. Bush, https://orcid.org/0000-0001-6135-1179 Mark T. Lozano, https://orcid.org/0000-0002-8761-5475 Deb Niemeier, PhD, https://orcid.org/0000-0002-8937-7159 Alissa Kendall, PhD, https://orcid.org/0000-0003-1964-9080		**8. Performing Organization Report No.** UCD-ITS-RR-22-01
9. Performing Organization Name and Address University of California, Davis Institute of Transportation Studies 1605 Tilia Street, Suite 100 Davis, CA 95616.		**10. Work Unit No.** N/A **11. Contract or Grant No.** USDOT Grant 69A3551747114 Caltrans 65A0686 Task Order 025
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology 1200 New Jersey Avenue, SE, Washington, DC 20590 California Department of Transportation Division of Research, Innovation and System Information, MS-83 1727 30th Street, Sacramento, CA 95816		**13. Type of Report and Period Covered** Research Report (January 2020 –August 2021) **14. Sponsoring Agency Code** USDOT OST-R
15. Supplementary Notes DOI: https://doi.org/10.7922/G25M641F		

16. Abstract

Senate Bill 350 (SB 350) requires the California Public Utilities Commission (CPUC) to direct utilities to undertake transportation electrification (TE) activities and to ensure that, among other factors, access to TE-related opportunities for low- and moderate-income communities, as well as disadvantaged communities (DACs) increase as TE becomes more widespread. This research explores the range of tangible benefits that the implementation of TE programs can achieve for DACs. The research questions examine how funds spent to date through SB 350 target investment intended to support DACs; how public and private investments in DACs ensure energy justice, transportation justice, and equity, and finally how perceptions and priorities of stakeholders inform the implementation of TE programs. The researchers collected metrics from various California sources and across the literature, and then asked stakeholders in the CPUC Service List associated with SB 350 proceedings to rank and provide their expert opinion on various metrics by their relative importance. From this information, a final weighted evaluation framework was created. The most important metrics for projects targeted under SB 350 were tangible benefits for local community members; improvements in local air pollution; transparent and collaborative community engagement; consideration of end-of-life impacts, and enhanced access to additional sustainable technologies. The least important metrics include forecasted business closures; potential for accident zones; effects on native flora and fauna; upstream impacts (i.e., through raw material acquisition or construction phases), and/or the support of distributed generation and the development of micro-grids in electrification plans. The framework developed as part of this research supports program evaluation by guiding program administrators through a set of questions designed to facilitate a detailed account of expected outcomes and potential externalities.

17. Key Words Disadvantaged Communities, Senate Bill 350, transportation electrification, evaluation framework		**18. Distribution Statement** No restrictions.	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 65	**22. Price** N/A

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

About the National Center for Sustainable Transportation

The National Center for Sustainable Transportation is a consortium of leading universities committed to advancing an environmentally sustainable transportation system through cutting-edge research, direct policy engagement, and education of our future leaders. Consortium members include: University of California, Davis; University of California, Riverside; University of Southern California; California State University, Long Beach; Georgia Institute of Technology; and University of Vermont. More information can be found at: ncst.ucdavis.edu.

Disclaimer

Acknowledgments

This study was funded, partially or entirely, by a grant from the National Center for Sustainable Transportation (NCST), supported by the U.S. Department of Transportation (USDOT) and the California Department of Transportation (Caltrans) through the University Transportation Centers program. The authors would like to thank the NCST, the USDOT, and Caltrans for their support of university-based research in transportation, and especially for the funding provided in support of this project.

NCST

Improving Our Understanding of Transport Electrification Benefits for Disadvantage Communities

A National Center for Sustainable Transportation Research Report

January 2022

Kristen M. Bush, Energy Systems, Energy and Efficiency Institute, University of California, Davis

Mark T. Lozano, Energy Systems, Energy and Efficiency Institute, University of California, Davis

Deb Niemeier, Civil and Environmental Engineering, University of Maryland

Alissa Kendall, Civil and Environmental Engineering, University of California, Davis

NCST

[page intentionally left blank]

TABLE OF CONTENTS

EXECUTIVE SUMMARY v
Introduction 1
Research Questions 1
Background 2
Report Organization 4
Project Evaluation Criteria 4
Metrics 4
Weighting Survey Metrics and Categories 6
Survey Results 7
Frameworks and Formulas 10
Application of Survey Results 10
Discussion 12
Final Framework for Calculating TE Benefits 14
Case Study 18
References 26
Data Summary 27
Appendix 28

List of Tables

Table 1. Metrics ... 5
Table 2. Framework variables and formulas ... 11
Table 3. Mean category weight (community engagement) ... 14
Table 4. Mean metric weight (community engagement) ... 15
Table 5. Mean category weight (health and safety costs and benefits) ... 15
Table 6. Mean metric weight (health and safety costs and benefits) ... 16
Table 7. Mean category weight (effects of infrastructure) ... 16
Table 8. Mean metric weight (effects of infrastructure) ... 16
Table 9. Mean category weight (economic costs and benefits) ... 17
Table 10. Mean metric weight (economic costs and benefits) ... 17
Table 11. Mean category weight (technological resilience) ... 17
Table 12. Mean metric weight (technological resilience) ... 18
Table 13. Final framework: health and safety costs and benefits. ... 19
Table 14. Final framework: effects of infrastructure ... 20
Table 15. Final framework: economic costs and benefits ... 21
Table 16. Final framework: technological resilience ... 23
Table 17. Final framework category score example: health costs and safety benefits ... 24
Table 18. Final framework project performance indicator ... 25
Table A1. Overall statistics of weighted categories ... 28
Table A2. Economic costs and benefits - Statistics of weighted metrics ... 28
Table A3. Health and safety costs and benefits - Statistics of weighted metrics ... 29
Table A4. Community engagement - Statistics of weighted metrics ... 30
Table A5. Effects of infrastructure - Statistics of weighted metrics ... 31
Table A6. Technological resilience - Statistics of weighted metrics ... 31
Table A7. Overall statistics of weighted categories (government) ... 32
Table A8. Economic costs and benefits - Statistics of weighted metrics (government) ... 32
Table A9. Health and safety costs and benefits - Statistics of weighted metrics (government).. 33
Table A10. Community engagement - Statistics of weighted metrics (government) ... 34
Table A11. Effects of infrastructure - Statistics of weighted metrics (government) ... 35
Table A12. Technological resilience - Statistics of weighted metrics (government) ... 36
Table A13. Overall statistics of weighted categories (private sector) ... 36

Table A14. Economic costs and benefits - Statistics of weighted metrics (private sector).......... 37
Table A15. Health and safety costs and benefits - Statistics of weighted metrics (private sector) 38
Table A16. Technological resilience - Statistics of weighted metrics (private sector) 38
Table A17. Community engagement - Statistics of weighted metrics (private sector)................ 39
Table A18. Effects of infrastructure - Statistics of weighted metrics (private sector) 40
Table A19. Overall statistics of weighted categories (advocacy group) 40
Table A20. Economic costs and benefits - Statistics of weighted metrics (advocacy group)....... 41
Table A21. Health and safety costs and benefits - Statistics of weighted metrics (advocacy group)........ 41
Table A22. Community engagement - Statistics of weighted metrics (advocacy group)............. 42
Table A23. Effects of infrastructure - Statistics of weighted metrics (advocacy group) 43
Table A24. Technological resilience - Statistics of weighted metrics (advocacy groups)............. 43
Table A25. Overall statistics of weighted categories (environmental NGO) 44
Table A26. Health and safety costs and benefits - Statistics of weighted metrics (environmental NGO)........ 44
Table A27. Economic costs and benefits - Statistics of weighted metrics (environmental NGO) 45
Table A28. Effects of infrastructure - Statistics of weighted metrics (environmental NGO) 46
Table A29. Community engagement - Statistics of weighted metrics (environmental NGO)...... 47
Table A30. Technological resilience - Statistics of weighted metrics (environmental NGO) 47
Table A31. Overall statistics of weighted categories (legal representation)................ 48
Table A32. Economic costs and benefits - Statistics of weighted metrics (legal representation) 48
Table A 33. Technological resilience - Statistics of weighted metrics (legal representation) 49
Table A34. Health and safety costs and benefits - Statistics of weighted metrics (legal representation) 49
Table A35. Effects of infrastructure - Statistics of weighted metrics (legal representation) 50
Table A36. Community engagement - Statistics of weighted metrics (legal representation) 51
Table A37. Overall statistics of weighted categories (other)................ 51
Table A38. Economic costs and benefits - Statistics of weighted metrics (other) 52
Table A39. Health and safety costs and benefits - Statistics of weighted metrics (other)........... 52
Table A40. Community engagement - Statistics of weighted metrics (other) 53
Table A41. Effects of infrastructure - Statistics of weighted metrics (other).............................. 54
Table A42. Technological resilience - Statistics of weighted metrics (other).............................. 54

List of Figures

Figure 1. Example of sliding scale for the sorting of metrics 7
Figure 2. Mean scores of survey categories weighted by overall importance 8
Figure 3. Economic costs and benefits - Mean scores of survey metrics weighted by overall importance 8
Figure 4. Health and safety costs and benefits - Mean scores of survey metrics weighted by overall importance 9
Figure 5. Community engagement - Mean scores of survey metrics weighted by overall importance 9
Figure 6. Effects of infrastructure - Mean scores of survey metrics weighted by overall importance 10

Improving Our Understanding of Transport Electrification Benefits for Disadvantaged Communities

EXECUTIVE SUMMARY

Senate Bill 350 (SB 350) requires the California Public Utilities Commission (CPUC) to direct utilities to undertake transportation electrification (TE) activities and to ensure that, among other factors, access to TE-related opportunities for low- and moderate-income communities, as well as disadvantaged communities (DACs) increase as TE becomes more widespread. This research explores the range of tangible benefits that the implementation of TE programs can achieve for DACs. The research questions examine how funds spent to date through SB 350 target investment intended to support DACs; how public and private investments in DACs ensure energy justice, transportation justice, and equity, and finally how perceptions and priorities of stakeholders inform the implementation of TE programs.

We collected metrics from various California sources and across the literature and then asked stakeholders in the in the CPUC Service List associated with SB 350 proceedings to rank and provide their expert opinion on various metrics by their relative importance. We received responses from advocacy groups, environmental NGOs, representatives of state and local government, law firms, and members of the private sector. The metric categories include:

- Community Engagement: It is important to explore how communities engage with the projects. Further, how do these projects relate to the priorities of the community, and have these priorities been adequately assessed in the project development? These metrics are meant to bring attention to the role the communities have and will play in the rollout of the projects.
- Health and Safety Costs and Benefits: This set of metrics aims to determine to what extent the strategy or jurisdiction has considered the impacts of implementation on the health of the community, both positive and negative. This includes physical health, such as air pollution or infrastructure to promote exercise, as well as mental health. It also explores how the costs and benefits are distributed across communities.
- Effects of Infrastructure: These metrics deal with consequences that are beyond individual health and examine city-wide or regional safety.
- Economic Costs and Benefits: There are almost always financial costs associated with implementing green infrastructure or strategies. These metrics probe the types of economic costs and benefits that are expected, as well as how these trade-offs affect communities. It is important to note that not just the distribution of costs and benefits, but there may also be barriers to accessing benefits that are not immediately obvious. These metrics try to capture the full range of considerations.
- Technological Resilience: These metrics examine barriers to accessing technology and associated benefits. While this theme was explored under "Economic Costs and Benefits," here, we focus on the non-financial barriers.

Using our survey results, we created a final weighted evaluation framework. The most important metrics for projects targeted under SB 350 were tangible benefits for local community members; improvements in local air pollution; transparent and collaborative community engagement; consideration of end-of-life impacts, and enhanced access to additional sustainable technologies. The least important metrics include forecasted business closures; potential for accident zones; effects on native flora and fauna; upstream impacts (i.e., through raw material acquisition or construction phases), and/or the support of distributed generation and the development of micro-grids in electrification plans.

The framework developed as part of this research supports program evaluation by guiding program administrators through a set of questions designed to facilitate a detailed account of expected outcomes and potential externalities.

Introduction

California has long pursued targeted initiatives across many sectors to mitigate greenhouse gas (GHG) emissions (e.g., electric utility services, industry, transportation, and commercial and residential buildings), transportation electrification (TE). These reductions would have a large effect on the various clean air and GHG reduction goals mandated by the state (Steinberg et. al, 2017). GHG mitigation policies and targets are implemented at the agency or organizational level. Under Senate Bill 350 (SB 350), the Clean Energy and Pollution Reduction Act (Chapter 547, Statutes of 2015), new GHG reduction goals were established for 2030 and beyond. This legislation requires the California Public Utilities Commission (CPUC) to direct utilities to undertake TE activities and to consider the following (De León et. al, 2015):

1. Access for low- and moderate-income communities, as well as disadvantaged communities (DACs) should increase as TE becomes more widespread. This also applies to other users of zero-emission vehicles (ZEVs) as the increased use of these vehicles will effectively lower GHG emissions and ultimately enhance air quality. This would also serve as promotion of the overall benefits to targeted communities.
2. Widespread TE may also encourage innovation and competition by giving customers options for EVSE. This would also encourage infrastructure investments and job creation.
3. The deployment of EVs should also support grid management, reduced fuel costs, and the integration of renewable energy sources.
4. As EVSE is deployed, sales of EVs should increase with accessibility to charging. This should also facilitate the opportunity to use electricity as a cleaner and cheaper alternative to gasoline and other fossil fuels both publicly and privately. The tangible benefits of TE should also include and be distributed equitably amongst all communities. Without such effective measures in place, air pollution from mobile sources would likely continue to worsen under a business-as-usual scenario.

Research Questions

This report develops a new framework to support the actualization of tangible benefits for DACs through the implementation of TE programs. The research questions include,

1. Does the allocation of funds spent to date through SB 350 target the investment necessary to support DACs?
2. How are public and private investments in DACs informed by the barriers associated with ensuring energy justice, transportation justice, and equity?
3. How do the perceptions and priorities of stakeholders inform the implementation of TE programs?

This study will help policymakers who work closely with DACs to develop guidance that best serve DAC needs during the implementation of TE projects.

Background

SB 350 is an extension of AB 32, also known as the California Global Warming Solutions Act of 2006, which aims to reduce GHG emissions levels to 40 percent of those observed in 1990 by 2030. SB 350 extends the goals in AB 32 to reduce emissions to 80 percent below 1990 levels by 2050. Specifically, SB 350 is being implemented in tandem with state agencies to increase renewable electricity procurement to 50 percent by 2030. Integrated resource plans (IRPs) detailing the methods for meeting customers' needs, accelerating clean energy services, and reducing GHG emissions will be developed. SB 350 also shifts the California Independent System Operator (CAISO) to a regional organization and prioritizes TE (CA.gov, 2017). The objectives of the TE goals being pursued by Southern California Edison (SCE), Pacific Gas & Electric (PG&E), and San Diego Gas & Electric Company (SDG&E) are in accordance with both SB 350 and AB 32.

To date, pursuit of electrification projects includes prepared testimonies with Statements of Qualifications approved by the California Public Utilities Commission (CPUC) on behalf of utilities (i.e., SCE, PG&E, and SDG&E). The application process is facilitated by the CPUC in conjunction with (IOUs) upon request to lease, sell, or impede their facilities. The CPUC is then tasked with assessing the potential harm or benefit to the public and utility ratepayers. This includes considerations of power production, environmental stewardship, and land use (CA.gov, 2021a). These activities fall under two proceedings: the general proceeding and the environmental evaluation, which may occur simultaneously.

The general proceeding is led by both an Administrative Law Judge (ALJ) and a CPUC Commissioner who facilitates the pre-hearing conferences, evidentiary hearings, and public participation hearings on proposed TE activities. Following the pre-hearing conference, scoping memos are created by the ALJ to list issues raised, and schedule dates to address those obstacles. The evidentiary hearing allows for the presentation and questioning of prepared testimonies in which the ALJ and the CPUC Commissioner can collect information needed to better understand and judge the case. If public interest is significant, public participation hearings will also be held to allow for the opinions of the general public to be considered (CA.gov, 2021a). At the completion of the proceedings, the proposed decision-prepared by the ALJ-is then evaluated and/or adjusted by all CPUC Commissioners. Finally, the full Commission votes on the case.

In the initial pilot program undertaken by CPUC, each utility proposed and was subsequently granted different TE initiatives, many of which are currently underway. SDG&E's Residential Charging Program entails installing, operating, and maintaining 90,000 L2 charging stations. The utility also proposed three rates for their commercial grid integration rate; this was denied. PG&E's DC Fast Charging Make-Ready Program proposed design includes meeting part of PG&E's estimated need for a maximum of 916 fast chargers by 2050. It also includes reducing driver range anxiety and increasing access to home charging. Both PG&E and SCE proposed medium and heavy-duty vehicle charging programs. PG&E's Fleet Ready Program prepared a budget of $210 million and targets make-ready infrastructure (i.e., the wiring, conduit, distribution lines, and transformers needed to connect the charger to the grid) in support of

MD/HD fleets. This will entail providing utility-owned make-ready infrastructure at 700 sites for up to 8,800 charging points, customer education and outreach on EV benefits, and operation and maintenance of installed infrastructure. Likewise, SCE's Medium- and Heavy-Duty Vehicle Charging Infrastructure Program was given a $554 million budget to operate, install, and own the electric infrastructure to service charging equipment. This comes with a rebate to account for the costs of the charging equipment as well as installation. Budget estimates assumed 18,234 vehicles at 930 sites with 10,491 charge points (CPUC, 2018).

An additional CPUC consideration is the metric by which DACs are defined and serviced. SDG&E, in its Electric Vehicle-Grid Integration (VGI) Pilot Program, define DACs according to the top 25 percent of Cal EPA's CalEnviroScreen 3.0 census tracts scores-developed per SB 535-and calculated benefits on a service territory or state-wide basis. SB 535 directs that 25% of proceeds from the GHG Reduction Fund (i.e., cap-and-trade) be allocated to projects that provide a benefit to DACs. Similarly, AB 1550 also requires that 25% of proceeds from the fund be spent on projects located in DACs. This assists CalEPA's membership in prioritizing cleanup and resources and targeting cap-and-trade investments. Scores are based on socioeconomic, health, and environmental factors. The CalEnviroScreen platform identifies communities that are disproportionately affected by multiple sources of pollution (CA.gov, 2017). These communities also have population characteristics that leave them more susceptible to the effects of the pollution (CA.gov, 2021b). While strategies that focus on DACs are well-intentioned, there are several pitfalls that can be identified. Because the goals for these programs are usually framed in a broader context, they lack the support of detailed analysis needed to differentiate the needs of the communities they serve.

For instance, phases of PG&E's Fleet Ready Program were scrutinized as the tangible benefits proposed by the utility were not made clear. This caused local and regional priorities to exclude considerations related to the implementation of technology—specifically the timing required to enact it. Furthermore, PG&E recommended that a 75% rebate on EVSEs for buses, trucks, and forklifts be given to DACs (which accounts for about 25% of the utility's customer base). However, this rebate was not fully thought out as the utility could not pinpoint the number of DAC customers that actually owned and/or operated forklifts, as well as the availability of replaceable port equipment. These examples amplify the need for better ways of linking technological incentives to DAC benefits. This also suggests that low-income consumers often find themselves left out of discussions that are pertinent to policy implementation. With the increase of transportation electrification, equitable access to the various technologies in place must be distributed to DACs and low-income communities. These include residential charging, fast charging infrastructure, and MD/HD fleet infrastructure (CPUC, 2017).

The commitment to incorporate 25% of PG&E's DC Fast Charging Make-Ready Program infrastructure investments in support of fast charging availability in DAC faces a similar critique. When the utility proposed implementing a $25,000 incentive aimed at potential site hosts, the methods of selecting/identifying these site hosts lacked transparency. The DAC benefit uncertainty is exacerbated by the fact that is not at all clear that EV purchasing in DACs will increase with the addition of fast charging stations, nor is it certain that infrastructure investments will be offset by potential co-benefits (i.e. benefits of public charging in frequented locales) even with the inclusion of subsidies.

Report Organization

In this report, we develop a new framework for assessing DAC benefits resulting from the implementation of TE projects. Since the TE initiative itself is new, we expect that our framework will need modification and adjustment as experiences broaden.

- Developed a framework of metrics
- Surveyed experts and community advocates on weights to assign to the metrics

Project Evaluation Criteria

This chapter discusses the process used to develop a set of metrics for project evaluation with respect to DACs. This was done to examine equity considerations in program and project selection and implementation. Our process started with collection of metrics from various California sources and across the literature. We then asked a cross-cutting group of stakeholders to rank and provide their expert opinion on various metrics by their relative importance. Stakeholders were selected based on their inclusion in the CPUC Service List (those expressing interest in the proceedings) associated with the SB 350 proceeding (i.e., Proceeding A1701020 - SDG&E). All feedback was provided anonymously and was not attributed as any form of representation of anyone's respective agency, company, or organization. From this information, we created a final evaluation framework. This chapter reviews each component of the process.

Metrics

The criteria currently used for SB 350 program selection and implementation lack adequate consideration of equity and DAC effects. We reviewed the literature for criteria and metrics that should be considered. We included metrics contained in CARB's California Climate Investments Co-benefit Assessment Methodologies (CA.gov, 2020) organized into different categories based on the California Energy Commission's (CEC) "Scoring Criteria for Projects that Benefit Disadvantaged and Low-Income Communities (Criteria #9) (CA.gov, 2019). We were also informed by additional guidance in literature (Sovacool et al., 2015) and other frameworks such as those found within the NCST's "Framework for Life Cycle Assessment of Complete Streets Projects" report (Harvey et al., 2018). The criteria were divided into five categories: Community Engagement, Health and Safety Costs and Benefits, Effects of Infrastructure, Economic Costs and Benefits, and Technological Resilience. Each category had its own set of metrics (see Table 1), which we then asked stakeholders to weight.

Table 1. Metrics

Community Engagement	
Description	Conceptual Metrics
It is important to explore how communities engage with the projects. Further, how do these projects relate to the priorities of the community, and have these priorities been adequately assessed in the project development? These metrics are meant to bring attention to the role the communities have and will play in the rollout of the projects.	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-debriefing, renewal)
	Addressing a specified community need
	Delivering on priorities expressed by the community with respect to co-benefits of any new projects
	Addressing social and/or linguistic barriers
	Effects of indigenous peoples and their lands
	Effects on native flora and fauna
Health and Safety Costs and Benefits	
Description	Conceptual Metrics
This set of metrics aims to determine to what extent the strategy or jurisdiction has considered the impacts of implementation on the health of the community, both positive and negative. This includes physical health, such as air pollution or infrastructure to promote exercise, as well as mental health. It also explores how the costs and benefits are distributed across communities.	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)
	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)
	Potential for accident zones (i.e., crash risks due to increased truck traffic)
Effects of Infrastructure	
Description	Conceptual Metrics
These metrics deal with consequences that are beyond individual health and examine city-wide or regional safety.	Effects on the use of green space and/or recreational space
	Upstream impacts (i.e., through raw materials acquisition or construction phases)
	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)
	Effects of additional charging infrastructure and/or related equipment on traffic and congestion

Economic Costs and Benefits	
Description	Conceptual Metrics
There are almost always financial costs associated with implementing green infrastructure or strategies. These metrics probe the types of economic costs and benefits that are expected, as well as how these trade-offs affect communities. It is important to note that not just the distribution of costs and benefits, but there may also be barriers to accessing benefits that are not immediately obvious. These metrics try to capture the full range of considerations.	Expected tangible benefits for local community members
	Expected tangible benefits for local medium- and heavy-duty vehicle operators
	Potential barriers to benefits along with forecasted business closures
	Job creation
	Maintaining rate payer interests
	Economic burden on DACs due to increased electricity demand
Technological Resilience	
Description	Conceptual Metrics
These metrics examine barriers to accessing technology and associated benefits. While this theme was explored under "Economic Costs and Benefits," here, we focus on the non-financial barriers.	Improves or enhances grid stability and resilience
	Improves or enhances access to additional sustainable technologies
	Supports distributed generation and the development of micro-grids in electrification plans

Weighting Survey Metrics and Categories

To determine both the importance of evaluation categories and the metrics within categories, we sent a survey to 181 stakeholders and collected responses over a two-week period. A total of 51 responses were collected with 24 of them less than 100% complete. The remaining 27 survey responses were fully completed with four of the respondents declining to proceed with the survey for a response rate of approximately 15%. Respondents were asked to describe their affiliation as belonging to government, utility, private sector, community organization, advocacy group, environmental non-governmental organization (NGO), legal representation, or other. Of the completed survey responses, five of the respondents worked in government, four worked in the private sector, three worked in advocacy groups, two worked in environmental NGOs, five worked in legal representation, and four belonged to other affiliations. There were no respondents who worked for utilities or community organizations. One respondent from an investor-owned utility declined participation in the survey due to open regulatory items (i.e., SB 350) that were cited in the survey. The response rate is low and the results should be considered exploratory. Stakeholders were asked to weight five categories by their importance and to weight each of the metrics within each category such that weights equal to 100. Participants used a sliding scale to weight metrics (see Figure 1 below).

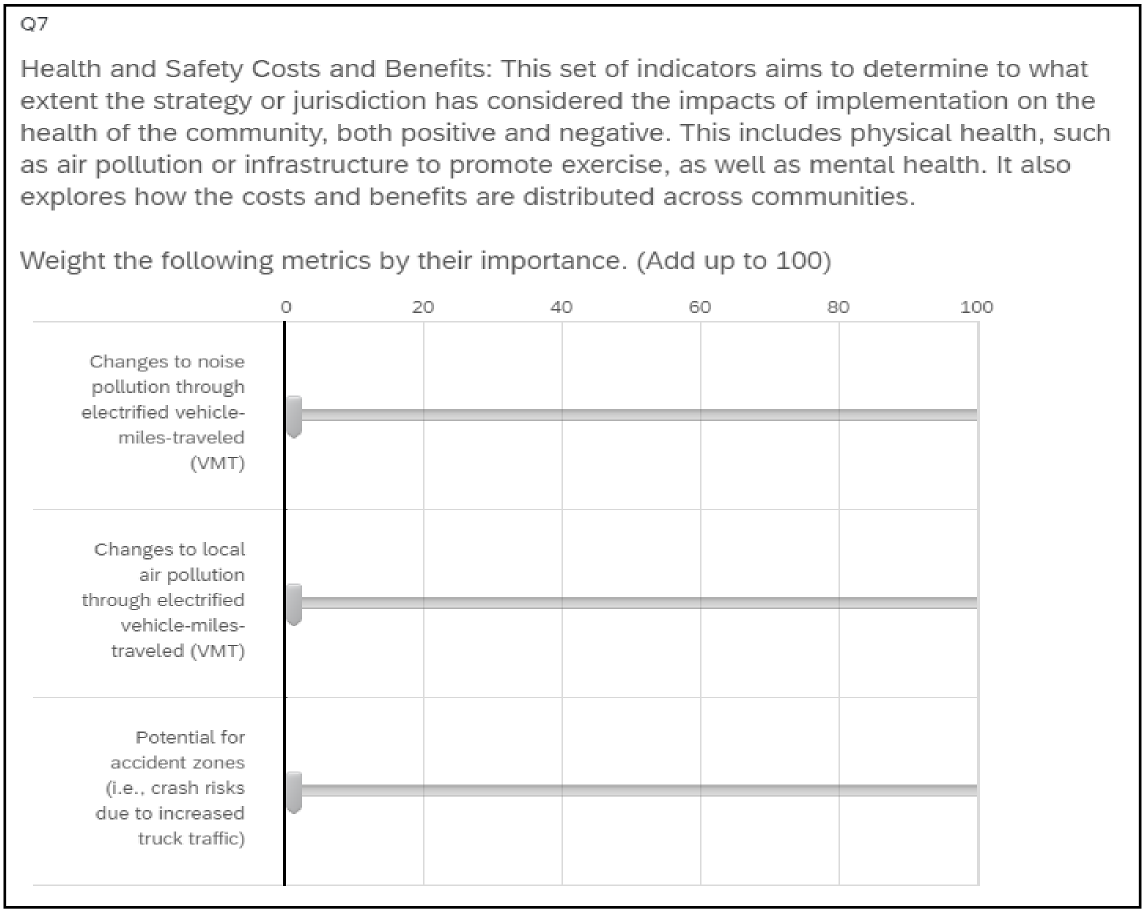

Figure 1. Example of sliding scale for the sorting of metrics

Survey Results

On average, respondents indicated that Economic Costs and Benefits were of most importance, followed by Health and Safety Costs and Benefits, Community Engagement, Effects of Infrastructure, and Technological Resilience. The mean weights for the survey categories as well as the individual metrics have been included in the Appendix (see Tables A1-A42) and Figures 2-6 below.

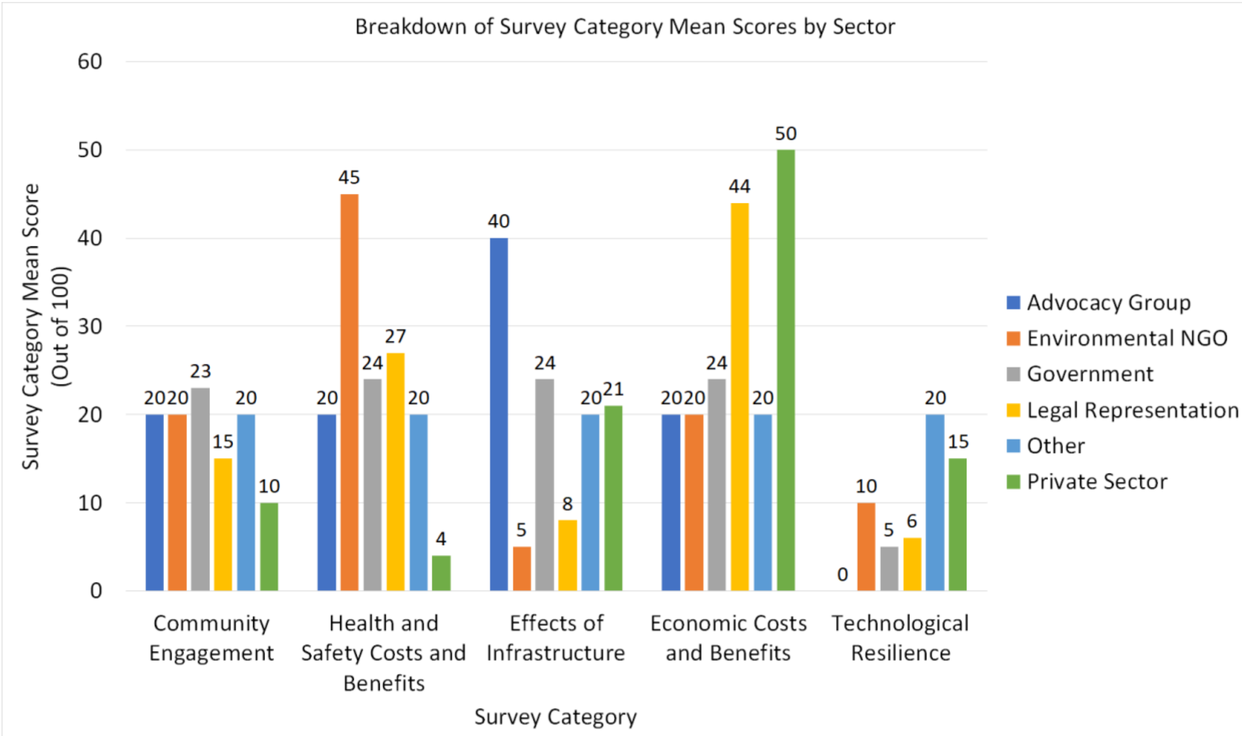

Figure 2. Mean scores of survey categories weighted by overall importance

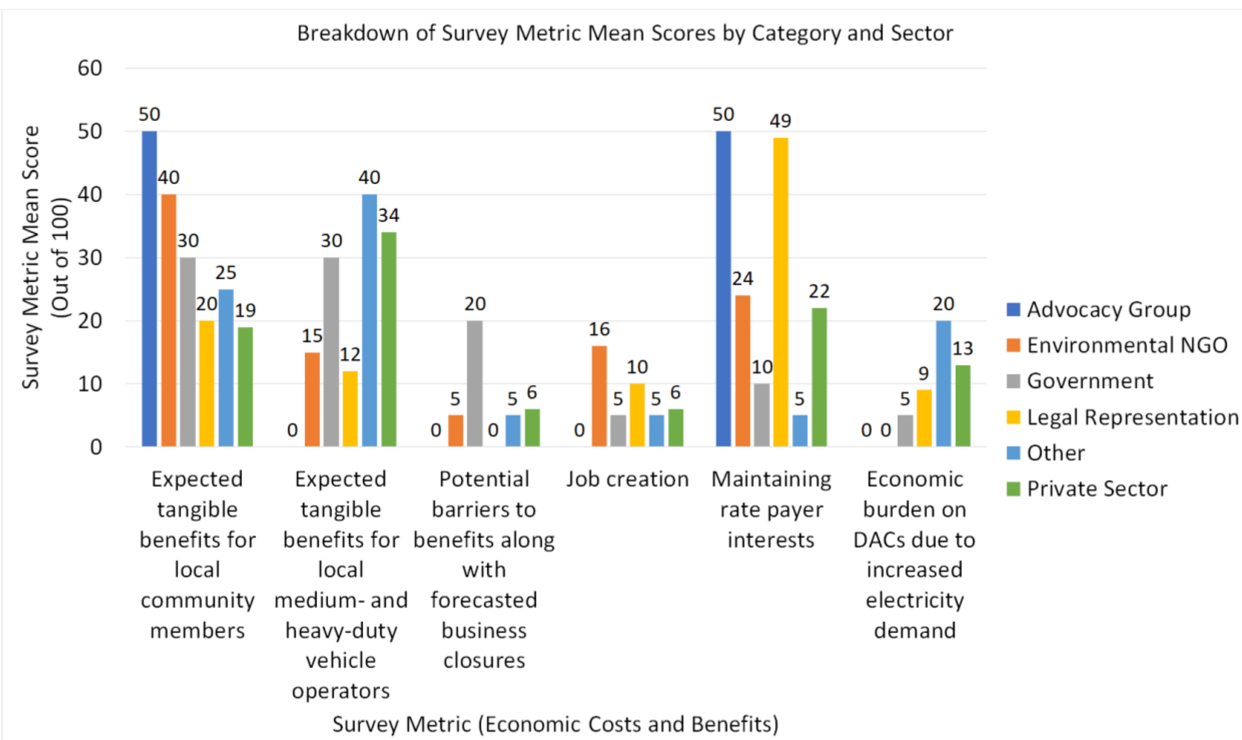

Figure 3. Economic costs and benefits - Mean scores of survey metrics weighted by overall importance

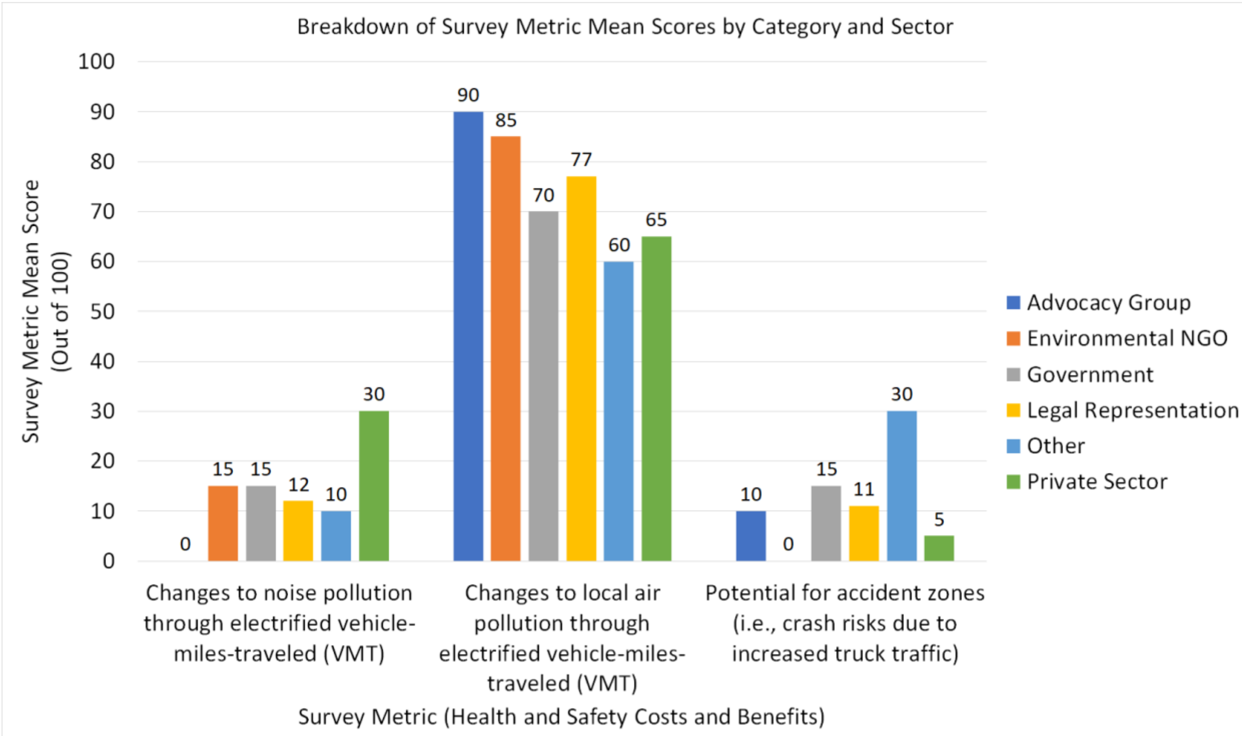

Figure 4. Health and safety costs and benefits - Mean scores of survey metrics weighted by overall importance

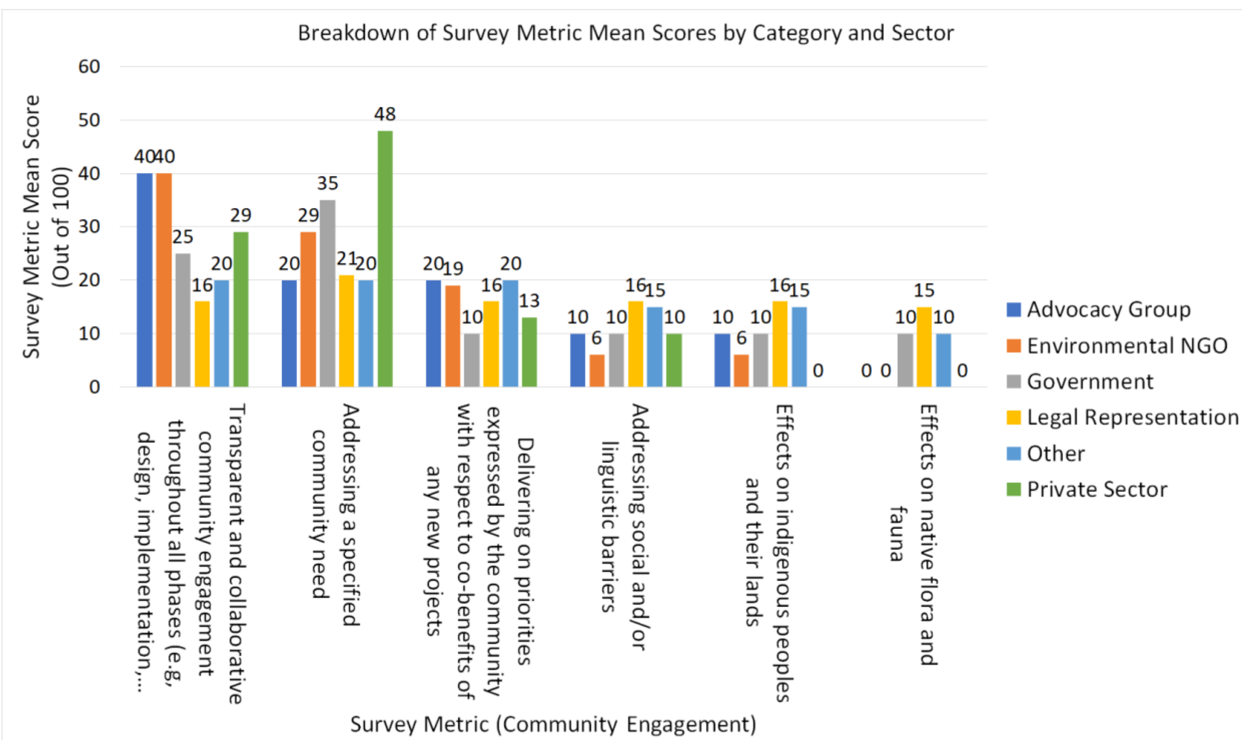

Figure 5. Community engagement - Mean scores of survey metrics weighted by overall importance

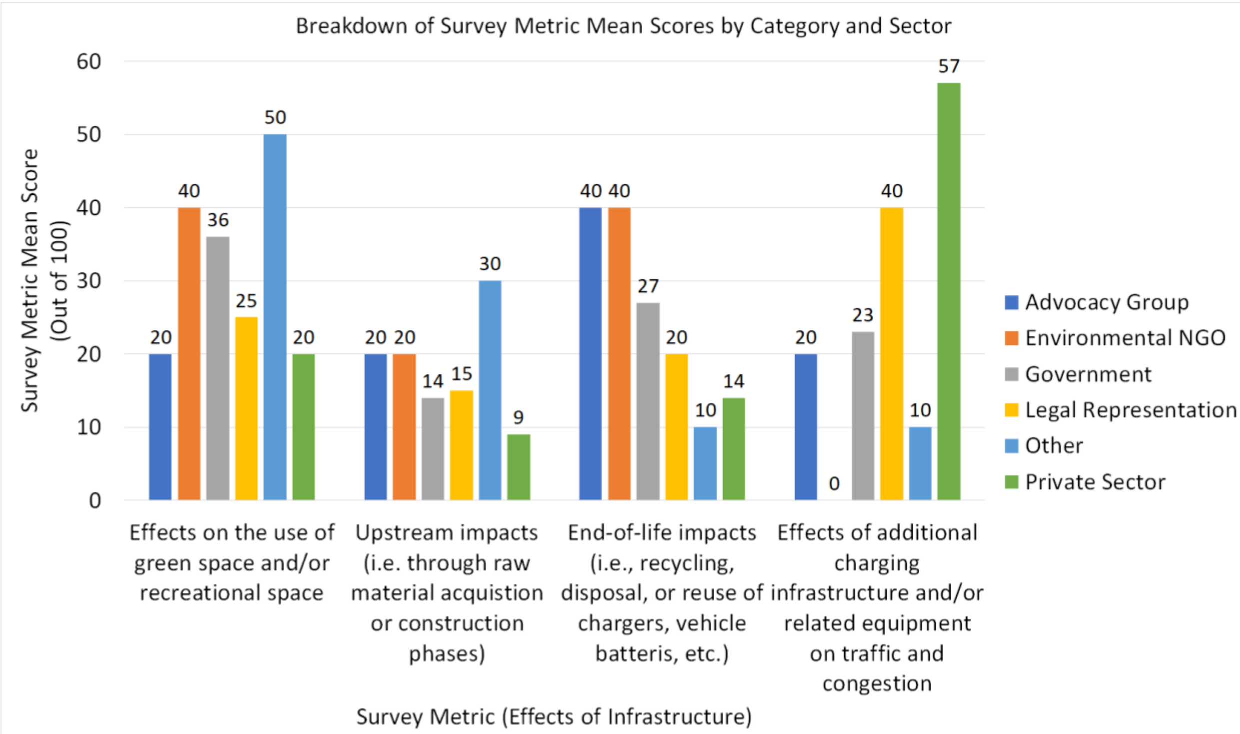

Figure 6. Effects of infrastructure - Mean scores of survey metrics weighted by overall importance

With the category and individual within category survey data, we then set about using our survey results to create a framework for evaluation of individual programs and projects.

Frameworks and Formulas

This chapter discusses the development of the framework to be used for evaluating the implementation of heavy-duty TE programs.

Application of Survey Results

The overall findings from the survey detailed in Section II were used to inform the scoring of responses to the framework questions. The variables used to formulate the maximum scores for the framework questions as well as the score range for the overall framework and each of the categories include: Score, Mean Metric Weight, Mean Category Weight, Category Score, and the Project Performance Indicator. Descriptions of these variables along with the resulting formulas have been provided below:

<u>Score:</u> This is the score given to responses to each of the metric questions (recall, each category has its own set of questions). It reflects how well a survey metric was considered in a project. A score of 1 is “Poor”, 2 is “Fair”, 3 is “Good”, 4 is “Very Good”, and 5 is “Excellent.”

<u>Mean Metric Weight (%):</u> The Mean Metric Weight (MMW) is the weight given to each of the survey metrics by survey participants between 1-100%. The average MMW is reported for all

survey participants, and also for each particip affiliation, including government (MMWg), private sector (MMWp), advocacy group (MMWa), legal representation (MMWl), and other (MMWo).

Mean Category Weight (%): The Mean Category Weight (MCW) represents the weight given to each of the survey categories by survey participants between 1-100%. The MCW given to each category by affiliation was also considered (i.e., MCWg, MCWp, MCWa, MCWl, and MCWo).

Category Score (CS): The CS represents the weighted score of each category in the framework based on both the Score and the MMW. A score of 1 is "Poor", 2 is "Fair", 3 is "Good", 4 is "Very Good", and 5 being "Excellent." The CS by affiliation was also considered.

Project Performance Indicator (PPI): The PPI is a weighted score based on the overall performance of a project (i.e., the responses to each of the framework questions). This was calculated by category and affiliation and can also receive a score of 1-5. A score of 1 is "Poor", 2 is "Fair", 3 is "Good", 4 is "Very Good", and 5 is "Excellent."

Table 2. Framework variables and formulas

Affiliation	Mean Metric Weight (%)	Mean Category Weight (%)	Category Score	Project Performance Indicator
Overall	MMW	MCW	CS = $\sum_{1}^{n} (MMW\ x\ Score)$	PPI = $\sum_{1}^{5} (MCW\ x\ CS)$
Government	MMWg	MCWg	CSg = $\sum_{1}^{n} (MMWg\ x\ Score)$	PPIg = $\sum_{1}^{5} (MCWg\ x\ CSg)$
Private Sector	MMWp	MCWp	CSp = $\sum_{1}^{n} (MMWp\ x\ Score)$	PPIp = $\sum_{1}^{5} (MCWp\ x\ CSp)$
Advocacy Group	MMWa	MCWa	CSa = $\sum_{1}^{n} (MMWa\ x\ Score)$	PPIa = $\sum_{1}^{5} (MCWa\ x\ CSa)$
Legal Representation	MMWl	MCWl	CSl = $\sum_{1}^{n} (MMWl\ x\ Score)$	PPIl = $\sum_{1}^{5} (MCWl\ x\ CSl)$
Other	MMWo	MCWo	CSo = $\sum_{1}^{n} (MMWo\ x\ Score)$	PPIo = $\sum_{1}^{5} (MCWo\ x\ CSo)$

Discussion

When taking all the selected affiliations into account (i.e., Government, Private Sector, Advocacy Group, Legal Representation, and Other), the most important metrics across all categories (i.e., Economic Costs and Benefits, Health and Safety Costs and Benefits, Community Engagement, Effects of Infrastructure, and Technological Resilience) were:

- Expected tangible benefits for local community members
- Changes to local air pollution through electrified VMT
- Transparent and collaborative community engagement, throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)
- End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)
- Improves or enhances access to additional sustainable technologies

The least important metrics across all categories were:

- Potential barriers to benefits along with forecasted business closures
- Potential for accident zones
- Effects on native flora and fauna
- Upstream impacts (i.e., through raw material acquisition or construction phases)
- Supports distributed generation and the development of micro-grids in electrification plans

Based on the survey weights, it is clear that the TE projects focused on HDVs should primarily consider the economic advancement of DACs and the tangible benefits associated with this advancement. These benefits should not only lead to improvements to local air pollution through a decrease in emissions (i.e., electrified VMT), but should also allow for the autonomy of DACs to be fully realized and strengthened through comprehensive community engagement. This community engagement should be transparent and should take place through all phases of project implementation and should prioritize the views and opinions of trusted DAC leaders and community organizers who can adequately speak to the needs of those who will directly be affected by the project. Additionally, while TE projects should improve or enhance access to sustainable technologies, the end-of-life impacts of these technologies and the infrastructure needed to support this technology must be considered to avoid any negative impacts to DACs and the local environment. The metrics of least importance may allude to shortcomings in program implementation and the supporting legislation. Although TE projects may deliver positive impacts to DACs and the local environment, more needs to be done to ensure that the potential for negative externalities has been thoroughly considered.

A section of the survey allowed respondents to offer additional comments and feedback regarding the contents of the survey and any suggestions for additional metrics. From the government sector, one respondent suggested adding more detail to the job creation metric and separating out medium- and heavy-duty impacts on localized air pollution and respiratory problems in DACs. Another suggested including a metric that considers driving technology advancement, helping to meet state goals (e.g., petroleum reduction, GHG reductions, and infrastructure deployment), and facilitating compliance with other state regulations. A respondent from an advocacy group suggested including a metric that addressed “regressive impact on low- and middle-income customers funding these projects through utility bills.” A respondent from an environmental NGO suggested including a metric that addressed the “cluster effects of the entire goods movement system on air quality and public health for residents.” Another respondent offering a consultant’s perspective suggested including “redundancy and space availability for infrastructure.” A different respondent suggested including “compliance costs for maintaining a gas fleet and gas infrastructure” as a metric noting it as a significant avoided cost.

Another respondent from the government sector offered feedback on the SB 350 legislation itself:

> “Current SB350 incentives encourage the development of heavy industrial infrastructure in DAC's, without regards to job creation, while giving no incentives to provide actual clean transportation service to the residents of DACs-unless that service is confined to the DAC. Projects allowing people in DACs to travel to where the jobs and opportunities are located outside the SB350 areas aren't incentivized. A massive fleet vehicle charging station with heavy duty vehicle traffic all night long gets subsidized, electric bus service from poor neighborhoods (e.g., San Jose) to restaurant and entertainment districts (e.g., Los Gatos and Mountain View downtowns) does not. Also, consumer friendly infrastructure subsidized with SB 350 funding, such as the last three BART stations, created massive, rapid gentrification in the immediate neighborhoods, driving out the original DAC residents.”

From the private sector, a suggested metric was “economic benefit to all ratepayers of increased throughput of electricity through existing fixed cost electric grid.” Another respondent offered the following:

> “DACs need to go beyond and include small commercial business customers. The technology and load associate[d] [with] EVs creates a rate design barrier related to demand fees and/or subscription fees. All small commercial customer sites will be impacted in rate design. Small commercial customers do not have the same amount of [VMT] to increase their kilowatt hour energy use as it relates to demand fees [therefore] these customers will be most impacted by the low load factor issue. This does not create equity for small commercial customers. Incentives and infrastructure for small commercial customers should be the same as [those created for DACs]. Only DACs and small commercial customers should get the funding.”

Finally, the same respondent also offered this statement:

> “Understanding public charging versus medium-/heavy-duty fleet charging is critical. Fleets and the medium-/heavy-duty sector will require higher voltage equipment which is more expensive but provides the solution that EVs require to increase capacity for every charger installed and allow the charging speed needed to keep the vehicles on the

road daily (i.e., opportunity charging). In addition, understanding and creating a definition for a small commercial fleet, a medium commercial fleet, and/or a large commercial fleet is important. A small, a medium, or a large fleet, each Will have a different footprint at a different amount of kilowatt hours and energy consumed and thereby just as in electric rate design for residential versus commercial there needs to be a creation of a definition for rates that support these different sectors uniquely. In addition, in California there is the Low Carbon Fuel Standards program. There needs to be more equity and education as it relates to the revenue created from these communities when using the technology. This revenue should not be going to the utilities. Lastly, I will add that the decision makers after CPUC and/or advocating parties have room for education and improvement as it relates to the medium-/heavy-duty sector which is very different compared to public charging and residential charging. The commission needs to understand that public charging is currently not passing on any rate design benefits to the drivers and [therefore] is not in the interest of [ratepayers] as there really is no behavior signal to support charging at off-peak versus peak time when charging at a public charging station." One respondent from the legal profession shared that, "a major issue is the cost shifting in current rate structures, particularly where volumetric rates are used to collect non-variable costs." They also stated that, "There's a significant tension in the transition to low/zero carbon and maintenance of supply reliability during periods where extreme weather variability is increasing due to climate change."

Final Framework for Calculating TE Benefits

This chapter discusses the final version of the framework and provides additional detail regarding the data that were used. This proposed framework will support program evaluation by guiding program administrators through a set of questions designed to facilitate a detailed account of expected outcomes and potential externalities. This process was largely informed by the findings drawn from the survey. The mean category weights for were also separated by sector and can be found in Tables 3-12. The final set of questions used in the framework were divided into five categories similar to the survey.

Community Engagement: It is important to explore how communities engage with the projects. Further, how do these projects relate to the priorities of the community, and have these priorities been adequately assessed in the project development? These metrics are meant to bring attention to the role the communities have and will play in the rollout of the projects.

Table 3. Mean category weight (community engagement)

MCW	MCWg	MCWp	MCWa	MCWl	MCWo
15.8%	17.2%	12.5%	21.7%	12.8%	17.3%

1. Across which phases of this project was/will the community be engaged (e.g., design, implementation, education, end-of-project debriefing, renewal)?
2. Does the project address a specified community need? How will community engagement continue after the completion of the project?
3. Has the community expressed its priorities with respect to co-benefits of any new projects? How do the co-benefits of installing additional chargers compare to these expressed priorities/needs?
4. Were social and/or linguistic barriers addressed in promoting the project? How?
5. Has the project considered its effects on indigenous peoples and their lands?
6. Does this project affect native flora and fauna?

Table 4. Mean metric weight (community engagement)

#	MMW	MMWg	MMWp	MMWa	MMWl	MMWo
1	26.9%	20.6%	23.5%	35.0%	33.0%	20.5%
2	26.6%	25.4%	34.5%	26.7%	20.0%	27.0%
3	22.9%	25.6%	23.3%	20.0%	22.2%	21.5%
4	9.3%	10.0%	10.0%	6.7%	8.2%	11.8%
5	8.4%	12.2%	5.0%	6.7%	7.8%	11.8%
6	5.9%	6.2%	3.8%	5.0%	8.8%	7.5%

Health and Safety Costs and Benefits: This set of metrics aims to determine to what extent the strategy or jurisdiction has considered the impacts of implementation on the health of the community, both positive and negative. This includes physical health, such as air pollution or infrastructure to promote exercise, as well as mental health. It also explores how the costs and benefits are distributed across communities.

Table 5. Mean category weight (health and safety costs and benefits)

MCW	MCWg	MCWp	MCWa	MCWl	MCWo
24.7%	26.0%	18.5%	23.3%	21.4%	25.8%

1. Does this project increase or decrease noise pollution and where? Who sees these costs/benefits?
2. Does this project increase or decrease local air pollution and where (i.e., % air pollutant reduction)? Who sees these costs/benefits?
3. Do potential accident zones disproportionately affect low-income communities? Will increased truck VMT exacerbate existing accident zones?

Table 6. Mean metric weight (health and safety costs and benefits)

#	MMW	MMWg	MMWp	MMWa	MMWl	MMWo
1	20.9%	27.0%	20.0%	13.3%	22.0%	23.8%
2	65.5%	58.4%	63.8%	78.0%	66.0%	55.0%
3	13.7%	14.6%	16.3%	8.7%	12.0%	21.3%

Effects of Infrastructure: These metrics deal with consequences that are beyond individual health and examine city-wide or regional safety.

Table 7. Mean category weight (effects of infrastructure)

MCW	MCWg	MCWp	MCWa	MCWl	MCWo
14.9%	15.4%	10.3%	21.7%	14.6%	13.0%

1. Does this project affect green space and/or recreational space?
2. Are there upstream impacts (i.e., through raw material acquisition or the construction phases) that can be tracked and located? How are those communities affected?
3. What are the end-of-life impacts of this project? What happens to the chargers, vehicle batteries, etc.?
4. What are the effects of the additional charging infrastructure on traffic and congestion?

Table 8. Mean metric weight (effects of infrastructure)

#	MMW	MMWg	MMWp	MMWa	MMWl	MMWo
1	22.6%	14.4%	22.8%	27.0%	15.0%	30.0%
2	18.6%	22.4%	16.8%	21.7%	16.8%	17.5%
3	30.2%	35.2%	18.0%	34.7%	30.0%	35.8%
4	28.6%	28.0%	42.5%	16.7%	38.2%	16.8%

Economic Costs and Benefits: There are almost always financial costs associated with implementing green infrastructure or strategies. These metrics probe the types of economic costs and benefits that are expected, as well as how these trade-offs affect communities. It is important to note that not just the distribution of costs and benefits, but there may also be barriers to accessing benefits that are not immediately obvious. These metrics try to capture the full range of considerations.

Table 9. Mean category weight (economic costs and benefits)

MCW	MCWg	MCWp	MCWa	MCWl	MCWo
30.4%	26.2%	42.5%	31.7%	27.6%	31.3%

1. Will local community members benefit?
2. Will local MDV and HDV operators within the community benefit?
3. What are the potential barriers to benefits? Will local business be at risk of closure?
4. Does this project create short- and/or long-term jobs? How is this verified?
5. How will this project maintain the interests of rate payers?
6. Does the increased electricity demand increase the economic burden on DACs?

Table 10. Mean metric weight (economic costs and benefits)

#	MMW	MMWg	MMWp	MMWa	MMWl	MMWo
1	27.1%	26.4%	22.3%	34.3%	26.0%	27.5%
2	22.6%	24.4%	26.0%	13.3%	19.8%	30.0%
3	7.2%	11.2%	6.5%	3.3%	5.6%	10.0%
4	12.2%	6.0%	15.3%	3.3%	14.0%	10.8%
5	21.4%	17.2%	23.0%	42.3%	22.8%	12.0%
6	9.6%	14.8%	7.0%	3.3%	11.8%	9.8%

Technological Resilience: These metrics examine barriers to accessing technology and associated benefits. While this theme was explored under "Economic Costs and Benefits," here, we focus on the non-financial barriers.

Table 11. Mean category weight (technological resilience)

MCW	MCWg	MCWp	MCWa	MCWl	MCWo
14.1%	15.2%	16.3%	1.7%	23.6%	12.8%

1. How does increased electricity demand affect grid stability and resilience?
2. If there is an increase in sustainable technologies, who can access them?
3. Does an electrification plan include support for distributed generation and development of micro-grids?

Table 12. Mean metric weight (technological resilience)

#	MMW	MMWg	MMWp	MMWa	MMWl	MMWo
1	35.4%	31.8%	38.0%	47.0%	36.0%	32.5%
2	37.0%	42.6%	27.0%	44.7%	22.6%	47.5%
3	27.5%	25.6%	35.0%	8.3%	41.4%	20.0%

Case Study

The final framework was tested against one of the Priority Review Projects approved in the pilot effort of the SB 350 legislation to check for clarity and effectiveness. This case study has been provided below in Tables 13-18:

Table 13. Final framework: health and safety costs and benefits.

Health and Safety Costs and Benefits			
This set of indicators aims to determine to what extent the strategy or jurisdiction has considered the impacts of implementation on the health of the community, both positive and negative. This includes physical health, such as air pollution or infrastructure to promote exercise, as well as mental health. It also explores how the costs and benefits are distributed across communities.			
Framework Question:	Does this project increase or decrease noise pollution and where? Who sees these costs/benefits?	Does this project increase or decrease local air pollution and where (i.e., % air pollutant reduction)? Who sees these costs/benefits? (Consider changes in drive cycle emissions as well as fuel/electricity emissions)	Do potential accident zones disproportionately affect low-income communities? Will increased truck VMT exacerbate existing accident zones? (Evaluate crash risks due to increased truck traffic)
Response:		Anticipated decreases in local air pollution. Urban routes have a lot of stop-and-go and idling, the energy use of which is greatly reduced in EVs (compared to ICEs/diesel) Expected emissions of 0.67 MT of NOx annually. This number would need to be compared to emissions of diesel trucks to find the expected change in emissions. These emissions occur in communities where energy providers are located (i.e., natural gas plants, nuclear plants, etc.)	No additional VMT, so N/A
Score (1-5):	1	3	2
Excellent = 5 Very Good = 4 Good = 3 Fair = 2 Poor = 1			
MMW x Score: (ROUNDED)	0	2	0
MMWg x Score: (ROUNDED)	0	2	0
MMWp x Score: (ROUNDED)	0	2	0
MMWa x Score: (ROUNDED)	0	2	0
MMWl x Score: (ROUNDED)	0	2	0
MMWo x Score: (ROUNDED)	0	2	0

Table 14. Final framework: effects of infrastructure

Effects of Infrastructure				
These indicators deal with consequences that are beyond individual health and examine city-wide or regional safety.				
Framework Question:	Does this project affect green space and/or recreational space? (Proximity to green space)	Are there upstream impacts (i.e., through raw material acquisition or the construction phases) that can be tracked and located? How are those communities affected? (Consider impacts that occur prior to installation and use)	What are the end-of-life impacts of this project? What happens to the chargers, vehicle batteries, etc.? (Give an overview of plans for end-of-life impacts for the installed chargers)	What are the effects of the additional charging infrastructure on traffic and congestion? (Quantify changes in travel time and total mileage)
Response:	No.	Workhorse is an Ohio-based electric truck manufacturing company. They have a plant in Lordstown, Ohio.	TBD	No. We are fairly certain it is a 1-1 replacement of ICE to EVs. This is substantiated by decisions to test this in areas with shorter routes (i.e. urban routes), the requirement for the client to purchase new vehicles, and claims that potential participants did not participate in the program because they had recently bought new ICE's.
Score (1-5):	3	2	1	3
Excellent = 5 Very Good = 4 Good = 3 Fair = 2 Poor = 1				
MMWg x Score: (ROUNDED)	1	0	0	1
MMWp x Score: (ROUNDED)	0	0	0	1
MMWa x Score: (ROUNDED)	1	0	0	1
MMWl x Score: (ROUNDED)	0	0	0	1
MMWo x Score: (ROUNDED)	1	0	0	1

Table 15. Final framework: economic costs and benefits

Economic Costs and Benefits						
There are almost always financial costs associated with implementing green infrastructure or strategies. These indicators probe the types of economic costs and benefits that are expected, as well as how these trade-offs affect communities. It is important to note that not just the distribution of costs and benefits, but there may also be barriers to accessing benefits that are not immediately obvious. These indicators try to capture the full range of considerations.						
Framework Question:	Will local community members benefit? (Evaluate the expected tangible benefits for local community members)	Will local MDV and HDV operators within the community benefit? (Evaluate the expected tangible benefits for local MDV and HDV operators)	What are the potential barriers to benefits? Will local businesses be at risk of closure? (Evaluate potential barriers to benefits along with forecasted business closures)	Does this project create short- and/or long-term jobs? How is this verified?	How will this project maintain the interests of ratepayers?	Does the increased electricity demand increase the economic burden on DACs? (Forecast changes to customer prices related to the project/program)
Response:		Yes. Amazon hires local delivery companies to handle its intra-city services. We note the barrier of these local businesses to purchase the new vehicles, as the examined program only provides charging infrastructure		Short-term: Installation of charging infrastructure Long-term: Contracts for local delivery businesses; occasionally, maintenance and replacement of chargers and charging infrastructure	It's assumed all end users will see benefits from decreased peak demand, but how exactly those benefits are distributed is unclear.	Theoretically, off-peak charging decreases peak energy demand and consumption, which would decrease generation costs that reach utility customers. They plan to collect data on charging patterns and energy use to minimize related costs and impacts. With the measures in place, it is not

						expected to increase burden in DACs. Rather, with decreased peak demand, this could alleviate burdens on DACs (or at least communities that house peak generators)
Score (1-5):	1	3	1	3	2	4
Excellent = 5 Very Good = 4 Good = 3 Fair = 2 Poor = 1						
MMWg x Score: (ROUNDED)	0	1	0	0	0	1
MMWp x Score: (ROUNDED)	0	1	0	0	0	0
MMWa x Score: (ROUNDED)	0	0	0	0	1	0
MMWl x Score: (ROUNDED)	0	1	0	0	0	0
MMWo x Score: (ROUNDED)	0	1	0	0	0	0

Table 16. Final framework: technological resilience

Community Engagement						
It is important to explore how communities engage with the projects. Further, how do these projects relate to the priorities of the community, and have these priorities been adequately assessed in the project development? These indicators are meant to bring attention to the role the communities have and will play in the rollout of the projects.						
Framework Question:	Across which phases of this project was/will the community be engaged (e.g., design, implementation, education, end of project debriefing, renewal)?	Does the project address a specified community need? How will community engagement continue after the completion of the project? (Work with community members to create a plan)	Has the community expressed its priorities with respect to co-benefits of any new projects? How do the co-benefits of installing additional chargers compare to these expressed priorities/needs?	Were social and/or linguistic barriers addressed in promoting the project? How?	Has the project considered its effects on indigenous peoples and their lands?	Does this project affect native flora and fauna?
Response:	Lots of engagement during planning (pamphlet communication, delivery forums for education, etc. to find potential participants).	Community opinions and feedback were requested during forums. There is no clear plan for engagement after completion of the project.	N/A - Pretty sure Deb said we only care about local pollution	No.	No.	Assuming chargers were installed on existing developed infrastructure, then no.
Score (1-5):	3	3	2	1	1	2
Excellent = 5 Very Good = 4 Good = 3 Fair = 2 Poor = 1						
MMWg x Score: (ROUNDED)	1	1	1	0	0	0
MMWp x Score: (ROUNDED)	1	1	0	0	0	0

MMWa x Score: (ROUNDED)	1	1	0	0	0	0
MMWl x Score: (ROUNDED)	1	1	0	0	0	0
MMWo x Score: (ROUNDED)	1	1	0	0	0	0

Table 17. Final framework category score example: health costs and safety benefits

Health and Safety Costs and Benefits		
Category Score (CS): ∑(MMW x Score)	2	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Health and Safety Costs and Benefits (Government)		
Category Score (CSg): ∑(MMWg x Score)	2	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Health and Safety Costs and Benefits (Private Sector)		
Category Score (CSp): ∑(MMWp x Score)	2	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Health and Safety Costs and Benefits (Advocacy Group)		
Category Score (CSa): ∑(MMWa x Score)	3	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Health and Safety Costs and Benefits (Legal Representation)		
Category Score (CSl): ∑(MMWl x Score)	2	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Health and Safety Costs and Benefits (Other)		
Category Score (CSo): ∑(MMWo x Score)	2	
	Lower	Upper
Excellent	4.2	5.0
Very Good	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Table 18. Final framework project performance indicator

Project Performance Indicator (PPI)		
∑(MCW x CS):	2.3	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Project Performance Indicator (PPIg) (Government)		
∑(MCWg x CSg):	2.2	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Project Performance Indicator (PPIp) (Private Sector)		
∑(MCWp x CSp):	2.3	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Project Performance Indicator (PPIa) (Advocacy Group)		
∑(MCWa x CSa):	2.2	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Project Performance Indicator (PPIl) (Legal Representation)		
∑(MCWl x CSl):	2.2	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

Project Performance Indicator (PPIo) (Other)		
∑(MCWo x CSo):	2.2	
	Lower	Upper
Excellent	4.2	5.0
Very	3.3	4.1
Good	2.4	3.2
Fair	1.5	2.3
Poor	1.0	1.4

References

CA.gov, 2017. CalEnviroScreen 3.0 Factsheet. *California Office of Environmental Health Hazard Assessment*. https://oehha.ca.gov/media/downloads/calenviroscreen/fact-sheet/ces30factsheetfinal.pdf

CA.gov, 2019. Scoring Criteria for Projects that Benefit Disadvantaged and Low-Income Communities. *California Energy Commission Research & Development.* https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/Infrastructure/DC/Item%206a_EPIC%20grant%20scoring%20criteria.pdf

CA.gov, 2020. California Climate Investments Co-benefit Assessment Methodologies. *California Air Resources Board*. https://ww2.arb.ca.gov/resources/documents/cci-methodologies

CA.gov, 2021a. CPUC Decision & Review Process. *California Public Utilities Commission*. https://www.cpuc.ca.gov/General.aspx?id=4166

CA.gov, 2021b. Draft CalEnviroScreen 4.0. *California Office of Environmental Health Hazard Assessment*. https://oehha.ca.gov/calenviroscreen/report/draft-calenviroscreen-40

CPUC, 2017. Prepared Testimony on Pacific Gas and Electric Company's and Southern California Edison Company's Medium/Heavy-Duty Fleet Charging Infrastructure and Commercial Electric Vehicle Rates Programs. *California Public Utilities Commission*. https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A1701020/827/195587319.pdf

CPUC, 2018. Decision on the Transportation Electrification Standard Review Projects (D. 18-05-040). *California Public Utilities Commission*. https://www.cpuc.ca.gov/sb350te/

De León, S.; Leno, S.; Williams, A.; Allen, S.; Hancock, S.; McCarty, A.; Monning, S. (2015) SB-350 Clean Energy and Pollution Reduction Act of 2015. *California Legislative Information*. https://leginfo.legislature.ca.gov/faces/billPdf.xhtml?bill_id=201520160SB350&version=20150SB35093CHP

Harvey, J.T.; Kendall, A.; Saboori, A.; Ostovar, M.; Butt, A.A.; Hernandez, J.; Haynes, B. (2018). Framework for Life Cycle Assessment of Complete Streets Projects. *UC Davis: National Center for Sustainable Transportation*. https://escholarship.org/uc/item/0vw335dp

Sovacool, B.K.; Dworkin, M.H. (2015). Energy justice: Conceptual insights and practical applications. *Applied Energy*, 142:435-444. http://dx.doi.org/10.1016/j.apenergy.2015.01.002

Steinberg, D.; Bielen, D.; Eichman, J.; Eurek, K.; Logan, J.; Mai, T.; McMillan, C.; Parker, A.; Vimmerstedt, L.; Wilson, E. (2017). Electrification & Decarbonization: Exploring U.S. Energy Use and Greenhouse Gas Emissions in Scenarios with Widespread Electrification and Power Sector Decarbonization. *National Renewable Energy Laboratory*. https://www.nrel.gov/docs/fy17osti/68214.pdf

Data Summary

Products of Research

A sample survey of stakeholders was developed and implemented.

Data Format and Content

Data are included in the report as tables.

Data Access and Sharing

Data summaries are included in the report and additional data including statistical analysis are included in the appendices of this report. All are provided in table format.

Reuse and Redistribution

Data included in the report can be used with proper citation.

Appendix

Table A1. Overall statistics of weighted categories

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	8	50	30.4	11.2	126	23
2	Health and Safety Costs and Benefits	4	45	24.7	8.9	79.8	23
3	Community Engagement	0	25	15.8	6.9	47.5	23
4	Effects of Infrastructure	0	40	14.9	10.7	115.4	23
5	Technological Resilience	0	41	14.1	10.3	106.7	23

Table A2. Economic costs and benefits - Statistics of weighted metrics

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Expected tangible benefits for local community members	9	51	27.1	11.9	142.0	23
2	Expected tangible benefits for local medium- and heavy-duty vehicle operators	0	60	22.6	16.2	260.9	23
3	Maintaining rate payer interests	0	72	21.4	17.2	294.8	23
4	Job creation	0	50	12.2	11	120.3	23
5	Economic burden on DACs due to increased electricity demand	0	25	9.6	8.5	71.7	23
6	Potential barriers to benefits along with forecasted business closures	0	20	7.1	7.9	61.8	23

Table A3. Health and safety costs and benefits - Statistics of weighted metrics

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	15	90	65.5	18.8	351.6	23
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	0	44	20.9	11.4	128.8	23
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	45	13.7	12.7	162.1	23

Table A4. Community engagement - Statistics of weighted metrics

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	0	55	26.9	11.1	123.3	23
2	Addressing a specified community need	9	50	26.6	11.8	138.8	23
3	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	10	50	22.9	9.9	97.0	23
4	Addressing social and/or linguistic barriers	0	17	9.3	5.3	28.0	23
5	Effects on indigenous peoples and their lands	0	20	8.4	6.5	42.1	23
6	Effects on native flora and fauna	0	15	5.9	5.0	25.2	23

Table A5. Effects of infrastructure - Statistics of weighted metrics

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	10	88	30.2	17.3	300.5	23
2	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	0	65	28.6	17.5	305.0	23
3	Effects on the use of green space and/or recreational space	0	60	22.6	15.3	235.4	23
4	Upstream impacts (i.e., through raw material acquisition or construction phases)	0	40	18.6	8.6	74.4	23

Table A6. Technological resilience - Statistics of weighted metrics

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances access to additional sustainable technologies	10	80	37.0	19.7	387	23
2	Improves or enhances grid stability and resilience	9	70	35.4	16.0	256.4	23
3	Supports distributed generation and the development of micro-grids in electrification plans	0	60	27.5	15.2	231.9	23

Table A7. Overall statistics of weighted categories (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	24	32	26.2	2.9	8.6	5
2	Health and Safety Costs and Benefits	20	31	26	4.1	16.4	5
3	Community Engagement	0	25	17.2	8.9	79.8	5
4	Effects of Infrastructure	5	24	15.4	6.3	39.4	5
5	Technological Resilience	5	20	15.2	5.3	28.6	5

Table A8. Economic costs and benefits - Statistics of weighted metrics (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Expected tangible benefits for local community members	12	40	26.4	9.6	91.8	5
2	Expected tangible benefits for local medium- and heavy-duty vehicle operators	5	60	24.4	19.6	383.4	5
3	Maintaining rate payer interests	0	29	17.2	10.9	118.2	5
4	Economic burden on DACs due to increased electricity demand	0	25	14.8	10.3	106.2	5
5	Potential barriers to benefits along with forecasted business closures	0	20	11.2	7.8	60.6	5
6	Job creation	0	15	6	4.9	24	5

Table A9. Health and safety costs and benefits - Statistics of weighted metrics (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	42	70	58.4	11.1	122.2	5
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	15	40	27	8.1	66	5
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	33	14.6	11.6	134.6	5

Table A10. Community engagement - Statistics of weighted metrics (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	0	29	20.6	10.4	109.0	5
2	Addressing a specified community need	9	50	25.4	15.6	241.8	5
3	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	10	50	25.6	14.8	218.6	5
4	Addressing social and/or linguistic barriers	0	16	10	5.5	30.4	5
5	Effects on indigenous peoples and their lands	0	20	12.2	6.9	47.4	5
6	Effects on native flora and fauna	0	12	6.2	4.3	18.6	5

Table A11. Effects of infrastructure - Statistics of weighted metrics (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	25	45	35.2	7.8	61	5
2	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	10	50	28	13	167.6	5
3	Upstream impacts (i.e. through raw material acquisition or construction phases)	10	40	22.4	10.4	108.2	5
4	Effects on the use of green space and/or recreational space	0	36	14.4	12.7	161.0	5

Table A12. Technological resilience - Statistics of weighted metrics (government)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances access to additional sustainable technologies	28	65	42.6	14.73	217.04	5
2	Improves or enhances grid stability and resilience	20	44	31.8	7.81	60.96	5
3	Supports distributed generation and the development of micro-grids in electrification plans	5	40	25.6	11.46	131.44	5

Table A13. Overall statistics of weighted categories (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	35	50	42.5	7.5	56.25	4
2	Health and Safety Costs and Benefits	4	35	18.5	11.15	124.25	4
3	Technological Resilience	10	20	16.25	4.15	17.19	4
4	Community Engagement	10	20	12.5	4.33	18.75	4
5	Effects of Infrastructure	0	21	10.25	10.26	105.19	4

Table A14. Economic costs and benefits - Statistics of weighted metrics (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Expected tangible benefits for local medium- and heavy-duty vehicle operators	15	34	26	7.1	50.5	4
2	Maintaining rate payer interests	15	30	23	5.4	29.5	4
3	Expected tangible benefits for local community members	15	30	22.3	5.7	32.7	4
4	Job creation	6	25	15.3	7.6	57.7	4
5	Economic burden on DACs due to increased electricity demand	0	15	7	7.0	49.5	4
6	Potential barriers to benefits along with forecasted business closures	0	20	6.5	8.2	66.8	4

Table A15. Health and safety costs and benefits - Statistics of weighted metrics (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	35	80	63.8	17.5	304.7	4
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	5	30	20	9.4	87.5	4
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	40	16.3	15.6	242.2	4

Table A16. Technological resilience - Statistics of weighted metrics (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances grid stability and resilience	30	50	38	7.9	62	4
2	Supports distributed generation and the development of micro-grids in electrification plans	25	50	35	9.4	87.5	4
3	Improves or enhances access to additional sustainable technologies	18	35	27	6.3	39.5	4

Table A17. Community engagement - Statistics of weighted metrics (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	15	30	23.5	6.3	39.3	4
2	Addressing a specified community need	25	48	34.5	8.6	73.3	4
3	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	13	35	23.3	9.4	89.2	4
4	Addressing social and/or linguistic barriers	5	15	10	3.5	12.5	4
5	Effects on indigenous peoples and their lands	0	15	5	6.1	37.5	4
6	Effects on native flora and fauna	0	10	3.8	4.2	17.2	4

Table A18. Effects of infrastructure - Statistics of weighted metrics (private sector)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	23	65	42.5	18.7	350.8	4
2	Effects on the use of green space and/or recreational space	15	31	22.8	5.9	35.2	4
3	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	10	25	18	6.2	38.5	4
4	Upstream impacts (i.e., through raw material acquisition or construction phases)	9	25	16.8	7.3	53.2	4

Table A19. Overall statistics of weighted categories (advocacy group)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	20	45	31.7	10.3	105.6	3
2	Health and Safety Costs and Benefits	20	30	23.3	4.7	22.2	3
3	Community Engagement	20	25	21.7	2.4	5.6	3
4	Effects of Infrastructure	0	40	21.7	16.5	272.2	3
5	Technological Resilience	0	5	1.7	2.4	5.6	3

Table A20. Economic costs and benefits - Statistics of weighted metrics (advocacy group)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Maintaining rate payer interests	5	72	42.3	27.9	777.6	3
2	Expected tangible benefits for local community members	25	50	34.3	11.2	124.2	3
3	Expected tangible benefits for local medium- and heavy-duty vehicle operators	0	40	13.3	18.9	355.6	3
4	Potential barriers to benefits along with forecasted business closures	0	10	3.3	4.7	22.2	3
5	Job creation	0	10	3.3	4.7	22.2	3
6	Economic burden on DACs due to increased electricity demand	0	10	3.3	4.7	22.2	3

Table A21. Health and safety costs and benefits - Statistics of weighted metrics (advocacy group)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	64	90	78	10.7	114.7	3
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	0	25	13.3	10.3	105.6	3
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	5	11	8.7	2.6	6.9	3

Table A22. Community engagement - Statistics of weighted metrics (advocacy group)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	25	40	35	7.1	50	3
2	Addressing a specified community need	20	40	26.7	9.4	88.9	3
3	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	20	20	20	0	0	3
4	Addressing social and/or linguistic barriers	0	10	6.7	4.7	22.2	3
5	Effects on indigenous peoples and their lands	0	10	6.7	4.7	22.2	3
6	Effects on native flora and fauna	0	15	5	7.1	50	3

Table A23. Effects of infrastructure - Statistics of weighted metrics (advocacy group)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	15	49	34.7	14.4	206.9	3
2	Effects on the use of green space and/or recreational space	20	31	27	5	24.7	3
3	Upstream impacts (i.e., through raw material acquisition or construction phases)	20	25	21.7	2.4	5.6	3
4	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	0	30	16.7	12.5	155.6	3

Table A24. Technological resilience - Statistics of weighted metrics (advocacy groups)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances grid stability and resilience	20	70	47	20.6	424.7	3
2	Improves or enhances access to additional sustainable technologies	24	80	44.7	25.1	630.2	3
3	Supports distributed generation and the development of micro-grids in electrification plans	0	25	8.3	11.8	138.9	3

Table A25. Overall statistics of weighted categories (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Health and Safety Costs and Benefits	40	45	42.5	2.5	6.3	2
2	Economic Costs and Benefits	20	20	20	0	0	2
3	Effects of Infrastructure	5	30	17.5	12.5	156.3	2
4	Community Engagement	10	20	15	5	25	2
5	Technological Resilience	0	10	5	5	25	2

Table A26. Health and safety costs and benefits - Statistics of weighted metrics (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	85	90	87.5	2.5	6.3	2
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	5	15	10	5	25	2
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	5	2.5	2.5	6.3	2

Table A27. Economic costs and benefits - Statistics of weighted metrics (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Job creation	16	50	33	17	289	2
2	Expected tangible benefits for local community members	20	40	30	10	100	2
3	Expected tangible benefits for local medium- and heavy-duty vehicle operators	15	20	17.5	2.5	6.3	2
4	Maintaining rate payer interests	0	24	12	12	144	2
5	Economic burden on DACs due to increased electricity demand	0	10	5	5	25	2
6	Potential barriers to benefits along with forecasted business closures	0	5	2.5	2.5	6.3	2

Table A28. Effects of infrastructure - Statistics of weighted metrics (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Effects on the use of green space and/or recreational space	40	40	40	0	0	2
2	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	10	40	25	15	225	2
3	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	0	40	20	20	400	2
4	Upstream impacts (i.e., through raw material acquisition or construction phases)	10	20	15	5	25	2

Table A29. Community engagement - Statistics of weighted metrics (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	30	40	35	5	25	2
2	Addressing a specified community need	29	30	29.5	0.5	0.3	2
3	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	19	30	24.5	5.5	30.3	2
4	Addressing social and/or linguistic barriers	6	10	8	2	4	2
5	Effects on indigenous peoples and their lands	0	6	3	3	9	2
6	Effects on native flora and fauna	0	0	0	0	0	2

Table A30. Technological resilience - Statistics of weighted metrics (environmental NGO)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances access to additional sustainable technologies	34	60	47	13	169	2
2	Improves or enhances grid stability and resilience	20	33	26.5	6.5	42.3	2
3	Supports distributed generation and the development of micro-grids in electrification plans	20	33	26.5	6.5	42.3	2

Table A31. Overall statistics of weighted categories (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	8	44	27.6	13.1	171.4	5
2	Technological Resilience	6	41	23.6	13.8	190.6	5
3	Health and Safety Costs and Benefits	15	30	21.4	6.0	36.2	5
4	Effects of Infrastructure	0	29	14.6	10.8	117.0	5
5	Community Engagement	8	20	12.8	4.3	18.2	5

Table A32. Economic costs and benefits - Statistics of weighted metrics (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Expected tangible benefits for local community members	9	51	26	16.8	280.4	5
2	Maintaining rate payer interests	4	49	22.8	14.6	211.8	5
3	Expected tangible benefits for local medium- and heavy-duty vehicle operators	12	30	19.8	5.9	34.6	5
4	Job creation	10	20	14	4.9	24	5
5	Economic burden on DACs due to increased electricity demand	0	20	11.8	7.6	57	5
6	Potential barriers to benefits along with forecasted business closures	0	20	5.6	7.8	61.4	5

Table A 33. Technological resilience - Statistics of weighted metrics (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Supports distributed generation and the development of micro-grids in electrification plans	15	60	41.4	14.8	217.4	5
2	Improves or enhances grid stability and resilience	9	61	36	19.1	364.4	5
3	Improves or enhances access to additional sustainable technologies	10	45	22.6	12.2	148.6	5

Table A34. Health and safety costs and benefits - Statistics of weighted metrics (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	44	89	66	15.5	241.2	5
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	11	44	22	11.9	142	5
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	20	12	6.8	46.8	5

Table A35. Effects of infrastructure - Statistics of weighted metrics (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	20	55	38.2	11.7	137.8	5
2	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	20	40	30	8.6	73.6	5
3	Upstream impacts (i.e., through raw material acquisition or construction phases)	4	25	16.8	7.1	51	5
4	Effects on the use of green space and/or recreational space	3	25	15	7.6	57.2	5

Table A36. Community engagement - Statistics of weighted metrics (legal representation)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	16	55	33	13.4	180.4	5
2	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	10	40	22.2	10.4	109	5
3	Addressing a specified community need	9	40	20	11.2	124.4	5
4	Effects on native flora and fauna	2	15	8.8	4.7	22.2	5
5	Addressing social and/or linguistic barriers	3	16	8.2	5	24.6	5
6	Effects on indigenous peoples and their lands	0	16	7.8	6	35.4	5

Table A37. Overall statistics of weighted categories (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Economic Costs and Benefits	20	45	31.3	11.4	129.7	4
2	Health and Safety Costs and Benefits	20	33	25.8	5.9	34.2	4
3	Community Engagement	4	25	17.3	7.9	62.7	4
4	Effects of Infrastructure	10	20	13	4.1	17	4
5	Technological Resilience	6	20	12.8	5.3	27.7	4

Table A38. Economic costs and benefits - Statistics of weighted metrics (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Expected tangible benefits for local medium- and heavy-duty vehicle operators	0	60	30	22.4	500	4
2	Expected tangible benefits for local community members	20	45	27.5	10.3	106.3	4
3	Maintaining rate payer interests	5	30	12	10.5	109.5	4
4	Job creation	3	25	10.8	8.6	74.2	4
5	Potential barriers to benefits along with forecasted business closures	0	20	10	7.9	62.5	4
6	Economic burden on DACs due to increased electricity demand	2	20	9.8	6.6	43.2	4

Table A39. Health and safety costs and benefits - Statistics of weighted metrics (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Changes to local air pollution through electrified vehicle-miles-traveled (VMT)	15	85	55	25.3	637.5	4
2	Changes to noise pollution through electrified vehicle-miles-traveled (VMT)	10	40	23.8	11.9	142.2	4
3	Potential for accident zones (i.e., crash risks due to increased truck traffic)	0	45	21.3	17.5	304.7	4

Table A40. Community engagement - Statistics of weighted metrics (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Addressing a specified community need	18	40	27	8.8	77	4
2	Delivering on priorities expressed by the community with respect to co-benefits of any new projects	18	30	21.5	5	24.8	4
3	Transparent and collaborative community engagement throughout all phases (e.g., design, implementation, education, end-of-project debriefing, renewal)	15	29	20.5	5.2	27.3	4
4	Addressing social and/or linguistic barriers	0	17	11.8	6.8	46.7	4
5	Effects on indigenous peoples and their lands	5	17	11.8	4.7	21.7	4
6	Effects on native flora and fauna	5	10	7.5	1.8	3.3	4

Table A41. Effects of infrastructure - Statistics of weighted metrics (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	End-of-life impacts (i.e., recycling, disposal, or reuse of chargers, vehicle batteries, etc.)	10	88	35.8	31.9	1014.2	4
2	Effects on the use of green space and/or recreational space	0	60	30	25.5	650	4
3	Upstream impacts (i.e., through raw material acquisition or construction phases)	0	30	17.5	10.9	118.8	4
4	Effects of additional charging infrastructure and/or related equipment on traffic and congestion	10	35	16.8	10.6	111.7	4

Table A42. Technological resilience - Statistics of weighted metrics (other)

#	Field	Minimum (%)	Maximum (%)	Mean (%)	Std Deviation (%)	Variance (%)	Count
1	Improves or enhances access to additional sustainable technologies	20	80	47.5	23.9	568.8	4
2	Improves or enhances grid stability and resilience	10	60	32.5	19.2	368.8	4
3	Supports distributed generation and the development of micro-grids in electrification plans	10	30	20	7.1	50	4