CERA Fuel Conversion Reporting Tool User's Guide and Project Report

October 14, 2024

ICF

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Executive Summary

This project developed the CERA Fuel Conversion Reporting Tool to track and report the emissions benefits associated with projects funded under Washington's Carbon Emission Reduction Account (CERA). The primary objective of the tool is to support the Joint Transportation Committee (JTC) of the Washington Legislature to monitor the fiscal expenditures, benefits to vulnerable populations and overburdened communities, and greenhouse gas emission reductions achieved through CERA investments. The tool applies standard methodologies for assessing the benefits of CERA-funded fuel conversion projects, which involve replacing internal combustion engines with zero-emission alternatives like battery electric and hydrogen fuel cell vehicles.

The Tool is a cloud-based, dashboard application accessed via a direct link to the SharePoint site:

https://icfonline.sharepoint.com/sites/JTC-CERA

The Tool is currently released as version 1.0 and is considered a beta release. Access is restricted to approved users.

Tool's primary purpose is to inform the JTC and Washington State Legislature about the investments and benefits of the projects funded in the transportation budget. Specifically, it tracks and reports the items required under the transportation budget proviso (Proviso) governing this study (S-3376.1/23, p18, lines 1-12). It is a dashboard application, built in Microsoft's SharePoint and PowerBI platforms to track individual projects and aggregate impacts in three broad reporting categories. The following table summarizes these mandatory reporting categories and how they are implemented in the Tool.

Reporting Category	Measure	How Implemented in the Tool
Budgetary Impacts	Emission Reduction per Total Project Cost	Total emissions per year and cumulative emissions[1] divided by total project cost
	Emission Reduction per Funded Amount	Total emissions per year and cumulative emissions divided by CERA funded amount
Emissions Reduction	Annual Emissions Reduced	GHG and CAP emissions reduced per year
	Total Emissions Reduced	Total GHG emissions reduced over the defined project lifetime
EJ Impacts	Location of Reductions for Criteria Pollutants	Optional display of location of emission reductions (dependent on user inputs)
	Project in DAC[2] (Yes/No)	Is the project located in a DAC (dependent on user inputs of impacted Census tracts)
	Tribal support (Yes/No)	Does the project receive tribal support (dependent on user inputs)

[1] Cumulative emissions are determined over the project's lifetime. Each Project Element has a fixed, standard lifetime.
[2] Disadvantaged Community. Here this term is used synonymously with vulnerable populations and overburdened communities.

The Tool is intended to be used primarily by the Legislature's transportation committees and reporting partners, such as funding recipients. It is designed to help the Legislature develop recommendations for program delivery, adjustments to future funding allocations, and other programmatic improvements. The Tool is designed to assemble available information, be accessible and usable to agencies implementing CERA funds, and support evaluation of the efficacy of carbon emission reductions (e.g., in GHG emissions reduced per dollar spent) from CERA investments. It is designed to support information sharing, enable regular data input and reporting, support tracking of EJ benefits, improve the user's understanding of the costs and benefits of CERA expenditures, and inform actionable recommendations.

The design criteria of the Tool were set through direct communications with stakeholders in the legislature and a Technical Team appointed by JTC. It was built to be compatible with fuel conversion project types funded through direct CERA appropriations in the 2023-2025 biennial and 2024 supplemental transportation budgets. It addresses nine categories of fuel conversion projects:

1. **EV Purchase** – projects that purchase **electric vehicles** to replace ICE vehicles
2. **FCEV Purchase** – projects that purchase **hydrogen fuel cell** vehicles to replace ICE vehicles
3. **Off-Road ZE Purchase** – projects that purchase **zero emissions** versions of off-road equipment to replace ICE equipment. The replacement equipment may be fueled by either electricity or hydrogen fuel cells. The baseline equipment may be gasoline, diesel, CNG, or LPG fueled, depending on the equipment type.
4. **EV Charging Infrastructure** – projects that promote vehicle electrification by installing electric vehicle charging infrastructure (also known as electric vehicle supply equipment (EVSE))
5. **FCEV Fueling Infrastructure** – projects that promote the use of zero emission hydrogen as a fuel by installing hydrogen fueling infrastructure
6. **EV Carshare** – projects that expand the use of electric vehicles in carshare programs
7. **Watercraft Purchase: Ferry** – projects that purchase more efficient ferries and promote ferry electrification. This is specific to ferry electrification projects undertaken by Washington State Ferry (WSF). It includes both more efficient vessels and dock electrification, which provides shore power while docked and charges ferries for electrified trips. To avoid double counting, WSF ferry electrification projects should rely on this element only, rather than the Shore Power element.
8. **ZE Watercraft Purchase: Non-Ferry** – non-WSF projects that purchase electric watercraft to replace fossil fueled vessels
9. **Port Shore Power** – non-WSF projects that install port shore power for vessels to access instead of using their own auxiliary engines

This document is the comprehensive User's Guide supporting the Tool. It is also a summary report for the project. It is organized into four parts:

1. **Introduction and Background.** This section provides background information on CERA, a summary of the project, and a brief overview of the Tool.
2. **User's Guide.** Section 2 serves as a user's guide for the tool. It provides an overview of the tool, details of the platform, defines key terms used by the tool, provides a "quick start guide" for users, and a detailed walkthrough of each of the Tool's various components.

3. **Methodology and Specifications.** The third section provides "under the hood" details of the Tool. This includes details on the calculation approach for each of the nine types of projects, design specifications, a list of notable assumptions and areas for future improvement, and a brief, technical summary of the tool's architecture.
4. **Additional Material**. Sections 4, 5, and 6 provide supplementary material, including a glossary, list of contributors, and appendices including the full set of calculation factors derived for use in the Tool, design blueprint, and a list of the funded fuel conversion projects.

This project is organized into two phases. This document and the beta release of the Tool are the primary deliverables of Phase 1. Phase 2 encompasses potential future work building off the outcomes discussed in this document and could include revisions to the Tool based on user feedback, design for supplementary data collection, and other support for JTC in assessing project outcomes with the Tool. Phase 2 includes some additional scope requiring consultation with the JTC.

1 Introduction

This section provides an overview of the development of the CERA Fuel Conversion Tool for the Washington State Joint Transportation Committee (JTC).

This report summarizes the work conducted under Phase 1 of this project. Phase 1 concludes with the release and presentation of the beta version of this Tool. Phase 2 represents potential future development work and is only briefly discussed in this report as next steps for tool development after beta testing in **Section 3.4.**

1.1 Background

Washington State stands at the forefront of implementing policies and initiatives to curb greenhouse gas (GHG) emissions. It has set forth legislative GHG reduction goals to mitigate severe climate change consequences, targeting a reduction of 45% from 1990 levels by 2030, 70% by 2040, and net-zero emissions by 2050. The Climate Commitment Act (CCA), enacted by the Washington State Legislature in 2021, established a cap-and-invest system to decrease carbon emissions throughout the state, supporting Washington's ambitious GHG reduction objectives. The Department of Ecology (Ecology) is responsible for informing the state Legislature about allocating CCA-generated funds. Additionally, the CCA stipulates that a minimum of 35% of the revenue from auctions is allocated to projects that directly benefit vulnerable groups in overburdened communities and mandates that 10% of the proceeds support projects endorsed by Tribes.

The Department of Ecology gathers data from funding beneficiaries. Ecology ensures this data is available on its website annually and submits a report to the legislative body no later than September 30th each year. The Carbon Emission Reduction Account (CERA), financed through cap-and-invest auction proceeds, represents one of seven such accounts. The majority of the appropriations from the CCA in the transportation budget, including CERA, are allocated to the Washington State Department of Transportation (WSDOT). The primary objective of CERA is to finance initiatives that contribute to reducing emissions from transportation sources.

The Legislature holds the authority to allocate funds and select the specific activities and projects that will receive financial support. This project is designed to support the Legislature in implementing a system that monitors fiscal expenditures, environmental justice (EJ) impacts, and greenhouse gas (GHG) emission reductions to fulfill its reporting obligations. To do so, this project created a tool that applies standard methodologies for assessing the benefits of CERA-funded fuel conversion projects. Fuel conversion here means replacing internal combustion engines (ICE) with zero emission (ZE) alternatives, such as battery electric (BE) and hydrogen fuel cell (H2FC). This project focuses entirely on fuel conversion projects, although not all CERA-funded projects are related to fuel conversion. This tool is also designed to support mandated reporting by other entities, including WSDOT.

1.2 Project Summary

Phase I of this project developed a functional reporting tool to track the emissions benefits associated with projects receiving funding under Washington's Carbon Emission Reduction Account (CERA). Specifically, the purpose of the Tool is to track and report the items required under the transportation budget proviso (Proviso) governing this study (S-3376.1/23, p18, lines 1-12), including the following requirements in bold:

> *…state appropriation is for the joint transportation committee to oversee the development of tools and methodologies to assist in program delivery evaluation for programs that receive appropriations from the carbon emissions reduction account. Program delivery evaluation must include* ***carbon emissions reduction estimates by program and by unit of time, program cost per unit of emission reduction, quantified benefits to vulnerable populations and overburdened communities by program cost,*** *any additional appropriate qualitative and quantitative metrics, and actionable recommendations for improvements in program delivery. A report is due to the transportation committees of the legislature by October 1, 2024.*

Hence, the JTC of the Washington Legislature must report on the reduction in GHG emissions statewide and EJ benefits of CERA-funded fuel conversion projects. The tool's functionality supports tracking these benefits for CERA fuel conversion appropriations. In this context, "fuel conversion" means replacing emission-producing vehicles or vessels with zero-emission alternatives of the same functionality. The Tool's primary purpose is to directly inform the JTC and Washington State Legislature on the investments and benefits of the projects they have funded. Ultimately, the Tool will help the Legislature develop recommendations for program delivery, adjustments to future funding allocations, and other programmatic improvements. The secondary purposes of the Tool include supporting funding recipients to meet subsequent monitoring and data reporting requirements. The bolded text above highlights the Tool's mandated outputs. Per the JTC's direction, the "actionable recommendations for improvements in program delivery" are not the tool's output but the legislature's objective in utilizing it.

There are two objectives of this report. The first is to provide an overview of the Tool and a User's Guide describing how to use it, which is described in **Section 2**. The second objective is to describe the design, design considerations, and technical specifications of the CERA Fuel Conversion Reporting Tool developed through this project, which is covered in **Section 3**. Calculation factors derived for and used in the Tool, the Tool design blueprint, a summary of projects funded through CERA to date, and how those project allocations determine the types of projects included in the beta release of the Tool are included in the **Appendices**.

1.3 Overview of pollutants

The Tool considers two types of pollutants: **criteria** (and precursor) **pollutants** and **greenhouse gases (GHG).** Criteria pollutants are particulate matter ($PM_{2.5}$), carbon monoxide (CO) and the precursors for ozone (volatile organic carbon compounds, VOC, and oxides of nitrogen, NOx). GHG are presented as carbon dioxide (CO_2) and CO_2 equivalent (CO_2e).

GHGs affect the climate globally, with impact determined by the total amount released, not the location. Thus, GHGs are reported on a **full lifecycle** basis – meaning all emissions associated with the production, distribution, and use of the fuels – are captured, and cumulative emissions over the **project's lifetime** are reported. No segregation is done on emission changes by location. Project lifetime is the standardized number of years for which a project type operates. Cumulative emissions are important given the long lifetime of GHGs in the atmosphere once released.

Criteria pollutants, on the other hand, have local impacts and relatively short-lived. These pollutants are related to degraded air quality and public health. They are presented annually (except for cumulative $PM_{2.5}$ emissions, which is also shown to indicate the total avoidable mass of this toxic pollutant from an **environmental justice (EJ)** perspective). Criteria pollutants associated with "upstream" fuel production and transport are excluded here as they are not released in the project's location. This Tool has limited ability to track locations of these pollutant emissions and thus relies on the user to describe these inputs. It reports only whether any areas the user has input as being affected by the project are also EJ areas. Other tools and methods should be consulted if better assessments of air quality impacts of projects are needed.

1.4 Overview of Phase 1 Project Activities

This project was achieved through a framework of six tasks, which were developed simultaneously and harmoniously. This section briefly summarizes the organization of the work completed in this project.

Evaluate and Recommend a Strategy and Tool for Tracking CERA Funded Fuel Conversion GHG Emission Reductions

In the first Task, the consulting team, ICF, met with JTC to agree on the work scope, schedule, and other project development considerations. WSDOT, a Technical Team member for the development of this Tool, was also consulted to collect technical information related to tool scoping. Based on the technical team's review, a work plan was developed and refined to guide project development.

The consulting team researched existing methods and tools that could be used to frame the development of this Tool. This primarily focused on work conducted by WSDOT and projects funded by the Legislature. Calculation methodologies, including WSDOT's existing tools, were researched, adapted, and informed the framework for the Tool as deemed suitable for Washington state.

The technical requirements developed for the new Tool include project types, input data, reporting components, suitability of existing tools, and definitions and calculation methodologies to use in the Tool. Finally, an Interim Report was developed to consolidate the consulting team's recommendations for the tool's design and design considerations to meet this project's unique reporting requirements, including the most appropriate software platform and the tool development schedule.

The Project Elements included in the Tool were based on the projects funded by the 2023-25 biennial budget (ESHB 1125) or the supplemental budget (ESHB 2134), as listed in Table 1. The color-coded items in the second column evolved into the nine (9) Project Elements in the Tool (See **Section 1.4**)

Table 1. Project Element Categories based on Current CERA Funding

Recipient	Project Elements	ESHB 1125	ESHB 2134
Commerce	BE/HE/FCE Watercraft	$0	$5,000,000
Ecology	EV Charging/FCEV Fueling	$0	$4,000,000
	EV/FCEV Purchase		
Enterprise Services	EV Charging/FCEV Fueling	$6,000,000	$18,000,000
Natural Resources	EV Charging/FCEV Fueling	$2,200,000	$0
	EV/FCEV Purchase		
Parks & Recreation	EV Charging/FCEV Fueling	$2,000,000	$0

	EV/FCEV Purchase		
Transportation	BE/HE/FCE Watercraft	$372,170,000	$421,693,000
	EV Carshare		
	Port Shore Power		
	EV/FCEV Purchase		
	EV Charging/FCEV Fueling		
	Off-Road ZEV Purchase		

Consult with JTC Legislators

In the second Task, a regular feedback loop between ICF and the identified JTC members was developed and implemented. This included several virtual and in-person meetings with legislators and staff, including two in-person presentations to the JTC in the May 14 and October 17, 2024, JTC meetings.

Design and Develop the Data Reporting Tool

In the third Task, the consulting team designed and developed the main deliverable of this project, which is presented in this report: a beta version of the data reporting Tool. This report includes a design blueprint to accompany the detailed requirements document developed in the first Task. The Tool built for the JTC has undergone quality assurance and control testing.

Coordinate with Technical Team

The fourth Task ensured that an advisory group ("Technical Team") was consulted throughout the study for advice and direction on the Tool's development and coordination. The Technical Team included representatives of the JTC, House Transportation Committee (HTC), Senate Transportation Committee (STC), and WSDOT.

Present the Work

This fifth Task consisted of various presentations to stakeholders made throughout the project. These include in-person presentations to the full JTC and, as directed by committee chairs, to the HTC and STC.

Prepare Draft and Final Project Reports and User Guide

Finally, in the sixth Task the consulting team prepared the second main deliverable of the project: draft and final reports documenting the Tool and the project. This report is the draft version. It will be refined following the Technical Team's review and feedback.

1.5 Tool Summary

The Tool is accessed via a direct link to the SharePoint site:

https://icfonline.sharepoint.com/sites/JTC-CERA

The current Tool is released as a beta version. This version has undergone extensive quality assurance by ICF but has not yet undergone user testing from JTC or other users.

The primary purpose of this tool is to support the tracking of benefits arising from CERA-funded fuel conversion appropriations. The types of Projects (referred to in the tool as "Project Elements") currently included are those funded in the 2023-2025 biennial and 2024 supplemental transportation budgets and outlined in Table 1:

1. **EV Purchase** – projects that purchase **electric vehicles** to replace ICE vehicles
2. **FCEV Purchase** – projects that purchase **hydrogen fuel cell** vehicles to replace ICE vehicles
3. **Off-Road ZE Purchase** – projects that purchase **zero-emissions** versions of off-road equipment to replace ICE equipment. The replacement equipment may be fueled by either electricity or hydrogen fuel cells. Depending on the equipment type, the baseline equipment may be fueled by gasoline, diesel, CNG, or LPG
4. **EV Charging Infrastructure** – projects that promote vehicle electrification by installing electric vehicle charging infrastructure (also known as electric vehicle supply equipment (EVSE))
5. **FCEV Fueling Infrastructure** – projects that promote the use of zero-emission hydrogen as a fuel by installing hydrogen fueling infrastructure
6. **EV Carshare** – projects that expand the use of electric vehicles in carshare programs
7. **Watercraft Purchase: Ferry** – projects that purchase more efficient ferries and promote ferry electrification. This is specific to ferry electrification projects undertaken by Washington State Ferry (WSF). It includes both more efficient vessels and dock electrification, providing shore power while docked and charging ferries for electrified trips. To avoid double counting, WSF ferry electrification projects should rely on this element only rather than the Shore Power element.
8. **ZE Watercraft Purchase: Non-Ferry** – consists of non-WSF projects that purchase electric watercraft to replace fossil-fueled vessels
9. **Port Shore Power** – non-WSF projects that install port shore power for vessels to access instead of using their own auxiliary engines

Future projects with these Project Elements can be added and tracked in the Tool without modification. However, if future appropriations add new Project Elements (or project types) to the existing mix of categories being funded, the tool will need to be updated.

Section 1.2 listed the governing Proviso for this project. This Tool meets all objectives identified in the Proviso. **Table 2** outlines the performance measures associated with the three (3) main reporting categories (e.g., Budgetary Impacts, Emissions Reduction, and EJ Impacts) and how each measure is addressed in the Tool. The Tool's reporting of these measures will support JTC in its determination of the efficacy and cost-effectiveness of different projects and Project Elements. Ultimately, the Tool's findings can inform program improvements and a better understanding of the return on investment of CERA-funded projects and support the mandate for actionable recommendations for improvements in program delivery.

Table 2. Performance Measures by Reporting Category Matrix

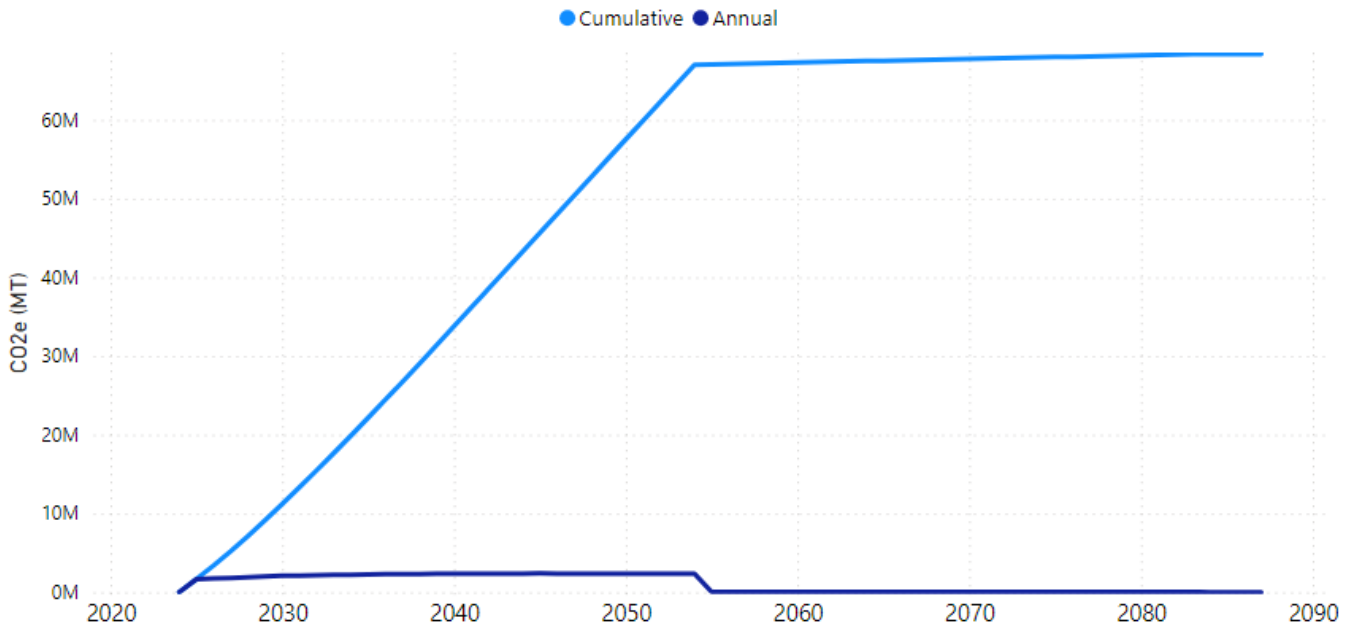
Measure	How Implemented in the Tool	Reporting Category
Emission Reduction per Total Project Cost	Total emissions per year and cumulative emissions[3] divided by total project cost	Budgetary Impacts
Emission Reduction per Funded Amount	Total emissions per year and cumulative emissions divided by CERA funded amount	
Annual Emissions Reduced	GHG and CAP emissions reduced per year	Emissions Reduction
Total Emissions Reduced	Total GHG emissions reduced over the defined project lifetime[4]	
Location of Reductions for Criteria Pollutants	Optional display of location of emission reductions (dependent on user inputs)	EJ Impacts
Project in DAC[5] (Yes/No)	Is the project located in a DAC (dependent on user inputs of impacted Census tracts)	
Tribal support (Yes/No)	Does the project receive tribal support (dependent on user inputs)	

The Tool currently reports on all required metrics through a series of pages in the PowerBI dashboard (**Section 2** describes the different components of the Tool; **Section 2.2.3** describes the different PowerBI dashboard pages). The Tool provides mapping, graphic visualizations, and summary descriptions of projects to support reporting, including comparing benefits across projects. Using a standardized approach, the Tool currently only forecasts GHG and criteria pollutant emission reductions over the project's lifetime. **Figure 1** shows an example of a hypothetical project comprising many different Project Elements with contrasting lifetime. Note that the Tool uses a standardized set of lifetimes for Project Element categories to facilitate comparison.

Once projects are operational, their ongoing performance and lifetime are likely to deviate from initial forecasts. As ongoing project performance data is not currently being collected, the beta release version of the Tool does not report this, nor does it allow a comparison of forecast to actual performance. This functionality may be added in later versions, pending the implementation of an ongoing data collection regime for actual data depicting project performance.

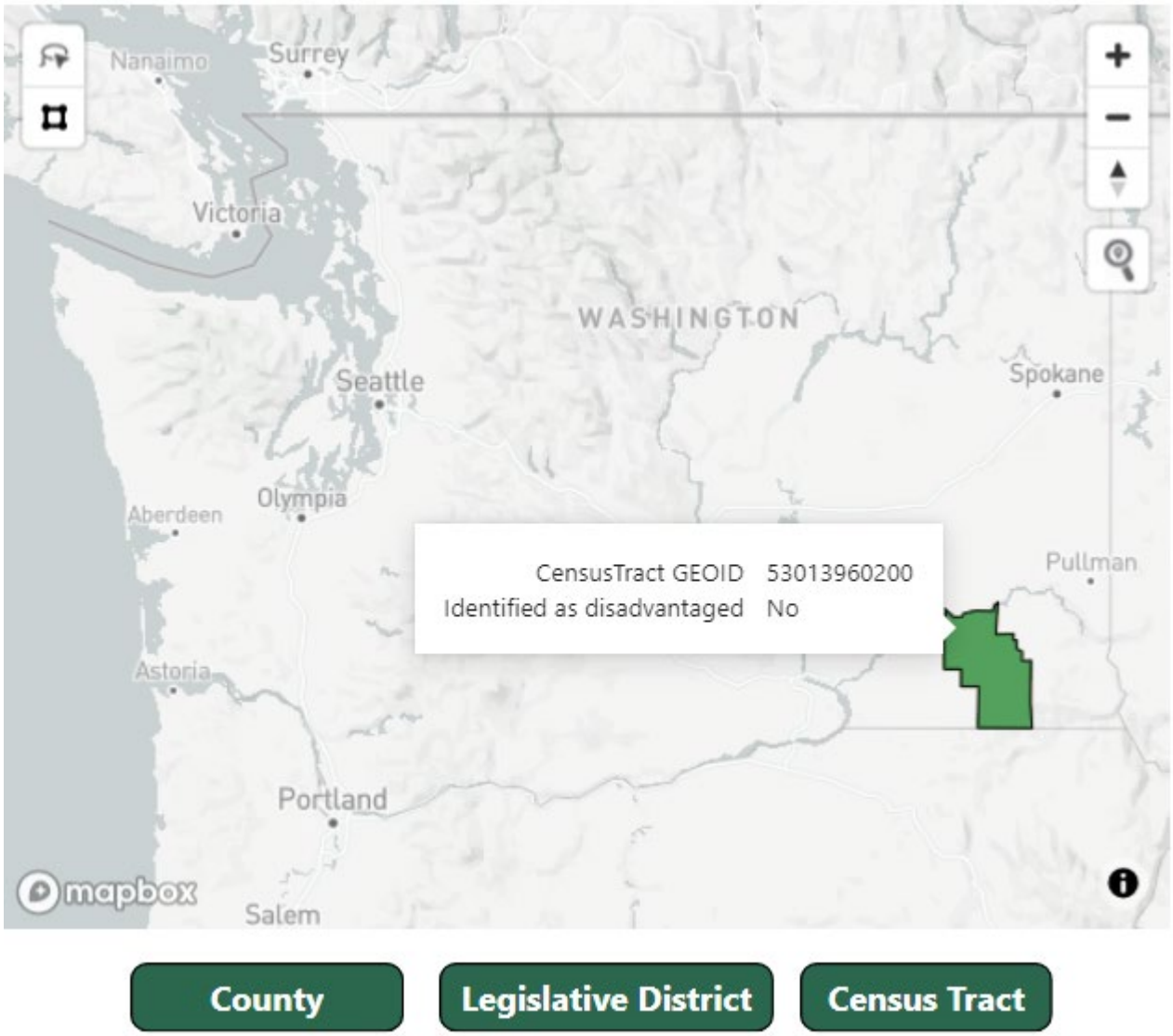
[3] Cumulative emissions are determined over the project's lifetime. Each Project Element has a fixed lifetime set in the project's Factors.
[4] Lifetime is the same as the period over which cumulative emissions are calculated. See footnote 3.
[5] Disadvantaged Community. Here this term is used synonymously with vulnerable populations and overburdened communities.

Figure 1. Example Graph of Forecast Cumulative and Annual CO_2e Reduced over a Project's Lifetime in the CERA Reporting Tool.



The Tool displays the location of the benefits of projects through its mapping capabilities. These impacted areas can be defined at the county, legislative district, and census tract levels. The Tool also identifies which projects impact disadvantaged communities. Note that all mapping capabilities in the Tool are limited. This is due to the inherent limitations in the MapBox (a customizable mapping application) functionality of PowerBI, inherent limitations in what the Tool can calculate, and the abbreviated development schedule for the Tool. The Tool relies on user inputs of impacted areas in each geography. It does not have the capability to compute the concentration of pollution in different areas resulting from the project to determine impacted areas on its own. MapBox also does not allow the display of multiple layers; thus, the Tool displays a single geography at a time. The Tool identifies which Project Elements impact disadvantaged communities by comparing input Census tracts to a fixed list of such communities based on the Federal Justice40 Environmental Justice initiative. Subsequent releases of the Tool may consider adding the display of project locations and relying on the Washington Department of Health's Environmental Health Disparities data rather than Federal community definitions.

Figure 2. Example Map of Census Tracts Affected by a Project Identified by the User's Inputs.



2 Tool Overview and User's Guide

This section provides users with a detailed guide on accessing and using the CERA Fuel Conversion Reporting Tool ("Tool").

2.1 Status of the Tool

2.1.1 Version Number and Release Dates

The beta release version of the CERA Tool is 1.00. The release date is September 20, 2024.

Version 1.00 should be considered a beta version of the Tool. It is being released for testing by the JTC and its partners.

2.1.2 Types of Projects the Tool Can Analyze

The Tool is organized around a scheme that includes "Projects" and "Project Elements". A Project can consist of any number of Project Elements. There are (9) nine types of Project Elements the Tool currently support for reporting and analysis:

1. **Electric Vehicle Purchase** – projects that purchase **electric vehicles** to replace ICE vehicles.
2. **Fuel Cell Electric Vehicle Purchase** – projects that purchase **hydrogen fuel cell** vehicles to replace ICE vehicles.
3. **Off-Road Zero Emission Vehicle Purchase** – projects that purchase **zero-emissions** versions of off-road equipment to replace ICE equipment. The replacement equipment may be fueled by either electricity or hydrogen fuel cells. The baseline equipment may be gasoline, diesel, CNG, or LPG fueled, depending on the equipment type.
4. **Electric Vehicle Charging Infrastructure** – projects that promote vehicle electrification by installing electric vehicle charging infrastructure (also known as electric vehicle supply equipment (EVSE))
5. **Fuel Cell Electric Vehicle Fueling Infrastructure** – projects that promote the use of zero-emission hydrogen as a fuel by installing hydrogen fueling infrastructure
6. **Electric Vehicle Carshare** – projects that expand the use of electric vehicles in carshare programs
7. **Watercraft Purchase (Ferry)** – projects that purchase more efficient ferries and support ferry electrification. This is specific to ferry electrification projects undertaken by WSF. It includes both more efficient vessels and the electrification of docks to provide shore power while docking and charging the ferries for electrified trips. WSF ferry electrification projects should rely on this element only, not the Shore Power element, to avoid double counting. Ferry projects that are not WSF should not use this project element.
8. **Watercraft Purchase (Non-Ferry)** – projects that purchase electric watercraft other than WSF to replace fossil-fueled vessels.
9. **Port Shore Power** – projects (other than WSF) that install port shore power for vessels to access instead of using their own auxiliary engines.

2.1.3 Overview of the Platform

The beta version of the Tool comprises three (3) main platforms, each of which is a Microsoft product, and are described below. **Section 4.4** provides additional details about the Tool's underlying system.

- **SharePoint** is a cloud-based platform for creating sites and sharing files.[6] In the Tool, users interface first with the SharePoint site. The direct link to the Tool's SharePoint site is: https://icfonline.sharepoint.com/sites/JTC-CERA
  This home page hosts the tool and provides users with the ability to create new Projects, add Project Elements to their Projects, view project documents, view reported data loaded into the Tool, and preview the Tool's dashboard. This homepage also provides access to the where users can access other application components: Microsoft Forms and Power BI dashboard.

- **Microsoft Forms** is a tool for gathering, analyzing, and exporting specified data inputs.[7]
  In the Tool these forms are used to collect the different Project and Project Element data that feed data into the Power BI dashboard for benefit calculations. There are different forms for each of the Project Elements and entering new projects. The forms are stored on the SharePoint site.

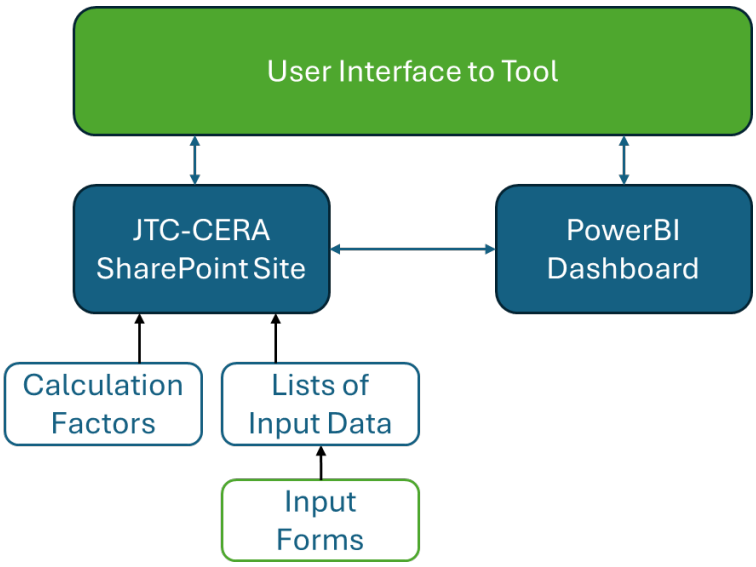
- **PowerBI** is a data storage, visualization, and sharing platform from Microsoft. It consists of desktop and mobile applications as well as an online service.[8]
  The PowerBI automated workflow entails building a paginated report in the Report Builder and then publishing it to the Report Server, where authorized users can interact with it. The PowerBI dashboard is the main interface for users to explore project data. This Tool's dashboard consists of seven (7) pages displayed to the user.

The consulting team selected Power BI over a custom software implementation for its low/no code back-end interface, the ease of integration with other Microsoft products for consistency and universal availability, and to deliver a tool within the project delivery's time constraints. While PowerBI offers several reporting options and is a dynamic tool that allows users to explore and export data, there are limitations. PowerBI is a business intelligence tool intended to report on data collected, but it is not designed for scenario analyses. PowerBI is also constrained in its mapping capabilities and interactions. Notably, the MapBox interface does not display multiple map layers. The Tool was designed around these limitations. **Sections 3.3** and **3.4** describe notable limitations and areas that may be of interest for future updates.

Figure 3 is a rough illustration of the different components of the tool with which the user interacts. User interfaces are green. **Section 3.6** provides a more technical presentation of the components and processes.

[6] To learn more about SharePoint, see: https://support.microsoft.com/en-us/office/what-is-sharepoint-97b915e6-651b-43b2-827d-fb25777f446f.
[7] To learn more about Microsoft Forms, see: https://support.microsoft.com/en-us/office/what-is-microsoft-forms-6b391205-523c-45d2-b53a-fc10b22017c8
[8] To learn more about the Power BI platform, see: https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview

Figure 3. Schematic of the Tool's Basic Components and how Users Interact with It.



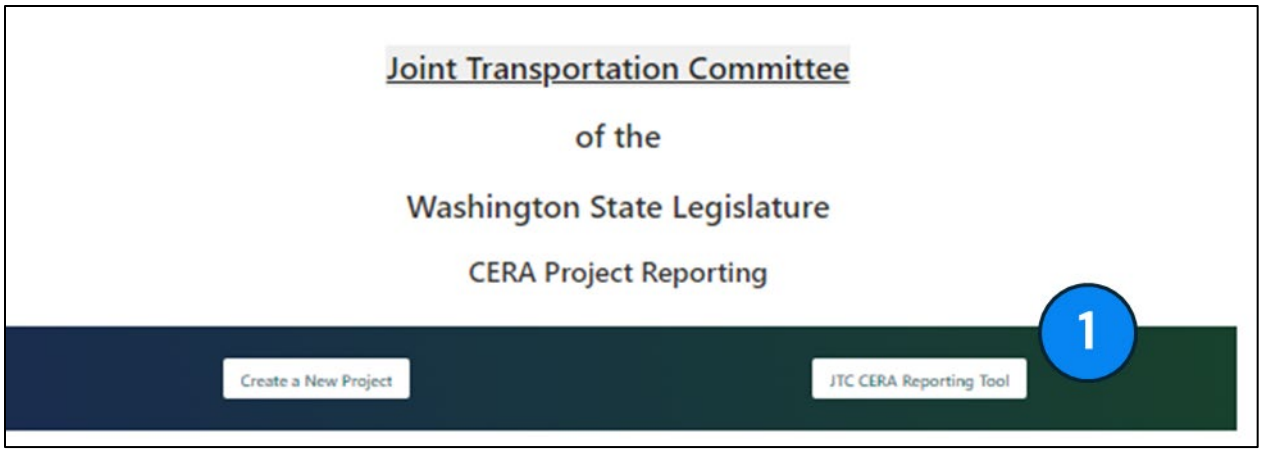
2.2 Overview

2.2.1 Access

The user will access the Tool primarily through the SharePoint site:

https://icfonline.sharepoint.com/sites/JTC-CERA

From the SharePoint site, the user can directly access the reporting PowerBI dashboard. The image below shows the button to do this as item (1).



As noted below, the dashboard is also embedded in the SharePoint homepage and may be viewed directly on the SharePoint site.

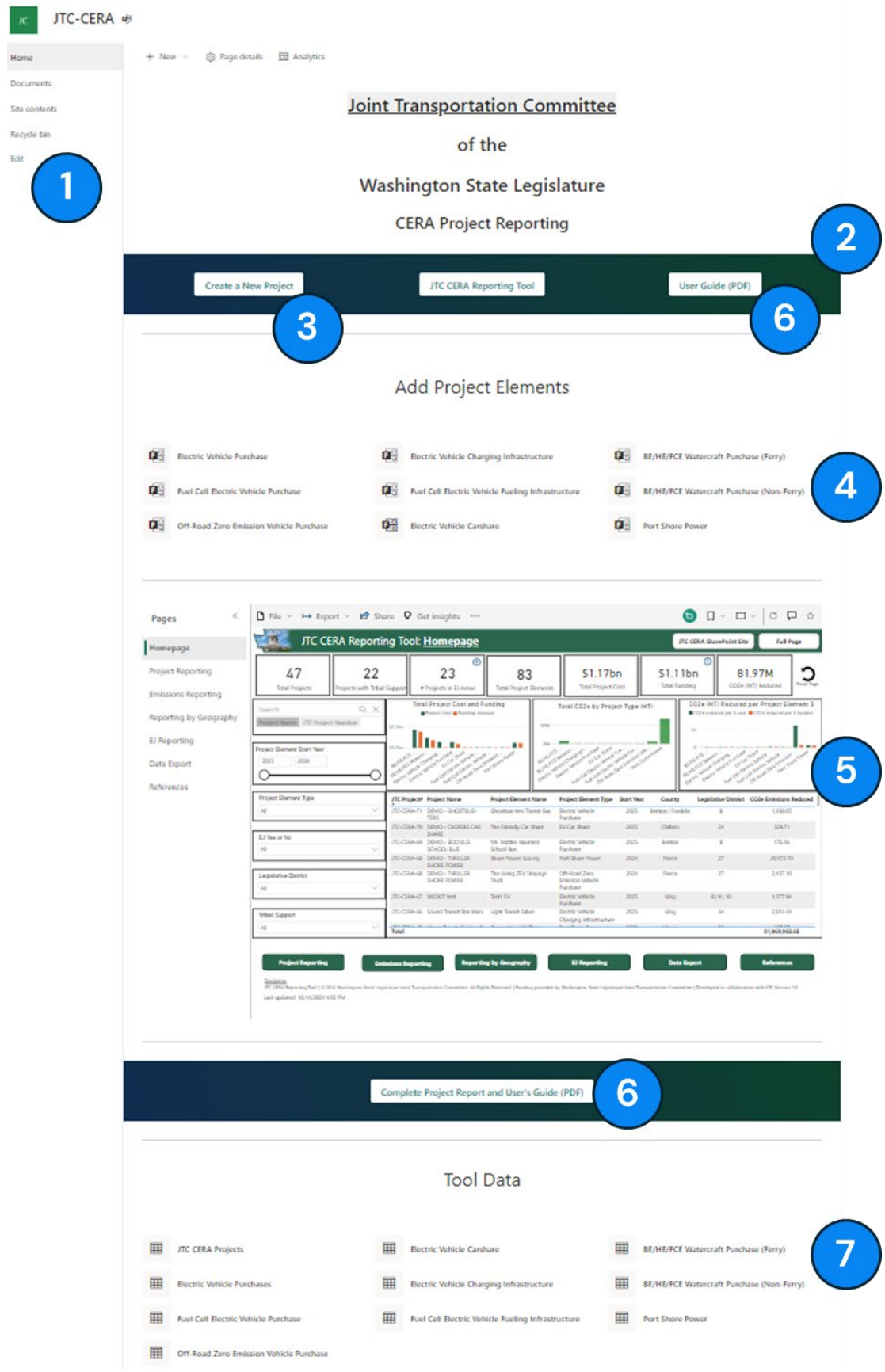
ICF is currently hosting and maintaining the SharePoint site and the PowerBI dashboard. ICF will add users to the site to grant access. Please email any of the following people to be added to the user list.

Seth.Hartley@ICF.com
Kat.Regnier@ICF.com
Kimberly.Latham@icf.com

2.2.2 Organization of the SharePoint Site

The landing page on the SharePoint site provides access to all the Tool's elements with which users will interface. This page has seven (7) areas, illustrated in the image below. The following list summarizes and describes the purpose of each section.

1. **Navigation access to the SharePoint site**. This section provides access to the contents of the site. Generally, users will only need to access the homepage. Documents provides access to documents used by the Tool. The only item that may be of interest to the user is the Project Element Factors table, which contains all calculation factors. See **Section 3.2** for more information.
2. **Header**. This section names the Tool and provides access to the PowerBI dashboard, as discussed above.
3. **Create a new project**. All Project Elements must be associated with a Project. The "create a new project" button opens an input form for users to create a new project. Projects are identified by their Project's name and unique Project ID number, which is generated when the project is loaded into the PowerBI dashboard.
4. **Add project elements**. This section contains options to create new Project Elements. Nine (9) types of Project Elements are available, listed above. To be saved, each Project Element must be associated with a Project through the Project's name. Unpaired Project Elements are orphaned and will not be read by the Tool; thus, they will be missing from the various reporting pages. Each button opens an input form for that project element. The user uses this form to populate the input data list for each project element, including the project to which it is linked.
5. **Embedded dashboard**. This section includes the PowerBI dashboard embedded in the SharePoint site. It is identical to the full dashboard (see **Section 2.2.3**). This is for users who prefer to maintain all access via the SharePoint site.
6. **User's Guide.** These two items (in the header and below the embedded dashboard) provide user documentation. The link in the header section provides the standalone User's Guide. The link below the dashboard provides the full User's Guide and Project Report (this document).
7. **Tool data.** This section provides access to the input data lists created by the forms and used by the Tool. This is a convenient way to view or modify any Project Element data after it has been entered through the forms.


JTC-CERA
Home
Documents
Site contents
Recycle bin
Edit
1
+ New
Page details
Analytics
Joint Transportation Committee
of the
Washington State Legislature
CERA Project Reporting
2
Create a New Project
JTC CERA Reporting Tool
User Guide (PDF)
3
6
Add Project Elements
Electric Vehicle Purchase
Electric Vehicle Charging Infrastructure
BE/HE/FCE Watercraft Purchase (Ferry)
Fuel Cell Electric Vehicle Purchase
Fuel Cell Electric Vehicle Fueling Infrastructure
BE/HE/FCE Watercraft Purchase (Non-Ferry)
4
Off-Road Zero Emission Vehicle Purchase
Electric Vehicle Carshare
Port Shore Power
Pages
Homepage
Project Reporting
Emissions Reporting
Reporting by Geography
EJ Reporting
Data Export
References
JTC CERA Reporting Tool: Homepage
47
22
23
83
$1.17bn
$1.11bn
81.97M
5
Complete Project Report and User's Guide (PDF)
6
Tool Data
JTC CERA Projects
Electric Vehicle Carshare
BE/HE/FCE Watercraft Purchase (Ferry)
Electric Vehicle Purchases
Electric Vehicle Charging Infrastructure
BE/HE/FCE Watercraft Purchase (Non-Ferry)
7
Fuel Cell Electric Vehicle Purchase
Fuel Cell Electric Vehicle Fueling Infrastructure
Port Shore Power
Off-Road Zero Emission Vehicle Purchase

2.2.3 Organization of the PowerBI Dashboard

There are five (5) main pages for the dashboard:

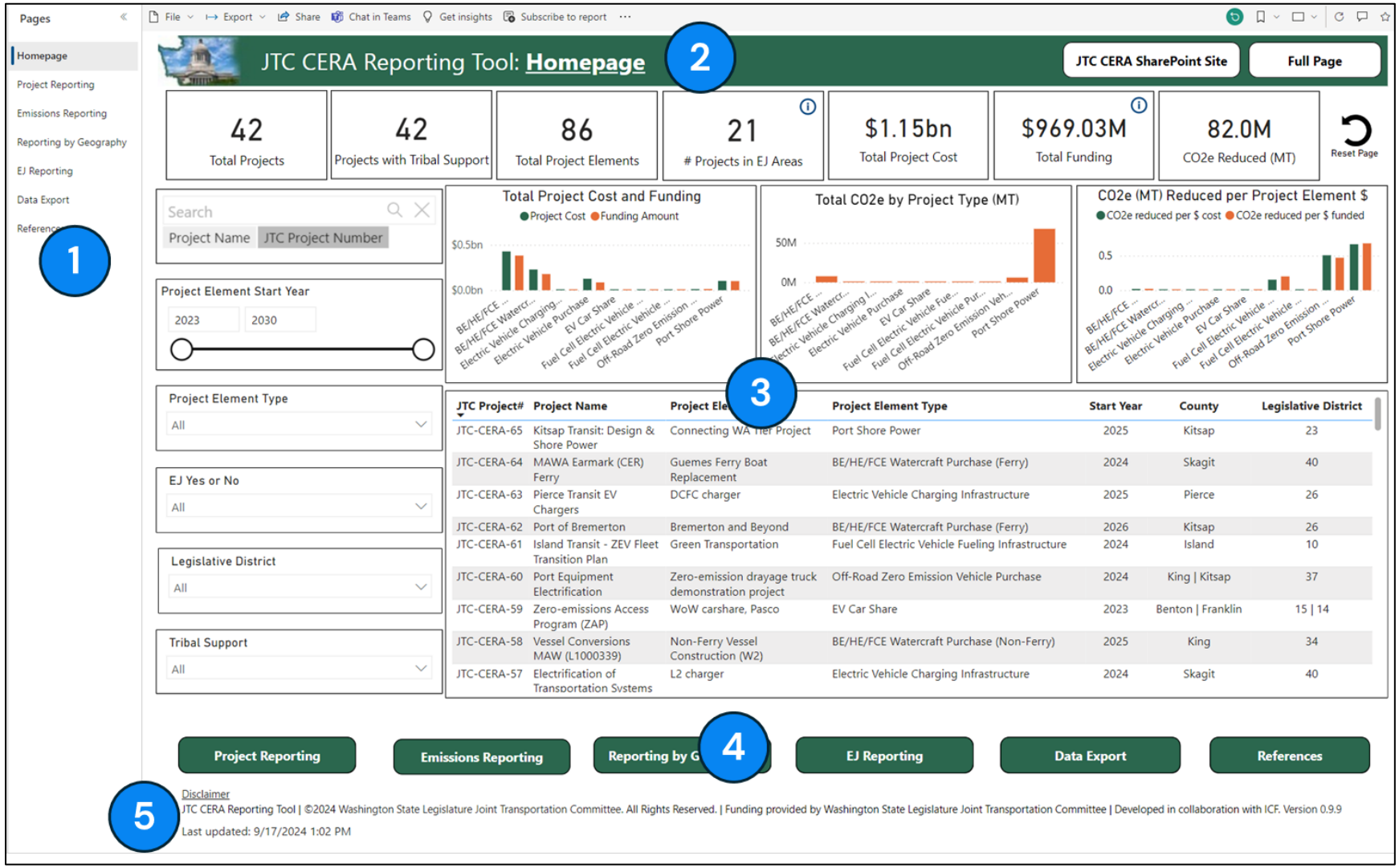
- **Homepage**. This is designed to provide quick access to a range of information and the most essential summaries.
- **Project reporting**. This page is designed to enable the user to drill down on a particular Project and all of its Project Elements, including budgetary information unrelated to emissions.
- **Emissions reporting.** This page emphasizes the emissions impacts of the Project or Project Elements, including all pollutants, and provides indicators of the emissions-related budgetary impacts.
- **Reporting by geography**. This page echoes user inputs of the Project's location at various, relevant scales.
- **EJ reporting.** This page displays project metrics relevant to environmental justice impacts.

There are two (2) additional information pages:

- **Data export.** This page allows the user a single page to export all calculated information.
- **References**. This page provides users with a glossary of terms. More importantly, it provides the list of all Projects that have been entered. This is critical to confirming that Project Elements are entered correctly and correspond to the correct Project's naming convention.

The following image shows the PowerBI's Dashboard Homepage and describes the main components of this page. While the five (5) main pages follow a similar format, only the Homepage is presented in this report. Other pages are discussed in **Section 3.1.** This page has five (5) areas, illustrated in the image below. The following list summarizes and describes the purpose of each section.

1. Areas 1 and 4 provide access to the different reporting pages.
2. The header describes which page is being viewed and provides links that return to the SharePoint site.
3. The main information display panel provides a range of Key Performance Indicators (KPI), tables, and graphs tailored to the page's focus. It also provides a range of slicers to select parameters for the displayed Projects and Project Elements.
4. Section 4, like Section 1, provides access to the different reporting pages.
5. The Disclaimer section provides critical information, including the most recent update date and the Tool version number.


Pages
Homepage
Project Reporting
Emissions Reporting
Reporting by Geography
EJ Reporting
Data Export
References
1
File
Export
Share
Chat in Teams
Get insights
Subscribe to report
JTC CERA Reporting Tool: Homepage
2
JTC CERA SharePoint Site
Full Page
42
Total Projects
42
Projects with Tribal Support
86
Total Project Elements
21
Projects in EJ Areas
$1.15bn
Total Project Cost
$969.03M
Total Funding
82.0M
CO2e Reduced (MT)
Reset Page
Search
Project Name
JTC Project Number
Project Element Start Year
2023
2030
Project Element Type
All
EJ Yes or No
All
Legislative District
All
Tribal Support
All
Total Project Cost and Funding
Project Cost
Funding Amount
$0.5bn
$0.0bn
Total CO2e by Project Type (MT)
50M
0M
CO2e (MT) Reduced per Project Element $
CO2e reduced per $ cost
CO2e reduced per $ funded
0.5
0.0
BE/HE/FCE Watercr...
Electric Vehicle Charging ...
Electric Vehicle Purchase
EV Car Share
Fuel Cell Electric Vehicle ...
Off-Road Zero Emission ...
Port Shore Power
3
JTC Project#
Project Name
Project Element Type
Start Year
County
Legislative District
JTC-CERA-65 Kitsap Transit: Design & Shore Power Port Shore Power 2025 Kitsap 23
JTC-CERA-64 MAWA Earmark (CER) Ferry Guemes Ferry Boat Replacement BE/HE/FCE Watercraft Purchase (Ferry) 2024 Skagit 40
JTC-CERA-63 Pierce Transit EV Chargers DCFC charger Electric Vehicle Charging Infrastructure 2025 Pierce 26
JTC-CERA-62 Port of Bremerton Bremerton and Beyond BE/HE/FCE Watercraft Purchase (Ferry) 2026 Kitsap 26
JTC-CERA-61 Island Transit - ZEV Fleet Transition Plan Green Transportation Fuel Cell Electric Vehicle Fueling Infrastructure 2024 Island 10
JTC-CERA-60 Port Equipment Electrification Zero-emission drayage truck demonstration project Off-Road Zero Emission Vehicle Purchase 2024 King | Kitsap 37
JTC-CERA-59 Zero-emissions Access Program (ZAP) WoW carshare, Pasco EV Car Share 2023 Benton | Franklin 15 | 14
JTC-CERA-58 Vessel Conversions MAW (L1000339) Non-Ferry Vessel Construction (W2) BE/HE/FCE Watercraft Purchase (Non-Ferry) 2025 King 34
JTC-CERA-57 Electrification of Transportation Systems L2 charger Electric Vehicle Charging Infrastructure 2024 Skagit 40
4
Project Reporting
Emissions Reporting
Reporting by G
EJ Reporting
Data Export
References
5
Disclaimer
JTC CERA Reporting Tool | ©2024 Washington State Legislature Joint Transportation Committee. All Rights Reserved. | Funding provided by Washington State Legislature Joint Transportation Committee | Developed in collaboration with ICF. Version 0.9.9
Last updated: 9/17/2024 1:02 PM

2.2.4 Important Terminology

Section 4 of this report provides a glossary of terms. This section briefly describes terms of art used in this Tool and document.

One of most important concepts to understand is the difference between **Projects and Project Elements**. A Project can consist of multiple Project Elements. On the other hand, a Project Element may be entered, but it cannot be defined by the Tool unless it is linked to a Project. Some pages of the dashboard display Project results while others depict Project Element results. Please be aware of the distinction.

Two types of pollutants are considered: **criteria** (and precursor) **pollutants** - $PM_{2.5}$, VOC, NOx, and CO – and **greenhouse gases** - CO_2 and CO_2 equivalent (CO_2e). For GHGs, the impact is determined by the total amount released, not the location. Thus, GHGs are reported on a **full lifecycle** basis – meaning all emissions associated with the production, distribution, and use of the fuels – are captured, and cumulative emissions over the **project's lifetime** are reported. Project lifetime is the standardized number of years for which a project of the given type operates. Cumulative emissions are important given the long lifetime of GHGs in the atmosphere once released. Criteria pollutants, on the other hand, have local impacts and relatively short-lived. These are presented annually except for cumulative $PM_{2.5}$ emissions, which are featured as an indication of the total avoidable mass of this highly toxic pollutant from an **environmental justice (EJ)** perspective. Criteria pollutants associated with "upstream" fuel production and transport are excluded here as they are not released in the project's location. For this project, EJ refers to overburdened or disadvantaged communities, defined at the census tract level using Federal J40 definitions.

This tool is focused on characterizing **fuel switching** projects. Fuel switching in this project means transitioning from internal combustion engines to zero-emission alternatives, battery electric, and hydrogen fuel cell.

The Tool tracks Projects and Project Elements for benefits, meaning emission reductions and the effectiveness of investments, as a **metric tonne** of CO_2e reduced per dollar. A metric tonne is 1,000 kg. Financial metrics are reported as both Project or Project Element **cost** – the total dollar cost – and **funded amount** - the amount invested, which may be less than the total cost. The latter captures the benefits of leverage. The **responsible agency** is the agency responsible for project reporting and may or may not be the same as the agency dispensing funds to the project. The **funding recipient** is the agency receiving the funds and operating the project element. This could be the same as the responsible agency in some instances.

All benefits are measured in terms of emissions **mass:** criteria pollutants are reported in kg and GHGs in MT CO_2e. This does not account for pollutant dispersion or concentration, which is a critical measure of health benefits of criteria pollutant emissions reduction.

2.2.5 Tool Tips

It is important to note that the Tool was designed for fuel conversion projects funded under the 23-24 and supplemental budgets. Other Project Element types not captured in this version of the Tool will likely be funded in the future, and at this point, the Tool will need to be modified accordingly.

All reporting is organized around the three (3) main reporting categories shown in **Figure 1.** There is some reporting overlap between the different pages, but the pages are designed to focus on these reporting categories and other metrics that may be of interest to the JTC.

As described in **Section 3.6**, when data is entered into the Tool using the forms, there may be a lag before the data appears in the Tool's dashboard and data tables. This is an unfortunate artifact of the architecture selected to deliver this Tool on schedule. At times, the lag may be rather extensive. In particular, Projects or Project Elements entered later in the day may not show up until after 8 a.m. the following day. As mentioned earlier, Project Elements not associated with a Project will not appear until the corresponding Project is entered.

It is important to note that the Ferry project element is designed for Washington State Ferry (WSF) projects that involve replacing vessels with more efficient vessels and providing shore power to supply those vessels. In this case, the shore power component is included in this Project Element. Shore power for other vessel types is addressed in the Shore Power project element. The user should not add a Shore Power project element for WSF projects to avoid double counting.

It is also important to note that this Tool does not allow for sophisticated geospatial analysis and does not perform any sort of analysis of the dispersion of pollutants emitted from projects. For greenhouse gas emissions, it reports CO_2 and CO_2e. The location from which these pollutants are released is unimportant, so a full lifecycle analysis of these pollutants is included. For the criteria pollutants (and precursors) VOC, NOx, CO, and $PM_{2.5}$, the location of impacts relies on user inputs. A more detailed analysis could model the areas impacted by project emissions, but that is beyond the scope of this Tool's functionality. Instead, the user must input census tracts that they understand to be impacted by the project. This could be determined by proximity, dispersion modeling, community feedback, or other sources. Note these may differ from the project's location. The Tool then cross-checks if any listed census tract is also an EJ area (currently defined by the Federal Justice40 definitions). This does not indicate the magnitude of impact and entirely relies on the user to accurately describe the areas impacted by a project element.

Similarly, it is important to note the difference between Projects and Project Elements. The impact of emissions and the budgetary impact (metric tonnes of CO_2e reduced per dollar spent) will be different at the Project level from the Project Element level.

The Tool also distinguishes between **Project Element cost** and **funding amount**. Financial benefits – **metric tonnes** (1,000 kg) of CO_2e per dollar spent or funded – are reported both ways. The former captures the overall project or project element benefit; the latter captures leverage that can be achieved through public-private-partnership arrangements.

The Tool currently only **forecasts benefits** of new Projects and its Project Elements. If ongoing project reporting is implemented, the Tool may also be updated to report actual, achieved benefits of ongoing projects using the same metrics as forecast. However, the data to support this is currently unavailable, and this capability is not included in this beta release version. If this data becomes available, the Tool may be updated as part of Phase II to allow this comparison. See **Section 3.4.**

2.2.6 Differences from the CCA Reporting Dashboard

The Department of Ecology has also published a dashboard for CCA reporting in Washington, including CERA appropriations.[9]

[9] The CCA dashboard is available at: https://climate.wa.gov/washington-climate-action-work/climate-commitment-act-polluters-pay-communities-benefit/cca-dashboard-climate-commitment-act-projects-awards-and-appropriations

This CERA Fuel Conversion Tool is similar to but distinct from, the CCA dashboard. This Tool is designed to be internal-facing only. It can support JTC and others in evaluating Projects and Project Elements, maintaining knowledge of CERA investments, and supporting legislators and other stakeholders with a quick-turnaround comparison for internal use and decision-making. The public-facing tool has similar projects and reporting metrics. It is also built in PowerBI. It does not allow users to input projects and does not report any emissions or EJ metrics, only financial and location information.

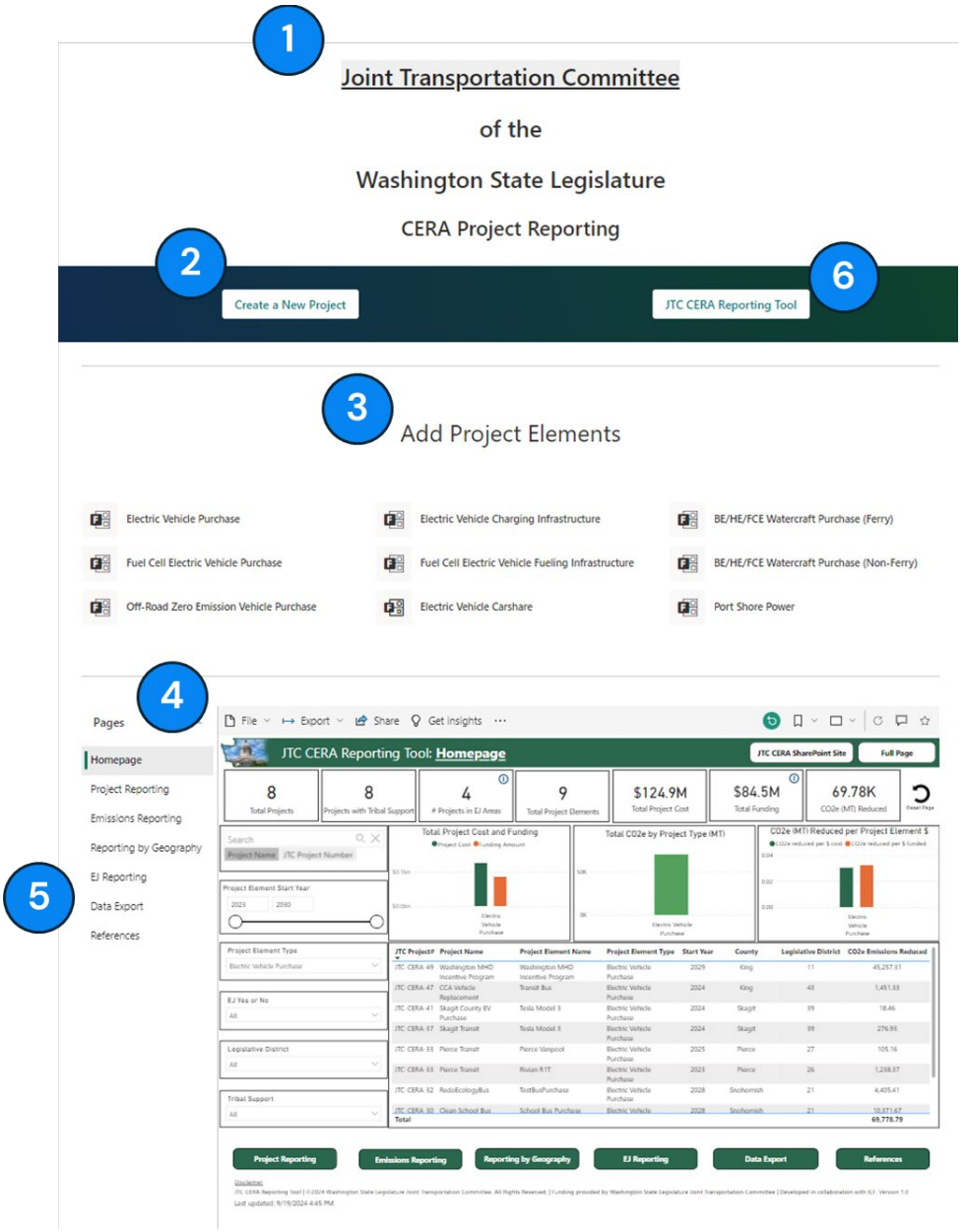
2.3 Quick Start Guide

Section 2.2 provided an overview of the different components of the Tool. This section provides a very brief, high-level, step-by-step overview to users to quickly walk them through using the Tool. Generally, a user will perform the following steps to analyze their project using this tool:

1. **Project and Project Element Identification**: Determine the specific project investment that requires tracking and reporting.
2. **Data Collection**: Gather all necessary data related to the Project and Project Elements, including activity and location data.
3. **Data Entry**: Use the SharePoint site for the CERA Fuel Conversion Reporting Tool to input the collected data using the input forms.
4. **Data Analysis**: Analyze the data generated by the Tool's PowerBI dashboard component to generate reports on forecast emissions reductions, anticipated budgetary impacts (emission reduction per unit cost), and indications of air pollution benefits to vulnerable populations.
5. **Project Reporting**: These data can support reporting, exploring the relative benefits of Projects and Project Element categories, benefits to specific geographies, allocated funding, and other metrics.

Steps 2-4 will be conducted in the Tool.

To do so, the user will generally follow the following steps, which are also depicted in the following image.



1. Navigate to the JTC-CERA SharePoint site: https://icfonline.sharepoint.com/sites/JTC-CERA
2. Create a new overarching Project in Microsoft Forms unless the Project already exists.
    - Checking if a Project has already been entered before creating a new Project is strongly recommended to avoid duplications. A list of populated projects is available on the Tool's **References** page.
3. Submit Microsoft Forms for the applicable Project Element types. Be sure to click "Submit" at the end of each form! Users may need to submit multiple forms for the same Project Element type to account for different vehicle and fuel type combinations. Project Elements currently available are:
    - Electric Vehicle Purchase
    - Fuel Cell Electric Vehicle Purchase

- Off-Road Zero Emission Vehicle Purchase
- Electric Vehicle Charging Infrastructure
- Fuel Cell Electric Vehicle Fueling Infrastructure
- Electric Vehicle Carshare
- Watercraft Purchase (WSF Ferries)
- BE Watercraft Purchase (Non-Ferry)
- Port Shore Power

4. Explore the impacts of the entered Projects and Project Elements in the PowerBI dashboard by navigating the various pages. This may be done in the embedded dashboard on the SharePoint site, or by navigating to the standalone page (item #6)
5. Export data as necessary.
6. If desired, navigate to the standalone PowerBI dashboard page.

Note that all data entered is available on the dashboard. However, there may be a substantial lag between data entry and display on the dashboard. In this case, the user can refresh the site or check the dashboard after a few minutes or, in some cases, the next day.

2.4 Additional Details on User Interface and Components

The previous sections provided a summary of the Tool and an overview of how to quickly understand and use the different components. This section builds off the information in the Quick Start Guide with more complete details. This is for users looking for more information on the different components of the Tool. Details on the calculation methodology are in **Section 3.**

2.4.1 SharePoint Sitemap

The Tool is accessed via a direct link to the SharePoint site:

https://icfonline.sharepoint.com/sites/JTC-CERA

The different sections were described in **Section 2.2.2** for a description of the different sections of the SharePoint page.

2.4.2 Input Forms

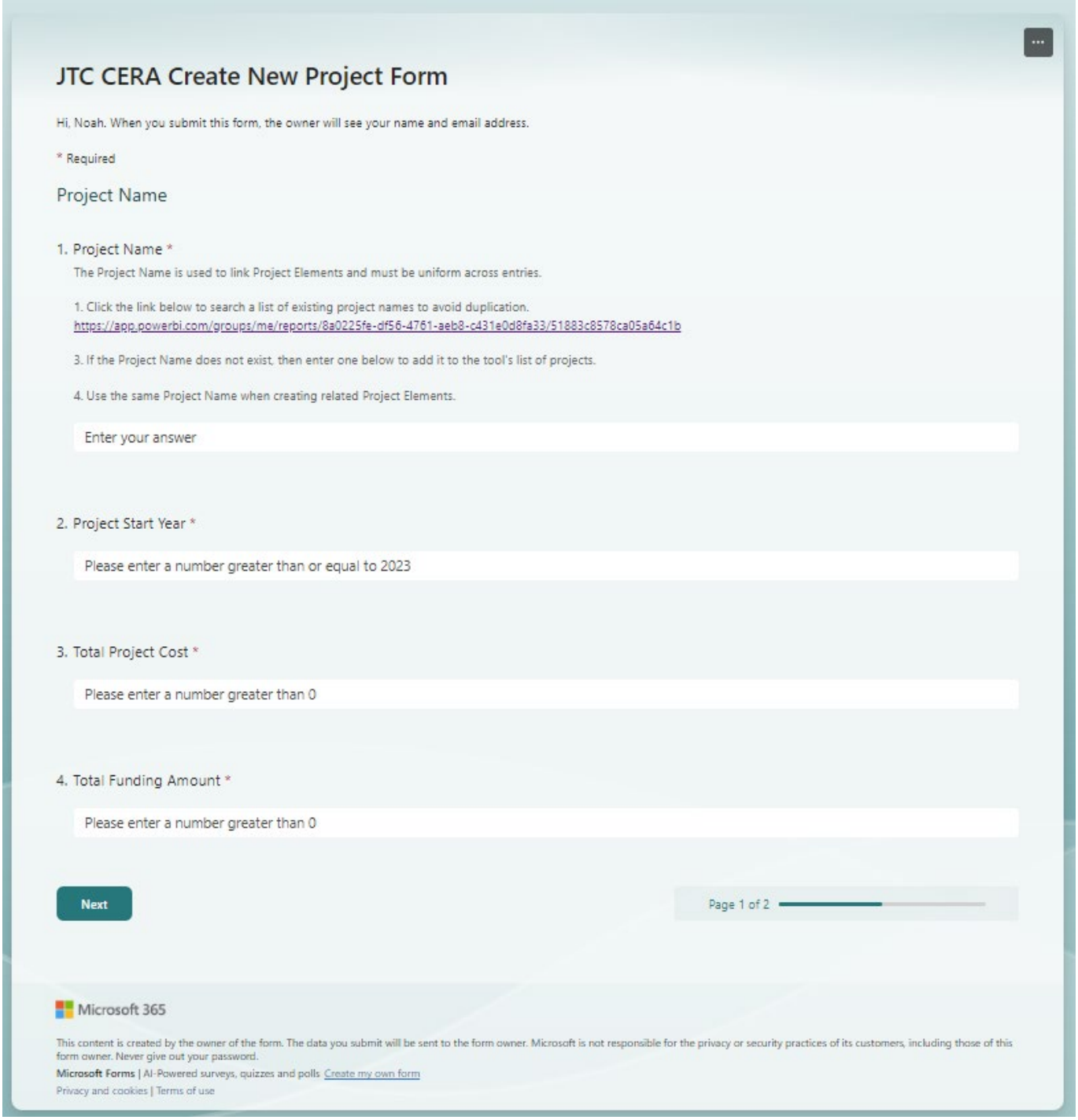
The forms were introduced in **Section 2.2.2**. This section below provides additional details on the input forms.

2.4.2.1 New Project Form

The new Project form solicits the following inputs:

1. **Project Name** — This is the name of an overarching project, which may contain multiple Project Elements. The Project name links the Project Elements and must be uniform and exact across entries.
    a. The list of Project names and ID numbers is available on the Tool's References page.
    b. If the Project name does not exist in the tool for the new Project, then enter it to add it to the list of projects.
    c. Use the same Project Name when creating related Project Elements.

    Note that the Project Name in the Tool is case sensitive. It must be entered as an exact match in each entry for the project-project element pairing to work.
2. **Project Start Year** – Users must enter a number greater than or equal to 2023. This is the year the Project begins operations, not the year funds are allocated or distributed.
3. **Total Project Cost** – Enter the total Project cost, which may exceed the total funding amount input below.
4. **Total Funding Amount** – Enter the total amount of CERA funding for this project.



2.4.2.2 Project Element Forms

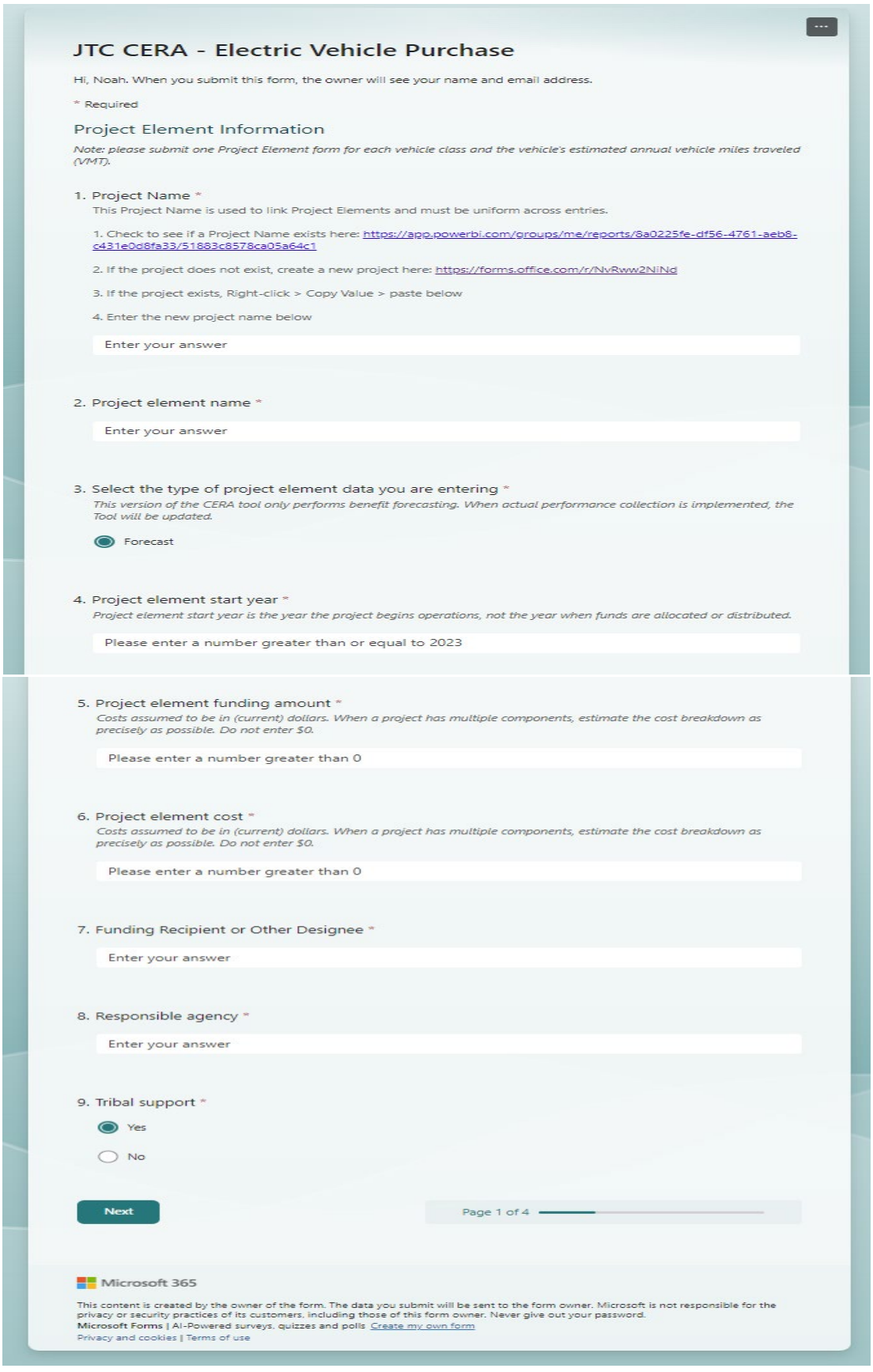
Once the Project is entered into the Tool, the user will populate the associated Project Elements.

Note that a new Project Element form is required for each element. This means any of the nine (9) different project element categories (**Section 2.1.2**) associated with the Project would require a new form entry. It also means any variations of Project Elements will require new forms. For example, if a project includes three (3)

different types of off-road equipment, the user will populate the Off-Road Zero Emission Vehicle Purchase form three times. Each will appear as a new Project Element under the given Project name.

All of the Project Element forms solicit the same general inputs:

1. **Project Name** – The Project name links Project Elements and must be exact across entries.
    a. Go to the References page on the PowerBI dashboard to view the projects already loaded into the Tool.
    b. If the project being entered does not already exist, create a new Project following the instructions in **Section 2.3.**
        i. If the project already exists, Right-click > Copy Value > Paste below
        ii. Enter the new Project name below.
2. **Project Element Name** - This is the name of the Project Element.
3. **Type of Data** – Select forecast. (Actual data is not implemented in this version of the CERA Tool. See **Section 3.4**).
4. **Project Element Start Year** - Users must enter a number greater than or equal to 2023. The Project Element start year is the year the project begins operations, not the year funds are allocated or distributed.
5. **Project Element Funding Amount –** enter the amount of CERA funding for this Project Element. Costs assumed to be in (current) dollars. When a project has multiple components, estimate the cost breakdown as precisely as possible. Do not enter $0.
6. **Project Element Cost** – enter the total Project Element cost, which may exceed the Project Element funding amount above. Costs are assumed to be in (current) dollars. When a project has multiple components, estimate the cost breakdown as precisely as possible. Do not enter $0.
7. **Funding Recipient or Other Designee** – This is the entity receiving and expending the CERA funding, or a designee thereof.
8. **Responsible Agency** – This is the entity with responsibility for reporting (e.g., WSDOT)
9. **Tribal Support** – Indicate whether the project receives support from any recognized tribal community.



JTC CERA - Electric Vehicle Purchase

Hi, Noah. When you submit this form, the owner will see your name and email address.

* Required

Project Element Information

Note: please submit one Project Element form for each vehicle class and the vehicle's estimated annual vehicle miles traveled (VMT).

1. Project Name *
   This Project Name is used to link Project Elements and must be uniform across entries.

   1. Check to see if a Project Name exists here: https://app.powerbi.com/groups/me/reports/8a0225fe-df56-4761-aeb8-c431e0d8fa33/51883c8578ca05a64c1

   2. If the project does not exist, create a new project here: https://forms.office.com/r/NvRww2NiNd

   3. If the project exists, Right-click > Copy Value > paste below

   4. Enter the new project name below

   Enter your answer

2. Project element name *

   Enter your answer

3. Select the type of project element data you are entering *
   This version of the CERA tool only performs benefit forecasting. When actual performance collection is implemented, the Tool will be updated.

   Forecast

4. Project element start year *
   Project element start year is the year the project begins operations, not the year when funds are allocated or distributed.

   Please enter a number greater than or equal to 2023

5. Project element funding amount *
   Costs assumed to be in (current) dollars. When a project has multiple components, estimate the cost breakdown as precisely as possible. Do not enter $0.

   Please enter a number greater than 0

6. Project element cost *
   Costs assumed to be in (current) dollars. When a project has multiple components, estimate the cost breakdown as precisely as possible. Do not enter $0.

   Please enter a number greater than 0

7. Funding Recipient or Other Designee *

   Enter your answer

8. Responsible agency *

   Enter your answer

9. Tribal support *

   Yes

   No

Next

Page 1 of 4

Microsoft 365

This content is created by the owner of the form. The data you submit will be sent to the form owner. Microsoft is not responsible for the privacy or security practices of its customers, including those of this form owner. Never give out your password.
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Privacy and cookies | Terms of use

Note that while all Project Element forms solicit the following location-related inputs, their numbering varies based on the form. Note also that the Tool has limited mapping capabilities. The Tool relies on user inputs to determine project impact locations as it does not have the capacity to determine this on its own.

- **Project Location**
  - Navigate to www.maps.google.com
  - Enter the address of the project location
  - Right-click on the location and select the WGS-84 latitude and longitude coordinates (e.g. 47.603, -122.330). Note that longitude must be negative (west).
  - Paste in the box below
  - This is the project's "address". In the current, beta version of the Tool, this is just stored. In a later version it should be added to the mapping.
- **Selected Counties** – select all counties that are affected by the project. To lookup or confirm the county the Project Element occurs in, please visit: https://geo.wa.gov/datasets/12712f465fc44fb58328c6e0255ca27e
- **Legislative District Impacted** – select all legislative districts that are affected by the project. To lookup or confirm the legislative district that this Project Element occurs in, please visit: https://geo.wa.gov/datasets/wa-ofm::washington-state-legislative-districts-2024/explore
- **Census tract(s) Impacted -** used by the Tool to display the impacted areas more finely and determine if disadvantaged communities are impacted by the Project Element. Enter the census tracts impacted by the project element.
  - Use https://geocoding.geo.census.gov/geocoder/geographies/address?form to find the Census Tract Name
  - Select the Census2010_Current data using the "Vintage" dropdown
  - Copy and paste the GEOID found under the Census Tracts: heading
  - Multiple census tract GEOIDs must be entered using comma-separated format (no spaces)

  Note that if impacted census tract IDs are not entered, the EJ reporting component of the tool will not function for that project element. In this case, EJ reporting defaults to "no". Users are strongly advised to enter this data carefully to support accurate reporting.
- **Location of Benefits (if different from project element location)** – follow the same steps for project location. This is the location of the emission reductions from the project, which may or may not be the same as the project's location. As with project location, in the current, beta version of the Tool, this is just stored. In a later version it should be added to the mapping.

In addition, each project element form solicits inputs specific to the calculation methodology employed.

EV Purchase

This form solicits the following unique inputs:

Number of Vehicles Being Replaced – Indicate the number of vehicles of the same class and annual VMT per vehicle. Submit one Project Element form for each combination of vehicle class and annual VMT.

Vehicle Class[10] – Select either passenger car, passenger truck, LD commercial truck, other bus, transit bus, school bus, refuse truck, single-unit short haul truck, single-unit long haul truck, combination short haul truck, or combination long haul truck.
Estimated Annual VMT Per Vehicle – Provide the estimated annual vehicle miles traveled per vehicle.

FCEV Purchase

This form solicits the following unique inputs:

- **Number of Vehicles Being Replaced** - Indicate the number of vehicles of the same class and annual VMT per vehicle. Submit one Project Element form for each combination of vehicle class and annual VMT.
- **Vehicle Class** – Select either passenger car, passenger truck, LD commercial truck, other bus, transit bus, school bus, refuse truck, single-unit short haul truck, single-unit long haul truck, combination short haul truck, or combination long haul truck.
- **Estimated Annual VMT Per Vehicle** – Provide the estimated annual vehicle miles travelled per vehicle.
- **H2 Fuel Type**[11] – Select either steam methane reformation (grey), steam methane reformation from biomethane, electrolysis with WA state average grid electricity, electrolysis with renewable electricity (green), steam methane reformation with carbon capture (blue).

Off-Road ZEV Purchase

This form solicits the following unique inputs:

- **Number of Vehicles Being Replaced** - Indicate the number of vehicles of the same engine rated power, equipment and fuel type, and annual operating hours per vehicle. Submit one Project Element form for each unique combination of these inputs.
- **Estimated Annual Operating Hours per Vehicle** – Indicate the annual operating hours
- **Engine Rated Power (hp)** – Indicate rated power of the engine in horsepower, per the manufacturer.
- **ICE Fuel Type** – Select either CNG, Diesel, Gasoline, or LPG.[12]
- **Equipment and Fuel Type** – Select one of the combinations of fuel type (CNG, Diesel, Gasoline, or LPG) and the following equipment types: 2-Wheel Tractors, AC Refrigeration, Aerial Lifts, Agricultural Mowers, Agricultural Tractors, Air Compressors, Airport Support Equipment, All Terrain Vehicles, Balers, Bore/Drill Rigs, Cement & Mortar Mixers, Chain Saws > 6 HP, Chippers/Stump Grinders, Combines, Commercial Mowers, Commercial Turf Equipment, Concrete/Industrial Saws, Cranes, Crawler Tractor/Dozers, Crushing/Proc. Equipment, Dumpers/Tenders, Excavators, Forest Eqp - Feller/Bunch/Skidder, Forklifts, Front Mowers, Gas Compressors, Generator Sets, Golf Carts, Graders, Hydro Power Units, Inboard/Sterndrive, Irrigation Sets, Lawn & Garden Tractors, Lawn mowers, Leafblowers/Vacuums, Off-Highway Tractors, Off-highway Trucks, Offroad Motorcycles, Other Agricultural Equipment, Other Construction Equipment, Other General Industrial Eqp, Other Lawn & Garden Eqp, Other Material Handling Eqp, Other Oil Field Equipment, Outboard, Pavers, Paving

[10] For more information about vehicle classes, see: https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm
[11] For more information about the different types ("colors") of hydrogen fuel, see: https://afdc.energy.gov/fuels/hydrogen-production
[12] Note that this is redundant with the next item, but is an artifact of the development process and so appears twice.

Equipment, Personal Water Craft, Plate Compactors, Pressure Washers, Pumps, Railway Maintenance, Rear Engine Riding Mowers, Rollers, Rotary Tillers < 6 HP, Rough Terrain Forklift, Rough Terrain Forklifts, Rubber Tire Loaders, Scrapers, Shredders > 6 HP, Signal Boards/Light Plants, Skid Steer Loaders, Snowblowers, Snowmobiles, Specialty Vehicle Carts, Sprayers, Surfacing Equipment, Swathers, Sweepers/Scrubbers, Switcher Locomotive, Tampers/Rammers, Terminal Tractors, Tillers > 6 HP, Tractors/Loaders/Backhoes, Trenchers, Trimmers/Edgers/Brush Cutter, Welders.

- **ZEV Type** – Select whether the new equipment will be fueled with electricity (Electric) or hydrogen (H2 Fuel Cell).

EV Charging Infrastructure

This form solicits the following unique inputs:

- **Number of Chargers** - Indicate the number of chargers of the same vehicle class, type, and days in use per year. Submit one Project Element form for each unique combination of these inputs.
- **Vehicle Class** – Select Light-Duty, Medium-Duty, or Heavy-Duty.
    a. **[If Light-Duty]** –Select either Depot, Multifamily L2, Public DCFC, Public L2, or Workplace.
    b. **[If Medium-Duty]** –Select either Depot, Public DCFC, School Bus Depot, or Transit Depot.
    c. **[If Heavy-Duty]** – Select either Depot, School Bus Depot, or Transit Depot.
- **Days in Use per Year** – Estimate the number of days for which the charger is in use per year.

FCEV Fueling Infrastructure

This form solicits the following unique inputs:

- **Station Type** – Select Light, Medium, or Heavy Traffic. The traffic level determines the amount of H2 sold each day (Light = 25%; Medium = 50%; Heavy = 75%)
- **Capacity** – Indicate the daily hydrogen sales capacity (kg H2/day)
- **Hydrogen Type** – Select the "color" of hydrogen to be used in the project. Available choices are: Steam Methane Reformation (Grey) generated Off-Site. Steam Methane Reformation from biomethane generated Off-Site, Electrolysis with WA State Average Grid Electricity generated Off-Site, Electrolysis with Renewable Electricity (Green) generated Off-Site, Steam Methane Reformation with carbon capture (Blue) generated Off-Site, Electrolysis with Grid Electricity generated On-Site, or Electrolysis with Renewable Electricity (Green) generated On-Site.[13]
- **Vehicle Class** – Select Light-Duty, Medium-Duty, or Heavy-Duty.
- **Days in Use per Year** — Estimate the number of days for which the fueling station is in use per year.

Note this form is "per station". A new form should be added for a new project element for each station.

EV Carshare

This form solicits the following unique input:

[13] For more information about hydrogen fuel, please see: https://afdc.energy.gov/fuels/hydrogen-production

- **Number of Carshare Vehicles** – Indicate the number of vehicles in the carshare program.

BE/HE/FCE Watercraft Purchase (Ferry)

This form solicits the following unique inputs:

- **Existing Vessel Class** – Select either Jumbo Mark II, Jumbo, Super, Olympic, Issaquah, Evergreen State, or Kwa-di Tabil.[14]
- **New Vessel Class and Route** – select either Hybrid Electric Olympic (Mukilteo-Clinton), Hybrid Electric Olympic (Seattle-Bremerton), Jumbo Mark II (Edmonds-Kingston), Jumbo Mark II (Seattle-Bainbridge), Kwa-di Tabil (Point Defiance-Tahlequah), Kwa-di Tabil (Port Townsend-Coupeville), New 124 Class (Southworth-Fauntleroy), New 124 Class (Triangle Route), New 124 Class (Vashon-Fauntleroy), New 124 Class (Vashon-Southworth), or New 144 Class (Edmonds-Kingston).[15]
- **Annual Fuel Consumption (gallons/year)** – Indicate the annual fuel consumption per vessel in gallons/year.
- **Annual Fuel Consumption (gallons/year)** – Indicate the annual fuel consumption per vessel of the vessel to be replaced, in gallons/year.
- **Shore Power Availability Year** – Specify the year in which shore power will become available. This is used to determine whether the vessel will be running on electricity or fossil fuels for each year of the project.

BE/HE/FCE Watercraft Purchase (Non-Ferry)

This form solicits the following unique inputs:

- **Number of Vessels Being Replaced** – Indicate the number of vessels being replaced as part of the project.
- **Annual Fuel Consumption** – Indicate the sum of all main and auxiliary engines per vessel (gallons per vessel per year).
- **Engine Model Year** – Select a year from 1999 to 2017 (or Pre-1999 or 2018+).
- **Base Fuel** – Select either Diesel, Gasoline-Conventional, or Gasoline-High Performance.
    a. **[If Diesel] Diesel Engine Power (hp)** – Select either 0-8, 8-19, 19-37, 37-600, 600-1000, 1000-1400, 1400-2000, 2000-3700, or 3700+.
    b. **[If Gasoline-High Performance] Gasoline-High Performance Engine Power (hp)** – Select either 0 to 485 or 485+.

Port Shore Power

This form solicits the following unique inputs:

- **Number of Vessel Calls per Year** – Indicate the average number of vessel calls per year for that specific vessel type.

[14] For more information about these classes, please see: https://wsdot.com/ferries/vesselwatch/Vessels.aspx.
[15] For a route map, please see: https://wsdot.wa.gov/sites/default/files/2021-04/WashingtonStateFerries-RouteMap.pdf

- **Average Number of Hours of Hoteling per Call** – Indicate the average number of hours of hoteling per vessel call. Per the EPA, hoteling refers to "the period that a vessel is secured at berth and running main engines, generators, or auxiliary engines."[16]
- **Type of Vessels Being Docked** – Select one of the following: Bulk Carrier - Small; Bulk Carrier - Handysize; Bulk Carrier - Handymax; Bulk Carrier - Panamax; Bulk Carrier - Capesize; Bulk Carrier - Capesize Largest; Chemical Tanker - Smallest; Chemical Tanker - Small; Chemical Tanker - Handysize; Chemical Tanker - Handymax; Container Ship - 1,000 TEU; Container Ship - 2,000 TEU; Container Ship - 3,000 TEU; Container Ship - 5,000 TEU; Container Ship - 8,000 TEU; Container Ship - 12,000 TEU; Container Ship - 14,500 TEU; Container Ship - Largest; Cruise - 2,000 Ton; Cruise - 10,000 Ton; Cruise - 60,000 Ton; Cruise - 100,000 Ton; Cruise - Largest; Ferry/Passenger (C3) - 2,000 Ton; Ferry/Passenger (C3) - Largest; Ferry/Roll-on/Passenger (C3) - 2,000 Ton; Ferry/Roll-on/Passenger (C3) - Largest; Fishing (C3) - All C3 Fishing; General Cargo - 5,000 DWT; General Cargo - 10,000 DWT; General Cargo - Largest; Liquified Gas Tanker - 50,000 DWT; Liquified Gas Tanker - 100,000 DWT; Liquified Gas Tanker - 200,000 DWT; Liquified Gas Tanker - Largest; Miscellaneous (C3) - All C3 Misc.; Type of vessels being docked, and using shore power – Select one of the following: Bulk Carrier - Small; Bulk Carrier - Handysize; Bulk Carrier - Handymax; Bulk Carrier - Panamax; Bulk Carrier - Capesize; Bulk Carrier - Capesize Largest; Chemical Tanker - Smallest; Chemical Tanker - Small; Chemical Tanker - Handysize; Chemical Tanker - Handymax; Container Ship - 1,000 TEU; Container Ship - 2,000 TEU; Container Ship - 3,000 TEU; Container Ship - 5,000 TEU; Container Ship - 8,000 TEU; Container Ship - 12,000 TEU; Container Ship - 14,500 TEU; Container Ship - Largest; Cruise - 2,000 Ton; Cruise - 10,000 Ton; Cruise - 60,000 Ton; Cruise - 100,000 Ton; Cruise - Largest; Ferry/Passenger (C3) - 2,000 Ton; Ferry/Passenger (C3) - Largest; Ferry/Roll-on/Passenger (C3) - 2,000 Ton; Ferry/Roll-on/Passenger (C3) - Largest; Fishing (C3) - All C3 Fishing; General Cargo - 5,000 DWT; General Cargo - 10,000 DWT; General Cargo - Largest; Liquified Gas Tanker - 50,000 DWT; Liquified Gas Tanker - 100,000 DWT; Liquified Gas Tanker - 200,000 DWT; Liquified Gas Tanker - Largest; Miscellaneous (C3) - All C3 Misc.; Offshore Support/Drillship - All Offshore Support/Drillship; Oil Tanker - Smallest; Oil Tanker - Small; Oil Tanker - Handysize; Oil Tanker - Handymax; Oil Tanker - Panamax; Oil Tanker - Aframax; Oil Tanker - Suezmax; Oil Tanker - VLCC; Other Service - All Other Service; Other Tanker - All Other Tanker; Reefer - All Reefer; RORO - 5,000 Ton; RORO - Largest; Vehicle Carrier - 4,000 Vehicles; Vehicle Carrier - Largest; Yacht - C2/C3 Yacht.
- **Vessel Fuel Type** – Select either Marine Gas Oil (MGO) (0.10% S), Marine Diesel Oil (MDO) (0.50% S), or Liquid Natural Gas (LNG). Vessel fuel type – Select the fuel being used in the current vessel, either Marine Gas Oil (MGO) (0.10% S), Marine Diesel Oil (MDO) (0.50% S), or Liquid Natural Gas (LNG).
- **MDO Engine Type** – Select either Tier 0, Tier I, Tier II, or Tier III.MDO Engine Type – Select the vessel engine tier, either Tier 0, Tier I, Tier II, or Tier III.

[16] https://www.epa.gov/ports-initiative/ocean-going-vessel-ogv-best-practices-improve-air-quality https://www.epa.gov/ports-initiative/ocean-going-vessel-ogv-best-practices-improve-air-quality

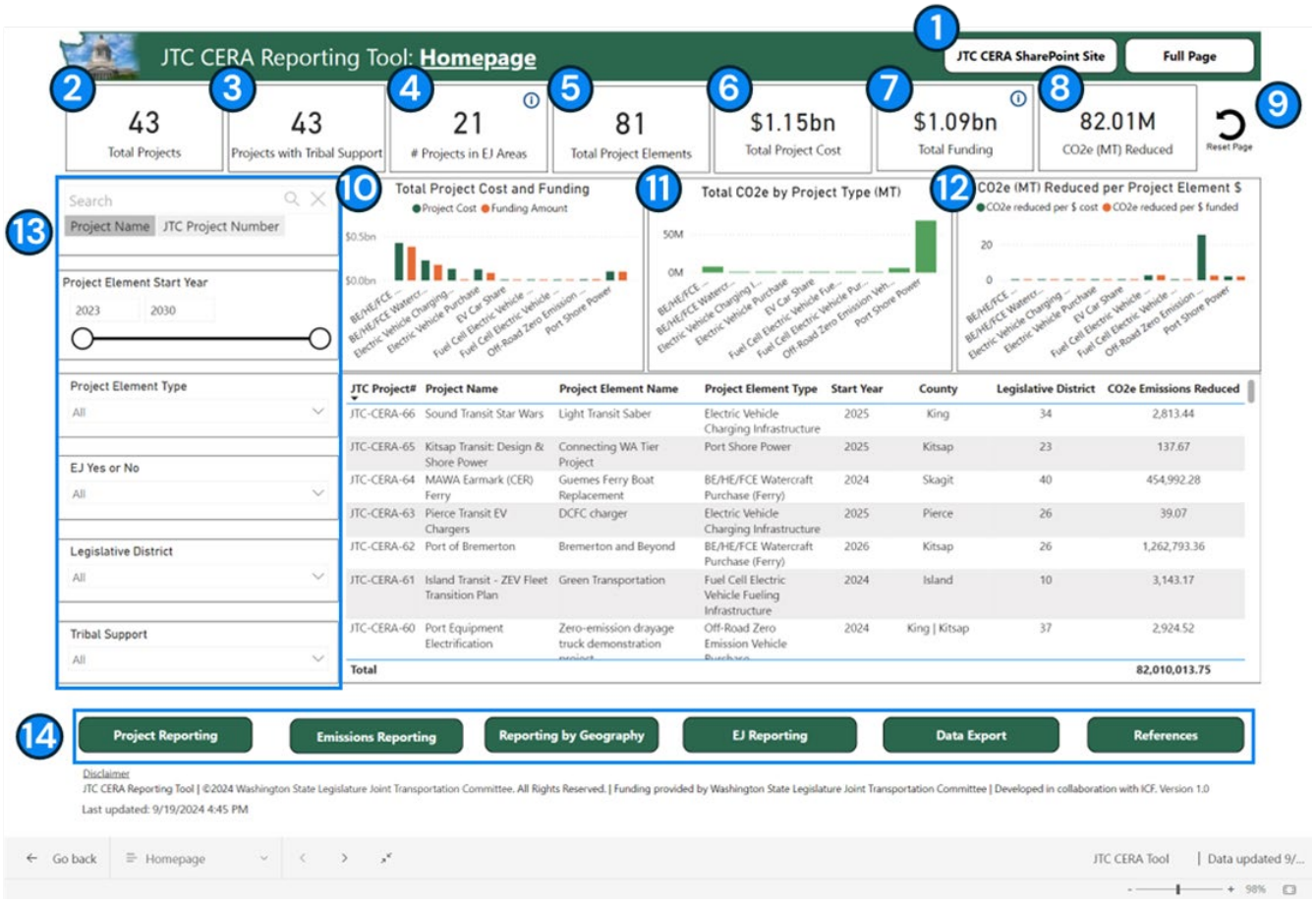
2.4.3 PowerBI Dashboard Pages

Section 2.2.3 introduced the different pages of the PowerBI dashboard. This adds detail to that introduction and explains the different elements of each page.

2.4.3.1 Homepage

The homepage is the first page that opens in the dashboard. It provides the user with an overview of the data entered into the dashboard thus far. This includes high-level metrics, key charts, a table of Project Elements, and various options to filter the data.

NOTE: Hovering over any content box in the dashboard brings up a menu with various options, including copy as image with caption, see which filters are affecting the data displayed, share, export data, etc. Clicking on the ellipses icon provides more options, including the ability to export data. This is a very convenient way to access data contained in the dashboard

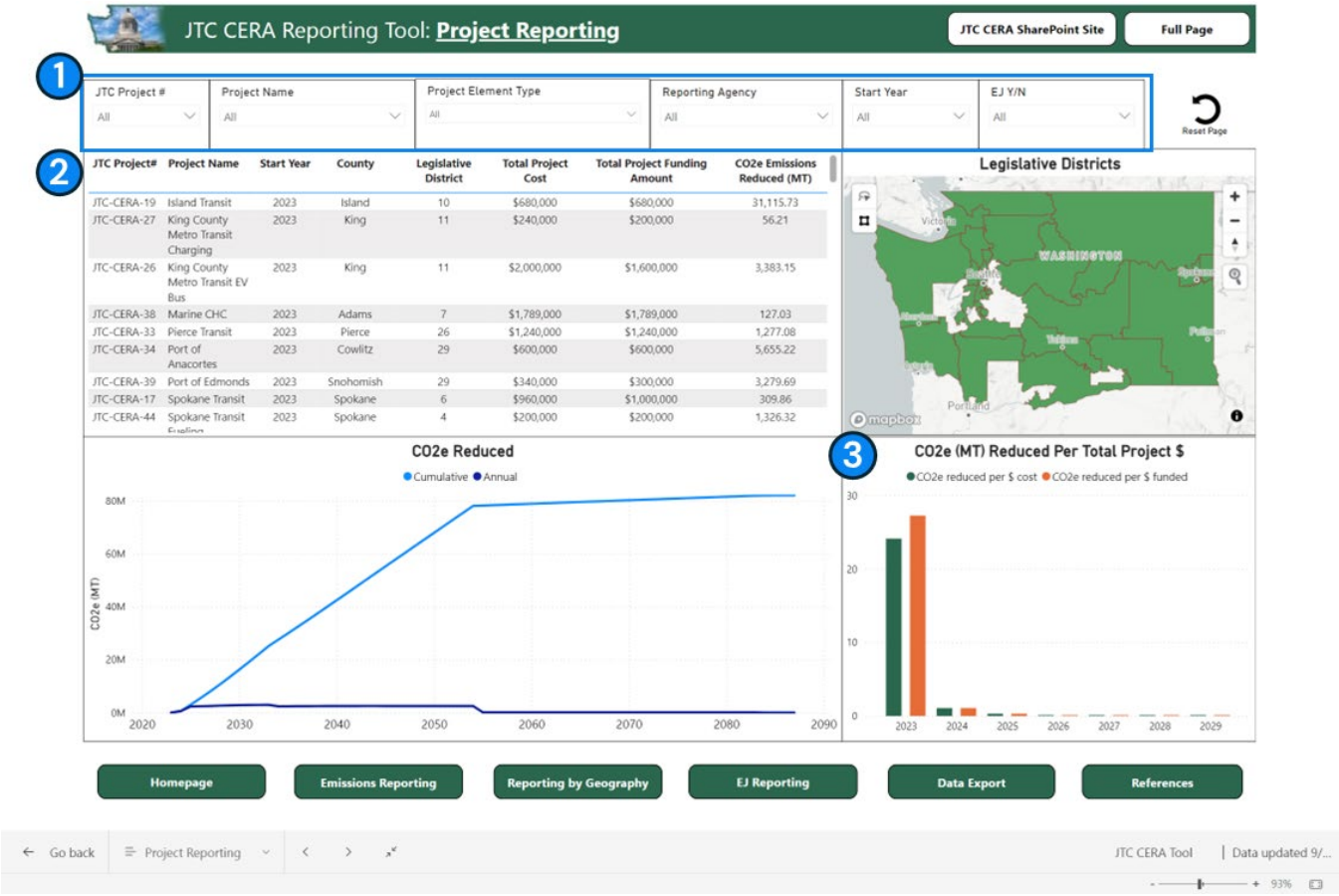


1. This button returns the user to the JTC-CERA SharePoint site.
2. This box displays the total number of Projects, per the applied filters.
3. This box displays the total number of Projects with tribal support, per the applied filters.
4. This box displays the total number of Projects in Environmental Justice areas, per the applied filters.
5. This box displays the total number of Project Elements, per the applied filters.

6. This box displays the sum of total Project cost, per the applied filters.
7. This box displays the total CERA funding, per the applied filters.
8. This box displays the amount of CO_2e reduced in MT, per the applied filters.
9. This button resets any filters that have been applied to the page.
10. This box displays a bar chart of total Project cost (green bar) and funding amount (orange bar) by Project Element type, per the applied filters. Users can select a specific bar to use it as a filter.
11. This box displays a bar chart of total CO_2e reduced in MT by project element type, per the applied filters. Users can select a specific bar to use it as a filter.
12. This box displays a bar chart of cost-effectiveness in terms of dollars per MT of CO2e reduced by Project Element type for both cost (green bar) and funding amount (orange bar) per the applied filters. Users can select a specific bar to use it as a filter.
13. These boxes allow the user to search by Project name or JTC project number as well as filter the data by Project Element start year, Project Element type, EJ (yes or no), legislative district, and tribal support (yes or no).
14. These buttons allow the user to navigate among the pages of the dashboard.

2.4.3.2 Project Reporting

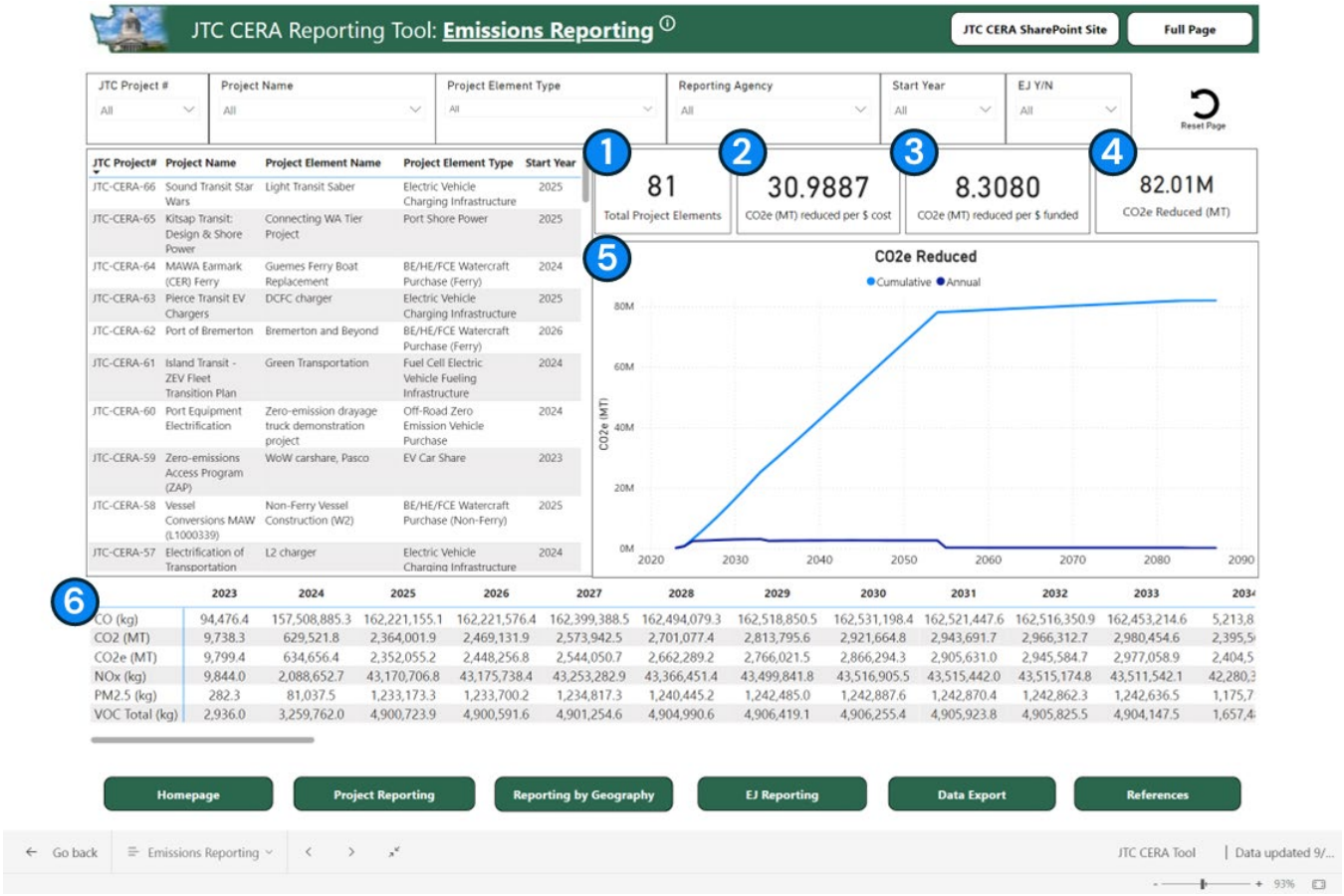
The project reporting page allows the user to drill down on a particular Project, which may contain multiple Project Elements. It contains a table of Projects as well as a map of Projects by legislative district, a line chart of CO_2e reduced, and a bar chart of cost effectiveness.



1. These boxes allow the user to filter the data by Project number, Project name, Project Element type, reporting agency, start year, and EJ (yes or no).
2. This box displays a table of Project Elements by Project number, Project name, Project Element name, Project Element type, start year, county, and legislative district, per the applied filters. Each of these fields is sortable. Users can select a specific row to use it as a filter.
3. This box displays a bar chart of cost-effectiveness in terms of dollars per MT of CO2e reduced by Project for both cost (green bar) and funding amount (orange bar) per the applied filters. Users can select a specific bar to use it as a filter.

2.4.3.3 Emissions Reporting

The emissions reporting page allows the user to home in on the emissions impact of the project, with a chart of CO_2e reduced and a table of emissions reduced by pollutant by year, in addition to high-level metrics.



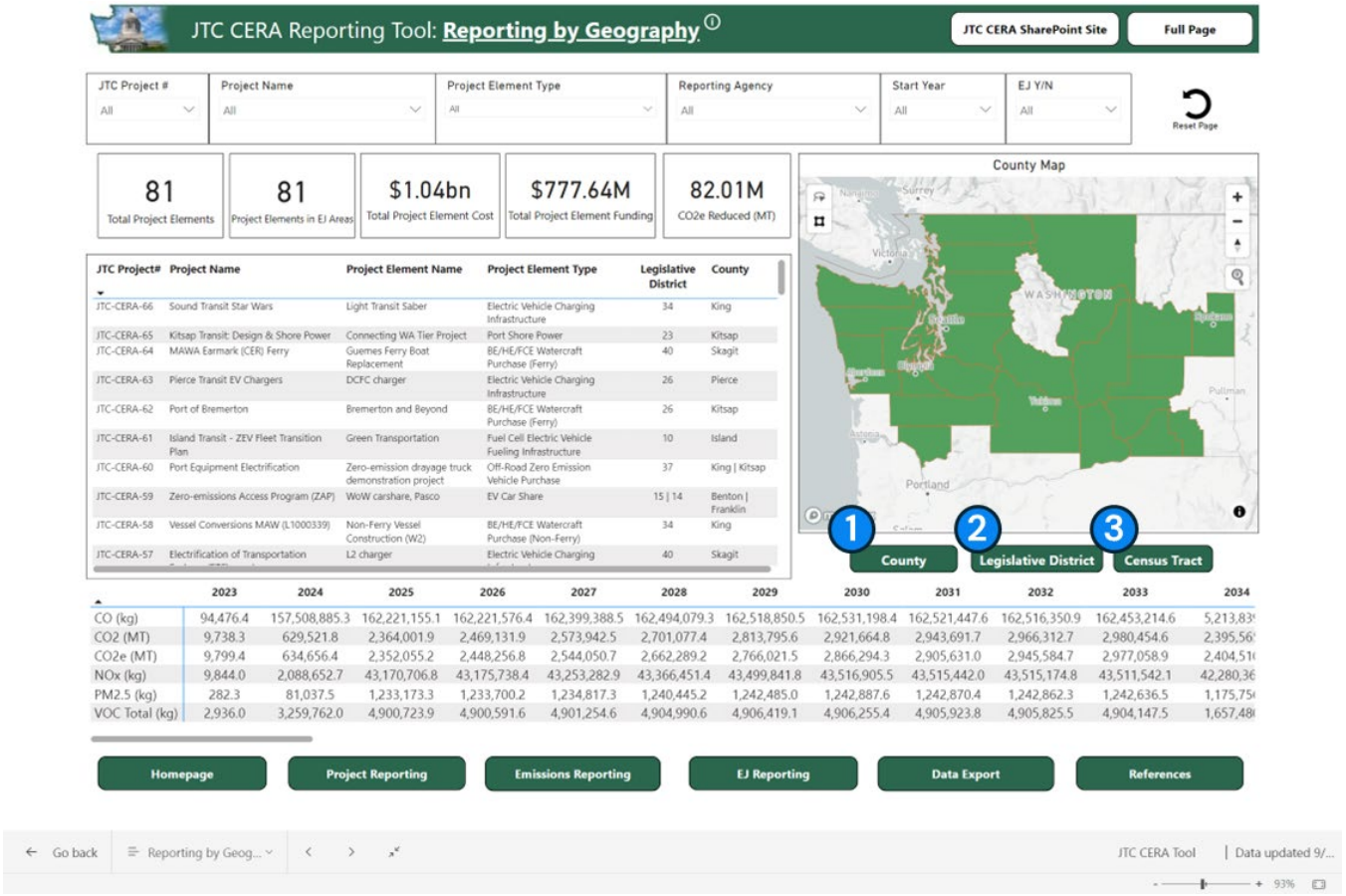
JTC Project#	Project Name	Project Element Name	Project Element Type	Start Year
JTC-CERA-66	Sound Transit Star Wars	Light Transit Saber	Electric Vehicle Charging Infrastructure	2025
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025
JTC-CERA-64	MAWA Earmark (CER) Ferry	Guemes Ferry Boat Replacement	BE/HE/FCE Watercraft Purchase (Ferry)	2024
JTC-CERA-63	Pierce Transit EV Chargers	DCFC charger	Electric Vehicle Charging Infrastructure	2025
JTC-CERA-62	Port of Bremerton	Bremerton and Beyond	BE/HE/FCE Watercraft Purchase (Ferry)	2026
JTC-CERA-61	Island Transit - ZEV Fleet Transition Plan	Green Transportation	Fuel Cell Electric Vehicle Fueling Infrastructure	2024
JTC-CERA-60	Port Equipment Electrification	Zero-emission drayage truck demonstration project	Off-Road Zero Emission Vehicle Purchase	2024
JTC-CERA-59	Zero-emissions Access Program (ZAP)	WoW carshare, Pasco	EV Car Share	2023
JTC-CERA-58	Vessel Conversions MAW (L1000339)	Non-Ferry Vessel Construction (W2)	BE/HE/FCE Watercraft Purchase (Non-Ferry)	2025
JTC-CERA-57	Electrification of Transportation	L2 charger	Electric Vehicle Charging Infrastructure	2024

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
CO (kg)	94,476.4	157,508,885.3	162,221,155.1	162,221,576.4	162,399,388.5	162,494,079.3	162,518,850.5	162,531,198.4	162,521,447.6	162,516,350.9	162,453,214.6	5,213,8
CO2 (MT)	9,738.3	629,521.8	2,364,001.9	2,469,131.9	2,573,942.5	2,701,077.4	2,813,795.6	2,921,664.8	2,943,691.7	2,966,312.7	2,980,454.6	2,395,5
CO2e (MT)	9,799.4	634,656.4	2,352,055.2	2,448,256.8	2,544,050.7	2,662,289.2	2,766,021.5	2,866,294.3	2,905,631.0	2,945,584.7	2,977,058.9	2,404,5
NOx (kg)	9,844.0	2,088,652.7	43,170,706.8	43,175,738.4	43,253,282.9	43,366,451.4	43,499,841.8	43,516,905.5	43,515,442.0	43,515,174.8	43,511,542.1	42,280,3
PM2.5 (kg)	282.3	81,037.5	1,233,173.3	1,233,700.2	1,234,817.3	1,240,445.2	1,242,485.0	1,242,887.6	1,242,870.4	1,242,862.3	1,242,636.5	1,175,7
VOC Total (kg)	2,936.0	3,259,762.0	4,900,723.9	4,900,591.6	4,901,254.6	4,904,990.6	4,906,419.1	4,906,255.4	4,905,923.8	4,905,825.5	4,904,147.5	1,657,4

1. This box displays the total number of Project Elements, per the applied filters.
2. This box displays the amount of CO_2e reduced in MT per cost, per the applied filters.
3. This box displays the amount of CO_2e reduced in MT per funding amount, per the applied filters.
4. This box displays the total amount of CO_2e reduced in MT, per the applied filters.
5. This box displays a line chart of CO_2e reduced in MT over time, with the darker blue line reflecting annual reductions and the lighter blue line reflecting cumulative reductions. Users can select a specific year to use as a filter.
6. This box displays a table of emissions reduced by pollutant (in either kg or MT) by year as well as cumulative emissions over the lifetime of the Project Element (user must scroll horizontally to reveal).

2.4.3.4 Reporting by Geography

The reporting by geography page allows the user to explore the geographic impacts of projects, with an interactive map that displays counties, legislative districts, and census tracts.

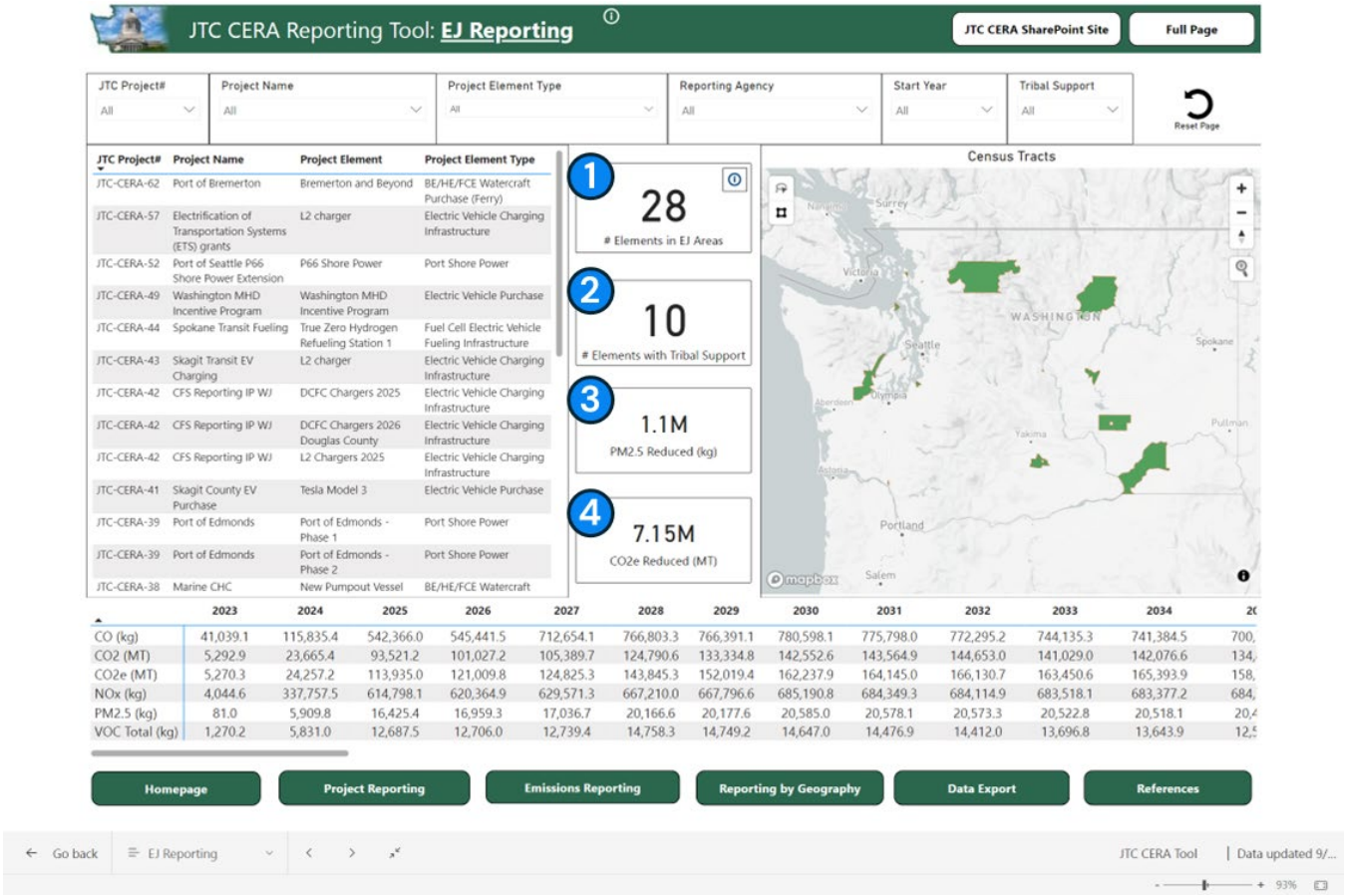


1. This button displays a map of Project Elements by county. Users can click on a specific county to use it as a geographic filter. They can also use the lasso or polygon tools to select multiple counties at once.
2. This button displays a map of Project Elements by Washington State legislative district. Users can click on a specific district to use it as a geographic filter. They can also use the lasso or polygon tools to select multiple districts at once.
3. This box displays a map of Project Elements by Census Tract. Users can click on a specific tract to use it as a geographic filter. They can also use the lasso or polygon tools to select multiple tracts at once.

2.4.3.5 EJ Reporting

The EJ reporting page allows users to focus on the EJ impacts of projects in overburdened or disadvantaged communities, with high-level metrics for the number of Project Elements in Justice40 tracts and with tribal support as well as a map of census tracts.

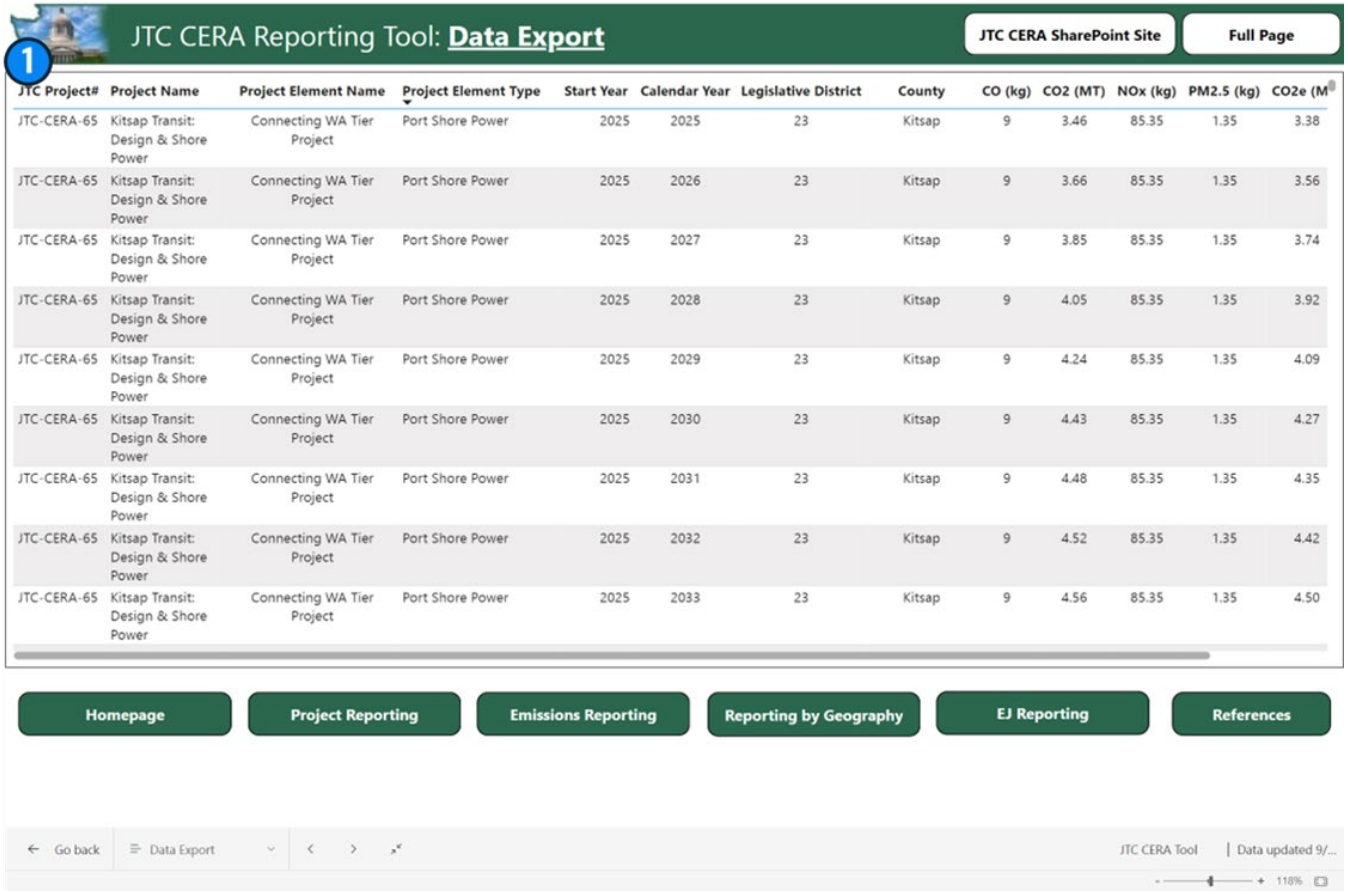
NOTE: The EJ reporting in the Tool is limited and highly dependent on the accuracy of user's input data. Data inputs must match census tracts that have been predefined as disadvantaged. It does not determine what portion of emissions occur in a given tract or how pollution is dispersed from the source across the census tract(s). The KPIs merely count census tracts identified by users as being impacted by project(s) that are disadvantaged.



1. This box displays the number of Project Elements in Environmental Justice areas, per the applied filters.
2. This box displays the number of Project Elements with tribal support, per the applied filters.
3. This box displays the quantity of $PM_{2.5}$ reduced in kg, per the applied filters.
4. This box displays the quantity of CO_2e reduced in MT, per the applied filters.

2.4.3.6 Data Export

The data export page allows the user to export for other analyses all data in the dashboard, with rows for interim years between the starting year and the project lifespan.

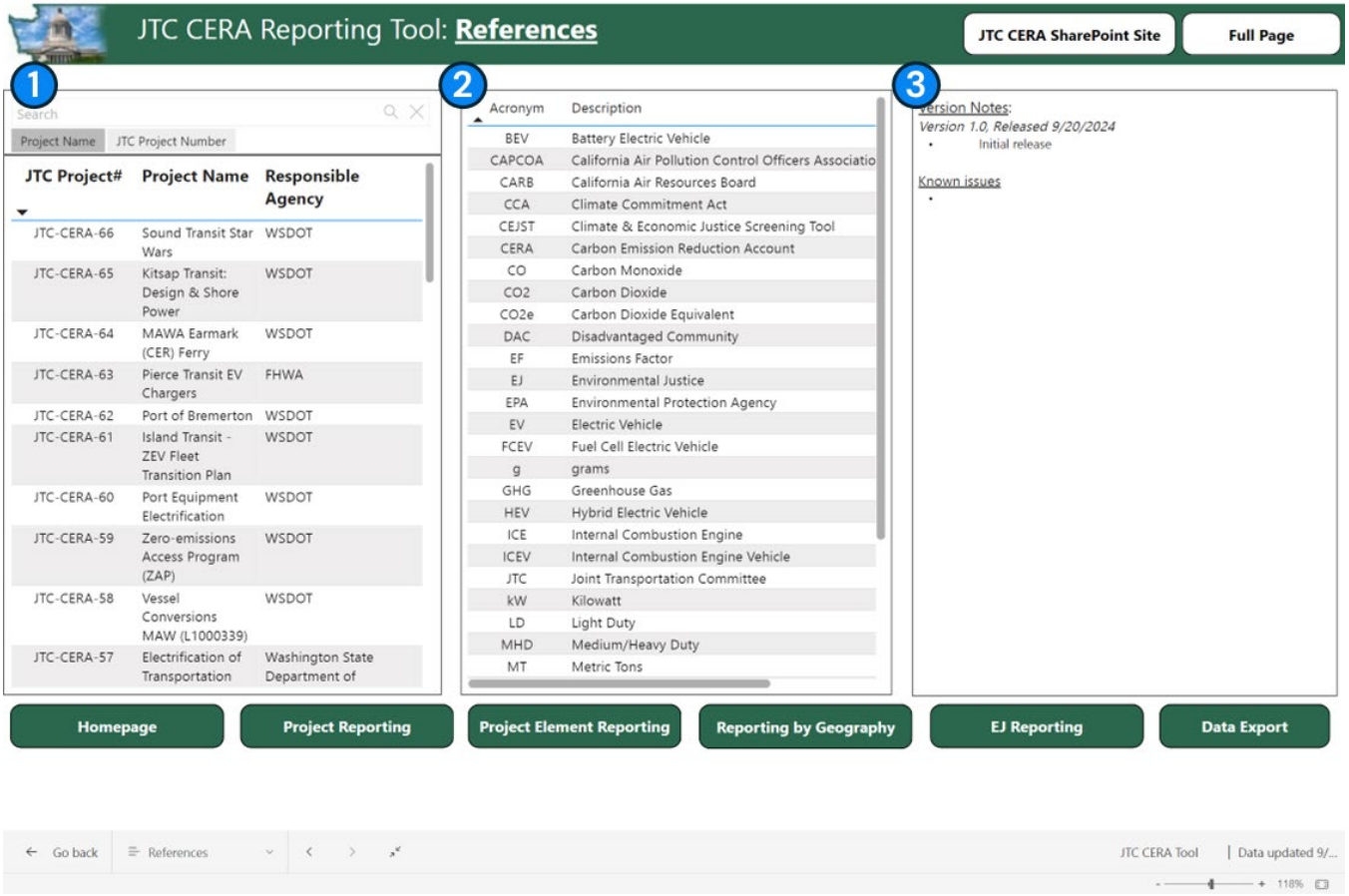


JTC Project#	Project Name	Project Element Name	Project Element Type	Start Year	Calendar Year	Legislative District	County	CO (kg)	CO2 (MT)	NOx (kg)	PM2.5 (kg)	CO2e (M
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2025	23	Kitsap	9	3.46	85.35	1.35	3.38
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2026	23	Kitsap	9	3.66	85.35	1.35	3.56
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2027	23	Kitsap	9	3.85	85.35	1.35	3.74
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2028	23	Kitsap	9	4.05	85.35	1.35	3.92
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2029	23	Kitsap	9	4.24	85.35	1.35	4.09
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2030	23	Kitsap	9	4.43	85.35	1.35	4.27
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2031	23	Kitsap	9	4.48	85.35	1.35	4.35
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2032	23	Kitsap	9	4.52	85.35	1.35	4.42
JTC-CERA-65	Kitsap Transit: Design & Shore Power	Connecting WA Tier Project	Port Shore Power	2025	2033	23	Kitsap	9	4.56	85.35	1.35	4.50

1. This box displays a table of Project Elements by project number, project name, Project Element name, Project Element type, start year, calendar year, legislative district, county, and pollutants. It contains one row for every Project Element for every year from the start year until the applicable project lifetime is reached.

2.4.3.7 References

The references page provides the user with important information about project names, acronyms, and developer notes.



1. This box displays a list of Projects by number, name, and responsible agency against which to compare new Projects and ensure they do not already exist in the dashboard.
2. This box displays a list of acronyms and descriptions used in the dashboard.
3. This box contains the dashboard's current version number and release date, as well as any developer notes.

3 Methodology Details and Specifications

This section provides in-depth information on the parameters, equations, data, and other materials on which the fuel conversion reporting Tool depends.

3.1 Calculation Methodology and Data for the Different Project Element Categories

This section provides details of the emissions calculations for each of the nine (9) Project Elements. Each element is described by a numbered equation. Given their similar methods, note that some elements are combined in the following sections. Each section discusses calculation methodologies, assumptions (also listed in the next section), factors used, and how they were derived. Additionally, critical assumptions are assembled in **Section 3.4** and the calculation factors are summarized in **Appendix A**.)

In all calculations, greenhouse gas emissions are represented as both CO_2 and CO_2e. GHG emissions represent full lifecycle (WTW) emissions for all fuels. Other pollutants included in the calculation are the criteria pollutants from vehicle exhaust $PM_{2.5}$, NOx, CO, and VOC, which is a precursor to the criteria pollutant O3. All criteria pollutants are tailpipe emissions (TTW) only. This is to capture the effects of pollution on identified downstream communities. In contrast, the location of GHG emissions is irrelevant, only the total amount. This is captured in the emission factors (EF) used in the methods below and included in **Appendix A**. Furthermore, as the total amount of GHG is relevant, cumulative reductions in CO_2e emissions are reported over a project's lifetime. For comparison of projects, lifetime is a common parameter for each Project Element, which is not specified by the user.

ZE equipment considered here could be either electric – meaning powered by grid electricity, most commonly battery-electric (BE) – or fueled by H2 fuel cells (H2FC). Grid electricity is assumed to vary over time as the grid evolves. H2 production information is currently limited, so these EFs do not vary over time. The following pathways for the production of H2 include:

- Steam Methane Reformation (a.k.a., Grey H2)
- Steam Methane Reformation from biomethane
- Electrolysis with WA State Average Grid Electricity
- Electrolysis with Renewable Electricity (a.k.a. Green H2)
- Steam Methane Reformation with carbon capture (a.k.a. Blue H2)
- Electrolysis with Grid Electricity

3.1.1 EV Purchase & FCEV Purchase

This methodology quantifies the benefits of purchasing an electric vehicle (Project Element 1) or a FCEV (Project Element 2) instead of an ICEV alternative.

3.1.1.1 Calculation Methodology

Our methodology mirrors the typical quantification technique for estimating the benefits of clean-fuel vehicles across most calculators, as illustrated in the CAPCOA Handbook.[17] Under project type T-30 in the

[17] Sacramento Metropolitan Air Quality Management District. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity
Designed for Local Governments, Communities, and Project Developers.
https://www.airquality.org/ClimateChange/Documents/Handbook%20Public%20Draft_2021-Aug.pdf.

CAPCOA Handbook, the counterfactual example of a new ICE vehicle is used as the baseline instead of considering the emissions from the old vehicle being replaced.

This equation is applied for each year over the project's lifetime.[18] Note that certain factors vary by year. ICEV EFs vary by calendar and model year (**Appendix A**). Note also that it is assumed new vehicles are fully "fuel switched" from ICEV to ZEV; hybrid vehicles are not included in this calculation.

It is also assumed that the vehicles purchased have a model year equal to the calendar year of the project start year. This model year stays the same as the calendar year changes.

$$Emission\ Reduction_{annual} = n_{vehicles} \times VMT_{annual} \times (EF_{ICE} - EF_{electric} \times \varepsilon_{EV}) \quad (1)$$

$$Emission\ Reduction_{annual} = n_{vehicles} \times VMT_{annual} \times (EF_{ICE} - EF_{H2} \times \varepsilon_{FCEV}) \quad (2)$$

Cumulative emissions of CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

Where years are all years in a project's lifetime.

Expression		Description	Units	Type
$\boldsymbol{Emission\ Reduction_{annual}}$	=	Annual emissions reduction	g pollutant /yr	Output
$\boldsymbol{n_{vehicles}}$	=	Number of vehicles of a given class replaced	count	Input
Vehicle Class	=	Class of vehicle being replaced	Unitless	Input
$\boldsymbol{VMT_{annual}}$	=	Miles traveled annually	Miles/yr	Input
$\boldsymbol{EF_{ICE}}$	=	Emissions factor of average ICE car	g pollutant/mi	Factor
$\boldsymbol{EF_{electric}}$	=	Emissions factor of WA electricity	g pollutant/kWh	Factor
$\boldsymbol{\varepsilon_{EV}}$	=	Average electric vehicle efficiency	kWh/mi	Factor
$\boldsymbol{EF_{H2}}$	=	Emission factor of WA hydrogen	g pollutant/kg H_2	Factor
$\boldsymbol{\varepsilon_{FCEV}}$	=	Average fuel cell vehicle efficiency	kg H_2/mi	Factor
H2 Fuel Type	=	Hydrogen fuel type	Unitless	Input
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	years	Factor

Standard Project Element Inputs

[18] Note that CERA reporting currently does not require ongoing reporting of project performance metrics. Accordingly, this tool does not currently report actual project performance, only the forecast performance for new projects. In most cases, this assumes that project utilization, or activity, does not change over time.

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Location
- Project County
- Legislative District Impacted
- Census Tracts Impacted
- Location of Benefits

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the Project Element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determine based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.1.2 References and Discussion

For this Tool, vehicle classes were selected to match with classes used in the EPA MOVES 4.0 model. This allowed us to take advantage of statewide emission factors estimated by model year for each vehicle type in the MOVES model. EV efficiencies were also determined using the MOVES model by selecting only electricity as the fuel for EVs and dividing the annual energy use by annual mileage. Fuel cell vehicle efficiencies were determined in a similar manner; however, MOVES includes fuel cell vehicles that are heavy-duty. To estimate efficiencies for light-duty FCEV, EPA's approach was used to adjust EV energy consumption upward by 25%[19] and then convert from units of MJ/mi to kg H_2/mi by assuming an energy density of 120 MJ/kg[20]. When estimating the CO_2 and CO_2e emissions for vehicles, the values from MOVES were used for an estimate of use-phase emissions and GREET for an estimate of upstream emissions for each fuel type every five (5) years. Then, years between those 5-year periods were interpolated. Since GREET factors were in units of g/MJ, the team had to find the emissions by vehicle fuel type by multiplying the GREET factor by the annual energy consumption and then reincorporating that into the MOVES carbon emissions estimate to get the emissions factor in grams per mile. Electricity emission factors used throughout this Tool were estimated using GREET

[19] Greenhouse Gas and Energy Consumption Rates for Onroad Vehicles in MOVES4, EPA-420-R-23-026 August 2023, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10186RQ.pdf
[20] The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs, 2004. National Academies. https://nap.nationalacademies.org/read/10922/chapter/21

factors for the Western Electricity Coordinating Council (WECC) region. Since the GREET factors only consider well-to-plant emissions, the factors were increased to account for distribution losses, using the average loss for the state of Washington of 4%. Electric grid emission factors vary by year. Hydrogen emission factors were also estimated using GREET fuel factors and WECC-region electricity for Washington State. Instead of including hydrogen factors, which vary by year, the Tool is conservatively using only factors for 2025, although it is noted that future Hydrogen emission factors may be lower.

3.1.2 Off-Road ZEV Purchase

This methodology quantifies the benefits of purchasing a new off-road zero-emission vehicle (such as a tractor, forklift, or ATV) relative to a counterfactual purchase of new ICE-powered equipment.[21]

3.1.2.1 Calculation Methodology

Our methodology mirrors the typical quantification technique for estimating the benefits of clean-fuel vehicles across most calculators, as illustrated in the CAPCOA handbook under T-30.

$$Emission\ Reduction_{annual} = n_{equipment} \times Hours_{annual} \times HP \times LF \times (EF_{ICE} - EF_{ZEV} \times A/\varepsilon_{ZEV}) \quad (3)$$

This equation is applied to both electric and H2FC ZE equipment. If the ZE equipment type is electric, the statewide WA electric emission factors are used, which vary over time. If the ZE equipment is H2FC, the corresponding WTW EFs for hydrogen are applied.

Expression		Description	Units	Type
$\boldsymbol{Emission\ Reduction_{annual}}$	=	Annual emissions reduction	g pollutant/yr	Output
$\boldsymbol{n_{vehicles}}$	=	Number of pieces of equipment of a given type replaced	Count	Input
Equipment Type	=	Type of equipment being replaced	Unitless	Input
ICE Fuel Type	=	Fuel type of equipment being replaced (gasoline, diesel, CNG, or LPG)	Unitless	Input
$\boldsymbol{Hours_{annual}}$	=	Hours of operation per year	Hours	Input
$\boldsymbol{HP}$	=	Engine power	Horsepower	Input
$\boldsymbol{LF}$	=	Load factor	%	Factor
$\boldsymbol{EF_{ICE}}$	=	Emissions factor of the ICE equipment	g pollutant/hp-hour	Factor
$\boldsymbol{EF_{ZEV}}$	=	Emissions factor of the ZEV (electric, FC) equipment	g pollutant/kWh	Factor
$\boldsymbol{\varepsilon_{ZEV}}$	=	Energy efficiency ratio factor for converting between ICE	Unitless	Factor

[21] Except for switcher locomotives, which are a special case project for replacing very old and specific equipment, as described below.

		and ZEV (electric, FC) engines		
A	=	0.746 kW/hp (Constant)	kW/hp	Factor
ZEV Type	=	Fuel type of new equipment	Unitless	Input
H2 Fuel Type	=	Hydrogen fuel type	Unitless	Input
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	Years	Factor

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Location
- Project County
- Legislative District Impacted
- Census Tracts Impacted
- Location of Benefits

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the Project Element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determine based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.2.2 References and Discussion

The equipment categories used in this calculator were selected to align with categories included in the MOVES4.0 nonroad model. Using a MOVES run, emission rates were estimated for equipment in Washington State for 2023 across all equipment types, fuel types, and horsepower levels. Then, GREET upstream emissions for CO_2 and CO_2e by fuel type for 2023 were added in units of g pollutant per horsepower hour. Load factors were also calculated using this MOVES data by fuel and equipment type. Energy efficiency ratios

for converting between electric and ICE are based on values from CARB's LCFS guidance.[22] No information on EER for H2FC is available. Accordingly, different EERs for H2FC replacements were not used. These calculations assume that FC has an efficiency equivalent to that of electric equipment. All EER values are by fuel type and do not vary by equipment – this assumes that the conversion of any gasoline equipment to electric would lead to the same percentage improvement in efficiency as any other. Hydrogen emissions factors used in the Off-road calculator are the same as ones used for FCEV conversion but converted to g/kWh.

The H2 EFs used here vary by production pathway but not over time. This implies that the lifecycle emissions for hydrogen production do not vary over time as those for electricity do. The ICE equipment EFs do not vary by model year or calendar year, although they do vary by fuel. EPA emission standards have not been updated since Tier 4 equipment was phased in across the 2008-2015 model years.

Switcher locomotives are a unique case that is included to address the Tacoma project. MOVES do not include locomotives. This tool includes factors unique to the Tacoma project and is explicitly calculated for this Tool to match the other nonroad equipment types in the Factors tables. The two battery-electric switcher locomotives that Tacoma Rail intends to purchase will replace two diesel-electric switcher locomotives that were built in 1965.[23] 1965 era locomotives are pre-Tier 0.[24] This Tool uses the corresponding uncontrolled EFs from EPA's Port EI Guidance.[25] As specific use case information was available, this project relies on time-in-mode (notch) data from the Port of Oakland Emission Inventory,[26] and notch power consumption settings from EPA's: Locomotive Emission Standards Regulatory Support Document.[27] Fuel density from API[28] Table 3-8 and non-CO_2 GHG factors for diesel locomotives from EPA's EF Compendium, along with GWP values from AR5,[29] were used to determine the CO_2e emission factor. Note that the emission factors thus determined are specific to these very old switcher locomotives. In this case, the counterfactual is not new equipment purchases but continued use of the very old equipment, consistent with the funded project.

3.1.3 EV Charging & FCEV Fueling Infrastructure

This methodology quantifies the benefits of installing an EV charger, which enables driving fueled by electricity from the charger. Due to double counting, this methodology is not to be used in combination with a ZEV

[22] CARB. Low Carbon Fuel Standard (LCFS) Guidance 20-04 Requesting EER-Adjusted Carbon Intensity Using a Tier 2 Pathway Application, April 2020. https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_20-04.pdf
[23] Pauley, S. (2024). Tacoma authorizes $4M in federal grants to purchase two electric locomotives. https://www.thecentersquare.com/washington/article_94d04046-bbd6-11ee-b694-037fe6eff9b4.html
[24] DieselNet. Locomotives. https://dieselnet.com/standards/us/loco.php
[25] U.S. EPA. Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions, EPA-420-B-22-011, April 2022. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1014J1S.pdf
[26] Port of Oakland. 2020 Seaport Aiir Emissions Inventory. https://www.portofoakland.com/wp-content/uploads/bsk-pdf-manager/2024/05/Port-Oakland-2020-Emissions-Inventory-Final-Report.pdf
[27] U.S. EPA. EPA-420-R-98-101, April, 1998. Available at: https://nepis.epa.gov/Exe/ZyNET.exe/P100F9QT.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C95thru99%5CTxt%5C00000032%5CP100F9QT.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#
[28] API. Compendium Of Greenhouse Gas Emissions Methodologies For The Natural Gas And Oil Industry, 2021. https://www.api.org/-/media/files/policy/esg/ghg/2021-api-ghg-compendium-110921.pdf
[29] Greenhouse Gas Protocol. Global Warming Potential Values. https://ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

purchase project if the charger is to be exclusively used by the CERA-funded vehicles. This methodology works equally for either public, depot, workplace, or multi-family chargers.

3.1.3.1 Calculation Methodology

Our methodology is adapted from the quantification technique used by California's LCFS program, where the benefits are estimated by converting the amount of electricity sold into an amount of ICE VMT displaced. This calculation will be repeated for projects with multiple chargers of different types or power levels, and the reductions will be the sum of those calculations.

Note that ε_{EV} varies by light and heavy-duty vehicles.

$$Emission\ Reduction_{annual} = n_{chargers} \times Days_{in\ use} \times \frac{UtilizationEV}{\varepsilon_{EV}} \times (EF_{ICE} - EF_{electric} \times \varepsilon_{EV}) \quad (4)$$

$$Emission\ Reduction_{annual} = Capacity_{dailyH2} \times Days_{in\ use} \times \frac{PercentCapacityDispersed_{H2}}{\varepsilon_{FCEV}} \times (EF_{ICE} - EF_{H2} \times \varepsilon_{FCEV}) \quad (5)$$

Cumulative emissions for CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

Expression		Description	Units	Type
$Emission\ Reduction_{annual}$	=	Annual emissions reduction	g pollutant/yr	Output
$n_{chargers}$	=	Number of chargers of each type	count	Input
Charger Power Level	=	L2 or DCFC		Input
Charger Type	=	Public, workplace, multi-family, or depot		Input
Vehicle Class	=	LD, MD, or HD		Input
$Days_{in\ use}$	=	Days in use per year	Days/yr	Input
$Utilization_{EV}$	=	Amount of use for the charger per day	kWh/day	Factor
ε_{EV}	=	Average EV efficiency	kWh/mi	Factor
EF_{ICE}	=	Emissions factor of the average ICE vehicle	g pollutant/mi	Factor
$EF_{electric}$	=	Emission factor of WA electricity	g pollutant/kWh	Factor
$Capacity_{dailyH2}$	=	Daily hydrogen sales capacity	kg H_2/day	Input
$PercentCapacityDispersed_{H2}$	=	Average fraction of sales capacity sold	%	Factor
EF_{H2}	=	Emissions factor of hydrogen	g pollutant/kg H_2	Factor
ε_{FCEV}	=	Average FCEV efficiency	kg H_2/mi	Factor
Station Type	=	Amount of traffic to the station	High – Medium – or Low	Input
Hydrogen Type	=	Manufacturing method used to make the hydrogen	Multiple options included.	Input

Project Element Lifespan	=	Standard length of this project element type. Used for cumulative calculation.	years	Factor
Location of Generation	=	Where Hydrogen is made (on-site vs. off-site)		Input

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Element Location
- Project Element County
- Legislative District Impacted

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the Project Element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determine based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.3.2 References and Discussion

Emission factors for ICE vehicles were determined using a MOVES run for Washington State from 2023 through 2039. Vehicles were broken down into groups (i.e., light-duty, medium-duty, and heavy-duty) using the regulatory class as the determinant. Class 2b through 5 vehicles were considered medium-duty, Class 6 through 8 were heavy-duty, and all passenger vehicles were grouped into light-duty. For each group, emission factors were weighted by VMT; thus, medium-duty vehicle factors are much closer to factors for Class 2b trucks than Class 5 trucks since they are much more common. GREET factors for GHG pollutants for each fuel type were included by year in the same manner as for vehicle replacement by fuel type and then reaggregated such that fuel type would not be needed as an input. Emission factors for electricity are also the same GREET emission factors as those used throughout the Tool using the WECC region. Emission factors for hydrogen are the same as those used for FCEVs, with the addition of a data input on whether the hydrogen was produced on-site or off-site. It should be considered that if EV penetration into the market continues to

grow, this approach could become less accurate, as additional charger use may not exclusively offset ICEV miles.

3.1.4 EV Carshare

This methodology quantifies the benefits of starting or expanding an EV carshare program to offset the use of ICE vehicles.

3.1.4.1 Calculation Methodology

The methodology is adapted from the quantification technique used in the CAPCOA handbook, where benefits are quantified as the amount of ICE VMT avoided because of the carshare program.

$$Emission\ Reduction_{annual} = n_{EVs} \times (cVMT_{avoided} \times EF_{ICE} - eVMT \times \varepsilon_{EV} \times EF_{electricity}) \quad (6)$$

Cumulative emissions for CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

Note that the project implementation year should be the first calendar year. Then, proceed with the following years until the project's lifespan is reached.

Expression		Description	Units	Type
$Emission\ Reduction_{annual}$	=	Annual emissions reduction	g pollutant/yr	Output
n_{EVs}	=	Number of carshare EVs	Count	Input
$cVMT_{avoided}$	=	ICE vehicle miles avoided per year per carshare vehicle	ICE miles/vehicle yr	Factor
$eVMT$	=	Electric vehicles miles added per year per carshare vehicle	Electric miles/vehicle yr	Factor
ε_{EV}	=	Average EV efficiency	kWh/mi	Factor
EF_{ICE}	=	Emissions factor of the average ICE vehicle	g pollutant/mi	Factor
$EF_{electricity}$	=	Emission factor of WA electricity	g pollutant/kWh	Factor
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	years	Factor

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual

- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Element Location
- Project Element County
- Legislative District Impacted

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the project element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determined based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.4.2 References and Discussion

ICE emission factors used for the carshare calculator mirror the light-duty factors calculated for the EV and FCEV infrastructure using MOVES. Similarly, LD EV efficiencies also mirror those used in the EV Charging calculator as determined from MOVES using VMT weighting of passenger car and truck factors. Estimates for the amount of VMT reduction and the increase in electric VMT came from the Car2Go study conducted by Elliot Martin and Susan Shaheen in 2016.[30] It is quite possible that eVMT increases and VMT reduction would be higher today given that EVs have a much longer range than the 84 miles on the Smart car EVs available to users in 2016.

3.1.5 BE Watercraft Purchase (Non-Ferry)

This methodology quantifies the benefits of purchasing an electric vessel instead of an ICEV alternative. Unlike for EV or FCEV purchases, this does not exclusively assume the counterfactual is a new vessel. This is accomplished by requiring data inputs on the engine model year.

Note that this approach can also be applied for ferry vessels that are not part of the WSF electrification program.

3.1.5.1 Calculation Methodology

Our methodology mirrors the typical quantification technique for estimating the benefits of clean-fuel vehicles, based here on the CAPCOA handbook method T-30.

[30] U.S. EPA. Impacts of car2go on Vehicle Ownership, Modal Shift, Vehicle Miles Traveled, and Greenhouse Gas Emissions: An Analysis of Five North American Cities. https://www.epa.gov/sites/default/files/2017-06/documents/05312017-martin.pdf

Note this methodology does not include fuel cell or hybrid vessels. For this reason, this section is entitled only BE (battery electric), as those are the only vessels funded to date.

$$Emission\ Reduction_{annual} = n_{vessels} \times Fuel_{annual,baseline} \times (EF_{ICE} - \frac{EF_{electric}}{\varepsilon_{EV}} \times FuelFactor) \quad (7)$$

Cumulative emissions for CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

Expression		Description	Units	Type
$\boldsymbol{Emission\ Reduction_{annua}}$	=	Annual emissions reduction	g pollutant/year	Output
$\boldsymbol{n_{vessels}}$	=	Number of vessels of the specific vessel type	Count	Input
Vessel Type	=	Type of the vessel being replaced (if Ferry, use Equation 8 & 9)	Unitless	Input
$\boldsymbol{Fuel_{annual}}$	=	Annual fuel consumption, sum of all main and auxiliary engines per vessel	Units/year (e.g., gallons)	Input
$\boldsymbol{EF_{ICE}}$	=	Emissions factor of the ICE fuel	g pollutant/Unit	Factor
$\boldsymbol{EF_{electric}}$	=	Emissions factor of the electric vessel	g pollutant/kWh	Factor
$\boldsymbol{\varepsilon_{EV}}$	=	Energy economy ratio for electric marine engines	dimensionless	Factor
FuelFactor	=	(Constant) 33.3 for gas, 29.3 for diesel[31]	kWh/gal	Factor
Base Fuel	=	(Select) Diesel, gasoline, or gasoline high performance		Input
Engine Model Year	=	ICE engine model year	Year	Input
Engine Power	=	Engine Power	kW	Input
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	years	Factor

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount

[31] U.S. DOE. Fuel Conversion Factors. https://epact.energy.gov/fuel-conversion-factors

- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Element Location
- Project Element County
- Legislative District Impacted

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the project element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determined based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.5.2 References and Discussion

The general design of this calculator was designed to fit with the data available through the EPA Port Emission Inventory Guidance,[32] used throughout this tool, and the WSDOT tool. For example, the fuel types listed included those available in the harborcraft section of the Inventory guidance and those included in EPA regulations for smaller vessels such as fishing and sport boats.[33] The ranges of engine power levels were also based on those included in the Port Inventory guidance. Carbon emissions were based on emission coefficients from the Energy Information Administration for diesel and gasoline and were adjusted with the same GREET emissions factors used throughout this tool for 2025. Emissions factors thus do not vary over time and assume a counterfactual with constant annual emissions. Criteria pollutant emissions factors were pulled directly out of the Inventory Guidance and the EPA regulations, then converted from units of g/kWh to g/gallon using the BSFC in the Port Inventory Guidance and using average fuel energy density. Electricity emission factors included in this tool are the same GREET factors included in every other tool here, which quantifies electrical emissions. These factors vary each year up through 2050 and remain constant for every year afterward. The energy economy ratios used for vessels are based on a study from CleanFuture applying a specific EER for a harborcraft aiming to obtain Clean Fuels Program credits.[34] This EER is used for gasoline and diesel, although the authors acknowledge that the EER for gasoline is likely lower than diesel. However, since there is no data to use in making this comparison, a single EER value is chosen.

[32] U.S. EPA. Port Emissions Inventory Guidance. https://www.epa.gov/state-and-local-transportation/port-emissions-inventory-guidance
[33] U.S. EPA. Marine Spark-Ignition Engines and Vehicles: Exhaust Emission Standards. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1000A0G.pdf
[34] Oregon Department of Environmental Quality. EER Application for Harbor Craft. https://www.oregon.gov/deq/ghgp/Documents/cfp-EERApplication-HarborCraft.pdf

3.1.6 Watercraft Purchase (Ferry)

This methodology quantifies the benefits of purchasing a ZEV or low-emission ferry over a contemporary ICE alternative. It uses a well-to-wheels methodology that considers the carbon intensity of WA utilities and traditional petroleum fuels.

Note that this approach is specialized for the Washington State Ferries (WSF) system. Available options are limited to those already captured in the Ferry System Electrification Plan. This includes two equations for vessels operating before and after shore power is deployed.

Note also that these calculations in this beta version use state average electricity emission factors. However, WSF has agreed to use renewable energy that has a lower carbon intensity and emission factor than the state average. This will be updated in later versions of the tool.

3.1.6.1 Calculation Methodology

ICF adopted WSDOT's approach for calculating Ferry emissions since WSDOT has already identified all the necessary data. Note that, consistent with the approach in the WSDOT calculator, users are allowed to input both when the vessel is purchased and when the shore power is installed. If the shore power availability year is the same as the project start year, then only equation 9 applies. If the shore power availability year is after the project start year, then equation 8 is applied for all years until the shore power availability year.

ICF Ferry Calculation Methodology – Before Charging is Installed

$$Emission\ Reduction_{annual} = FC_{baseline,annual} \times HybridSavings \times EF_{ICE\ vessel} \quad (8)$$

ICF Ferry Calculation Methodology – After Charging is Installed

$$Emission\ Reduction = FC_{baseline,annual} \times (EVSavings \times EF_{Fuel}) - CrossingEnergy \times ChargeCycles_{annual} \times EF_{electric} \quad (9)$$

Cumulative emissions for CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

Expression		Description	Units	Type
$\boldsymbol{Emission\ Reduction_{annual}}$	=	Annual emissions reduction	g pollutant/year	Output
$\boldsymbol{HybridSavings}$	=	Percent fuel savings from hybrid system alone (still diesel fueled, prior to shore power installation)	%	Factor
$\boldsymbol{EVSavings}$	=	Percent fuel savings from hybrid system operating with shore power	%	Factor

CrossingEnergy	=	Energy needed for the vessel to complete the planned route	kWh/cycle [a]	Factor
ChargeCycles$_{annual}$	=	Expected charge cycles per year	Count/year	Factor
EF$_{ICE\ vessel}$	=	Emissions factor of the ICE fuel	g pollutant/gallon	Factor
EF$_{Electric}$	=	Emissions factor of the electric vessel	g pollutant/kWh	Factor
Existing Vessel Class	=	Type of the old vessel	Lookup	Input
Ferry Route	=	Primary route the ferry takes	Lookup	Input
New Vessel Class	=	Type of the new vessel	Lookup	Input
FC$_{baseline,annual}$ (Annual Fuel Consumption)	=	Fuel consumed per year by the ferry being replaced	gallons/yr	Input
Shore Power Availability Year	=	Year that shore power becomes available	year	Input
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	years	Factor

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Element Location
- Project Element County
- Legislative District Impacted

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the Project Element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determined based on input project benefit location)

- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.6.2 References and Discussion

As the WSF has already completed a detailed analysis of the expected usage and duty cycles of hybrid electric ferries, this approach leverages much of the work in the WSF System Electrification Plan and its appendices.[35] For example, this resource contained data for the crossing energy for each route, the number of crossing cycles expected per year, the expected fuel savings from hybrid-only operations, and the expected fuel savings when using shore power. Then, when estimating the carbon emissions associated with electricity, the same GREET emission factors are applied as those throughout the rest of the Tool going forward to 2050 since that is as far as GREET will project. Past 2050, constant emission factors were used for electricity rather than attempting to project further forward into the future. Emission factors for the existing vessels were based on the carbon intensity for diesel cited in the WSDOT Ferry tool, with upstream emission factors added from GREET for 2025. Particulate emission factors are based on values for Ocean Going Vessels included in the EPA Port Emissions Inventory Guidance based on the known build year and power level of the engines in each ferry class. Emission factors for all ferries built before 1999 were given the same PM emission factors because all vessels older than that are subject to the same emissions limit. Since factors in the EPA Port Emissions Inventory Guidance are given in units of g/kWh, they are converted to units of g/gallon of diesel using BSFC values in the WSDOT tool and in the Port Inventory guidance by engine power level.

3.1.7 Port Shore Power

This methodology quantifies the benefits of installing shore power for ships at a port, allowing them to run on electricity from the grid instead of their auxiliary engines when docked.

This project element is not designed for Washington State Ferries since the benefits from those projects will be captured through the methodology outlined in Section 3.1.6. Using this Project Element for a WSF project will lead to a double counting of benefits.

3.1.7.1 Calculation Methodology

This methodology follows the technique used by the EPA Shore Power Calculator. It calculates the emission reduction as the difference in emissions from the on-board generators and the WA grid.

$$Emissions\ Reduction_{annual} = \left(EF_{vessel\ fuel} - EF_{electric}\right) \times Load_{Aux} \times Vessel\ Calls_{annual} \times \left(Hours_{hotel} - Hours_{connect}\right) \times ShorePowerUse_{fraction} \quad (10)$$

Cumulative emissions for CO_2e are computed as:

$$Emission\ Reduction_{cumulative} = \sum_{years} Emission\ Reduction_{annual}$$

[35] https://wsdot.wa.gov/sites/default/files/2021-11/WSF-System-Electrification-Plan-Appendices.pdf

This calculation will be repeated for each vessel class and fuel type combination, and the total reduction will be the sum of those reductions.

Expression		Description	Units	Type
$Emission\ Reduction$	=	Annual emissions reduction	g pollutant/year	Output
$Load_{aux}$	=	Auxiliary vessel loads of that specific vessel type in port, considering the generator efficiency.	kW	Factor
$Vessel\ Calls_{annual}$	=	Average number of vessel calls per year for that specific vessel type	Count	Input
$Hours_{hotel}$	=	Average number of hours of hoteling per vessel call	Hours	Input
$Hours_{connect}$	=	Average time for connection and disconnection of a ship to shore power per vessel call	Hours	Factor
$ShorePowerUse_{fraction}$	=	Fraction of vessel calls where shore power is used	%	Factor
$EF_{vessel\ fuel}$	=	Emission factor of the auxiliary engine used by the ship	g pollutant/kWh	Factor
$EF_{electric}$	=	Emissions factor for WA electricity	g pollutant/kWh	Factor
Vessel Types	=	Types of vessels being docked		Input – new calculation for each vessel type
Vessel Fuel Type/Tier	=	Combination of engine tier and vessel fuel type		Input for each vessel type
Project Element Lifespan		Standard length of this project element type. Used for cumulative calculation.	years	Factor

Standard Project Element Inputs

- Project Name
- Project Element Name
- Data Type: Forecast or Actual
- Project Element Start Year
- Project Element Funding Amount
- Project Element Cost
- Funding Recipient or Other Designee
- Responsible Agency
- Tribal Support (Yes or No)
- Project Element Location

- Project Element County
- Legislative District Impacted

Standard Project Element Outputs

- Annual emissions reduced across all pollutant types (CO_2e, CO_2, $PM_{2.5}$, total VOCs, NO_x, CO) for all years in the Project Element's lifetime (CO_2e, CO_2 in metric tonnes, other pollutants in kg)
- Total GHG emissions reduced (CO_2e, CO_2 in metric tonnes) over the Project Element's lifetime
- Location of emission reductions for criteria pollutants (PM, VOC, NO_x, CO)
- Whether the Project Element benefits a DAC (determine based on input project benefit location)
- GHG emission reduction per total Project or Project Element cost (in metric tonnes per $)
- GHG emission reduction per Project or Project Element funded amount (in metric tonnes per $)
- Funding per Project Element location (county, census tract, senate district, assembly district)
- Responsible agency

3.1.7.2 References and Discussion

The shore power calculator was built with a very similar philosophy as the EPA Shore Power Calculator,[36] but with slightly more conservative assumptions to account for the fact that ships with shore power capabilities do not plug in at every port visit, and there is an inherent connection time associated with getting the vessel connected and disconnected from shore power during each visit. Based on the EPA Port Emissions Inventory Guidance for Ocean Going Vessels,[37] the same set of emission factors as the EPA calculator were applied. Similarly, the types of vessels and the assumptions about typical auxiliary engine power by vessel type were also based on the EPA tool. Electricity emission factors used for this calculator are the same GREET electric emission factors used throughout the rest of the Tool. The connection times and shore power use fraction are based on the consultant's previous experience (including the Port of Oakland shore power program).[38] Gasoline is not included as an option for fueling as it is not used for the large vessels included here.

3.2 Key Specifications

The Tool created through this project must assemble available information, be accessible and usable to a range of agencies implementing CERA funds, and support the evaluation of the efficacy of carbon emission reductions (such as in dollars per ton) from CERA investments. It must support information sharing, enable regular data input and reporting, and provide the complex, often geospatial data and reporting needs to track EJ benefits. The Tool should improve the user's understanding of the costs and benefits of CERA expenditures and inform actionable recommendations for JTC on feasible program improvements. This tool's primary focus is to support tracking direct CERA fuel conversion appropriations in the 2023-2025 biennial and 2024 supplemental transportation budgets.

[36] U.S. EPA. Shore Power Technology Assessment at U.S. Ports. https://www.epa.gov/ports-initiative/shore-power-technology-assessment-us-ports#assessment
[37] U.S. EPA. Port Emissions Inventory Guidance. https://www.epa.gov/state-and-local-transportation/port-emissions-inventory-guidance
[38] Port of Oakland. Shore Power. https://www.oaklandseaport.com/facilities/shore-power/#:~:text=Shore%20power%20is%20grid%2Dbased,going%20to%20zero%20emissions%20operations

3.2.1 Approach

This tool's primary focus is to support tracking direct CERA fuel conversion appropriations in the 2023-2025 biennial and 2024 supplemental transportation budgets. Subsequent monitoring requirements and the needs of different fund recipients to fully implement the CERA requirements, such as data submission, will also be considered.

Guidance received from various stakeholders informed the tool's design criteria. This included individual meetings with Representative Fey and Senator Liias, the Technical Team, and an extended set of state employees at WSDOT, Ecology, and JTC to collect input on different users' needs, design considerations, and potential architecture solutions for the Tool.

We note that this beta version is designed to meet the requirements of the governing Proviso and is not perfectly aligned with CCA reporting requirements later issued by Ecology.[39] Future versions of the tool could explore modifying reporting to better align with these requirements if of interest to users.

3.2.2 Approach for Determining the Outputs

The Proviso describes three (3) output categories to be reported across the various projects and project elements. Those can be summarized as:

- Budgetary Impacts
- Emissions Reductions
- EJ Impacts

Seven (7) specific reporting metrics were identified to meet the reporting requirements. These metrics will be produced for all project types. **Table 2** maps these outputs to reporting categories. Together, these seven outputs address all required reporting. The Tool was built to address all required reporting for each Project Element type.

3.2.3 Design Specifications for the Dashboard

Section 3.1 addressed the methodologies for individual Project Elements. This section summarizes the specifications assigned to the entire dashboard once individual projects have been analyzed.

The dashboard will be responsible for many of the requirements of the overall tool. Key specifications were determined with the Technical Team to include in the Tool. All specifications but two were included in the design:

- The ability to sum and filter the costs and benefits of multiple projects by geographic area, project category, and related elements. This includes the ability to group projects for reporting by key topic areas to capture different project types, such as EV Charging and EV purchases that may be coupled but exist in separate projects.
- Supporting actionable recommendations for program improvement by reporting the costs and benefits of individual projects.
- The ability to export summaries of individual projects and project groups as spreadsheets (or CSV files) for later analysis.

[39] Memo, "Ecology Rulemaking on Climate Funds Reporting", From Laura Watson to Agency Leaders, October 8, 2024.

- Provide limited mapping displays to support EJ reporting, potentially for multiple projects. Due to limitations in the PowerBI mapping capabilities, this display will be limited to showing Washington State, DACs, the project's location, and the project's benefit. Both the project and benefit location will be user input—not calculated by the Tool.

The following two (2) specifications were originally considered for the Tool but not included in the beta release version.

- For individual projects, having the ability to display both forecasts (for the initial reporting year) and current (for subsequent reporting years) as an overlay to measure actual against anticipated performance. There is currently no data being collected to support this feature, so it was not included in the beta release of the Tool. Should a data collection program be established that collects and the parameters of the data to be collected be established, the Tool can be updated to add this reporting.
- It was determined that creating a composite score across categories would not be included due to the subjectivity of weighting between categories and the mixture of quantitative and qualitative metrics. Users may create their own scoring rubric based on the Tool's outputs if desired.

3.3 Notable Assumptions and Issues

This section documents some of the key assumptions and limitations in the approach of which users should be aware.

3.3.1 General Content

- The tool only considers fuel conversion projects, largely meaning electrification or other zero emission technologies. It does not consider projects that move from one ICE fuel or technology to another. For example, upgrading to a higher tier off road engine may have emissions benefits, but will not be addressed by this tool. Similarly, hybrid technologies are not included here, other than for the hybrid WSF vessels. This is more limited than the full set of project types considered under CCA or CERA.
- Disadvantaged communities in the beta version of the Tool are defined by Federal J40 definitions. The WA DOH maintains their own definitions of EJ areas. These were obtained but could not be incorporated into the Tool within the available schedule. This may be added at a later date. However, WA and the Federal government seem to treat tribal lands differently. This could have a significant impact on the reporting in the Tool's EJ page, which first filters only for Project Elements affecting EJ areas, and then displays those that also have tribal support. It is noted also that not all Project Elements with tribal support must occur on tribal lands. The subtleties of these distinctions should be considered if the underlying data is modified from the Federal J40 to the state DOH data.
- The Tool does not apportion emissions or costs to different geographies (tracts, counties, legislative districts) for either benefit or cost calculations. The Tool is designed to be used to compare the GHG effectiveness of different projects and elements. Such measures are not geographically specific due to the global nature of GHG emissions. It is not designed to compare benefits of other pollutants in different areas, such as which projects may reduce PM emissions in EJ areas. For example, if a project or project element spans two counties, total emissions are shown, and the Geography page shows both counties. If a user then clicks on one county, the Tool then shows all projects/project elements in that county. It does not apportion the first project to counties, as data to support that allocation is not available.

3.3.2 Factors Development

All methods described in **Section 3.1** rely on a mix of user inputs and factors. All calculation factors are contained in **Appendix A.** The following are some notable assumptions relevant to these factors. Others are described in **Section 3.1** at the end of the methodology section for each Project Element.

- All NONROAD data used in the analysis was modeled with the US EPA's MOVES model. In all cases, this was for Skagit County, Snohomish County, and Walla Walla County in WA. These counties were chosen as representatives, given their rural and urban components. Nonroad emission rates are not very sensitive to location. All fuel categories were included.
- Upstream emission factors for hydrogen do not vary over time and may be conservative for fuel cell vehicles going into the future.
- Electricity emission factors are for the entire Western Electricity Coordinating Council region. As such, they do not decrease to zero by 2045 in alignment with Washington's Clean Energy Transformation Act.[40] The regulation does not mandate electricity to have zero lifecycle emissions, just to be zero-emission in the production phase. Still, WECC factors are likely to be overly conservative for WA alone. WECC includes everything west of roughly North Dakota to Texas and states with much more coal-dependent grids than WA. However, this is the best information available to forecast values for the state.
- Off-road equipment was modeled using the MOVES model's NONROAD module. The equipment list was taken directly from the default values in that model. Total annual emissions were calculated in units of gr pollutant, assuming all months and days in the year 2023. Emissions factors were calculated in the units of gr pollutant per horsepower hour by dividing total annual emissions by the total multiplication of source hours, average horsepower, and load factor. The exception is switcher locomotives, which are unique cases for offroad equipment and not included in the NONROAD model. This is discussed further in **Section 3.1.2.**
- All emission factors for criteria pollutants are tailpipe emissions only. All emission factors for GHGs are full lifecycle. Emissions factors are derived from MOVES4 and R&D GREET model version 2023.
- MOVES4 distinguishes FC and BE vehicles but omits FC LDVs. The team used a methodology documented by the EPA that takes an EER for BEVs and reduces it by 25% to account for FC efficiency. This is documented in **Section 3.1.**
- The C_{vmt} factor in Equation 6 is entered into the Tool here as a factor. This may also be calculated from user inputs. Given the timing for tool development, the factor approach was selected. This could be updated in later versions of the Tool.
- The watercraft methodology relies on emission factors for propulsion engines from EPA. It takes user input in gallons of fuel burned per year. Refinements could be made to accommodate the different emission factors for propulsion and auxiliary engines, although this is minor for harborcraft and primarily affects the criteria pollutants.
- Currently, the watercraft equation relies on EER for electric marine engines. This value is largely unknown, so there is no distinction between replacing gas or diesel with electric or whether the engine is BEV or FCEV. This should be updated in later versions of the Tool. The value for this parameter is

[40] Washington State Department of Commerce. Clean Energy Transformation Act (CETA) Overview. https://www.commerce.wa.gov/growing-the-economy/energy/ceta/ceta-overview/

unknown. A rough guess value of 3.0 is used, roughly consistent with ARB values for streetcar or eOGV.[41]

- FC station utilization for Equation 5 is largely unknown; however, a source from DOE completed by NREL in 2016 was applied. As Washington is a ZEV state in this study, the team used average FCEV station utilization projections for ZEV states.[42]

3.3.3 Tool Capabilities

The Tool's architecture (see **Section 3.5**) use of SharePoint Lists results in a lag between data entry and data appearing in the tool after a refresh. Because of this, data entered by a form may be delayed in appearing in the Tool, sometimes by up to an hour, and for data entered at the end of a day, until the next required refresh the next morning. Users may need to wait, sometimes for an extended period, before their data is visualized.

The methodology for ferries has limited capabilities and flexibility. This is by design to be consistent with the WSDOT tool. Later versions may revisit this to make the approach more generic.

The Tool built is based on what has already been funded. Future projects that fit these categories can use the Tool to enter their funding and activity data. Future projects that do not fall into one of these categories would require future updates to the Tool. This is especially true for ferry projects, which are limited to those already captured in the WSDOT tool's calculations shared with ICF. In this case, even projects of the same kind that cover different routes or vessels would need updates to the underlying data and calculations.

The tool uses the terms "Project" and "Project Element" purposefully. These are tracked and reported separately. Users should be aware of this distinction when comparing values across the different pages of the Tool.

Currently, only BE non-ferry vessels are included. This is because the Tool is designed to be consistent with the 2023-25 budget and supplemental budget-funded projects. Other ZE vessels, such as fuel cell are possible and could be added later.

Ferries are not included in the port shore power project element. Ferry electrification and shore power should be handled in the ferry purchase element instead to avoid double counting these benefits.

Do not enter $0 for Projects or Project Elements for funded or cost values. This will lead to zero errors when computing tonnes reduced per dollar spent. The Cost and Funding fields do not accept zero as a value and provide a system message to avoid this.

Funding amounts and costs are entered at the project and Project Element levels. These are not spread over time or budgets. This is not necessary for the calculations here; only the total amounts are needed. Note that the time series of funding amounts in the Tool may not reflect actual timelines of expenditures.

The tool is developed using commonly accepted and available methodologies. Notably, it is assumed that EV charging infrastructure facilitates EV miles and thus displaces ICEV miles. This assumption may be no longer valid in the future, where EVs are more common.

[41] For more information on CARB values, please see:
https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_20-04.pdf
[42] U.S. DOE. National FCEV and Hydrogen Refueling Station Scenarios.
https://www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/progress16/ix_11_melaina_2016.pdf

While project locations in terms of census tracts are an optional input, EJ reporting is dependent on this. This is done to simplify data entry, but limits the available reporting by a project.

3.3.4 Project Lifetime

Project lifetimes are typical project lifetime values. They are standardized across project types to support forecasting. Values are generally taken from ARB.[43]

Values for Equation 4 come from ChargeSmartEV's EV Charging Station Maintenance Guide.[44]

Values for Equation 6 use CARB LDV assumptions, minus three years, to account for higher than average usage of carshare.

Values for Equations 7 and 8 rely on WSDOT lifetimes.[45]

Values for Equation 9 rely on a reasonable value based on a typical 10- to 30-year lifetime, depending on the type of vessel and water salinity.

Values for Equation 10 are derived from Clean & Prosperous Washington.[46]

3.4 Potential Improvements

These improvements to the Tool are recommended to be considered in any future version of the tool that JTC authorizes:

- **Actuals.** The current version of the Tool only forecasts the impacts and benefits of CERA-funded projects. A future iteration allowing recipients to enter actual data would allow meeting the specification to compare forecast and project performance. This would first require the design and implementation of an actual performance data collection program, which is not in this project's scope.
- **Time-varying data inputs.** The current version of the Tool only takes a single set of inputs and applies them for all forecast years. Some data may vary over the forecast period. A future iteration of the Tool may consider more variation in input data for forecast projects.
- **Mapping.** The current version of the Tool stores but does not display project locations or benefit locations as a point on the map. The addition of latitude/longitude mapping capabilities for project location and benefit location should be considered for future implementation.
- **EJ impacts:** There are limitations in the Tool's ability to analyze and present the impacts of projects in disadvantaged communities.
    - Currently, this tool version uses Justice40 census tracts to identify affected EJ areas. A future Tool iteration may consider replacing this with WDOH's Environmental Disparities data.
    - To accurately forecast benefits in these areas, a more sophisticated methodology may be considered to identify impacted areas for use in the Tool. The project location is not sufficient alone. This is particularly complex for non-stationary projects, such as vehicle purchases,

[43] For more information on Project Lifetime, please visit: https://ww2.arb.ca.gov/sites/default/files/2020-06/Congestion_Mitigation_Air%20_Quality_Improvement_Program_cost-effectiveness_methods_may2005.pdf
[44] ChargeSmart EV. EV Charging Station Maintenance Guide. https://chargesmartev.com/ev-charging-station-maintenance-guide/
[45] WSDOT. WSF 2040 Long Range Plan. https://wsdot.wa.gov/sites/default/files/2021-11/WSF-2040-Long-Range-Plan-2019.pdf
[46] Clean & Prosperous Washington. Transportation Decarbonization in Washington Case Studies: Shore Power https://www.cleanprosperouswa.com/wp-content/uploads/2022/02/DecisiveDecade_ShorePower.pdf

which would need to understand vehicle operating locations. A different tool to determine these inputs and dispersion of pollutants from the project(s) could be developed to provide this information to this Tool. This would be a major undertaking.

- **Calculation Methodologies:**
  - **Off Road inefficiencies.** This current tool version does not distinguish between FC and BEV efficiency for off-road equipment. A future iteration of the Tool could incorporate distinguishing off-road ZE technology by fuel type (i.e., FC versus BEV).
  - **Watercraft EER.** This version of the Tool does not distinguish between ICE fuels.
  - **ZE Upstream Emission Factors.** The methodology of this current version of the Tool assumes that the EFs for electricity used in all the electric equipment change over time, but the same EFs for the production of H2 do not, even when H2 is produced using grid electricity. Variations in upstream emission factors for H2 production over time could be incorporated. Also, a more refined estimate of average WA grid emission factors could be included than the WECC factors currently used.
  - **Ferries.** This methodology assumes that there will be a delay between when the vessels are placed into service and shore power availability. This assumption may lead to an inconsistency in the vessel type, which is assigned by route in the Shore Power case but is input before Shore Power is available. It is anticipated to be minor and consistent with the WSDOT calculation methodology. This methodology also uses statewide average electricity. WSF has agreed to use renewable energy to power these vessels. Thus this beta version of the tool underestimates the total benefits. This will be corrected in later versions of the tool.
  - **EV charging infrastructure.** Adding specifications for workplace and depot charging scenarios should be considered.
- **Tool Performance: Rudimentary Update Schedule / Refresh Cycle:**
  - Currently, the Tool updates the dashboard on a set schedule. Thus, data submitted via a Project Element form may not show up immediately and may take approximately 1 hour to be visible in the dashboard. A future iteration of the Tool could add a dedicated database such as SQL or Dataverse to process transactions and refresh quicker. This would require a new architecture design and implementation.

Reporting: This tool is based on the reporting proviso, not the CCA reporting requirements released at the end of Phase 1 of this project. As such, the following improvements may be considered in future revisions if the tool is to be modified to better support this reporting.

- **GHG reductions per funded amount and project/element cost.** A reviewer noted that CCA funds reporting requirements note that GHG reductions should be reported as the prorated emissions from current FY CCA expenditure relative to total project costs. No proration is included here. Similarly, we report reduction in MT per dollar, while CCA reporting requires $ per MT. Coordination could be considered for future revisions.
- **Data Export tab could be expanded to provide additional information.** Per review comments, these could include project useful life (years), number of replaced vehicles/equipment, and financial metrics. These could be explored in later versions of the Tool.
- **Additional reporting on energy dispensed** (electric or H2) in addition to GHG reductions achieved could be added to support other reporting.
- **An additional slicer** could be added to report by Agency.
- **Additional granularity** to financials could be added such as budget or year budgets are spent.

- **Additional metrics on PM emissions could be added to help support EJ reporting,** including a slicer to filter projects according to levels of PM reduction and ability to total and show PM reductions by legislative districts.

3.5 Tool Architecture

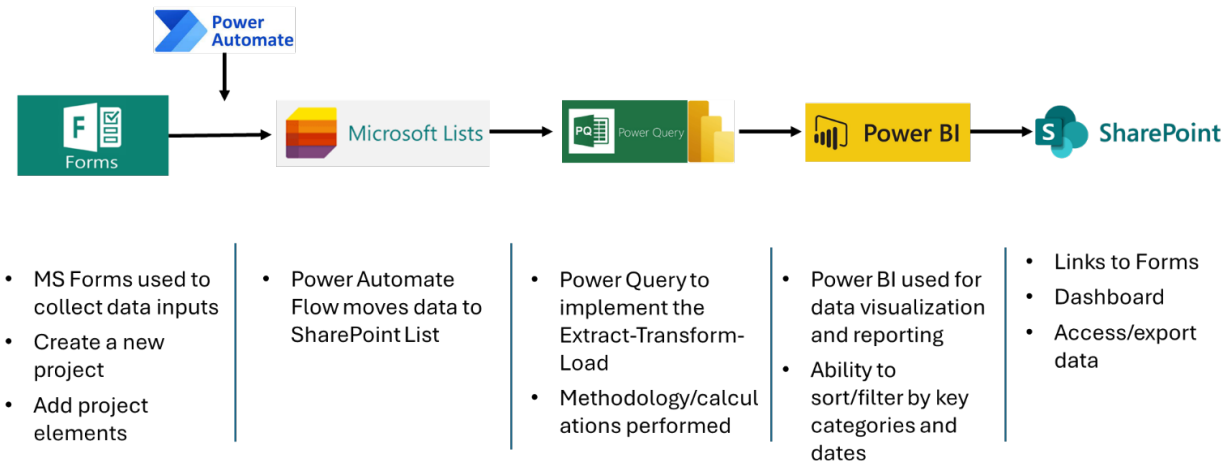
Section 3.2 listed the critical specifications of the Tool. This section discusses the architecture of the Tool developed to meet those requirements.

3.5.1 Solution Design

3.5.1.1 Microsoft 365 General Architecture

The solution was designed using applications native to the M365 business environment to input, track, evaluate, and visualize carbon emission reductions over time. **Figure 4** shows a generalized representation of the process.

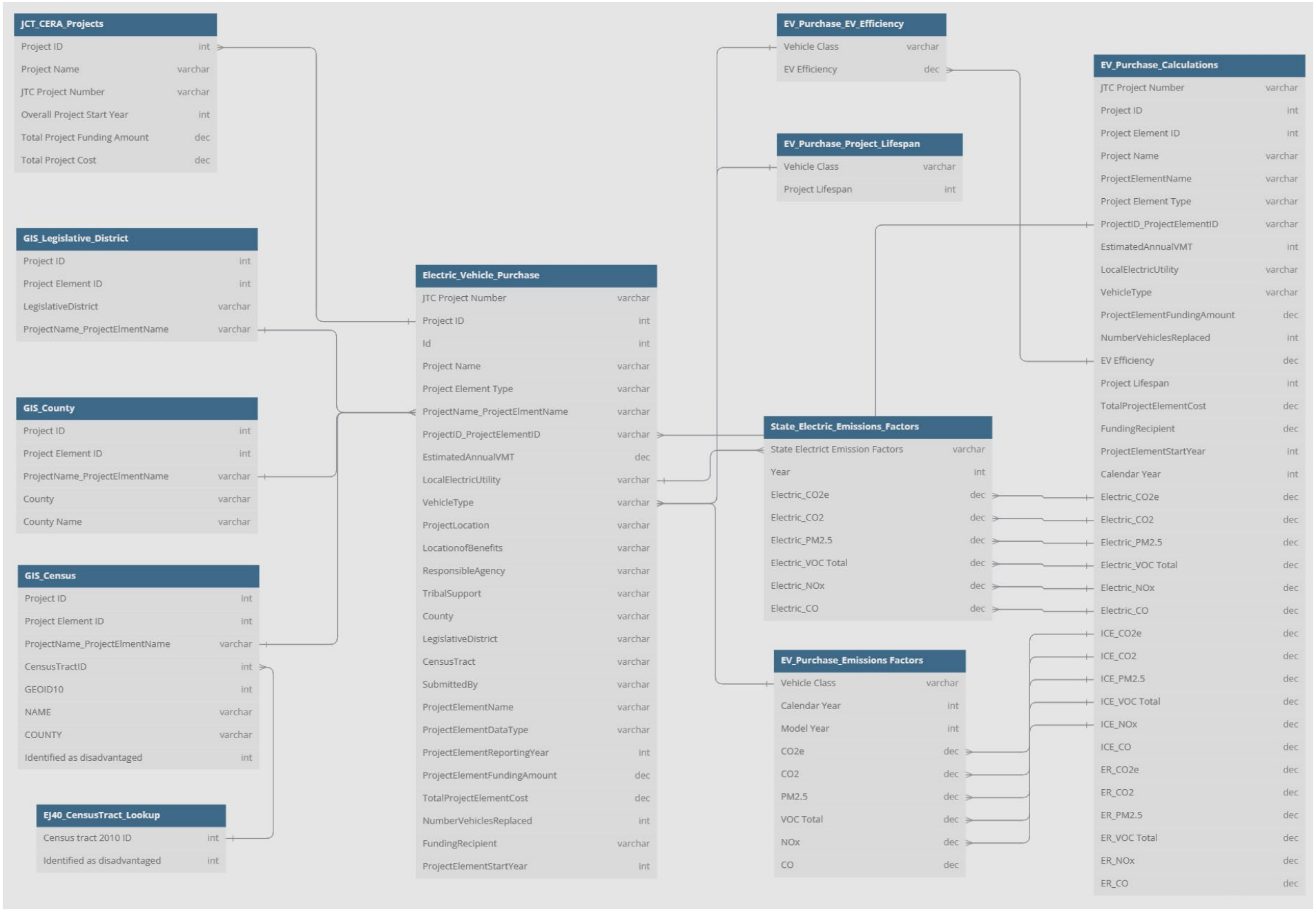
Figure 4. Solution Design Framework for the JTC CERA Tool.



Microsoft Forms collects Project Element inputs using branching logic to guide respondents through different paths based on their choices. MS Forms is built on Microsoft's security and compliance framework, which includes data encryption, GDPR compliance, and support for multi-factor authentication. Once a form is submitted, responses are stored as individual records in a Microsoft SharePoint List by workflows designed in Microsoft Power Automate. These automated, auditable processes enforce the robust security and compliance features inherent to the M365 environment, including data encryption, role-based access control, integration with Azure Active Directory for identity management, and full integration with SharePoint.

SharePoint offers a centralized location to link to Project Element forms, the dashboard, and export data. It has a generous 250 GB file upload limit, well beyond the demands of the Tool. There is no distinct limit to the number of guests accessing the SharePoint site. Once data is staged in SharePoint Lists, PowerBI is used to create a data model that joins the List data, Project Factor Table, and GIS transformations that generate the calculation, lookup, and visualization tables. The Tool's query dependencies span ten (10) tables for form inputs, forty-one (41) tables for Project Factors, nine (9) tables for Calculations, fifteen (15) tables for transformation and lookups, twelve (12) tables for Visualization, three (3) tables for GIS, and two (2) others used for dashboard processes. The PBIX development file contains an interactive layout of the query dependencies across all the table relationships (PowerBI > Transform data > View tab > Query Dependencies). **Figure 5** describes the generalized relationships between these tables for one project factor.

Figure 5. Relational Table Schema Example



Due to the total number of system tables exceeding the ability to fit on a single page, the **Figure 5** outlines the relationship between key tables that produce the Tool. Each time the data is refreshed Power BI must rebuild the model results as this operation is not delegable to a server. This query caching is limited to refresh up to 48 times per day.

3.5.1.2 Mapbox

Mapbox GL JS was used to integrate county, legislative, and census tract maps into the Tool. It is a JavaScript library for vector maps on the Web that provides a Geographic Information System (GIS) platform for developers to create custom maps. MapBox uses tileset jobs, billed per processed megabyte and per processed compute unit (CUs), for each successfully published tileset. CUs represent the compute resources required to process a tileset job. These are limited to 10,000 Megabytes monthly of tile source uploads by Mapbox and 20 monthly CUs. The number of custom tilesets multiplied by the days per month of each hosted tileset, is metered daily as Tileset Hosting Days. The Tool is designed to use less than the Mapbox limit of 750 monthly tileset hosting days. For example, three (3) tilesets (County, Legislative, Census) hosted for 30 days results in 90 tileset hosting days.

A map load occurs when a MapBox object is initialized on a webpage or dashboard, allowing users unlimited interactivity with the web map, with a maximum session length of 12 hours. If a user has the same map open after 12 hours, it is counted as a new map load session. The Tool allows for 50,000 free loads per month. The Tool is designed to process up to 100,000 monthly Tilequery API requests per month, up to 200,000 monthly Vector Tile API requests, and up to 750,000 monthly Raster Tile API requests. These APIs were used to integrate the custom maps and geospatial data into the Tool and support various functionalities such as creating and updating tilesets and managing map styles.[47]

3.5.2 Considerations

SharePoint Lists have known constraints that impact data processing. Delegating data processing and querying to a server is often necessary to transform and manipulate large datasets efficiently and responsively, which requires compute resources. Delegation of this type is not possible with SharePoint Lists due to limitations in how SharePoint handles data processing and querying. SharePoint Lists have a threshold limit of 5,000 items that can be retrieved in a single query. When a query exceeds this limit, it cannot be delegated to the server, and client-side processing becomes necessary. This can result in a lag between data entry and data refresh as models are rebuilt in the data visualization rather than compiled by a server. Additionally, certain complex operations, including filtering, sorting, and aggregating data, cannot be delegated, forcing them to be performed on the client side, which can lead to performance issues. Due to the project timeline a more robust and responsive data storage, processing, and querying solution was not achievable.

When using Mapbox, there are several third-party considerations to keep in mind to ensure the Tool performs as designed. There are tileset processing, compute resource, map view, API requests, and data storage limitation that can impact optimal performance when reached. If the number of users accessing the Tool exceeds these limits, it may require additional licensing fees to achieve acceptable performance.

[47] More information on Mapbox documentation can be found by visiting: https://docs.mapbox.com.

4 Glossary

BE: Battery Electric

BEV: Battery Electric Vehicle

BSFC: Brake Specific Fuel Consumption

CAPCOA: California Air Pollution Control Officers Association

CARB: California Air Resources Board

CCA: Climate Commitment Act

CEJST: Climate & Economic Justice Screening Tool

CERA: Carbon Emission Reduction Account

CO: Carbon Monoxide

CO_2: Carbon Dioxide

CO_2e: Carbon Dioxide Equivalent. Determined as the GWP-weighted emissions value of all GHGs emitted.

DAC: Disadvantaged Community

DOH: The WA Department of Health

Ecology: The WA Department of Ecology

EER: Energy Efficiency Ratio

EF: Emissions Factor

EJ: Environmental Justice

EPA: Environmental Protection Agency

EV: Electric Vehicle

FCEV: Fuel Cell Electric Vehicle

GHG: Greenhouse Gas

GREET: the Argonne National Laboratory's Greenhouse gases, Regulated Emissions, and Energy use in Technologies life cycle analysis model

g: gram

GWP: Global Warming Potential

H2: Hydrogen

H2FC: Hydrogen Fuel Cell

HD: Heavy Duty (truck)

HEV: Hybrid Electric Vehicle

HTC: House Transportation Committee

ICE: Internal Combustion Engine

ICEV: Internal Combustion Engine Vehicle

J: Joules

J40: The Federal Justice40 screening tool and data

JTC: Joint Transportation Committee

kg: kilograms

kW: Kilowatt

kWh: kilowatt-hours

LD: Light Duty

MD: Medium Duty (truck)

MOVES: the US EPA's MOtor Vehicle Emissions Simulator

MHD: Medium/Heavy Duty

MT: Metric Tonne (1,000 kg)

NOx: Nitrogen Oxide

O3: Ozone

PM: Particulate Matter

$PM_{2.5}$: Particulate Matter less than 2.5 μm in (equivalent) diameter

STC: Senate Transportation Committee

TTW: Tank-to-Wheels (a.k.a., downstream)

VMT: Vehicle Miles Traveled

VOC: Volatile Organic Compound

WSDOT: Washington State Department of Transportation

WSF: Washington State Ferries

WTW: Well-to-Wheels (a.k.a., full lifecycle)

ZE: Zero Emissions (a.k.a., non-combustion powered)

ZEV: Zero Emission Vehicle

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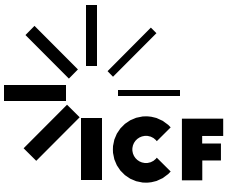


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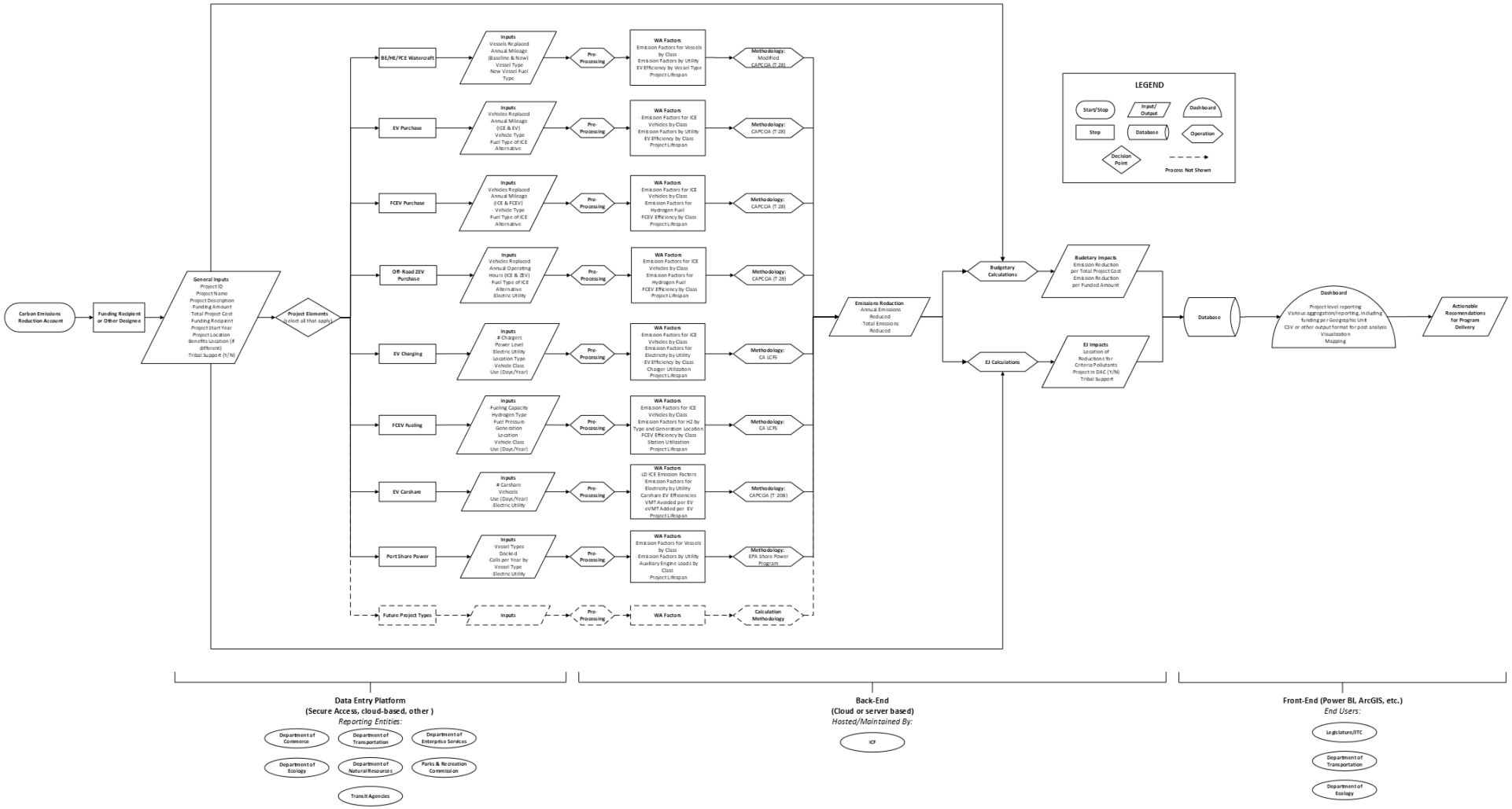
6 Appendices

Appendix A: Calculation Factors used in the CERA Fuel Conversion Tool

Factors provided as spreadsheet file: "Appendix A.Project Element Factors.xlsx".

Appendix B: Initial Draft Blueprint of the CERA Fuel Conversion Tool



Appendix C: Typology of Funded Fuel Conversion Projects

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
Replacement of vehicles and equipment with electric alternatives	Parks & Recreation	$2M	104(3)	--	--	Deletion[50]	EV/FCEV Purchase, EV Charging/FCEV Fueling
Tribal electric boat grant program for converting fishing vessels to electric	Commerce	--	--	$5M	103(2)	Addition	BE/HE/FCE Watercraft
ZEV supply equipment infrastructure to accommodate charging station installations	Enterprise Services	$6M	114(1)(3)	$12M additional	106(1)	Increase	EV Charging/FCEV Fueling
Fleet charging infrastructure expansion assessment, charger installation plan, and procure and deploy electric pickup trucks	Natural Resources	$2.2M	115	--	--	Deletion	EV Charging/FCEV Fueling, EV/FCEV Purchase?
To provide grants to transition from diesel school buses to ZEVs and fueling infrastructure	Ecology	--	--	$4M	108(1)	Addition	EV/FCEV Purchase, EV Charging/FCEV Fueling
Design of infrastructure and incentive strategy	JTC	$2M	204(5)	$2M	204(4)	Same	Not fuel conversion

[48] 2023-2025 Transportation Budget, ESHB 1125: https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session%20Laws/House/1125-S.SL.pdf
[49] 2023-2025 Supplemental Transportation Budget, ESHB 2134: https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session%20Laws/House/2134-S.SL.pdf
[50] Projects with a funding line that is included in the budget but crossed out or removed in the supplemental are interpreted as "Deleted".

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
for MHDZEVs and cargo handling and off-road equipment; review of passenger vehicle tax incentive							
Development of tools and methodologies for program delivery evaluation	JTC	$1M	204(7)	$1M	204(6)	Same	Not fuel conversion
Study impacts of implementing CA emissions standards for ocean-going vessels at birth	JTC	--	--	$0.477M	204(12)	Addition	Not fuel conversion. Only an exploratory study.
Clean alternative fuel vehicle charging and refueling infrastructure program (Chapter 287, Laws of 2019)	Transportation	$30M	215(1)	$15M additional	215(1)	Increase	EV Charging/FCEV Fueling
Pilot program to provide clean alternative fuel vehicle use opportunities to underserved communities	Transportation	$2M	215(6)	$3.4M additional	215(4)	Increase	EV Carshare
Medium and heavy-duty vehicle and equipment infrastructure and incentive programs and	Transportation	$100M	215(7)(b)	$10M additional	215(5)	Increase	EV/FCEV Purchase, EV Charging/FCEV Fueling

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
ZEV school buses and refueling infrastructure							
Administer early action grant program for ZEV commercial vehicle infrastructure demonstration projects	Transportation	$20	215(7)(a)	--	--	Deletion	EV/FCEV Purchase, EV Charging/FCEV Fueling
EV charging infrastructure at Mount Vernon library	Transportation	$2.1M	215(9)	$2.1M	215(6)	Same	EV Charging/FCEV Fueling
Hydrogen refueling infrastructure investments	Transportation	$3M	215(8)	--	--	Deletion	EV Charging/FCEV Fueling
Hydrogen fueling infrastructure grants for medium and heavy-duty vehicles w/federal match	Transportation	--	--	$10M	215(8)	Addition	EV Charging/FCEV Fueling
Zero emission cargo handling equipment incentives	Transportation	$2.5M	215(10)	--	--	Deletion	Off-Road ZEV Purchase, EV Charging/FCEV Fueling
Clean off-road equipment incentives	Transportation	$5M	215(11)	--	--	Deletion	EV/FCEV Purchase, EV Charging/FCEV Fueling
Bellevue & Redmond electric fire truck	Transportation	--	--	$800K	215(9)	Addition	EV/FCEV Purchase

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
Tacoma Public Utilities medium-duty zero-emission utility service vehicle pilot project that includes charging infrastructure and mobile battery units[51]	Transportation	--	--	$1.725M	215(10)	Addition	EV Charging/FCEV Fueling
Community outreach, education, and technical assistance program for carbon reduction strategies	Transportation	$3M	219(13)	$1M additional	219(10)	Increase	Not fuel conversion
Low carbon transportation planning efforts for World Cup organizing committee	Transportation	--	--	$1M	219(12)	Addition	Not fuel conversion
$1M for Jefferson Transit electric bus replacement, $1.023M for Pacific Transit electrification of paratransit fleet, $3.795M for C-TRAN hydrogen fueling station infrastructure, and $1.623M for Island Transit fleet expansion	Transportation	--	--	$7.442M	221(11)	Addition	EV/FCEV Purchase, EV Charging/FCEV Fueling

[51] This is understood to be support equipment for electric vehicles, and assumed to be processed as a charging infrastructure type project.

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
$1.467M for Kitsap Transit inductive charging units, $1.891M for Twin Transit ZEV acquisition, and $4.4M for C-TRAN hydrogen fuel cell buses	Transportation	--	--	$7.758M	221(15)	Addition	EV Charging/FCEV Fueling, EV/FCEV Purchase
Washington State University extension energy program for technical assistance and education program for public agencies on alternative fuel vehicles	Transportation	$0.5M	221(19)	$0.5M	221(20)	Same	Not fuel conversion
New transit coordination grants to/from Washington state ferry terminals	Transportation	--	--	$2M	221(24)	Addition	Not fuel conversion
Implement recommendations from 2023 frequent transit service study	Transportation	--	--	$0.9M	221(25)	Addition	Not fuel conversion
For projects: Base Refurbish & Expansion for Growth/Columbia County Public Transportation, Kitsap Transit: Design & Shore Power, Pierce Transit – Meridian, King County	Transportation	--	--	$11.8M	221(26)	Addition	Mostly not fuel conversion with some Port Shore Power elements

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
Metro South Annex Base - Electrification Elements							
[Section states $2.25M from CERA but all textual references are to Multimodal Transportation Account]	Transportation	$2.25M	223	$2.25M	223	Same	N/A
To support Pierce, Skagit, Whatcom, and Wahkiakum county ferries with youth zero-fare policies	Transportation	--	--	$0.275M	224(8)	Addition	Not fuel conversion
Construction of hybrid electric Olympic class vessel	Transportation	--	--	$11.554M	307 (4)	Addition	BE/HE/FCE Watercraft
Construction of hybrid electric vessels	Transportation	--	--	$6.175M	307(11)	Addition	BE/HE/FCE Watercraft
Terminal electrification	Transportation	--	--	$24.265	307(12)	Addition	Port Shore Power
State match contributions for federal grant opportunities for new ultra high-speed ground transportation corridor	Transportation	$50M	309(6)	$25M	308(7)	Decrease	Not fuel conversion
Zero emission drayage truck demonstration	Transportation	$6.3M	309(9)	$6.3M	308(10)	Same	EV Charging/FCEV

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
project at Northwest Seaport Alliance							Fueling, EV/FCEV Purchase
Zero emission shore power infrastructure demonstration project at Northwest Seaport Alliance	Transportation	$14M	309(10)	$14M additional	308 (11)	Increase	Port Shore Power
Replacement of two Tacoma rail diesel-electric switcher locomotives with BEVs and charging equipment	Transportation	$5M	309(11)	$5M	308(12)	Same	EV/FCEV Purchase, EV Charging/FCEV Fueling
Port electrification competitive grants	Transportation	$26.5M	309(13)	$26.5M	308(14)	Same	Port Shore Power
Port electrification at Port of Bremerton	Transportation	$2M	309(14)	$2M	308(15)	Same	Port Shore Power
Port electrification at Port of Anacortes	Transportation	$0.5M	309(15)	$1.5M additional	308(16)	Increase	Port Shore Power
Puyallup tribe port electrification project	Transportation	--	--	$20M	308(18)	Addition	Port Shore Power
Guemes Ferry Boat Replacement project	Transportation	$14M	310(11)	$10M additional	309(11)	Increase	BE/HE/FCE Watercraft
E-bike rebate program[52]	Transportation	$5M	310(16)(a)	$3M	309(16)(a)	Decrease	Not fuel conversion
E-bike lending library and ownership grant program	Transportation	$2M	310(16)(b)	$2M	309(16)(b)	Same	Not fuel conversion

[52] Note that e-bike programs are not considered fuel conversion.

Project Description	Recipient	ESHB 1125 Amount[48]	ESHB 1125 Section	ESHB 2134 Amount[49]	ESHB 2134 Section	Change	Project Elements
For LEAP projects: North Aurora Safety Improvements, North Broadway Pedestrian Bridge, State Route 547 Pedestrian and Bicycle Safety Trail, 72nd Ave & Washington Ave Active Transportation Components, Bluff Trail Hood River to White Salmon, Columbia Heights Safety Improvements, La Center Pac. Hwy Shared Use Path, SR 240/Aaron Dr Complete Streets Improvements, View Ridge Safe Routes to Schools, 84th Ave NE Pedestrian and Bicycle Project, Communities for a Health Bay electric boat, SR 303 Warren Ave Bridge Pedestrian Improvement, SR 520 & 148th NE Bicycle/Pedestrian Crossing	Transportation	$74.027M	308	$22.944M	309(22)	Decrease	Mostly not fuel conversion with electric watercraft element.