![Center for Climate and Energy Solutions logo] CENTER FOR CLIMATE AND ENERGY SOLUTIONS
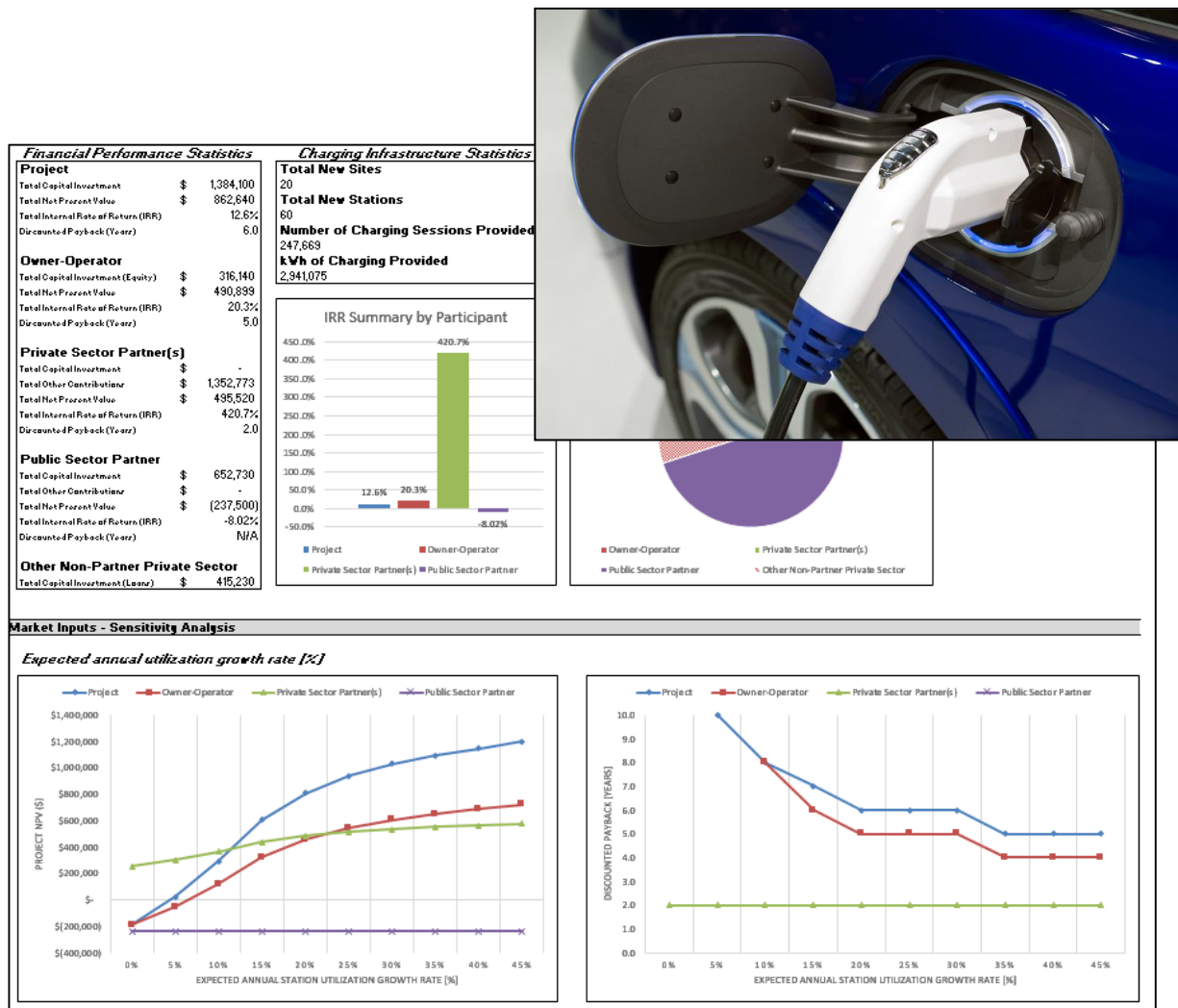
EV CHARGING FINANCIAL ANALYSIS TOOL USER GUIDE

A free tool designed to evaluate the financial viability of EV charging infrastructure investments involving multiple private and public sector partners

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Introduction

The EV Charging Financial Analysis Tool was developed as part of a study commissioned by the Washington State Legislature's Joint Transportation Committee (JTC) to identify business models for financially sustainable, private-sector funded charging networks. The JTC selected the Center for Climate and Energy solutions (C2ES) to conduct the study, which was conducted from May 2014 to March 2015. The final report can be found online at:

- C2ES website: http://www.c2es.org/initiatives/alternative-fuel-vehicle-finance
- JTC website: http://leg.wa.gov/JTC/Pages/ElectricVehicleChargingStationNetworksStudy.aspx

The tool was developed by the Cadmus Group, a subcontractor to C2ES and was designed to evaluate the financial viability of EV charging infrastructure investments involving multiple private and public sector partners. The tool uses the discounted cash flow (DCF) analysis method to determine the expected financial returns for EV charging infrastructure investments over the expected lifetime of the charging equipment based on inputs provided by the user. The tool also provides financial viability metrics from the perspective of both private and public sectors as well as sensitivity analyses for key inputs and assumptions.

Overview of the Tool Structure

The EV Charging Financial Analysis Tool was built using Microsoft Excel and is contained in a standalone Excel workbook. It is divided into four functional areas, each area consisting of multiple like-colored tabs within the spreadsheet, as follows:

- **Overview and Settings** – Grey Tabs
- **User Inputs** – Orange Tabs
- **Financial Calculations** – Blue Tabs
- **Analysis Results and Financial Statements** - Green Tabs

Information flows from the user inputs, through the calculations, to the analysis results, as shown in the diagram on the first "Overview" tab in the tool.

The Owner-Operator, Private Sector Partner, and Public Sector Partner

The tool analyzes the proposed EV charging infrastructure investment from the perspective of three potential partners, a private sector owner-operator, a private sector partner who contributes funding to project deployment, and a public sector partner who contributes funding or in other ways helps finance project deployment. The roles of these three partners are described below. For the model to produce useful results, it requires information about the overall EV market and the owner-operator. Information about the other partners may be added or removed as needed.

- **Owner-Operator** – Organization that owns and operates the charging station and receives the revenue associated with charging services.
- **Private Sector Partner** – A private sector organization that contributes funding to the owner-operator, to help pay charging network deployment costs. This partner stands to benefit from the deployment of charging infrastructure through an increase in revenue related to the provision of EV

charging services. This organization is assumed to value this benefit and be willing to share some of its related revenue or otherwise subsidize the deployment of EV charging infrastructure.

- Public Sector Partner – A state or local entity that contributes funding or enacts policies to enable a private owner-operator to successfully deploy a charging network. The public partner is assumed to value the deployment of charging infrastructure because of its benefit to the public and is willing to support the owner-operator through a combination of low-interest debt, grants, etc.

Getting Started

Step 1: Opening the Tool

To open the tool, double click on the file entitled "ev_charging_analysis_tool.xlsm." Make sure to enable macros by clicking the "Enable Content" button that appears in the yellow bar at the top of the screen. Enabling macros will allow you to use the save and load functionality built into the tool.
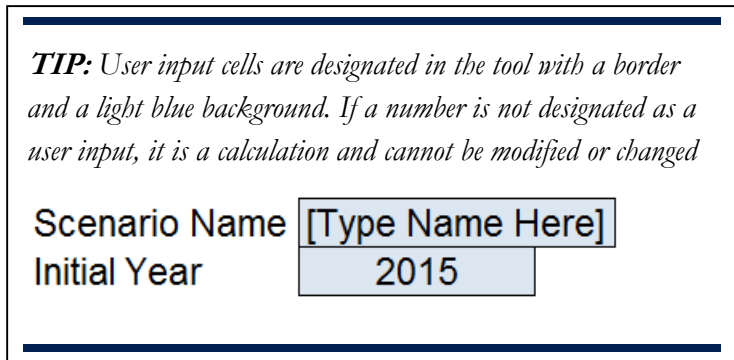
Step 2: Initial Settings Tab

Initial Settings

The "Initial Settings" tab contains basic inputs for the model including:
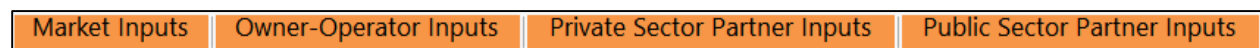
- Scenario Name
- Initial Year

This information should be completed before proceeding to the other tabs.

TIP: User input cells are designated in the tool with a border and a light blue background. If a number is not designated as a user input, it is a calculation and cannot be modified or changed

Scenario Name	[Type Name Here]
Initial Year	2015

Open and Save Functions

The "Initial Settings" tab includes buttons that allow you to save or "export" all of the user inputs to an external file. The format of this file allows it to be read in any text editor, including Microsoft Notepad or Word. These saved inputs can be reloaded later or shared with other users of the tool. If you have received a user inputs file from another user or if you have previously exported a file, you can reload them into the tool by clicking the "Open" button and selecting the previously saved file. **Note: Loading inputs from an external file will overwrite any existing inputs in the tool.**

Step 3: User Input Tabs

Market Inputs	Owner-Operator Inputs	Private Sector Partner Inputs	Public Sector Partner Inputs

The orange input tabs are where the variables that are used in the financial analysis are entered. There are four tabs with inputs by theme as follows:

- **Market Inputs** – Contains inputs related to the expected overall demand for EV charging services and expected growth in that demand. On this tab, you can select one of two options for entering expected charging station utilization. The first option attempts to derive utilization from traffic

patterns along the route. The second option allows you to enter charging station utilization factors directly.

- **Owner-Operator Inputs –** Contains inputs for the owner-operator organization, including information on charging equipment (the tool allows for up to three different types of equipment each with unique cost, technical, and usage profiles), revenue sources, costs, investment/funding sources, and factors that affect financial statements for the owner-operator.
- **Private Sector Partner Inputs** – Contains inputs related to the revenue sources and costs of the private sector partner. The model allows for three sources of revenue: revenue from leasing of sites, revenue from sales due to increased traffic at the site, and indirect revenue (revenue unrelated to time spent by the customer at a charging site). These can be used in conjunction with each other or independently. This tab also defines how much of this revenue will be shared with the owner operator and whether the private sector partner will provide additional subsidy.
- **Public Sector Partner Inputs** – Contains inputs that define the involvement of the public sector including whether the public sector will provide low interest debt, equity, a one-time grant, or ongoing financial support.

Step 4: Financial Calculation Tabs

Owner-Operator DCF	Private Sector Partner DCF	Public Sector Partner DCF

Combined DCF	Debt Schedule	Terminal Value Model

The blue financial calculation tabs do not contain any user inputs. They show the details of the DCF analysis from the perspective of each of the three partners and for the investment as a whole (all of the money going in and all of the money coming out). It is possible for an investment to have positive financial performance in the aggregate, but be financially unviable for one or more of the individual participants or vice versa.

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*TIP: Each line where a user input is required contains **a label, a unit, and an input cell**. In the example below, the line indicates an input for "average charging energy per session" (label) in "kWh/session" (unit) and the blue box is the input cell.*

Energy Usage
Average charging energy per session [kWh/session]   15

Step 5: Output Tabs - Analysis Results and Financial Statements

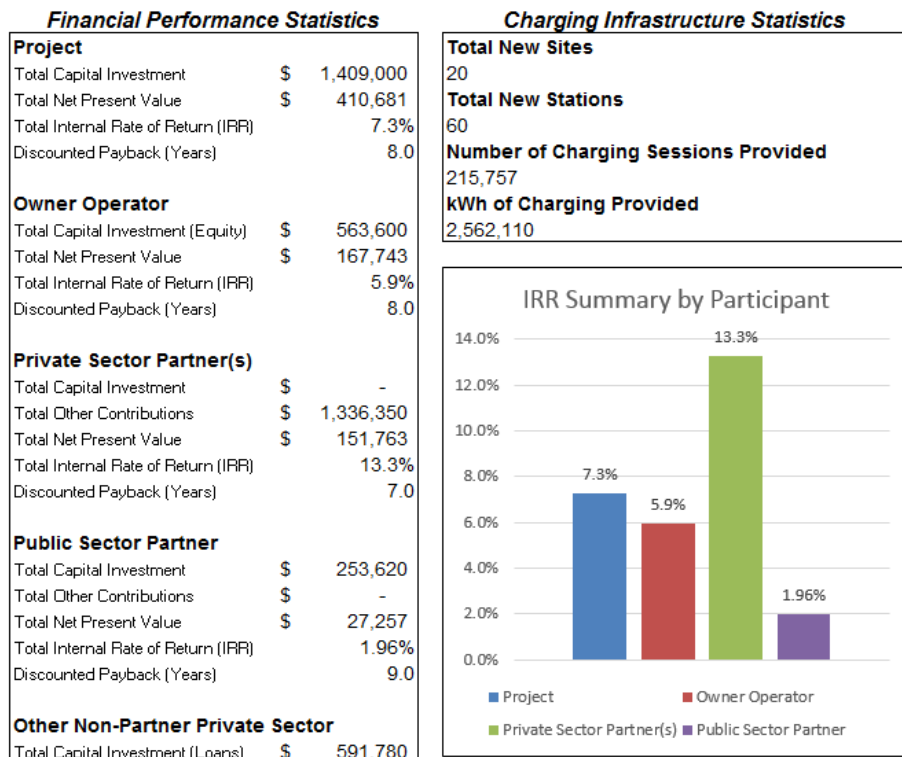| Outputs Dashboard	Income Statement	Balance Sheet	SCF	Sensitivity Tables

The green output tabs contain a dashboard that displays the results of the DCF analysis and a sensitivity analysis on various key inputs. The remaining three output tabs contain financial statements like those used by entrepreneurs or private companies to communicate financial performance.

Outputs Dashboard

The top section of the outputs dashboard displays key performance metrics for each of the partners. Financial metrics include:

- **Total Capital Investment** – The total outlay of funds by all participating organizations.
- **Net Present Value (NPV)** – Shows the net profit or loss of an investment by summing incoming and outgoing cash flows over the lifetime of the equipment and adjusting for the time value of money. A positive NPV indicates an investment will result in a net profit in today's money. A negative NPV indicates a net loss in today's money.
- **Internal Rate of Return** –Measures the profitability of an investment. Expressed as an annual rate.
- **Discounted Payback** – A simple payback (or breakeven measure) based on cash flows adjusted for the time value of money.

The dashboard also displays non-financial metrics like number of charging sites, number of new stations, projected number of charging sessions provided over the analysis timeframe and the total charging energy provided.

Financial Performance Statistics

Project

Total Capital Investment	$	1,409,000
Total Net Present Value	$	410,681
Total Internal Rate of Return (IRR)		7.3%
Discounted Payback (Years)		8.0

Owner Operator

Total Capital Investment (Equity)	$	563,600
Total Net Present Value	$	167,743
Total Internal Rate of Return (IRR)		5.9%
Discounted Payback (Years)		8.0

Private Sector Partner(s)

Total Capital Investment	$	-
Total Other Contributions	$	1,336,350
Total Net Present Value	$	151,763
Total Internal Rate of Return (IRR)		13.3%
Discounted Payback (Years)		7.0

Public Sector Partner

Total Capital Investment	$	253,620
Total Other Contributions	$	-
Total Net Present Value	$	27,257
Total Internal Rate of Return (IRR)		1.96%
Discounted Payback (Years)		9.0

Other Non-Partner Private Sector

Total Capital Investment (Loans)	$	591,780

Charging Infrastructure Statistics

Total New Sites
20

Total New Stations
60

Number of Charging Sessions Provided
215,757

kWh of Charging Provided
2,562,110

IRR Summary by Participant

In the dashboard tab, underneath the statistics tables are a series of sensitivity analysis charts. The sensitivity analysis charts isolate a single input and run multiple versions of a scenario varying only that input. The resulting chart shows how the results of the analysis would be different for each of the partners if that assumption turned out to be higher or lower than initially projected (all other inputs held equal). The example below shows changes in the net present value if the initial charging station utilization rate were higher or lower than projected, over a range from 0 percent utilization to 45 percent utilization.

Expected annual utilization growth rate [%]
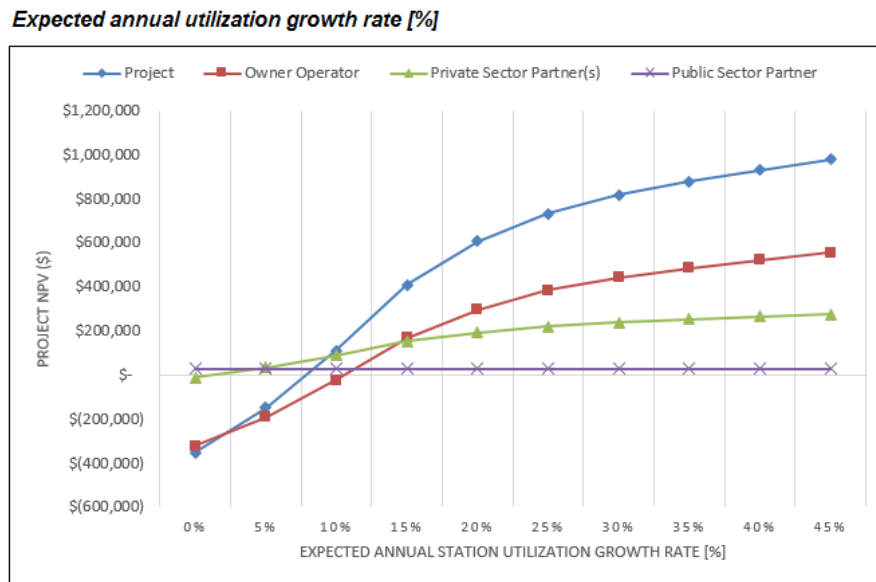
Users can adjust the assumptions for the sensitivity analyses results in the Sensitivity Tables tab. The figure below shows the sensitivity table for station utilization growth rate. The default value set by the user in the "Input Settings" tab (22.00 percent) is shown in purple. The user can edit the minimum and maximum range for the sensitivity analysis. In this case, the range is 0 to 45 percent. The results of the analysis are presented in the table and serve as inputs to the sensitivity analysis graphs in the "Outputs Dashboard" tab.

Sensitivity Analysis #1

	Expected annual utilization growth rate [%]							
	NPV				Payback			
22.00%	Project	Owner-Operator	Private Sector Partner(s)	Public Sector Partner	Project	Owner-Operator	Private Sector Partner(s)	Public Sector Partner
	$ 862,640	$ 490,899	$ 495,520	$ (237,500)	6.0	5.0	2.0	#N/A
0%	$ (187,569)	$ (189,704)	$ 254,967	$ (237,500)	#N/A	#N/A	2.0	#N/A
5%	$ 24,058	$ (53,471)	$ 303,560	$ (237,500)	10.0	#N/A	2.0	#N/A
10%	$ 294,365	$ 119,595	$ 365,436	$ (237,500)	8.0	8.0	2.0	#N/A
15%	$ 605,304	$ 319,535	$ 436,040	$ (237,500)	7.0	6.0	2.0	#N/A
20%	$ 808,676	$ 454,318	$ 483,005	$ (237,500)	6.0	5.0	2.0	#N/A
25%	$ 941,046	$ 544,090	$ 513,832	$ (237,500)	6.0	5.0	2.0	#N/A
30%	$ 1,029,551	$ 604,618	$ 535,060	$ (237,500)	6.0	5.0	2.0	#N/A
35%	$ 1,095,463	$ 650,277	$ 550,697	$ (237,500)	5.0	4.0	2.0	#N/A
40%	$ 1,148,206	$ 686,842	$ 563,524	$ (237,500)	5.0	4.0	2.0	#N/A
45%	$ 1,200,320	$ 723,293	$ 575,894	$ (237,500)	5.0	4.0	2.0	#N/A

Financial Statements

The tool includes a set of financial statements for the owner-operator business model. These statements include:

- Income Statement – Shows the revenues, costs, and resulting income for the owner-operator over the lifetime of the equipment.
- Balance Sheet – Shows the assets, liabilities, and resulting equity for the owner-operator over the lifetime of the equipment.
- Statement of Cash Flows (SCF) – Shows the flow of money in and out of the owner-operator organization and the resulting cash balance over the lifetime of the equipment.

The financial statements may be of interest to potential partners in the private sector who are considering pursuing an owner-operator role.