

# **Car GHG**

A Software Analysis Tool for Vehicle Greenhouse  
Gas Emissions and Cost

**User Guide for Version 3.1x**

Karim Hamza, Jean Chu & Ken Laberteaux

**June 2022**

# Contents

- ❑ Preface to version 3.1x of the software
- ❑ Installation & System Requirements
- ❑ Launching the Software
- ❑ Main Modules
- ❑ What the Software Can and Cannot Do
- ❑ Details of Main Modules
  - Module #1: Changing Current Analysis
  - Module #2: Vehicle Models Documentation
  - Module #3: Fuel Economy Simulations
  - Common Features in Results Visualization Modules (Modules 4-6)

# Preface to Version 3.1x

## Background Note

Car GHG was previously branded (in versions 3.0x) under the name **PVC** which stood for “Plug-in Vehicle Competitiveness” – although most documentation has been updated, the term “PVC” may appear in certain areas, including the source code on GitHub... As such, it should be clear that the terms “Car GHG”, “CarGHG” & “PVC” (whenever it appears) are referring to the same thing

## New in Version 3.1x

- ❑ Public version of the software now includes toggle for considering an estimate of the manufacturing GHG of the vehicles
- ❑ Updated/re-tuned FASTSim vehicle models per research paper\*
- ❑ Capability to save & retrieve user-defined scenarios, including quick reset to default baseline scenario
- ❑ Several behind-the-scenes modifications (output results in JSON format, data structures for modeling commercial electric vehicle fleets) that will enable more customization options for Advanced Users\*\*

\* Please see vehicle models documentation for more details and a draft copy

\*\* An upcoming advanced manual (not included in this document) aims to allow “Advanced Users” to perform more complex analysis tasks than the available functionality via the graphical user interface

# Installation & System Requirements

## Installation

- Un-zip to a local drive, and wait for un-zipping to completely finish
  - Note: the un-zip folder location ...~\carGHG\_vXX\ will be referred to as ***“Car GHG Root Folder”***

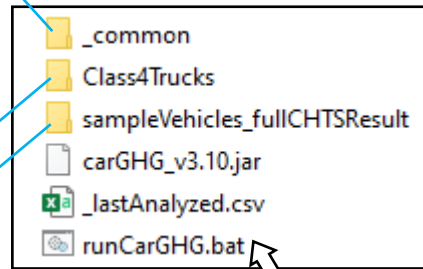
## System Requirements

- ❑ **Java Run-Time Environment (JRE) 1.6** or a more recent version
  - Note: An easy way to check if JRE is already installed (JRE is not need for download/unzip) is:  
**Check the Windows icon for the file “carGHG\_v3.1x.jar”...**  
**If “carGHG\_v3.1x.jar” looks like a Coffee Cup, JRE is already installed**
  - Note: JRE 1.6 is pretty old, so any windows PC that had installed the JRE after 2012 will have 1.6 or more recent)
  - **If JRE is not yet installed, it needs to be downloaded:**  
<https://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html> -- for **Windows 10** (recommended x64 .exe installer)  
<https://www.oracle.com/technetwork/java/javase/install-windows-152927.html> -- for **Windows 32 bit**
- ❑ **Adobe Reader** or any other software that can read PDF files
- ❑ **Free storage** space of at least **0.5 GB (1 GB recommended)**, plus an additional **2-3 GB** if planning to download the full CHTS dataset (which is a separate download)

# Launching the Software

Folders with names starting with underscore character (“\_”) contain data that should not be edited by a “regular” user

## Start

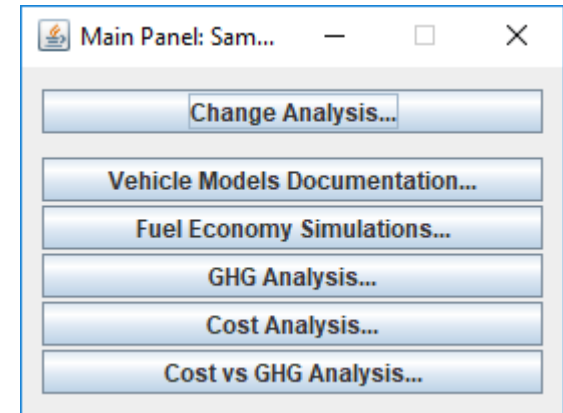


Available Analysis Folders

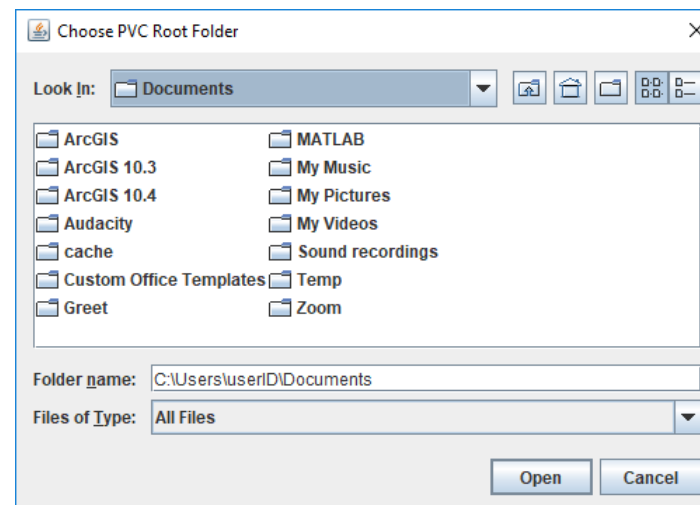
Launch the software tool by double-clicking the .jar file OR the .bat file in Car GHG root folder

If for some reason the .jar file had been moved to a different location, it will prompt the user to locate the Car GHG root folder

## “Main Panel”



Successful?

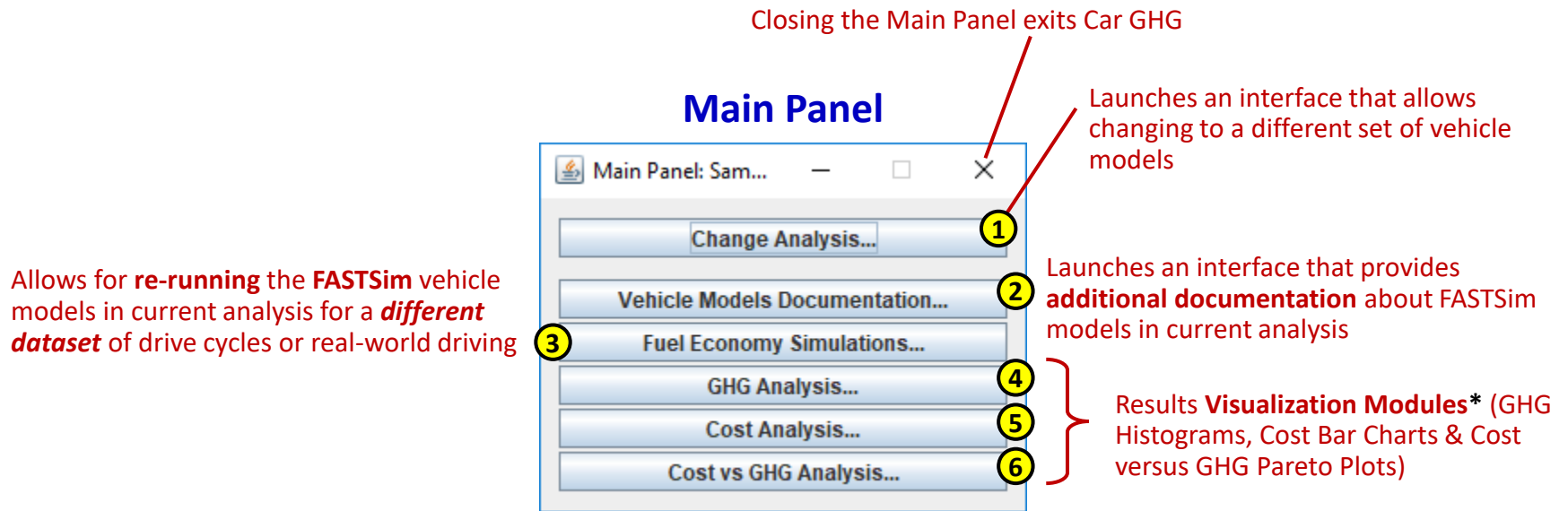


Exit

Unsuccessful?

Ensure the Car GHG root folder include the pre-packaged \_common & at least one analysis folder, consider re-downloading & unzipping

# Main Modules



## \* Notes

- The zip file for Car GHG software package typically comes with pre-generated fuel economy simulations. When/if there are no results to show, the three buttons for visualization modules will be grayed out
- To limit distribution file size, Car GHG software package includes pre-generated fuel economy simulations, plus *samples* of real-world driving trips. **Full California Household Travel Survey (CHTS)** set of trips is **available as a separate download** (from a link at [carghg.org](http://carghg.org)) which interested users are encouraged to obtain, unzip & place within the folder: **<CarGHG-root>\\_common\realWorldDriving\**

# What the Software Can & Cannot Do

## Can Do

- View/visualize pre-analyzed fuel simulations under **\*Many\*** different adjustable scenario parameters, including: Cost of various powertrain technologies, Cost and Greenhouse Gas (GHG) of Electricity and other Fuels, as well as various aspects of vehicle owner behavior
- Save a “Snapshot” of any Scenario to .CSV File (exporting results to MS-Excel)
- Run fuel economy simulations via the existing FASTSim vehicle models for any set of drive cycles or real-world trips (not limited to CHTS or pre-analyzed results)
- Delete previous fuel simulations

## Cannot Do\*

- Create New or Directly Edit the FASTSim Vehicle Models\*\*
- Any adjustment to parameters that would invalidate or skew pre-analyzed results. Examples of this include: changing the charging behavior beyond default limits (e.g. 5-min duration charging events), or including a percentage of bio-fuel in Diesel or Gasoline... for those type of modeling edits, an Advanced User\* should first delete all previous fuel economy simulations, make the change via text files, then re-run the fuel economy simulations

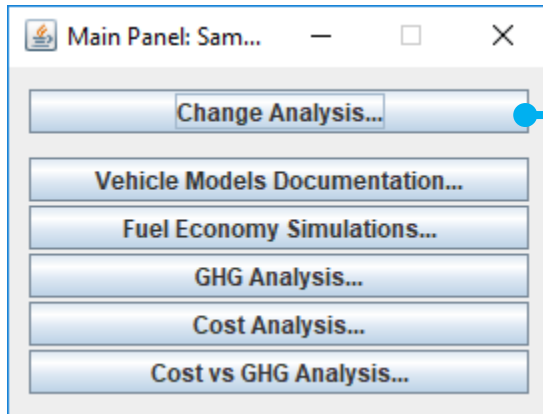
\* An “Advanced User” can do any of the tasks listed as “Cannot do via the software graphical user interface (GUI)” via editing text files within CarGHG folder structure (a separate manual for advanced users will eventually become available)

\*\* Though a GUI functionality for editing FASTSim model parameters was available in earlier versions of PVC, research activity by the authors revealed that it takes expertise, time, and a non-trivial amount of data in order to create validated FASTSim vehicle models that closely resemble real-world vehicle performance. As such, this modeling capability is now reserved for advanced users.

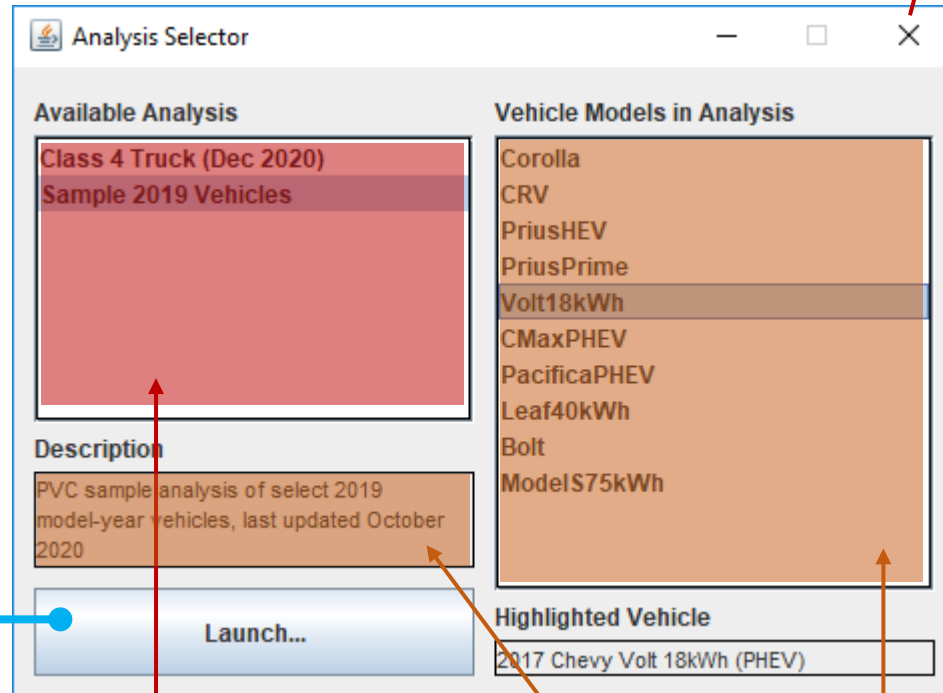
# Module #1: Changing Current Analysis

Closing this window exits Car GHG

## Main Panel



## Analysis Selection Interface



Clicking **Launch** sets the selected analysis (set of vehicle models) and returns to the main panel

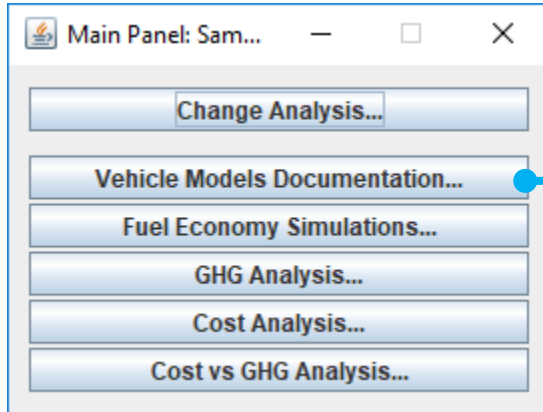
Click-**Selecting** an item in this list will...

- Show a more detailed description in this area
- Show a list of the FASTSim vehicle models included in that analysis in this area

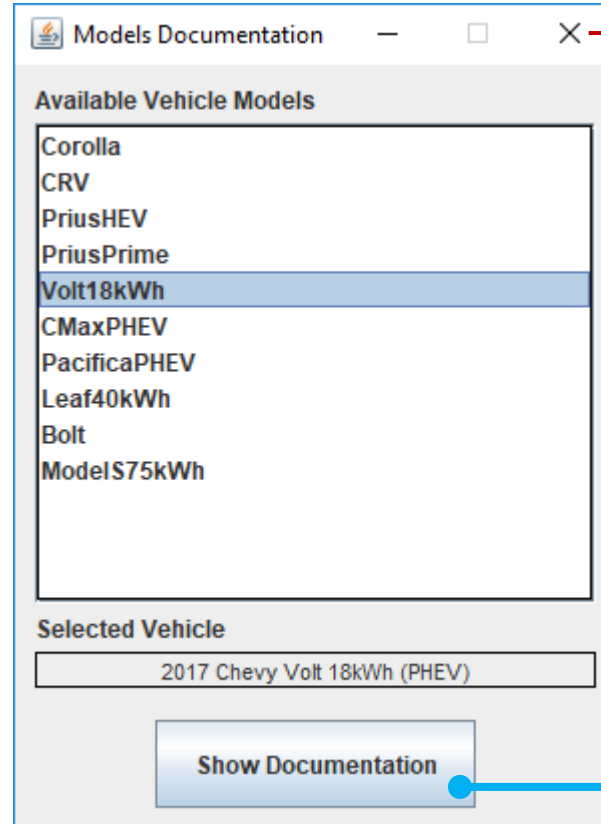


# Module #2: Vehicle Models Documentation

**Main Panel**



**Models Documentation Module**

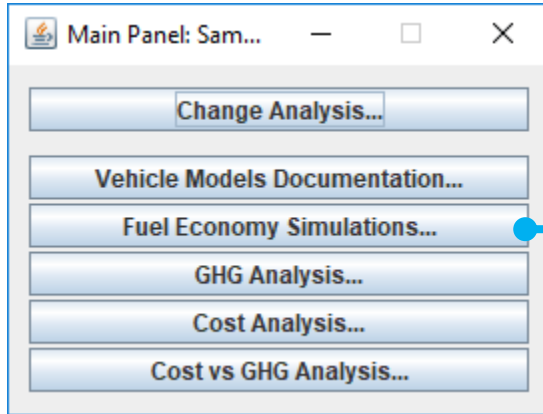


Closing this window returns to Main Panel

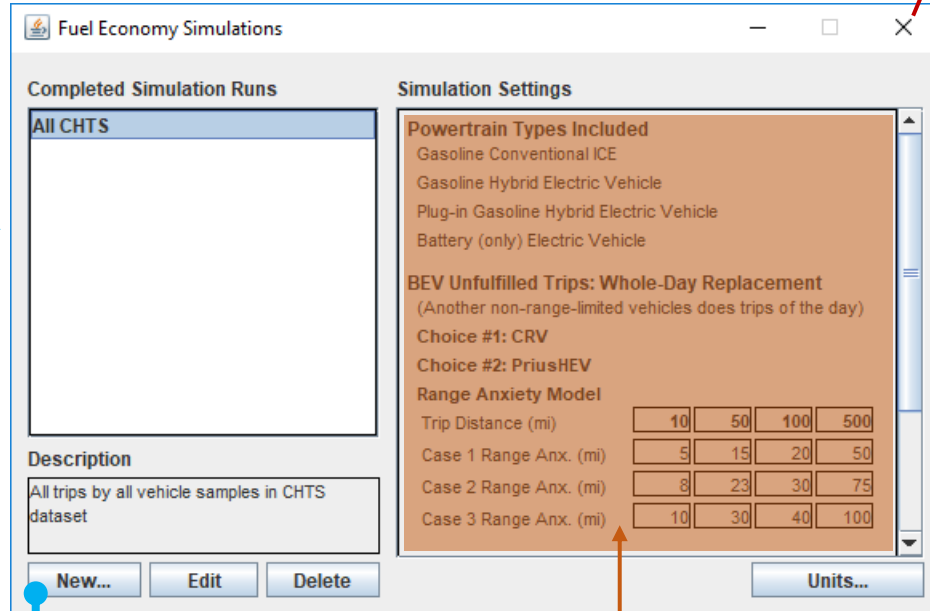
PDF Document Reader

# Module #3: Fuel Economy Simulations

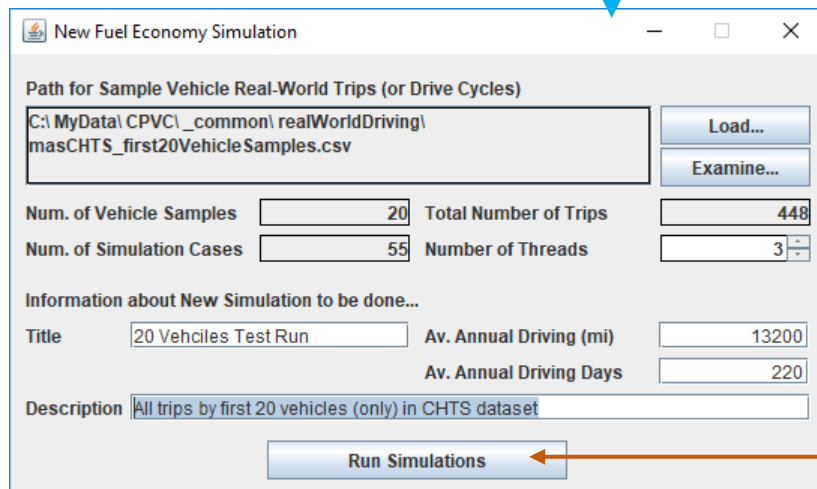
**Main Panel**



**Fuel Economy Simulations Manager**



**Dialog for New Fuel Economy Simulations Run**



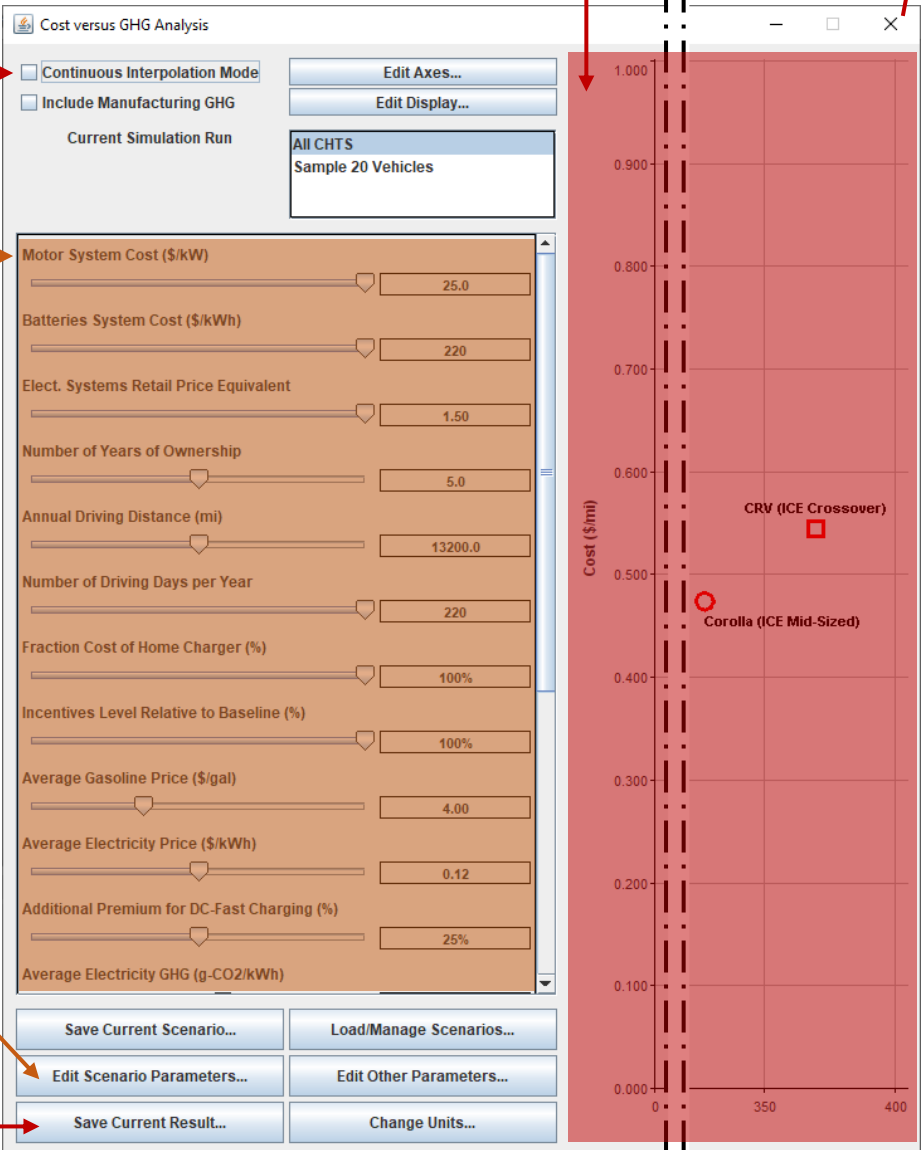
This area provides a summary of simulation settings for current analysis (visible but not editable except for Advanced Users)

After clicking this button (and waiting for the simulations to complete), the text in "Title" field will appear as an available choice in subsequent modules

# Results Visualization (Modules 4-6)

## Any of (Modules 4-6)

Toggles the slides bars between discrete values and continuous interpolation



Closing this window returns to Main Panel

Graph Visualization Area

### Scenario Parameters (Slider Bars) Area

There can be **\*many\*** adjustable parameters that affect the cost and/or GHG performance of a vehicle. Thus, to keep things more tractable:

- Only relevant adjustable parameters for vehicle models within current analysis will be visible. For example, since there are no Diesel vehicles in the current set, there will be no slider bars for cost of a Diesel Engine nor the cost and GHG of Diesel fuel
- Only adjustable parameters will have slider bars, thus when not considering variations in the GHG of Gasoline, there will be no slider bar for its GHG
- The **user has additional control** to adjust the min/max limit values, number of discrete choices, re-ordering and/or turning off slider bars via this button

Allows saving the data of currently shown results (in Graphics Visualization Area) to .CSV file (for exporting to MS-Excel)

# Results Visualization (Modules 4-6)

Closing this window returns to Main Panel

## Any of (Modules 4-6)

Displays a dialog for editing axis/axes options such as range and grid density

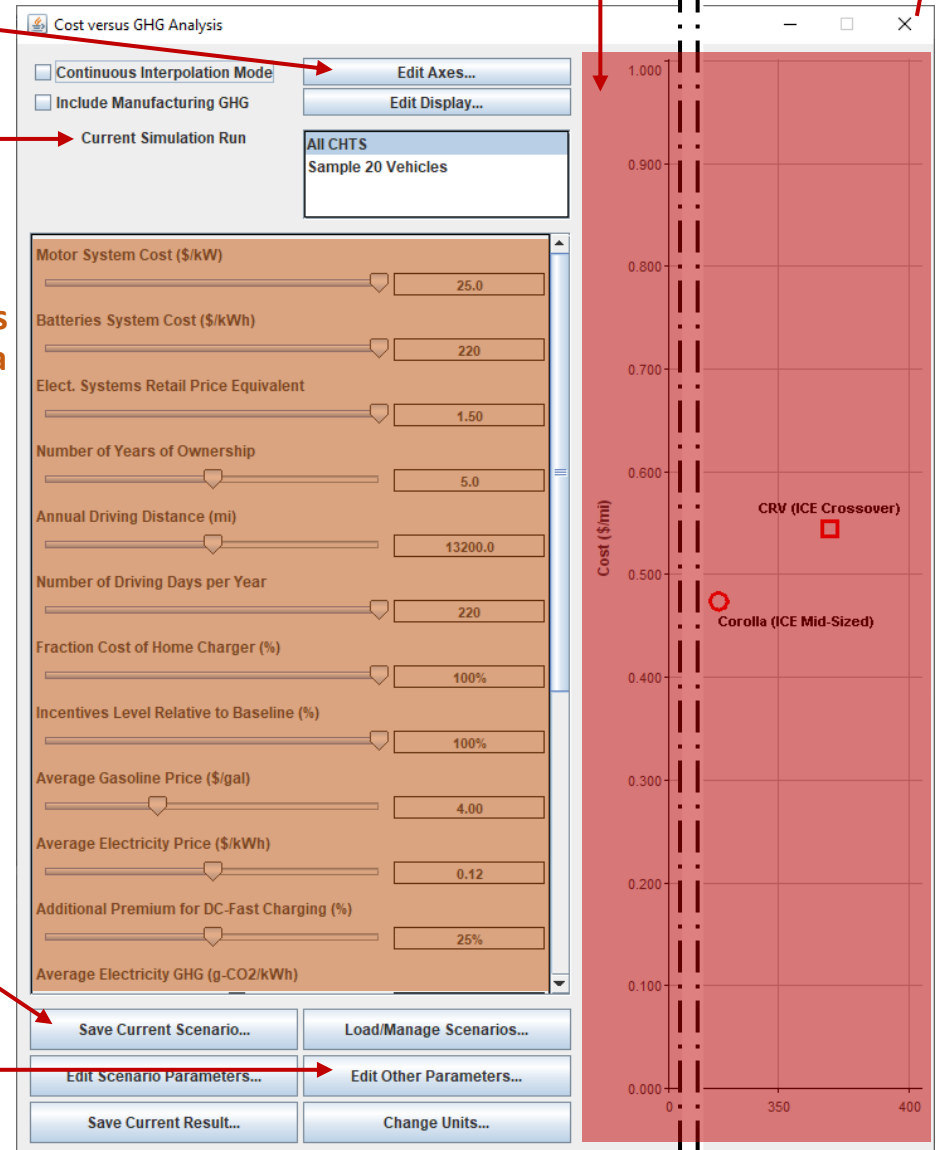
Allows for quick & seamless switching in showing results for different drive cycles or sets of real-world driving

### Scenario Parameters (Slider Bars) Area

Saves the current state of the slider bars, axes limits, display labels and all other user-adjustable parameters into a named (user-defined) scenario, which can be quickly recalled later

Allows for editing other model parameters that aren't adjustable via sliders bars (such as vehicle depreciation)

### Graph Visualization Area



# Results Visualization (Modules 4-6)

Closing this window returns to Main Panel

## Any of (Modules 4-6)

Displays a dialog for editing other graphing options (such as color and size of symbols)

[If Manufacturing GHG information is not included, this Check-Box will be invisible] When available, this allows toggling between including Manufacturing GHG so **GHG result becomes LCA** (under the commonly made assumption that end-of-life processing contributes only a negligible amount of GHG and can thus be ignored)

Or leaving it unchecked so **GHG result becomes Well-to-Wheels**

## Scenario Parameters (Slider Bars) Area

Opens an interface that allows managing/recalling previously defined scenarios (including reset to the default values)

Allows changing the display units (e.g. kilometers instead of miles)

## Graph Visualization Area

