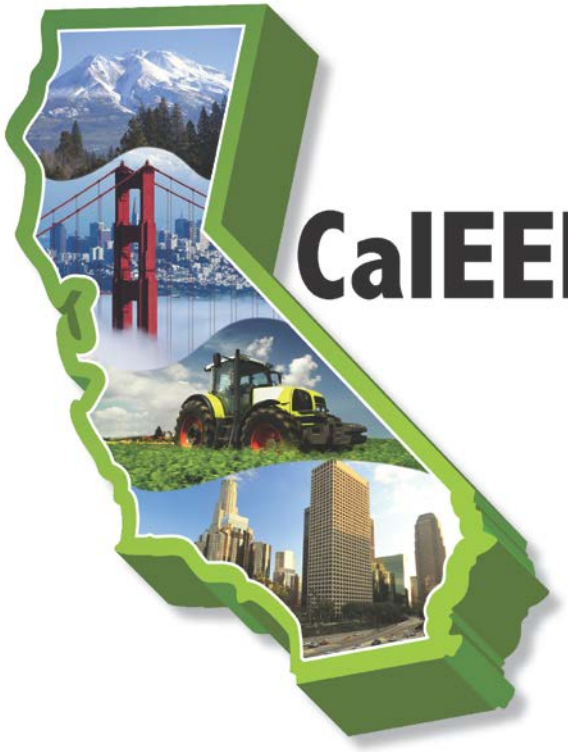

CalEEMod®

California Emissions Estimator Model®

User's Guide

Version 2016.3.1

Prepared for:
California Air Pollution Control Officers Association (CAPCOA)

Prepared by:
BREEZE Software, A Division of Trinity Consultants
in collaboration with South Coast Air Quality Management District and the California Air Districts

Date:
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California Air Districts' Development Staff

Michael Krause	SCAQMD
Barbara Radlein	SCAQMD
Ian MacMillan	SCAQMD
Jack Cheng	SCAQMD
Sam Wang	SCAQMD
Alison Kirk	Bay Area AQMD
Angel Green	Placer County APCD
Karen Huss	Sacramento Metropolitan AQMD
Patia Siong	San Joaquin Valley APCD
Mark Montelongo	San Joaquin Valley APCD
Eric McLaughlin	San Joaquin Valley APCD
Andy Mutziger	San Luis Obispo APCD
Carly Barham	Santa Barbara County APCD
Krista Nightingale	Santa Barbara County APCD

Additional Beta Testers/Contributors

Stephen Zelinka	California Air Resources Board
Hang Liu	California Air Resources Board
Agnes Dugyon	California Air Resources Board
Cheryl Laskowski	California Air Resources Board
Cari Anderson	California Air Resources Board
Josh Pollak	Bay Area AQMD
Jeff Inabinet	SCAQMD
Cynthia Carter	SCAQMD
Patrick Sutton	Baseline Environmental Consulting
Lora Granovsky	iLanco Environmental
Nicole Vermilion	PlaceWorks
John Vang	PlaceWorks
Stephanie Chen	PlaceWorks.
Steve Bush	PlaceWorks.
Shari Libicki, Ph.D.	Ramboll Environ
Michael Ratte	RCH Group
Patrick Griffith	Los Angeles County Sanitation Districts
Josephine Fong	Rincon Consultants
Jennifer Reed	Dudek
Joe O'Bannon	OB-1 Air Analyses

Trinity Staff

Weiping Dai	Director
Vineet Masuraha	Director
Ronald Hunter	Managing Principal
Qiguo Jing	Senior Consultant
Nick Petro	Developer
Yinqing Liu	Consultant
Allan Daly	Consultant
Weifen Qiu	Developer
Eric Rydberg	Senior Developer
Molly Saso	Consultant

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1 Introduction

This User's Guide (Guide) to the California Emission Estimator Model (CalEEMod)® is meant to give the user an introduction on how to use the program as well as to document the detailed calculations and default assumptions made in associated appendices. The purpose of CalEEMod is to provide a uniform platform for government agencies, land use planners, and environmental professionals to estimate potential emissions associated with both construction and operational use of land use projects. It is intended that these emission estimates are suitable for quantifying air quality and climate change impacts as part of the preparation of California Environmental Quality Act (CEQA) documents. In addition, individual districts may rely on the model's emission estimates to show compliance with local agency rules.

CalEEMod utilizes widely accepted methodologies for estimating emissions combined with default data that can be used when site-specific information is not available. Sources of these methodologies and default data include but are not limited to the United States Environmental Protection Agency (USEPA) AP-42 emission factors, California Air Resources Board (CARB) vehicle emission models, studies commissioned by California agencies such as the California Energy Commission (CEC) and CalRecycle. In addition, some local air districts provided customized values for their default data and existing regulation methodologies for use for projects located in their jurisdictions. When no customized information was provided and no regional differences were defined for local air districts, then state-wide default values were utilized. Since resource data and regulations are constantly changing, local agencies should be consulted to determine whether there are any circumstances when updated values should be used in place of the defaults currently incorporated into CalEEMod. A majority of CalEEMod's default data associated with locations and land use is derived from surveys of existing land uses. For any project that substantially deviates from the types and features included in the surveys, site-specific data that are supported by substantial evidence should be used, if available.

The model provides a number of opportunities for the user to change the defaults in the model; however, users are required to provide justification for all changes made to the default settings (e.g., reference more appropriate data sources) in the Remarks box provided at the bottom of the screen before the user will be able to proceed to the next screen. Further, the user should make every effort to ensure that correct data is entered, including the choice and percent reduction of mitigation most applicable to the land use project being evaluated.

1.1 Purpose of Model

CalEEMod provides a simple platform to calculate both construction emissions and operational emissions from a land use project. It can calculate both the daily maximum and annual average for criteria pollutants as well as annual greenhouse gas (GHG) emissions. The output from these calculations can be used in the preparation of quality and GHG analyses in CEQA documents such as Environmental Impact Reports (EIRs) and Negative Declarations. For projects located in the jurisdiction of San Luis Obispo APCD, the model can also calculate the sum of reactive organic gas (ROG) and nitrogen oxide (NO_x) emissions on a rolling quarterly basis. In addition, CalEEMod contains default values for estimating water and energy use

which may be useful for preparing hydrology and energy analyses in other sections of a CEQA document. Specifically, the model can aid the user by conducting the following calculations:

- Short-term construction emissions associated with the demolition, site preparation, grading, building, coating, and paving from the following sources:
  - Off-road construction equipment;
  - On-road mobile equipment associated with workers, vendors, and hauling;
  - Fugitive dust associated with grading, demolition, truck loading, and on-road vehicles traveling along paved and unpaved roads. (Fugitive dust from wind blown sources such as storage piles and inactive disturbed areas, as well as fugitive dust from off-road vehicle travel, are not quantified in CalEEMod, which is consistent with approaches taken in other comprehensive models.)
  - Architectural coating activities *(including the painting/striping of parking lots)* and paving (ROG).
- Operational emissions for fully built-out land use development from the following sources:
  - On-road mobile vehicle traffic generated by the land uses;
  - Fugitive dust associated with roads;
  - Architectural coating activities (ROG);
  - Off-road equipment (e.g., forklifts, cranes) used during operation;
  - Landscaping equipment;
  - Emergency generators, fire pumps, and process boilers;
  - Use of consumer products, parking lot degreasers, fertilizers/pesticides, and cleaning supplies (ROG);
  - Wood stoves and hearth usage;
  - Natural gas usage in the buildings;
  - Electricity usage in the buildings (GHG only);
  - Electricity usage from lighting in parking lots and lighting, ventilation and elevators in parking structures;
  - Water usage per land use (GHG only); and,
  - Solid waste disposal per land use (GHG only).
- One-time vegetation sequestration changes
  - Permanent vegetation land use changes
  - New tree plantings

- Mitigation adjustments to both short-term construction and operational emissions. Several of the mitigation measures described in CAPCOA's Quantifying Greenhouse Gas Mitigation Measures[1] have been incorporated into CalEEMod.

[1] Available at: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

2 Program Installation

The program is distributed and maintained by the California Air Pollution Control Officers Association[2]. The most recent version can be downloaded from www.caleemod.com.

2.1 Operating System Requirements

CalEEMod was programmed by Trinity using Microsoft SQL Compact Edition in conjunction with a Visual Basic Graphical User Interface (GUI). CalEEMod requires the following system requirements:

- Microsoft Windows 8 or 10 Operating System with Microsoft .NET Framework 3.5 (includes .NET 2.0 and 3.0)
- Microsoft Windows XP, Vista, or 7 Operating System with Microsoft .Net Framework 4 or higher
- Microsoft SQL Server Compact 3.5 SP2
- 300 Mb hard drive space available

2.2 Installation Procedures

To install

1. Be sure to uninstall any previous versions of CalEEMod before installing a new version as some file names will be the same potentially confusing the computer. To uninstall for most computers, under Settings, Control Panel, Programs and Features, highlight CalEEMod and then click 'uninstall.'

2. Ensure you have the required Microsoft .Net framework installed on your machine. Microsoft .NET Framework 3.5 is available free from Microsoft at https://www.microsoft.com/en-us/download/details.aspx?id=21, and Microsoft .NET Framework 4.0 or higher is available free from Microsoft at https://www.microsoft.com/en-us/download/details.aspx?id=17851. Once this file is downloaded, unzip the file anywhere on your computer and run the installation file (setup.exe) and follow the instructions on Microsoft's website to locate the appropriate .msi file. To install Microsoft SQL Server Compact 3.5 SP2, go to https://www.microsoft.com/en-us/download/details.aspx?id=5783. For 32-bit computers, you will need to install SSCERuntime_x86-ENU.msi. For a 64-bit computer, you will need to install both the 32-bit and the 64-bit version of the SQL Server Compact 3.5 SP2 MSI files because the existing SQL Server Compact 3.5 applications may fail if only the 32-bit version of the .msi file is installed on the 64-bit computer.

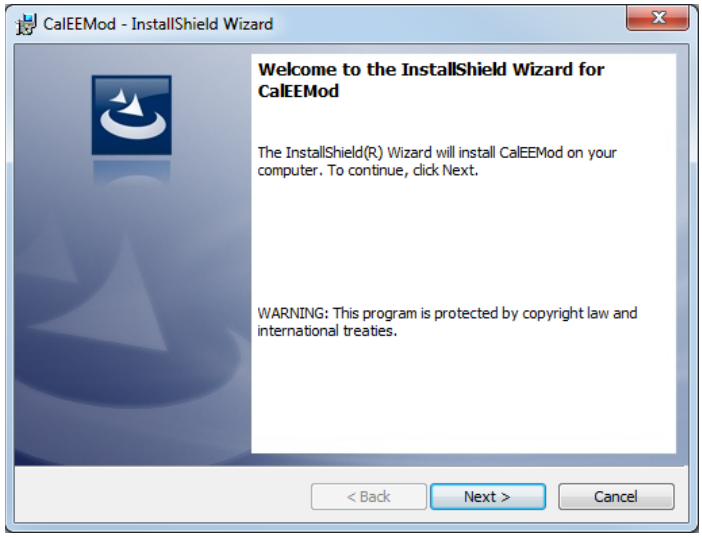
3. From www.CalEEMod.com, download the installation file (CalEEMod2016.3.1.exe), click on file and follow the instructions. Pages 5 through 7 show screen shots of the CalEEMod InstallShield Wizard.

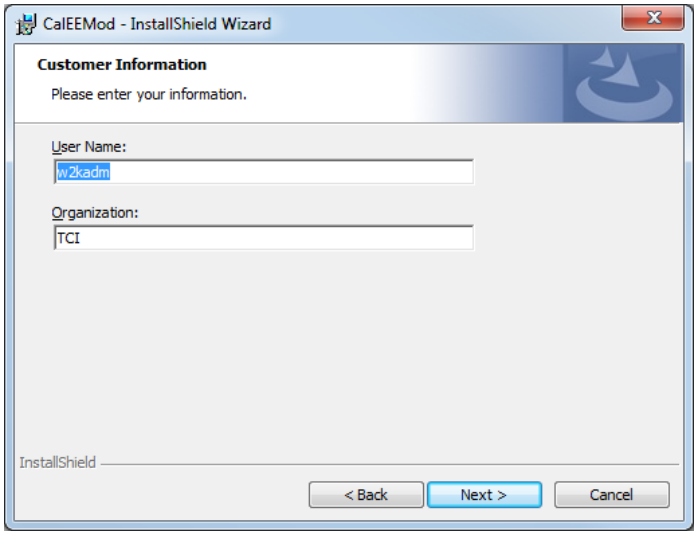
2 CalEEMod® 2016 All Rights Reserved by California Air Pollution Control Officers Association.

4. The default directory for CalEEMod is C:\CalEEMod\. To select an alternative directory location, choose Custom Installation[3].

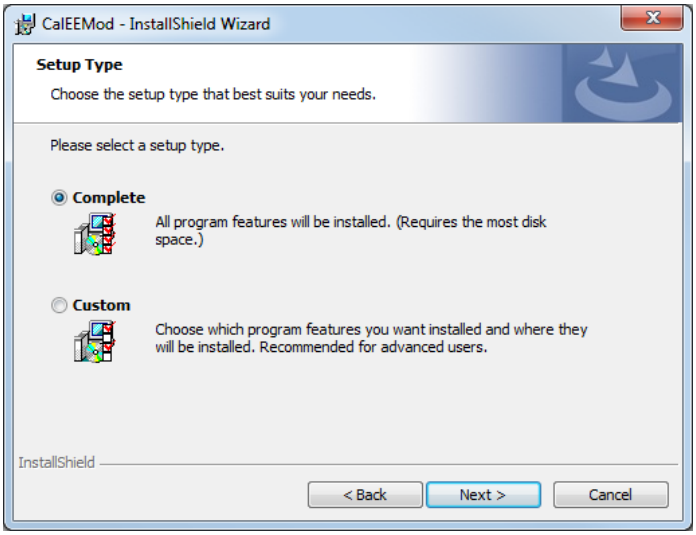
5. Click Next until the installation has completed, then click Finish to exit the installer.

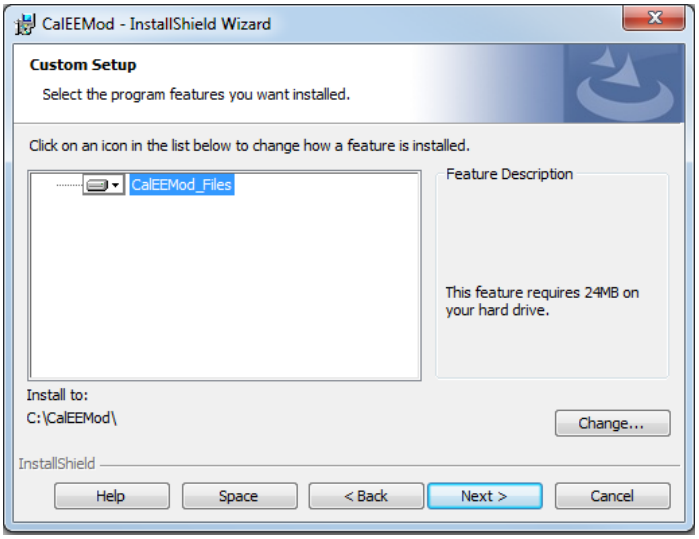
6. If you have any further trouble installing CalEEMod, verify that you have appropriate user privileges and that your computer meets the operating system requirements.

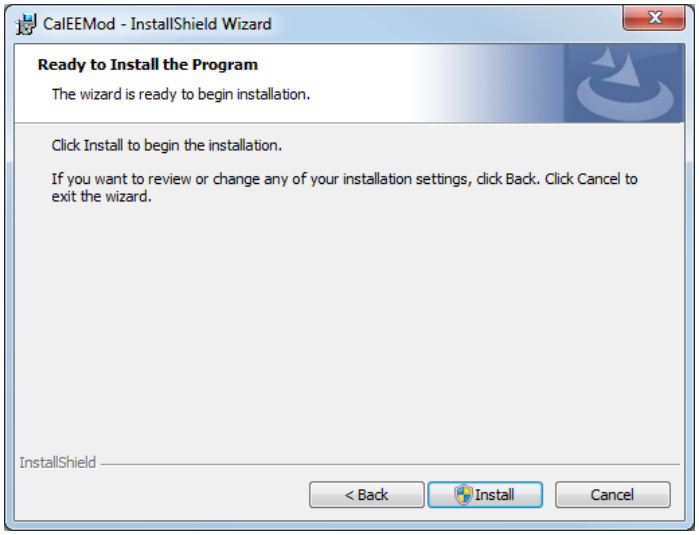


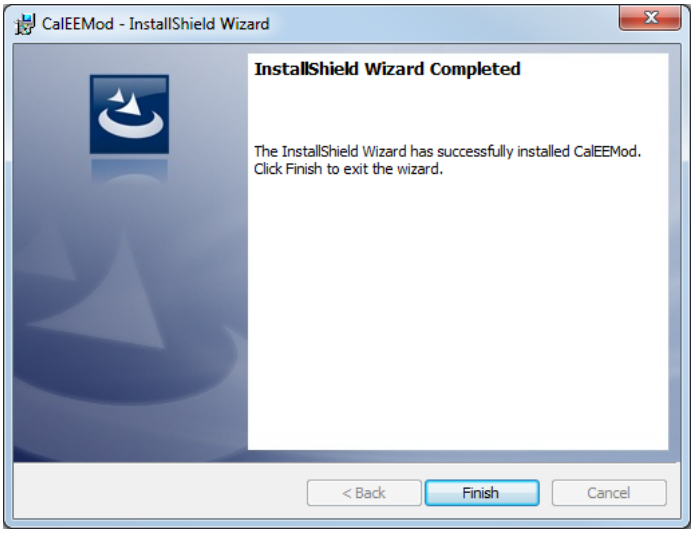


3 If you use Windows Vista, 7, 8 or 10, file privileges may not allow access rights to some folders during program operations such as C:\Program Files\.


CalEEMod - InstallShield Wizard
Setup Type
Choose the setup type that best suits your needs.
Please select a setup type.
Complete
All program features will be installed. (Requires the most disk space.)
Custom
Choose which program features you want installed and where they will be installed. Recommended for advanced users.
InstallShield
< Back
Next >
Cancel

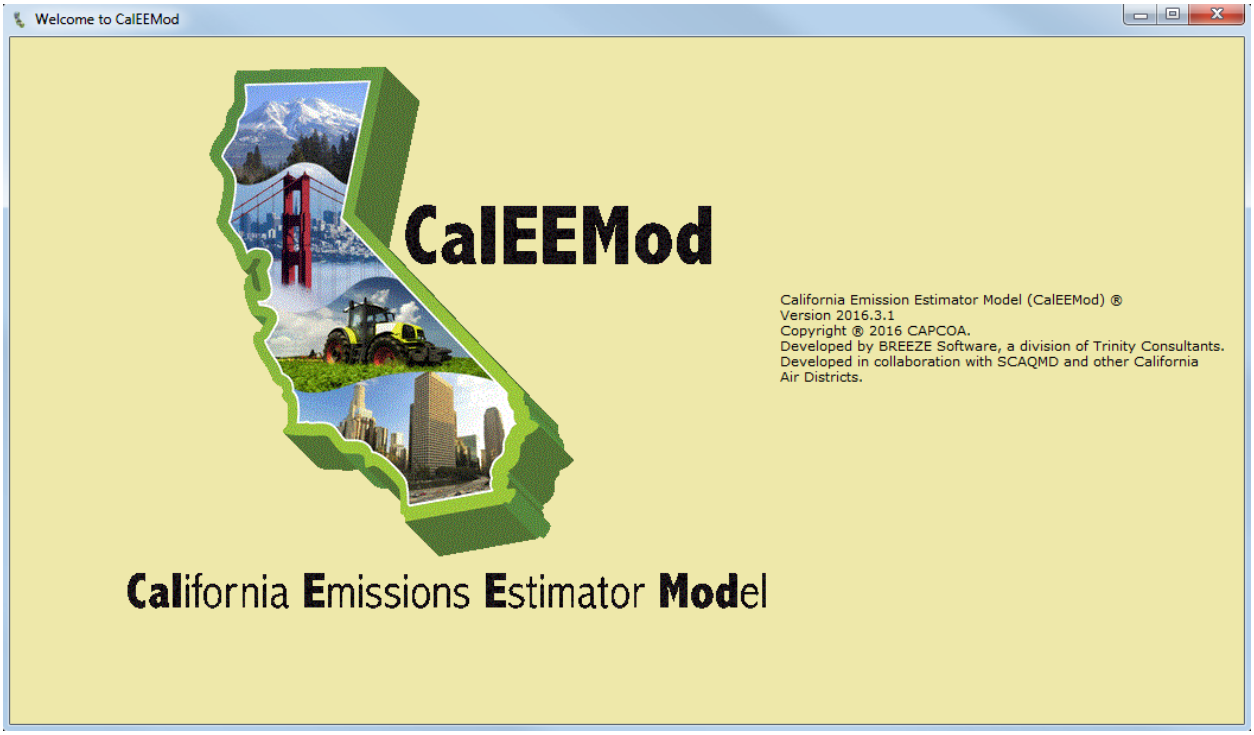

CalEEMod - InstallShield Wizard
Custom Setup
Select the program features you want installed.
Click on an icon in the list below to change how a feature is installed.
CalEEMod_Files
Feature Description
This feature requires 24MB on your hard drive.
Install to:
C:\CalEEMod\
Change...
InstallShield
Help
Space
< Back
Next >
Cancel


CalEEMod - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
Click Install to begin the installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
InstallShield
< Back
Install
Cancel



2.3 Starting CalEEMod

After the installation is complete, a CalEEMod short cut icon will be appear on the desktop and CalEEMod will appear in the list of Programs available from the Start Button. To start the model, select CalEEMod from the program files or double click on the CalEEMod short cut icon.



3 Using CalEEMod

3.1 Key Features

CalEEMod is comprised of a linear series of screens with each screen designed with an individual purpose to define features of the project such as project characteristics, construction schedule and equipment, operational activity, mitigation measures, etc. The user will need to input basic information about the project such as location, land use type (e.g., residential, commercial, retail, etc.) and project size and the model will populate later screens with pre-determined defaults. The user may override the defaults to input more accurate, project-specific information as appropriate.

The figure on page 10 identifies some key features of CalEEMod which are described below.

1. Menu Bar: A drop down menu bar is found on all screens. For example, the Home menu controls file features such as New Project, Open Project, Save Project, and Save As Project. The Help menu will link to appropriate information for the relevant screen from this User's Guide. All of the other menus will allow navigation between the screens in any order.

2. Screen Name: Identifies the name of the current screen.

3. Default Button: This button allows the user to restore the program defaults after the user has changed any default values on the screen. User-entered values will be highlighted in yellow to clearly indicate the defaults that have been changed. The user will be prompted to specify whether the default should be restored for the current or last cell on the screen or for the entire screen. The Import csv option will allow the user to load in a .csv file for a specific data grid. Clicking on the Undo button will allow the user to cancel or undo the previous action.

4. Remarks: This section is located at the bottom of each screen and it requires the user to enter comments regarding any defaults that have been replaced with user-defined values. The Remarks section is meant to assist project reviewers to determine or assess the justification for user-defined values entered.

5. Next Button: When the user clicks on this button, the next sequential screen will appear. As the user progresses through the model, later screens will also show a Previous button that will take the user to the previous screen.

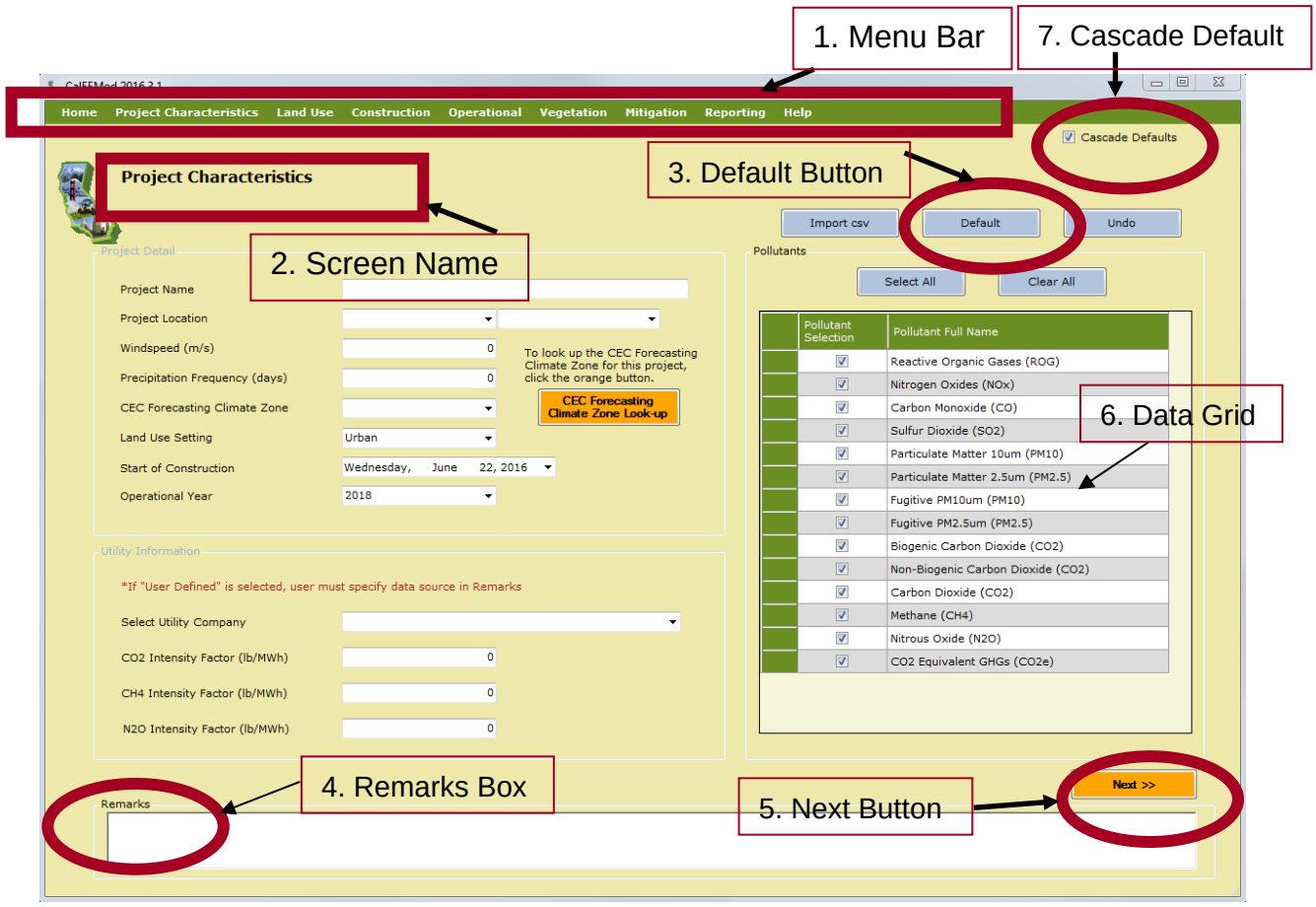
6. Data Grid: This is a common box where values for the variables defined across the top are to be filled in with data. The number of rows will automatically be adjusted based on the number of rows of information required to define the information. On some data grids, the last row may have an asterisk (*) and once the user begins adding information to this row, a new row will be added at the end. To delete a row, select the desired row to delete, and hit the delete button on your keyboard. (Deleting information is generally allowed unless the data grid contains a fixed list such as the Pollutant selection list.)

Scroll bars (both horizontal and vertical) may also occur on some data grids, as appropriate.

7. Cascade Defaults: CalEEMod has a feature that freezes the automatic downloading of the programmed defaults. Each input screen displays a box called Cascade Default which will be automatically checked to populate defaults in future screens. However, if user unchecks the Cascade Default box, no defaults will be populated in subsequent screens and the user will need to input project-specific data. Unless all the necessary input parameters required for a proper analysis are known, the user should run the model at least once with "Cascade Default" button checked to allow the defaults to be populated. Then, if the user would like to change the project's parameters (e.g., number of dwelling units, building square footage, etc.) without cascading new defaults in later screens, then the user should uncheck the Cascade Default box when in the Land Use screen. This feature may be helpful when the defaults are replaced with project-specific information (e.g., construction schedule, construction equipment, water use, energy use, etc.) and the user would like to evaluate different project scenarios with the same basic project information (e.g., land use type, location, etc.). In addition, by unchecking the Cascade Default box, the following will occur:

   - The defaults in *ALL* subsequent screens will be frozen.
   - Any changes that are made to screens that follow the Land Use screen (e.g., adding a new construction phase) will not cascade defaults relating to that change or add new tabs (e.g., trips and VMT, dust material movement). Thus, the user will need to manually input project-specific information in order for the impacts to be calculated.
   - If any changes to land use type (e.g., from single family housing to a hospital) are made, the subsequent screens will not reflect the new land use type causing some incorrect calculations (e.g., impacts from energy and water use) to be performed.

   When changing or adding a land use type, the user should click on the Cascade Default button so the future screens will be populated with appropriate defaults and the correct calculations specific to the changed or added land use type will occur.


1. Menu Bar
7. Cascade Default
Home
Project Characteristics
Land Use
Construction
Operational
Vegetation
Mitigation
Reporting
Help
Cascade Defaults
3. Default Button
Import csv
Default
Undo
Project Characteristics
2. Screen Name
Project Detail
Project Name
Project Location
Windspeed (m/s)
Precipitation Frequency (days)
CEC Forecasting Climate Zone
Land Use Setting
Urban
Start of Construction
Wednesday, June 22, 2016
Operational Year
2018
To look up the CEC Forecasting Climate Zone for this project, click the orange button.
CEC Forecasting Climate Zone Look-up
Utility Information
*If "User Defined" is selected, user must specify data source in Remarks
Select Utility Company
CO2 Intensity Factor (lb/MWh)
CH4 Intensity Factor (lb/MWh)
N2O Intensity Factor (lb/MWh)
Pollutants
Select All
Clear All
Pollutant Selection
Pollutant Full Name
Reactive Organic Gases (ROG)
Nitrogen Oxides (NOx)
Carbon Monoxide (CO)
Sulfur Dioxide (SO2)
Particulate Matter 10um (PM10)
Particulate Matter 2.5um (PM2.5)
Fugitive PM10um (PM10)
Fugitive PM2.5um (PM2.5)
Biogenic Carbon Dioxide (CO2)
Non-Biogenic Carbon Dioxide (CO2)
Carbon Dioxide (CO2)
Methane (CH4)
Nitrous Oxide (N2O)
CO2 Equivalent GHGs (CO2e)
6. Data Grid
4. Remarks Box
Remarks
5. Next Button
Next >>

3.2 Home

The Home tab on the file menu bar that controls the file saving and opening features. The available options are:

- New Project
- Open Project
- Save
- Save As
- Exit

The user should select Open Project to open a project that has been previously created and saved or New Project to create a new project. Note that opening a previously saved project will remove any information that has been entered into the GUI unless it has been saved to a file. Save will save the currently loaded project database as a Microsoft Excel file and this file can be closed, and then re-opened later. Save As will allow the user to change the name of the saved project file. Exit will close CalEEMod. The Microsoft Excel file can be edited following the format of the save file to quickly make edits outside of the Graphical User Interface (GUI) but the user will still need to use the GUI in order to report the results. This can be most useful in making changes to construction lists. Data for individual tabs can be uploaded as a .csv file in various places in CalEEMod to minimize the data entry.

3.3 Defining a Project

In order to define a project, the user will need to enter information on both the Project Characteristics screen and the Land Use screen. After entering information on these two screens, CalEEMod will populate all of the other information required to calculate unmitigated construction (unless there is demolition, grading, or site preparation) and operation emissions using default data. If demolition, grading, and/or site preparation activities are part of the project, then the user will need to enter additional information on the appropriate construction screens, including but not limited to, the amount of material to be demolished and transported to or from the site. If site-specific information is not needed for the project, the user can skip this part and jump to the Mitigation screen and enter mitigation measures. After completing the Mitigation screen, the user can proceed to the Reporting screen to select the type of report to be generated for the project.

3.4 Altering Default Data

CalEEMod was designed with default assumptions supported by substantial evidence to the extent available at the time of programming. The functionality and content of CalEEMod is based on fully adopted methods and data. However, CalEEMod was also designed to allow the user to change the defaults to reflect site- or project-specific information, when available, provided that the information is supported by substantial evidence as required by CEQA. If the user chooses to modify any defaults, an explanation will be required in the Remarks box found

at the bottom of the screen to justify and support the modification before the user will be able to proceed to the next screen. Modifications to defaults and the explanations are noted in the output report. Comments in the Remarks box are also included in the report and alert reviewers of modifications to the defaults. Comments are important because they show the user's justification for the modifications, which allows the reviewers the ability to determine whether or not the modifications are appropriate and sufficiently justified.

3.5 Mitigation

Common construction mitigation measures that impact the calculations in CalEEMod have been incorporated as options for the user to select. It is important to note that compliance with fugitive dust rules vary widely by district and include requirements to reduce dust. Even though the fugitive dust rules contain requirements that when implemented, have the effect of mitigating dust emissions, these requirements are not considered to be mitigation per se. For these reasons, requirements such as percentage adjustments to fugitive dust rules have not been incorporated into the unmitigated fugitive dust calculations.

Several mitigation measures from CAPCOA's Quantifying Greenhouse Mitigation Measures have been incorporated including combinations and caps when using multiple mitigation measures. . CalEEMod was designed to include typical mitigation measures that are some of the more effective measures available to development projects. If mitigation measures are not available as options in CalEEMod, the user can alter the inputs in the program to adjust to account for mitigation measures that may be less common. This will require separate runs of CalEEMod files in order to properly account for unmitigated and mitigated scenarios. For more details regarding mitigation, see Subchapter 4.11.

3.6 Reporting

The Reporting tab allows the user to select the type of report (e.g., annual, winter or summer) to present the results of the calculations. The reports can be viewed on screen and then saved as either a Microsoft Excel file or a .pdf file. For more details regarding reporting, see Subchapter 4.11.

4 Detailed Program Screens

4.1 Project Characteristics

The Project Characteristics screen is starting point where the user enters the project name, project location, and selects utility provider, climate zone, and pollutants to be analyzed. The information entered on this screen will trigger project appropriate default data to populate subsequent screens. Any changes entered on this screen will override any previously entered user-defined data and the corresponding default data. The project name will appear in the reports. Each of the information categories on this screen are described in more detail below.

Project Location

To define the region where the project is located, the user is given the option to select Air District, Air Basin, County, or Statewide. The second drop down box will reveal a list of specific locations to the region selected. If the user selects County, It is important to note that there may be some counties that are shared by multiple Air Districts, Air Basins or District-specific sub-regions and the default values (e.g., on-road vehicle emissions, trip lengths, water supply and treatment electricity use, solid waste disposal rates, amount of paved roads, days of landscaping equipment use, architectural coating emissions, and hearth usage) may vary accordingly. Thus, if the user selects County, the user may also be prompted to select the sub-county area. If you are uncertain about what region to choose for your project location, consult your lead agency.

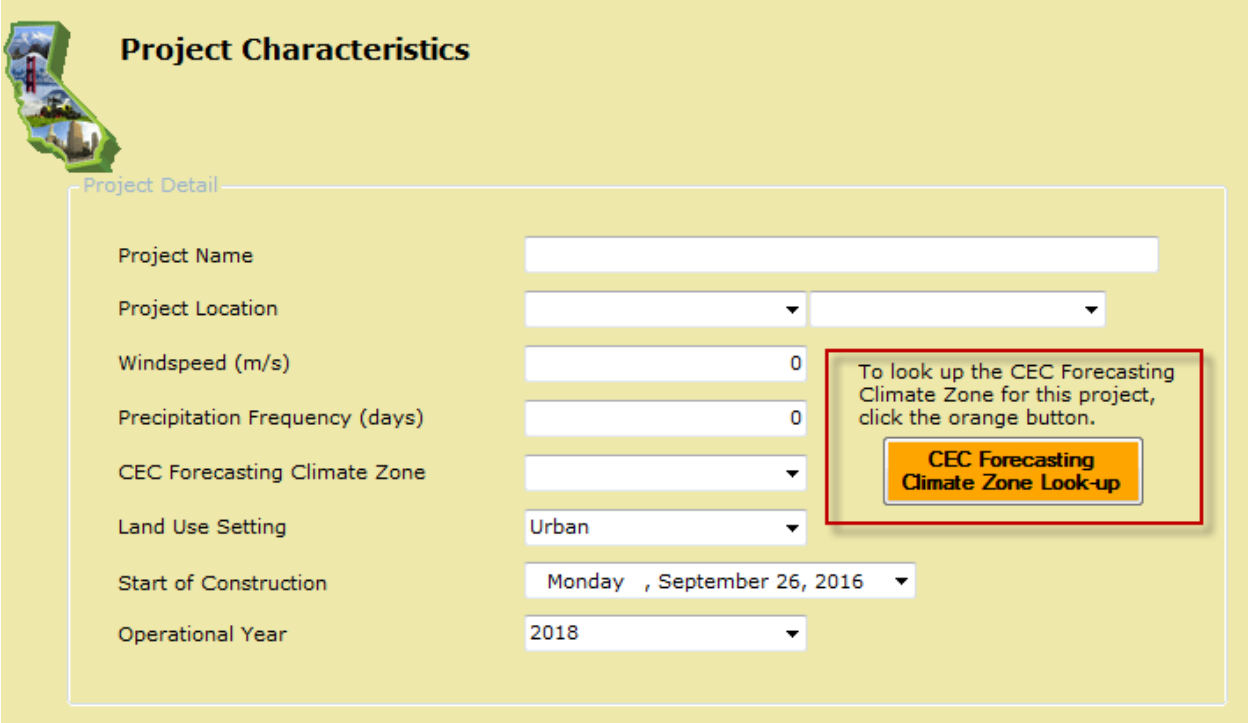
Wind Speed and Precipitation Frequency

Selection of project location will automatically fill in the default wind speed and precipitation frequency. The user can also choose to override this information and enter a different value. The wind speed, in meters per second (m/s), is used in the fugitive dust calculations. Precipitation frequency, e.g. the number of days per year with a precipitation amount measuring greater than 0.01 inches in one day, is used in the fugitive dust calculations.

Climate Zone

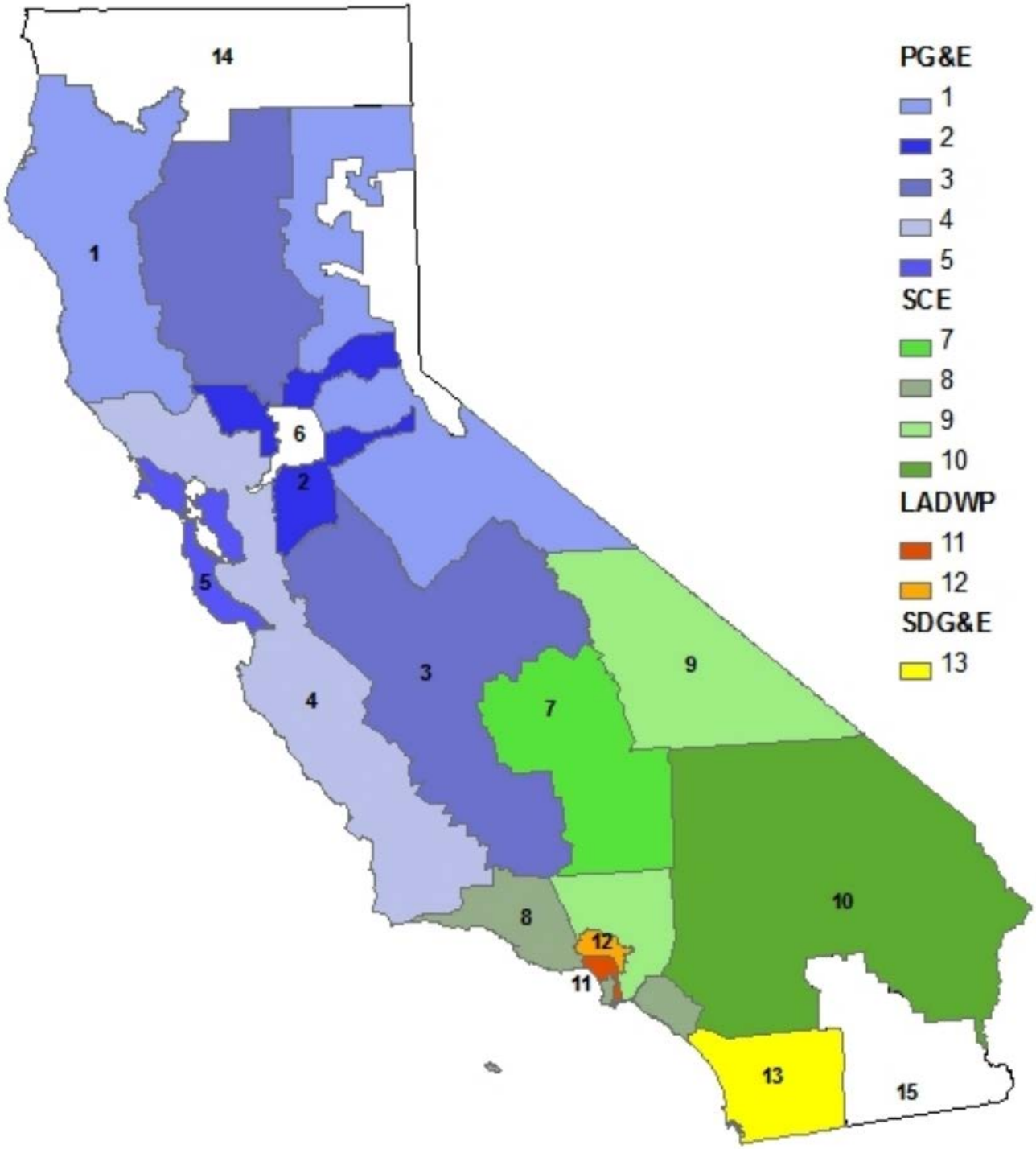
Selection of project location will restrict the climate zones available for the user to choose from based on the climate zones in the project location. The climate zones that have been programmed into CalEEMod are based on the California Energy Commission's (CEC) Forecasting Climate Zones, which are different from the Title 24 Building Climate Zones. The user should determine the correct climate zone by either referring to the figure below or by clicking on the orange button that says "CEC Climate Zone Forecasting Look-up" on the Project Characteristics screen. In addition, the user may also determine the climate zone by city or zip code from the look up tables in Appendix F.

CEC Forecasting Climate Zone Look-up Button



CalEEMod utilizes the Forecasting Climate Zones because the baseline data in the 2002 California Commercial End Use Survey (CEUS) and 2009 Residential Appliance Saturation Survey (RASS), upon which CalEEMod relies, are categorized in this manner. Further information on the calculation of building energy usage, including the application of data specific to the Forecasting Climate Zones, is contained in Appendix E.

CEC Forecasting Climate Zones[4,5]



4 Adapted from Figure ES-2 of CEC. 2010. Residential Appliance Saturation Survey. Available at: http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-ES.PDF

5 White spaces represent areas served by other electric utilities not included in survey.

Land Use Setting

The Land Use Setting tab is where the user indicates whether the project is located in a rural or urban setting. The user should contact the local air district for the region where the project is located for guidance on the appropriate Land Use Setting to select.

Start of Construction

To indicate when construction of the project will begin, the user will need to insert a date in the Start of Construction field. The date when construction will start triggers a rolling calendar that starts with the construction start date and follows by various construction phases that will be populated with default date ranges in the Construction screen.

Operational Year

CalEEMod is currently designed to key off of one year to initiate the beginning of the full operation of the project. Thus, to indicate when the project will begin operation activities, the user will need to insert a year. CalEEMod will use this year to determine the appropriate emission factors to be used in all operational module calculations. CalEEMod can accommodate the following years for the initial operational year: 2000, 2005, 2010-2035, 2040, 2045, and 2050. To conduct a backcasting analysis by inserting an operational year that occurs in the past, the selection of years is limited to minimize the file size associated with vehicle emission factors. For a project that consists of multiple phases with operation activities occurring over multiple years, the user should run the model multiple times for the various input parameters for each operational year.

Utility Company

From the drop down list, the user will need to select the appropriate utility company that will serve the project location. . When a specific utility is selected, the intensity factors for CO_2, CH_4 and N_2O will be automatically populated with defaults applicable to the specified utility. However, if the utility for the project is not in the drop down list, the user may select User Defined and the user will need to manually enter the various intensity factors. In addition, the user will need to identify the utility in the Remarks section.

The intensity factors are used in various modules to calculate the GHG emissions associated with electricity use. The default values are based on CARB's Local Government Operations Protocol (LGO)[6] for CO_2, updated public utility protocols for CO_2, and E-Grid values for CH_4 and N_2O. Each default CO_2 intensity factor is based on the latest reporting year available for each utility. Appendix D, Table 1.2 provides the default CO_2 intensity factor and reporting year from which the factor was identified for each utility identified in the drop down list. As with other defaults in the model, if a new intensity factor is identified before the defaults in CalEEMod are updated, the user may override the default and provide justification for the change in the Remarks section at the bottom of the Project Characteristics screen.

6 Available at: http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm

Pollutants

CalEEMod provides a list of pollutants with adjacent check boxes for the user to select. Upon starting a new project, all of the boxes are automatically checked and if the boxes remain checked, all pollutants will be quantified and identified in the reports. If user unchecks any of the boxes, the unchecked pollutants will be excluded from the calculations and the reports. Some of the pollutants may overlap other identified pollutants. For example, carbon dioxide (CO_2) is identified on its own, and it is separated into biogenic and non-biogenic categories. In addition, CO_2 Equivalent GHGs represents, all CO_2 emissions plus methane (CH_4) and nitrous oxide (N_2O) as adjusted by their corresponding Global Warming Potential (GWP) weighted value. The GWPs are based on the 2007 IPCC's Fourth Assessment Report (AR4)[7], and are consistent with 2014 CARB's Scoping Plan Update[8].

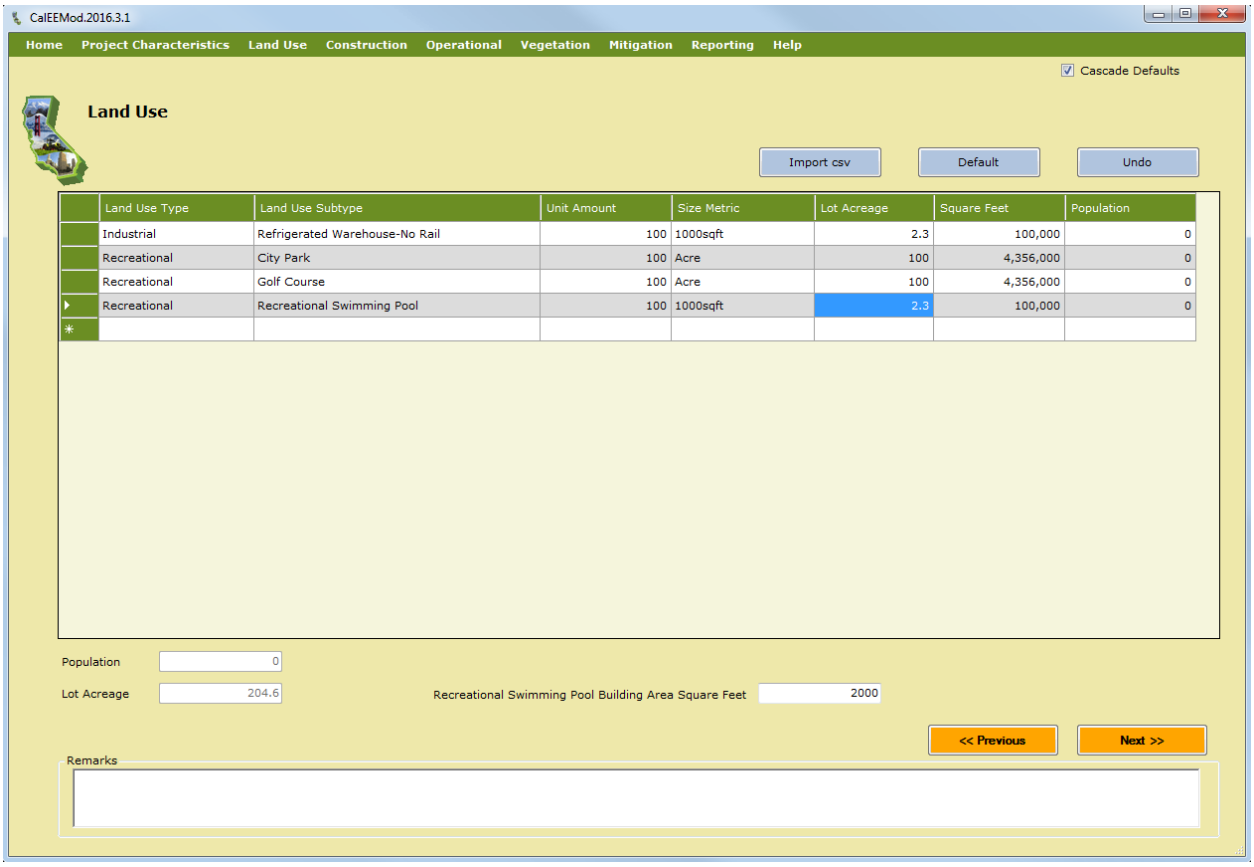
Remarks

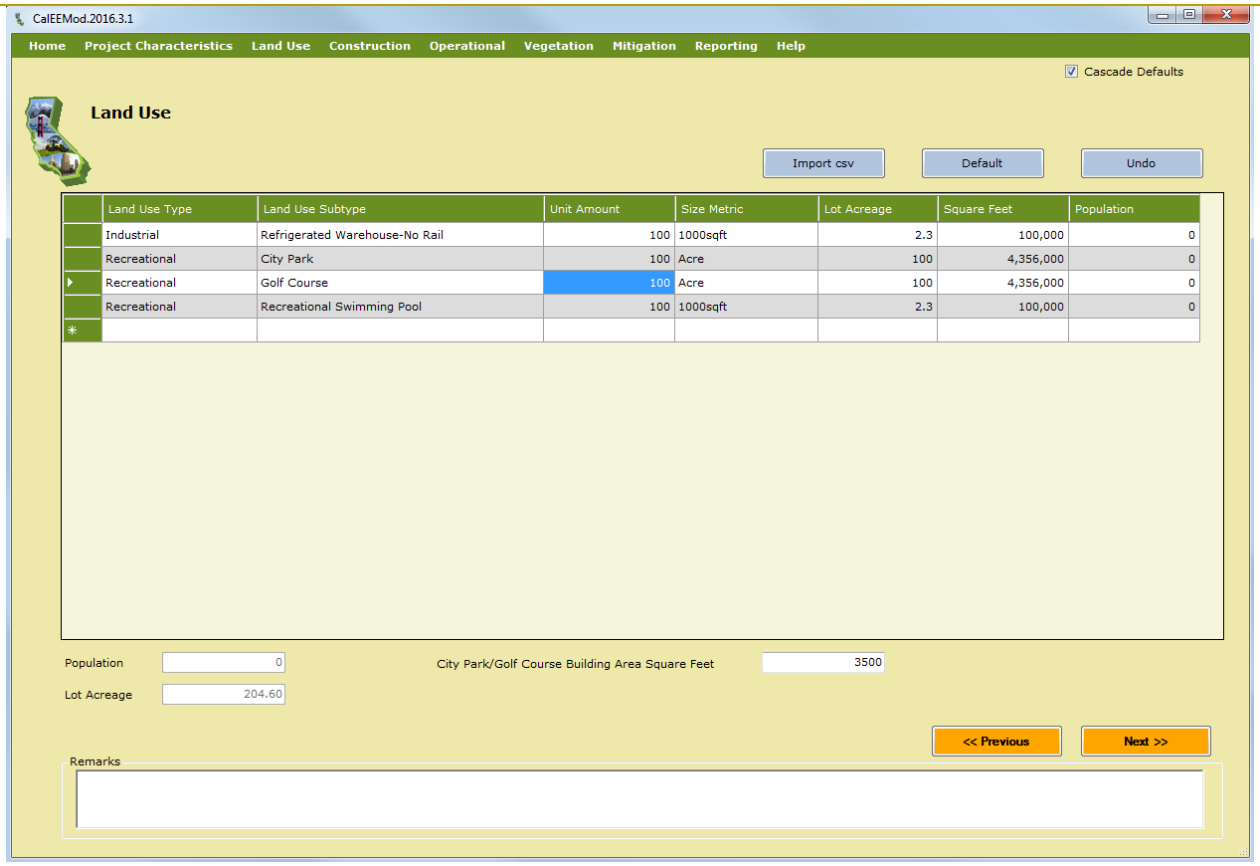
As previously explained in Subchapter 3.4, if the user chooses to modify any defaults, the user will be required to provide an explanation or justification in the Remarks section for incorporating user defined (e.g., non-default) values before the user will be able to proceed to the next screen. Any remarks that are entered will be included in the reports and will assist a reviewer in understanding the reasons for a change in the default value (e.g., new trip rate based on a project-specific traffic study conducted by traffic engineers).

4.2 Land Use

The Land Use screen is where the user identifies the land use(s) that will occur at the project site. The data in the land use types and subtypes, unit amounts, size metric, lot acreage, square feet and population fields determine the default variables that are used in the calculations. It is important to note that for any project that includes a city park, golf course, or recreational swimming pool land use, the user will be prompted to enter the square footage of the buildings associated with these land uses (e.g., restrooms/changing rooms, pro-shop, etc.). By excluding the entire lot size for these three land use types, and instead only using the square footage of the buildings, the calculations for consumer product use will provide a more accurate representation of where these materials are actually used and avoid incorrectly attributing consumer products use to greenspaces and pool water. For more information on the calculations for consumer product use, see Subchapter 4.5, Section 4.5.2.0

7 Available at: https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_full_report.pdf
8 Available at: http://www.arb.ca.gov/cc/scopingplan/document/updatedscopingplan2013.htm

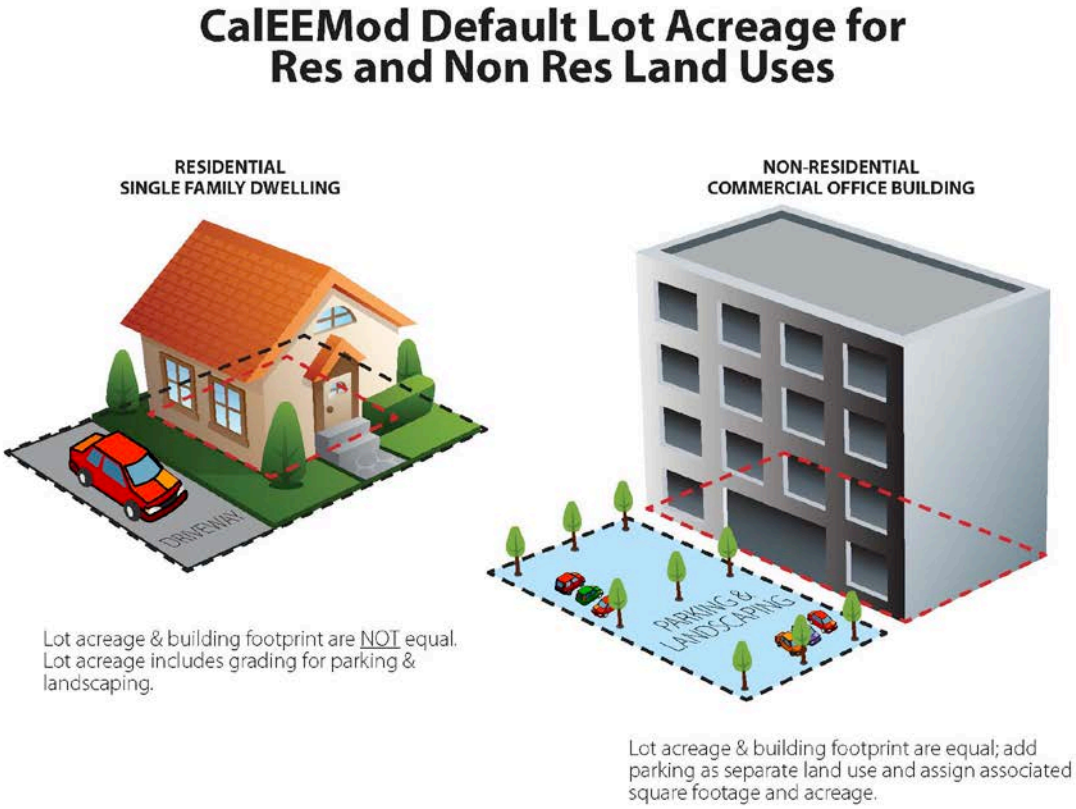

CalEEMod.2016.3.1
Home
Project Characteristics
Land Use
Construction
Operational
Vegetation
Mitigation
Reporting
Help
Cascade Defaults
Land Use
Import csv
Default
Undo
Land Use Type
Land Use Subtype
Unit Amount
Size Metric
Lot Acreage
Square Feet
Population
Industrial
Refrigerated Warehouse-No Rail
100
1000sqft
2.3
100,000
0
Recreational
City Park
100
Acre
100
4,356,000
0
Recreational
Golf Course
100
Acre
100
4,356,000
0
Recreational
Recreational Swimming Pool
100
1000sqft
2.3
100,000
0
Population
0
Lot Acreage
204.6
Recreational Swimming Pool Building Area Square Feet
2000
<< Previous
Next >>
Remarks



Land Use Type

The Land Use Type tab allows the user to select any of the following primary land use types from a drop down list: Commercial, Educational, Industrial, Parking, Recreational, Residential, and Retail. The 63 different land use types were chosen for inclusion in CalEEMod because each has an established trip rate critical for mobile source calculations.

CalEEMod specifically designates parking areas as a separate land use rather than as a part of an associated non-residential land use (e.g., commercial buildings, retail facilities, etc.). However, no separate parking land use for a driveway or garage needs to be identified for residential land uses because parking is already included in the calculation For more information on how CalEEMod treats parking based on the footprint and lot acreage of residential and non-residential land uses, please refer to the following figure. As depicted, the lot acreage of a residential land use includes the parking and building footprint. For non-residential land uses, the lot acreage is the same as the building footprint, so parking needs to be entered as a separate land use.



For the parking land use subtype, two primary options are available: parking lot or parking structure (e.g., garage). There are four types of parking structures: 1) enclosed; 2) enclosed with an elevator; 3) unenclosed; and, 4) unenclosed with an elevator. The reason for these specific descriptions is so that the model properly accounts for energy impacts associated with ventilation and elevator operations.

For land use subtypes that are not listed (e.g., roads, underground parking, pipelines, etc.) or that do not accurately represent the project being analyzed, each land use subtype has a User Defined option that the user can select. If a User Defined land use subtype is selected, there is no default data (including size metric) that will automatically populate the data fields. Instead, the user will need to manually enter the unit amount, size metric, lot acreage, etc.. If these fields are left blank, no emissions will be calculated for the User Defined land use subtype. Also, whatever size metric (e.g., per acre, per 1000 square foot, etc.) the user chooses for the User Defined land use subtype needs to be consistently applied to all subsequent default values (e.g., gallons of water used *per acre* or *per 1000 square foot*). An alternative approach to entering a User Defined land use subtype would be to choose a land use subtype that most closely fits the project and allow the model to populate the data fields with the defaults. Then,

the user can go back through the model and modify the defaults with any known specific project information and enter the required Remarks to explain why the defaults are modified.

Land Use Subtype

63 land use subtypes have been included in CalEEMod and each has an established trip rate that is used for calculating mobile source emissions. By tabbing over to the next column in a row, the user can select a variety of land use subtypes. The user also has the option to select a User Defined land use subtype; however, as explained previously, there is no default data (including size metric) that will automatically populate the data fields. Instead, the user will need to manually enter the unit amount, size metric, lot acreage, etc. Land use subtypes are based primarily on the land use definitions used for (mobile source) trip generation rate information from the Institute of Transportation Engineers (ITE) 9th edition of the Trip Generation Manual. In some cases similar generalized land uses or surrogate data was mapped to some land use subtypes in order to generate the default data needed for various modules.

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
RESIDENTIAL		
Apartments High Rise	High-rise apartments are units located in rental buildings that have more than 10 levels and most likely have one or more elevators.	222
Apartments Low Rise	Low-rise apartments are units located in rental buildings that have 1-2 levels.	221
Apartments Mid Rise	Mid-rise apartments in rental buildings that have between 3 and 10 levels.	223
Condo/Townhouse	These are ownership units that have at least one other owned unit within the same building structure.	230
Condo/Townhouse High Rise	These are ownership units that have three or more levels.	232
Congregate Care (Assisted Living)	These facilities are independent living developments that provide centralized amenities such as dining, housekeeping, transportation and organized social/recreational activities. Limited medical services may or may not be provided.	253
Mobile Home Park	Mobile home parks consist of manufactured homes that are sited and installed on permanent foundations and typically have community facilities such as recreation rooms, swimming pools and laundry facilities.	240
Retirement Community	These communities provide multiple elements of senior adult living. Housing options may include various combinations of senior adult housing, congregate care, assisted living, and skilled nursing care aimed at allowing the residents to live in one community as their medical needs change.	255
Single Family Housing	All single-family detached homes on individual lots typical of a suburban subdivision	210

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
EDUCATIONAL		
Day-Care Center	A day care center is a facility where care for pre-school age children is provided, normally during the daytime hours. Day care facilities generally include classrooms, offices, eating areas and playgrounds.	565
Elementary School	Elementary schools typically serve students attending kindergarten through the fifth or sixth grade. They are usually centrally located in residential communities in order to facilitate student access and have no student drivers.	520
High School	High schools serve students who have completed middle or junior high school.	530
Junior College (2Yr)	This land use includes two-year junior, community, or technical colleges.	540
Junior High School	Junior High schools serve students who have completed elementary school and have not yet entered high school.	522
Library	A library is a facility that consists of shelved books; reading rooms or areas; and sometimes meeting rooms.	590
Place Of Worship	A church is a building in which public worship services are held. A church houses an assembly hall or sanctuary; it may also house meeting rooms, classrooms and occasionally dining catering or party facilities.	560
University/College (4Yr)	This land use includes four-year universities or colleges that may or may not offer graduate programs.	550
RECREATIONAL		
Arena	Arenas are large indoor structures in which spectator events are held. These events vary from professional ice hockey and basketball to non-sporting events such as concerts, shows, or religious services. Arenas generally have large parking facilities, except when located in or around the downtown of a large city.	460
City Park	City parks are owned and operated by a city.	411
Fast Food Restaurant W/O Drive Thru	This land use includes fast-food restaurants without drive-through windows. Patrons generally order at a cash register and pay before they eat.	933
Fast Food Restaurant With Drive Thru	This category includes fast-food restaurants with drive-through windows.	934
Golf Course	Golf courses include 9, 18, 27 and 36 hole courses. Some sites may also have driving ranges and clubhouses with a pro shop, restaurant, lounge and banquet facilities.	430
Health Club	These are privately-owned facilities that primarily focus on individual fitness or training. Typically they provide exercise classes; weightlifting, fitness and gymnastics equipment; spas; locker rooms; and small restaurants or snack bars.	492

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
High Turnover (Sit Down Restaurant)	This land use consists of sit-down, full-service eating establishments with turnover rates of approximately one hour or less. This type of restaurant is usually moderately priced and frequently belongs to a restaurant chain.	932
Hotel	Hotels are places of lodging that provide sleeping accommodations and supporting facilities such as restaurants; cocktail lounges; meeting and banquet rooms or convention facilities; limited recreational facilities and other retail and service shops.	310
Motel	Motels are places of lodging that provide sleeping accommodations and often a restaurant. Motels generally offer free on-site parking and provide little or no meeting space and few supporting facilities.	320
Movie Theater (No Matinee)	Movie theaters consist of audience seating, single or multiple screens and auditoriums, a lobby and a refreshment stand. Movie theaters without matinees show movies on weekday evenings and weekends only; there are no weekday daytime showings.	443
Quality Restaurant	This land use consists of high quality, full-service eating establishments with typical turnover rates of at least one hour or longer. Quality restaurants generally do not serve breakfast, some do not serve lunch; all serve dinner. This type of restaurant usually requires reservations and is generally not part of a chain. Patrons commonly wait to be seated, are served by a waiter, order from menus and pay for meals after they eat.	931
Racquet Club	These are privately-owned facilities that primarily cater to racquet sports.	491
Recreational Swimming Pool	This is a typical recreational swimming pool that may be associated with community centers, parks, swim clubs, etc.	495
PARKING		
Enclosed Parking Structure	This is an enclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting and ventilation, and will be more than one floor with no elevator.	
Enclosed Parking with Elevator	This is an enclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting and ventilation, and will be more than one floor with an elevator.	
Other Asphalt Surfaces	This is an asphalt area not used as a parking lot (e.g., long driveway, basketball court, etc.)	
Other Non-Asphalt Surfaces	This is a non-asphalt area (e.g., equipment foundation, loading dock area, etc.).	
Parking Lot	This is a typical single surface parking lot typically covered with asphalt. This land use will require lighting.	
Unenclosed Parking Structure	This is an unenclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting but not ventilation. It will be more than one floor with no elevator.	
Unenclosed Parking with Elevator	This is a unenclosed parking structure that may be above or below ground. It is not covered in asphalt. This land use will require lighting but not ventilation. It will be more than one floor with an elevator.	

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
RETAIL		
Automobile Care Center	An automobile care center houses numerous businesses that provide automobile-related services, such as repair and servicing; stereo installation; and seat cover upholstering.	942
Convenience Market (24 Hour)	These markets sell convenience foods, newspapers, magazines and often beer and wine. They do not sell or dispense motor vehicle fuels (e.g., gasoline and diesel).	851
Convenience Market With Gas Pumps	These markets sell or dispense motor vehicle fuels (e.g., gasoline and diesel), convenience foods, newspapers, magazines and often beer and wine. This includes convenience markets with motor vehicle fueling dispensers where the primary business is the selling of convenience items, not the fueling of motor vehicles.	853
Discount Club	A discount club is a discount store or warehouse where shoppers pay a membership fee in order to take advantage of discounted prices on a wide variety of items such as food, clothing, tires and appliances. Many items are sold in large quantities or in bulk.	857
Electronic Superstore	These are free-standing facilities that specialize in the sale of electronic merchandise.	863
Free-Standing Discount Store	Discount stores offer centralized cashiering and sell products that are advertised at discount prices. These stores offer a variety of customer services and maintain long store hours seven days a week.	815
Free-Standing Discount Superstore	The discount superstore is similar to the free-standing discount stores with the addition that they also contain a full-service grocery department under the same roof that shares entrances and exits with the discount store area.	813
Gasoline/Service Station	This land use includes service stations where the primary business is the fueling of motor vehicles. They may also have ancillary facilities for servicing and repairing motor vehicles.	944
Hardware/Paint Store	These stores sell hardware and paint supplies and are generally free-standing buildings.	816
Home Improvement Superstore	These are free-standing facilities that specialize in the sale of home improvement merchandise.	862
Regional Shopping Center	A shopping center is an integrated group of commercial establishments that is planned, developed, owned and managed as a unit. A shopping center's composition is related to its market area in terms of size, location and type of store.	820
Strip Mall	Small strip shopping centers contain a variety of retail shops and specialize in quality apparel, hard goods and services such as real estate offices, dance studios, florists and small restaurants.	826

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
Supermarket	Supermarkets are free-standing retail stores selling a complete assortment of food: food preparation and wrapping materials; and household, cleaning items. Supermarkets may also contain the following products and services: ATMs, automobile supplies, bakeries, books and magazines, dry cleaning, floral arrangements, greeting cards, limited-service banks, photo centers, pharmacies and video rental areas.	850
COMMERCIAL		
Bank (With Drive-Through)	Drive-in banks provide banking facilities for motorists who conduct financial transactions from their vehicles; many also serve patrons who walk into the building.	912
General Office Building	A general office building houses multiple tenants where affairs of businesses commercial or industrial organizations or professional persons or firms are conducted. If information is known about individual buildings, it is suggested that this land use be used instead of the more generic office park.	710
Government (Civic Center)	A group of government buildings that are interconnected by pedestrian walkways.	733
Government Office Building	This is an individual building containing either the entire function or simply one agency of a city, county, state, federal, or other governmental unit.	730
Hospital	A hospital is any institution where medical or surgical care and overnight accommodations are provided to non-ambulatory and ambulatory patients. However, it does not refer to medical clinics or nursing homes.	610
Medical Office Building	This is a facility that provides diagnoses and outpatient care on a routine basis but is unable to provide prolonged in-house medical and surgical care. One or more private physicians or dentists generally operate this type of facility.	720
Office Park	Office parks are usually suburban subdivisions or planned unit developments containing general office buildings and support services, such as banks, restaurants and service stations, arranged in a park-or campus-like atmosphere. This should be used if details on individual buildings are not available.	750
Pharmacy/Drugstore W/O Drive Thru	These are retail facilities that primarily sell prescription and non-prescription drugs. These facilities may also sell cosmetics, toiletries, medications, stationery, personal care products, limited food products and general merchandise. The drug stores in this category do not contain drive-through windows.	880

Table 1: Land Use Subtype Descriptions

Land Use Subtype	Description[1]	ITE Number
Pharmacy/Drugstore With Drive Thru	These are retail facilities that primarily sell prescription and non-prescription drugs. These facilities may also sell cosmetics, toiletries, medications, stationery, personal care products, limited food products and general merchandise. The drug stores in this category contain drive-through windows.	881
Research & Development	R&D centers are facilities devoted almost exclusively to R&D activities. The range of specific types of businesses contained in this land use category varies significantly. R&D centers may contain offices and light fabrication areas.	760
INDUSTRIAL		
General Heavy Industry	Heavy industrial facilities usually have a high number of employees per industrial plant and are generally limited to the manufacturing of large items.	120
General Light Industry	Light industrial facilities are free-standing facilities devoted to a single use. The facilities have an emphasis on activities other than manufacturing and typically have minimal office space. Typical light industrial activities include printing, material testing and assembly of data processing equipment.	110
Industrial Park	Industrial parks contain a number of industrial or related facilities. They are characterized by a mix of manufacturing, service and warehouse facilities with a wide variation in the proportion of each type of use from one location to another. Many industrial parks contain highly diversified facilities.	130
Manufacturing	Manufacturing facilities are areas where the primary activity is the conversion of raw materials or parts into finished products. It generally also has office, warehouse, and R&D functions at the site.	140
Refrigerated Warehouse-No Rail	This is a warehouse that has refrigeration but no rail spur.	152
Refrigerated Warehouse-Rail	This is a warehouse that has refrigeration and a rail spur.	152
Unrefrigerated Warehouse-No Rail	This is a warehouse that does not have refrigeration and no rail spur.	152
Unrefrigerated Warehouse-Rail	This is a warehouse that does not have refrigeration but has a rail spur.	152

1. Based on land use descriptions in Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition.

Unit Amount and Size Metric

By tabbing over to the Unit Amount and Size Metric columns, respectively, the user can enter the number of units (e.g., houses, apartments, etc.) and the corresponding size metric (e.g., per

1000 sq ft, employees, students, etc.). This data combination will be used to populate the lot acreage, square feet and population columns on this screen. For example, a school land use allows the user to define its size by the number of students, building square footage, or number of employees. It is important to note that the square footage, which is used for calculating such impacts as architectural coatings and energy use, relates to the total building square footage and not the building footprint or lot acreage which is used for housing density as well as grading and site preparation calculations.

Lot Acreage

If actual lot acreage data is available, the user should override the default value. However, for a mixed use, multi-story building, the user should not override the square footage default value for each individual land use or the acreage default value assigned to the residential portion or the split between the non-residential land uses if there is no residential portion. The figure below provides an example of a mixed use project and instructions for applying the appropriate square footage and acreage.

Acreage is used to estimate housing density and assign construction default data (e.g., grading, site preparation, etc.). Table 2 contains housing density default data per land use in terms of dwelling units (DU) per acre. By using this data, CalEEMod can estimate the number of acres per dwelling unit (DU) for residential land use. For example, if the user enters 10 apartments in a low rise building, then the lot acreage will be 0.625 acre (10 DU divided by 16 acres/DU). According to the California Energy Commission's Residential Appliance Saturation Survey (RASS), the metric for low rise apartments is 1,000 square feet per DU (see Table 2.1). Similarly, using the same example, the building footprint will be 0.23 acre (10 DU x 1000 sq ft/DU x 1 acre/43,560 sq ft). Thus, the total lot acreage includes the residential footprint plus driveway and landscaping/open space.

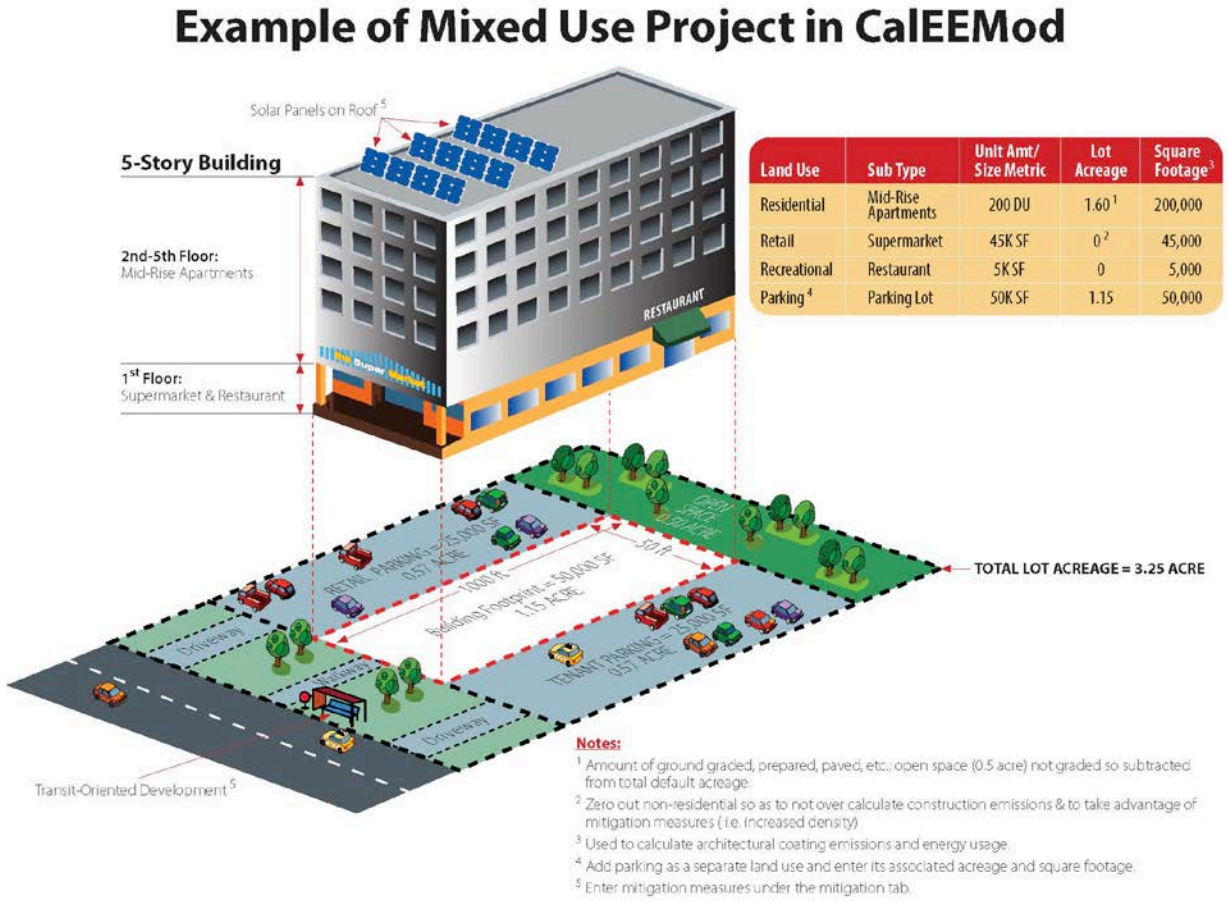


Table 2: Default Housing Density

Land Use Subtype	Density (Dwelling Units/Acre)
Single Family Housing	3
Apartments low rise	16
Apartments mid rise	38
Apartments high rise	62
Condo/townhouse	16
Condo/townhouse high rise	64
Mobile Home Park	8
Retirement Community	5
Congregate care (Assisted Living)	16

1. Based on the density assumed in ITE Trip Generation 8th Edition

After the user has completed entering all of land uses for the project, CalEEMod will add the lot

acreage values for each land use and the total will be reflected in the lot acreage text box located at the bottom of the screen. The value in the total lot acreage box cannot be modified by the user.

Square Footage

If actual square footage of the total building or building footprint is known, the user should override the default value.

Population

After the completing the tabs for unit amount, size metric, lot acreage, and square footage, the population field will contain a default which represents an estimate of the population for each land use type and subtype selected by the user. If the actual population data is known, the user should override the default value.

After the user has completed entering all of land uses for the project, CalEEMod will add the population values for each land use and the total will be reflected in the population text box located at the bottom of the screen. The value in the total population box cannot be modified by the user.

City Park/Golf Course Building Area Square Feet (text box)

If the user selects a City Park and/or Golf Course land use, a text box will appear at the bottom of the screen that will prompt the user to enter the building square footage of all the buildings that will be located on the City Park and/or Golf Course property (e.g., restrooms/changing rooms, pro-shop, etc.). The user must input site-specific building square footage data because there are no default values for building footprints on these types of land uses. If the building square footage is left blank (e.g., zero square feet), a warning message will appear to remind the user to enter a value in this field.

Recreational Swimming Pool Building Area Square Feet (text box)

If the user selects a Recreational Swimming Pool land use, a text box will appear at the bottom of the screen that will prompt the user to enter the building square footage of all the buildings that will be located on the property (e.g., restrooms/changing rooms, pro-shop, etc.). The user must input site-specific building square footage data because there is no default value for the building footprint on this type of land use. If the building square footage is left blank (e.g., zero square feet), a warning message appear to remind the user to enter a value in this field.

4.3 Construction

After completing the Land Use screen and clicking on the Next button, the Construction screen will appear along with seven tabs/sub-screens that cover the following construction topic areas: Construction Phase; Off-Road Equipment; Dust from Material Movement; Demolition; Trips and VMT, On-Road Fugitive Dust, and Architectural Coatings. To move from one tab/subscreen to another, the user can use the Next and Previous buttons, or click on any of grey tabs. The

construction tabs/sub-screens contain default information that was obtained from a survey of construction sites conducted by South Coast Air Quality Management District (SCAQMD). The construction survey data is grouped by construction phase and lot acreage and can be found in Appendix E1. The default construction equipment list and phase length data were determined to be the most appropriate for the size and types surveyed. In addition, some data in the survey was extrapolated to create default values for project sizes that were not in the survey. However, if the user has more detailed site-specific equipment and phase information, the user should override the default values.

4.3.1 Construction Phase

The Construction Phase tab is where the user can enter the type of each construction phase and the date range for each phase. . Default phases are based on the total lot acreage of the project. Depending on the project being modeled, not all phases may be necessary so the user may need to delete phases that are not applicable to the project. For example, not all projects require demolition. In addition, the user may need to add multiple phases of similar types for large projects with staged build out scenarios. It is important to note that if a project has demolition, grading, and site preparation phases, the user will need to provide additional project-specific data on the Demolition and Dust from Material Movement sub-screens.

Phase Name and Phase Type

The Phase Name and Phase Type fields will be automatically populated with the following default construction phases: Site Preparation; Demolition; Grading; Building Construction; Paving; and, Architectural Coating. The inclusion of any of these phases will define the types of calculations and default assumptions for on-road vehicle trips and fugitive emissions that occur in subsequent construction sub-screens. The definitions of the default phase types are as follows:

- *Demolition* involves removing buildings or structures.
- *Site Preparation* involves clearing vegetation (grubbing and tree/stump removal) and removing stones and other unwanted material or debris prior to grading.
- *Grading* involves the cut and fill of land to ensure that the proper base and slope is created for the foundation.
- *Building Construction* involves the construction of the foundation, structures and buildings.
- *Architectural Coating* involves the application of coatings to both the interior and exterior of buildings or structures, the painting of parking lot or parking garage striping, associated signage and curbs, and the painting of the walls or other components such as stair railings inside parking structures.
- *Paving* involves the laying of concrete or asphalt such as in parking lots, roads, driveways, or sidewalks.

Start Date and End Date

The user can enter with the aid of a calendar, the Start Date and End Dates for each construction phase. The default Start Date is the Start of Construction date defined on the Project Characteristics screen. The cells will be automatically populated with a default construction schedule starting with the Demolition phase, with subsequent phases starting the following day after the previous phase's end date. The user may change the defaults to alter the total days estimated for each phase. Because CARB's emission factors vary from year to year, when the user inserts the start and end dates for each construction phase, the model will select the correct emission factors for the year when each piece of off-road equipment will be utilized.

Days per Week

The user can select from a drop down box the number of days per week (either 5, 6, or 7 days) that construction will occur. Five days per week assumes that construction will occur from Monday through Friday, and six days per week assumes that construction will occur Monday through Saturday.

Total Days

The Total Days field is intended to indicate the number of days that it will take to complete a particular construction phase and this field is initially populated with default values. If the End Date or the Days per Week fields are changed, clicking the Total Days field will trigger a recalculation of the Total Days. If the Total Days field for any phase is changed, then once leaving this field, the program will automatically adjust the End Date based on the Start Date for that phase.

4.3.2 Off-Road Equipment

The Off-Road Equipment tab is for the user to select the type and quantity of off-road equipment needed for each construction phase and to define the daily usage schedule. Since equipment lists can be lengthy and vary widely for each construction phase, the user will need to first select the phase from Phase Name drop down list or by clicking on the Previous or Next buttons located next to the phase name, and then select the off-road equipment that will be used for each construction phase. The Off-Road Equipment screen calculates emissions based on the expected off-road equipment engine use for each piece of equipment listed over the duration of the phase length. It is important to note that fugitive emissions from off-road equipment are calculated elsewhere on other construction screens.

After the user enters the Equipment Type, Number of Units, and Hours per Day for each piece of equipment that will be used in any phase, The Horsepower and Load Factor fields will be automatically populated with the default average values from CARB's OFFROAD2011., If equipment-specific information is available, the user can override these default values. In some cases, CARB's OFFROAD2011 emission factors are not available for all years. Thus, if the user selects a construction year that does not have corresponding emission factors, CalEEMod has been programmed to substitute the emissions factors from nearest, lower end (e.g., oldest) year. For example, if construction will occur in year 2037 (a year which does not have emission factors), CalEEMod will substitute the emission factors from year 2035 instead. Since newer

equipment tends to have less emissions than older equipment, by selecting emission factors from year 2035 (an older year), the calculations may result in a conservative, slight overestimate of emissions.

If the project requires the use of off-road equipment that is not specifically listed in the drop down list, the user can select from three generalized equipment categories to add customized equipment to the analysis: 1) Other Construction Equipment; 2) Other General Industrial Equipment; and, 3) Other Material Handling Equipment. In addition, the user may choose to select a surrogate equipment type which has a similar horsepower rating and load factor. To include water trucks and cement trucks in the analysis, the user needs to first determine if these trucks are off-road or on-road vehicles. If they are only driven off-road, then the user can select the Off-Highway Trucks category in the Off-Road Equipment screen. If the trucks are driven on-road, the user can account for the on-road emissions by entering this information as Additional Vendor Trips on the Trips and VMT screen (see Subchapter 4.3.5).

4.3.3 Dust from Material Movement

The Dust from Material Movement sub-screen is intended for calculating fugitive dust emissions associated with the Site Preparation and Grading phases (defaults) during construction. This sub-screen calculates the following three types of fugitive dust: 1) fugitive dust from dozers moving dirt; 2) fugitive dust from graders or scrapers leveling the land; and; 3) fugitive dust from loading or unloading dirt into haul trucks. These methods have been adapted from USEPA's AP-42 method for Western Coal Mining. Once the enters the amount of material imported and exported to the site, CalEEMod will estimate the number of hauling trips associated with from material transport activities. The user may define the units in terms of Ton of Debris or Cubic Yards. The user may also select whether the import/export of material is phased (e.g., a the same truck that arrives with material departs with another load of material to export in one round trip or two-one way trips. The calculations for non-phased material import/export trips assume that one truck arrives empty and departs full and a different truck arrives full for a total of two round trips (or four one-way trips). Thus, phasing material import and export trips reduces the number of haul trips.

The Total Acres Graded field represents the cumulative distance traversed on the property by the grading equipment, assuming a blade width of 12 feet. In order to properly grade a piece of land, multiple passes with grading equipment may be required. So even though the lot size is a fixed number of acres, the Total Acres Graded could be an order of magnitude higher than the footprint of the lot and is calculated based on the equipment list (including number of equipment), the number of days need to complete the grading and/or site preparation phase, and the maximum number of acres a given piece of equipment can traverse in an 8-hour workday. For more information regarding how Dust from Material Movement is calculated, including grading rates, see Appendix A, Subchapter 4.3.

4.3.4 Demolition

The Demolition sub-screen is intended for the user to enter the amount of material that is demolished, if a demolition phase is selected by the user as part of the construction project.

The user can select the Size Metric to define the amount of demolished material that is expected to be generated during the demolition phase in terms of Ton of Debris or Building Square Footage. With this data, fugitive dust emissions generated during demolition are calculated. The calculation of fugitive dust emissions during demolition is derived from the methodology described in the report prepared for the USEPA by Midwest Research Institute, Gap Filling PM_{10} Emission Factors for Selected Open Area Dust Sources.

4.3.5 Trip and VMT

The Trip and VMT sub-screen is used to provide the number and length (in terms of vehicle miles traveled or VMT) of on-road vehicle trips for workers, vendors, and hauling for each construction phase. Depending on the land use type and subtype combined with the various construction phases, CalEEMod will populate the fields for Number of Trips, Trip Length, and Vehicle Class for worker, vendor and haul trips, respectively, with default values. The vehicle class descriptor HHDT, MHDT means that there is a 50/50 percent mix of heavy-heavy duty trucks and medium-heavy duty trucks. Similarly, the vehicle class descriptor LDA, LDT1, LDT2 means that there is a 50/25/25 percent mix of light duty autos, light duty truck class 1 and light duty truck class 2, respectively. The user may override the defaults and enter different weightings of vehicle fleet mixes. It is important to note that if the user selects a construction year that does not have corresponding EMFAC2014 emission factors for on-road vehicles, CalEEMod has been programmed to substitute the emissions factors from nearest, lower end (e.g., oldest) year. For example, if construction will occur in year 2037 (a year which does not have emission factors), CalEEMod will substitute the emission factors from year 2035 instead. Since newer equipment tends to have less emissions than older equipment, by selecting emission factors from year 2035 (an older year), the calculations may result in a conservative, slight overestimate of emissions.

CalEEMod quantifies the number of construction workers by multiplying 1.25 times the number of pieces of equipment for all phases (except Building Construction and Architectural Coating). For the Building Construction, the number of workers is derived from a study conducted by the Sacramento Metropolitan Air Quality Management District (SMAQMD) which determined the number of workers needed for various types of land uses and corresponding project size. This study and its analysis are included in Appendix E2. For the Architectural Coating phase, the number of workers is approximately 20% of the number of workers needed during the Building Construction phase.

The number of vendor trips during the Building Construction phase is also derived from a study conducted by the SMAQMD. The SMAQMD trip survey during construction counted cement and water trucks as vendor trips (instead of counting them as off-road vehicle trips) and these trip rates were incorporated into the calculations for the Building Construction phase. If the user deletes the Building Construction phase from the analysis, but the project will require water and/or cement trucks, then the user will need to account for these either as vendor trips under another construction phase or under the Off-Road equipment screen.

The default values for hauling trips are based on the assumption that a truck can haul 20 tons (or 16 cubic yards) of material per load. If one load of material is delivered, CalEEMod assumes that one haul truck importing material will also have a return trip with an empty truck (e.g., 2 one-way trips). Similarly, a haul truck needed to export material is assumed to have an arrival trip in an empty truck and a loaded departure truck (e.g., 2 one-way trips). Thus, each trip to import and export material is considered as two separate round trips (or 4 one-way trips). However, if the Phase box is checked, the same haul truck that imported the material will be assumed to be the same haul truck that export material resulting in one round trip (or 2 one-way trips).

4.3.6 On-Road Fugitive Dust

The On-Road Fugitive Dust sub-screen defines the variables that will be used to determine the fugitive dust emissions from on-road vehicles driving over paved and unpaved roads during construction. CalEEMod automatically populates the data fields based on the construction phase. The calculations use emission factors from USEPA's AP-42 for paved roads (January 2011 edition) and unpaved roads (November 2006 edition). Each data field is the same as those defined in the aforementioned AP-42 sections.

4.3.7 Architectural Coatings

The Architectural Coatings sub-screen is intended to calculate ROG emissions associated with painting the interior/exterior of residential and non-residential buildings as well as calculate emissions from parking lot painting or striping. The user may override any of the default interior and exterior surface areas estimated for residential and non-residential buildings. In addition, each of these surface types has a different emission factor indicating the ROG content of the paint in grams per liter (g/L). It is important to note that the parking area square footage is not included in the non-residential interior/exterior square footage when calculating emissions attributable to parking lot striping. See Appendix A, Subchapter 4.7 for the methodology of estimating surface areas to be coated from building square footage.

4.4 Operational Mobile

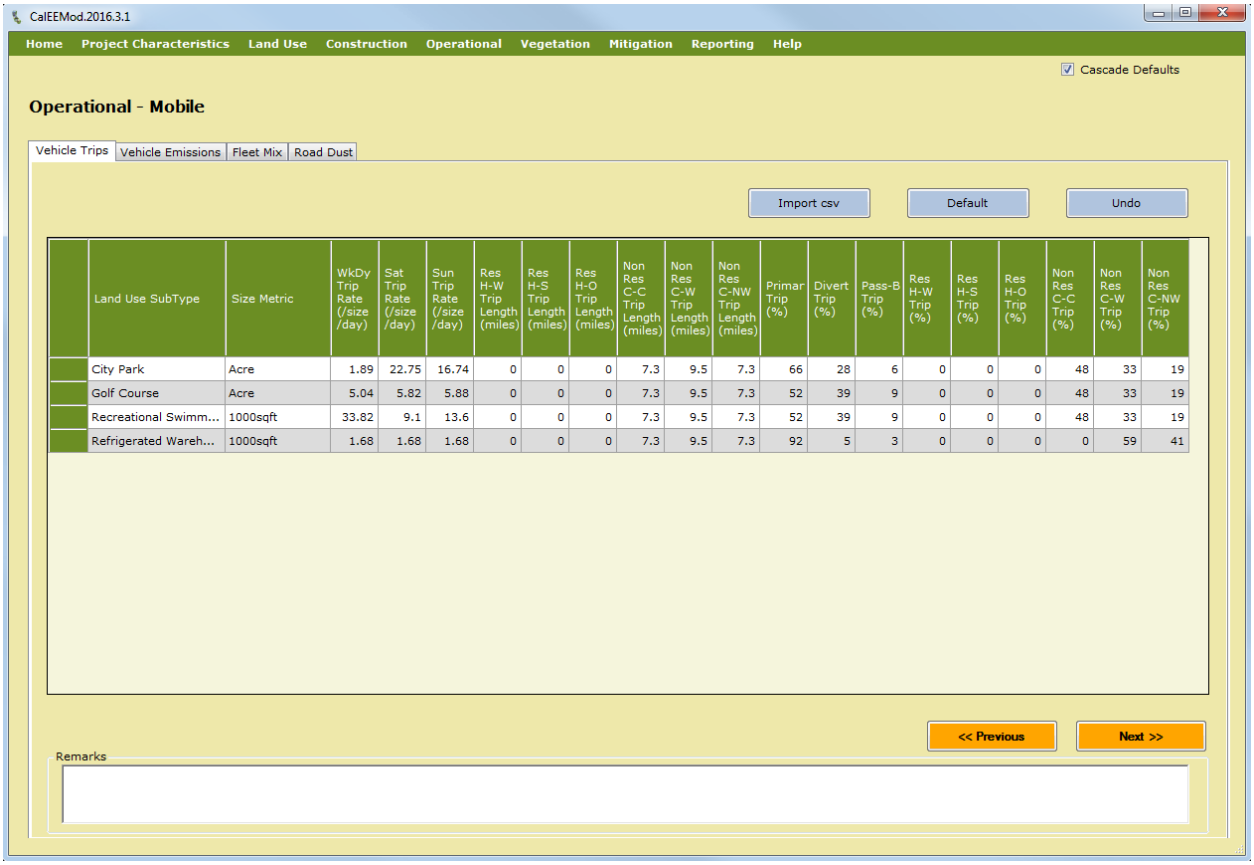
The operational mobile screen is made up of four sub-screens: Vehicle Trips, Vehicle Emissions, Fleet Mix and Road Dust. These screens are used in defining the information necessary to calculate the emissions associated with operational on-road vehicles.

4.4.1 Vehicle Trips

This sub-screen includes the trip rates, trip lengths, trip purpose, and trip type percentages for each land use subtype in the project. The user can edit any of this information by entering a new value in the appropriate cell. Trip rates are in terms of the size metric (thousand square footage or dwelling unit) defined on the land use screen and are listed for weekday, Saturday and Sunday if available. Trip lengths are for primary trips. Trip purposes are primary, diverted, and pass-by trips. Diverted trips are assumed to take a slightly different path than a primary trip and are assumed to be 25% of the primary trip lengths. Pass-by trips are assumed to be 0.1 miles in length and are a result of no diversion from the primary route. Residential trip types are

defined as home-work (H-W), home-shop (H-S), and home-other (H-O). Non-residential trip types are defined as commercial –customer (C-C), commercial-work (C-W), and commercial-nonwork (C-NW) such as delivery trips. Appendix A includes the equations and methodology used to calculate motor vehicle emissions from the operation of a project.

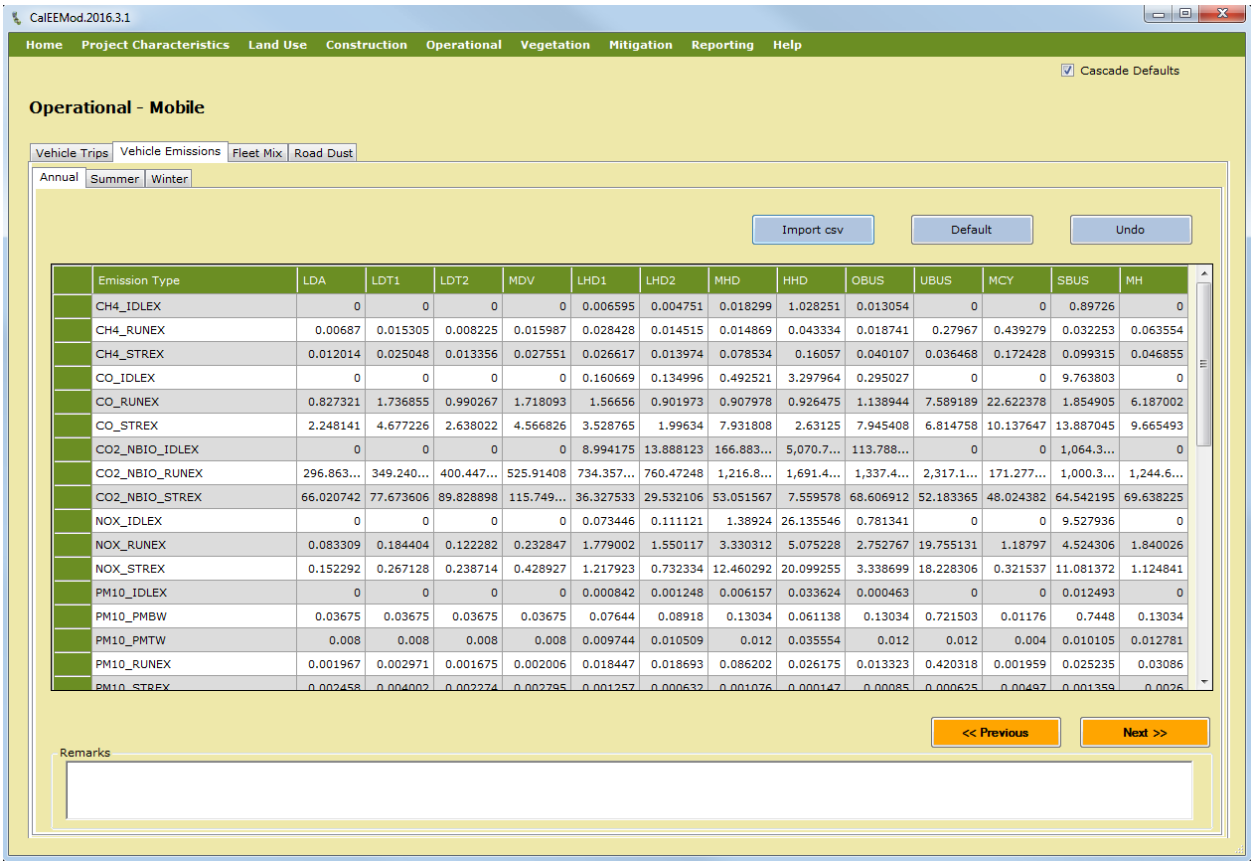
The trip rates are based on ITE 9th edition average trip rates for the respective land use categories.



4.4.2 Vehicle Emissions

This sub-screen contains the detailed vehicle emission factors based on EMFAC2014. Appendix A includes the description of how these emission factors were derived from EMFAC2014. It is anticipated that most users will not edit data in this sub-screen. There are separate tabs for annual, summer, and winter emissions values. If the user wants to alter the breakdown of fuel types (catalytic, non-catalytic, and other) within a vehicle class, they will have to provide their own data. This will likely be an infrequent change due to CEQA enforceability requirements.

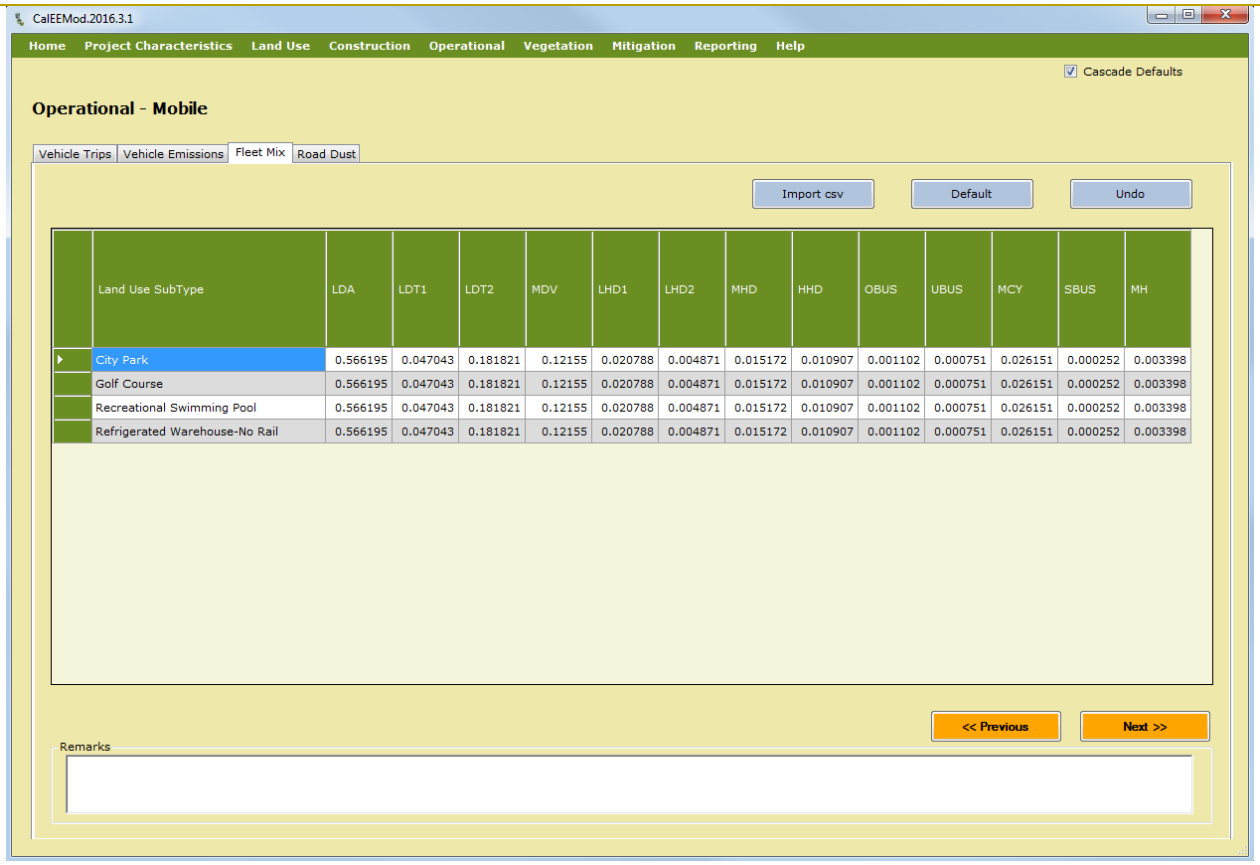
This screen along with the previous screen (Vehicle Trips) and next screen (Fleet Mix) will provide the data for the model to calculate the emissions associated with on-road motor vehicle use. The calculation does not include the fugitive dust emissions from travel over roads as these are associated with the next screen (Road Dust).



Emission Type	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
CH4_IDLEX	0	0	0	0	0.006595	0.004751	0.018299	1.028251	0.013054	0	0	0.89726	0
CH4_RUNEX	0.00687	0.015305	0.008225	0.015987	0.028428	0.014515	0.014869	0.043334	0.018741	0.27967	0.439279	0.032253	0.063554
CH4_STREX	0.012014	0.025048	0.013356	0.027551	0.026617	0.013974	0.078534	0.16057	0.040107	0.036468	0.172428	0.099315	0.046855
CO_IDLEX	0	0	0	0	0.160669	0.134996	0.492521	3.297964	0.295027	0	0	9.763803	0
CO_RUNEX	0.827321	1.736855	0.990267	1.718093	1.56656	0.901973	0.907978	0.926475	1.138944	7.589189	22.622378	1.854905	6.187002
CO_STREX	2.248141	4.677226	2.638022	4.566826	3.528765	1.99634	7.931808	2.63125	7.945408	6.814758	10.137647	13.887045	9.665493
CO2_NBIO_IDLEX	0	0	0	0	8.994175	13.888123	166.883...	5,070.7...	113.788...	0	0	1,064.3...	0
CO2_NBIO_RUNEX	296.863...	349.240...	400.447...	525.91408	734.357...	760.47248	1,216.8...	1,691.4...	1,337.4...	2,317.1...	171.277...	1,000.3...	1,244.6...
CO2_NBIO_STREX	66.020742	77.673606	89.828898	115.749...	36.327533	29.532106	53.051567	7.559578	68.606912	52.183365	48.024382	64.542195	69.638225
NOX_IDLEX	0	0	0	0	0.073446	0.111121	1.38924	26.135546	0.781341	0	0	9.527936	0
NOX_RUNEX	0.083309	0.184404	0.122282	0.232847	1.779002	1.550117	3.330312	5.075228	2.752767	19.755131	1.18797	4.524306	1.840026
NOX_STREX	0.152292	0.267128	0.238714	0.428927	1.217923	0.732334	12.460292	20.099255	3.338699	18.228306	0.321537	11.081372	1.124841
PM10_IDLEX	0	0	0	0	0.000842	0.001248	0.006157	0.033624	0.000463	0	0	0.012493	0
PM10_PMBW	0.03675	0.03675	0.03675	0.03675	0.07644	0.08918	0.13034	0.061138	0.13034	0.721503	0.01176	0.7448	0.13034
PM10_PMTW	0.008	0.008	0.008	0.008	0.009744	0.010509	0.012	0.035554	0.012	0.012	0.004	0.010105	0.012781
PM10_RUNEX	0.001967	0.002971	0.001675	0.002006	0.018447	0.018693	0.086202	0.026175	0.013323	0.420318	0.001959	0.025235	0.03086
PM10_STREX	0.002458	0.004002	0.002274	0.002795	0.001257	0.000632	0.001076	0.000147	0.00085	0.000625	0.00497	0.001359	0.0026

4.4.3 Fleet Mix

CalEEMod Version 2016.3.1 separates the fleet mix from the Vehicle Emissions screen and creates a Fleet Mix screen so that users are able to change default fleet mix associated with different land use subtypes.



4.4.4 Road Dust

This sub-screen is used to change any of the default values that are used in the USEPA's AP-42 methods for calculating fugitive emissions from paved and unpaved roads. The defaults for the road dust (e.g., material silt content, material moisture content, and mean vehicle speed) are statewide averages, but the user has the ability to override the defaults if data specific to the project is known. Local jurisdictions can also provide guidance to users as to what default properly reflects known regional road dust parameters.

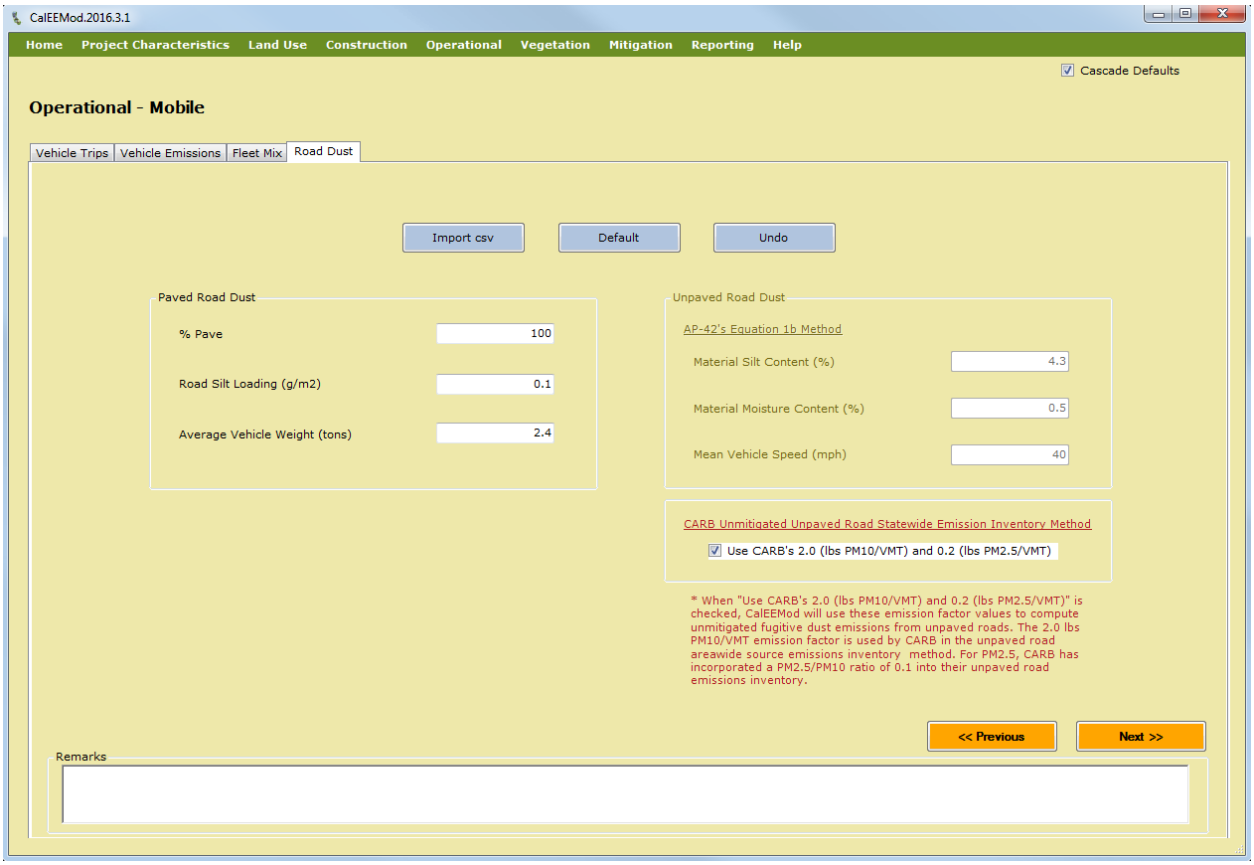
For the San Luis Obispo region, the user is recommended to provide the following unpaved road dust parameters overriding the statewide defaults if users choose to use USEPA's AP-42 methods:

9.3 for Material Silt Content (%) *(instead of 4.3 statewide default)*

0.1 for Material Moisture Content (%) *(instead of 0.5 statewide default)*

32.4 for Mean Vehicle Speed (mph) *(instead of 40 statewide default)*

For San Luis Obispo County APCD and Sacramento Metropolitan AQMD, the user has a new default option in CalEEMod Version 2016.3.1 to use CARB's 2.0 lbs PM_{10}/VMT[9] as the unmitigated fugitive dust emission factor for unpaved roads during the operational phase. An emission factor of 0.2 lbs $PM_{2.5}$/VMT is applied based on a 10% $PM_{2.5}$/ PM_{10} ratio[10, 11]. By checking the box, the program will use CARB's emission factor to override the calculated emission factor based on USEPA AP-42. Note: For project locations other than San Luis Obispo County APCD and Sacramento Metropolitan AQMD, CARB's 2.0 lbs PM_{10}/VMT is not a selection option.



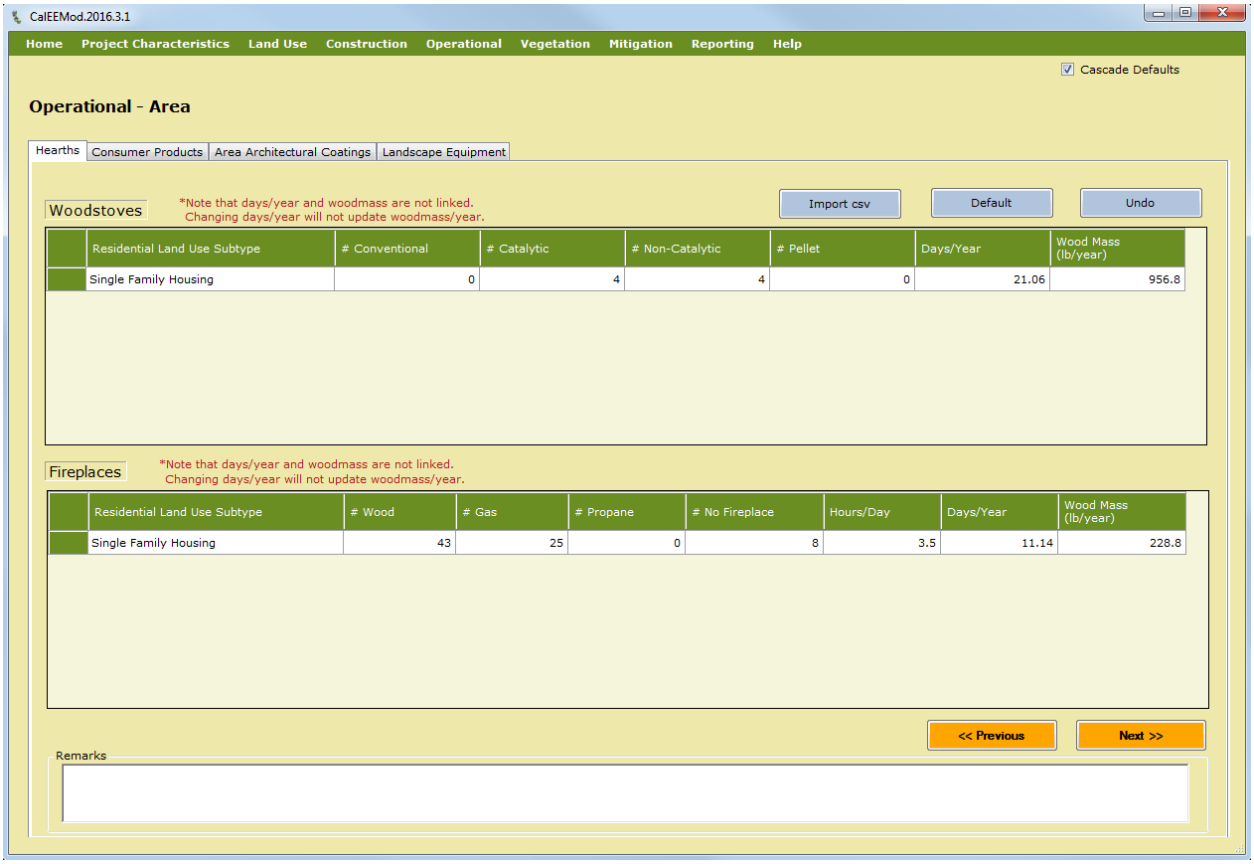
4.5 Area

The area source screen consists of four sub-screens: Hearths, Consumer Products, Area Architectural Coatings, and Landscaping Equipment. Natural gas emission variables from all uses except hearths are included in the energy use screen (described in Section 4.6).

9 Available at: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-10.pdf
10 Available at: http://www3.epa.gov/ttnchie1/ap42/ch13/related/mri_final_fine_fraction_dust_report.pdf
11 Available at: http://www.arb.ca.gov/app/emsinv/emssumcat_query.php?F_YR=2015&F_DIV=-4&F_SEASON=A&SP=2009&F_AREA=CA#0

4.5.1 Hearths and Woodstoves

This sub-screen allows the user to enter the number of woodstoves and hearths of various types as well as the usage of these devices. Woodstoves are separate from fireplaces since a home may have both and these devices may have different use patterns. The number of devices that is entered for each device type represents the total number of devices installed in the dwelling units for a particular land use. Appendix A contains the emissions calculation methodology and details of variables that the user cannot override. Some of these emissions may be classified as biogenic and are therefore reported as CO_2-Biogenic. For most locations a default percent of hearths and stoves was provided by air districts and is multiplied through. The number of devices was chosen to include in CalEEMod instead of a percentage to allow for incorporation of various air district rules regarding hearths and woodstoves in new residences without having specialized data entry screens. Commercial land uses by default do not have hearths or woodstoves in CalEEMod. These are included for those cases where they may occur such as in restaurants or hotels.



The San Joaquin Valley jurisdiction has a regulatory limit on the number of hearths depending upon the type and number of residential development. The regulatory limit is generated by CalEEMod but all the input parameters (e.g., unit density, etc.) are necessary to determine the value. Thus, the regulatory limit is disclosed during the reporting stage under the Default Value

box in the report. The model, however, calculates emission impacts from the number of hearths inputted on the Area source screen (listed under the New Value column in the report). Therefore, if the user wants to calculate emissions from regulatory limit, the report needs to be run to determine the regulatory limit and the user needs to go back to the Area Source screen to input that value and re-run the report. If the user chooses to calculate emissions from a different number of hearths (e.g., a number of hearths less than the regulatory limit), then that number needs to be inputted on the Area Source screen to properly calculate emissions. Again, the report will provide the regulatory limit under the Default Value column and the user input value under New Value column.

4.5.2 Consumer Products

Consumer products are various solvents used in non-industrial applications which emit ROGs during their product use. These typically include cleaning supplies, kitchen aerosols, cosmetics and toiletries. SCAQMD has developed an emission factor based on the total of all building square footage for both residential and non-residential buildings. Details of how this emission factor was developed can be found in Appendix E. The user can change this emission factor if they have more relevant data. CalEEMod Version 2016.3.1 separates ROG emissions from pesticides/fertilizers for City Parks and Golf Courses and ROG emissions from parking surface degreasers from the general category consumer products. CalEEMod Version 2016.3.1 also assumes that there would be no ROG emissions from the actual pool surface area for Recreational Swimming Pools because the chemicals used for maintaining pools are not considered to be ROGs. Details of how the ROG emission factors for pesticides/fertilizers and parking surface degreasers were determined can be found in Appendix E.

4.5.3 Area Architectural Coatings

This sub-screen has text boxes for the reapplication rate and coating ROG content for each building surface type and parking surface. The reapplication rate is the percentage of the total surface area that is repainted each year. A default of 10% is used, meaning that 10% of the surface area is repainted each year (i.e., all surface areas are repainted once every 10 years). Daily emissions divide the annual rate by 365 days per year. This is based on assumptions used by SCAQMD in their district rules regarding architectural coatings. Some districts provided details on their coating regulations that phase-in over time, which have been incorporated to the extent feasible, given the general classifications of paint (interior or exterior for residential and non-residential). Coating ROG content from state regulations are used for air districts that did not provide specific architectural coating information. Consult your local air district for suggested values that may be lower than the state regulations.

The ROG contents under the Operational Area Architectural Coatings screen (either CalEEMod defaults or site-specific values defined by users) become the default ROG contents for the Area Mitigation screen. The user may check the box under the Area Mitigation screen and specify a lower ROG content limit.

4.5.4 Landscape Equipment

This sub-screen has two text boxes to show the number of snow days or summer days. In addition, the defaults consider a realistic number of days which the landscaping equipment would be operated. For example, landscaping at commercial facilities typically do not take place during a weekend or during the summer at educational facilities that are not open. The number of days are applied to the appropriate landscape equipment types available in OFFROAD2011 using the average horsepower and load factors of the population mode. The derivation of emission factors used for each equipment type from OFFROAD2011 is described in Appendix A.

4.6 Energy Use

The energy use screen is used to gather the information necessary to estimate the emissions associated with building electricity and natural gas usage (non-hearth). The electricity energy use is in units of kilowatt hours (kWh) per size metric for each land use subtype. Natural gas use is in units of a thousand British Thermal Units (kBTU) per size metric for each land use subtype.

Title 24 of the California Code of Regulations, known as the California Building Standards Code or Title 24, contains energy conservation standards applicable to all residential and non-residential buildings throughout California. With CalEEMod, building electricity and natural gas use is divided into two categories: 1) end uses subject to Title 24 standards; and, 2) end uses not subject to Title 24 standards. The distinction is used when the mitigation measure for exceeding Title 24 standards (BE-1) is applied. Lighting is also a separate category in CalEEMod for which a separate mitigation measures (LUT-1) may be applied for using energy efficient lighting.

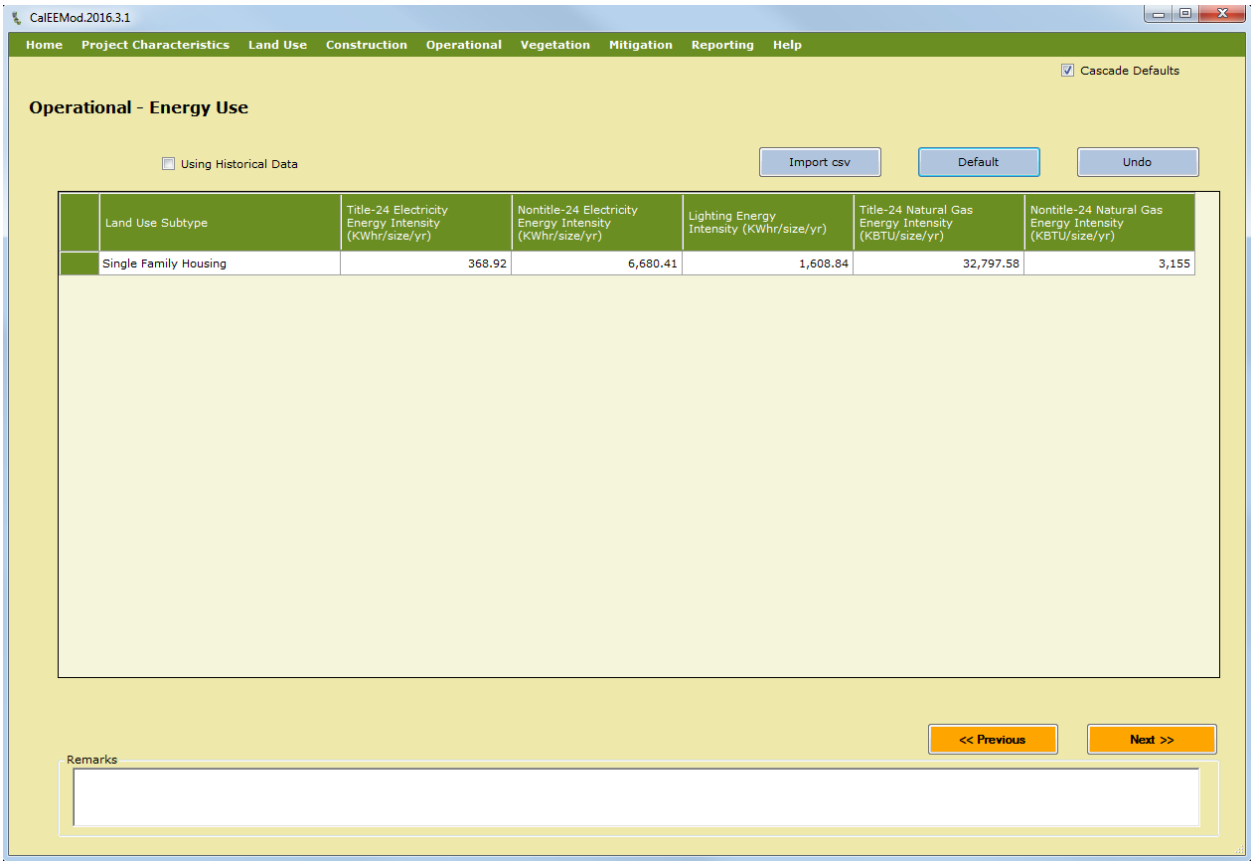
For electricity, Title 24 uses include the major building envelope systems covered by Part 6 (California Energy Code) of Title 24 such as space heating, space cooling, water heating, and ventilation. Non-Title 24 uses include all other end uses, such as appliances, electronics, and other miscellaneous plug-in uses. Because some lighting is not considered as part of the building envelope energy budget, and since a separate mitigation measure is applicable to this end use, CalEEMod makes lighting a separate category.

For natural gas, uses are likewise categorized as Title 24 or Non-Title 24, with Title 24 uses including building heating and hot water end uses. Non-Title 24 natural gas uses include cooking and appliances (including pool/spa heaters).

The baseline values are based on the CEC sponsored California Commercial End Use Survey (CEUS) and Residential Appliance Saturation Survey (RASS) studies[12]. For climate zones not included in these surveys, data from the closest climate zone was used as a surrogate. Since these studies are based on older buildings, adjustments have been made to account for

12 CEC. October 2010. Residential Appliance Saturation Survey. Available at: http://www.energy.ca.gov/appliances/rass
CEC. March 2006. Commercial End-Use Survey. Available at: http://www.energy.ca.gov/ceus/

changes due to Title 24 building codes as described in Appendix E. The user should select the use historical box if they only want an adjustment to the 2005 standards which were in effect when CARB developed its Scoping Plan 2020 No Action Taken predictions. After selecting the historical button, the user must also click the default button to load the historical default values.



4.7 Water and Wastewater Use

This screen estimates the land uses contribution of GHG emissions associated with supplying and treating water and wastewater. This screen is used to enter the amount of water in gallons used indoors and outdoors for each land use subtype[13]. The indoor water is also used to

13 Gleick, P.H.; Haasz, D.; Henges-Jeck, C.; Srinivasan, V.; Cushing, K.K.; Mann, A. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California. Published by the Pacific Institute for Studies in Development, Environment, and Security. Full report available at: http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf. Appendices available at: http://pacinst.org/publication/waste-not-want-not/

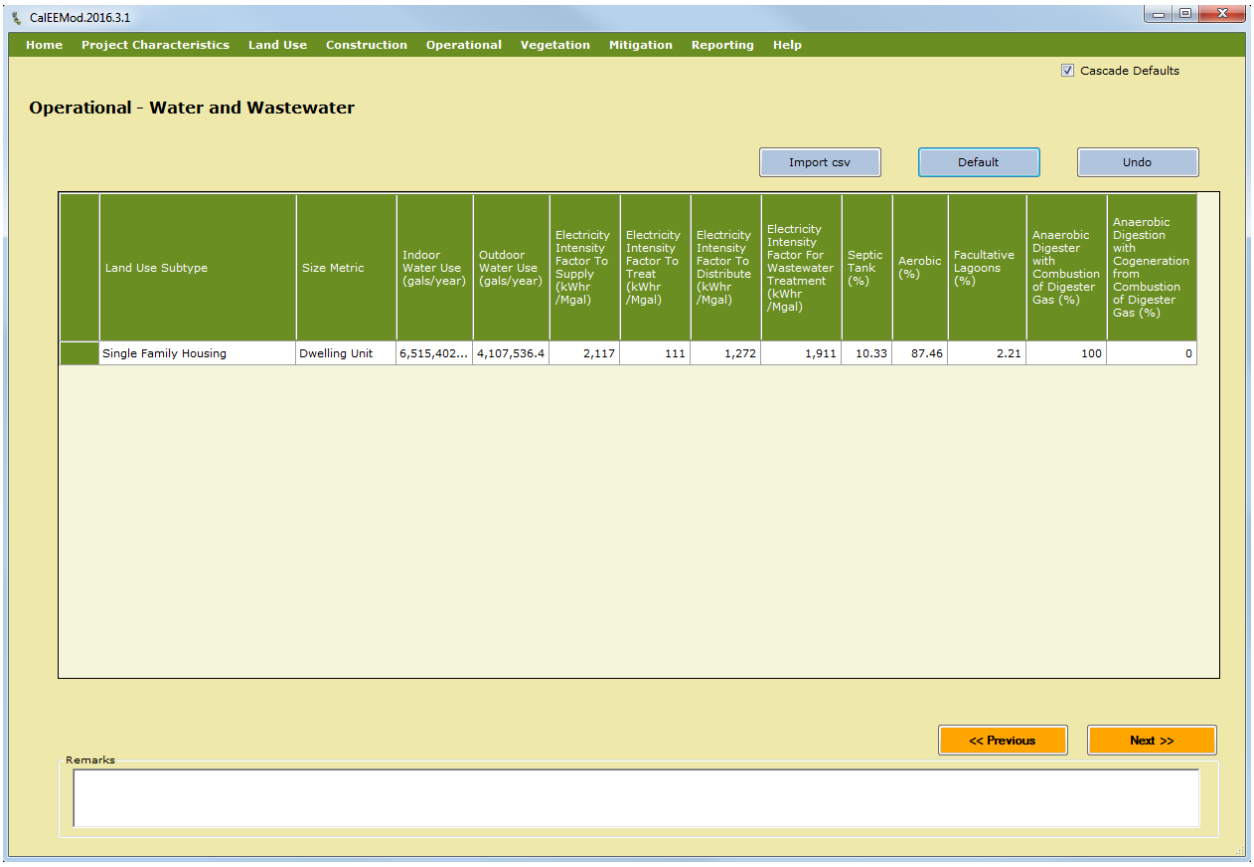
Dziegielewski; B.; Kiefer, J.C.; Optiz, E.M.; Porter, G.A.; Lantz, G.L.; DeOreo, W.B.; Mayer, P.W.; Nelson, J.O. 2000. Commercial and Institutional End Uses of Water. Published by the American Water Works Association Research Foundation.

Northern California Golf Association. Improving California Golf Course Water Efficiency. Available at: http://www.water.ca.gov/wateruseefficiency/docs/2004Apps/2004-079.pdf

estimate the amount of wastewater. The electricity intensity factor for various phases of providing water is provided. Depending on the specific water supply used or treatment method used these numbers can vary over a wide range. Supplying water is bringing the water from its primary source such as the ground, river, or snowpack to the treatment plant. Distributing the water is bringing the water from the treatment plant to the end users. The electricity intensity factors are multiplied by the utility GHG emissions intensity factors for the GHGs and are classified as indirect emissions. The default electricity intensity is from the CEC's 2006 Refining Estimates of Water-Related Energy Use in California using the average values for Northern and Southern California[14]. The location will automatically select the appropriate values if using these defaults. Since the electricity can vary greatly based on locations, the user should override these values if they have more specific information regarding their specific water supply and treatment.

Wastewater may also have direct emissions of GHGs. These depend on the type of wastewater treatment system (e.g., septic, aerobic or lagoons) used and therefore the wastewater treatment type percentages are variables. In addition, the model calculates impacts if the solids are digested either through an anaerobic digester or with co-generation from combustion of digester gas. Each type has associated GHG emission factors. Some of these may be classified as biogenic. Not all of the biogenic emissions are accounted for since there are not adequate emissions factors at this time. Refer to Appendix A on how to properly change the defaults, if necessary, and the methodology used to calculate impacts from wastewater treatment.

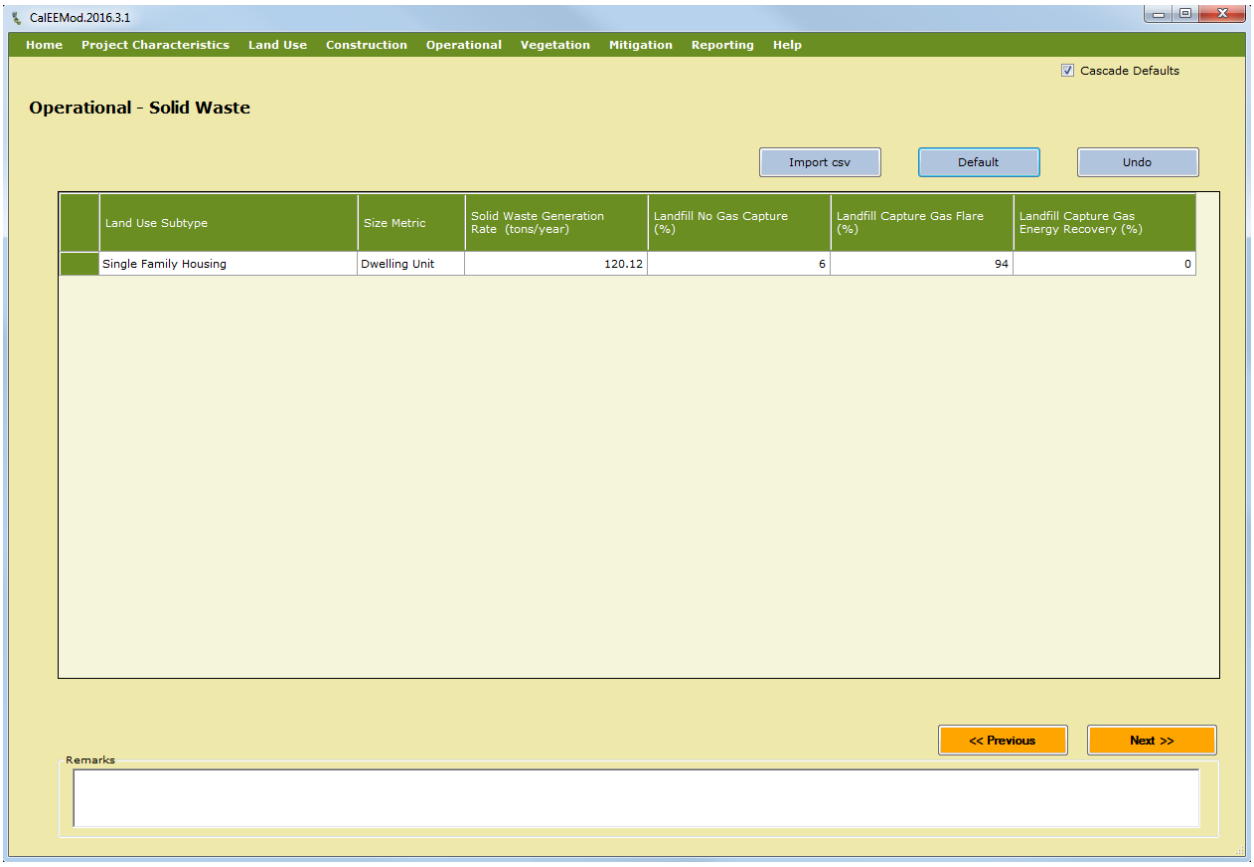
[14] CEC-500-2006-118. Available at http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.



4.8 Solid Waste

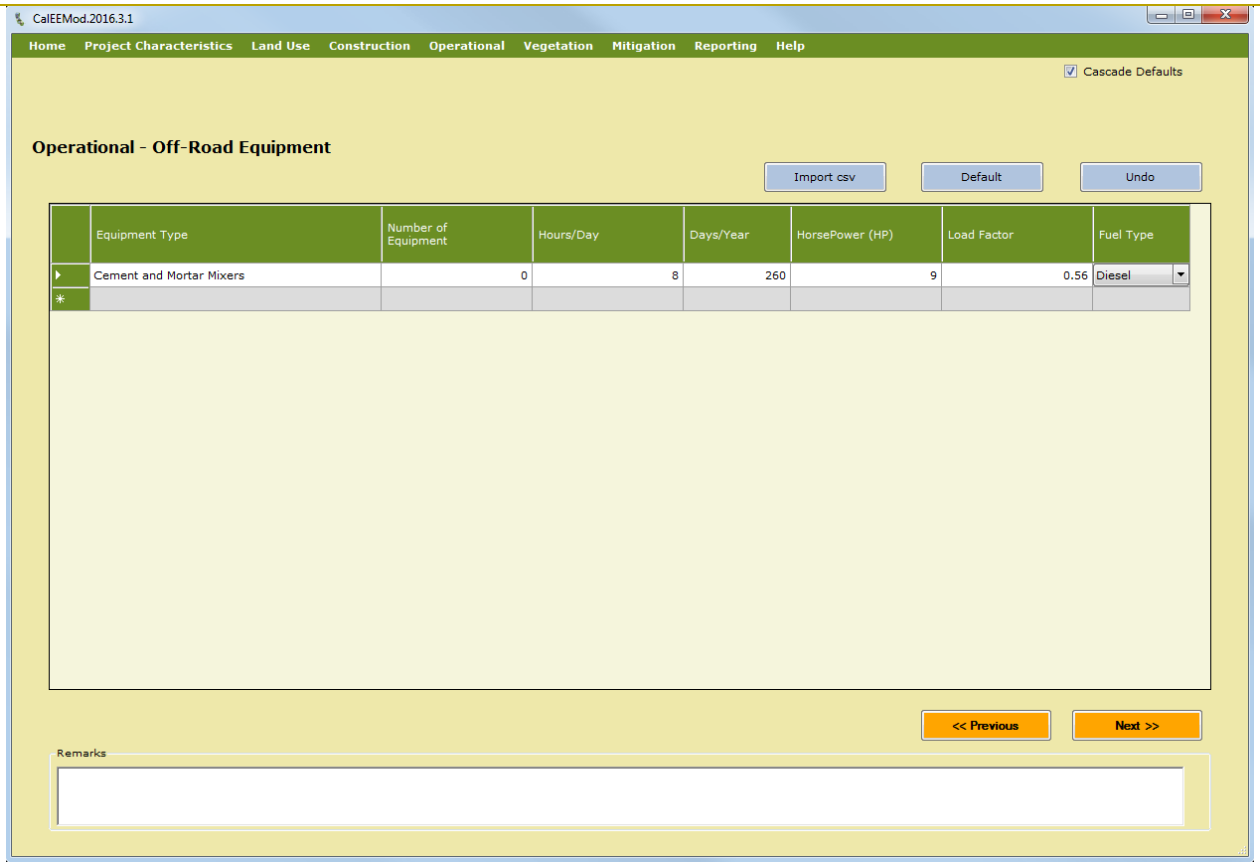
The solid waste screen determines the GHG emissions associated with disposal of solid waste into landfills. In order to estimate the eventual contribution of GHG emissions from solid waste disposed by a land use annually, the total amount of carbon dioxide and methane that would be evolved over the span of many years is calculated. This is based on the IPCC's methods for quantifying GHG emissions from solid waste using the degradable organic content of waste[15]. Waste disposal rates by land use and overall composition of municipal solid waste in California is primarily based on CalRecycle data. The amount of methane emitted depends on characteristics of the landfill, and therefore the default percentage is based on the types of landfills assumed by CARB in their GHG emissions inventories. Portions of these emissions are biogenic. The defaults for the gas capture (e.g., no capture, flaring, energy recovery) are statewide averages except for Santa Barbara APCD which has a 100% landfill capture gas flare. The user has the ability to override the defaults if the gas capture at the landfill to be used by the project is known. Local jurisdictions can also provide guidance to users as to what default properly reflects known regional solid waste gas capture.

15 IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5 Waste. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.



4.9 Off-Road Equipment

The Operational - Off-Road Equipment sub-screen allows the user to identify any off-road equipment used during operational activities (e.g., forklifts, cranes, loaders, generator sets, pumps, pressure washers, etc.) at the project site. Because such equipment cannot be assumed to be needed for a particular land use project, a user must provide the data in order for CalEEMod to calculate the resulting emissions from off-road equipment operation. A dropdown list of off-road equipment is provided for the user to identify each piece of equipment. The model requires the following specific information per equipment type. The user would need to provide the number of pieces for each equipment type. The model assumes an operation activity of 8 hours per day and 260 days per year, as well as the horsepower and load factor of the equipment type, but the user has the ability to override the default assumptions with project specific information. Finally, the model assumes diesel fuel, but a dropdown menu is provided to allow the user to choose bio-diesel, compressed natural gas (CNG) or electrical if known, to power the equipment.

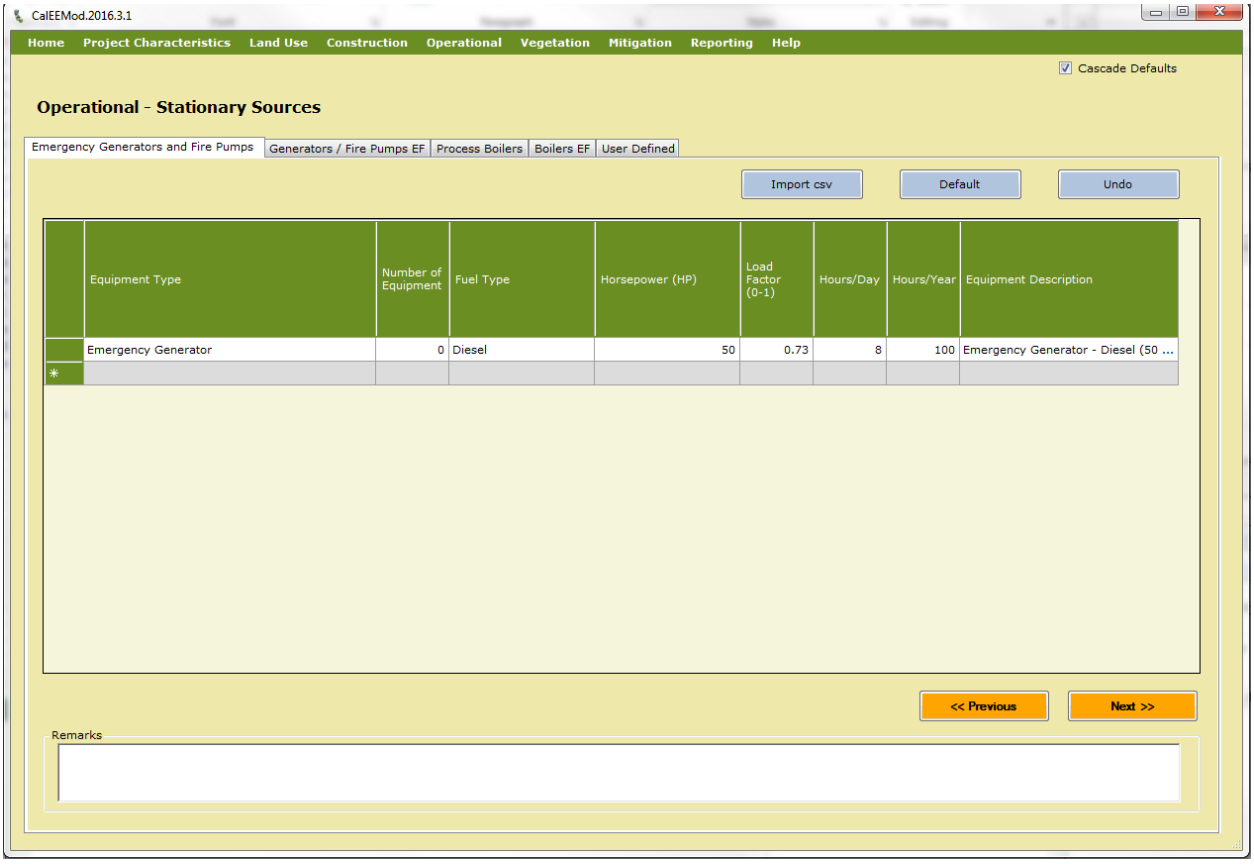


4.10 Stationary Sources

The Stationary Sources screen consists of five sub-screens: Emergency Generators and Fire Pumps and their default emission factors, Process Boilers and their default emission factors, and User Defined Sources. Consult with the local air district to determine if permitted stationary sources should be included in the project analysis using CalEEMod.

4.10.1 Emergency Generator and Fire Pumps and Default Emission Factors

Two sub-screens allow the user to enter emergency power generators and diesel fueled fire pumps and to estimate emissions. This type of equipment operates only for maintenance and testing, or during emergency situations, such as power failures. To calculate emissions, the user must enter the engine rating (in horsepower), the anticipated maximum daily usage, and the anticipated maximum annual usage into the Emergency Generators and Fire Pumps sub-screen. The user may change the default load factor. The default emission factors for the equipment are shown on the separate Generators/Fire Pumps EF (emission factor) sub-screen. The user can replace the default emission factors, but needs to provide custom emission factors in the predefined units. See Appendix A for the sources of default emission factors and emission calculation methodology.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Boilers EF
User Defined
Import csv
Default
Undo
Equipment Type
Number of Equipment
Fuel Type
Horsepower (HP)
Load Factor (0-1)
Hours/Day
Hours/Year
Equipment Description
Emergency Generator
0
Diesel
50
0.73
8
100
Emergency Generator - Diesel (50 ...
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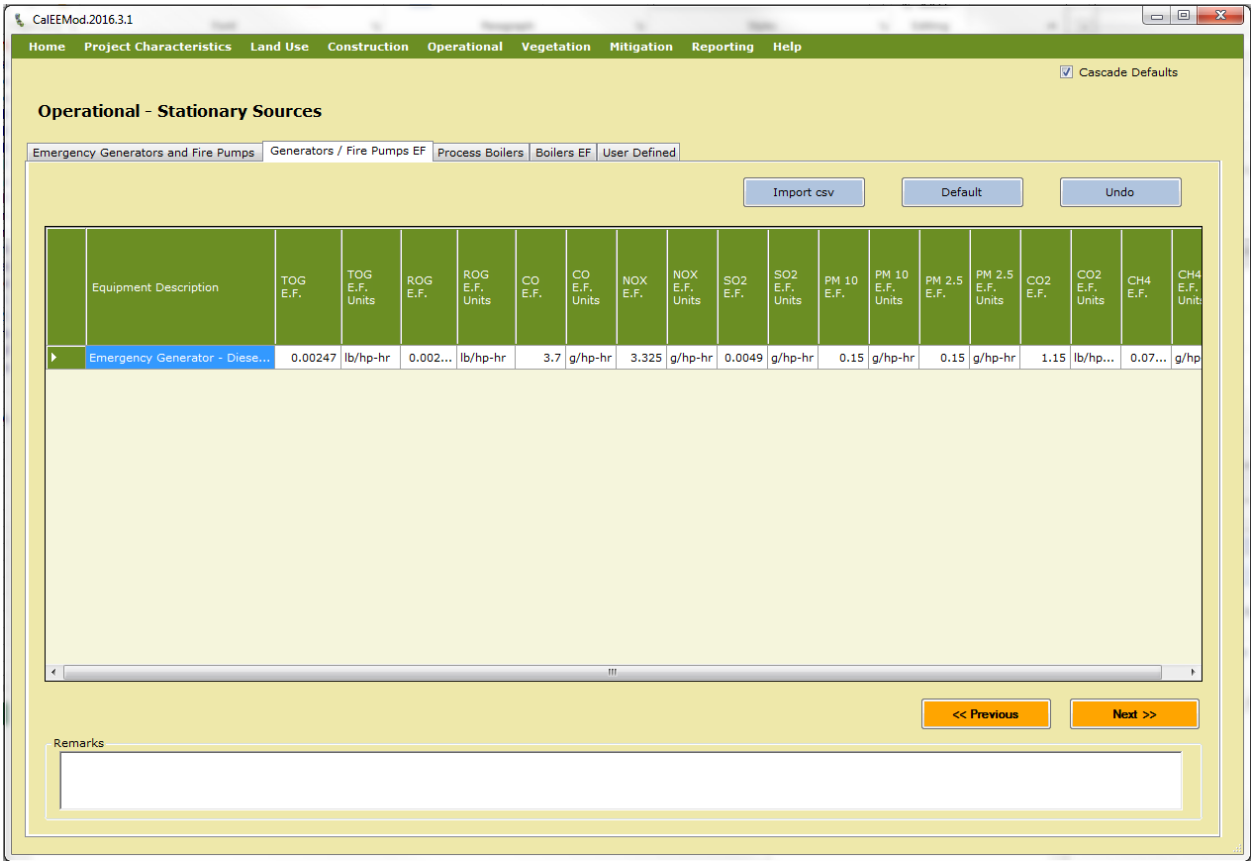
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Import csv
Default
Undo
Equipment Description
TOG E.F.
TOG E.F. Units
ROG E.F.
ROG E.F. Units
CO E.F.
CO E.F. Units
NOX E.F.
NOX E.F. Units
SO2 E.F.
SO2 E.F. Units
PM 10 E.F.
PM 10 E.F. Units
PM 2.5 E.F.
PM 2.5 E.F. Units
CO2 E.F.
CO2 E.F. Units
CH4 E.F.
Emergency Generator - Diese...
0.00247
lb/hp-hr
0.002...
lb/hp-hr
3.7
g/hp-hr
3.325
g/hp-hr
0.0049
g/hp-hr
0.15
g/hp-hr
0.15
g/hp-hr
1.15
lb/hp...
0.07...
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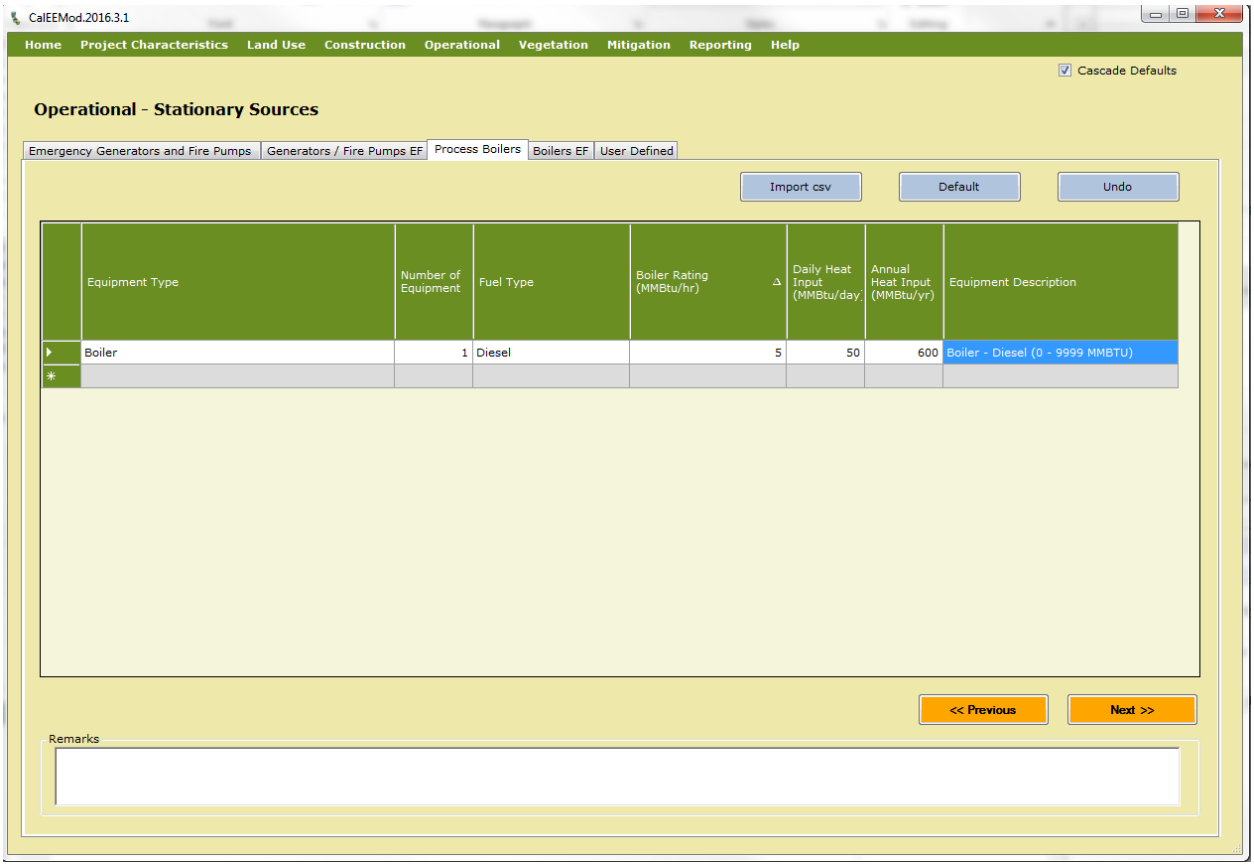
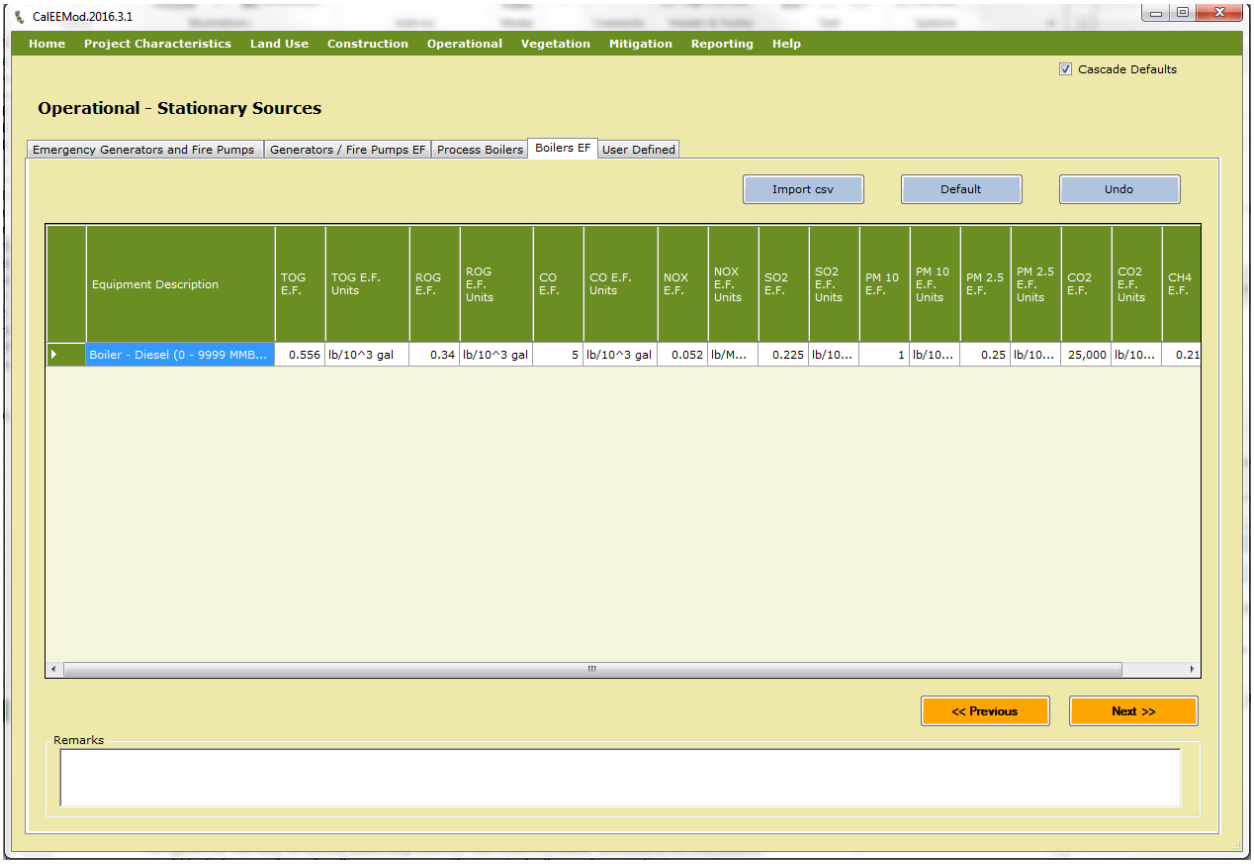
4.10.2 Process Boilers and Default Emission Factors

Two sub-screens allow the user to enter process boilers and to estimate emissions. Do not use this option for boilers providing space heating or building hot water, as these uses are included building energy use (See Subchapter 4.6). To calculate process boiler emissions, the user must enter the boiler rating (in million BTU/hr) and maximum anticipated daily and annual heat input in the Process Boilers sub-screen. The default emission factors for boilers are shown on the separate Boiler EF (emission factor) sub-screen. The user can replace the default emission factors, but needs to provide custom emission factors in the predefined units. See Appendix A for the sources of default emission factors and emission calculation methodology.

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Default
Undo
Equipment Description
TOG E.F.
TOG E.F. Units
ROG E.F.
ROG E.F. Units
CO E.F.
CO E.F. Units
NOX E.F.
NOX E.F. Units
SO2 E.F.
SO2 E.F. Units
PM 10 E.F.
PM 10 E.F. Units
PM 2.5 E.F.
PM 2.5 E.F. Units
CO2 E.F.
CO2 E.F. Units
CH4 E.F.
Boiler - Diesel (0 - 9999 MMB...
0.556
lb/10^3 gal
0.34
lb/10^3 gal
5
lb/10^3 gal
0.052
lb/M...
0.225
lb/10...
1
lb/10...
0.25
lb/10...
25,000
lb/10...
0.21
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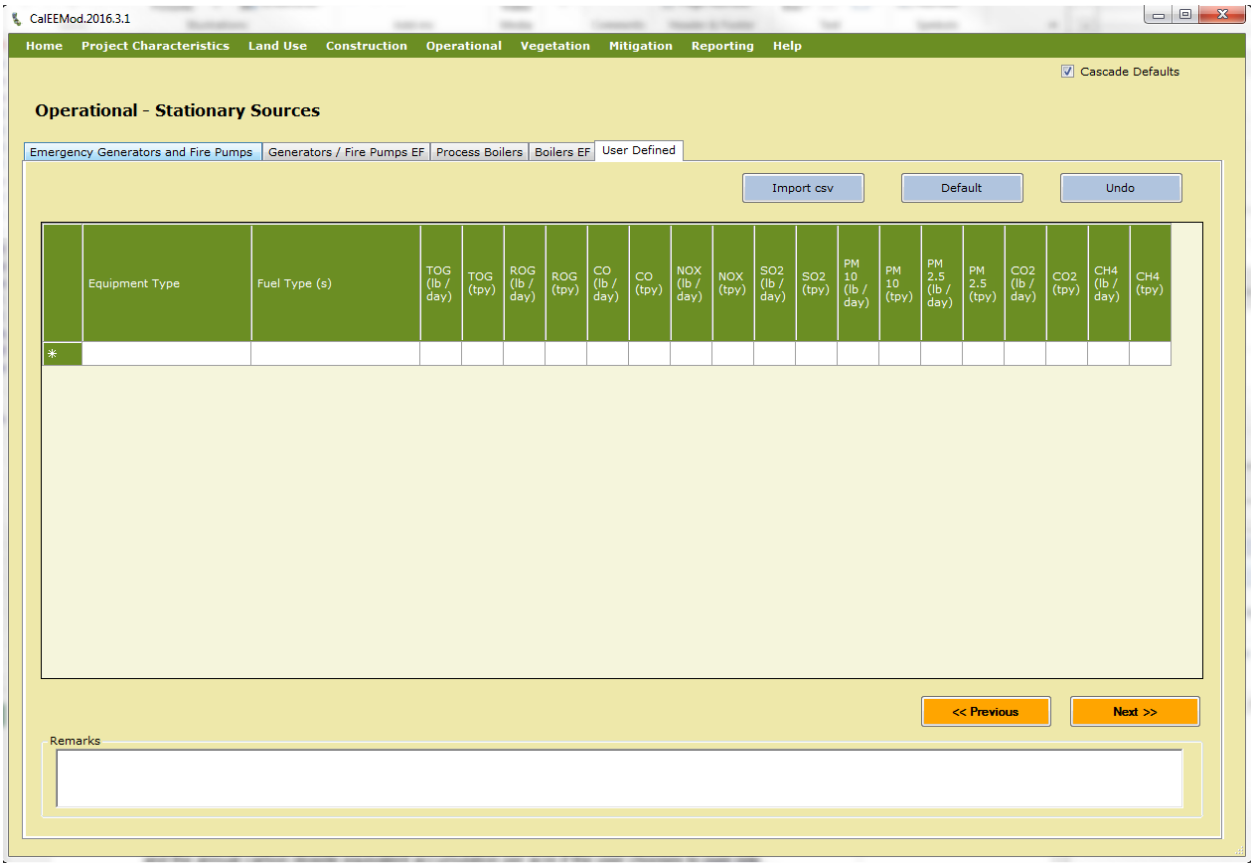
4.10.3 User Defined

An option for the user to define stationary sources other than emergency generators, fire pumps and process boiler has been included in the User Defined sub-screen. Emissions for this source would include any other miscellaneous sources that typically require permits to operate issued by an air district. Emissions may be manually entered here, either by transferring values from the permits to operate, or by calculating emissions outside of CalEEMod. Any emissions entered here will be transferred to the appropriate reports.

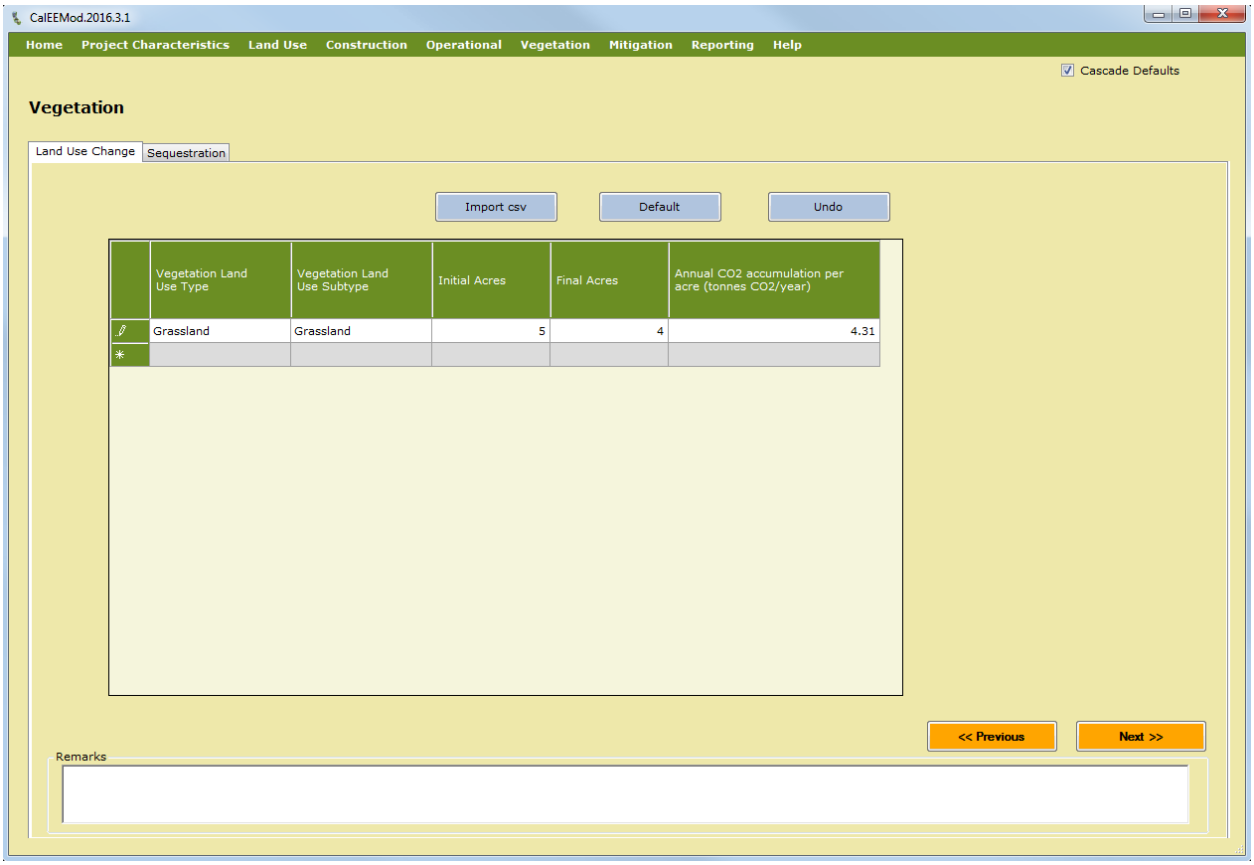


4.11 Vegetation

The vegetation screen is used to estimate the one-time change in carbon sequestration capacity due to a project. There are two sub-screens, Land Use Change and Sequestration. The methods used are based on IPCC[16].

4.11.1 Land Use Change

The Land Use Change sub-screen estimates GHG emissions due to a change in vegetation resulting from a change in land use type. The user enters the vegetation land use type, the initial and final acreage of the vegetation land use type, and the annual carbon dioxide equivalent accumulation per acre if the user chooses to override the default value. Settlement land use acreage is not considered since it is a net zero at steady state unless trees are added.



4.11.2 Sequestration

This sub-screen of Vegetation is used to estimate the GHG emissions associated with the sequestration of net new trees added to the project site. Consistent with IPCC recommendations a 20 year active growth period is assumed. The user enters the tree type or

16 IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4. Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

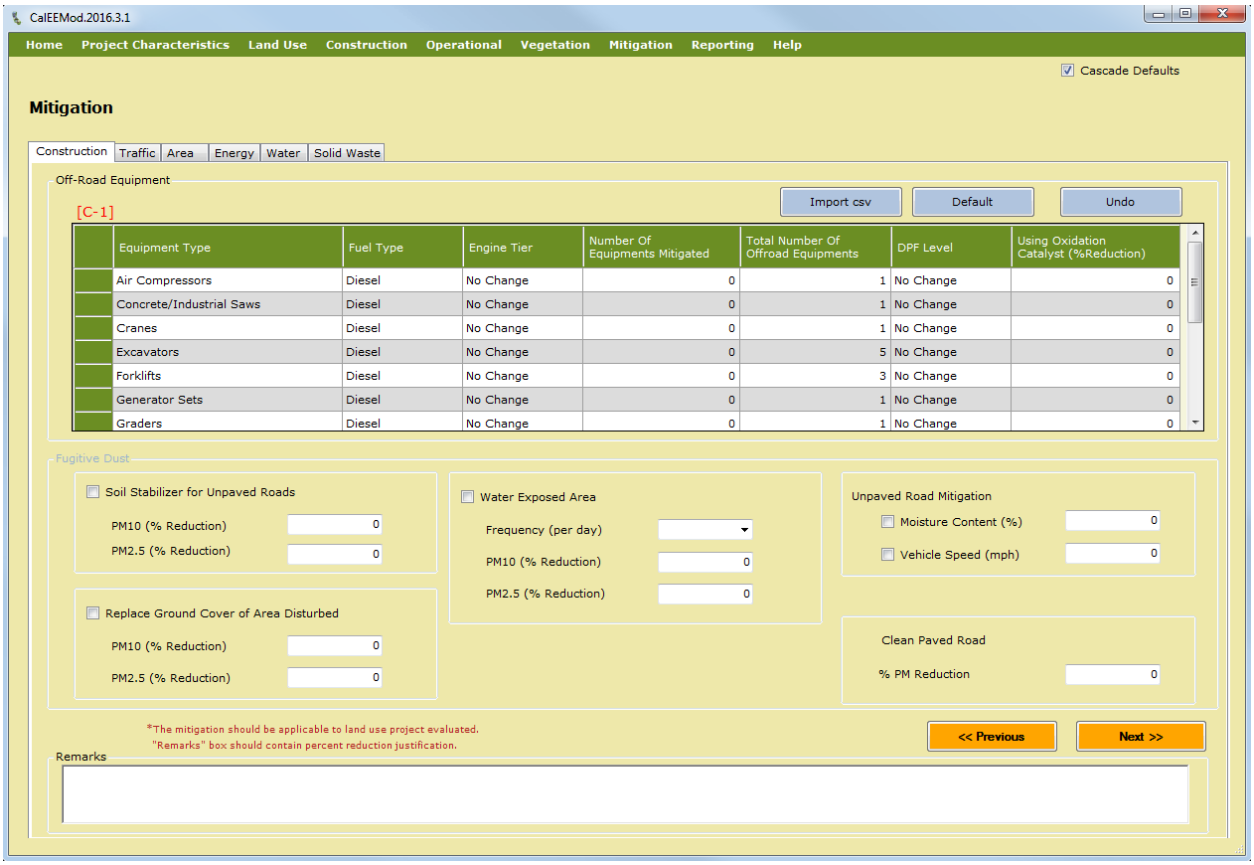
miscellaneous if it is not known, and the total number of trees. The user can override the default carbon sequestration rate.

4.12 Mitigation

The mitigation screen consists of six sub-screens that the user can indicate and supply the necessary information to estimate the emissions after mitigation measures have been implemented. The mitigation measures included in CalEEMod are largely based on the CAPCOA Quantifying Greenhouse Gas Mitigation Measures (http://www.capcoa.org/wp-content/uploads/downloads/2010/09/CAPCOA-Quantification-Report-9-14-Final.pdf) document. The CAPCOA measure numbers are provided next to the mitigation measures in CalEEMod to assist the user in understanding each measure by referencing back to the CAPCOA document.This User's Guide focuses on key aspects of the Mitigation sub-screens that users should pay particular attention.

4.12.1 Construction Mitigation

This sub-screen consists of a datagrid of off-road construction equipment to apply various mitigation measures and check boxes with supplemental information for fugitive dust emissions mitigation.



To apply mitigation to construction equipment, the user selects the equipment type, notes the number of equipment mitigated (of the total number of off-road equipment listed), and type of mitigation that applies. If substantial evidence supporting reductions was available at the time of development, options include fuel type (diesel, CNG, electric, hybrid, biodiesel), engine tier (typically select Tier 4), diesel particulate filter tiers (Tier 3 being the most effective), and use of oxidative catalysts. The program estimates how much if any increase or decrease in emissions to apply for each pollutant. Some mitigation measures have trade-offs in pollutant reductions and therefore may result in increases of some pollutants. The mitigation option to use alternative fuel for construction equipment is consistent with mitigation measure C-1 in the CAPCOA Quantifying GHG Mitigation document.

To apply mitigation to construction fugitive dust, the user selects the check box in front of the mitigation measure name, and enters in the appropriate information in the drop down or text boxes. Some fugitive dust mitigation required by some air districts do not appear here since the fugitive dust source they mitigate is not quantified by CalEEMod, in particular this includes fugitive dust generated by wind over land and storage piles. Since the fugitive dust source is not quantified it is not appropriate to apply the reduction.

For Unpaved Road Mitigation for construction fugitive dust, the maximum vehicle speed and the minimum moisture content for unpaved roads are entered. Defaults for these values are those entered on the On-Road Fugitive Dust screen. Mitigated emissions are calculated using the VMT from on-road vehicles traveling along unpaved roads, previously calculated from the percentages entered on the On-road Fugitive Dust Screen (e.g., % Pave Worker, % Pave Vendor or % Pave Hauling).

Users may check the boxes and provide a lower vehicle speed and a higher moisture content to conduct the mitigation calculation. If during a particular construction phase the user defined mitigated vehicle speed is higher than the unmitigated vehicle speed and/or the user defined mitigated moisture content is lower than the unmitigated moisture content, a warming message will be displayed. In this case, the unmitigated values will be used, resulting in no mitigation being calculated.

4.12.2 Traffic Mitigation

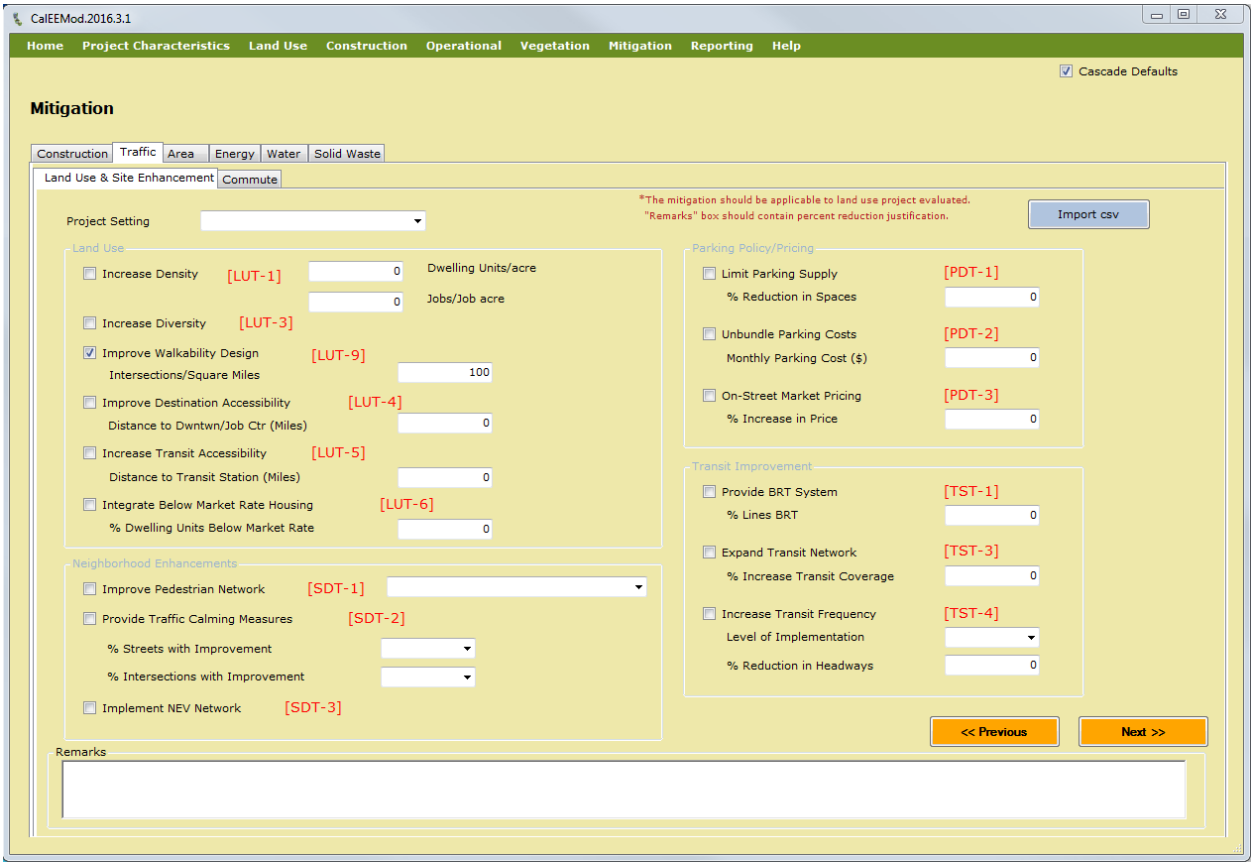
There are two traffic mitigation sub-screens that the user can select from, Land Use & Site Enhancement and Commute. First, the user must select the Project Setting as defined in the CAPCOA document (pp. 59-60).

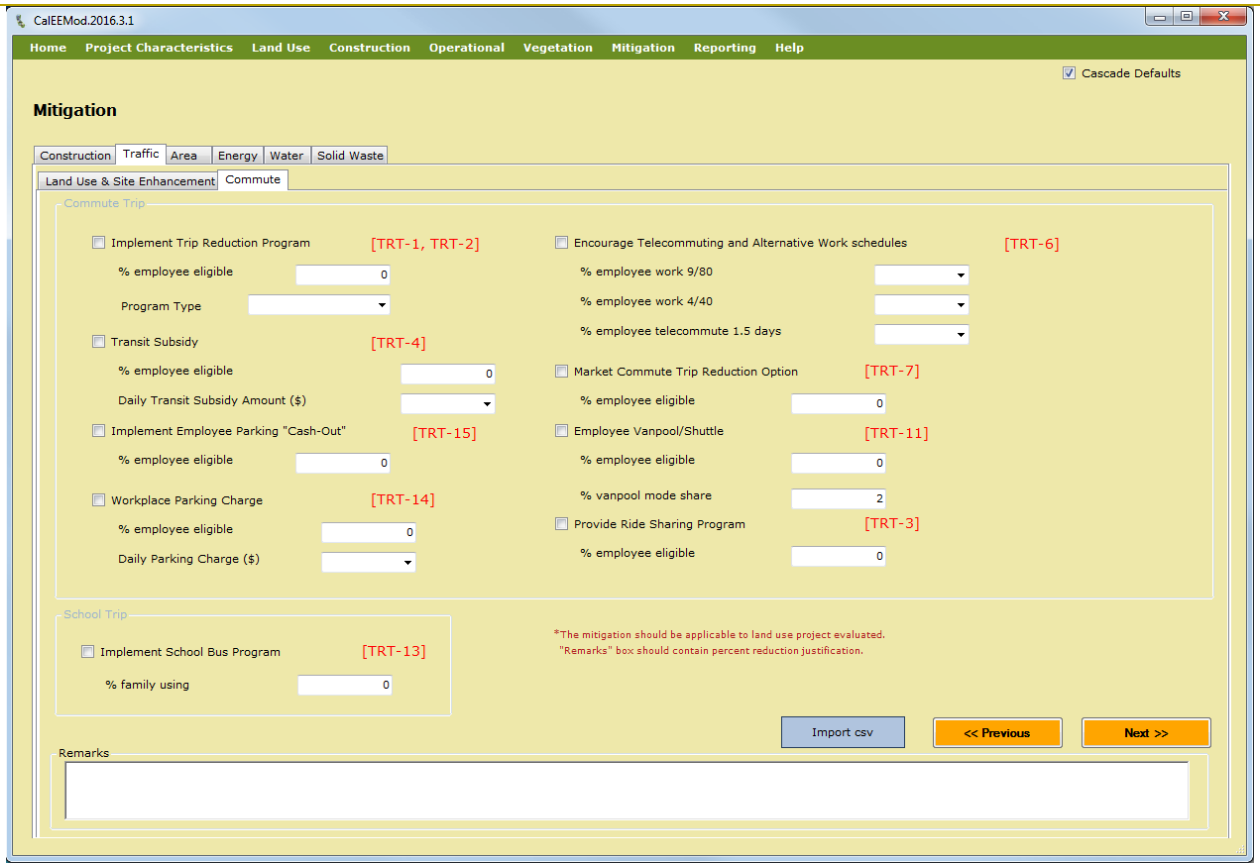
- Low Density Suburban: An area characterized by dispersed, low-density, single-use, automobile dependent land use patterns, usually outside of the central city (a suburb).
- Suburban Center: An area that serves the population of the suburb with office, retail and housing which is denser than the surrounding suburb.

- Urban: An area which is located within the central city with higher density of land uses than you would find in the suburbs. It may be characterized by multi-family housing and located near office and retail.
- Urban Center *(referred to as Compact Infill in the CAPCOA document)*: An area which is located within or contiguous with the central city. Examples may include redevelopment areas, abandoned sites, or underutilized older buildings/sites.

If the CAPCOA measure did not distinguish between Suburban Center and Low Density Suburban, values for Low Density Suburban were used. Similarly, if Urban Center and Urban values were not distinguished, Urban values were used.

The user checks the box next to each mitigation measure and fills in the appropriate information as required. The maximum reduction caps defined in the CAPCOA Quantifying GHG Mitigation document are integrated into these calculations. The CAPCOA traffic mitigation measure numbers included in CalEEMod are the following: LUT-1, LUT-3, LUT-9, LUT-4, LUT-5, LUT-6, SDT-1, SDT-2, SDT-3, PDT-1, PDT-2, PDT-3, TST-1, TST-3, TST-4, TRT-1, TRT-2, TRT-4, TRT-15, TRT-14, TRT-6, TRT-7, TRT-11,TRT-3, and TRT-13. The NEV network mitigation measure (SDT-3) assumes the low end of the CAPCOA recommendations.

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Commute
Commute Trip
Implement Trip Reduction Program
[TRT-1, TRT-2]
% employee eligible
0
Program Type
Transit Subsidy
[TRT-4]
% employee eligible
0
Daily Transit Subsidy Amount ($)
Implement Employee Parking "Cash-Out"
[TRT-15]
% employee eligible
0
Workplace Parking Charge
[TRT-14]
% employee eligible
0
Daily Parking Charge ($)
Encourage Telecommuting and Alternative Work schedules
[TRT-6]
% employee work 9/80
% employee work 4/40
% employee telecommute 1.5 days
Market Commute Trip Reduction Option
[TRT-7]
% employee eligible
0
Employee Vanpool/Shuttle
[TRT-11]
% employee eligible
0
% vanpool mode share
2
Provide Ride Sharing Program
[TRT-3]
% employee eligible
0
School Trip
Implement School Bus Program
[TRT-13]
% family using
0
*The mitigation should be applicable to land use project evaluated.
"Remarks" box should contain percent reduction justification.
Import csv
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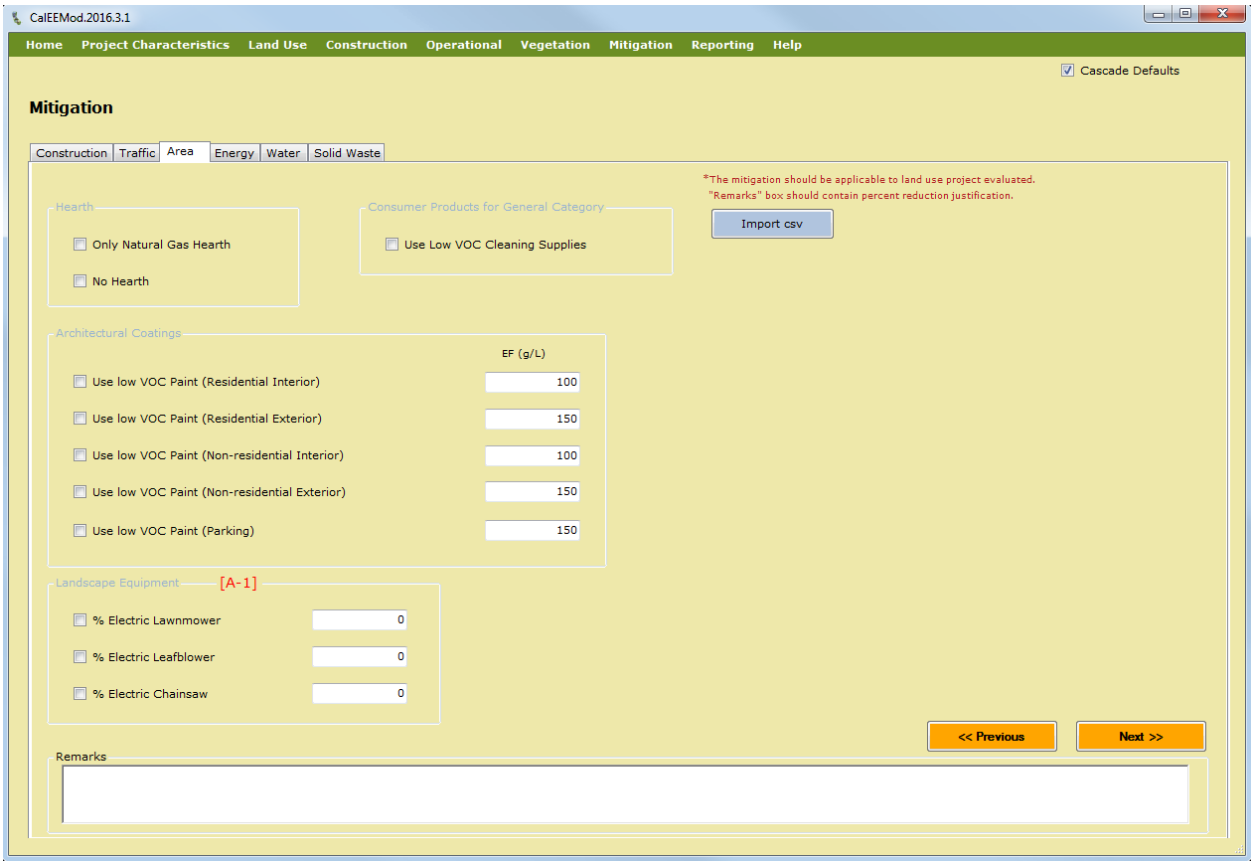
4.12.3 Area Mitigation

The user can select from a few area source mitigation measures on the Area sub-screen by checking the appropriate box and supplying any additional information in the text boxes. These measures include all natural gas hearths, no hearths, electric landscaping equipment use, reduced ROG coatings, and reduced general category consumer product ROG content. The area landscaping mitigation to prohibit gas powered landscape equipment is consistent with mitigation A-1 in the CAPCOA Quantifying GHG Mitigation document.

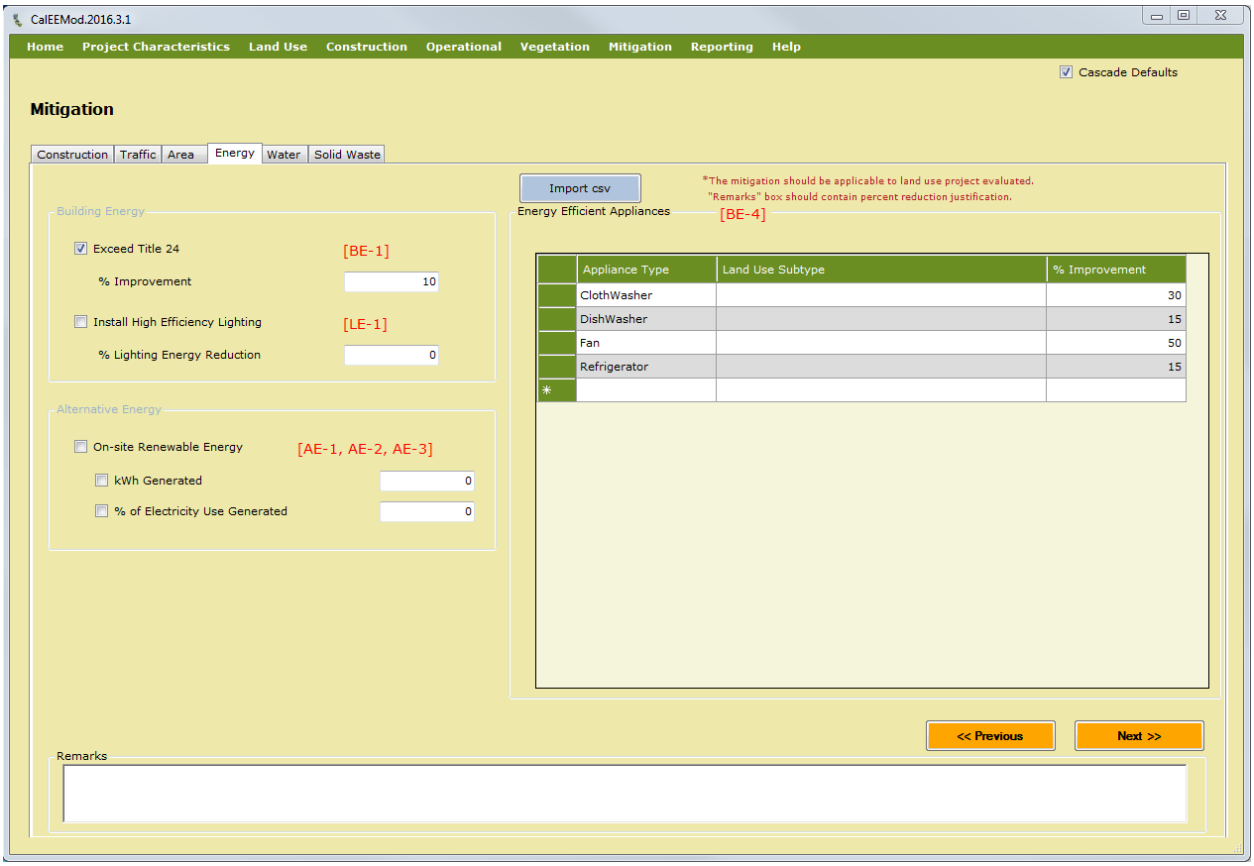


4.12.4 Energy Mitigation

The user selects energy mitigation measures on the Energy sub-screen by using the check boxes or the datagrid. These correspond to CAPCOA Mitigation Measures LE-1, BE-1, AE-1, AE-2, AE-3 and BE-4 as listed in the CAPCOA Quantifying GHG Mitigation document. The lighting is a percentage reduction in lighting as supplied by the user. The datagrid is used to enter the land use subtypes that will use energy efficient appliances. The percent improvement is the typical percent improvement above standard appliances according to the 2008 Energy Star Annual Report[17]. Alternative Energy has two methods to enter the amount of alternative energy. The first is the amount of kW-hr generated. The second is the percentage of the total

17 Available at: https://www.energystar.gov/ia/partners/annualreports/annual_report_2008.pdf

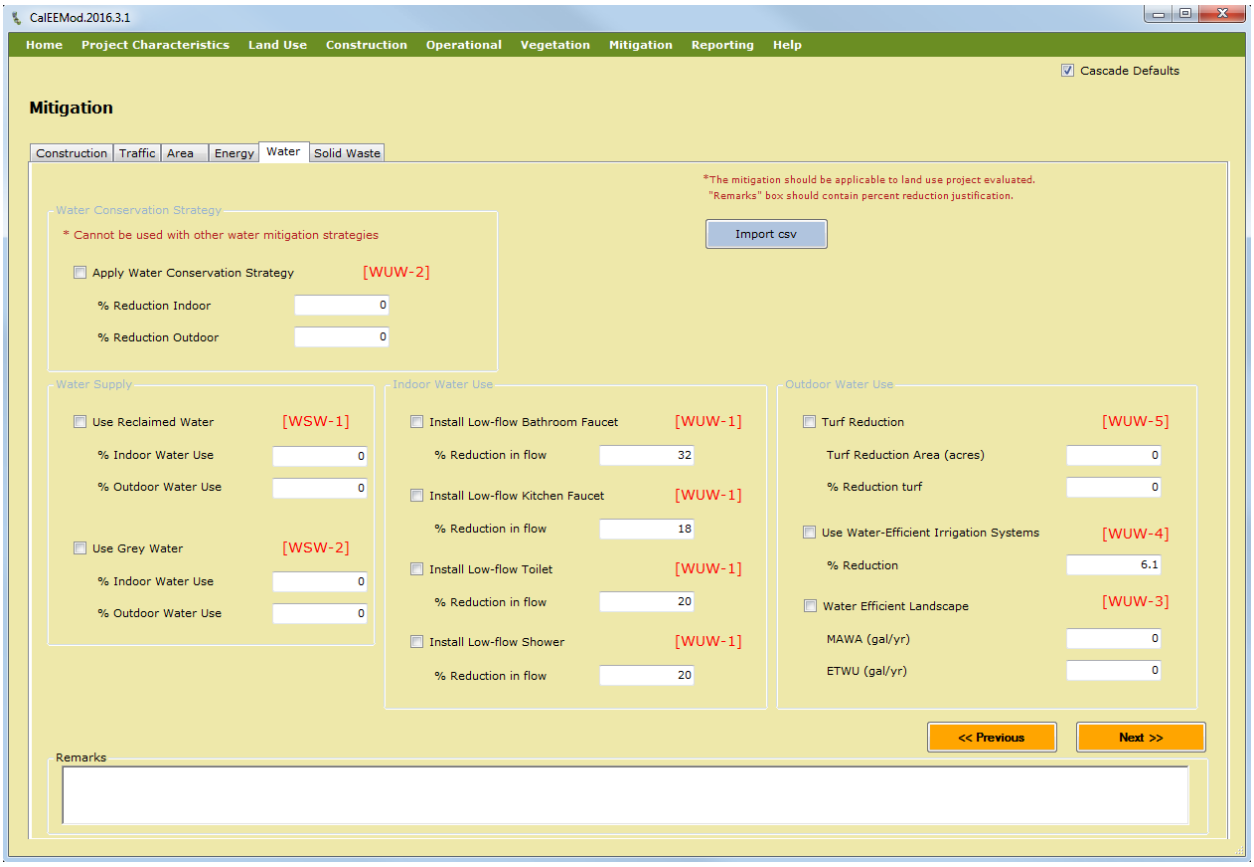
electricity use by buildings that is generated. At this time alternative energy methods that are not carbon neutral are not quantified. To apply the amount of alternative energy only one of the two methods (kW-hr or percentage) needs to be entered for CalEEMod to calculate emission reductions.



4.12.5 Water Mitigation

On the Water sub-screen, water mitigation can either be estimated as the percent reduction based on a water conservation strategy or the other individual mitigation measures. The CAPCOA Quantifying GHG Mitigation document includes water supply and use measures WSW-1 & 2, and WUW-1 through 5.

For CAPCOA Mitigation Measure WSW- 3 (Use Locally Sourced Water Supply), using locally-sourced water or water from less energy-intensive sources reduces the electricity and indirect CO_2 emissions associated with water supply and transport because water from local or nearby groundwater basins, nearby surface water and gravity-dominated systems have smaller energy-intensity factors. This mitigation measure is not included in the Water mitigation sub-screen, therefore, to implement WSW-3, the user should alter the energy intensity values in water and run a separate CalEEMod run to accommodate these values.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*The mitigation should be applicable to land use project evaluated.
"Remarks" box should contain percent reduction justification.
Import csv
Water Conservation Strategy
* Cannot be used with other water mitigation strategies
Apply Water Conservation Strategy
[WUW-2]
% Reduction Indoor
0
% Reduction Outdoor
0
Water Supply
Use Reclaimed Water
[WSW-1]
% Indoor Water Use
0
% Outdoor Water Use
0
Use Grey Water
[WSW-2]
% Indoor Water Use
0
% Outdoor Water Use
0
Indoor Water Use
Install Low-flow Bathroom Faucet
[WUW-1]
% Reduction in flow
32
Install Low-flow Kitchen Faucet
[WUW-1]
% Reduction in flow
18
Install Low-flow Toilet
[WUW-1]
% Reduction in flow
20
Install Low-flow Shower
[WUW-1]
% Reduction in flow
20
Outdoor Water Use
Turf Reduction
[WUW-5]
Turf Reduction Area (acres)
0
% Reduction turf
0
Use Water-Efficient Irrigation Systems
[WUW-4]
% Reduction
6.1
Water Efficient Landscape
[WUW-3]
MAWA (gal/yr)
0
ETWU (gal/yr)
0
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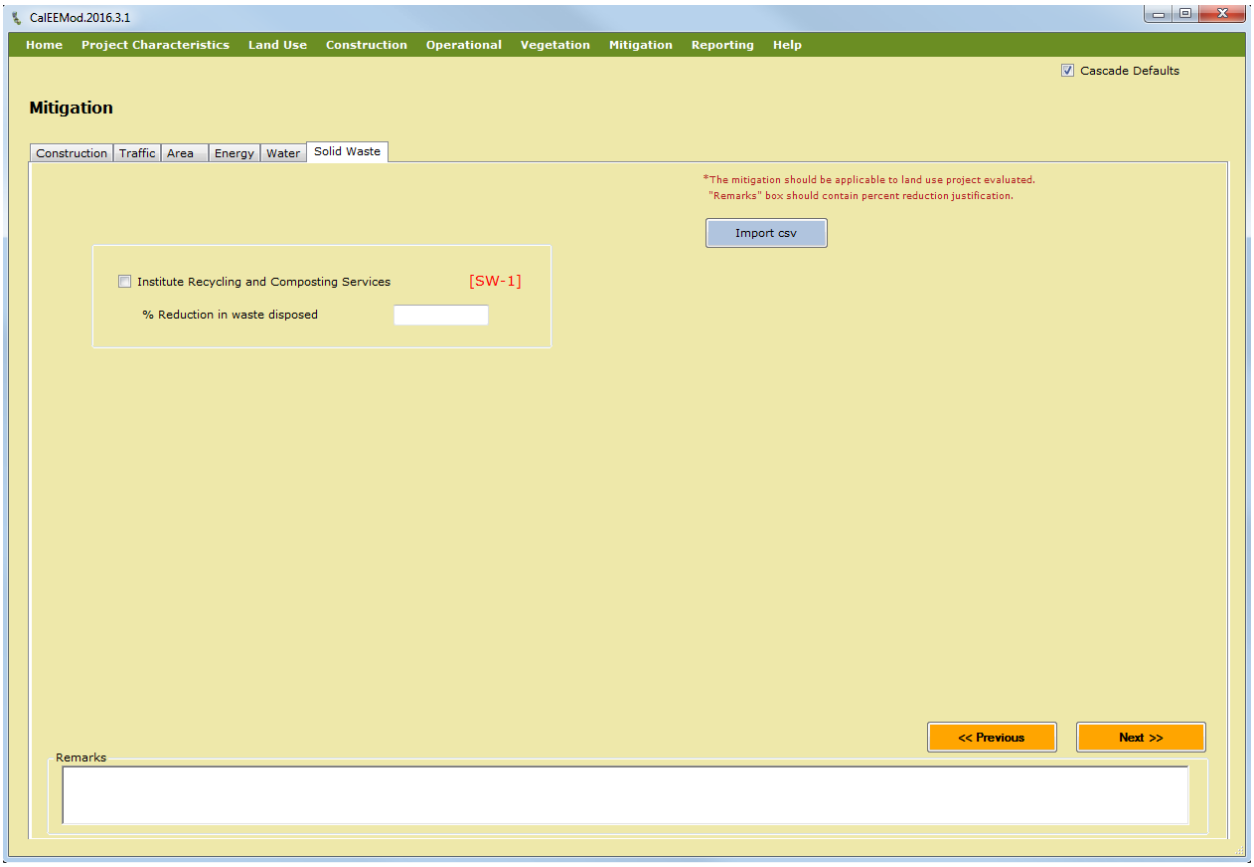
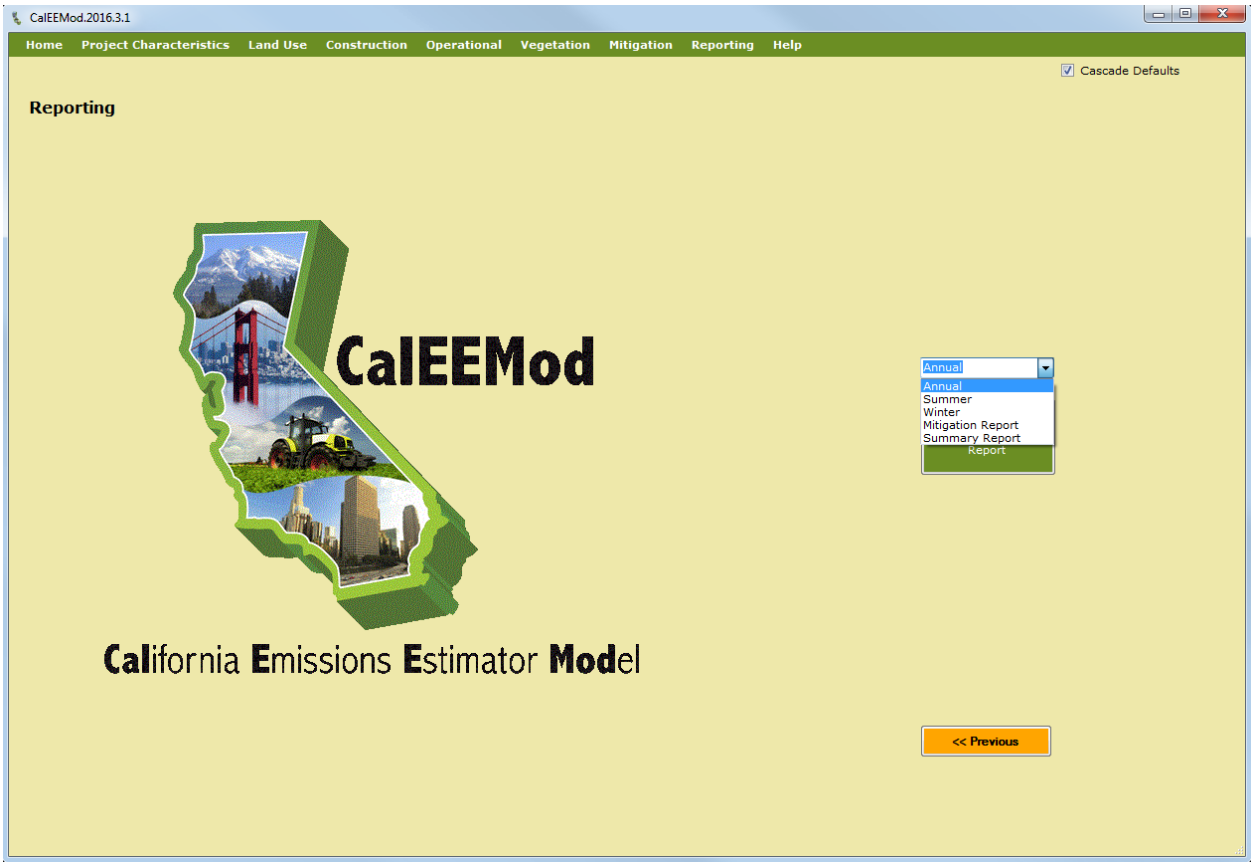
4.12.6 Solid Waste Mitigation

The user can get calculate an emissions reduction for recycling waste. This mitigation measure corresponds to CAPCOA Mitigation Measure: SW-1.



4.13 Reporting

The user initiates final emission calculations by selecting the report and clicking on the Recalculate All Emissions and Run Report button. The available reports include: Annual, Summer (peak) Daily, Winter (peak) Daily, Mitigation and Summary of peak daily emissions and annual GHG emissions. A separate report viewer will come up. From this report viewer, the user can view their report on-screen, print reports, save as Microsoft Excel xls file or save as an Adobe Acrobat pdf file, or in the case of the Mitigation report, a Microsoft Word doc file. The data in the Excel file has already been calculated and placed in the grids as text, thus, for example, the user cannot change an emission value and expect the report to change the summed total value. These values, however, can be copied to new Excel spreadsheet for any further desired calculation with the data.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