

# Community-Scale Greenhouse Gas Emissions Model: San Diego Region

User Guide

Version 1.0

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The Energy Policy Initiatives Center (EPIC) is a non-profit research center of the USD School of Law that studies energy policy issues affecting California and the San Diego region. EPIC integrates research and analysis, law school study, and public education, and serves as a source of legal and policy expertise and information in the development of sustainable solutions that meet future energy needs.

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## 1. Overview

The purpose of the Community Scale Greenhouse Gas Emissions Model is to enable a user to estimate business-as-usual greenhouse (BAU) gas emissions through 2035 and emissions reductions from a suite of mitigation measures for any of the 19 jurisdictions in the San Diego region, or the region as a whole.

The model consists of three primary modules: BAU Projection and Targets, Mitigation Calculators, and Summary Output. The BAU Projection and Targets module allows the user to select a jurisdiction, create a BAU emissions projection, and select emissions reductions targets for 2020 and 2035. In the second module, users can customize 25 different mitigation measures to explore the feasibility of achieving the previously selected reduction targets. The Mitigation Calculators module uses dynamically interrelated mitigation measures designed to allow a user to estimate the effects of an entire climate mitigation action plan or just a handful of mitigation measures. The Summary Output module allows a user to print summary tables and graphs based on the mitigation calculator settings present in Module 2.

This document provides brief instructions for the Community-Scale Greenhouse Gas Emissions Model. More detailed information on the methodology and data is located in the Technical Documentation.

## 2. Getting Started

This model was designed with many different potential intended uses, for both experts and non-experts alike. Microsoft Excel was chosen to house the model given its prevalence and because doing so does not require users to install any additional software. The model makes frequent use of dropdown menus. On some older versions of Excel, users may have difficulty with the dropdowns. If the dropdown functionality does not work you can still enter values in manually.

Upon opening the excel file, all users begin by selecting a jurisdiction from the drop down menu (cell F5) on the BAU and Targets tab. This is the default tab when the model is first opened. The next three sections of this document cover how to use the three primary modules of this model.

### 2.1. Organization of the Model

The model consists of a series of worksheets. A brief description of the content of each is provided below.

- BAU and Targets (Module I)
- Mitigation Calculations (Module II)
- Summary Output (Module III)
- BAU Background, Globals
- Elect. + NG Mitigation Measures
- Transport Mitigation Measures
- Waste & Water Mitigation Measures
- Module 2 & 3 Data Summary
- Community Data
- Dropdown Boxes and Energy Prices

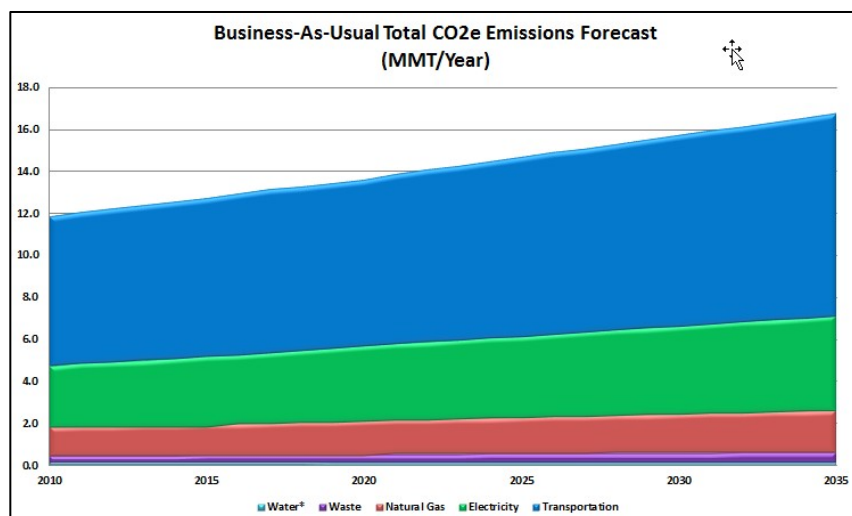
The following sections provide detailed information about how to...

### 3. Module 1: Business-As-Usual and Targets

#### 3.1. Business-As-Usual Projection Generator

The Business-As-Usual and Targets Module enables users to calculate a business-as-usual (BAU) projection of CO<sub>2</sub>e emissions from 2010 to 2035 for any of the 19 jurisdictions in the San Diego region, or the region as a whole. Emissions are partitioned by transportation, electricity, natural gas, waste, and water.<sup>1</sup> For each jurisdiction, the BAU projection can be customized to include emissions reductions resulting from Pavley I and/or the Renewable Portfolio Standard (RPS).<sup>2</sup> It is recommended that users DO NOT include the effects of the RPS and Pavley I in their BAU projection and instead include those as mitigation measures (Module II). This provides transparency about the policies and measures that lead to expected emissions reductions. Users interested only in comparing the BAU projections of cities within the region as calculated by a single, consistent calculation methodology need only use this BAU generator and the summary plots found in the “Summary Output” tab.

Figure 1 Illustrative Business-As-Usual projection from Module !



#### 3.2. Emission Reduction Targets

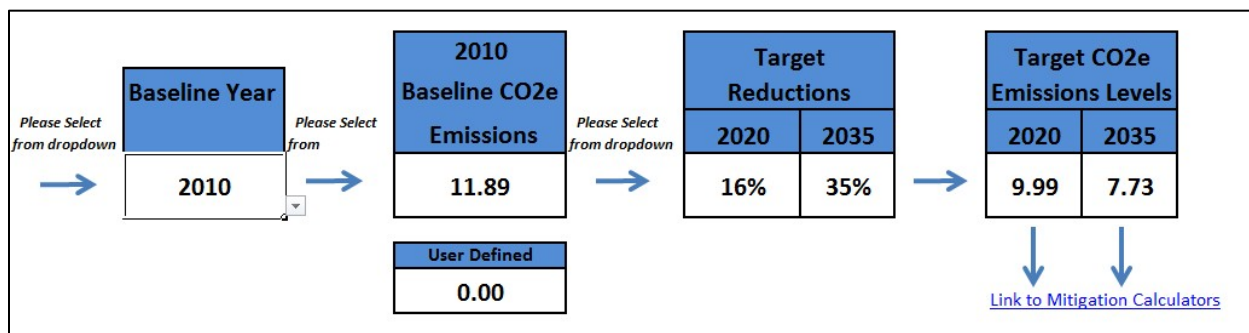
The second component of Module I is the ability to set emissions reductions target. Users that have (1) selected a jurisdiction and (2) customized the BAU emissions forecast as desired, can then set emission targets that will be used by the mitigation calculators of Module 2.

Here users begin by selecting a baseline year from which to set emission targets. Data has been compiled for each jurisdiction for the year 2005, the model can generate a BAU value for 2010, or a user can define their own baseline emissions level by selecting “User Defined” from the first dropdown. For example, if the users sets 2010 as the baseline and selects a 2020 reduction target of 16% (as in Figure 2), the reduction target will be 16% below the level of emissions in 2010 – in this case, 9.99 MMT CO<sub>2</sub>e.

<sup>1</sup> Emissions associated with water include only an estimate for emissions associated with supply and conveyance to the San Diego region. Emissions from energy associated with treatment, distribution, end-use, and wastewater treatment are included in the electricity and natural gas categories.

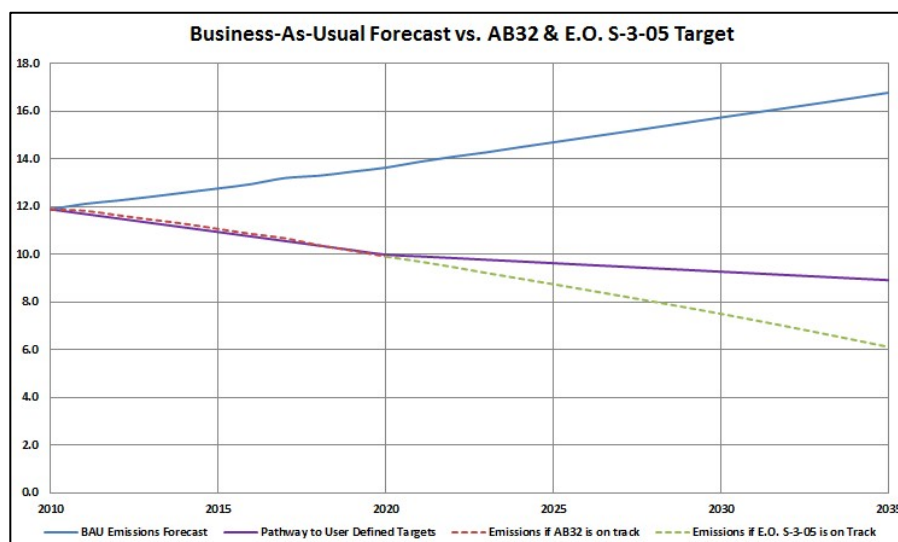
<sup>2</sup> The California Air Resources Board subtracted the expected greenhouse gas emissions reductions from the Renewable Portfolio Standard and Pavley I from its most recent emissions projection.

Figure 2 Setting GHG Reduction Targets in Module I



After a baseline emissions level is selected, the user selects target reduction levels. Users may select any target, regardless of how aggressive or how realistic it may be. Users may also rely upon the AB 32 guideline (red dotted line) or the E.O. S-3-05 (green dotted line). The target aids show what emissions rate would be required in each year if a jurisdiction is on pace to achieve AB 32 in 2020 or E.O. S-3-05 in 2050.

Figure 3 User Targets Compared to Statewide GHG Target Levels



After a jurisdiction has been selected and customized, and target reduction levels have been, users can navigate to Module 2 (mitigation calculators) via either the “Link to Mitigation Calculators” found below the target emissions value or by clicking the “Mitigation Calculators” tab found to the right of the “BAU and Targets” tab.

#### 4. Module 2: Mitigation Calculators

The Mitigation Calculators Module enables users to analyze the effects of any combination of mitigation measures for a selected jurisdiction, or the region as a whole. The mitigation measures are divided into three categories: Electric + Natural Gas, Transportation, and Waste & Water.

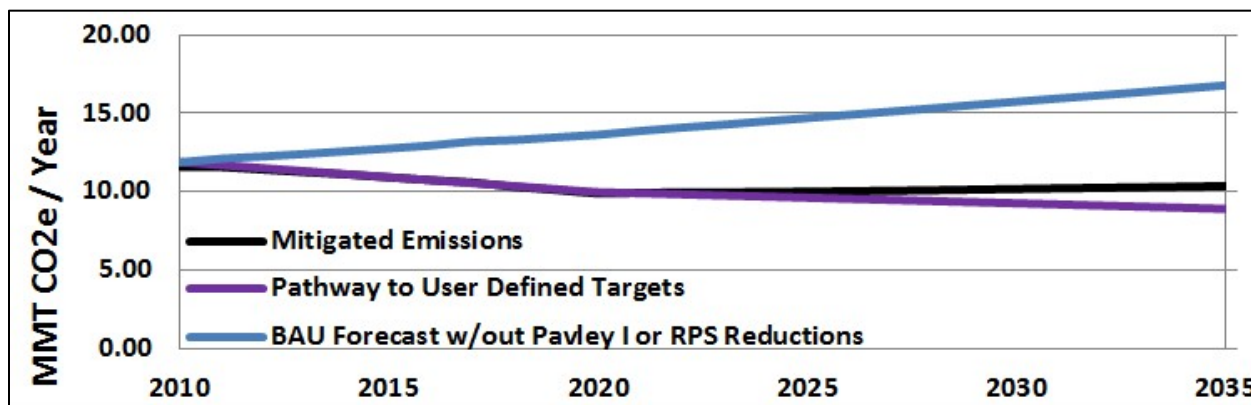
Many of the mitigation measures are inter-related, in that changing the input parameters for one mitigation measure can actually have an effect on the greenhouse gas emissions reductions of multiple other mitigation measures. For example, Average Commute is a transportation mitigation measure where the user can reduce transportation emissions by decreasing the average commute distance of the work force. However several other mitigation measures, like Van Pooling for example, necessarily include average commute distance as a dependent variable required to calculate emission reductions. Another example is Cogeneration. The greenhouse gas emissions reductions resulting from increasing cogeneration capacity is necessarily relative to the greenhouse gas intensity of electricity. The Renewable Portfolio Standard (RPS) will have a considerable effect on the greenhouse gas intensity of electricity which, in turn, will determine the relative greenhouse gas emissions reductions due to Cogeneration.

#### 4.1. Results Tracker

The Results Tracker of Module 2, located between rows 4 and 10 provides a summary of the user defined targets and dynamically updates the charts to reflect the change in emissions from the selected settings for each mitigation measure within Module 2.

The left graph tracks overall progress toward the target, showing the user-defined business-as-usual emissions projection (blue line) and the user-defined emissions target levels for 2020 and 2035 (purple line). This graph also shows an emissions projection that subtracts out the reductions expected from the user-defined mitigation measures.

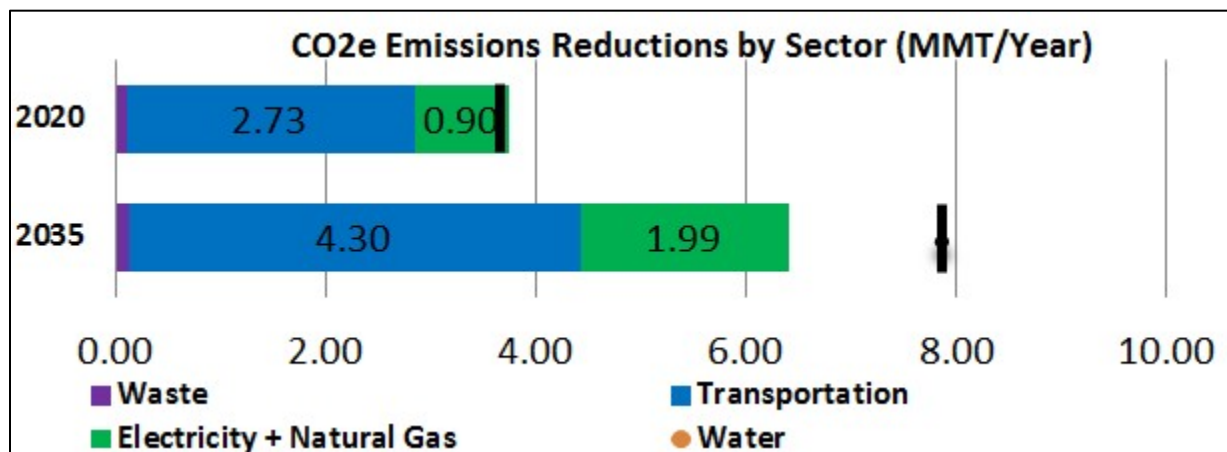
Figure 4 Tracking Overall Progress Toward User-Defined Targets



The right graph shows total CO2e emissions reductions by sector resulting from the user defined mitigation measures. The graph partitions emissions reductions into Transportation, Electricity + Natural Gas, Waste, and Water categories. The graph also shows vertical black bars indicating the 2020 and 2035 target reductions as defined by the user in Module 1. This is the total emissions reduction necessary to reduce expected emissions to the user-defined targets.



Figure 5 Total Emissions Reductions by Sector



Finally, the right of the Summary Section shows the quantitative Business-As-Usual and Target Levels for 2010, 2020, and 2035, as well as whether or not the mitigation settings selected are sufficient to achieve the target reductions.

#### 4.2. How To Use The Mitigation Calculators

The following section provides a brief summary of how to use a mitigation calculators in Module 2. Shown here is Residential Photovoltaics, found in the Electricity + Natural Gas section of Module 2.

Figure 6 Illustrative Mitigation Calculator in Module II

20	<b>Residential Photo-Voltaics</b>	<b>2010</b>	<b>2020</b>	<b>2035</b>	<b>0.003</b>	<b>0.005</b>	<b>\$313</b>	<b>\$127</b>
21	PV Installed Cost (2010\$/Watt)	\$8.00	\$6.00	-				
22	BAU Forecast PV Installed (Megawatt)	2.10	8.64	18.11				
23	User Defined PV Installed (Megawatt)	2.10	8.64	18.11				

Each mitigation calculator allows the user to set values for the key variables that affect CO2e emissions. Users can set values in yellow boxes. For the Residential Photovoltaics calculator shown above, users can set values for PV Installed Cost (row 21) as well as Installed Capacity (row 23). Where possible, we have provided smart defaults (white boxes, row 22). If a user is not familiar with, for example, what a reasonable installed PV capacity for the City of San Diego in 2035 is, smart defaults allow the user to make an educated guess. Where possible, smart defaults cite their data source via a note, accessible by rolling your cursor over the red triangle found in the upper right corner of the cell.

The columns to the right of the yellow input boxes show the expected CO2e emissions reductions from residential PV in 2020 and 2035 based on the user input. So while the emission reductions from residential PV are added to the expected reductions from other measures to generate an overall summary for the selected region, a user can also independently analyze a single or several specific measures only. Finally, where possible, certain measures estimate the cost of a measure to reduce emissions. The cost estimate is provided in the net present value in 2010 dollars per metric ton of CO2e. This unit allows the user to compare across measures to assess the cost effectiveness of various measures.

Most mitigation measures require values for a range of variables in order to calculate emissions reductions, however the mitigation calculator module normally only shows one or two. A user interested in a deeper or

more customized calculation for a particular measure can click the blue link to access the full calculation. For example, clicking the blue “[Residential Photovoltaics](#)” link shown in Figure 6 navigates to the “Elec. + NG Mitigation Measures” tab, where a user can access all the variables relevant to the Residential PV calculation. An explanation of how to use the more advanced, secondary level calculators is found in a tutorial video on EPIC’s website as well as in the technical documentation.

### 4.3. Electric + Natural Gas

The Electric + Natural Gas section features ten mitigation measures. It is important that users note that where possible mitigation measures are dynamically interdependent. That is, the emissions reductions from one measure can affect those of another. For example, emissions reductions expected from cogeneration are dependent upon what percentage of energy from SDG&E and other providers is from renewable energy sources as a result of the Renewable Portfolio Standard. If the RPS has achieved 100% renewable, then cogeneration actually contributes to GHG emissions. Conversely, if RPS is set to a very low value, then cogeneration use reduces GHG emissions.

- **Renewable Portfolio Standard (% of Sales):** California law requires California’s investor-owned utilities like San Diego Gas & Electric (SDG&E) to supply 33% of their electricity from renewable resources by 2020. This measure estimates the emissions reductions expected from an increase in renewable electricity supplied from SDG&E. To test the effects of different amounts of renewable electricity, the user can select the percentage of renewable electricity supplied in the region by 2020 and 2035. As the percentage of renewable energy increases, the GHG emissions from a unit of electricity decreases. Because the greenhouse gas intensity of electricity (lbs CO<sub>2</sub>e/MWh) will fall as the percentage of renewable energy under the RPS increases, the emissions reductions from measures that reduce energy use will also decrease. So, a unit of electricity at a 20% RPS has more associated GHG emissions than a unit of electricity at a 50% RPS.
- **Residential and Non-Residential Photovoltaics:** These measures estimate emissions reductions resulting from changes to the expected level of PV capacity installed in a jurisdiction and the cost effectiveness of this measure to reduce GHG emissions (\$2010 NPV/MT CO<sub>2</sub>e). Smart defaults estimate the installed capacity in 2020 and 2035.
- **Cogeneration:** This measure estimates emissions reductions from installed cogeneration capacity by comparing GHG emissions rates from cogeneration to the forecast SDG&E emissions rates. Cogeneration is one the only mitigation measures that can contribute to GHG emissions in certain scenarios. A net contribution to GHG emissions is observed when the “Total Annual Emissions Reductions” outputs a negative number.
- **Residential Efficiency Retrofits – Single Family and Multi Family:** These measures estimate emissions reductions resulting from efficiency retrofits in single- and multi-family homes.. Users can change values for the percentage of energy reduction per retrofit and the percentage of single-family homes in the selected jurisdiction that will be retrofit. A user can access the background calculation to modify the ratio between electricity and natural gas consumption. See technical documentation for details.
- **Commercial Efficiency Retrofits:** This measure estimates emissions reductions resulting from efficiency retrofits in commercial building. Users can change values for the percentage energy reduction per retrofit and the percentage of commercial square-feet in the selected jurisdiction that will be retrofit. A user can access the background calculation to modify ratio between electricity and natural gas consumption ratios. See technical documentation for details.

- **New Construction (Res. + Com.) (Non-Lighting):** California law provides for efficiency standards for new construction. This measure estimates the reductions in GHG emissions that would result from an improvement upon current standards. The calculator allows a user to change values for the percentage improvement over Title 20, Title 24, and Federal Standards.
- **Residential Solar Water Heating (New Cons. & Retrofits):** This measure estimates emissions reductions resulting from installation of solar water heaters in the selected jurisdiction. The user can change values for the percentage of homes (new construction and retrofits) that have a solar water heater installed.
- **Commercial Solar Water Heating (New Cons. & Retrofits):** This measure estimates emissions reductions resulting from installation of solar water heaters in the selected jurisdiction. The user can change the percentage of energy needed for commercial water heating (new construction and retrofits) that is provided by a solar water heater.

#### 4.4. Transportation

- **Vehicle Efficiency (Pavley I thru 2016):** Automakers are required by federal law to achieve a vehicle fleet efficiency of X grams of CO<sub>2</sub>e per mile by the year 2016. This measure allows users to adjust the expected total vehicle fleet emissions efficiency for a given jurisdiction. Total Fleet CO<sub>2</sub>e/Mile default values are derived from EMFAC2011 and include reductions in emissions resulting from Pavley I. Changes made to the LCFS reduction factors in the corresponding mitigation measure below, are dynamically reflected in this CO<sub>2</sub>e/Mile forecast. For a complete explanation, please see the technical documentation.
- **Low Carbon Fuel Standard (LCFS):** The CA Air Resources Board has adopted the LCFS, which seeks to reduce the greenhouse gas intensity of transportation fuels by 10% by 2020. This measure allows users to estimate the expected emission reductions from the LCFS by adjusting the percentage reduction in greenhouse gas intensity by 2020 (the default is 10%).
- **Electric Vehicles:** This measure estimates emissions reductions from changes in miles driven by electric vehicles. Users can change the percentage of the total miles driven by electric vehicles in 2020 and 2035. This measure is linked to the electric calculations in the model. Electricity needed to fuel electric vehicles increases the total amount of electricity consumed in the jurisdiction. Emissions reductions estimates from the EV calculator are dependent on both the values set in RPS and the Vehicle Efficiency measures.
- **Pump Price of Gas:** This measure estimates emissions reductions expected from changes in fuel consumption as a result of gasoline price increases. Users define pump price of gasoline in 2010, 2020, and 2035 in 2010 dollars. Users also can navigate to the background calculations in the “Transportation Mitigation Measures” tab to alter elasticity values if desired.
- **Average Commute:** This measure estimates emissions reductions resulting from changes to the average commute distance of the labor force for the selected jurisdiction. The Average Commute calculator acts as a fundamental component in several other mitigation calculators. Users that carefully consider the average commute of workers within the specific jurisdiction selected will achieve the most accurate results when using the transportation section of the model.
- **Alternate Work Schedule:** This measure estimates emissions reductions resulting from a work schedule that requires fewer weekly commutes. Users can vary the percentage of jobs participating in an alternate work schedule program, the number of workdays per week for those participating, and the number of miles driven on off days for participating workers.

- **Telecommuting:** This measure estimates emissions reductions from changes to the level of telecommuting. Users can vary the percentage of telecommutable jobs, the percentage of eligible people who telecommute, and the number of days per workweek telecommuted.
- **Mass Transit:** This measure estimates the emissions reductions from changes in mass transit use. Users can vary the percentage of commuters that use mass transit (i.e., ridership). Defaults are provided, however a user should carefully consider the mass transit present in the selected region, as there is substantial variance throughout the San Diego region. Also, changes in population density effect commuter mass transit ridership. Accordingly, those effects resulting from the Population Density Calculator are reflected here, in the Mass Transit Calculator cumulative emissions reductions.
- **Van Pooling:** This measure estimates emissions reductions resulting from changes in use of van pooling. User can vary both the average van pool size as well as the percentage of commuters that use van pools. Users can navigate to the “Transportation Mitigation Measures” tab to access other variables important to van pooling such as average van pool subsidy, average van pool fee per rider, etc.
- **Eco-driving:** This measure estimates emissions reductions from drivers being trained to drive more efficiently. Users can change the percentage of drivers that are trained in 2020 and 2035. Users also can navigate to the “Transportation Mitigation Measures” tab to access other variables important to eco-driving such as a trained driver’s increased efficiency.
- **Pricing Parking:** This measure estimates emissions reductions from changes in the cost to park. This calculator was designed for regions with metropolitan parking scenarios. Users should consider the practical applicability of this calculator to the region under analysis. Users can input the cost to park (in 2010 dollars) for the years 2020 and 2035. Users can navigate to the “Transportation Mitigation Measures” tab to access other variables important to pricing parking such as the price elasticity for parking and fraction of the labor force using public parking in metro areas, etc.
- **Reducing Parking:** This measure estimates emissions reductions from changes to available parking spaces. Users can change the number of spaces removed. This calculator was designed for regions with metropolitan parking scenarios. Users should consider the practical applicability of this calculator to the region under analysis. Users can navigate to the “Transportation Mitigation Measures” tab to access other variables important to reducing parking.
- **Preferential Parking for Electric Vehicles:** This measures emissions reductions resulting from a change in available parking for gasoline-powered vehicles. Users can change the number of spaces reserved for electric vehicles. This calculator was designed for regions with metropolitan parking scenarios. Users should consider the practical applicability of this calculator to the region under analysis. Users can navigate to the “Transportation Mitigation Measures” tab to access other variables important to preferential parking for EV’s.
- **Population Density:** This measure estimates the emissions reductions resulting from changes to population density. Practically, as population density increases so does the fraction of the population that lives in multi-family housing units. However, emissions associated with an increased fraction of the population living in multi-family housing units is not considered as part of this mitigation measure. Here, users can alter the forecast increase in population density for 2020 and 2035. Estimated emissions reductions represent shortened average commutes as well as an increase in commuter walking and mass transit ridership.
- **Bicycle Strategy:** This measure estimates emissions reductions from changes in commuter biking as a result of installing more bike lane miles per square mile. Defaults are provided but a user should carefully consider the rural/metropolitan balance of the region under analysis for best results. Users can navigate

to the “Transportation Mitigation Measures” tab to access other variables important to bicycle strategy such as percentage of commuters who commute via bicycle and elasticity of bike lane demand, etc.

#### 4.5. Waste & Water

- **Landfill Waste:** This measure estimates emissions reductions resulting from capturing landfill emissions. Users can change values for the percentage of landfill waste is captured and a corresponding GHG emissions reduction is calculated.
- **Wastewater:** This measure estimates emissions reductions from capturing wastewater treatment emissions. Users can change values for the percentage of wastewater treatment emissions that are captured and a corresponding GHG emissions reduction is calculated.
- **Per Capita Water Consumption:** This measure determines the total water consumption for the selected jurisdiction based on the user defined per capita water consumption. The emissions and corresponding emission reductions for all the other water measures are based on the user defined per capita consumption levels.
- **Supply and Conveyance:** This measure estimates emissions reductions from changes in consumption and efficiency within the network that supplies and conveys water to the San Diego region. Users can vary consumption in terms of gallons per capita per day, and efficiency in terms of CO<sub>2</sub>e/kWh, and kWh/Million Gallons. Emissions and corresponding reductions associated with Supply and Conveyance constitute an independent component of the overall emissions inventory.
- **Water Treatment:** This measure estimates emissions reductions from changes in the efficiency of the water treatment facilities within the network. Users can vary efficiency in terms of greenhouse gas intensity (CO<sub>2</sub>e/kWh) and energy intensity (kWh/Million Gallons). Improvements to the Water Treatment system efficiency correspond to reductions in the electricity demand for the selected jurisdiction. Reductions in the electricity demand correspond to reductions in the greenhouse gas emissions as a function of the greenhouse gas intensity of electricity as defined in the model.
- **Water Distribution:** This measure estimates emissions reductions from changes in the efficiency of the water distribution network. Users can vary efficiency in terms of greenhouse gas intensity (CO<sub>2</sub>e/kWh) and energy intensity (kWh/Million Gallons). Improvements to the Water Distribution system efficiency correspond to reductions in the electricity demand for the selected jurisdiction. Reductions in the electricity demand correspond to reductions in the greenhouse gas emissions as a function of the greenhouse gas intensity of electricity as defined in the model.

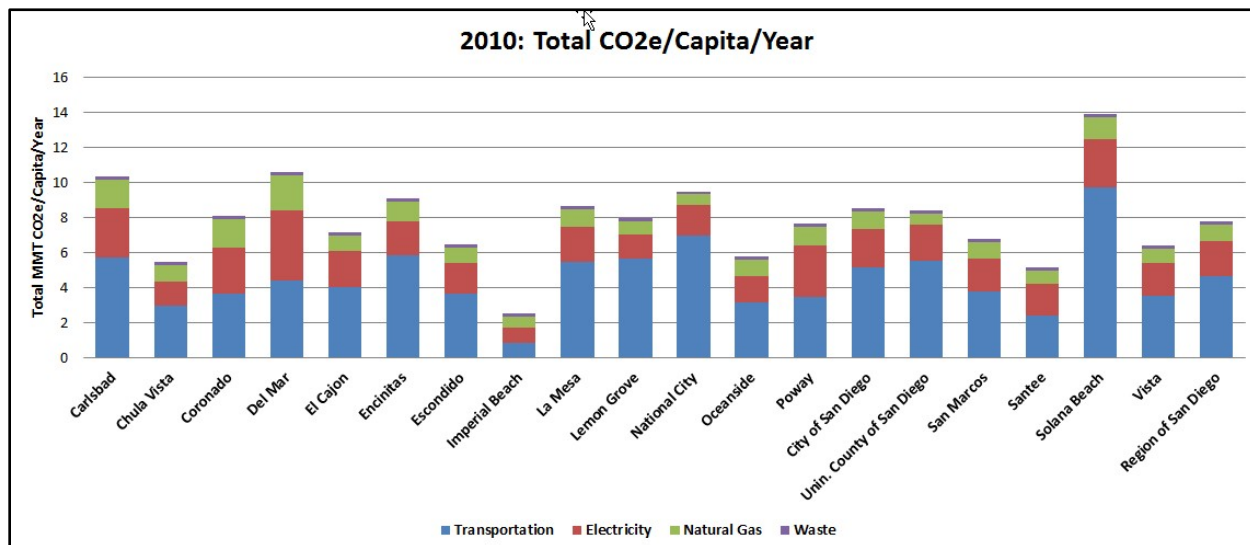
### 5. Module 3: Summary Output

The purpose of the summary output module is to allow a user to easily print or copy summary tables and graphs for use in other reports. Examples of the tables and figures are included below.

Figure 7 Sample Summary Table

Electric + Natural Gas		
Statewide Measures		
Renewable Portfolio Standard (% of Sales)	0.85	1.82
Local Measures		
Residential Photo-Voltaics	0.003	0.005
Non-Residential Distributed PV	0.004	0.007
Cogeneration	0.003	0.000
Residential Efficiency Retrofits - SF	0.003	0.003
Residential Efficiency Retrofits - MF	0.002	0.002
Commercial Efficiency Retrofits	0.020	0.043
New Construction (Res. + Com.) (Non-Lighting)	0.010	0.001
Residential SHW Installs (New Cons. & Retrofits)	0.018	0.059
Commercial SHW Installs (New Cons. & Retrofits)	0.004	0.045
Total Emissions Reductions		
Total Reductions from Statewide Measures	0.846	1.821
Total Reductions from Local Measures	0.056	0.165
Total Electric + Natural Gas Emissions Reductions	0.902	1.986

Figure 8 Sample Summary Figure



## 6. Background Calculations

A chief aim of the model was to create a tool that is both easily accessible to general audiences, while providing an opportunity for some users to change more variables. For each mitigation measure included in the Mitigations Calculations (Module II) tab only the most crucial variables are displayed to a user. The name of each mitigation calculator links to that measure's background calculations. Clicking on the

20	<a href="#">Residential Photo-Voltaics</a>	2010
21	PV Installed Cost (2010\$/Watt)	\$8.00
22	BAU Forecast PV Installed (Megawatt)	2.10
23	User Defined PV Installed (Megawatt)	2.10

name, in this example “[Residential Photovoltaics](#)”, links a user to the background calculation for that measure.

The background calculation for a typical mitigation measure, here Residential PV, is shown below...

Figure 9 Illustrative Background Calculations for a GHG Mitigation Measures

Residential PV		2010	2020	Decline in PV Production	Capacity Factor	O&M Rate	2010 Inverter Installed Cost	2020 Inverter Installed Cost	2030 Inverter Installed Cost	Discount Rate	2010 Name
		(\$313)	(\$127)	(%/yr)	20%	(\$/MWh)	(2010\$/W)	(2010\$/W)	(2010\$/W)	5%	
		-44,500,381	-43,453,781			\$0.01	\$0.75	\$0.50	\$0.50		
		-82,023,235	-852,260								
Year	Inputs	Electricity Production		GHG Emissions		PV Systems Installed in 2010			Ann		
	Total Capacity (MWh)	PV Installed Cost (2010\$/W)	Electricity Savings (kWh)	Total Electricity Savings (MWh)	GHG Intensity of Electricity (lbs/MWh)	Annual GHG Reductions (MMT CO2e)	Total GHG Reductions (MMT CO2e)	Annual Energy Savings (MWh)	Annual GHG Reductions (MMT CO2e)	Annual Savings for PV Installed (2010)	
2010	2.10	\$8.00	1,146,027	1,146	722	0.00038	0.0004	1,146	0.0004	\$186,532	
2011	2.75	\$7.80	1,146,027	2,292	704	0.00037	0.0007	1,135	0.0004	\$184,667	
2012	3.41	\$7.60	1,146,027	3,438	685	0.00036	0.0011	1,123	0.0003	\$178,379	
2013	4.06	\$7.40	1,146,027	4,584	667	0.00035	0.0014	1,112	0.0003	\$173,578	
2014	4.71	\$7.20	1,146,027	5,730	648	0.00034	0.0017	1,101	0.0003	\$169,433	
2015	5.37	\$7.00	1,146,027	6,876	630	0.00033	0.0020	1,090	0.0003	\$165,927	
2016	6.02	\$6.80	1,146,027	8,022	611	0.00032	0.0022	1,079	0.0003	\$161,338	
2017	6.68	\$6.60	1,146,027	9,168	593	0.00031	0.0025	1,068	0.0003	\$161,637	
2018	7.33	\$6.40	1,146,027	10,314	574	0.00030	0.0027	1,057	0.0003	\$162,528	
2019	7.99	\$6.20	1,146,027	11,460	556	0.00029	0.0029	1,047	0.0003	\$163,379	
2020	8.64	\$6.00	1,146,027	12,606	537	0.00028	0.0031	1,036	0.0003	\$164,212	
2021	9.27		1,105,748	13,712	528	0.00027	0.0033	1,026	0.0002	\$165,361	
2022	9.90		1,105,748	14,818	519	0.00026	0.0035	1,016	0.0002	\$166,287	
2023	10.53		1,105,748	15,924	510	0.00026	0.0037	1,006	0.0002	\$167,316	
2024	11.16		1,105,748	17,029	501	0.00025	0.0039	996	0.0002	\$169,082	
2025	11.79		1,105,748	18,135	492	0.00025	0.0040	986	0.0002	\$180,235	
2026	12.43		1,105,748	19,241	483	0.00024	0.0042	976	0.0002	\$191,324	
2027	13.06		1,105,748	20,347	474	0.00024	0.0044	966	0.0002	\$182,313	
2028	13.69		1,105,748	21,452	465	0.00023	0.0045	956	0.0002	\$193,105	
2029	14.32		1,105,748	22,558	456	0.00023	0.0047	947	0.0002	\$193,771	
2030	14.95		1,105,748	23,664	447	0.00022	0.0048	937	0.0002	\$192,552	
2031	15.58		1,105,748	24,770	437	0.00022	0.0049	928	0.0002	\$195,488	
2032	16.21		1,105,748	25,875	428	0.00021	0.0050	919	0.0002	\$196,186	
2033	16.84		1,105,748	26,981	419	0.00021	0.0051	910	0.0002	\$196,636	
2034	17.47		1,105,748	28,087	410	0.00021	0.0052	900	0.0002	\$197,460	

Most measures have a series of variables that can be changed to test the effect only that measure’s calculations. For example, in the example above, a user familiar with residential PV could elect to alter the capacity factor and inverter installed cost by simply typing the desired value into the corresponding cell.

The background calculations for any measure can also be accessed by clicking the appropriate tab at the bottom. Mitigation calculators related to transportation are found in the “Transportation Mitigation Measures” tab, mitigation measures related to buildings, electricity or natural gas consumption are found in the “Elec. + NG Mitigation Measures” tab, and mitigation measures related to waste and water and found in the “Waste & Water Mitigation Measures” tab. The “[Back](#)” link below the title links a user back to the Mitigation Calculators module.

A more in-depth and detailed explanation of the structure of the background calculations, specifically how they are dynamically interrelated, is located in the technical documentation.

## 7. Data

All data used by the model is housed in the “Community Data” tab. Data is organized (horizontally) by city and (vertically) by year and data category. When a user selects a jurisdiction in Module 1 (BAU and Targets module), the model uses a “lookup” function to locate just the data column that pertains to the selected jurisdiction. A user who wishes to use outside data for a particular calculation may do so by simply inputting the outside data in place of the default data. However, while relatively simple to do, if a user wishes to input outside data in place of the default data, please consult the technical documentation to ensure that proper procedure is followed. The technical documentation goes into greater detail with regards to the data and any assumptions used in this model.