



## South Coast Air Quality Management District

# Net Emissions Analysis Tool (NEAT) Getting Started Guide

### *Introduction*

The Net Emissions Analysis Tool (NEAT) is a modeling tool, developed by staff at the South Coast Air Quality Management District, which calculates the changes in emissions of NOX and greenhouse gases and evaluates the costs associated with switching residential appliances to cleaner and more efficient technologies. NEAT is specifically tailored to analyze the effects of new residential technologies in the South Coast Air Basin of California (SoCAB), and it is designed to calculate emission changes with respect to a baseline mix of technologies that is based on the 2009 Residential Appliance Saturation Survey (RASS). The tool allows the user to switch residential technologies per household type (single, multi-family and mobile home) and individual climate zones, and uses comprehensive rate structures that represent all the utilities that are specific to the various regions present in the SoCAB. For example, one can use NEAT to analyze the electrification of residential appliances, and its impact on emissions and costs due to shifting electricity and natural gas use. NEAT is a holistic tool that is designed to calculate changes in emissions and costs for a population of homes. It is not suited for modeling a specific home.

NEAT is equipped with a comprehensive modules that allows to add residential solar panels and calculate its costs and benefits. The tool accounts for how much panel area is available in an average single family and mobile home household in each climate zone. The amount of electricity that can be generated by the panels is calculated using NREL's PVWatts calculator. The solar panel module allows the user to input parameters related to the type of solar panel (i.e. standard, premium, and thin film), system loss, inverter efficiency, DC to AC efficiency, and panel tilt angle. Hourly solar and meteorological data used in the module is based on representative typical meteorological stations selected for each climate zone. The cost of the panels include installation and electricity savings based on zone-specific electricity rates. The module calculates the costs of various size configurations and finds the panel area that minimizes the overall cost.

With the parameters input by the user, NEAT simulates a mix of 15,000 homes that is representative of the appliance technology mix in each climate zone and each housing type. The results from NEAT simulations provide a distribution of homes with varying emission changes and costs per unit of emission change. The tool allows the user to screen for homes with the most cost effective appliance

changes. Along with other applications, the tool can be used to constrain the amount of funding used to implement an incentive program targeted to switch appliances and design incentive programs to maximize emission reductions with limited financial resources.

### System Requirements

NEAT must be installed on a Windows machine with at least 8 GB of RAM. It may be possible to run NEAT on a computer with less memory, but there may not be enough memory to calculate scenarios that involve all climate zones or all housing types simultaneously.

### Installation Instructions

Run NEATInstaller\_mcr.exe and follow the prompts. Note that there may be a slight delay after running the installer and before the installation window appears. There is no need to set up the “Connection Settings”. NEAT must be installed into a folder with write access. If you are unsure which folder to install NEAT to, install it to a subfolder in your “My Documents” folder.

### Modeling a Scenario

NEAT is designed to determine changes in cost and emissions by comparing the “baseline” case and the “scenario” case. The “BASELINE TECHNOLOGY MIX PARAMETERS” table indicates the mix of appliances in the baseline case and the penetration of each technology for the selected housing category and climate zone. The “SCENARIO TECHNOLOGY MIX PARAMETERS” indicates the appliance mix in the scenario case with the rows corresponding directly to the “BASELINE TECHNOLOGY MIX PARAMETERS” table. When both tables correspond across a row, an equal sign will be visible between the tables and no modification of that appliance will occur in the calculation. When the “SCENARIO TECHNOLOGY MIX PARAMETERS” table is modified to indicate a change in appliance, a “not equal” sign will appear for all rows where an appliance change-out is desired. For the calculation, NEAT assumes that all homes with the given type of technology receive the new technology. However, not all homes have the specific technology in the baseline case as penetration is typically less than one.

The screenshot displays the NEAT software interface with the following sections:

- Navigation:** Demand, Demand Input Summary, Power Supply, Economics, Computation, Results.
- Configuration:**
  - Housing Category: Single-Family, Multi-Family, Mobile Home, **Aggregate**
  - Climate Zone: 6 Coastal, 8 S. Near-Coastal, 9 N. Near-Coastal, 10 S. Inland, 15 S. Desert, 16 Mountain, **All CZ MAP**
  - Buttons: Load Default Parameters, Load Saved Parameters, Edit parameters in "Add Technology for Scenario Selection" and implement with "Replace Technology Tool", Load Saved Parameters.
- Category Selection:** Hot water heating, **Kitchen**, Laundry, Miscellaneous, Pool, Space heating and cooling, Transportation.
- BASELINE TECHNOLOGY MIX PARAMETERS:**

Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Penetration
A Electric	Water Heat	2.4684e+03	0	0	368	1700	13	0.0740
B Electric	Solar Water Heat with Electric Backup	1.9637e+03	0	0	1411	3869	13	0
C NatGas	Conventional Water Heater	192.9700	0.0023	11.7600	653	1900	13	0.7160
D NatGas	Solar Water Heat with Gas Backup	162.7800	0.0023	11.7600	4349	3869	13	0
- SCENARIO TECHNOLOGY MIX PARAMETERS:**

Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime
Electric	Water Heat	2.4684e+03	0	0	368	1700	13
Electric	Solar Water Heat with Electric Backup	1.9637e+03	0	0	1411	3869	13
NatGas	Conventional Water Heater	192.9700	0.0023	11.7600	653	1900	13
NatGas	Solar Water Heat with Gas Backup	162.7800	0.0023	11.7600	4349	3869	13
- NEW TECHNOLOGY PARAMETERS:**

#	Fuel	Technology	Profile	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Notes
1	Electric	Water Heat	Water Heating	2.4684e+03	0	0	368.0057	1700	13	General technology ca
2	Electric	Solar Water Heat with Electric Backup	Water Heating	1.9637e+03	0	0	1.4105...	3869	13	General technology ca
3	NatGas	Conventional Water Heater	Water Heating	192.9711	0.0023	11.7600	653.2697	1900	13	General technology ca
4	NatGas	Solar Water Heat with Gas Backup	Water Heating	162.7750	0.0023	11.7600	4.3485...	3869	13	General technology ca
5	NatGas	Whole House Tankless System	Water Heating	-9999	-9999	-9999	-9999	-9999	-9999	Values not specified
6	NatGas	High-Efficiency Condensing	Water Heating	-9999	-9999	-9999	-9999	-9999	-9999	Values not specified
- Replace Technology Tool:**

Replace Technology Tool (All households with the baseline technology will switch to the replacement tech.)  
 Select baseline technology to phase-out:  
 A Electric Water Heat  
 Select technology to use instead:  
 1 Electric Water Heat  
 Implement
- Buttons:** View Profile Definitions, Add Technology, Save List of New Technologies to File, RETURN TO PREVIOUS, ADVANCE TO NEXT.

There is a significant amount of embedded documentation within NEAT, which is accessible with buttons throughout the tool. It is strongly recommended that new users consult the embedded documentation when setting up a simulation. However, the following table addresses how to set up a scenario within NEAT. Users should refer to the additional embedded documentation as well.

<b>Desired Modification</b>	<b>How to Make Modification and What to Consider</b>
Load a previously generated setup file	Click "Load Setup" under the "File" menu. This looks for files with a .setup extension that were created with the tool. Ensure that the setup file you are loading was made with the same version of the tool.
Load a previously generated results file	Click "Load Results" under the "File" menu. This looks for files with a .results extension that were created with the tool. Ensure that the results file you are loading was made with the same version of the tool.
Restart the tool with default values	Click "Restart" under the "File" menu.
Take a screenshot of NEAT	Click "Capture Screen" at the top of the tool. Ensure that the entire window of NEAT is on the screen. NEAT will automatically open the captured image. Users can then copy or save the image.
<b>Demand Panel</b>	
View additional technical documentation	Click "View Technical Documentation" under the "Help" menu or click "NEAT Webpage" under the "Help" menu.
Select a specific housing category	Use the "Housing Category" panel on the "Demand" tab. Default technology mix parameters change when selecting different housing categories. Average technology mix parameters, representing the entire South Coast Air Basin (SoCAB) are used when "Aggregate" is selected.
Select a specific climate zone	Use the "Climate Zone" panel on the "Demand" tab. Default technology mix parameters change when selecting different climate zones. Average technology mix parameters, representing the entire South Coast Air Basin (SoCAB) are used when "All" is selected.
Load saved technology mix parameters	Use the "Load Saved Parameters" button on the "Populate Baseline and Scenario Technology Mix Parameters" panel. This operation only accepts .csv files with a specific format. These files can be generated automatically by saving the current mix parameters with the "Save Baseline and Scenario Technology Mix Parameters to File" button. These files can be edited with a .csv editor or systematically with a scripting language if desired. The light next to the "Load Saved Parameters" button should turn green if the data is loaded properly. It will turn red if there were errors loading the data.
Change the efficiency of an appliance	Modify the UEC column directly in the "BASELINE TECHNOLOGY MIX PARAMETERS" or the "SCENARIO TECHNOLOGY MIX PARAMETERS" tables. Use the tabs to

	<p>switch between different appliance categories. Default UEC values reflect the average of all the appliances in the housing category and climate zone. It is highly recommended to replace these with actual values when exploring a retrofit scenario. When all parameters in the BASELINE and SCENARIO table are equivalent across a horizontal row, no modification is implemented. Since NEAT is designed to only calculate changes in emissions and costs, it is not necessary to fine tune the parameters in the appliances that are not being modified.</p>
Change the emission factors of an appliance	<p>Modify the NOX EF and CO2e EF columns directly in the “BASELINE TECHNOLOGY MIX PARAMETERS” or the “SCENARIO TEHCNOLOGY MIX PARAMETERS” tables. Use the tabs to switch between different appliance categories. Default emission factors reflect the average of all the appliances in the housing category and climate zone. It is highly recommended to replace these with actual values when exploring a retrofit scenario. When all parameters in the BASELINE and SCENARIO table are equivalent across a horizontal row, no modification is implemented. Since NEAT is designed to only calculate changes in emissions and costs, it is not necessary to fine tune the parameters in the appliances that are not being modified.</p>
Change the unit cost and/or the installation cost of an appliance	<p>Modify the Unit Cost and Install Cost columns directly in the “BASELINE TECHNOLOGY MIX PARAMETERS” or the “SCENARIO TEHCNOLOGY MIX PARAMETERS” tables. Use the tabs to switch between different appliance categories. Default costs come from a survey of appliance costs. (Data sources are available in the NEAT workgroup #2 presentation, <a href="http://www.aqmd.gov/NEAT">www.aqmd.gov/NEAT</a>) It is highly recommended to replace these with actual values when exploring a retrofit scenario. When all parameters in the BASELINE and SCENARIO table are equivalent across a horizontal row, no modification is implemented. Since NEAT is designed to only calculate changes in emissions and costs, it is not necessary to fine tune the parameters in the appliances that are not being modified.</p>
Change the penetration of an appliance	<p>Modify the Unit Cost and Install Cost columns directly in the “BASELINE TECHNOLOGY MIX PARAMETERS” or the “SCENARIO TEHCNOLOGY MIX PARAMETERS” tables. Use the tabs to switch between different appliance categories. Default values come from the 2009 Residential Appliance Saturation Study conducted by the California Energy Commission. NEAT assumes the same penetration in the baseline and scenario case.</p>
Replace an appliance	<p>Use the “Replace Technology Tool” by selecting the technology you want to phase-out with the first dropdown menu. This list contains all the baseline technologies. Select</p>

	<p>the new technology you want to use instead with the second dropdown menu. This list contains all of the new technologies in the “NEW TECHNOLOGY PARAMTERS” table. One can edit or add custom technologies to the “NEW TECHNOLOGY PARAMETERS” table. After clicking “Implement”, the replacement technology should appear in the “SCENARIO TECHNOLOGY MIX PARAMETERS” table. Appliances with “-9999” values are included in the tool but do not have default values. Users must provide their own parameters for each of the implemented appliances before performing the calculation.</p>
Edit the hourly energy use profile for an appliance	<p>Double-click a profile in the “NEW TECHNOLOGY PARAMETERS” table to edit the hourly energy use profile. Profile definitions and an interactive plotting tool to view each profile are available after clicking the “View Profile Definitions” button. These hourly profiles tell NEAT how to apportion the energy use of each appliance on an hourly basis.</p>
Add a custom technology	<p>Use the “Add Technology” button to add a row to the “NEW TECHNOLOGY PARAMETERS” table. Specify the Fuel, the name of the technology, the profile, UEC, NOX EF, CO2e EF, unit cost, install cost, and lifetime. Use the “Replace Technology Tool” to implement the new technology by putting it in the “SCENARIO TECHNOLOGY MIX PARAMTERS” table.</p>
Save list of new technologies	<p>Use the “Save List of New Technologies to File” to save all the data from the “NEW TECHNOLOGY PARAMETERS” tables for all technology categories. These files are written in comma-separated-value format and can be used in NEAT with the “Populate List of New Technologies for Possible Implementation” panel.</p>
Load saved new technologies	<p>Use the “Load Saved Parameters” button on the “Populate List of New Technologies for Possible Implementation” panel. The light next to the “Load Saved Parameters” button should turn green if the data is successfully loaded. A red light indicates an error.</p>
<p><b>Demand Input Summary (for viewing only)</b>  The Demand Input Summary panel provides a summary of all the appliance changes that were implemented on the “Demand” tab.</p>	
<p><b>Power Supply Panel</b></p>	
Change the natural gas leak rate	<p>Use the “Natural Gas Leak Rates” panel in the “Methane Emissions from Natural Gas” panel to modify the before-meter methane leak rate and the before meter transmission/storage/distribution leak rate. Note that the before meter leak rate includes the before meter transmission/storage/distribution leak rate. Selecting</p>

	<p>“Custom Value” makes the “Before Meter Leak Rate [%]” and the “Before Meter Transmission/Storage/Distribution Leak Rate [%]” input boxes editable. Users can also change the behind meter methane leak rate with the “Behind Meter Leak Rate [%]” dialog box. Click the “More Information” button on this panel for additional details about these leak rates.</p>
Change the time horizon for the global warming potential	Use the “Global Warming Potential” dropdown selector in the “Methane Emissions from Natural Gas” to select the desired time horizon.
Change the heat content of natural gas	Use the “Heat Content [Btu/ft <sup>3</sup> ]” input box to modify the heat content.
Change the carbon intensity of natural gas production	Change the values in the “CO <sub>2</sub> e Emissions. (lb/therm)” column on the “GHG Emis. From Additional Natural Gas Production” panel.
Change the fraction of renewable natural gas used to satisfy an increase in natural gas usage	Change values in the “Supply Fraction” column on the “GHG Emis. From Additional Natural Gas Production” panel. NEAT assumes that all natural gas in the baseline case is from fossil sources, but uses the “Supply Fraction” and the “CO <sub>2</sub> e Emis. (lb/therm)” columns to model the carbon intensity of increased natural gas production.
Change the Well-to-Pump emissions of transportations fuels	Use the “Well-to-Pump Emis. of Transportation” panel to modify the CO <sub>2</sub> equivalent and NO <sub>x</sub> emission factors of gasoline and diesel production.
Add rooftop solar photovoltaics to every single-family and mobile home	Use the “Implement Rooftop Solar PV using PVWatts” checkbox in the “Distributed Solar Photovoltaics” panel to add solar to every single-family and mobile home in the “Scenario” case. NEAT assumes that no homes have rooftop solar PV in the baseline case. It is not possible to relax this assumption. After selecting the checkbox, users will be able to modify relevant settings for the calculation. It is not possible to implement rooftop solar PV on multi-family homes in NEAT.
Change the cost of rooftop solar PV	After clicking the “Implement Rooftop Solar PV using PVWatts” checkbox in the “Distributed Solar Photovoltaics” panel, users will be able to modify the solar cost function in the “For Advanced Users” panel, which is used to model the cost of rooftop solar as a function of capacity.
Change the assumptions used for calculation of the energy generated from rooftop solar PV	Relevant parameters can be changed in the “For Advanced Users” panel within the “Distributed Solar Photovoltaics” panel. Select the “More Information” button at the bottom of the panel for a description of all relevant parameters.
Change the emissions resulting from increased electricity demand	The “Electricity Generation from Grid” panel contains a panel titled “Emission Factor of INCREASED Electricity Use.” Four options can be selected. Case 1 assumes that all additional electricity comes from sources without any NO <sub>x</sub> or GHG emissions (centralized photovoltaics, wind, and centralized battery storage). Case 2 assumes that additional electricity is

	provided at the Basin-average dispatchable power emission factor. Case 3 assumes that all additional electricity is provided by peaker plants. The fourth option allows users to specify a mix of technologies by setting the percentage of each case. The “Electricity Generation Module Documentation” provides details for each of the three cases.
Select how the emissions from a decrease in electricity demand are calculated.	The “Electricity Generation from Grid” panel contains a panel titled “Emission Factor of REDUCED Electricity Use”. The “Electricity Generation Module Documentation” provides details for each of the three cases.
Change how NEAT calculates the transmission and distribution loss in the power grid	Three calculation options are available in the “Transmission and Distribution Loss in Power Grid” panel within the “Electricity Generation from Grid” panel. Users can select a flat loss percentage to use for all utilities, a hourly loss percentage to use for all utilities, and utility-specific loss percentages. Utility-specific loss percentages are editable directly. See “More Information” for details.
<b>Economics Panel</b>	
Change or view the fraction of homes in each climate zone and housing category that are eligible for low income natural gas and electric rates	Click the “View/Edit Low Income Fractions” button on the “For Advanced Users” panel within the “Low Income Rates Qualification” panel. This will open up the “Electricity Rate Structure Selector and Editor,” where users can view, edit, and save low income rate qualification percentages.
Load saved set of low income fractions	Click the “Load Saved Low Income Fractions” button on the “For Advanced Users” panel within the “Low Income Rates Qualification” panel. NEAT will look for files with an “.income” suffix, which can only be created with the Electricity Rate Structure Selector and Editor tool (see above).
Change or view electricity rate structures	Click the “View/Edit Rate Structures” button on the “For Advanced Users” panel within the “Electricity Rates” panel. This will open up the “Electricity Rate Structure Selector and Editor,” where users can view and edit electric rate structures.
Load saved electric rate structures	Click the “Load Saved Rate Structures” button on the “For Advanced Users” panel within the “Electricity Rates” panel. NEAT will look for files with a “.erate” suffix, which can only be created by saving a rate structure configuration in the “Electricity Rate Structure Selector and Editor” (see above).
Define how new natural gas appliances are categorized for natural gas rate assignment	All natural gas appliances must be categorized in the “Natural Gas Appliance Categorization” panel within the “Economics” tab. Users must select a checkbox only when adding a new natural gas fueled appliance technology that best describes the type of appliance. This categorization is used for natural gas rates that depend on the type of heat.
Change or view natural gas rate structures	Click the “View/Edit Rate Structures” button on the “For Advanced Users” panel within the “Natural Gas Rates” panel. This will open up the “Natural Gas Rate Structure Selector

	and Editor,” where users can view, edit, and save natural gas rate structures.
Load saved natural gas rate structures	Click the “Load Saved Rate Structures” button on the “For Advanced Users” panel within the “Natural Gas Rates” panel. NEAT will look for files with a “.grate” suffix, which can only be created by saving a rate structure configuration in the “Natural Gas Rate Structure Selector and Editor” (see above).
Allow for net metering	Select the “Use Net Metering” button within the “Net Metering” panel
Change how much the homeowner receives from excess electricity sold back to the grid	After selecting the “Use Net Metering” button within the “Net Metering” panel, users will be able to select between two net metering options. A fixed rate per kW-hr must be specified if the user selects the “Sell Electricity Back to Grid at Fixed Rate” option.
View or change the price for gasoline and diesel fuel	Change the price of gasoline and diesel fuel in the “Gasoline and Diesel Prices” panel.
<b>Electricity Rate Structure Selector and Editor (Separate Tool)</b>	
Open the “Electricity Rate Structure Selector and Editor”	Click the “View/Edit Rate Structures” button in the “Electricity Rates” panel on the “Economics” tab
Change or view the fraction of homes in each climate zone and housing category that are eligible for low income natural gas and electric rates	Click the “View/Edit Low Income Fractions” button on the “For Advanced Users” panel within the “Low Income Rates Qualification” panel. This will open up the “Electricity Rate Structure Selector and Editor,” where users can view, edit, and save low income rate qualification percentages.
Change of view the electricity rates that are assigned to each climate zone, housing category, or income qualification	Click “More Information” on the “Rate Selector” tab for details. All electricity rate edits must be stored with the corresponding “Store” button and then saved with the “SAVE ALL TO FILE” button.
Add a custom electricity rate	Click “+Add Custom Rate” button on the “Rate Selector” tab. Click “More Information” on the “Rate Selector” tab for details.
Save an edited set of rate structures to an “.erate” file	Click the “SAVE ALL TO FILE” button
Load an edited set of rate structures from an “.erate” file	Click the “LOAD ALL FROM FILE” button
Compare two electricity rates with a typical electricity use profile	Select the “Analysis” tab. This panel is for informational use only and does not make any changes in the rate structures or electricity use profiles used in NEAT.
<b>Natural Gas Rate Structure Selector and Editor (Separate Tool)</b>	
Open the “Natural Gas Rate Structure Selector and Editor”	Click the “View/Edit Rate Structures” button on the “For Advanced Users” panel within the “Natural Gas Rates” panel. This will open up the “Natural Gas Rate Structure Selector and Editor,” where users can view, edit, and save natural gas rate structures.
Change of view the natural gas rates that are assigned to each climate	Click “More Information” on the “Rate Selector” tab for details. All natural gas rate edits must be stored with the



zone, housing category, or income qualification	corresponding “Store” button and then saved with the “SAVE ALL TO FILE” button.
Add a custom natural gas rate	Click “+Add Custom Rate” button on the “Rate Selector” tab. Click “More Information” on the “Rate Selector” tab for details.
Save an edited set of rate structures to an “.grate” file	Click the “SAVE ALL TO FILE” button
Load an edited set of rate structures from an “.grate” file	Click the “LOAD ALL FROM FILE” button

### NEAT Test Case

We recommend that users run a simple test case to ensure that the tool is behaving as expected. Make the following edits to a new instance of the NEAT tool:

Demand Tab:

1. Select Single-Family Housing Category
2. Select “6 Coastal” for the Climate Zone
3. Select the “Kitchen” tab
4. Use the “Replace Technology Tool” to replace all natural gas range oven combinations with electric range oven combination

The screenshot displays the NEAT tool interface with the following components:

- Navigation Tabs:** Demand, Demand Input Summary, Power Supply, Economics, Computation, Results.
- Housing Category:** Single-Family (selected), Multi-Family, Mobile Home, Aggregate.
- Climate Zone:** 6 Coastal (selected), 8 S. Near-Coastal, 9 N. Near-Coastal, 10 S. Inland, 15 S. Desert, 16 Mountain, All (CZ MAP).
- Buttons:** Load Default Parameters, Load Saved Parameters (for both Baseline and Scenario parameters).
- Sub-Tabs:** Hot water heating, Kitchen (selected), Laundry, Miscellaneous, Pool, Space heating and cooling, Transportation.
- Tables:**
  - BASELINE TECHNOLOGY MIX PARAMETERS:** Lists technologies like Range Oven Combination, Dishwasher, First Refrigerator, Second Refrigerator, Freezer, Microwave, and NatGas Range Oven Combination with their respective UEC, NOX EF, CO2e EF, Unit Cost, Install Cost, Lifetime, and Penetration.
  - SCENARIO TECHNOLOGY MIX PARAMETERS:** Lists the same technologies as the baseline table.
  - NEW TECHNOLOGY PARAMETERS:** Lists technologies with their Profile, UEC, NOX EF, CO2e EF, Unit Cost, Install Cost, Lifetime, and Notes.
- Replace Technology Tool:** A pop-up window with a yellow background. It contains a warning: "CAUTION: Default appliance parameters may not be appropriate for most scenarios. For the most accurate results, SCAQMD recommends using actual values for the appliances that are being replaced or retrofit." It includes a dropdown to "Select baseline technology to phase-out" (G NatGas Range Oven Combination) and another dropdown to "Select technology to use instead" (1 Electric Range Oven Combination). An "Implement" button is at the bottom.
- Footer Buttons:** View Profile Definitions, Add Technology, Save List of New Technologies to File, RETURN TO PREVIOUS, ADVANCE TO NEXT.

Power Supply Tab:

1. Check the “Implement Rooftop Solar PV using PVWatts” checkbox

**Methane Emissions from Natural Gas**

Natural Gas Leak Rates (As percentage of usage)

- 2018 EPA GHG Emissions Inventory: 1.27%
- The 16 Study Series Synthesis Report: 1.7%
- Alvarez et al., 2018 Science Paper: 2.3%
- Custom Value

Before Meter Leak Rate [%]:  Behind Meter Leak Rate [%]:

Before Meter Transmission/Storage/Distribution Leak Rate [%]:

Global Warm. Potential:  Heat Content [Btu/ft<sup>3</sup>]:

**GHG Emis. from Increased Natural Gas Production**

(For Advanced Users)

Type	Pathway	Supply Fraction	CO2e Emis. (lb/therm)
bio	landfill	0	-0.8504
bio	wastewater	0	-7.2321
bio	manure	0	-73.1118
bio	food & green waste	0	-17.0455
fossil	natural gas	1	6.8368

\*"Supply Fraction" column must sum to unity

**Well-to-Pump Emis. of Transportation**

(For Advanced Users)

Fuel	CO2e (lb/gal)	NOx (lb/gal)
Gasoline	6.3030	0.0117
Diesel	7.2201	0.0152

**Electricity Generation from Grid**

Emission Factor of INCREASED Electricity Use

- All additional electricity from centralized photovoltaics, wind, and centralized battery storage (Case 1)
- All additional electricity provided at the Basin-average dispatchable power emission factor (Case 2)
- All additional electricity provided by peaker plants (Case 3)
- Grid emission factor changes modeled with HIGRID
- Additional electricity provided by a mixture of technologies

Emission Factor of REDUCED Electricity Use

- Reductions in electricity generation emissions determined with the Basin-average dispatchable power emission factor
- Reductions in electricity generation emissions arise by curtailing peaker plant emissions
- Grid emission factor changes modeled with HIGRID

Transmission and Distribution Loss in Power Grid (For Advanced Users)

- Use Flat Loss Percentage for all Utilities
- Use Hourly Loss Percentage for all Utilities
- Use Utility Specific Loss Percentages

Utility Name	Valid Years	Loss [%]
Azusa Light & Power	9	2.5000
Bear Valley Electric Service	9	12.2000
Burbank Water & Power	10	3.5000
City of Anaheim Public Utilities Department	10	4.9000

**Distributed Solar Photovoltaics**

Implement Rooftop Solar PV using PVWatts

Solar Cost Function: COST =  where "X" is defined as the panel size in kW DC under standard test conditions.

Module Type:  Rooftop Area Availability Ratio:

System Loss Value:  Useful Lifespan [yrs]:

Inverter Efficiency [%]:  Panel Tilt [degrees]:

DC to AC Size Ratio:

**Residential Battery Storage**

Implement Residential Battery using Battery Model

Battery System:  Battery Capacity [kW-hr]:  Installation Cost \$:  Lifetime [years]:

Battery Setup B: Battery Power [kW]:  Battery Cost \$:

After implementing the suggested changes, select the "Compute Results" button on the Computation slide. If the computation completed successfully, the first line in the output status should read "\*\*\* COMPUTATION COMPLETED SUCCESSFULLY!\*\*\*". This computation takes approximately 70 seconds on a modestly equipped South Coast AQMD computer (Intel Core i5-4570 CPU @3.20GHz with 8 GB RAM).

One should then verify if the results are as expected. Go to the "Results" tab and select the "ANALYZE" button after the results have loaded. Go to the "Apply Prescribed Funding" tab. With a default funding amount of \$100000 and a 0% cost share by the homeowner (also default setting), the approximate number of projects funded should be 14. The cumulative change in NOx emissions in lb/yr should be -8.68 and the cumulative change in CO2e emissions in lb/yr should be -1.12e6.

**Results**

Select Cost Effectiveness Subset  Appliance Mix  Apply Prescribed Funding  Query Individual Homes

Enter Funding Amount [\$]:  Funding is applied only to households filtered on the "Select Cost Effectiveness Subset" "Project" refers to all of the selected retrofits for a particular home

Cost Share by Homeowner [%]:

Description (click on a variable to view histograms)	Value
Approximate Number of Projects Funded	14
Number of Possible Projects in "Cost Effectiveness Subset"	409427
SCAQMD Cost to Fund All Projects in "Cost Effectiveness Subset" (only considers purchase and installation costs)	\$2,689,708,459.27
Cumulative Change in NOx Emissions [lb/yr]	-8.68e+00
Cumulative Change in NOx Emissions [TPD]	-1.19e-05
Cumulative Change in CO2e Emissions [lb/yr]	-1.12e+06
Cumulative Change in CO2e Emissions [TPD]	-1.54e+00
Average Incentive Amount Provided to Homeowner to Purchase and Install Appliances, PV (if selected), and Battery (if selected)	\$6,676.20
Median Incentive Amount Provided to Homeowner to Purchase and Install Appliances, PV (if selected), and Battery (if selected)	\$7,044.14
Average Cost-Share from Homeowner to Purchase and Install Appliances, PV (if selected), and Battery (if selected)	\$0.00
Median Cost-Share from Homeowner to Purchase and Install Appliances, PV (if selected), and Battery (if selected)	\$0.00
Average Change in Annual Utility and Fuel Costs for Homeowner	\$-602.32
Median Change in Annual Utility and Fuel Costs for Homeowner	\$-605.95
Average Change in Amortized Appliance Purchase and Installation Costs Borne By Homeowner Including PV and Battery (if selected)	\$0.00
Median Change in Amortized Appliance Purchase and Installation Costs Borne By Homeowner Including PV and Battery (if selected)	\$0.00

**Filter Homes**

Climate Zones

- 6 Coastal
- 8 S. Near-Coastal
- 9 N. Near-Coastal
- 10 S. Inland
- 15 S. Desert
- 16 Mountain
- All Climate Zones

Housing Category

- Only Single Family Homes
- Only Multi Family Homes
- Only Mobile Homes
- All Housing Types

Natural Gas Utilities

- Long Beach Gas & Oil
- Southern California Gas
- Southwest Gas Corp.
- City of Vernon Gas System

Electric Utilities

- Azusa Light & Power
- Bear Valley Electric Service
- Burbank Water & Power
- City of Anaheim Public Utilities Department
- City of Banning Electric Department
- City of Corona Department of Water & Power
- City of Riverside
- City of Vernon Municipal Light Department
- Glendale Water & Power
- Los Angeles Department of Water & Power
- Moreno Valley Utility
- Pasadena Water & Power
- Rancho Cucamonga Municipal Utility
- San Diego Gas & Electric
- Southern California Edison

409,427 homes meeting filter criteria above  
7.3813% of the total homes in SoCAB meet filter criteria

Previous computation loaded.