Net Emissions Analysis Tool (NEAT) Working Group

Formally the Residential Commercial Appliance Life Cycle Analysis Working Group

Meeting #6
January 16th, 2019

South Coast
Air Quality Management District

Development Status Update

Sang-Mi Lee, Ph.D.

Planning and Rules Division

South Coast
Air Quality Management District

Working Group Meetings and Comment Letters to Date

- Six working group meetings (including today) and eight comment letters
- Working group meetings
  - Meeting #1 August 30, 2017
  - Meeting #2 November 16, 2017
  - Meeting #3 January 31, 2018
  - Meeting #4 April 18, 2018
  - Meeting #5 September 28, 2018
  - Meeting #6 January 16, 2019
- Comment Letters
  - Sierra Club – Nov. 2017
  - PSE Healthy Energy – Feb. 2018
  - Sustainable Analysis, LLC – Feb. 2018
  - SoCalGas – Mar. 2018
  - Sierra Club – Apr. 2018
  - Tim Kabat – Apr. 2018
  - SoCalGas – Jun. k2018
  - Sierra Club – Sep. 2018

Development Progress

- Meeting #1 August 30, 2017
  - Initiative to develop a tool to estimate cost effectiveness of emission reductions in residential sector
  - Solar Technology Initiative
- Meeting #2 November 16, 2017
  - Demand segment
  - Solar PV calculator
  - Collecting input data
- Meeting #3 January 31, 2018
  - Electric rate calculator
  - Net metering
  - Emissions from electricity generation

Development Progress (continued)

- Meeting #4 April 18, 2018
  - Natural gas rate calculator
  - Fugitive methane emissions from natural gas use
  - Continued discussions on emissions from electricity generation
- Meeting #5 September 28, 2018
  - Battery storage module
  - Electricity transmission and distribution loss
  - Renewable natural gas
  - Lifecycle Emissions from Gasoline and Diesel

Development Progress (continued)

- Meeting #6 January 16, 2019
  - Implementation of Battery Storage Module
  - Residential Rooftop Photovoltaic Cost Calculation
  - Live Demonstration of NEAT

Comments and Responses
(since last meeting)

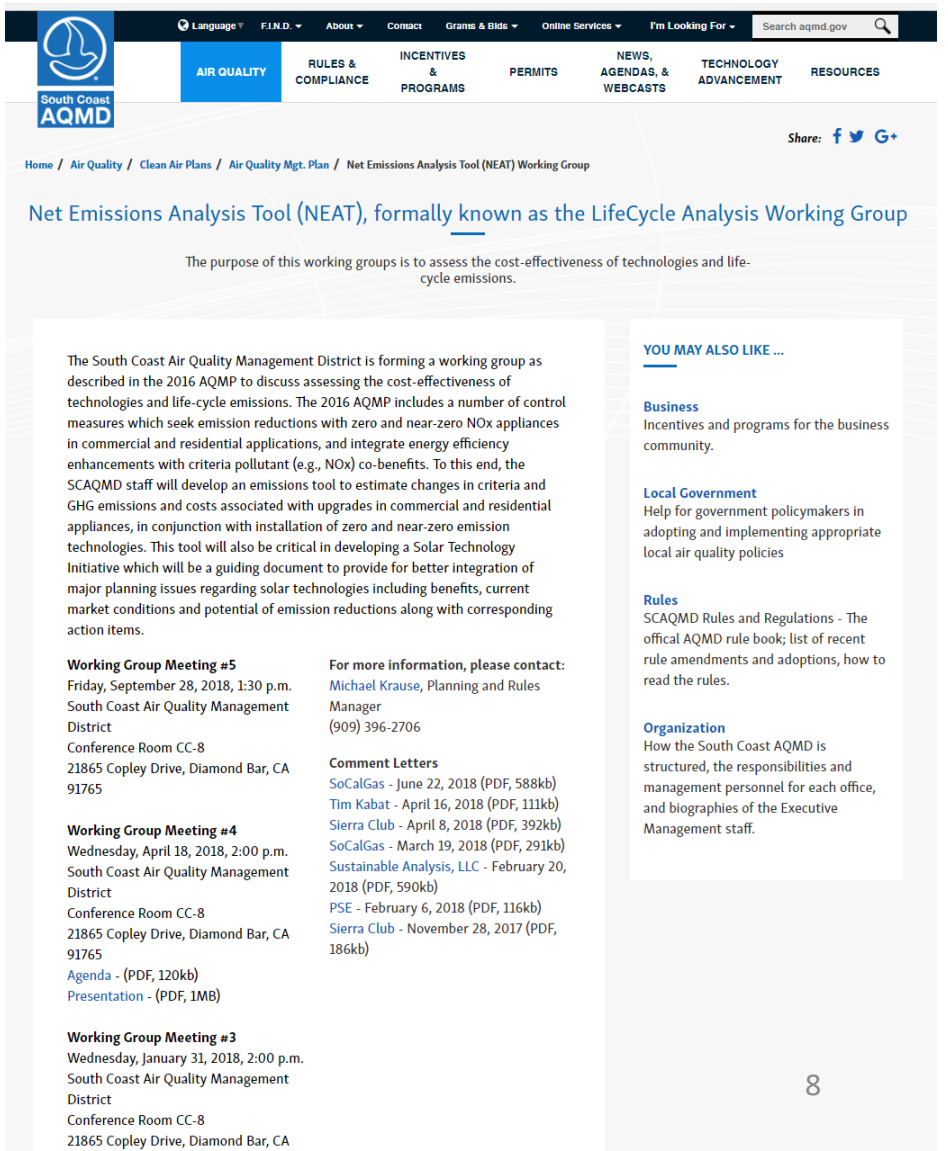
Scott A. Epstein Ph.D. & Marc Carreras Sospedra Ph.D.

Planning and Rules Division

South Coast
Air Quality Management District

Summary of Submitted Comments

- All comment letters posted to the NEAT website
  - www.aqmd.gov/NEAT
- No comment letters were submitted since last meeting, but we will discuss comments provided during last meeting



South Coast AQMD

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Net Emissions Analysis Tool (NEAT), formally known as the LifeCycle Analysis Working Group

The purpose of this working groups is to assess the cost-effectiveness of technologies and life-cycle emissions.

The South Coast Air Quality Management District is forming a working group as described in the 2016 AQMP to discuss assessing the cost-effectiveness of technologies and life-cycle emissions. The 2016 AQMP includes a number of control measures which seek emission reductions with zero and near-zero NOx appliances in commercial and residential applications, and integrate energy efficiency enhancements with criteria pollutant (e.g., NOx) co-benefits. To this end, the SCAQMD staff will develop an emissions tool to estimate changes in criteria and GHG emissions and costs associated with upgrades in commercial and residential appliances, in conjunction with installation of zero and near-zero emission technologies. This tool will also be critical in developing a Solar Technology Initiative which will be a guiding document to provide for better integration of major planning issues regarding solar technologies including benefits, current market conditions and potential of emission reductions along with corresponding action items.

Working Group Meeting #5
Friday, September 28, 2018, 1:30 p.m.
South Coast Air Quality Management District
Conference Room CC-8
21865 Copley Drive, Diamond Bar, CA 91765

Working Group Meeting #4
Wednesday, April 18, 2018, 2:00 p.m.
South Coast Air Quality Management District
Conference Room CC-8
21865 Copley Drive, Diamond Bar, CA 91765
Agenda - (PDF, 120kb)
Presentation - (PDF, 1MB)

Working Group Meeting #3
Wednesday, January 31, 2018, 2:00 p.m.
South Coast Air Quality Management District
Conference Room CC-8
21865 Copley Drive, Diamond Bar, CA

For more information, please contact:
Michael Krause, Planning and Rules Manager
(909) 396-2706

Comment Letters
SoCalGas - June 22, 2018 (PDF, 588kb)
Tim Kabat - April 16, 2018 (PDF, 111kb)
Sierra Club - April 8, 2018 (PDF, 392kb)
SoCalGas - March 19, 2018 (PDF, 291kb)
Sustainable Analysis, LLC - February 20, 2018 (PDF, 590kb)
PSE - February 6, 2018 (PDF, 116kb)
Sierra Club - November 28, 2017 (PDF, 186kb)

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Business
Incentives and programs for the business community.

Local Government
Help for government policymakers in adopting and implementing appropriate local air quality policies

Rules
SCAQMD Rules and Regulations - The offical AQMD rule book; list of recent rule amendments and adoptions, how to read the rules.

Organization
How the South Coast AQMD is structured, the responsibilities and management personnel for each office, and biographies of the Executive Management staff.

Comments and Responses

- Utility-Specific Electricity Transmission and Distribution Loss
  - Use utility-specific loss rates from EIA-861 schedule 2 for all utilities in database
  - *We added an option in the tool to use utility-specific loss rates from EIA-861*
  - *Loss rates are calculated as (total energy losses)/(total disposition)*
  - *Data from 2008 to 2017 was used for each utility*
  - *See https://www.eia.gov/electricity/data/eia861/ for details*
  - *Users have the choice to use flat loss rate across all utilities, use hourly loss rate for all utilities, or use utility-specific loss rate*

Comments and Responses (continued)

Utility-Specific Electricity Transmission and Distribution Loss

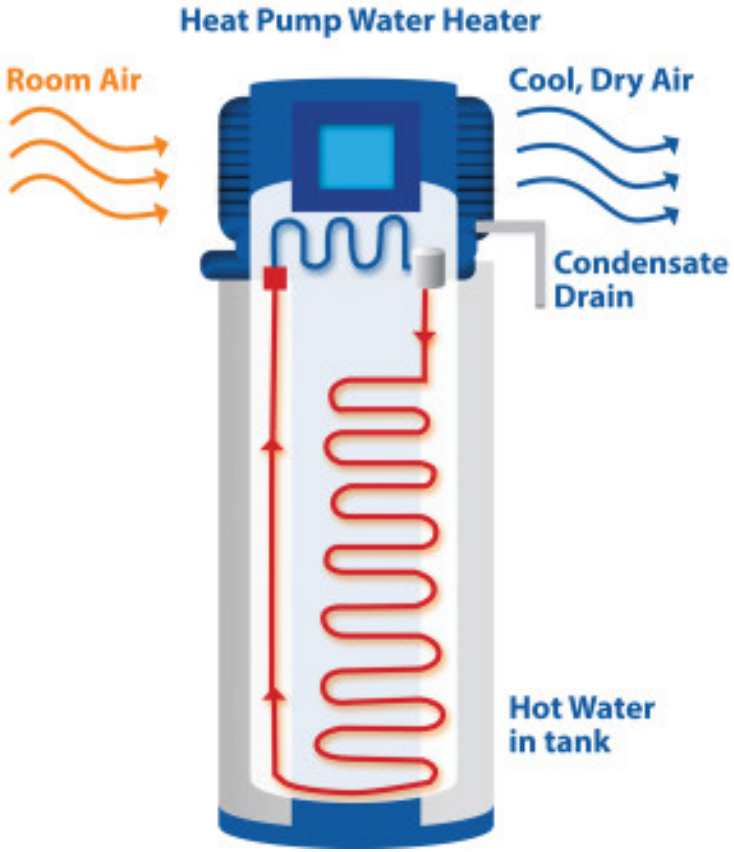
UTILITY NAME	Years Available	Mean Loss Percentage
Azusa Light & Power	9	2.5
Bear Valley Electric Service	9	12.2
Burbank Water & Power	10	3.5
City of Anaheim Public Utilities Department	10	4.9
City of Banning Electric Department	10	6.8
City of Corona Department of Water & Power	10	2.7
City of Riverside	10	5.4
City of Vernon Municipal Light Department	10	3.9
Glendale Water & Power	10	2.7
Los Angeles Department of Water & Power	8	9
Moreno Valley Utility	9	5.5
Pasadena Water & Power	10	4.2
Rancho Cucamonga Municipal Utility	4	2.9
San Diego Gas & Electric	10	4.3
Southern California Edison	10	5.2

Comments and Responses (continued)

- Thermal Storage Heat Pump Water Heaters
  - Include thermal storage heat pump water heater profiles in NEAT
  - *We included two additional electric profiles for electric water heating with basic strategies to shift electric load*

Electric Thermal Storage Water Heating

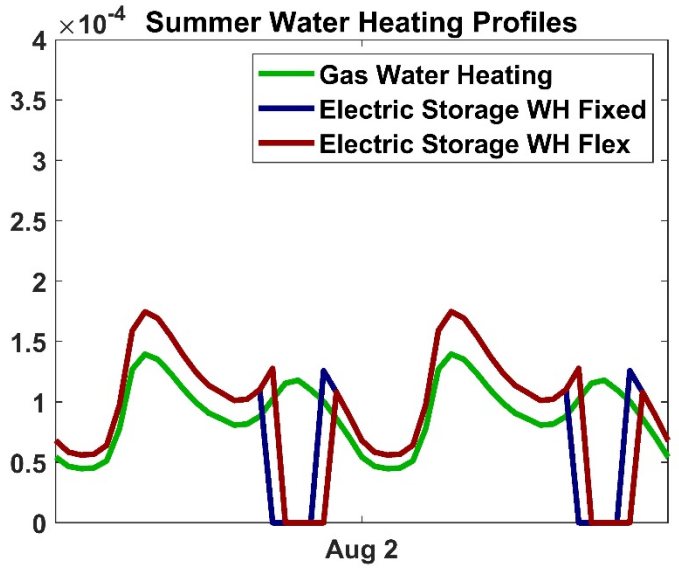
- Electric thermal storage water heating is an option to manage residential electrical load:
  - For peak shaving
  - For shifting demand to cheaper electricity rates
- Options include:
  - Electric resistance water heater (ERWH)
  - Heat pump water heater (HPWH)

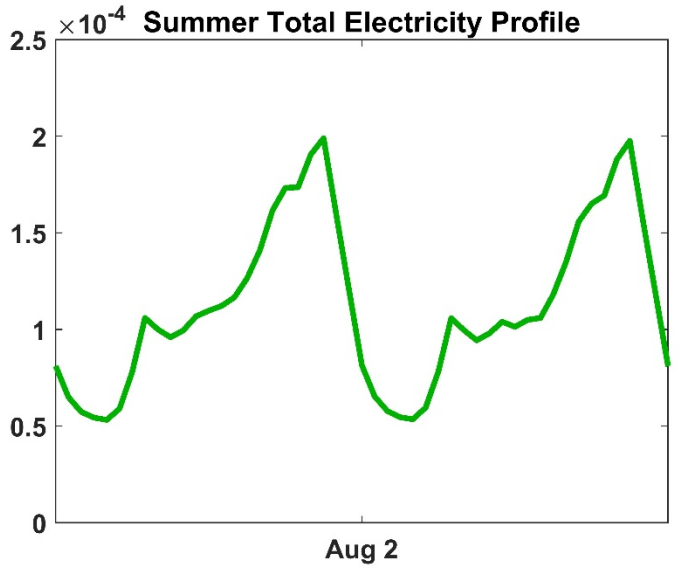


http://thesunriseguide.com

Electric Thermal Storage Water Heating

- We implemented two basic thermal cycles that are based on the default water heating profile:
  - Fixed profile: water heating is turned off in the evening hours (5pm to 8pm)
  - Flex profile: water heating is turned off when the hourly electrical load is at the top 25% of a given day
- Overall electricity use is calculated using the Unit of Energy Consumption (UEC) that is specific to a given technology (ERWH, HPWH)



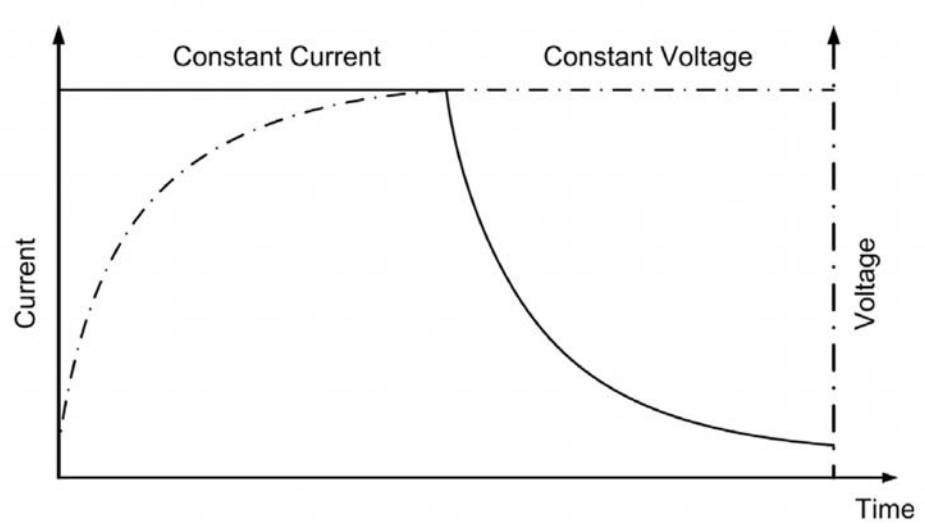


Comments and Responses (continued)

- EV Charging Profiles
  - Add additional EV charging profiles to NEAT
  - *We included two basic charging profiles for electric vehicles which correspond to Level 1 and Level 2 home EV chargers*

EV Charging Profiles

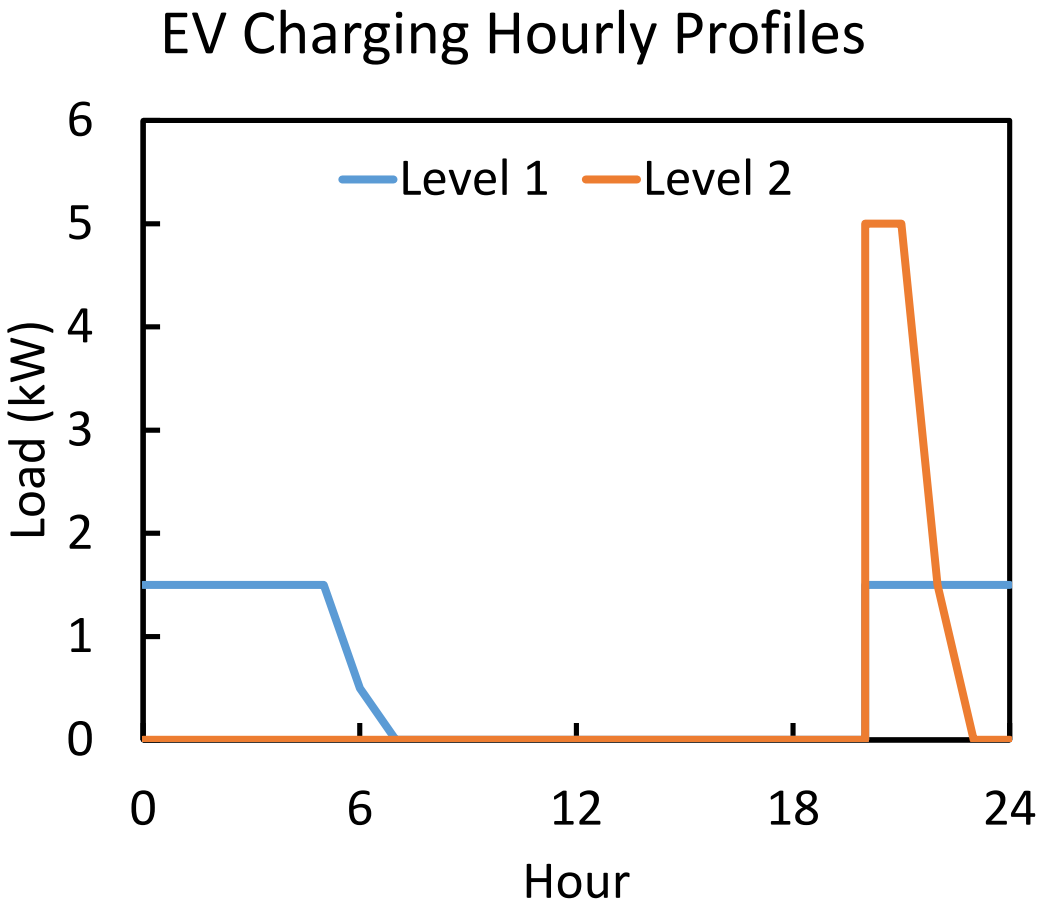
- We assumed that EV charging follows the strategy Constant Current/Constant Voltage (CC/CV) charging profile
- Vehicles are charged in the evening after 8 pm
- We included 2 charging profiles that represent Level 1 (~1.4 kW) and Level 2 (~5 kW) charging



Ying et al., Renew. Sustain. Energy Rev., 2015

EV Charging Profiles

- Duration of charging cycle depends on the charger level:
  - Level 1: 8 pm to 6 am
  - Level 2: 8 pm to 11 pm
- Charging cycle is assumed to be the same throughout the year



Implementation of Residential Battery Modeling in NEAT

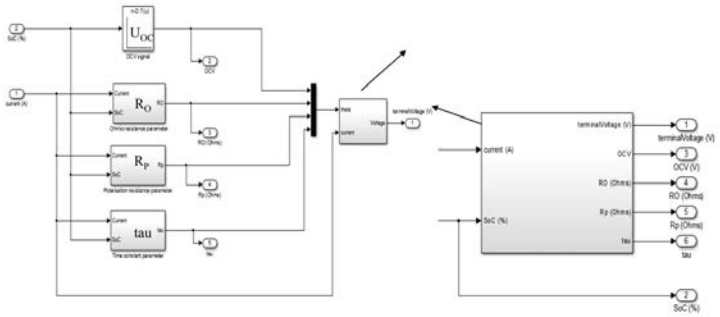
Seungbum Ha Ph.D.

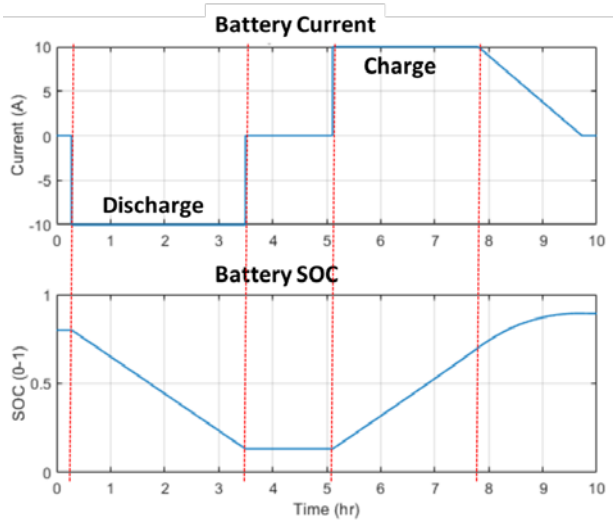
Technology Advancement Office

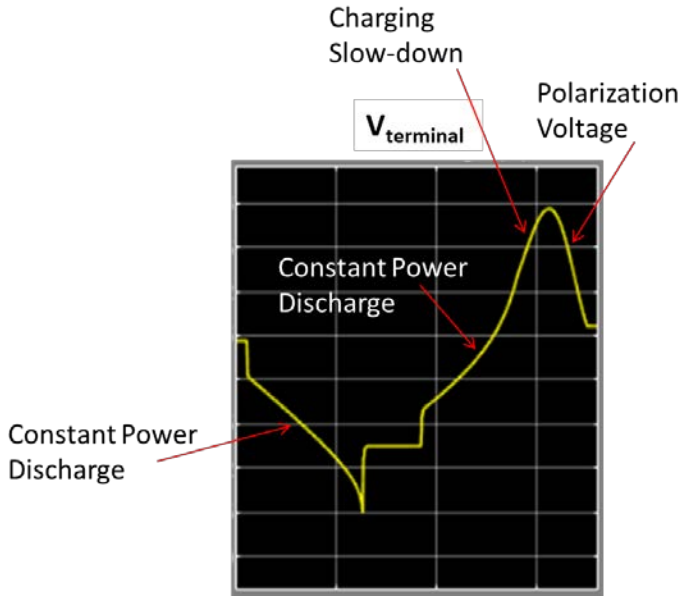
South Coast
Air Quality Management District

Summary of Previous Work

- Battery model has been developed
- Parameters for the model, test results from EV batteries, has been extracted from database provided by Argon National Laboratory
- Simple charging/discharging has been tested in the model

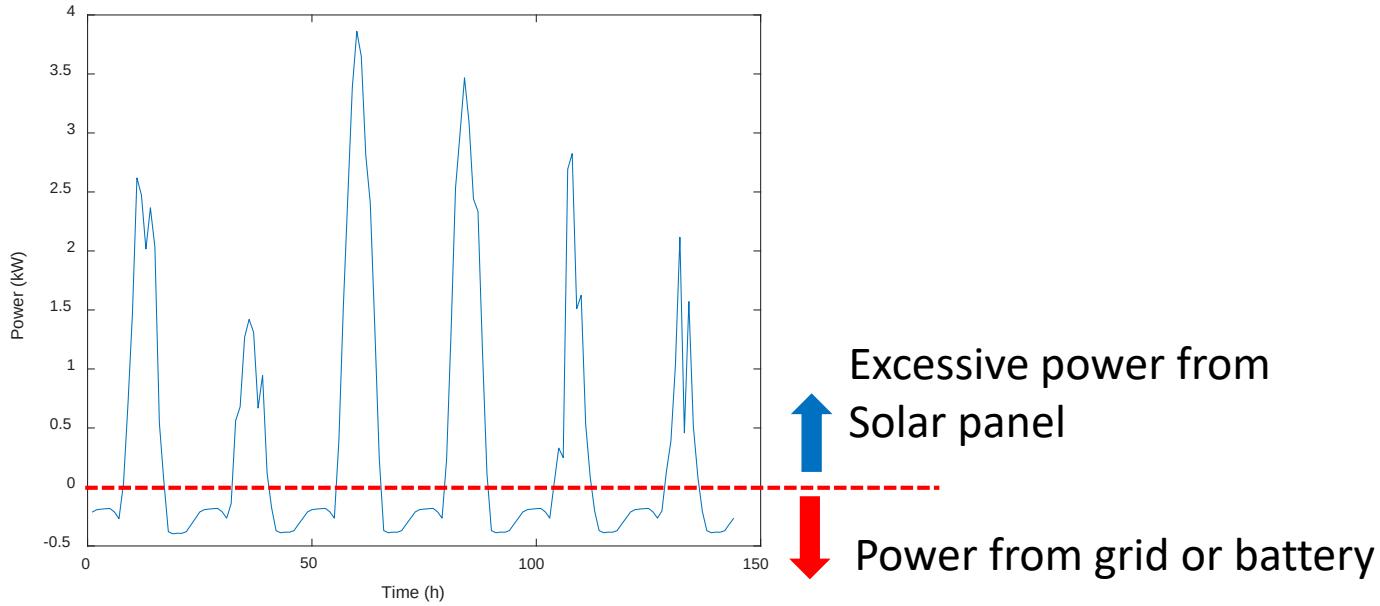






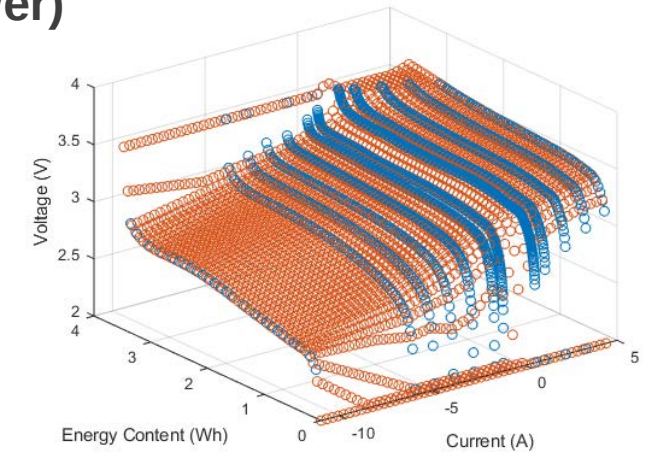
Integration of NEAT specific data into Model

- **Required power (Power_solar – Power_elec use) changes every hour.**



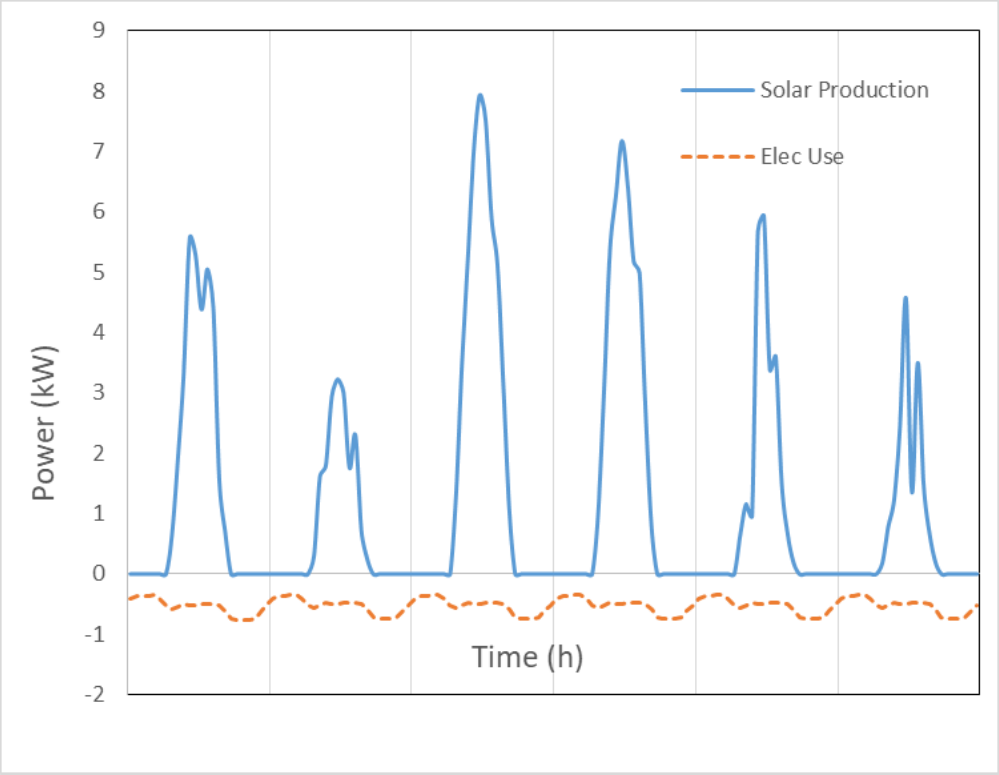
- **The model**
  - Parameterizes battery with charging-discharging behavior from datasheets(experimental results)
  - Calculates voltage profile as a function of SOC and input current (power)

- **Voltage-SOC profile varies for input current (power)**



Integration of NEAT specific data into Model

- Continued



Computation by battery model

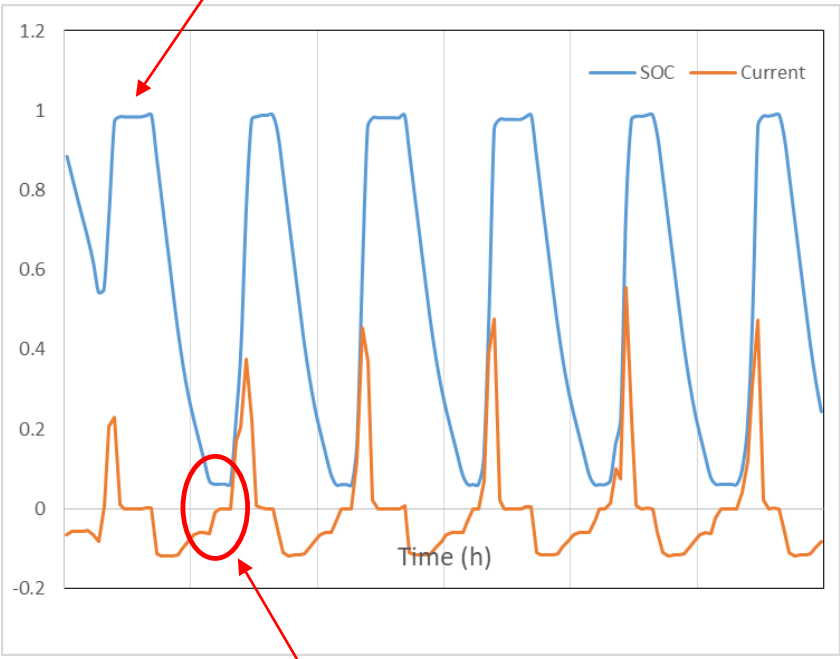
- Given the load and PV profile, the model calculates voltage and SOC change for every time step.
- Upper and lower charging/discharging rate limit is applied based on battery characteristics.
- The battery is programmed to discharge (charge) before reaching the minimum (maximum) SOC.

Integration of NEAT specific data into Model

- Continued

Tesla powerwall 1

Stop charging due to upper limit of SOC



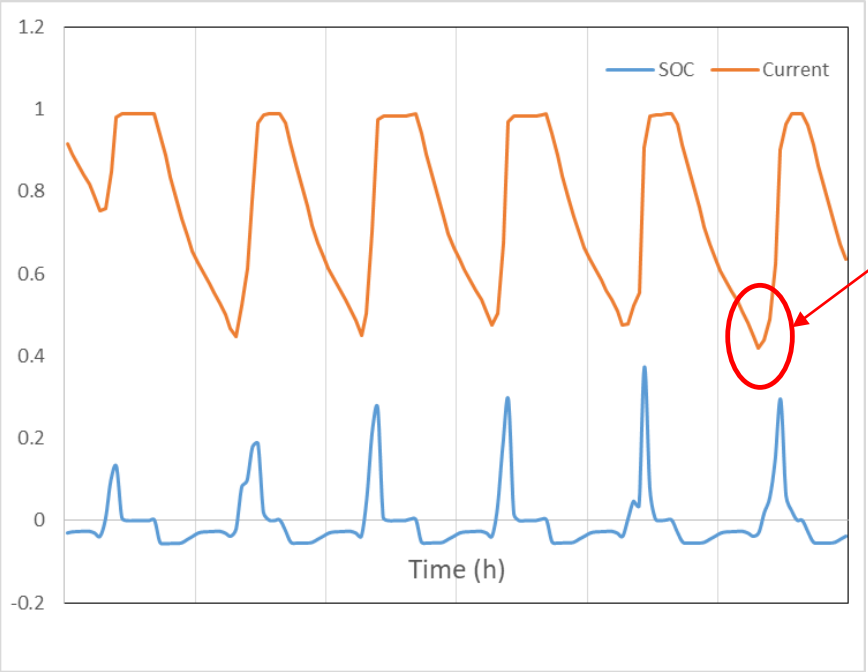
Power, continuous and peak	3.3 kW
Energy*	6.4 kWh
Internal Battery Voltage	< 50 VDC
System Operating Voltage	350 V–450 V
Voltage in OFF State	0 VDC
Current	9.5 ADC
Round Trip Efficiency*	92.5% (for a 400 V–450 V DC bus)
Depth of Discharge	100%
Equivalent Cycles	Unlimited cycles (provided Powerwall is only used for solar self-consumption and backup)

- **Stop discharging due to lower limit of SOC**
- **Use grid power**

Integration of NEAT specific data into Model

- Continued

Tesla powerwall 2

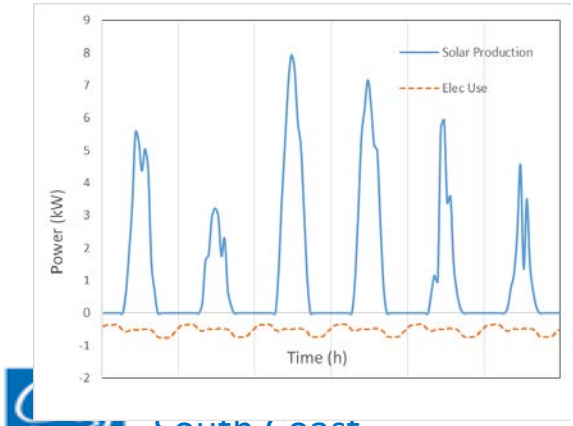


- 2x battery capacity
- Battery profile doesn't reach lower limit of SOC
  → minimizing use of grid power

DC Energy[1]	13.5 kWh
Power, continuous	5 kW (charge and discharge)
Power, peak (10s)	7 kW (discharge only)
DC Voltage Range	350–550 V
DC Current, continuous	14.3 A
DC Current, peak (10s)	20 A
Depth of Discharge	100%
Internal Battery DC Voltage	50 V
Round Trip Efficiency[1,2]	91.8%
Warranty	10 years

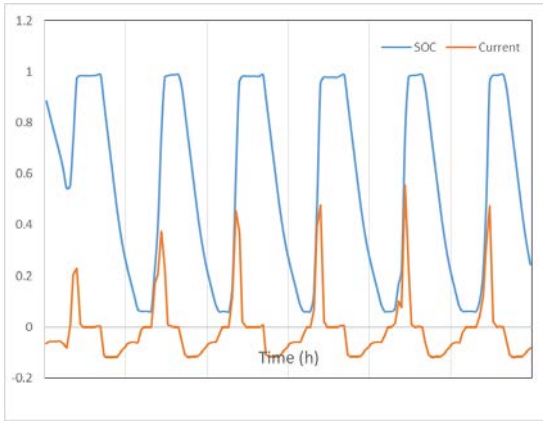
Implementation of Battery model into NEAT

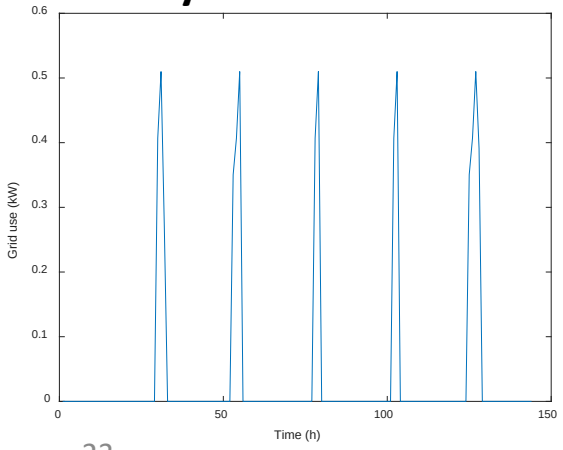
- Calculation algorithm needs to be optimized to implement into NEAT
- Adoptive charging/discharging control is required to develop
  - ➢ Charging/discharging strategy varies by battery characteristics, solar production profile, electricity use profile and Tier rates.
  - ➢ According to the strategy, electricity cost can be minimized.



- Enough solar production
- Relatively small and stable electricity use

Grid power is rarely used





Summary and Next steps

- **Where we are**
  - Battery model is tested using NEAT specific data
  - Two different types of residential batteries are simulated and charging/discharging profile is calculated.
- **What needs to be done next**
  - Battery model will be implemented into NEAT
    - optimizing algorithm
    - adopting improved charging/discharging strategy
  - Various scenarios will be tested.
    - Solar production, electricity use profile, battery size, tier rate

NEAT Demonstration

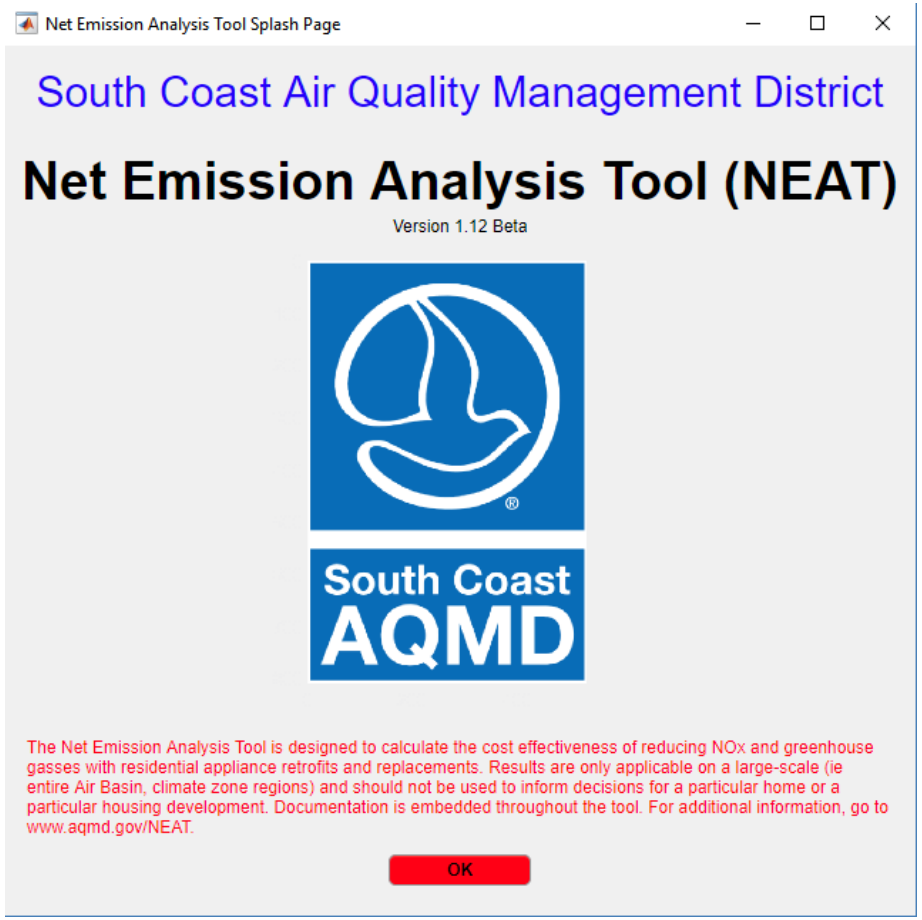
Scott A. Epstein Ph.D.

Planning and Rules Division

South Coast
Air Quality Management District

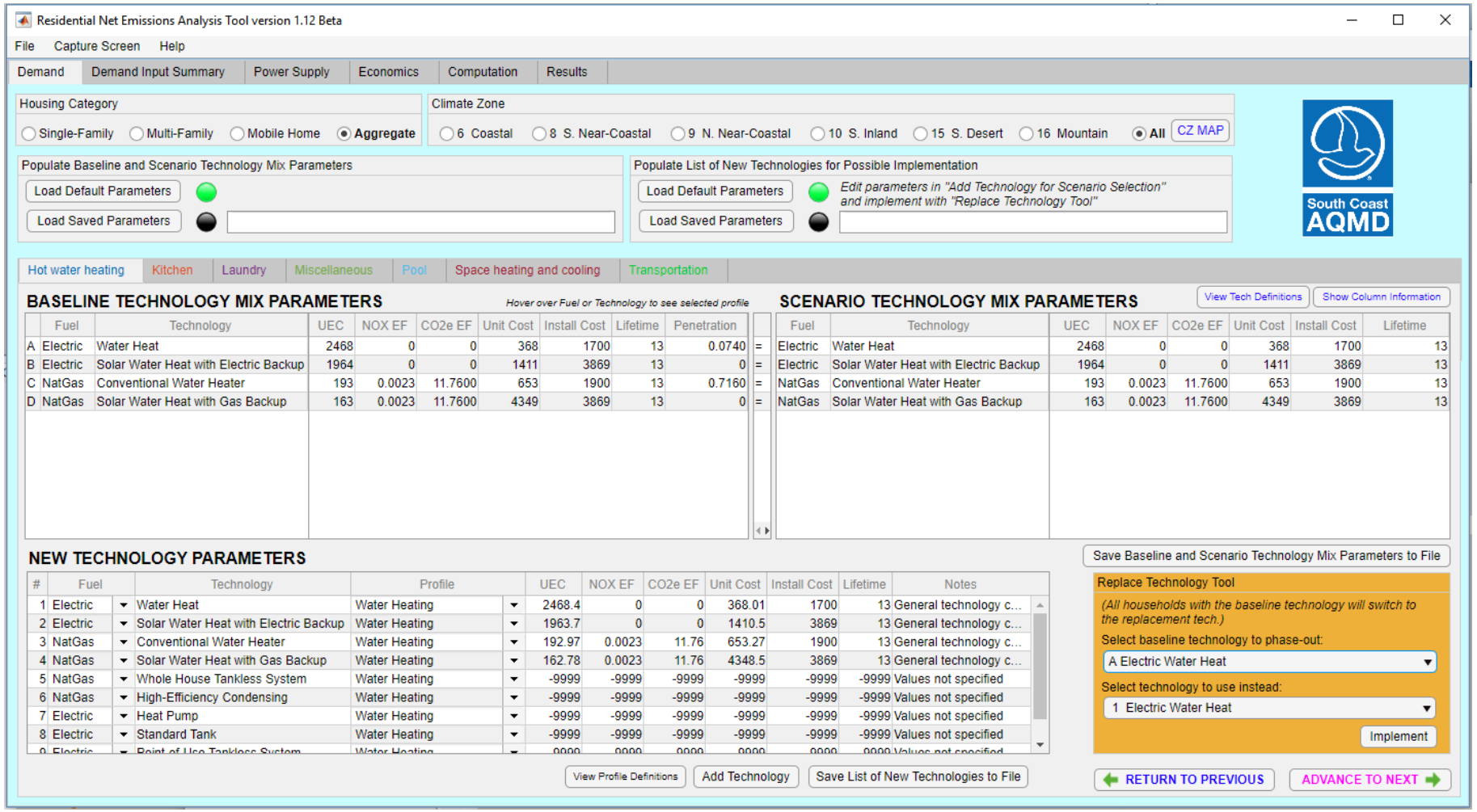
NEAT will still undergo extensive QA/QC from SCAQMD staff, the workgroup and other beta testers. Do not draw conclusions from demonstration results. Numbers are not final.

NEAT Splash Page



All results are preliminary and may change significantly after extensive QA/QC is conducted.

NEAT Starts in “Demand” Section



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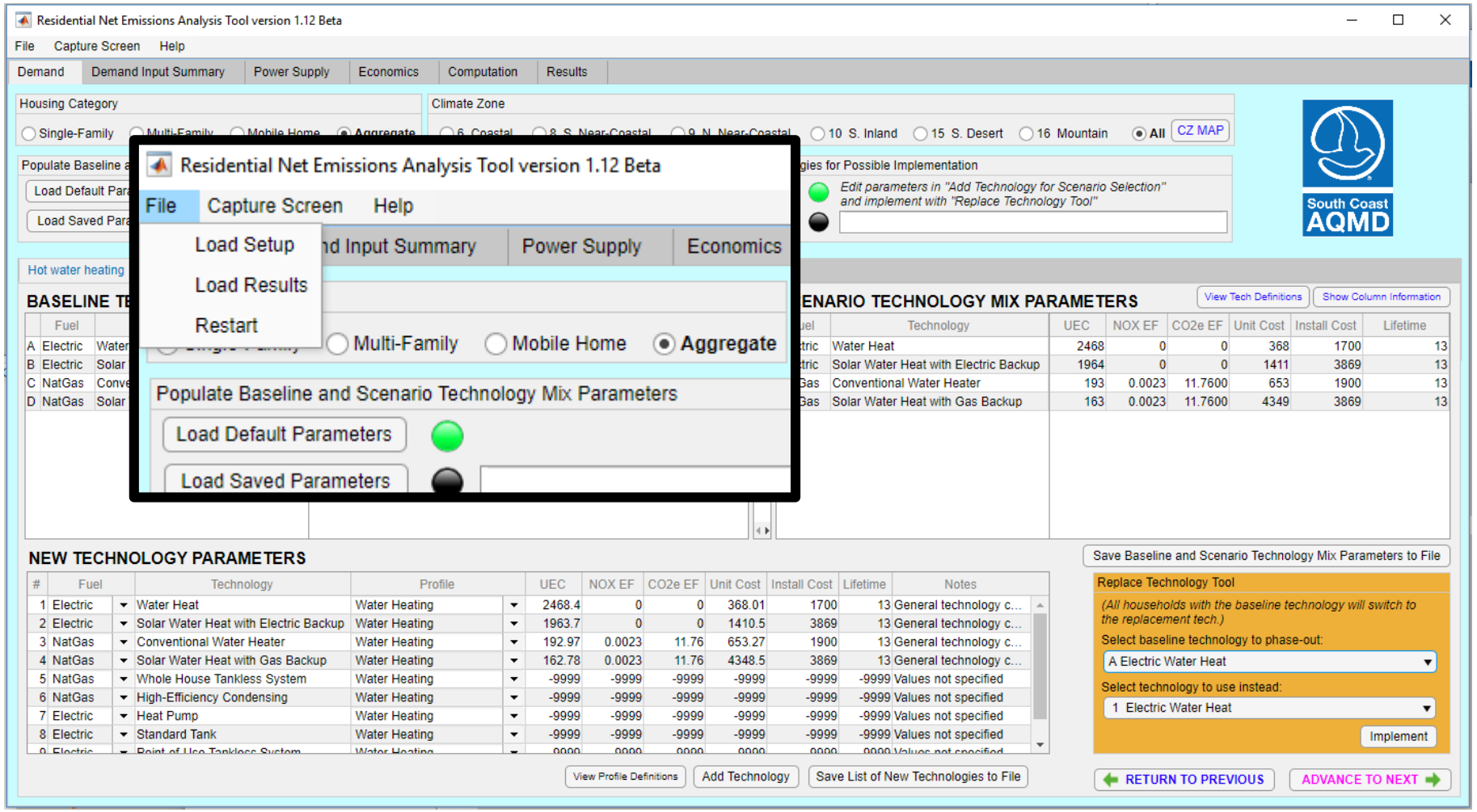
Ability to Load Entire Setup of Run or Results



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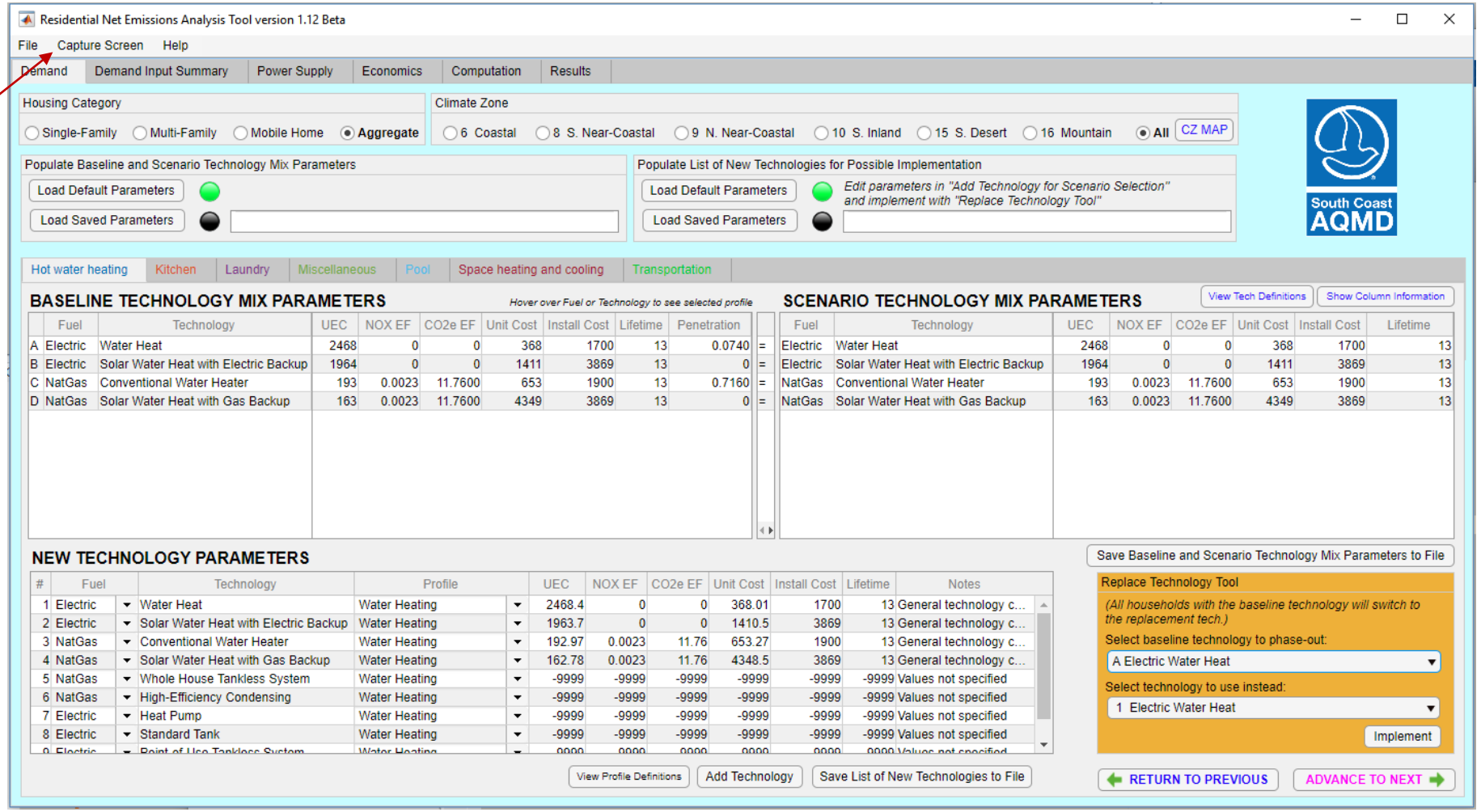
NEAT Starts in “Demand” Section

Capture any screen and open as .png file



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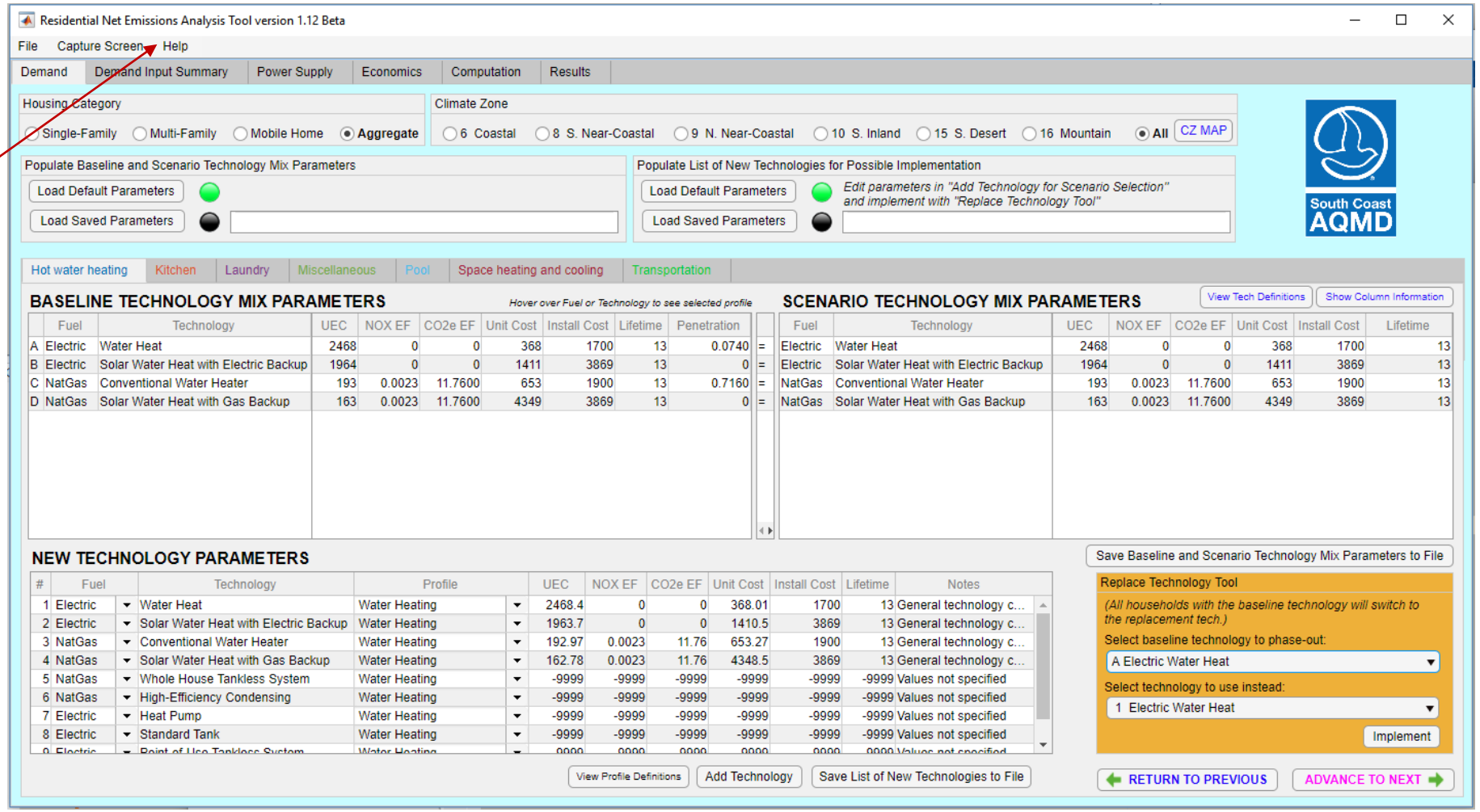
NEAT Starts in “Demand” Section

General help & documentation

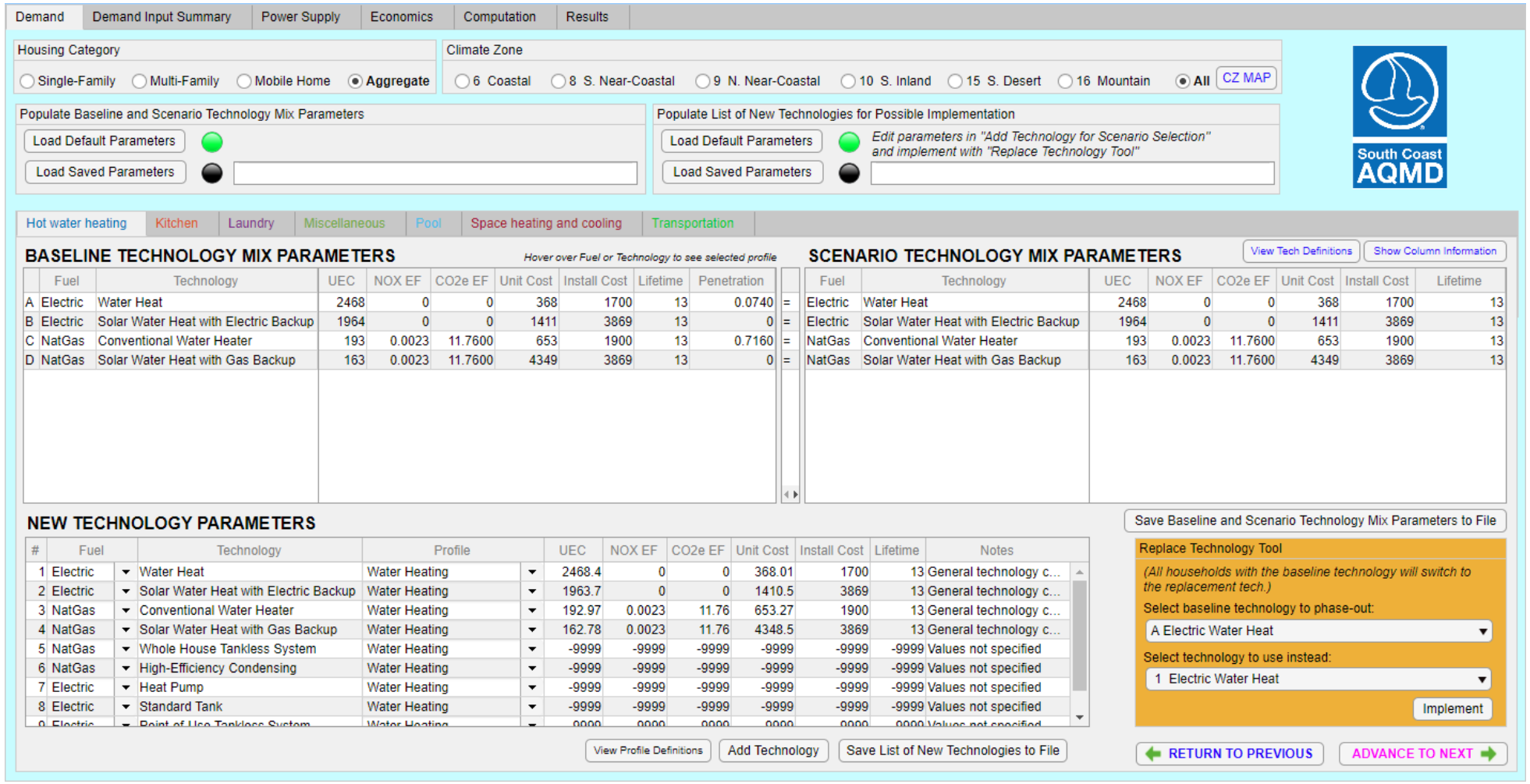


	Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Penetration
A	Electric	Water Heat	2468	0	0	368	1700	13	0.0740
B	Electric	Solar Water Heat with Electric Backup	1964	0	0	1411	3869	13	0
C	NatGas	Conventional Water Heater	193	0.0023	11.7600	653	1900	13	0.7160
D	NatGas	Solar Water Heat with Gas Backup	163	0.0023	11.7600	4349	3869	13	0

Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime
Electric	Water Heat	2468	0	0	368	1700	13
Electric	Solar Water Heat with Electric Backup	1964	0	0	1411	3869	13
NatGas	Conventional Water Heater	193	0.0023	11.7600	653	1900	13
NatGas	Solar Water Heat with Gas Backup	163	0.0023	11.7600	4349	3869	13

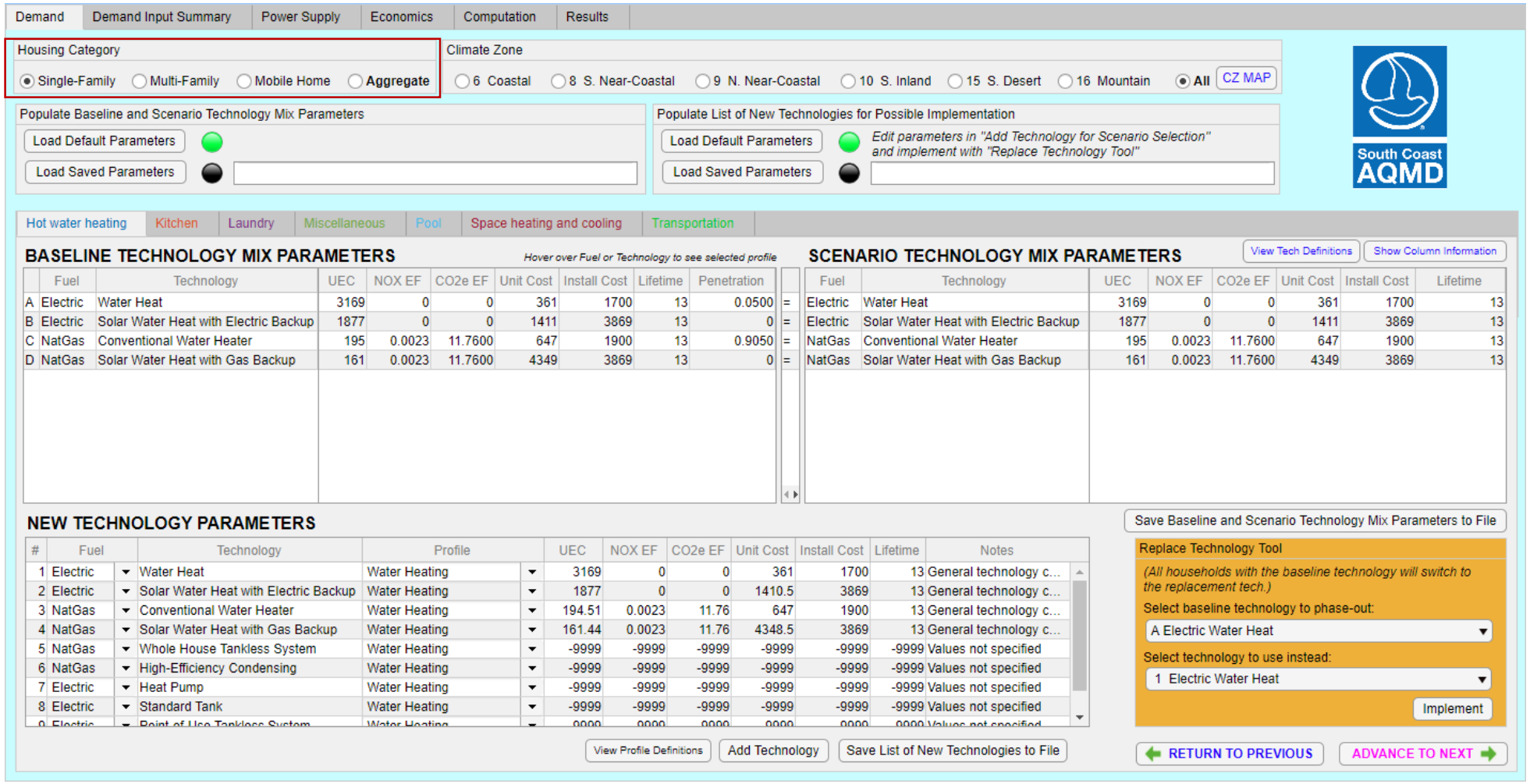
#	Fuel	Technology	Profile	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Notes
1	Electric	Water Heat	Water Heating	2468.4	0	0	368.01	1700	13	General technology c…
2	Electric	Solar Water Heat with Electric Backup	Water Heating	1963.7	0	0	1410.5	3869	13	General technology c…
3	NatGas	Conventional Water Heater	Water Heating	192.97	0.0023	11.76	653.27	1900	13	General technology c…
4	NatGas	Solar Water Heat with Gas Backup	Water Heating	162.78	0.0023	11.76	4348.5	3869	13	General technology c…
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
7	Electric	Heat Pump	Water Heating	-9999	-9999	-9999	-9999	-9999	-9999	Values not specified
8	Electric	Standard Tank	Water Heating	-9999	-9999	-9999	-9999	-9999	-9999	Values not specified

Simple Example: Electrify Hot Water Heating and Add Rooftop PV for Single-Family Homes



All results are preliminary and may change significantly after extensive QA/QC is conducted.

Select Single Family Homes



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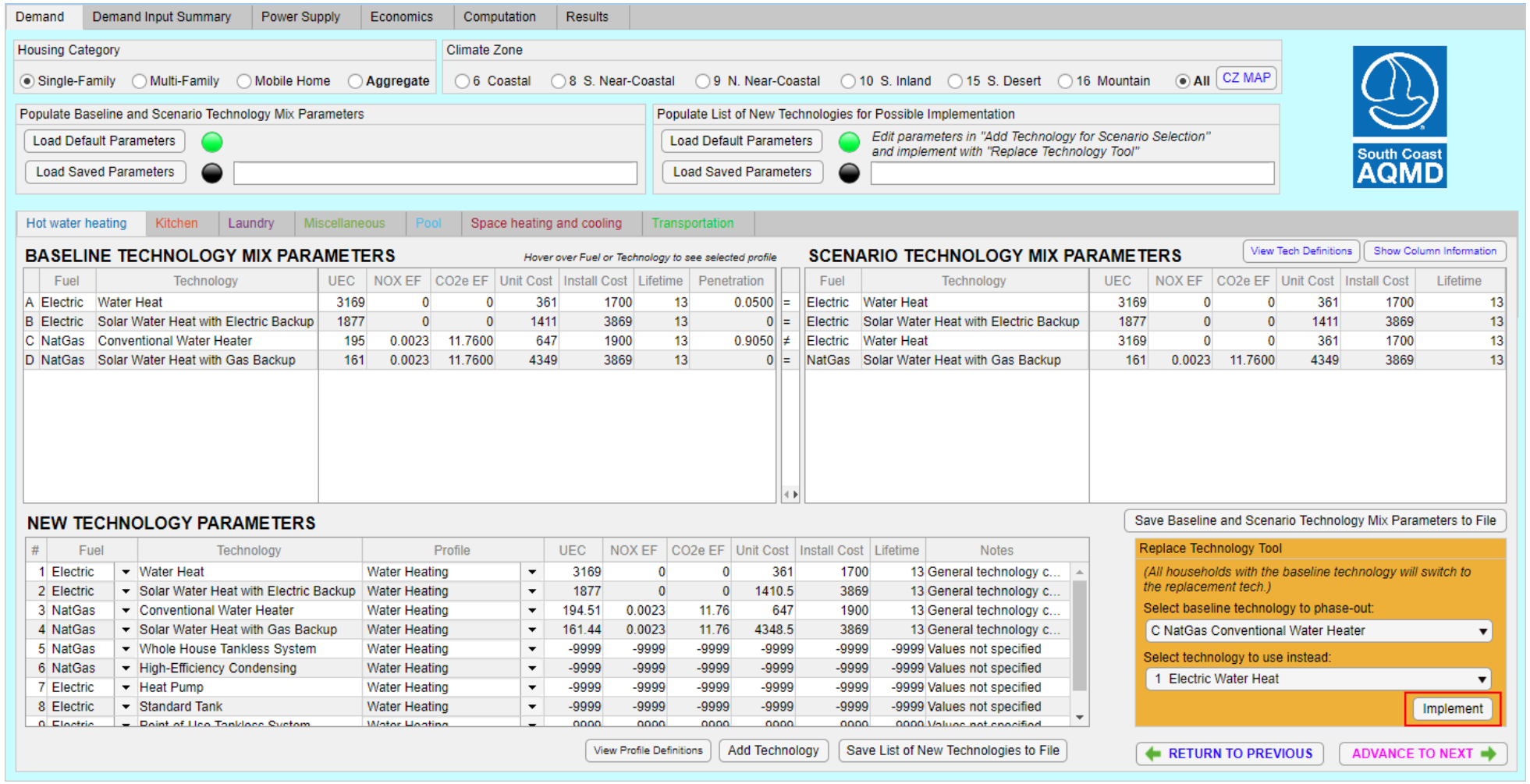
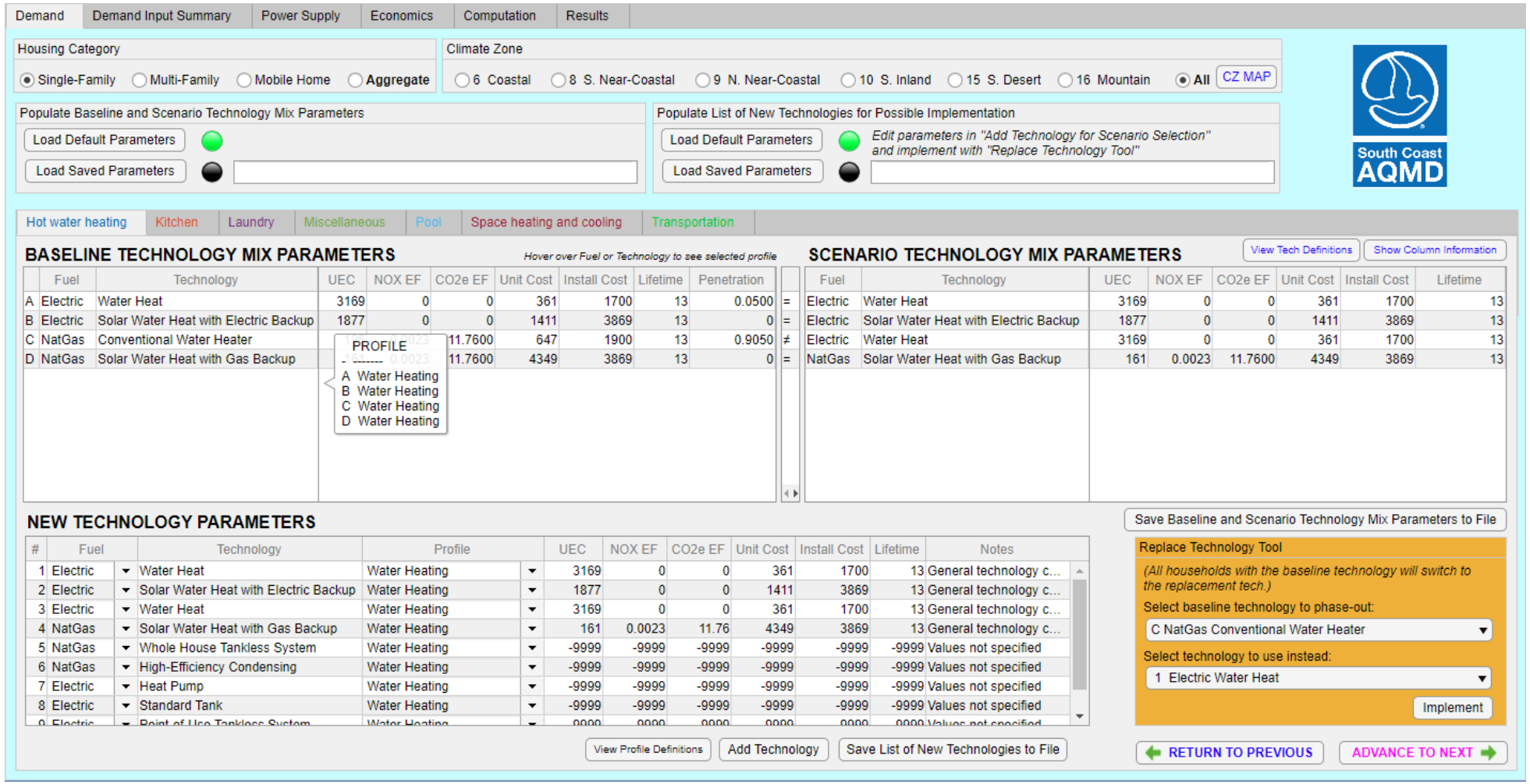
Implement Hot Water Heating Change

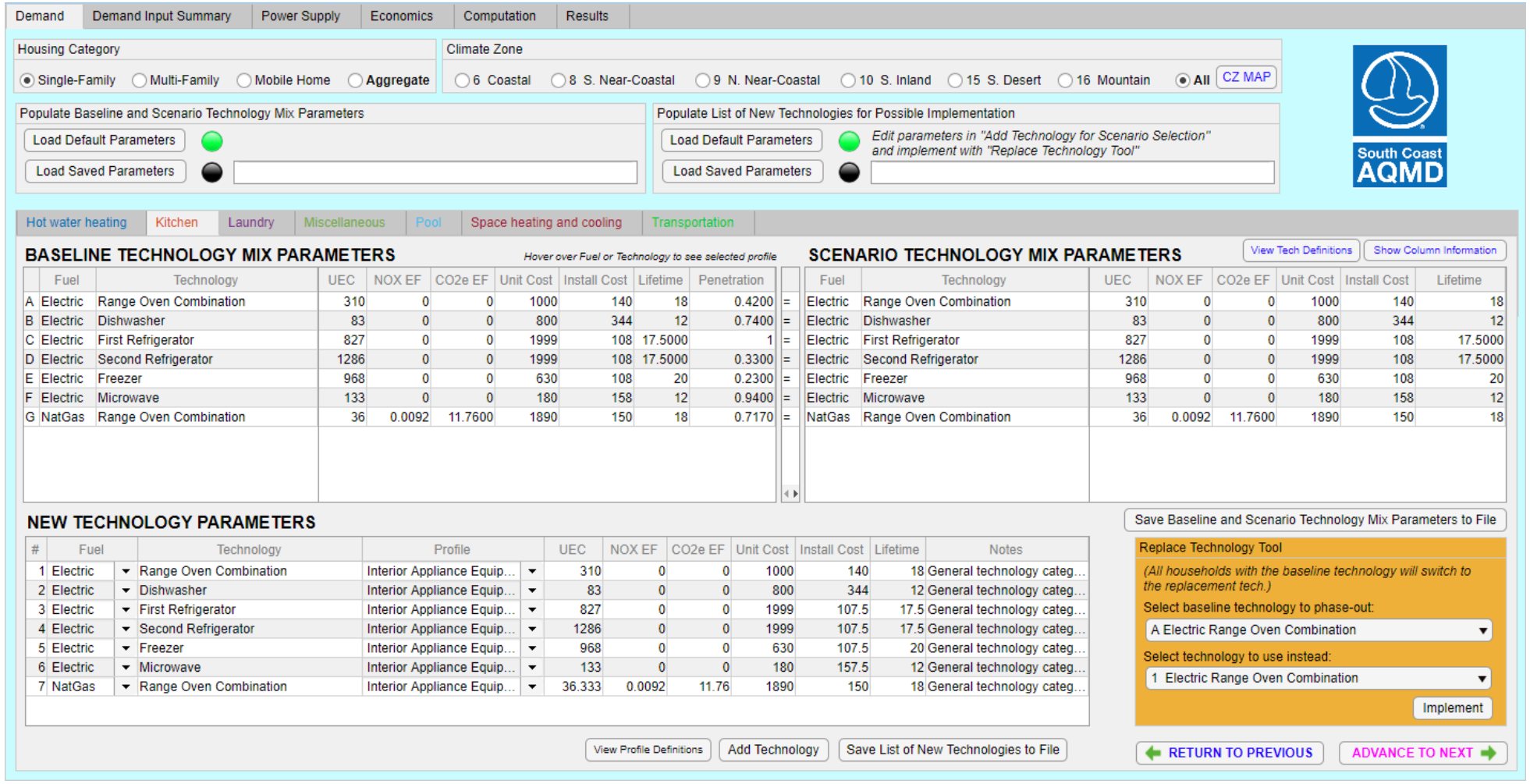


All results are preliminary and may change significantly after extensive QA/QC is conducted.

View Hot Water Heating Profiles (leave unchanged)



View Other Appliances (leave unchanged)



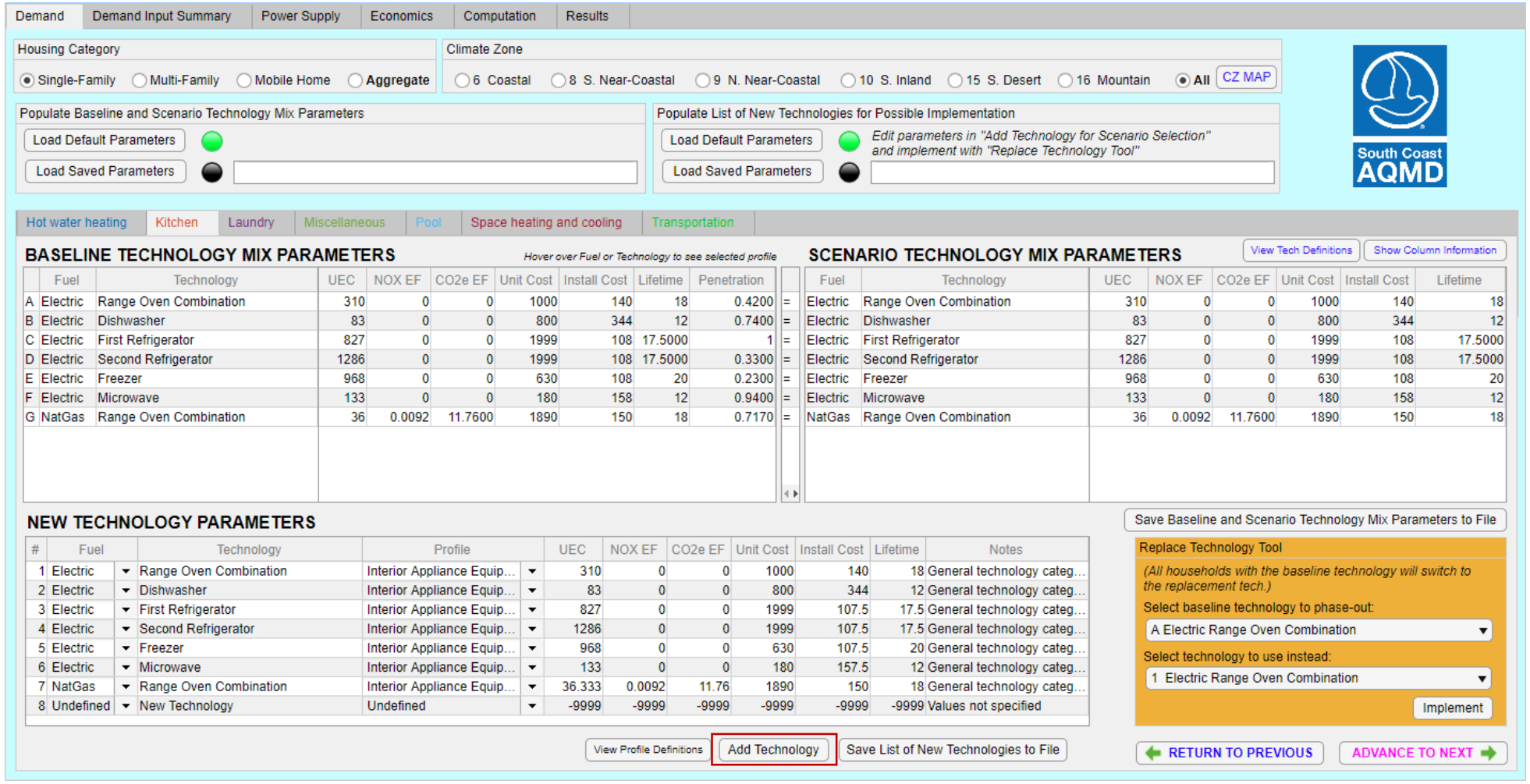
	Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Penetration
A	Electric	Range Oven Combination	310	0	0	1000	140	18	0.4200
B	Electric	Dishwasher	83	0	0	800	344	12	0.7400
C	Electric	First Refrigerator	827	0	0	1999	108	17.5000	1
D	Electric	Second Refrigerator	1286	0	0	1999	108	17.5000	0.3300
E	Electric	Freezer	968	0	0	630	108	20	0.2300
F	Electric	Microwave	133	0	0	180	158	12	0.9400
G	NatGas	Range Oven Combination	36	0.0092	11.7600	1890	150	18	0.7170

	Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime
=	Electric	Range Oven Combination	310	0	0	1000	140	18
=	Electric	Dishwasher	83	0	0	800	344	12
=	Electric	First Refrigerator	827	0	0	1999	108	17.5000
=	Electric	Second Refrigerator	1286	0	0	1999	108	17.5000
=	Electric	Freezer	968	0	0	630	108	20
=	Electric	Microwave	133	0	0	180	158	12
=	NatGas	Range Oven Combination	36	0.0092	11.7600	1890	150	18

#	Fuel	Technology	Profile	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Notes
1	Electric	Range Oven Combination	Interior Appliance Equip...	310	0	0	1000	140	18	General technology categ...
2	Electric	Dishwasher	Interior Appliance Equip...	83	0	0	800	344	12	General technology categ...
3	Electric	First Refrigerator	Interior Appliance Equip...	827	0	0	1999	107.5	17.5	General technology categ...
4	Electric	Second Refrigerator	Interior Appliance Equip...	1286	0	0	1999	107.5	17.5	General technology categ...
5	Electric	Freezer	Interior Appliance Equip...	968	0	0	630	107.5	20	General technology categ...
6	Electric	Microwave	Interior Appliance Equip...	133	0	0	180	157.5	12	General technology categ...
7	NatGas	Range Oven Combination	Interior Appliance Equip...	36.333	0.0092	11.76	1890	150	18	General technology categ...

All results are preliminary and should be subject to extensive QA/QC before interpreting.

Ability to Add Technologies (leave unchanged)



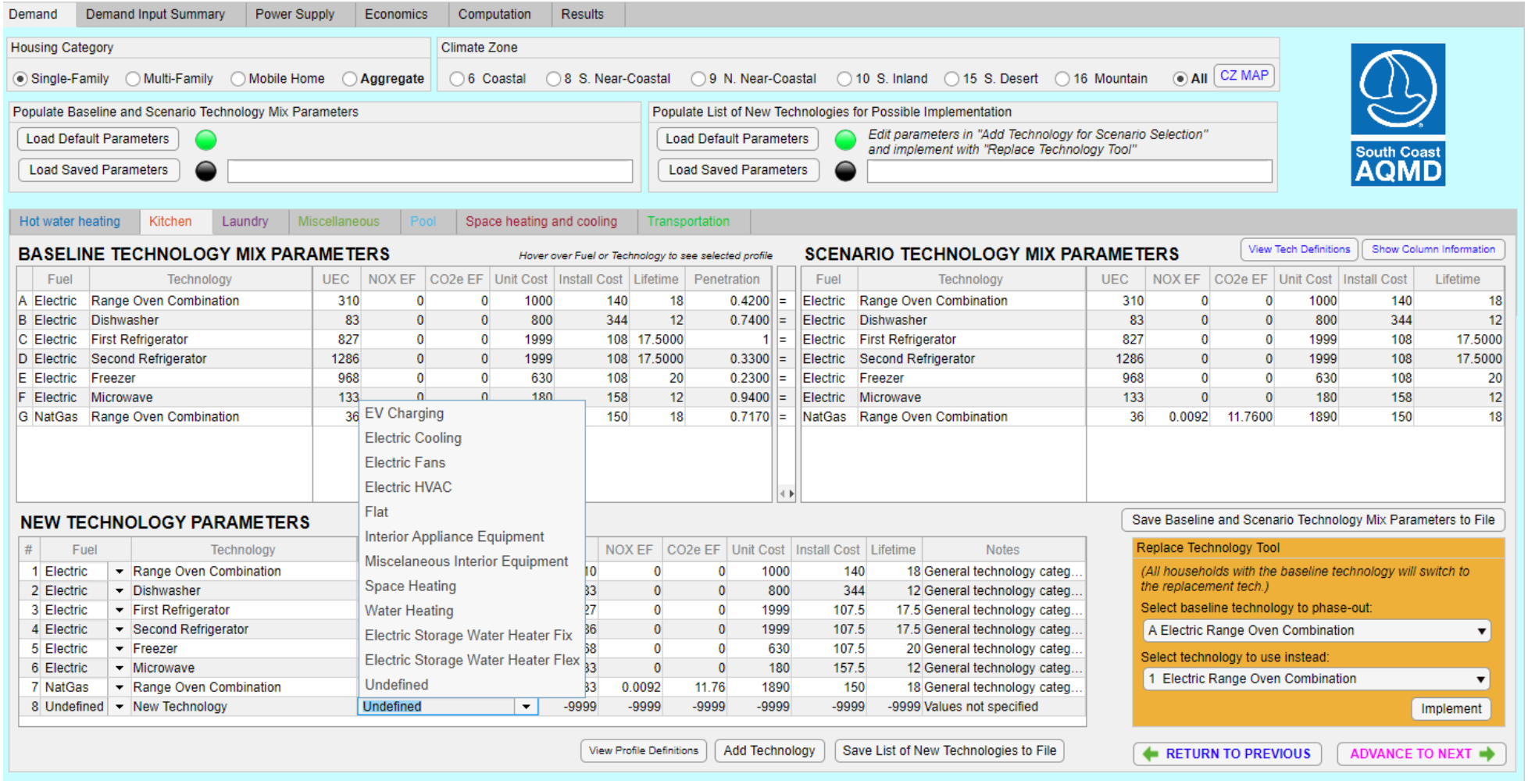
	Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Penetration
A	Electric	Range Oven Combination	310	0	0	1000	140	18	0.4200
B	Electric	Dishwasher	83	0	0	800	344	12	0.7400
C	Electric	First Refrigerator	827	0	0	1999	108	17.5000	1
D	Electric	Second Refrigerator	1286	0	0	1999	108	17.5000	0.3300
E	Electric	Freezer	968	0	0	630	108	20	0.2300
F	Electric	Microwave	133	0	0	180	158	12	0.9400
G	NatGas	Range Oven Combination	36	0.0092	11.7600	1890	150	18	0.7170

Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime
Electric	Range Oven Combination	310	0	0	1000	140	18
Electric	Dishwasher	83	0	0	800	344	12
Electric	First Refrigerator	827	0	0	1999	108	17.5000
Electric	Second Refrigerator	1286	0	0	1999	108	17.5000
Electric	Freezer	968	0	0	630	108	20
Electric	Microwave	133	0	0	180	158	12
NatGas	Range Oven Combination	36	0.0092	11.7600	1890	150	18

#	Fuel	Technology	Profile	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime	Notes
1	Electric	Range Oven Combination	Interior Appliance Equip...	310	0	0	1000	140	18	General technology categ...
2	Electric	Dishwasher	Interior Appliance Equip...	83	0	0	800	344	12	General technology categ...
3	Electric	First Refrigerator	Interior Appliance Equip...	827	0	0	1999	107.5	17.5	General technology categ...
4	Electric	Second Refrigerator	Interior Appliance Equip...	1286	0	0	1999	107.5	17.5	General technology categ...
5	Electric	Freezer	Interior Appliance Equip...	968	0	0	630	107.5	20	General technology categ...
6	Electric	Microwave	Interior Appliance Equip...	133	0	0	180	157.5	12	General technology categ...
7	NatGas	Range Oven Combination	Interior Appliance Equip...	36.333	0.0092	11.76	1890	150	18	General technology categ...
8	Undefined	New Technology	Undefined	-9999	-9999	-9999	-9999	-9999	-9999	Values not specified

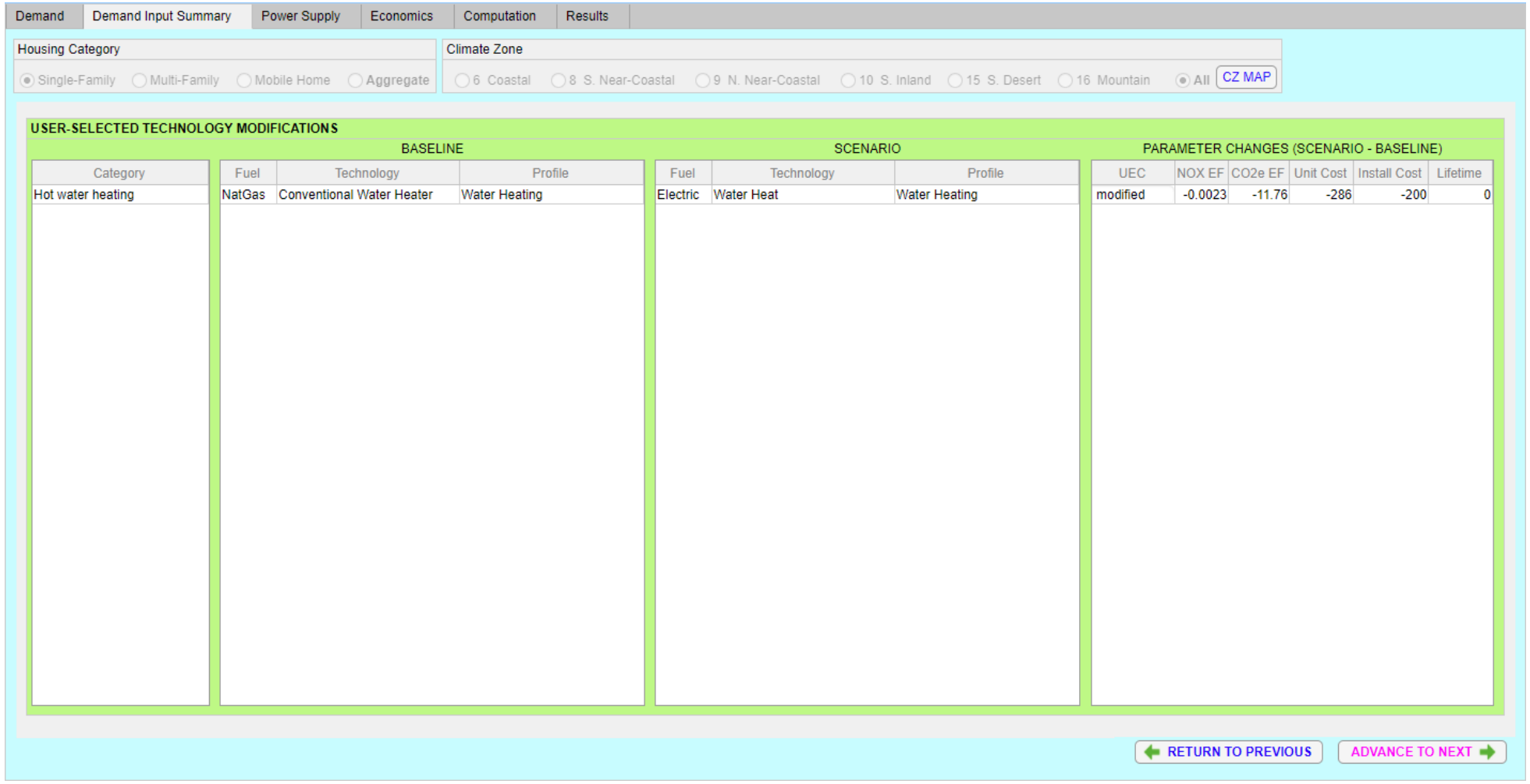
All results are preliminary and should be subject to extensive QA/QC before interpreting.

Ability to Assign Fuel, Profile, and Parameters to New Technology (leave unchanged)



All results are preliminary and should be subject to extensive QA/QC before interpreting.

View Demand Input Summary (leave unchanged)



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Air Quality Management District

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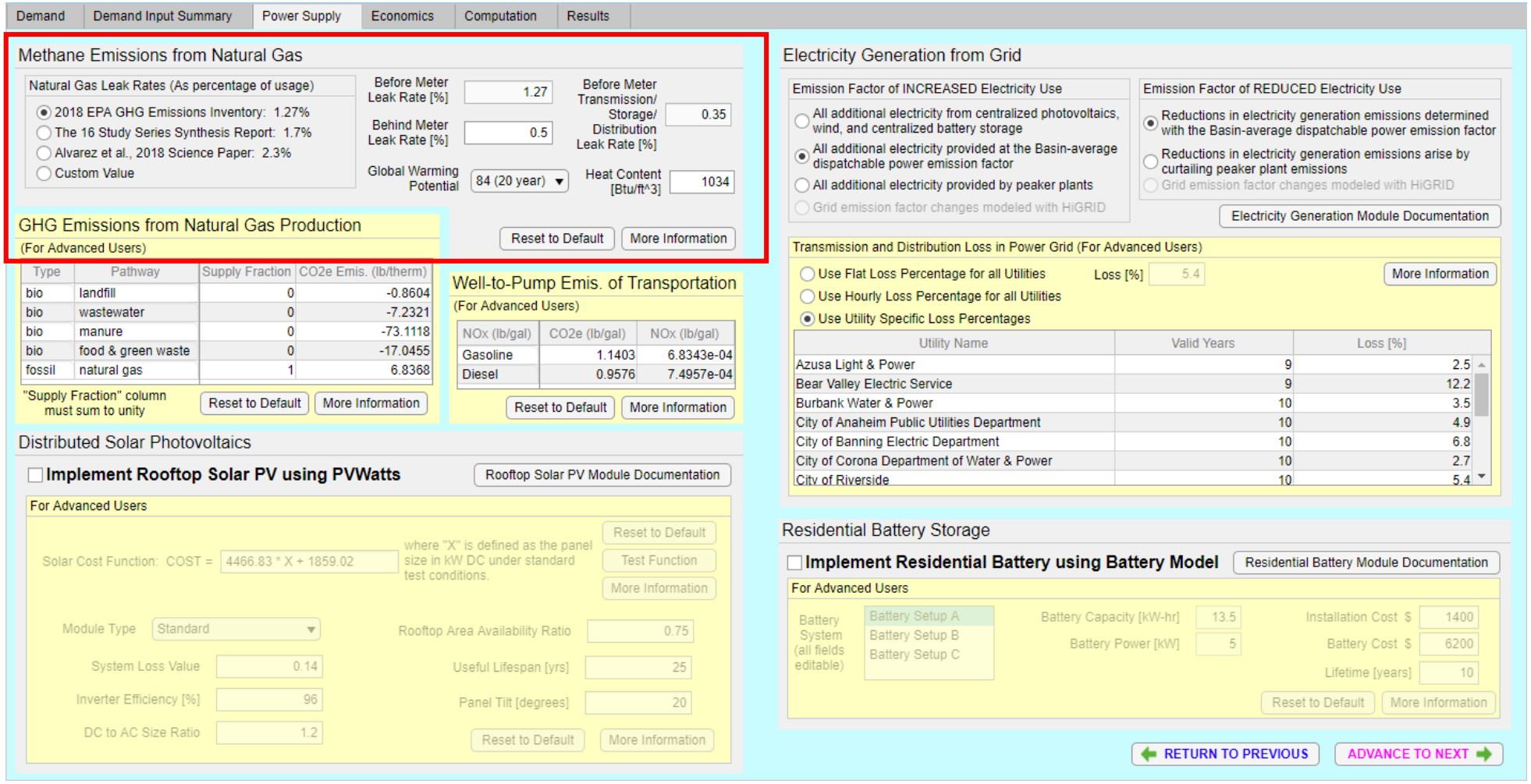
Modify Methane Emissions from Natural Gas (leave unchanged)



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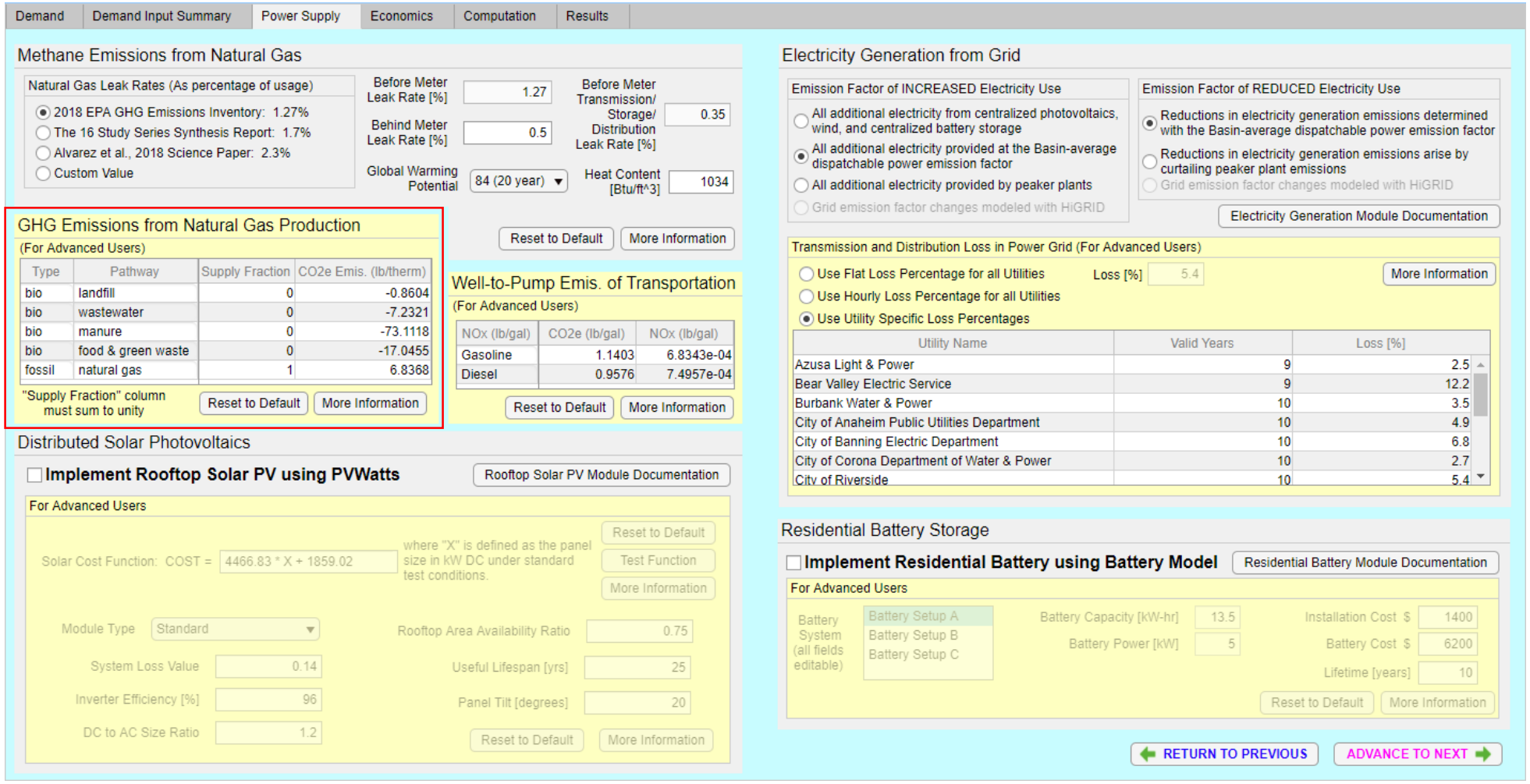
Modify Renewable/Fossil Natural Gas Mixture (leave unchanged)



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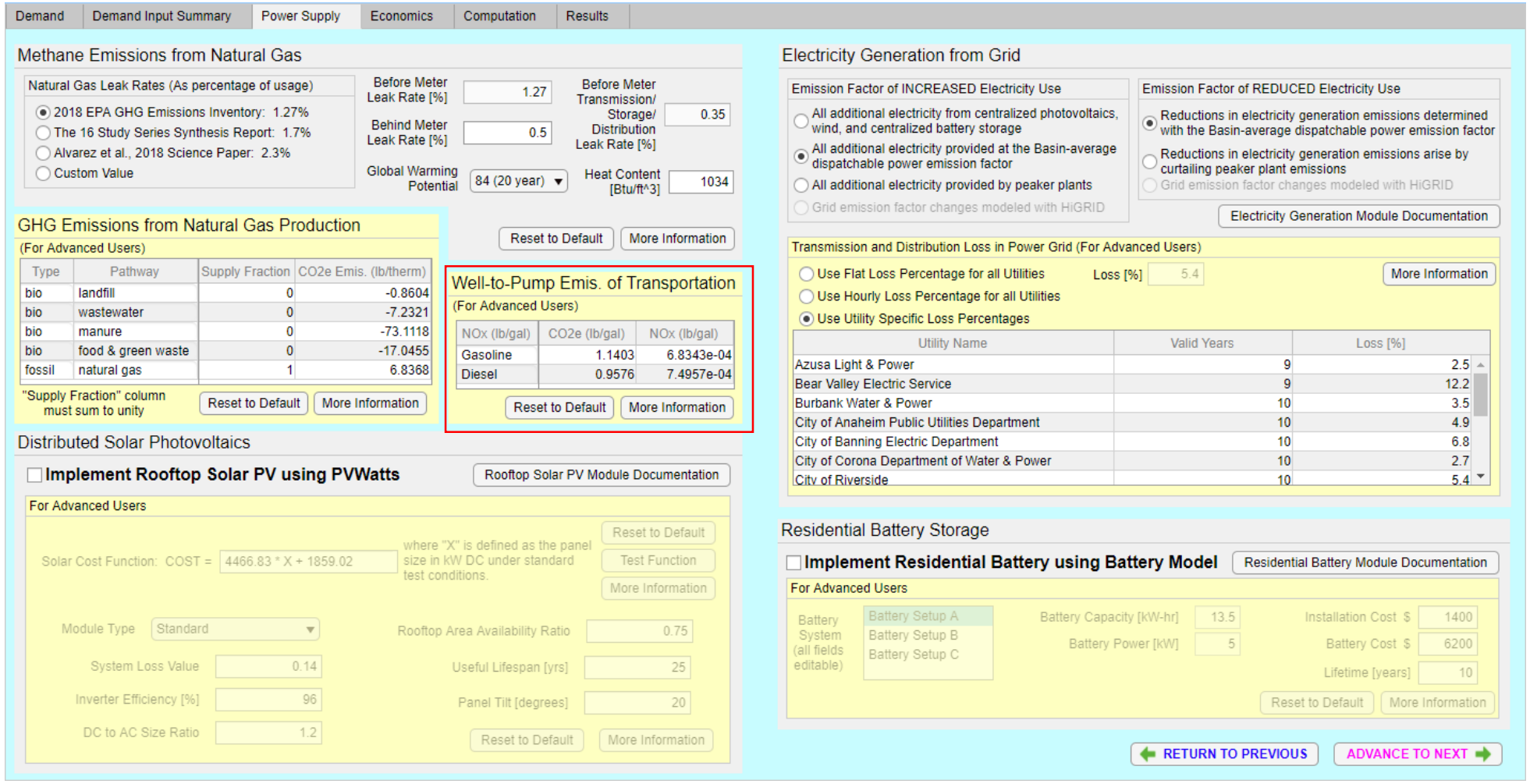
Modify Well-to-Pump Emissions of Transportation (leave unchanged)



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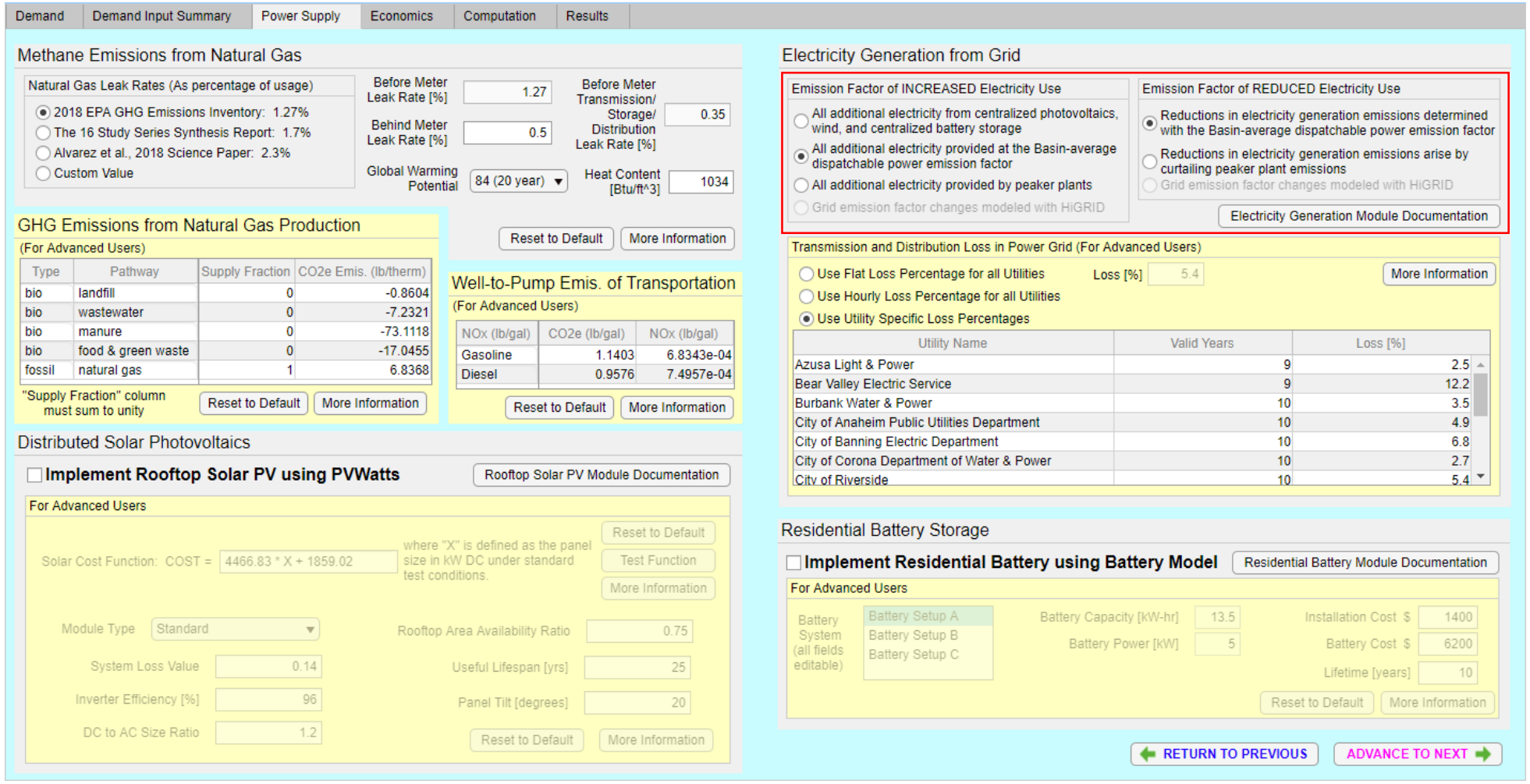
Modify Electricity Generation from Grid(leave unchanged)



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Air Quality Management District

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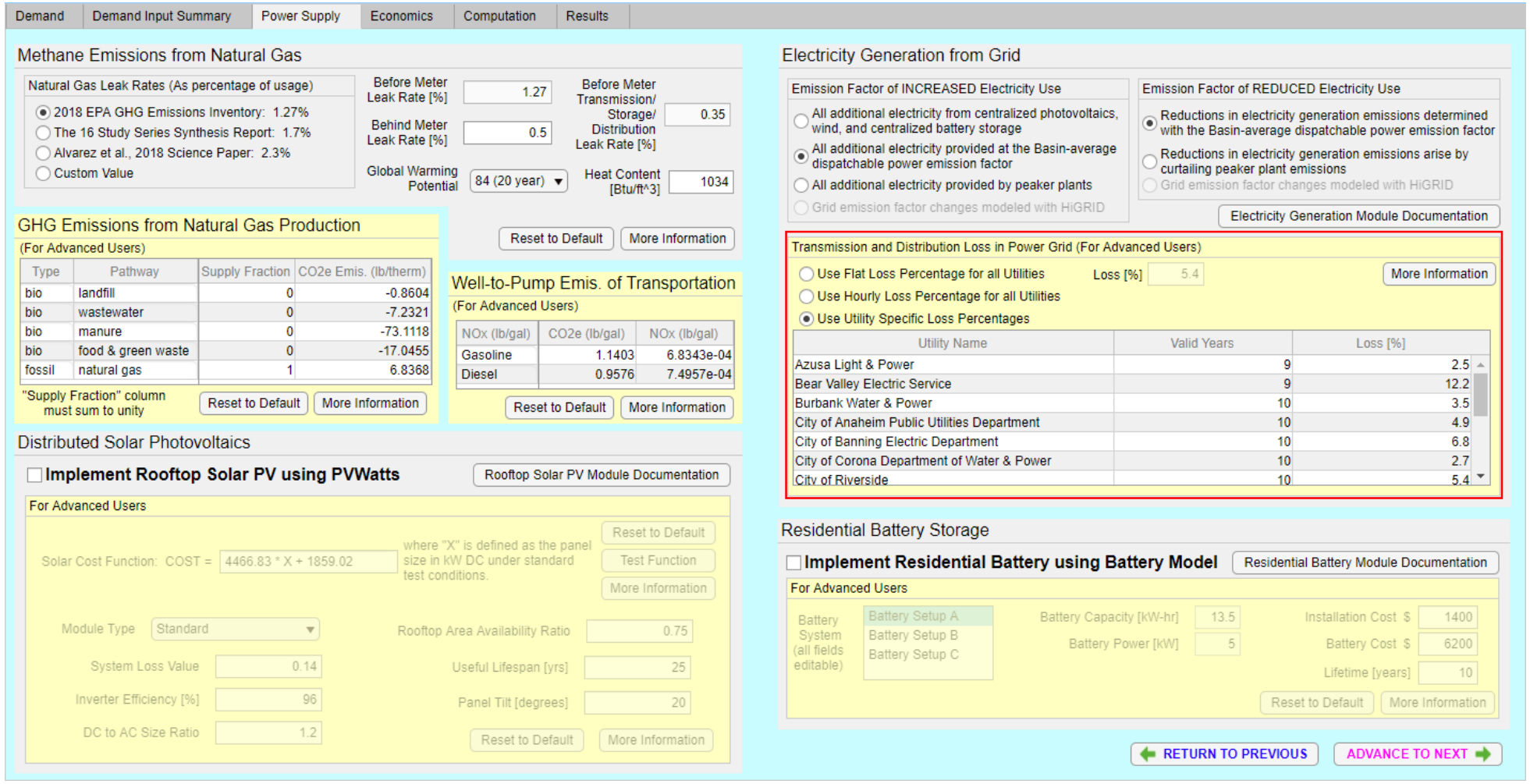
Modify Elec. Transmission and Distribution Loss (leave unchanged)



South Coast
Air Quality Management District

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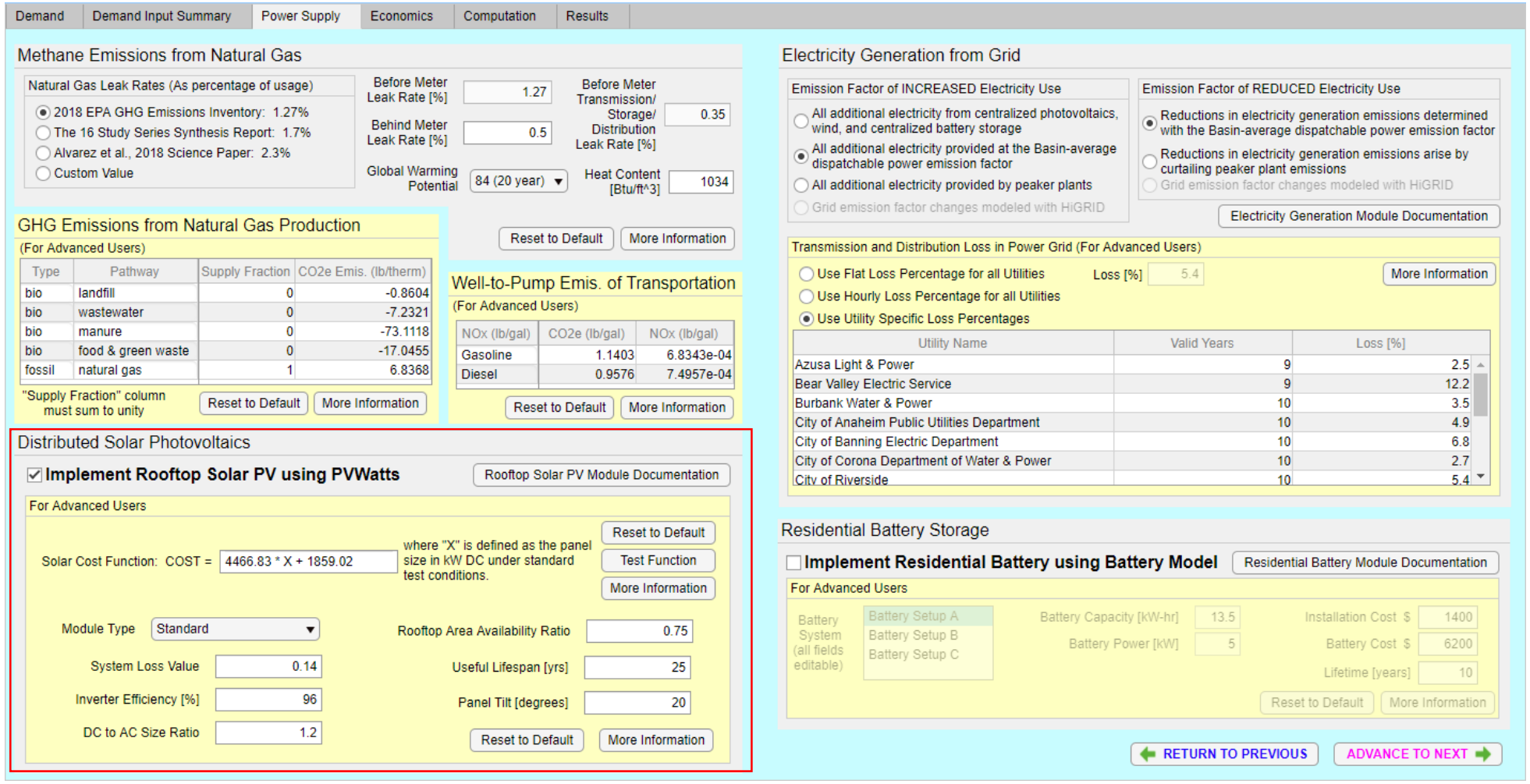
Implement Rooftop Solar PV



South Coast
Air Quality Management District

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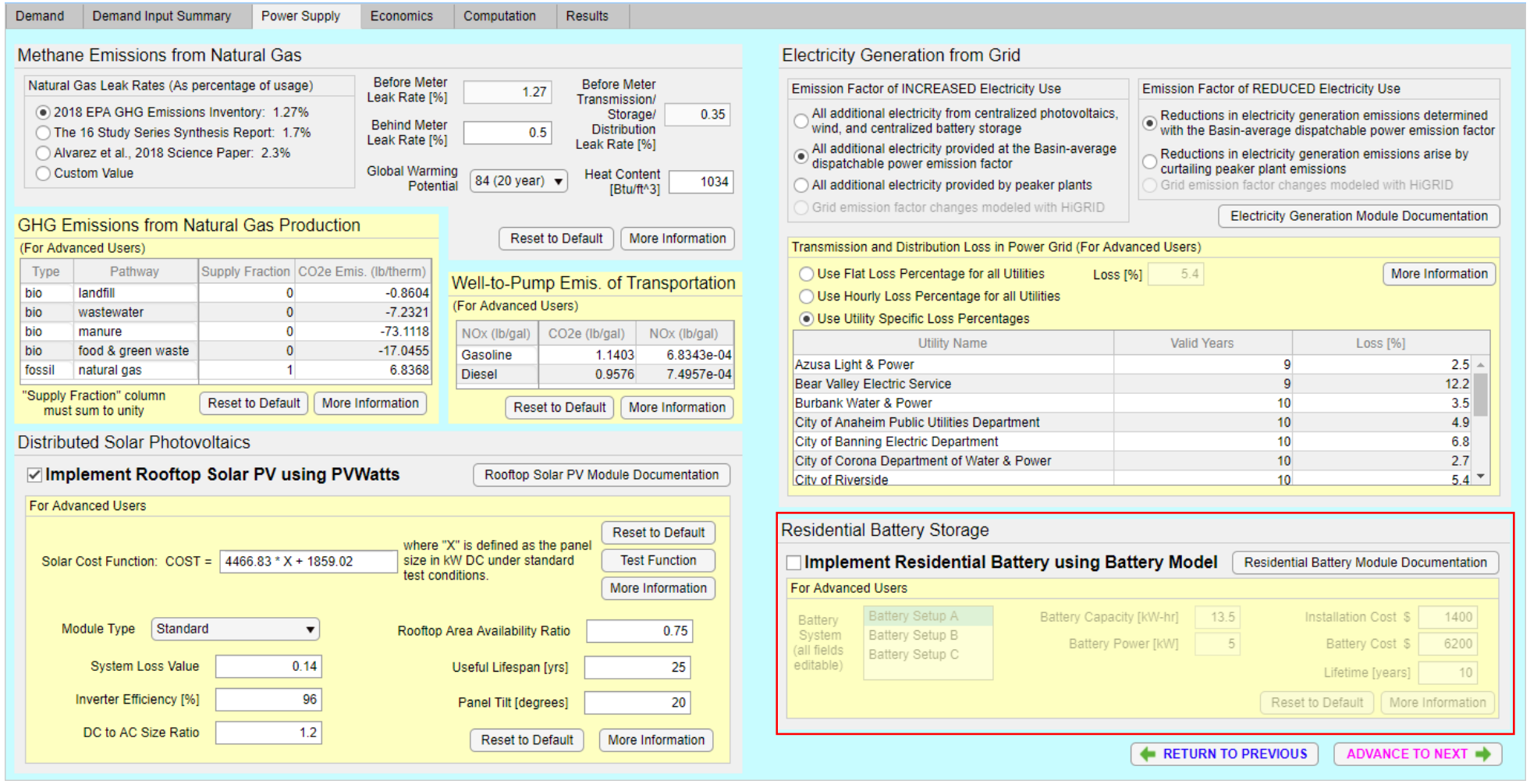
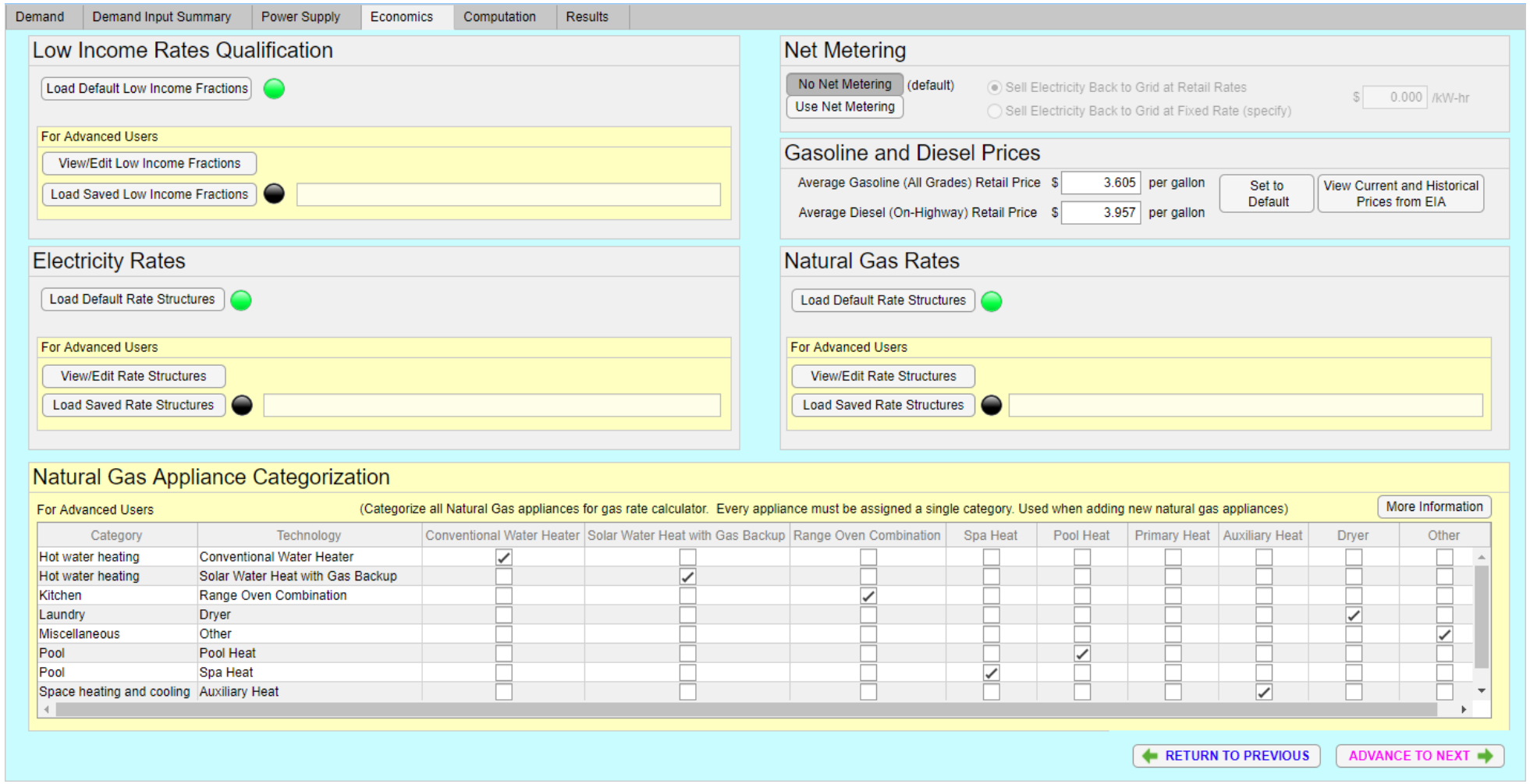
Implement Residential Battery Storage (leave unchanged)



South Coast
Air Quality Management District

All results are preliminary and should be subject to extensive QA/QC before interpreting.

Economics Tab (leave unchanged)



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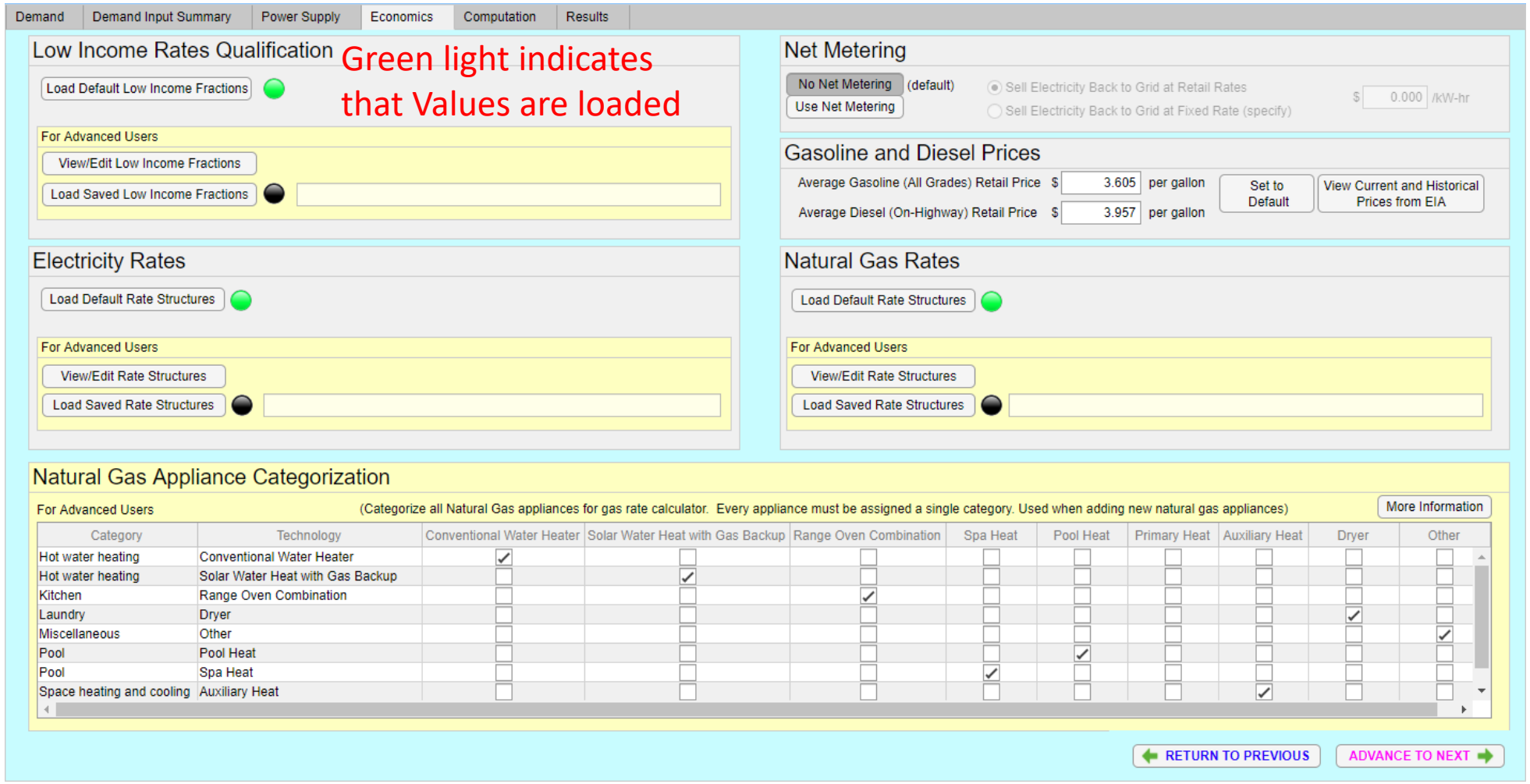
Economics Tab (leave unchanged)



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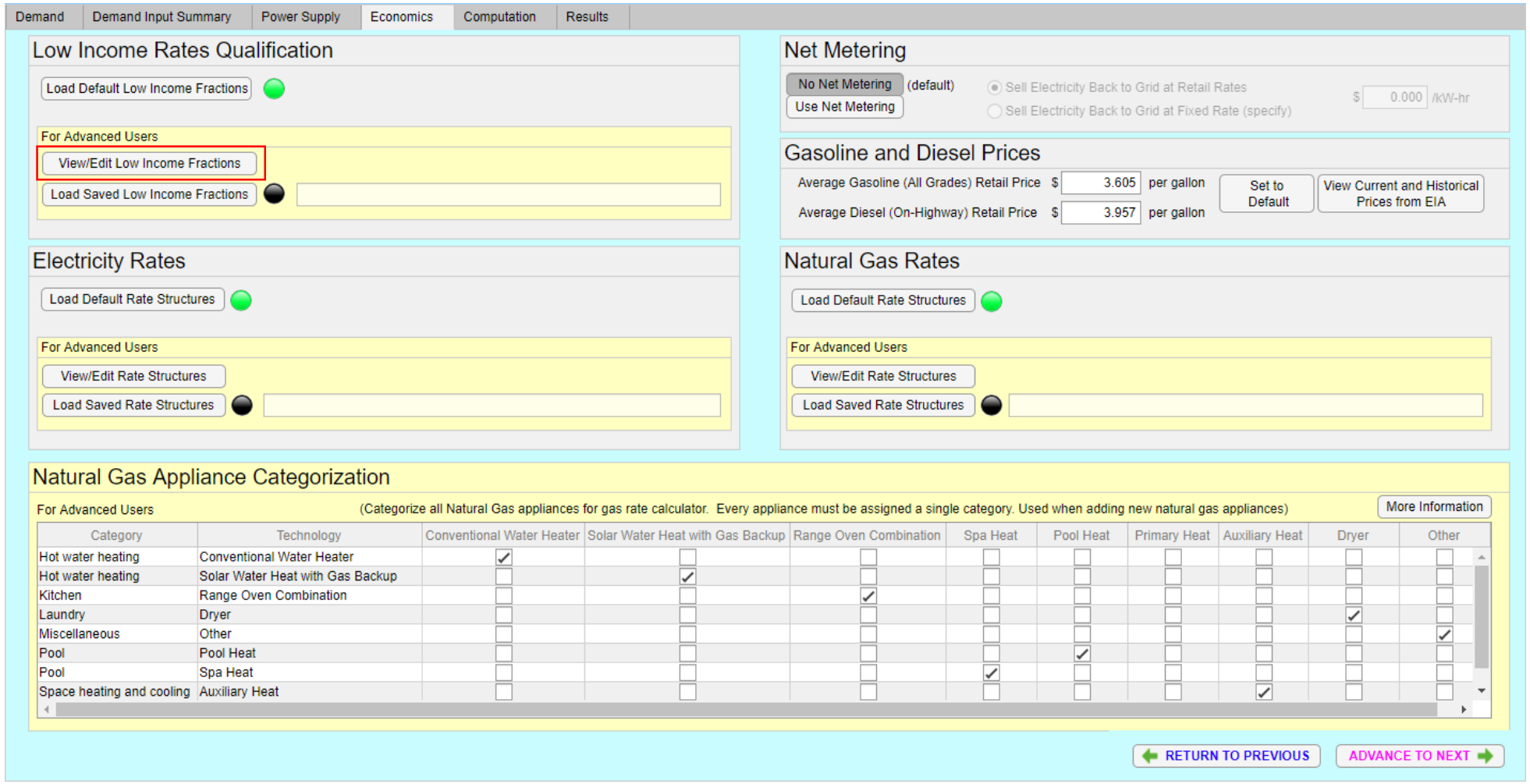
Economics Tab (leave unchanged)



South Coast
Air Quality Management District

View/Edit Low Income Fractions (leave unchanged)

Rate Selector | Analysis | Low Income Rates Qualification

Values below represent the percentage of homes in each electric/gas utility combination, climate zone, and housing category that are eligible for low income rates. Default values are estimated with a comprehensive analysis of IPUMS harmonized American Community Survey data from 2016, the most current year on record. Household income, units in structure, Public Use Microdata Area (cross-referenced to climate zone), residents in household, age of residents, public health insurance coverage, welfare income, food stamp recipiency, disability status, and veteran status, and military status are extracted. Residents living in group quarters were removed. The qualification criteria for low income rates for each utility was then identified and cross-referenced with the IPUMS data to determine the fraction of households in each climate zone and housing category that are eligible for the low income rates. In utilities with both California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA), only CARE rates are analyzed. Some utilities have low income rates that are a flat subsidy. These utilities are ignored in the low income rate analysis because NEAT performs a difference analysis and flat subsidy benefits cancel out when calculating the utility bill difference between the selected scenario case and the base case. The utilities without a low income rate or with flat subsidies for low income residents appropriate all residents into the "high income" designation for this analysis. The values that are currently stored in memory are initially loaded. Use the "Load Default Values" button to repopulate the table with the default values and then use the "Save to File" button to store the default values in memory. Any edits to the table must also be stored with the "Save to File" button.

				SINGLE FAMILY HOMES [%]						MULTI FAMILY HOMES [%]						MOBILE HOMES [%]					
Rate Type	Electric Utility	Rate Type	Gas Utility	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16
high	Azusa Light & Power	high	CITY OF VERNON GAS SYSTEM	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
high	Azusa Light & Power	high	LONG BEACH GAS & OIL	92.23	81.35	84.33	80.77	83.66	85.55	82.06	62.99	68.17	58.99	55.95	64.76	72.66	65.56	61.48	65.35	65.98	75.65
high	Azusa Light & Power	low	LONG BEACH GAS & OIL	7.77	18.65	15.67	19.23	16.34	14.45	17.94	37.01	31.83	41.01	44.05	35.24	27.34	34.44	38.52	34.65	34.02	24.35
high	Azusa Light & Power	high	SOUTHERN CALIFORNIA GAS	92.14	81.07	84.09	80.58	83.47	85.03	82	62.77	67.89	58.42	55.95	64.24	72.14	64.31	60.81	64.85	65.7	74.8
high	Azusa Light & Power	low	SOUTHERN CALIFORNIA GAS	7.86	18.93	15.91	19.42	16.53	14.97	18	37.23	32.11	41.58	44.05	35.76	27.86	35.69	39.19	35.15	34.3	25.2
high	Azusa Light & Power	high	SOUTHWEST GAS CORP.	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
high	Azusa Light & Power	low	SOUTHWEST GAS CORP.	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Bear Valley Electric Service	high	CITY OF VERNON GAS SYSTEM	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	CITY OF VERNON GAS SYSTEM	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Bear Valley Electric Service	high	LONG BEACH GAS & OIL	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	LONG BEACH GAS & OIL	8.29	7.91	8.9	7.4	21.56	14.96	15.67	13.21	14.25	13.42	21.8	21.79	20.41	18.4	17.99	24.83	33.06	32.11
low	Bear Valley Electric Service	low	LONG BEACH GAS & OIL	7.77	18.65	15.67	19.23	16.34	14.45	17.94	37.01	31.83	41.01	44.05	35.24	27.34	34.44	38.52	34.65	34.02	24.35
high	Bear Valley Electric Service	high	SOUTHERN CALIFORNIA GAS	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	SOUTHERN CALIFORNIA GAS	8.19	7.63	8.66	7.21	21.36	14.44	15.61	12.99	13.97	12.85	21.8	21.27	19.89	17.15	17.31	24.33	32.79	31.26
low	Bear Valley Electric Service	low	SOUTHERN CALIFORNIA GAS	7.86	18.93	15.91	19.42	16.53	14.97	18	37.23	32.11	41.58	44.05	35.76	27.86	35.69	39.19	35.15	34.3	25.2
high	Bear Valley Electric Service	high	SOUTHWEST GAS CORP.	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	low	SOUTHWEST GAS CORP.	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Burbank Water & Power	high	CITY OF VERNON GAS SYSTEM	90.18	88.05	87.16	87.59	81.21	81.43	85.27	81.25	80.49	78.38	72.98	75.3	64.15	73.27	64.67	62.34	59.41	58.71
low	Burbank Water & Power	high	CITY OF VERNON GAS SYSTEM	9.82	11.95	12.84	12.41	18.79	18.57	14.73	18.75	19.51	21.62	27.02	24.7	35.85	26.73	35.33	37.66	40.59	41.29
high	Burbank Water & Power	high	LONG BEACH GAS & OIL	85.62	76.03	78.12	75.46	71.28	73.53	74.62	57.79	62.67	52.93	41.63	53.57	55.36	50.49	47.4	44.45	39.85	48.49
high	Burbank Water & Power	low	LONG BEACH GAS & OIL	4.56	12.02	9.04	12.14	9.94	7.9	10.65	23.45	17.82	25.46	31.35	21.72	8.79	22.78	17.27	17.89	19.56	10.22
low	Burbank Water & Power	high	LONG BEACH GAS & OIL	6.62	5.32	6.2	5.31	12.39	12.01	7.45	5.2	5.5	6.06	14.32	11.18	17.3	15.07	14.08	20.9	26.13	27.17

IPUMS Data Source: Steven Ruggles, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. Integrated Public Use Microdata Series: Version 7.0 [dataset]. Minneapolis, MN: University of Minnesota, 2017. https://doi.org/10.18128/D010.V7.0

Load Default Values | Load Saved Values | Save to File

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View/Edit Low Income Fractions (leave unchanged)

Rate Selector | Analysis | Low Income Rates Qualification

Values below represent the percentage of homes in each electric/gas utility combination, climate zone, and housing category that are eligible for low income rates. Default values are estimated with a comprehensive analysis of IPUMS harmonized American Community Survey data from 2016, the most current year on record. Household income, units in structure, Public Use Microdata Area (cross-referenced to climate zone), residents in household, age of residents, public health insurance coverage, welfare income, food stamp recipiency, disability status, and veteran status, and military status are extracted. Residents living in group quarters were removed. The qualification criteria for low income rates for each utility was then identified and cross-referenced with the IPUMS data to determine the fraction of households in each climate zone and housing category that are eligible for the low income rates. In utilities with both California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA), only CARE rates are analyzed. Some utilities have low income rates that are a flat subsidy. These utilities are ignored in the low income rate analysis because NEAT performs a difference analysis and flat subsidy benefits cancel out when calculating the utility bill difference between the selected scenario case and the base case. The utilities without a low income rate or with flat subsidies for low income residents appropriate all residents into the "high income" designation for this analysis. The values that are currently stored in memory are initially loaded. Use the "Load Default Values" button to repopulate the table with the default values and then use the "Save to File" button to store the default values in memory. Any edits to the table must also be stored with the "Save to File" button.

				SINGLE FAMILY HOMES [%]						MULTI FAMILY HOMES [%]						MOBILE HOMES [%]					
Rate Type	Electric Utility	Rate Type	Gas Utility	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16	CZ 6	CZ 8	CZ 9	CZ 10	CZ 15	CZ 16
high	Azusa Light & Power	high	CITY OF VERNON GAS SYSTEM	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
high	Azusa Light & Power	high	LONG BEACH GAS & OIL	92.23	81.35	84.33	80.77	83.66	85.55	82.06	62.99	68.17	58.99	55.95	64.76	72.66	65.56	61.48	65.35	65.98	75.65
high	Azusa Light & Power	low	LONG BEACH GAS & OIL	7.77	18.65	15.67	19.23	16.34	14.45	17.94	37.01	31.83	41.01	44.05	35.24	27.34	34.44	38.52	34.65	34.02	24.35
high	Azusa Light & Power	high	SOUTHERN CALIFORNIA GAS	92.14	81.07	84.09	80.58	83.47	85.03	82	62.77	67.89	58.42	55.95	64.24	72.14	64.31	60.81	64.85	65.7	74.8
high	Azusa Light & Power	low	SOUTHERN CALIFORNIA GAS	7.86	18.93	15.91	19.42	16.53	14.97	18	37.23	32.11	41.58	44.05	35.76	27.86	35.69	39.19	35.15	34.3	25.2
high	Azusa Light & Power	high	SOUTHWEST GAS CORP.	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
high	Azusa Light & Power	low	SOUTHWEST GAS CORP.	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Bear Valley Electric Service	high	CITY OF VERNON GAS SYSTEM	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	CITY OF VERNON GAS SYSTEM	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Bear Valley Electric Service	high	LONG BEACH GAS & OIL	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	LONG BEACH GAS & OIL	8.29	7.91	8.9	7.4	21.56	14.96	15.67	13.21	14.25	13.42	21.8	21.79	20.41	18.4	17.99	24.83	33.06	32.11
low	Bear Valley Electric Service	low	LONG BEACH GAS & OIL	7.77	18.65	15.67	19.23	16.34	14.45	17.94	37.01	31.83	41.01	44.05	35.24	27.34	34.44	38.52	34.65	34.02	24.35
high	Bear Valley Electric Service	high	SOUTHERN CALIFORNIA GAS	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	high	SOUTHERN CALIFORNIA GAS	8.19	7.63	8.66	7.21	21.36	14.44	15.61	12.99	13.97	12.85	21.8	21.27	19.89	17.15	17.31	24.33	32.79	31.26
low	Bear Valley Electric Service	low	SOUTHERN CALIFORNIA GAS	7.86	18.93	15.91	19.42	16.53	14.97	18	37.23	32.11	41.58	44.05	35.76	27.86	35.69	39.19	35.15	34.3	25.2
high	Bear Valley Electric Service	high	SOUTHWEST GAS CORP.	83.95	73.44	75.43	73.36	62.1	70.59	66.4	49.79	53.92	45.57	34.15	42.96	52.25	47.16	43.49	40.52	32.92	43.54
low	Bear Valley Electric Service	low	SOUTHWEST GAS CORP.	16.05	26.56	24.57	26.64	37.9	29.41	33.6	50.21	46.08	54.43	65.85	57.04	47.75	52.84	56.51	59.48	67.08	56.46
high	Burbank Water & Power	high	CITY OF VERNON GAS SYSTEM	90.18	88.05	87.16	87.59	81.21	81.43	85.27	81.25	80.49	78.38	72.98	75.3	64.15	73.27	64.67	62.34	59.41	58.71
low	Burbank Water & Power	high	CITY OF VERNON GAS SYSTEM	9.82	11.95	12.84	12.41	18.79	18.57	14.73	18.75	19.51	21.62	27.02	24.7	35.85	26.73	35.33	37.66	40.59	41.29
high	Burbank Water & Power	high	LONG BEACH GAS & OIL	85.62	76.03	78.12	75.46	71.28	73.53	74.62	57.79	62.67	52.93	41.63	53.57	55.36	50.49	47.4	44.45	39.85	48.49
high	Burbank Water & Power	low	LONG BEACH GAS & OIL	4.56	12.02	9.04	12.14	9.94	7.9	10.65	23.45	17.82	25.46	31.35	21.72	8.79	22.78	17.27	17.89	19.56	10.22
low	Burbank Water & Power	high	LONG BEACH GAS & OIL	6.62	5.32	6.2	5.31	12.39	12.01	7.45	5.2	5.5	6.06	14.32	11.18	17.3	15.07	14.08	20.9	26.13	27.17

IPUMS Data Source: Steven Ruggles, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. Integrated Public Use Microdata Series: Version 7.0 [dataset]. Minneapolis, MN: University of Minnesota, 2017. https://doi.org/10.18128/D010.V7.0

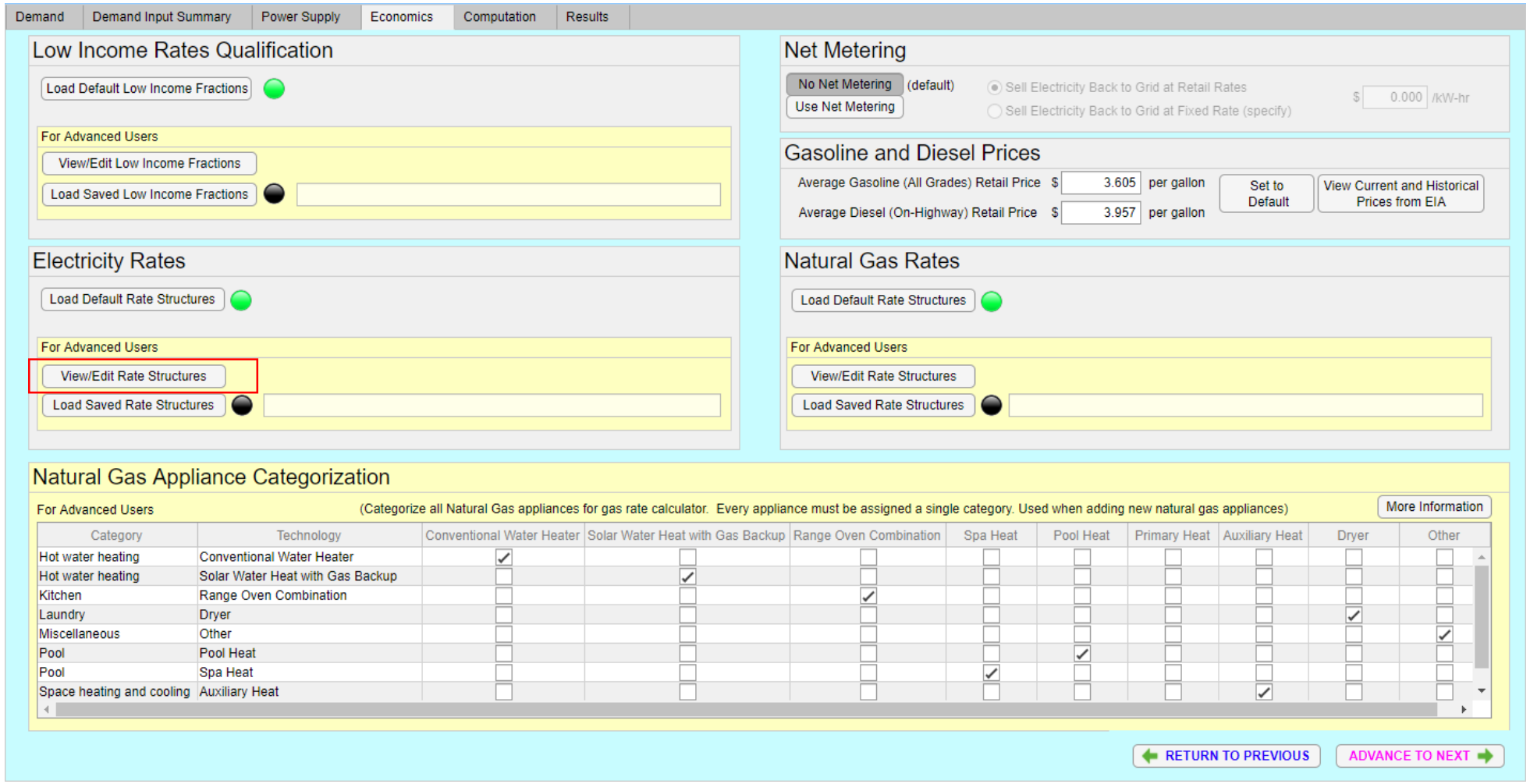
Use Buttons to Load and Save Values

Load Default Values | Load Saved Values | Save to File

South Coast
Air Quality Management District

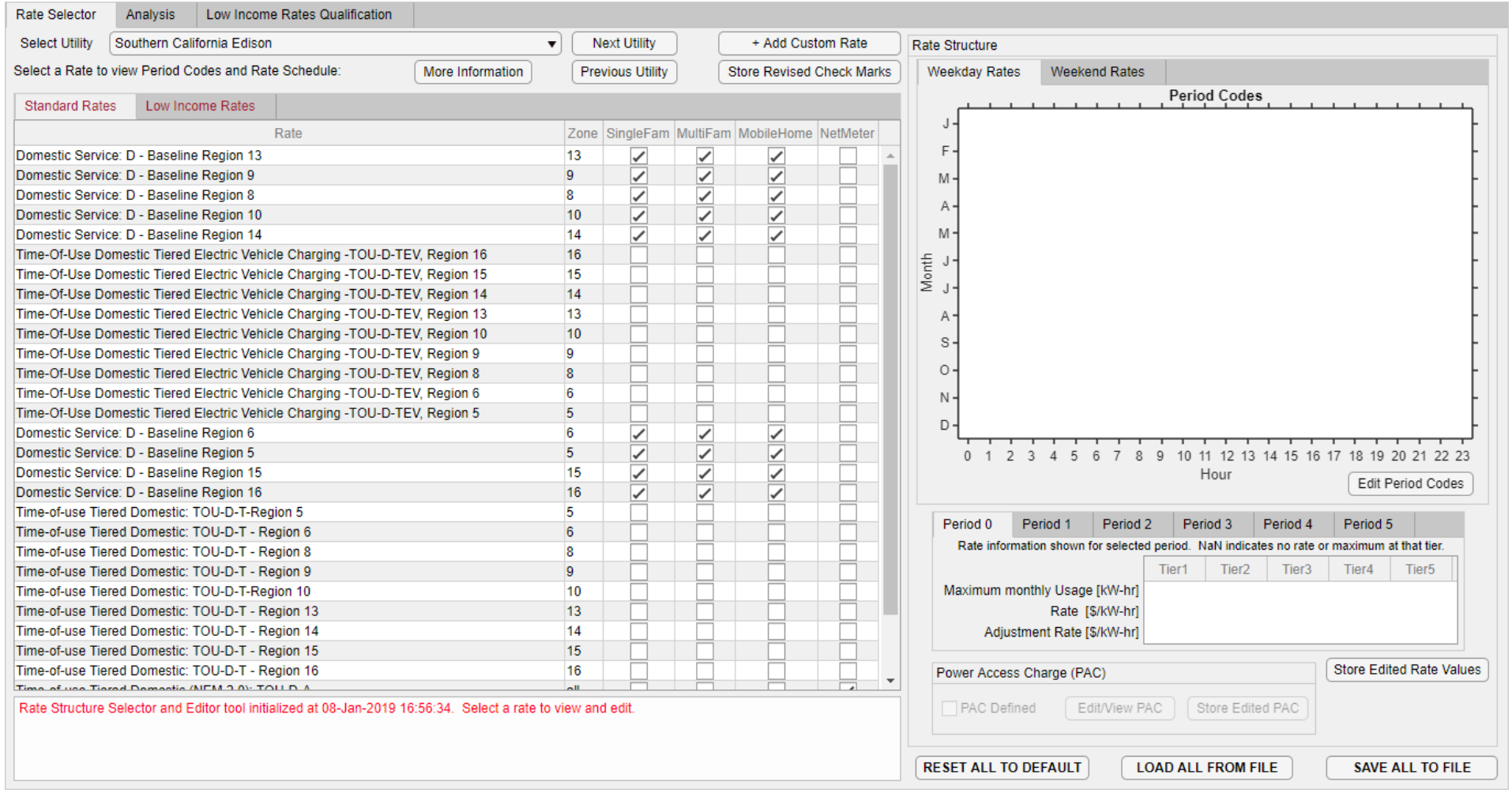
All results are preliminary and should be subject to extensive QA/QC before interpreting.

Economics Tab (leave unchanged)



South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)

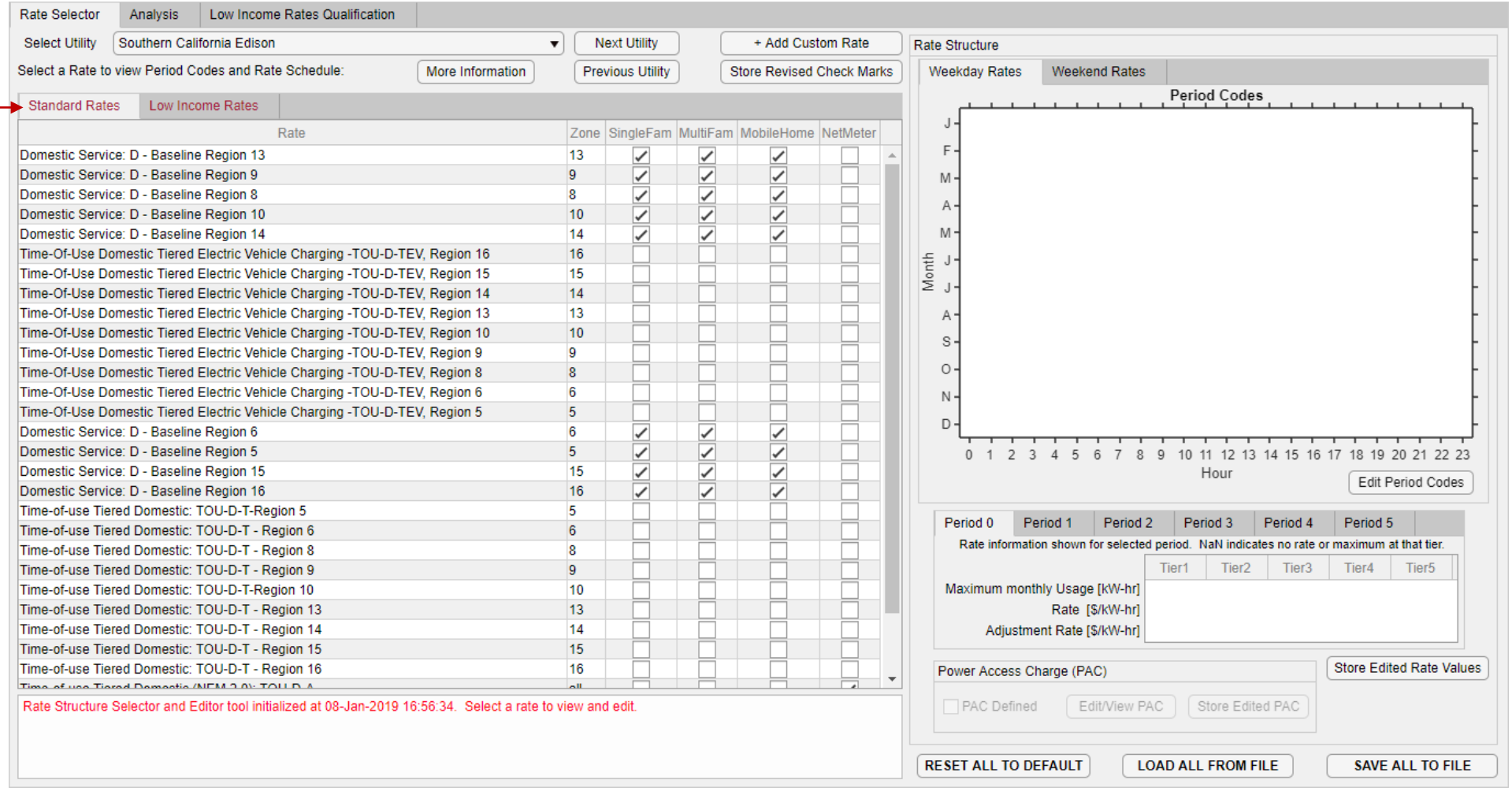


South Coast
Air Quality Management District

All results are preliminary and should be subject to extensive QA/QC before interpreting.

View/Edit Rate Structures (leave unchanged)

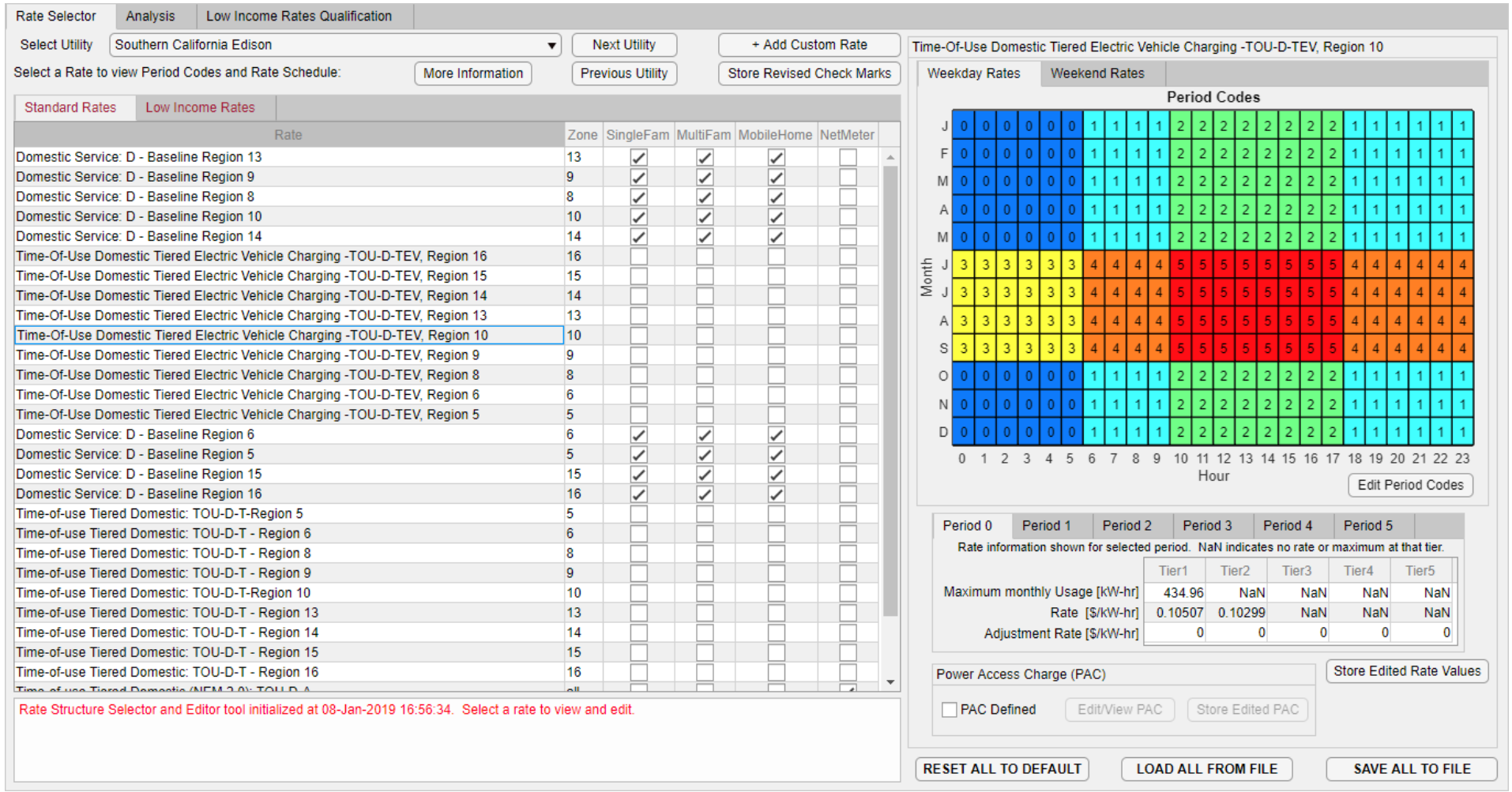
View/Edit both standard and low income rates



South Coast
Air Quality Management District

All results are preliminary and should be subject to extensive QA/QC before interpreting.

View/Edit Rate Structures (leave unchanged)

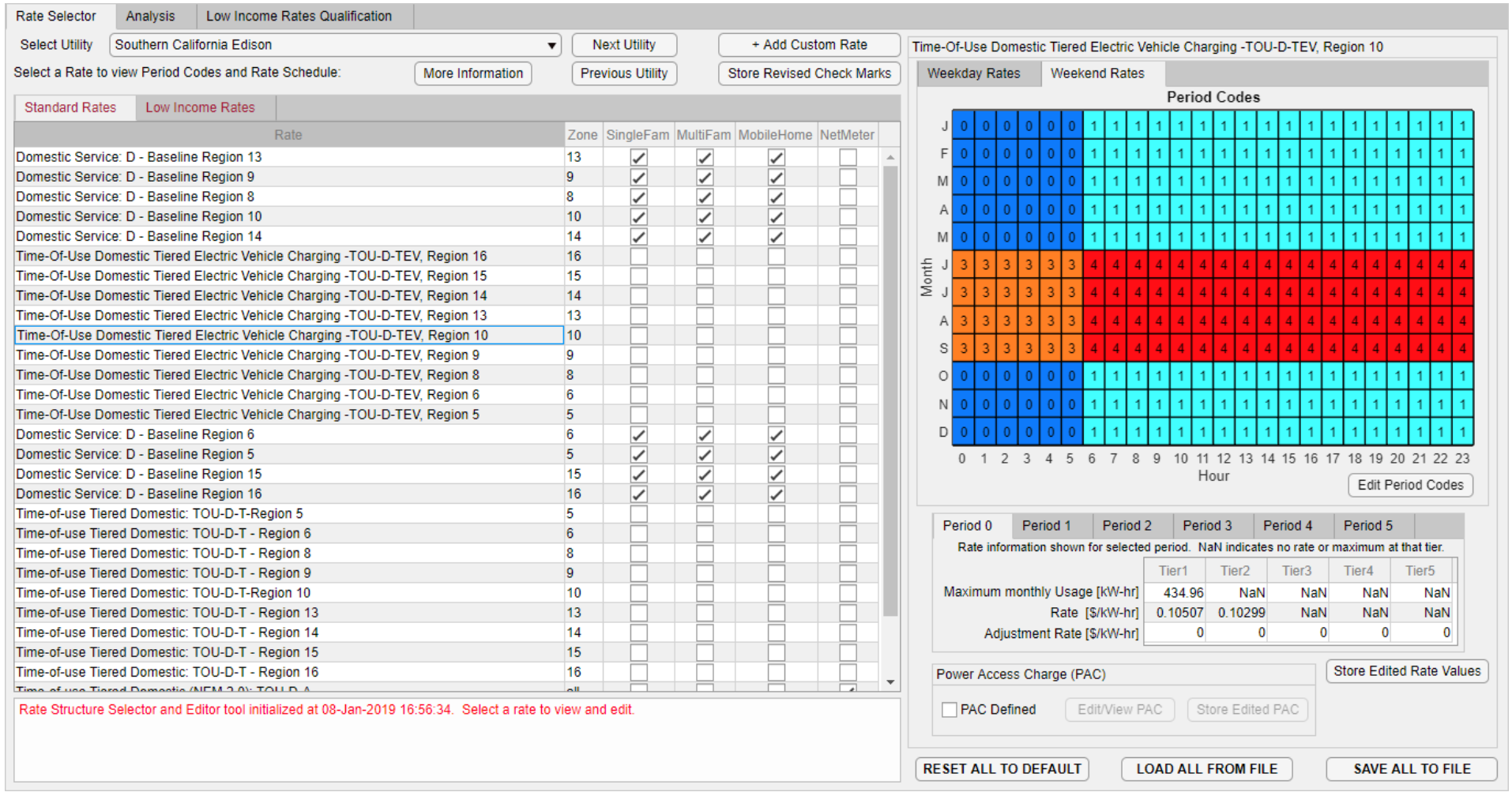


Rate periods as a function of month and hour

Rate information for each rate period

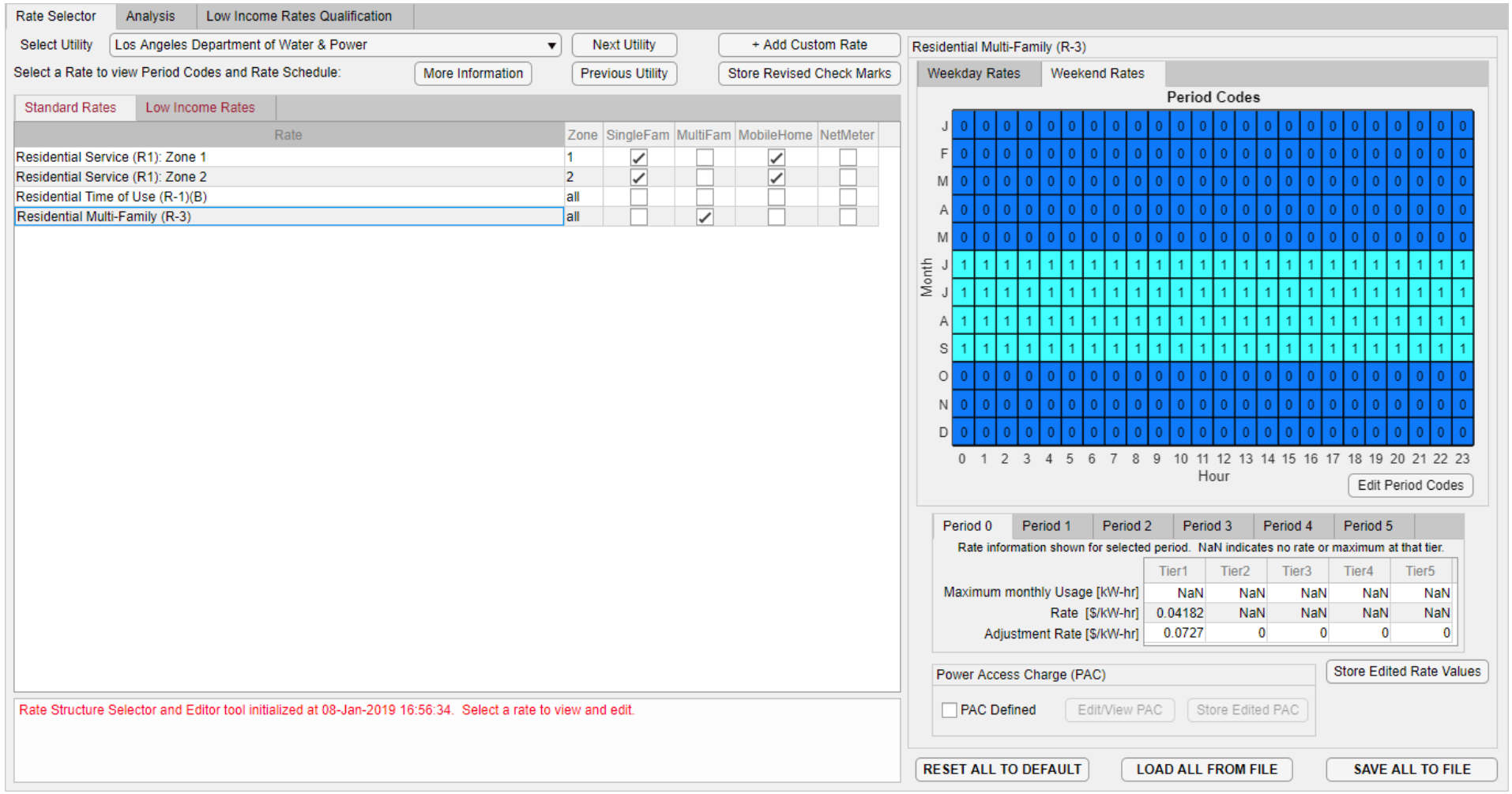
South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)



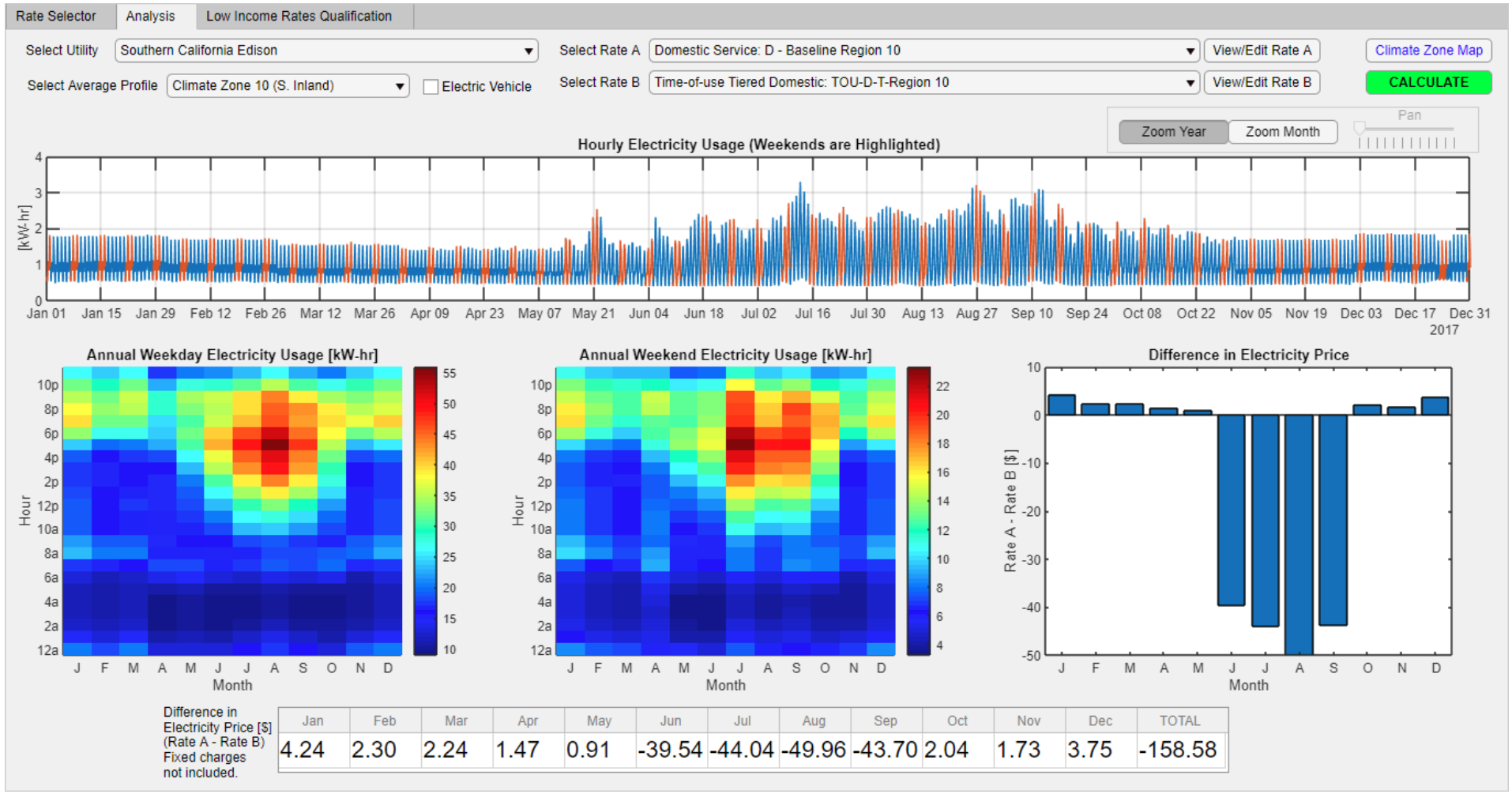
South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)



South Coast
Air Quality Management District

Compare Estimated Rate Differences (settings not used for calculation)



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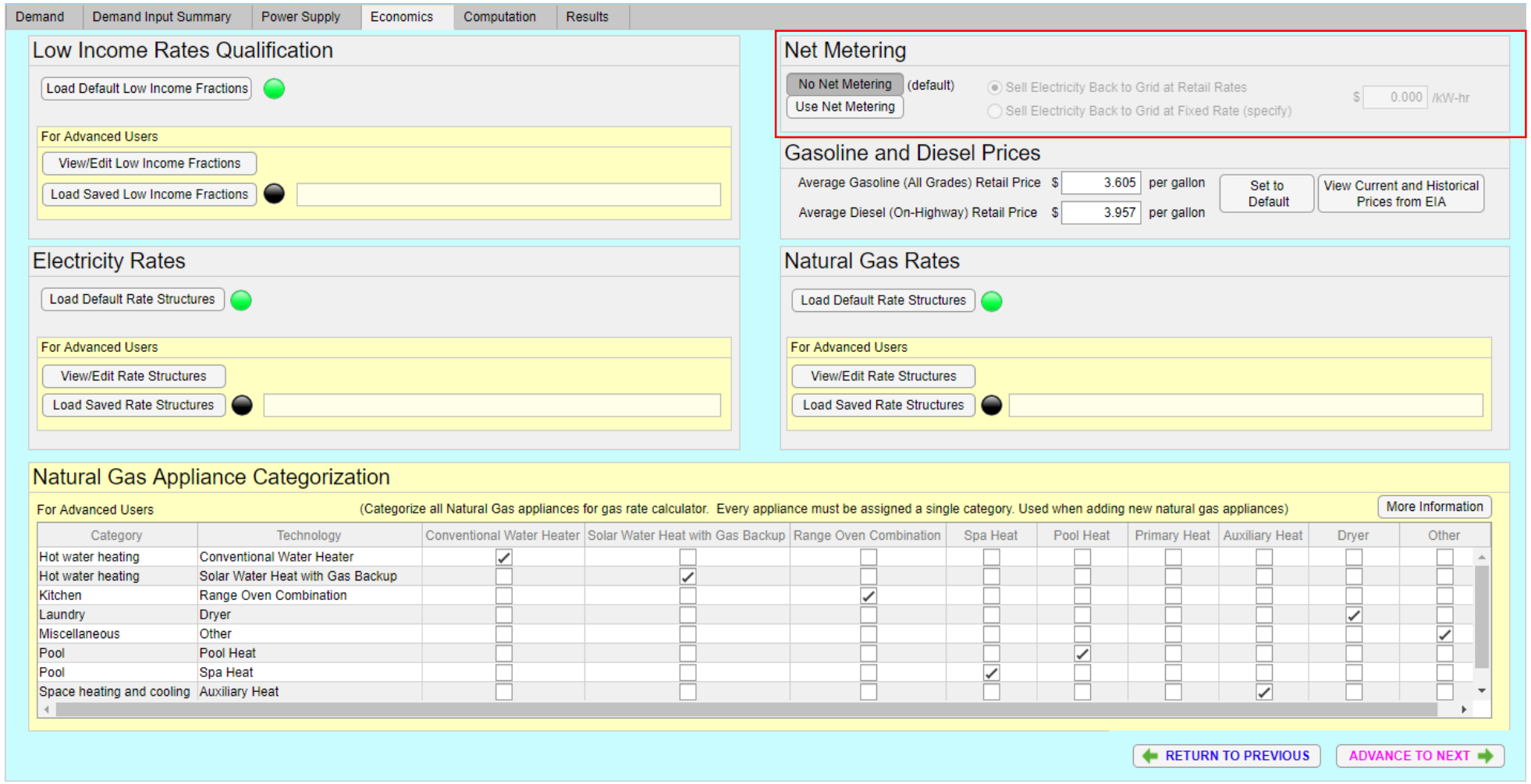
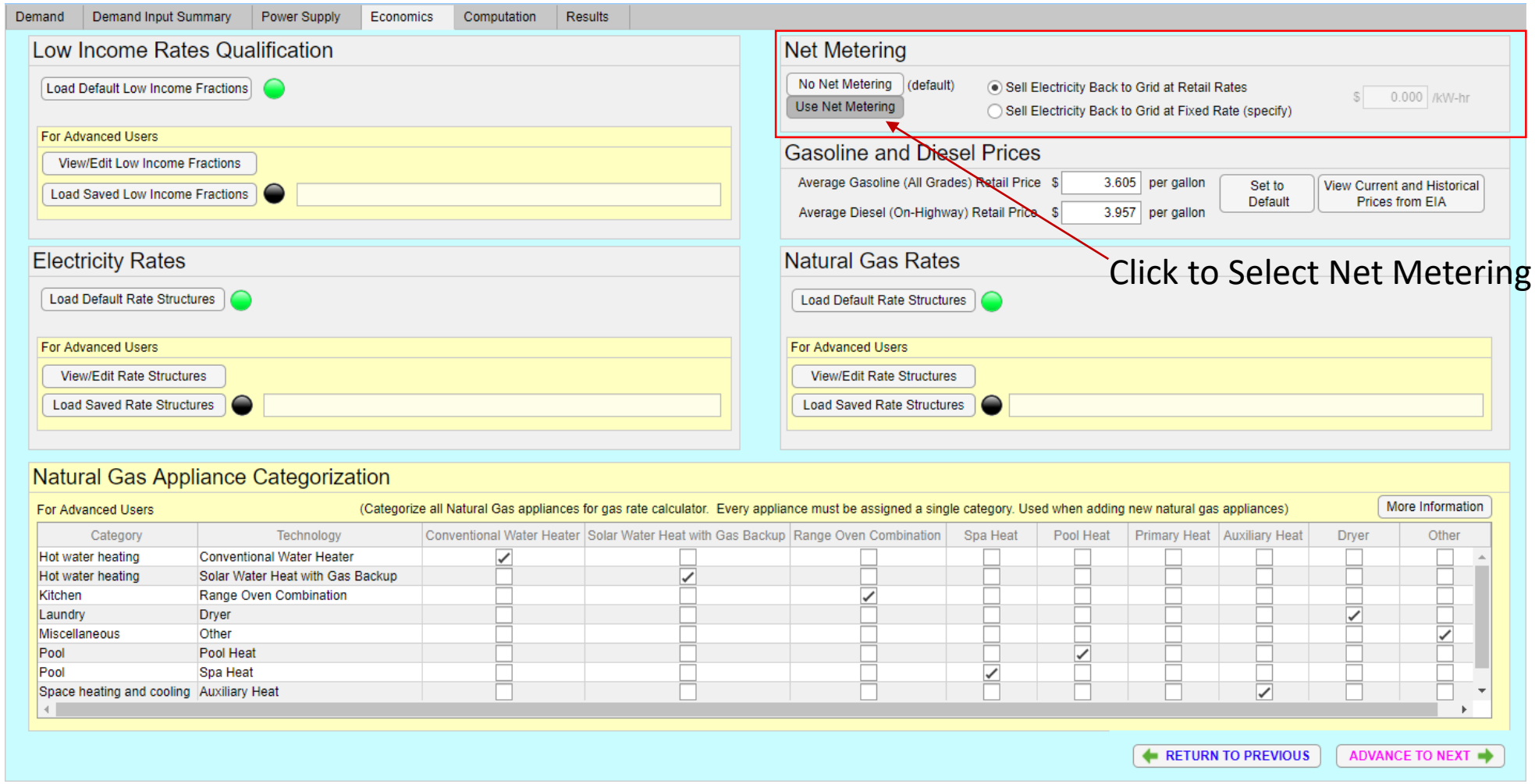
Net Metering

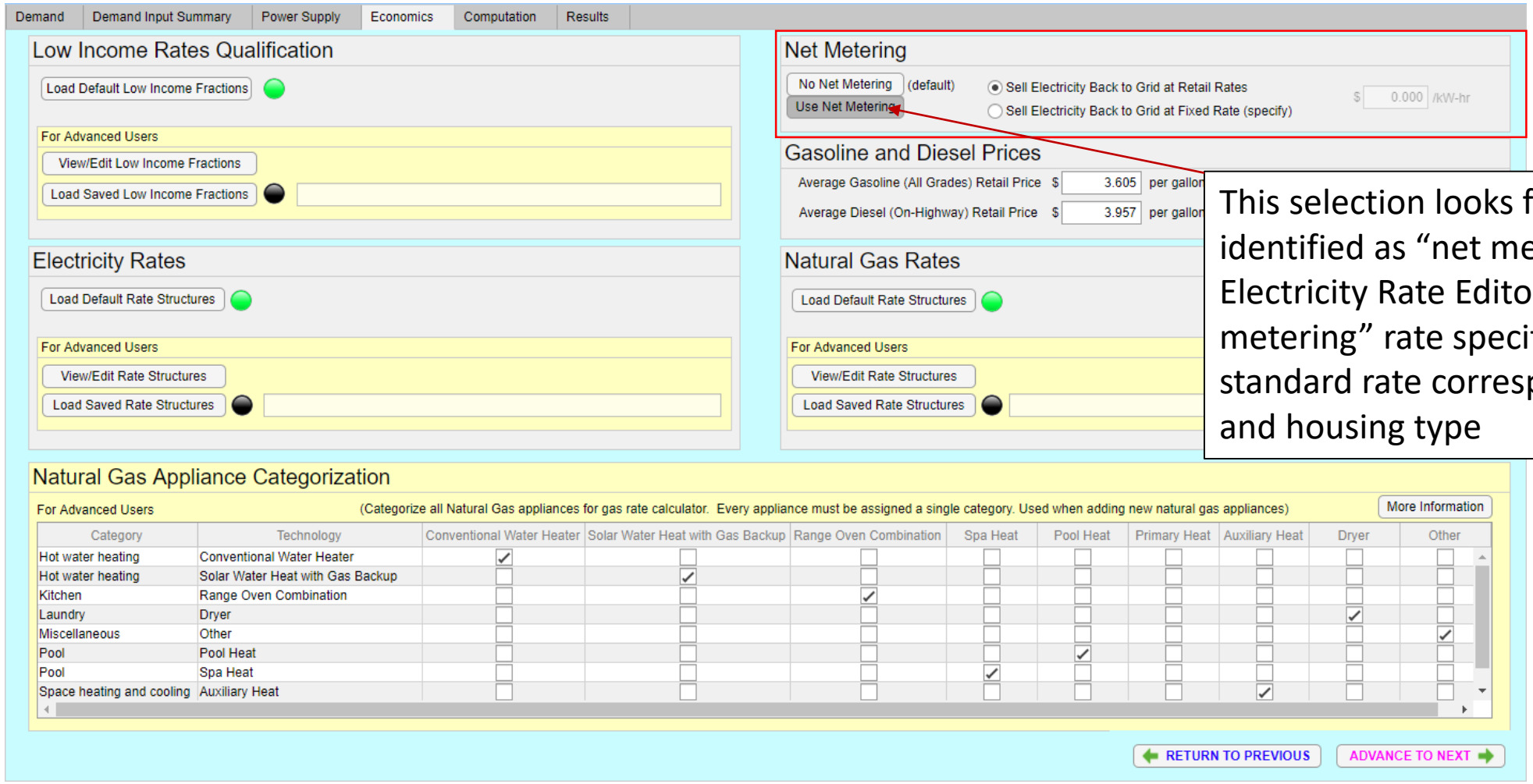


South Coast
Air Quality Management District

Select Net Metering



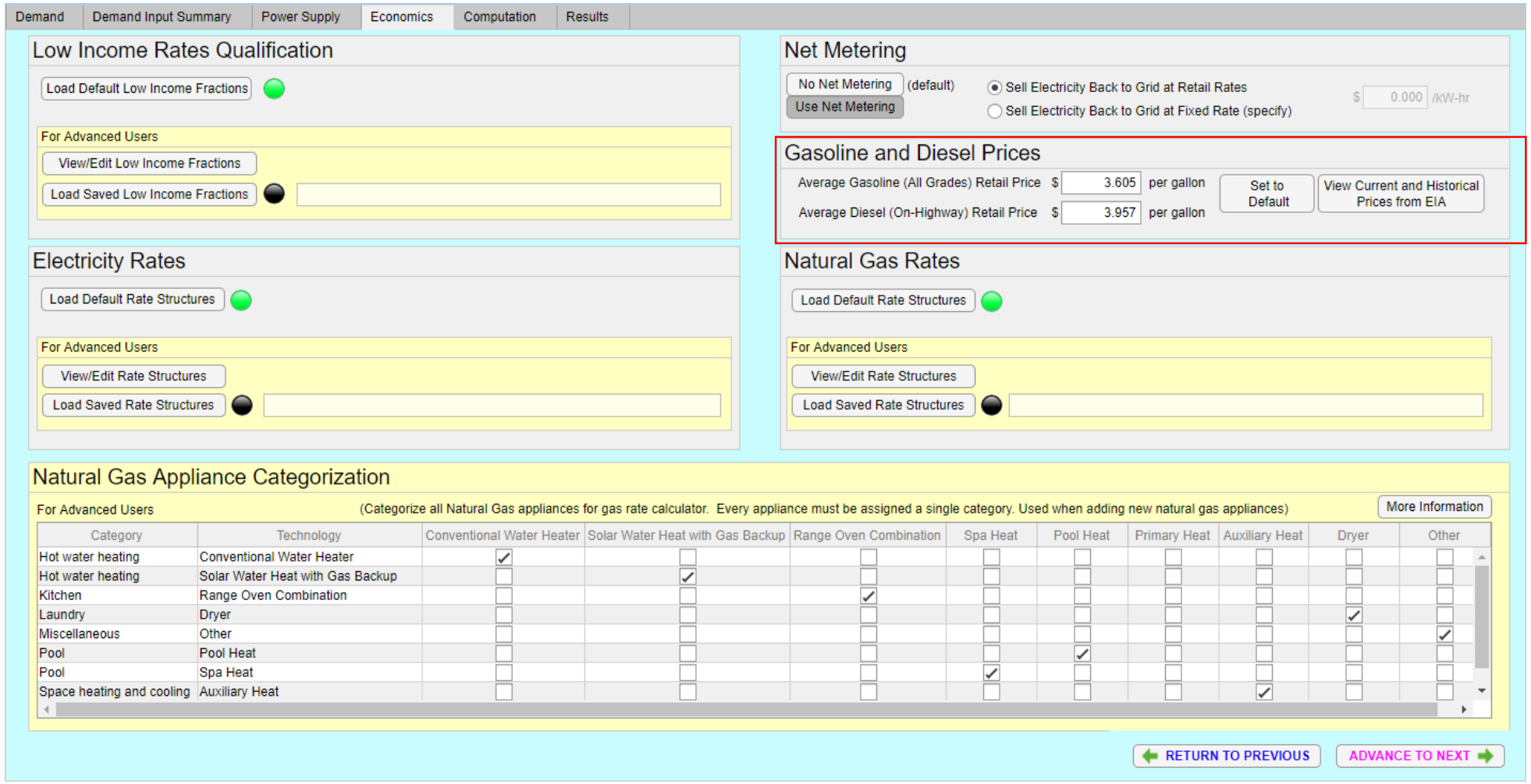
Select Net Metering



Category	Technology	Conventional Water Heater	Solar Water Heat with Gas Backup	Range Oven Combination	Spa Heat	Pool Heat	Primary Heat	Auxiliary Heat	Dryer	Other
Hot water heating	Conventional Water Heater	✓								
Hot water heating	Solar Water Heat with Gas Backup		✓							
Kitchen	Range Oven Combination			✓						
Laundry	Dryer								✓	
Miscellaneous	Other									✓
Pool	Pool Heat					✓				
Pool	Spa Heat				✓					
Space heating and cooling	Auxiliary Heat							✓		

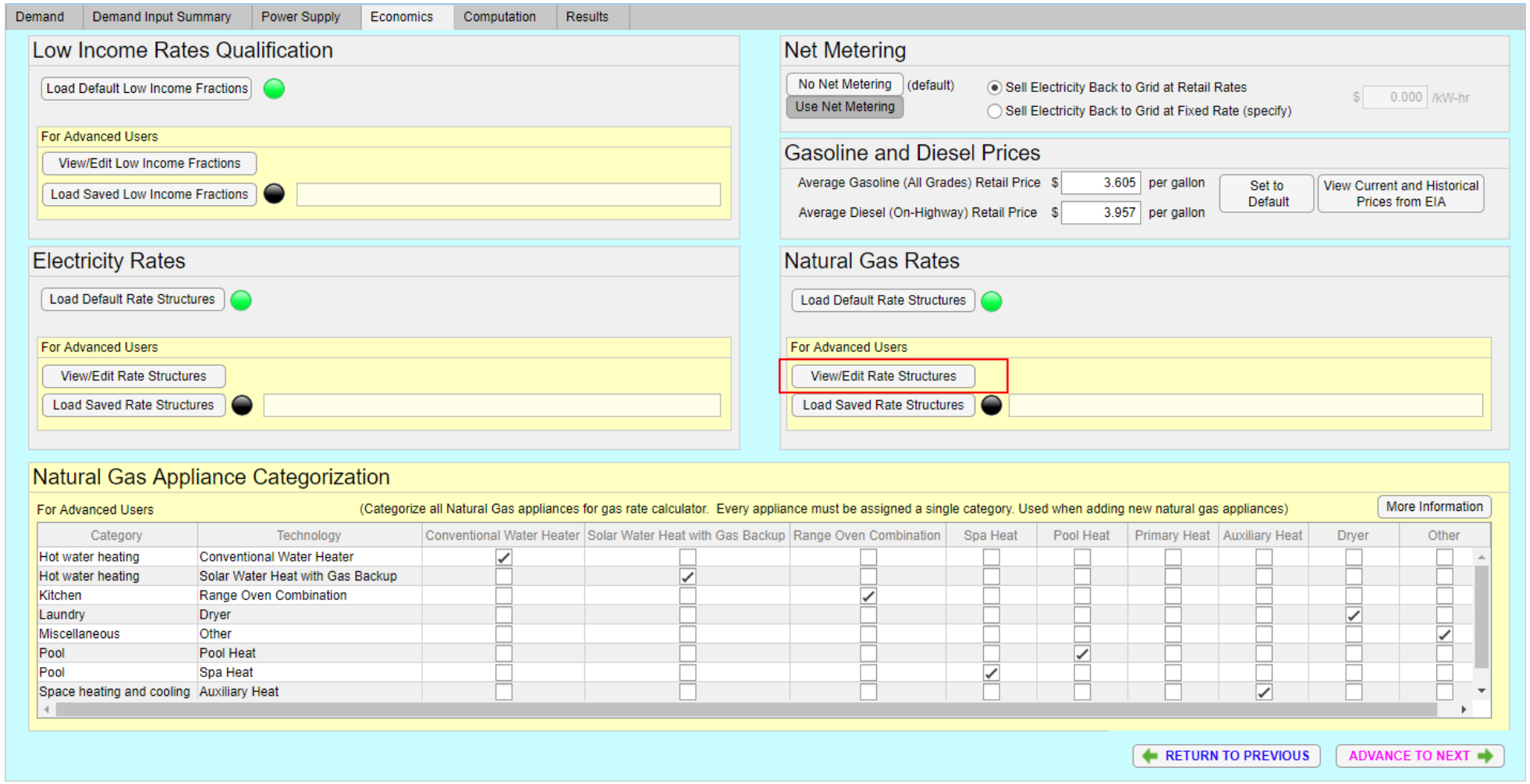
This selection looks for rates identified as “net metering” in Electricity Rate Editor. If no “net metering” rate specified, uses standard rate corresponding CZ and housing type

Edit Gasoline and Diesel Prices (leave unchanged)



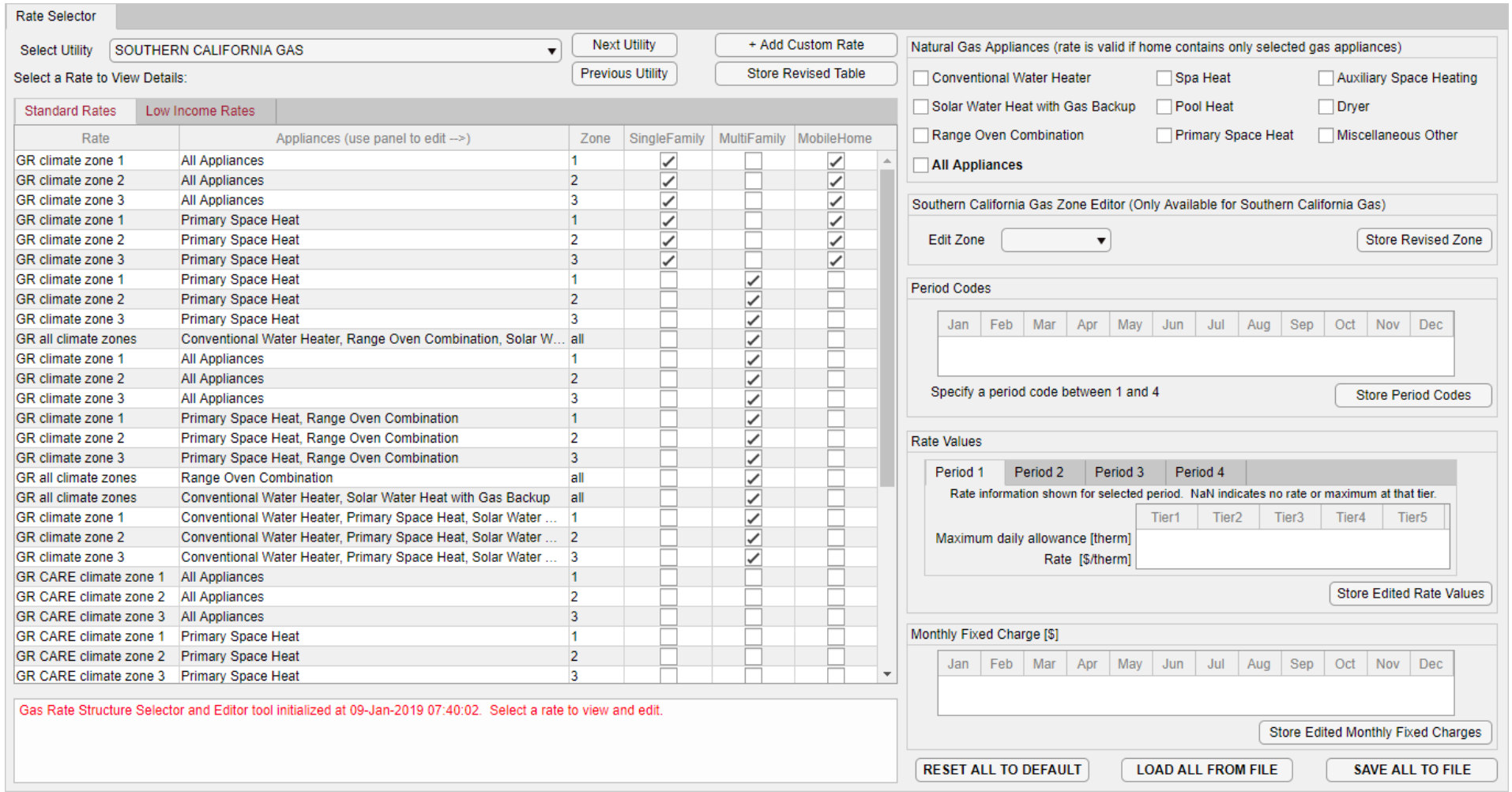
South Coast
Air Quality Management District

View/Edit Natural Gas Rate Structures



South Coast
Air Quality Management District

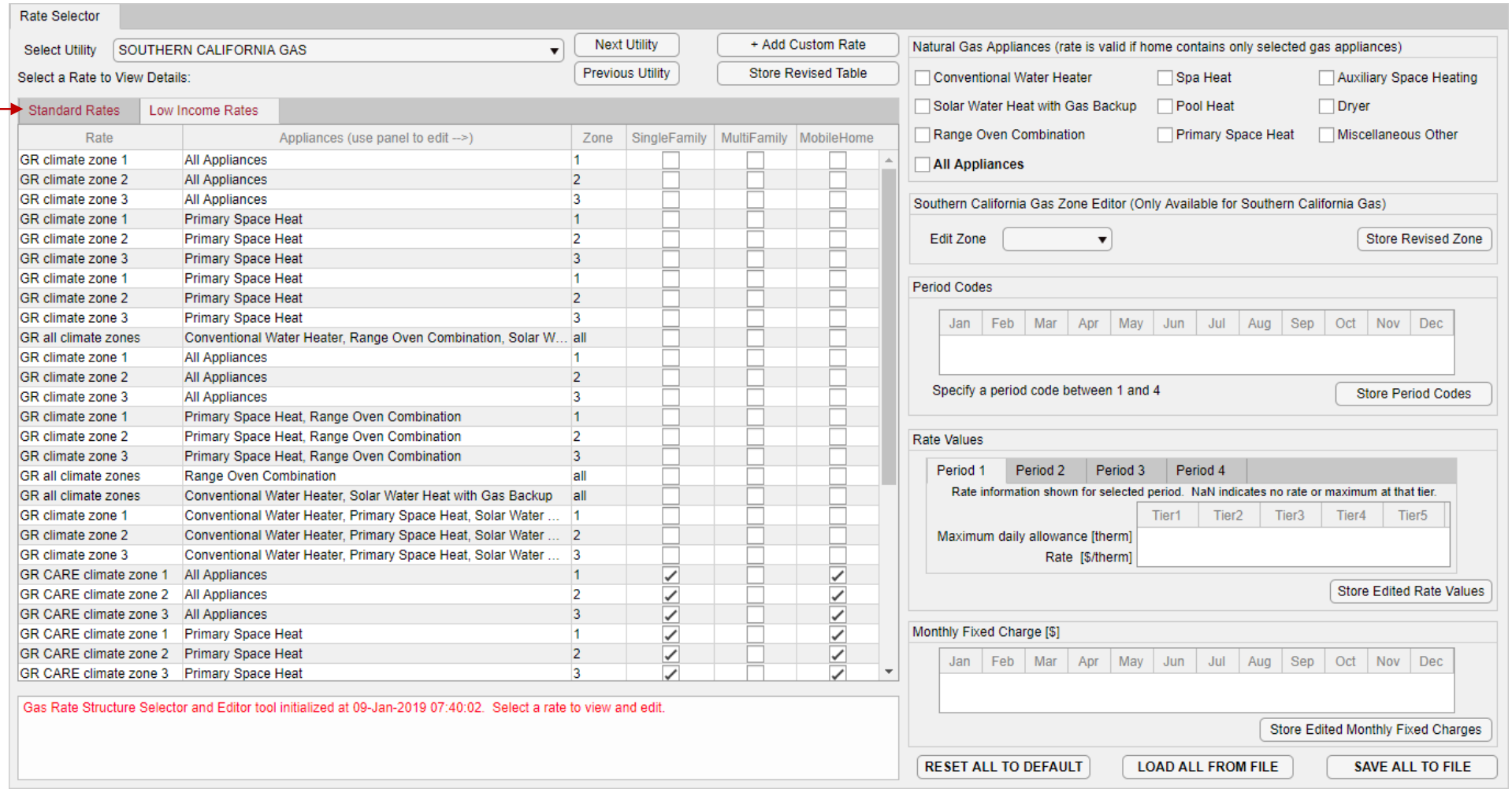
Natural Gas Rate Structure Editor (leave unchanged)



South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)

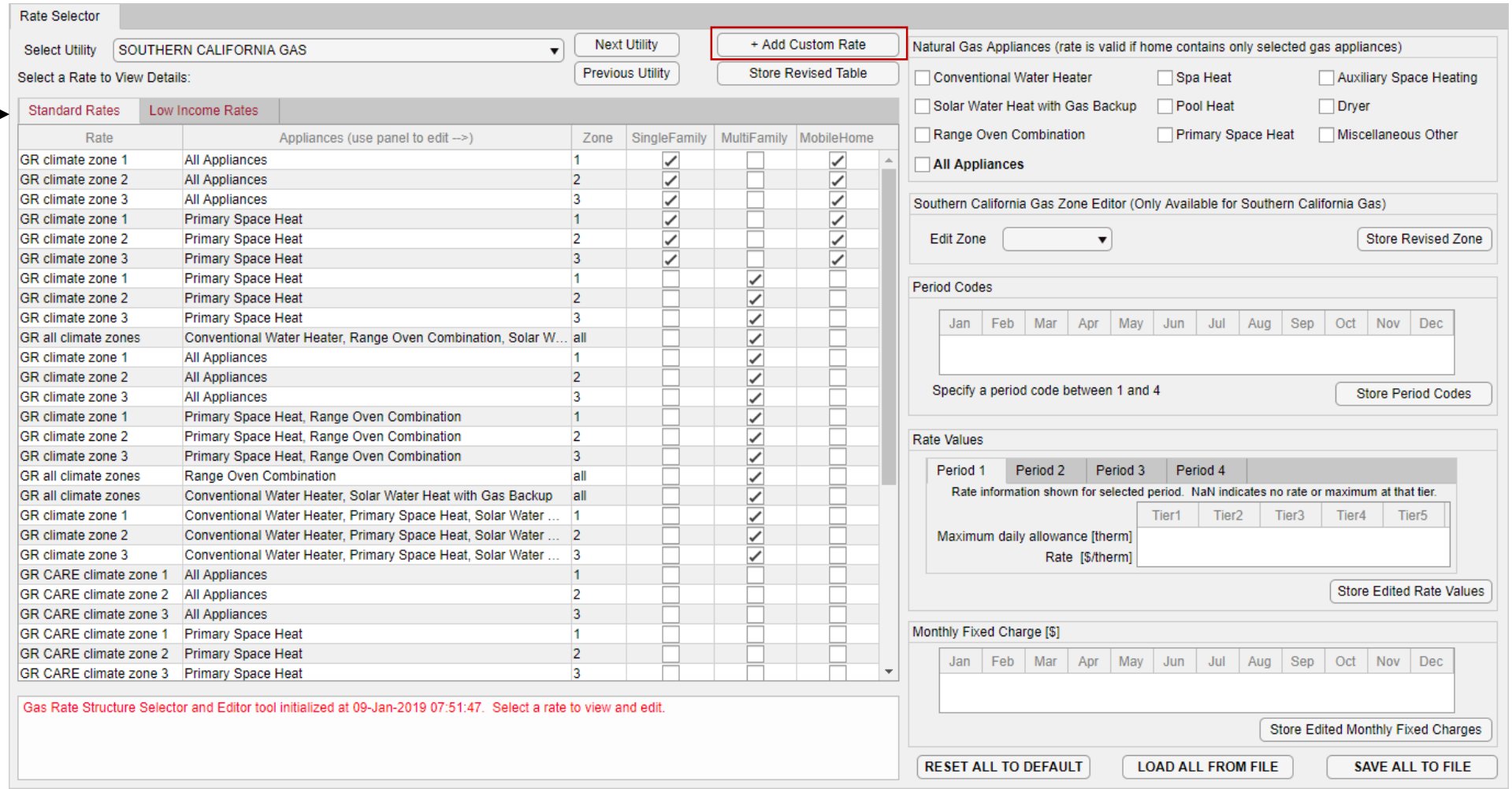
View/Edit both standard and low income rates



South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)

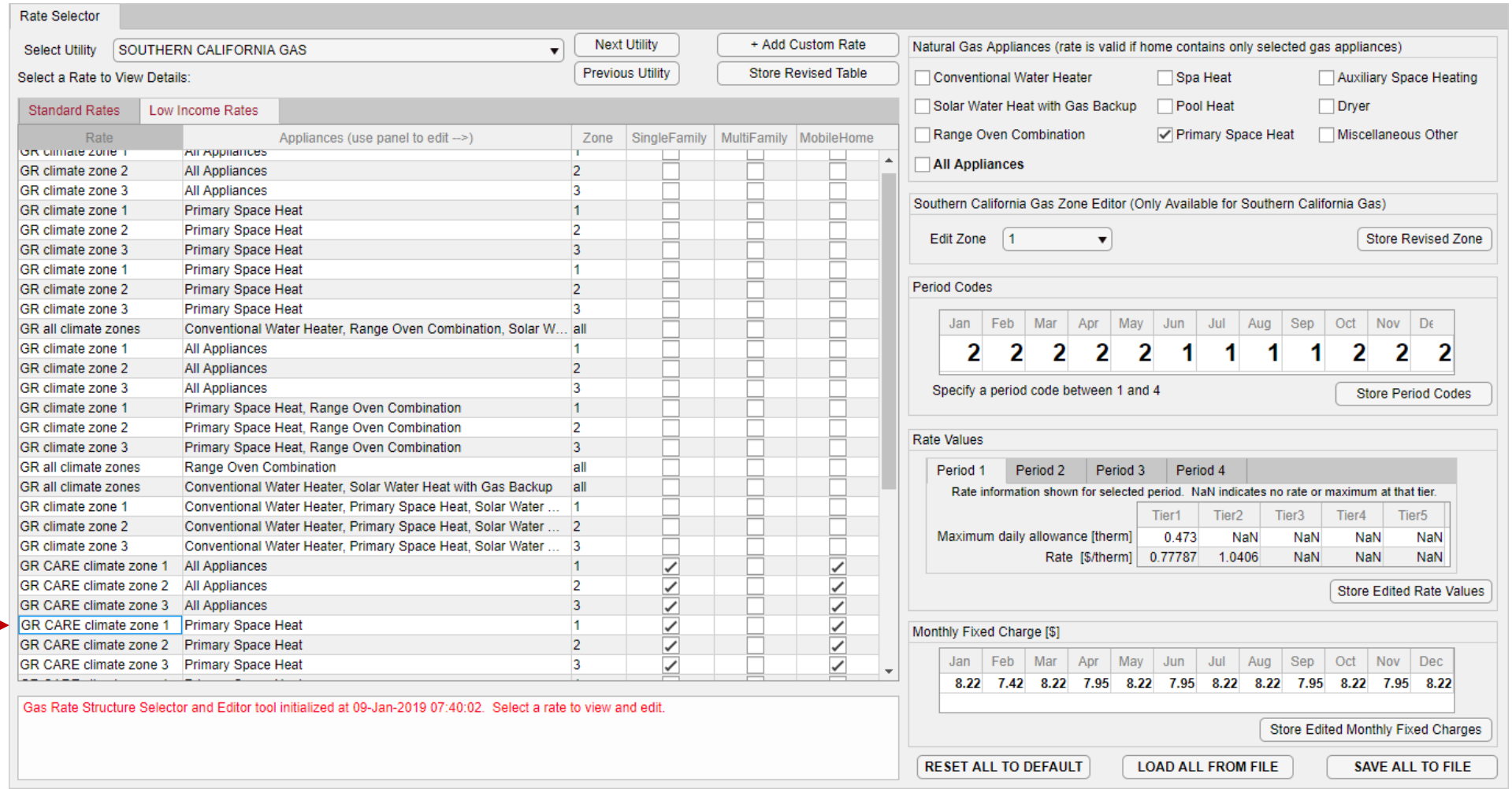
View/Edit both standard and low income rates →



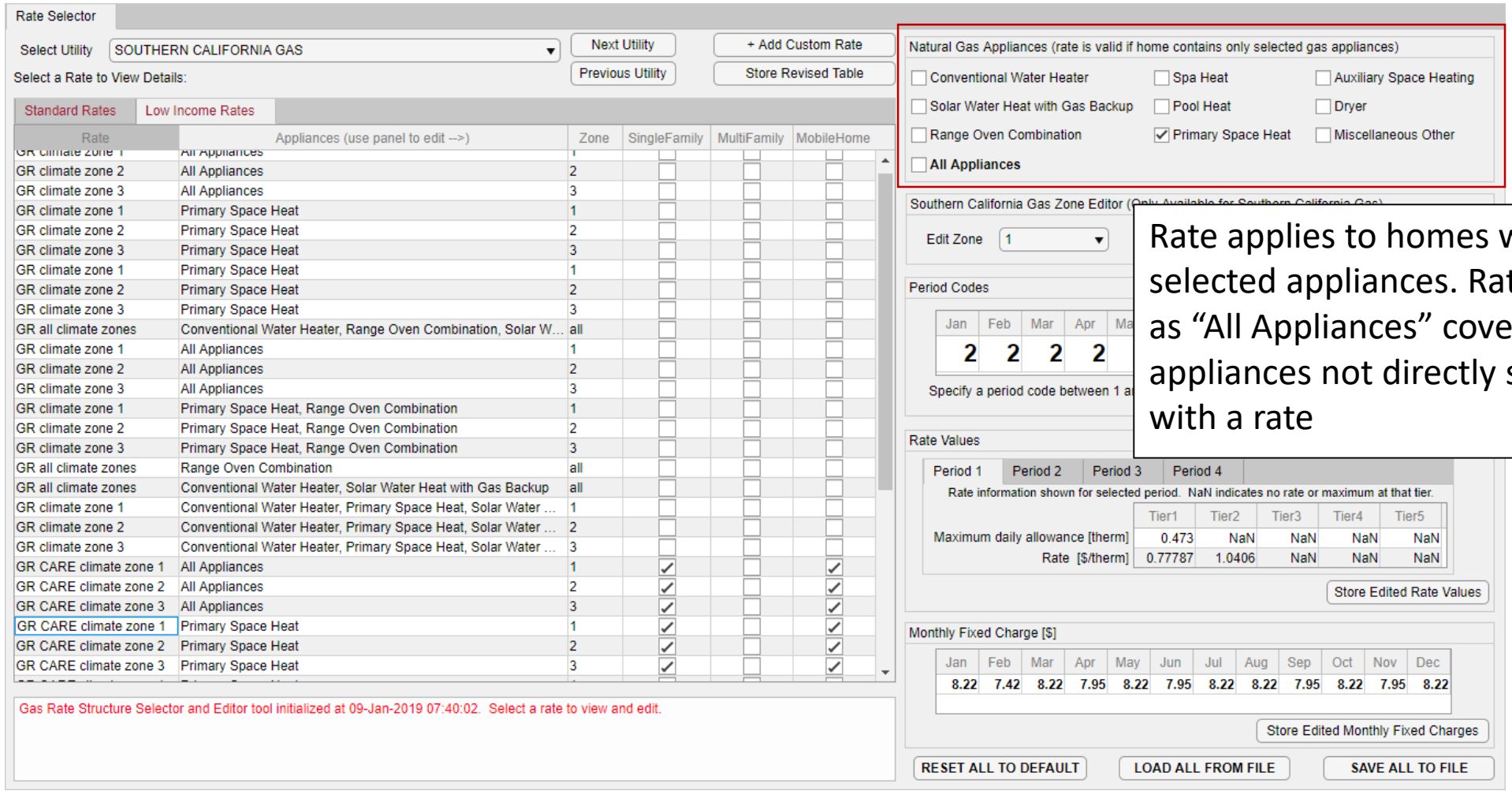
South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)

Click on rate to view details

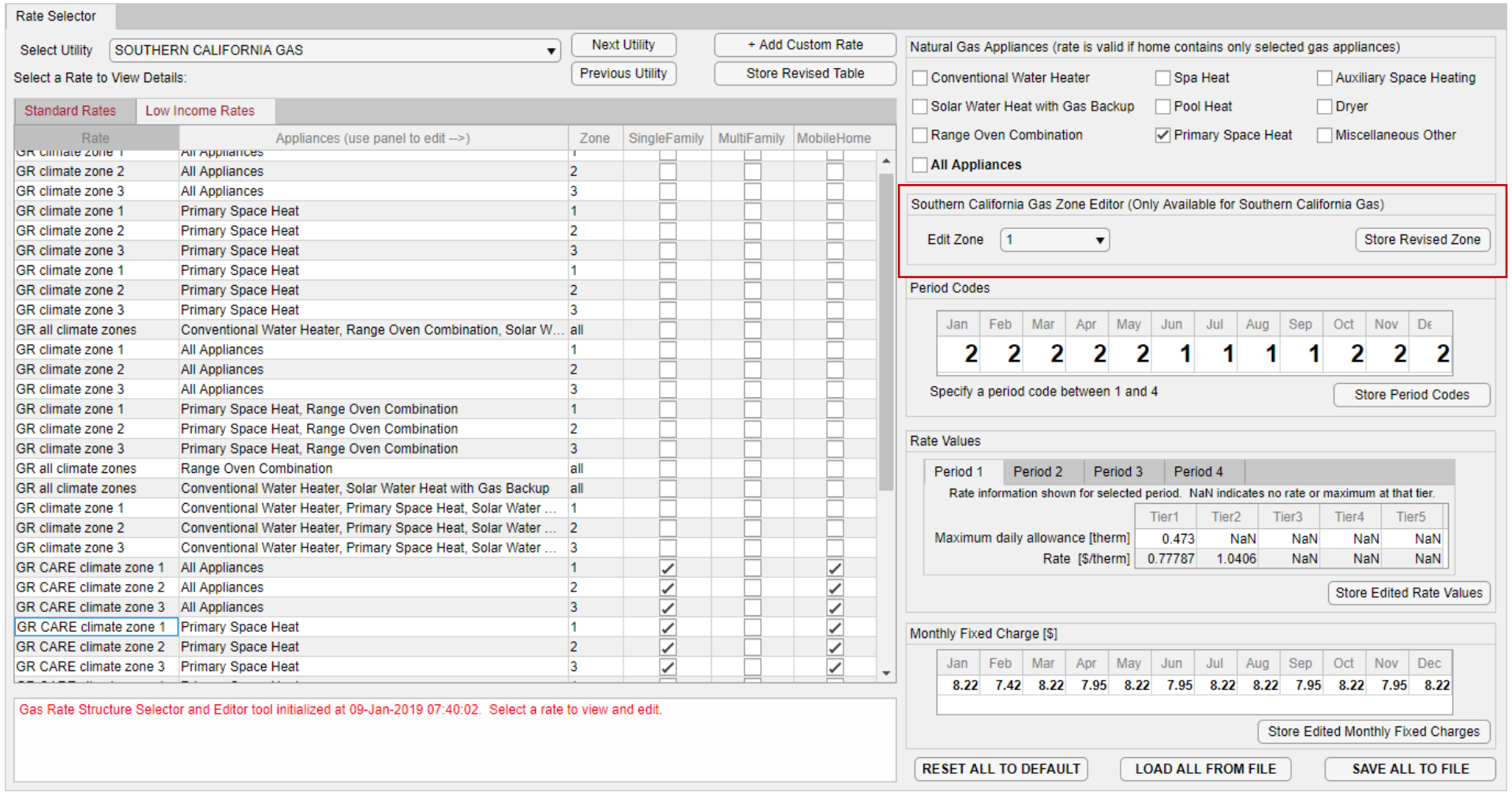


View/Edit Rate Structures (leave unchanged)



Rate applies to homes with only selected appliances. Rate labeled as “All Appliances” covers all appliances not directly specified with a rate

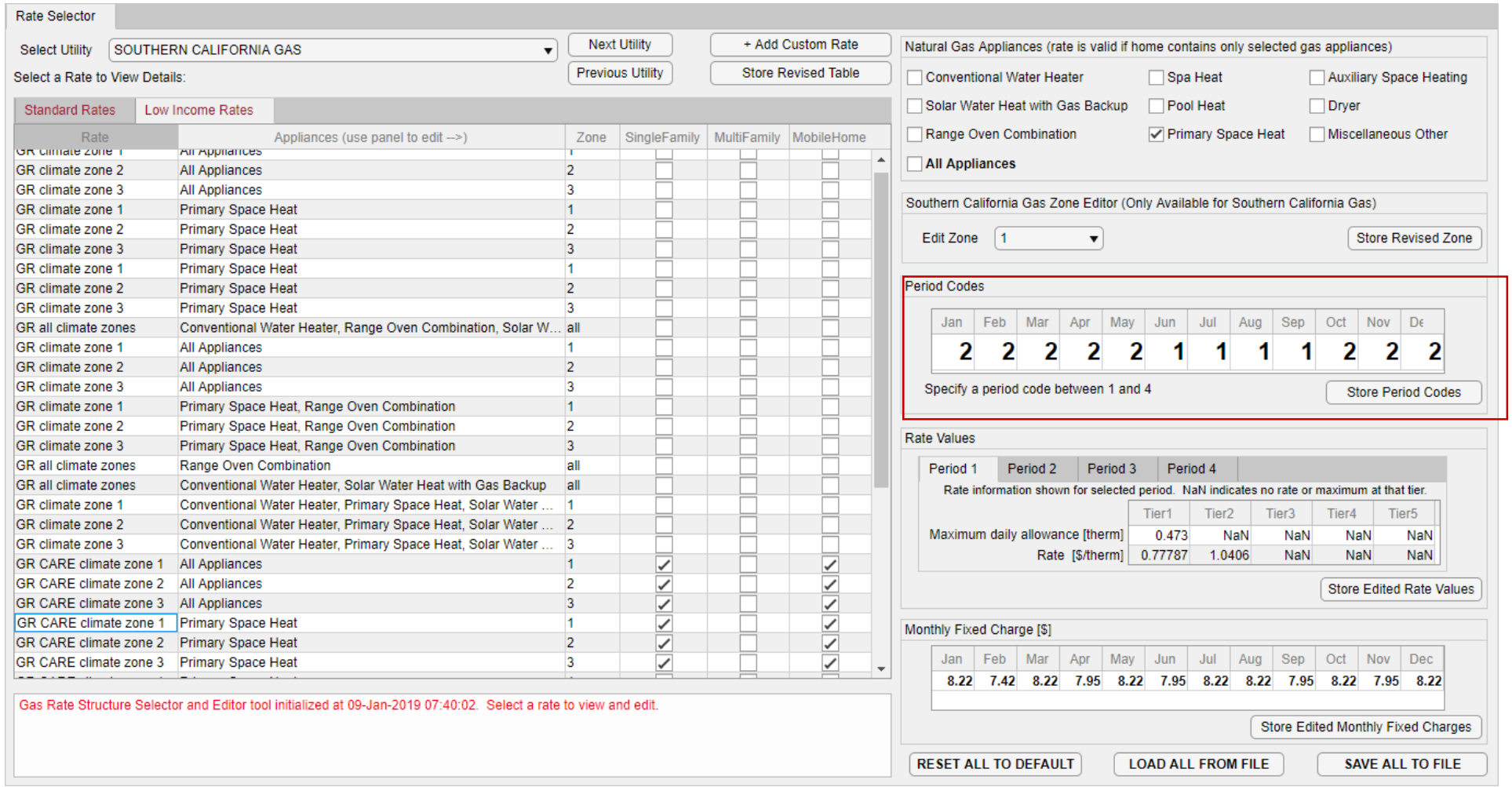
View/Edit Rate Structures (leave unchanged)



Set SoCalGas zone when creating custom rate

South Coast
Air Quality Management District

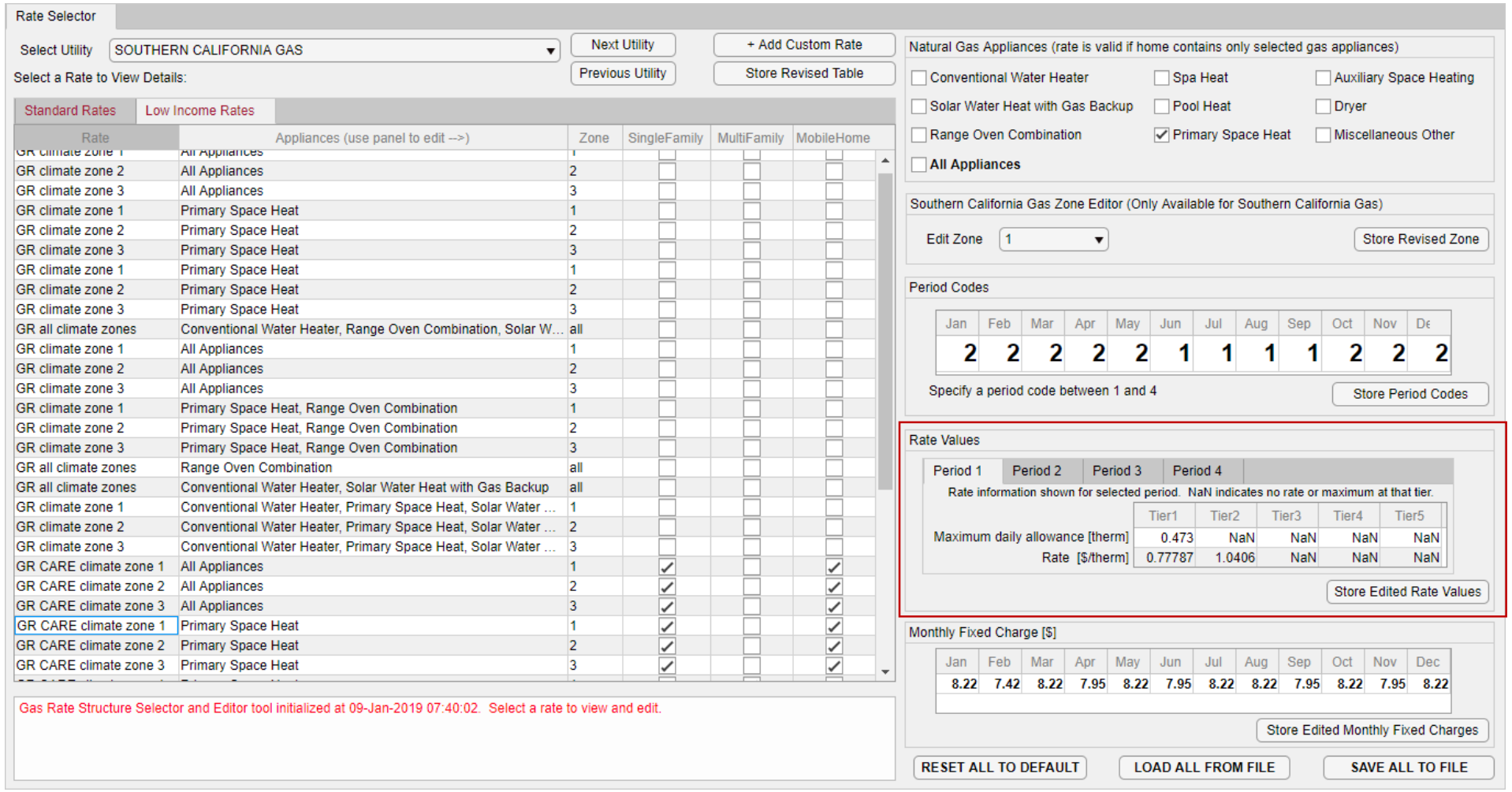
View/Edit Rate Structures (leave unchanged)



View/edit monthly period codes

South Coast
Air Quality Management District

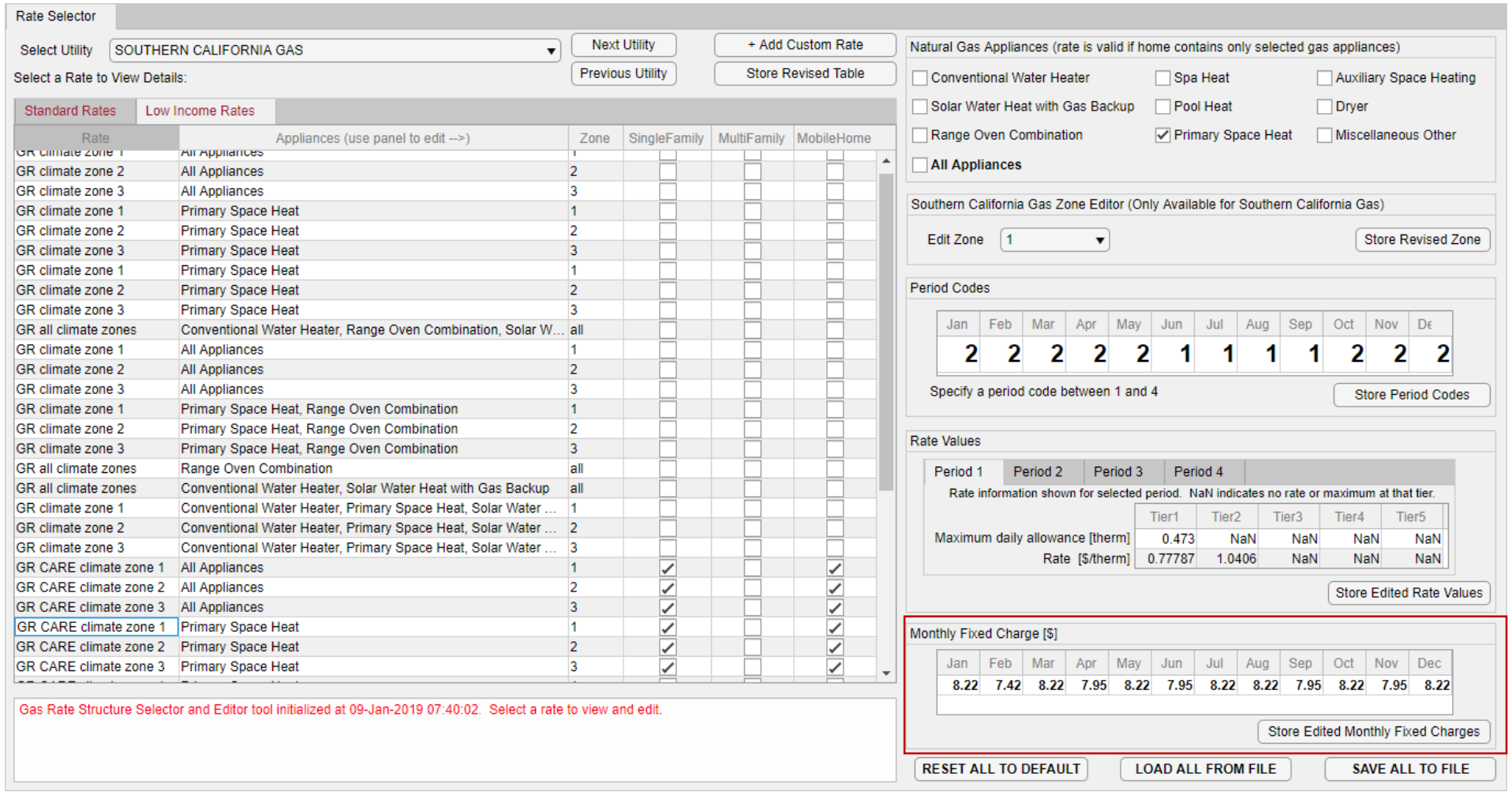
View/Edit Rate Structures (leave unchanged)



View/edit rates and tiers for each period code

South Coast
Air Quality Management District

View/Edit Rate Structures (leave unchanged)



View/edit monthly fixed charges

Categorize Natural Gas Appliances (leave unchanged)

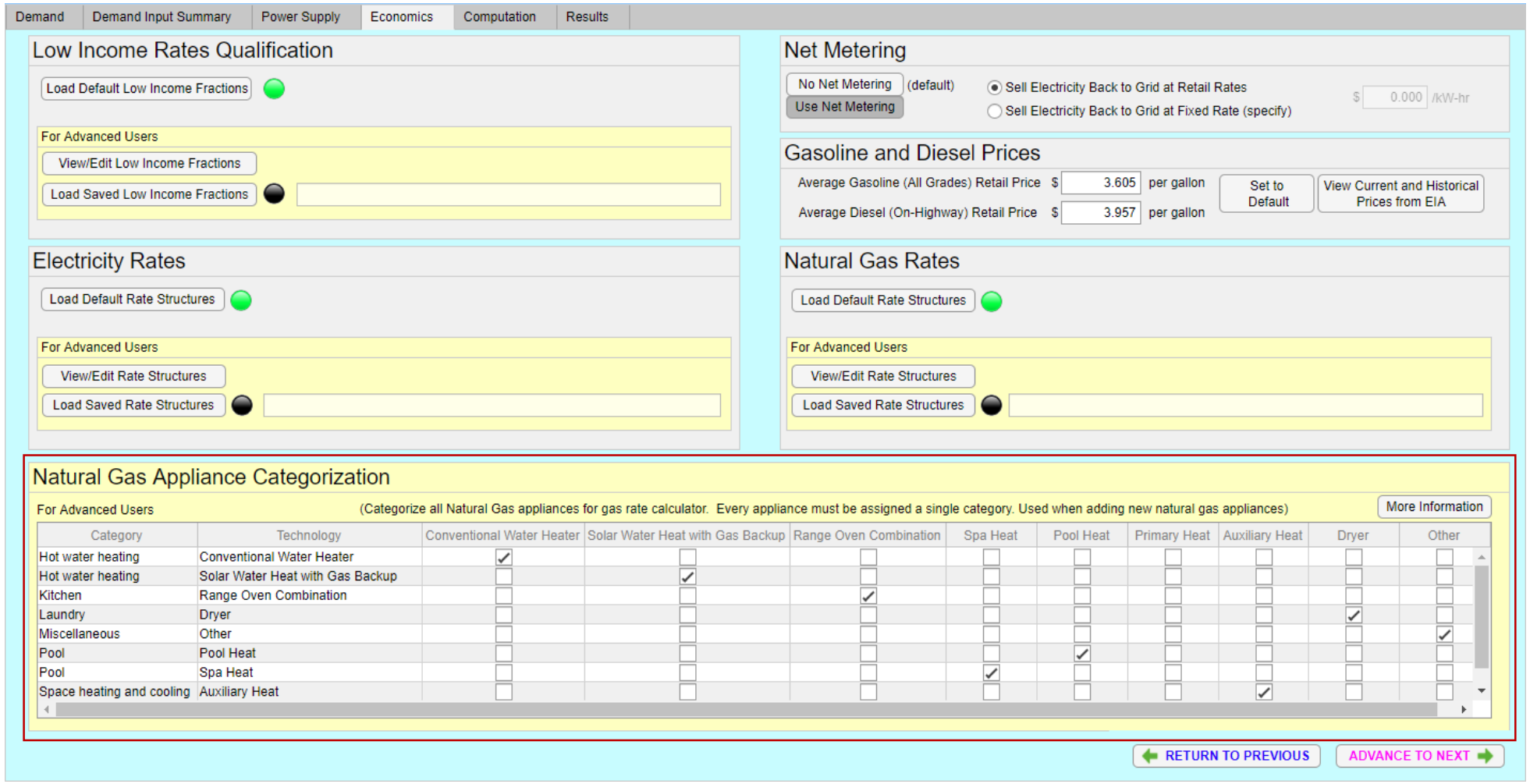
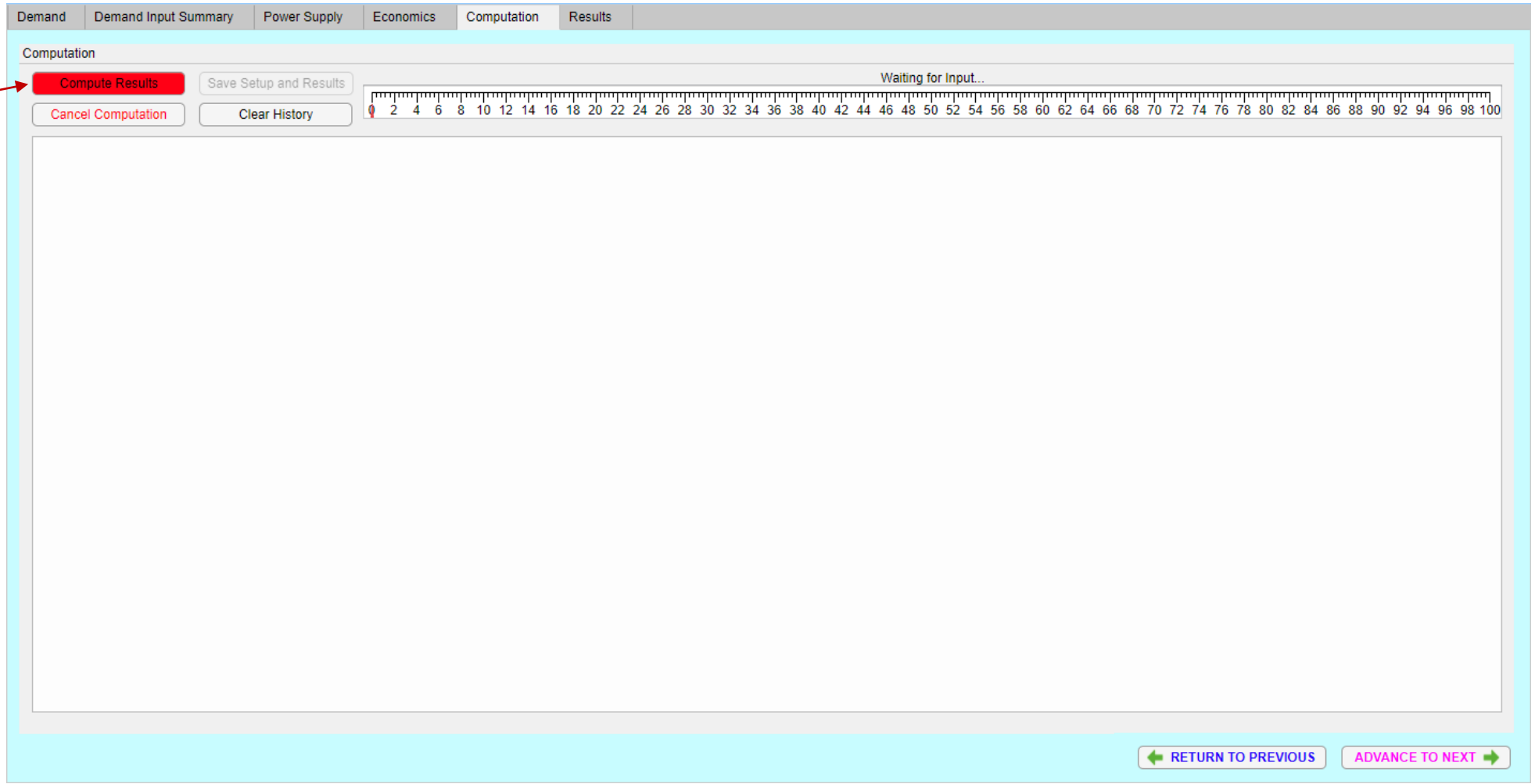


Table must be used when adding new natural gas appliances

Computation Panel (Run Simulation)

Push "Compute Results" to start computation



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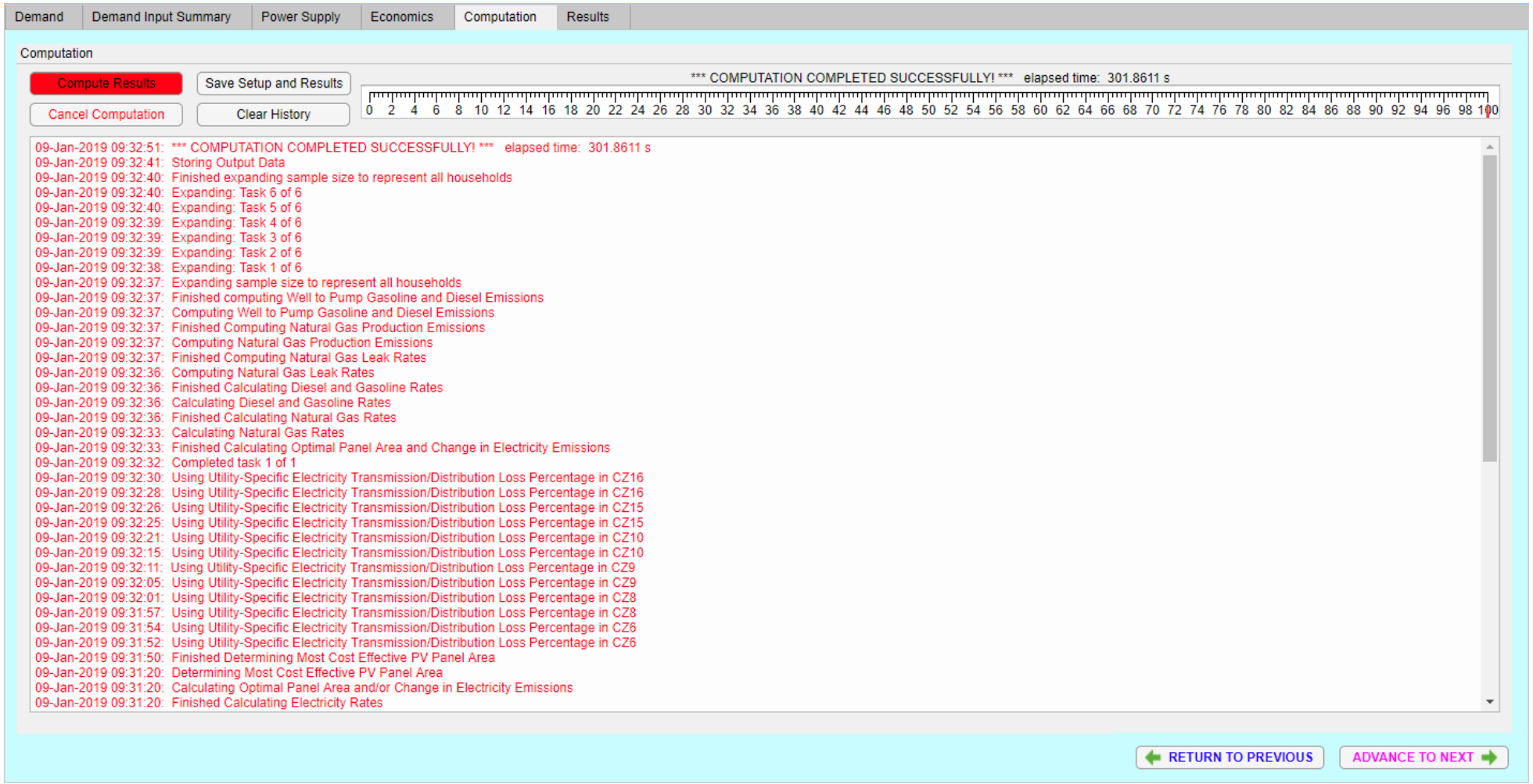
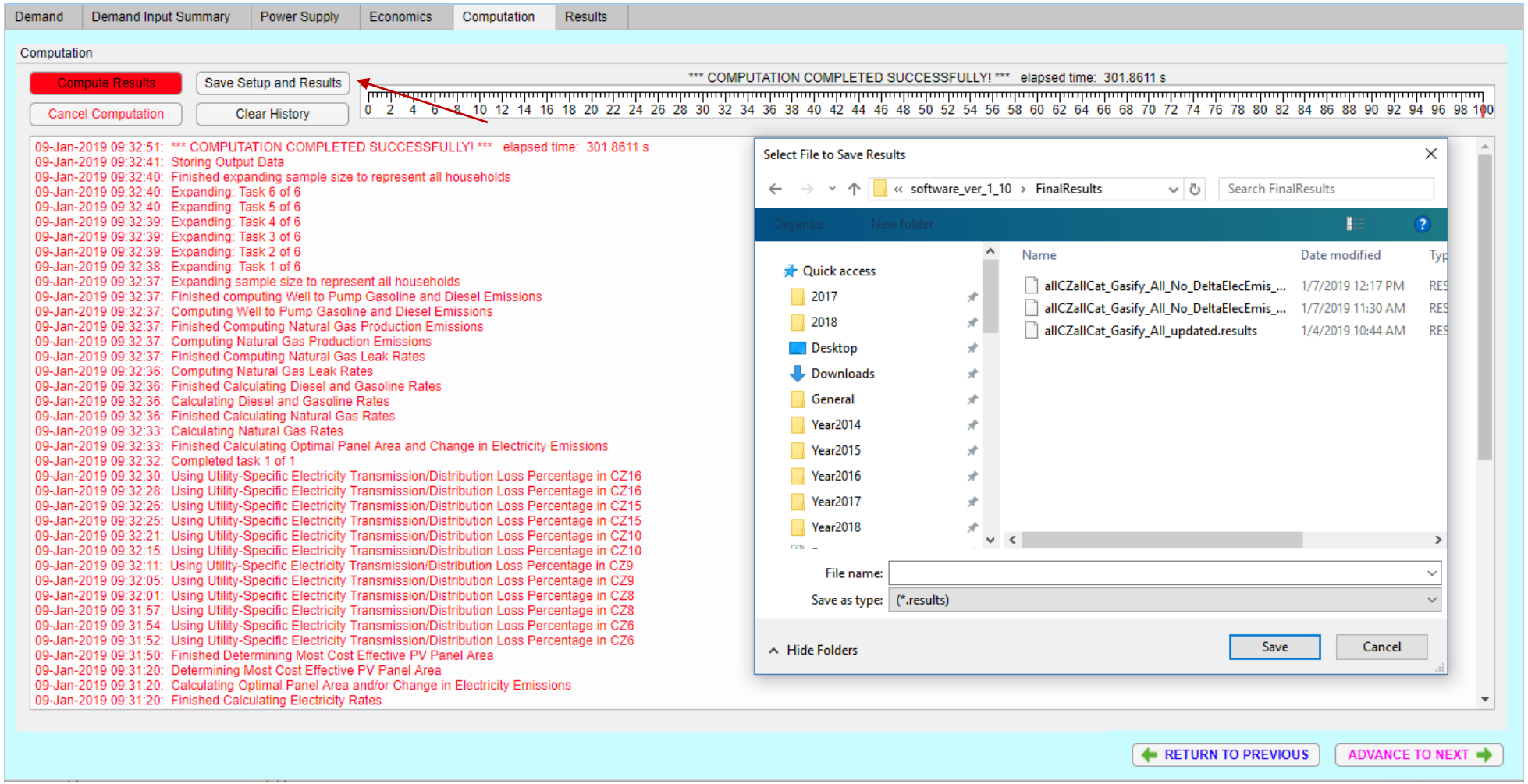
Air Quality Management District

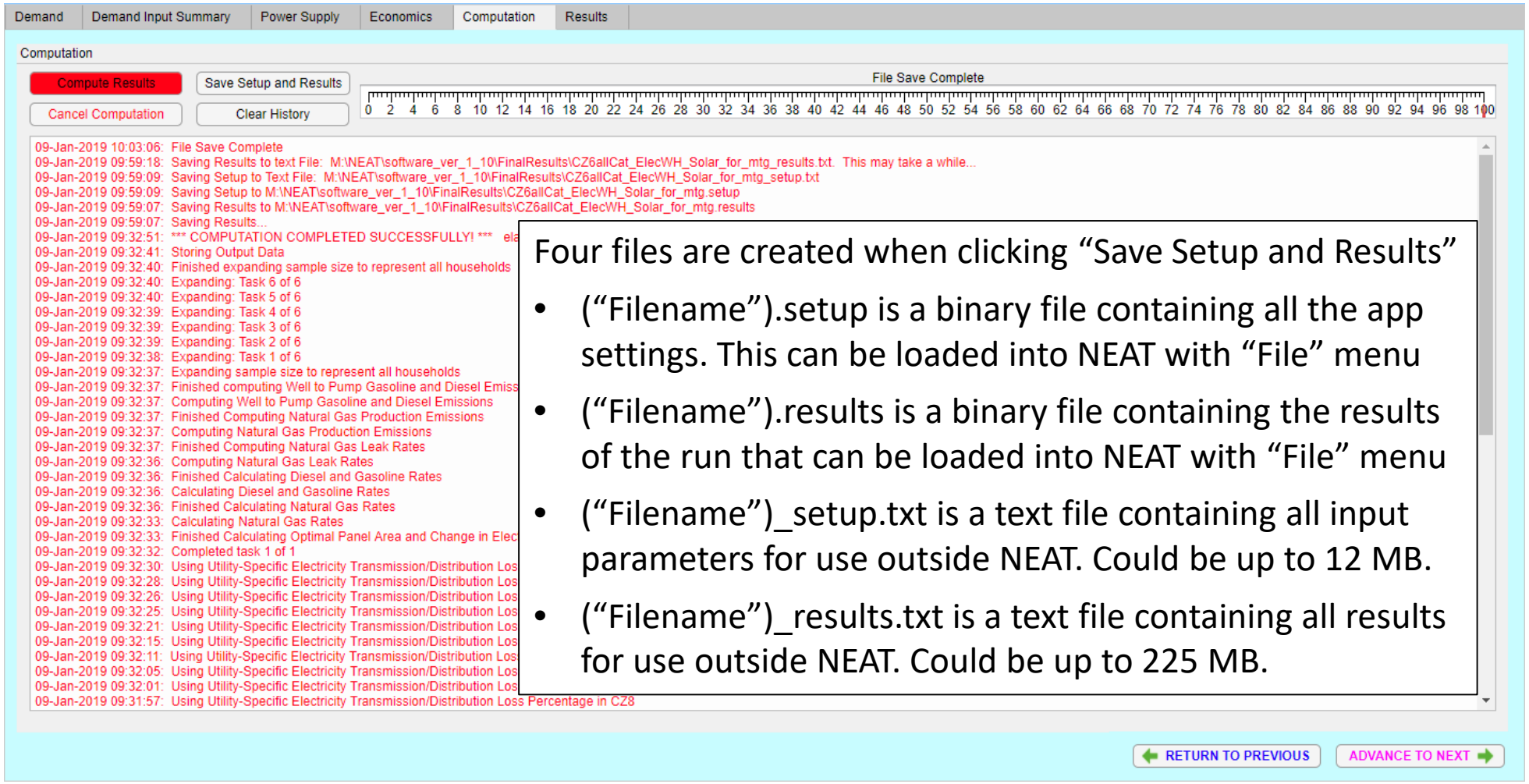
Computation Panel (View Simulation Status)



Computation Panel (Save Setup & Results)



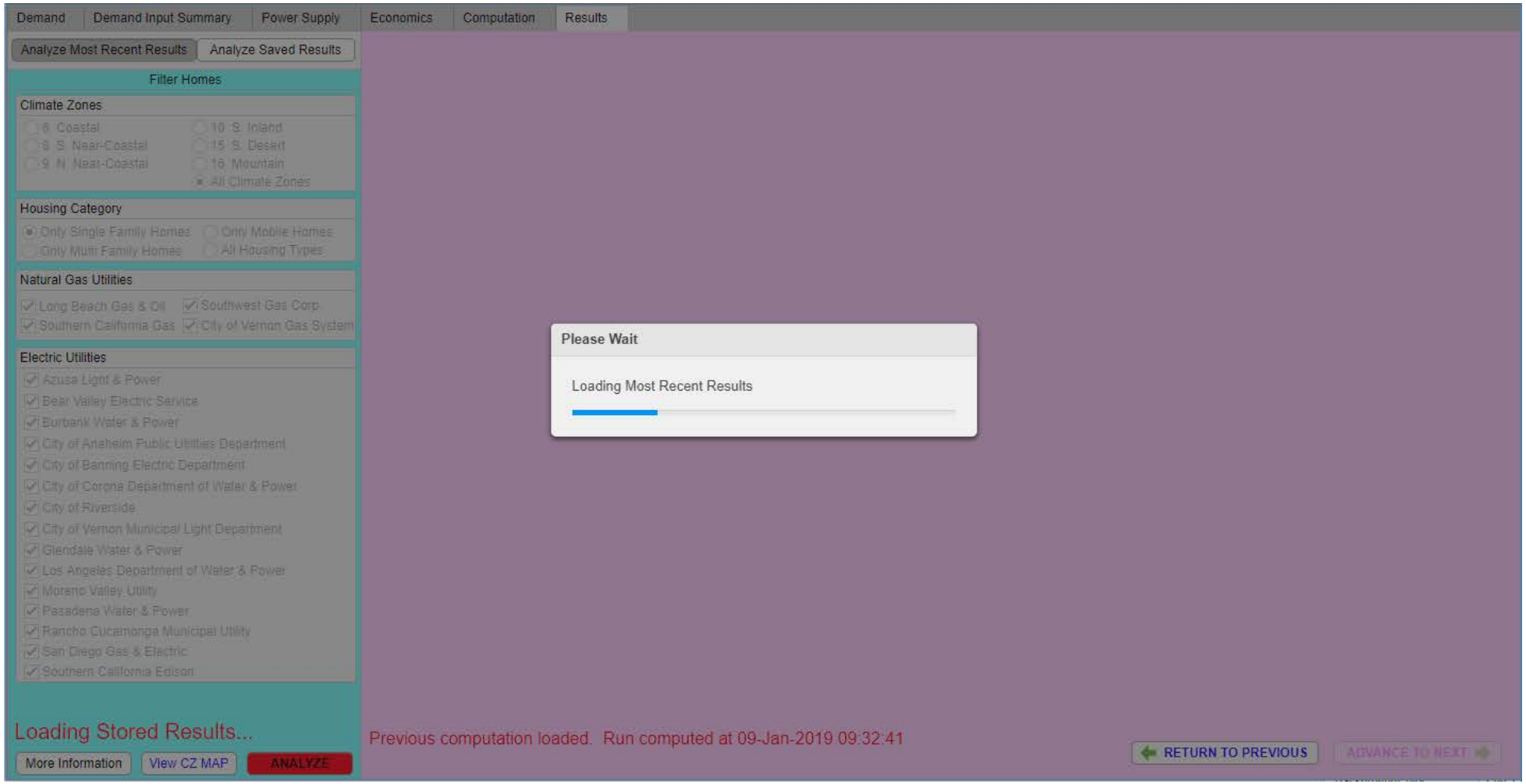
Computation Panel (Save Setup & Results)



Four files are created when clicking “Save Setup and Results”

- (“Filename”).setup is a binary file containing all the app settings. This can be loaded into NEAT with “File” menu
- (“Filename”).results is a binary file containing the results of the run that can be loaded into NEAT with “File” menu
- (“Filename”)_setup.txt is a text file containing all input parameters for use outside NEAT. Could be up to 12 MB.
- (“Filename”)_results.txt is a text file containing all results for use outside NEAT. Could be up to 225 MB.

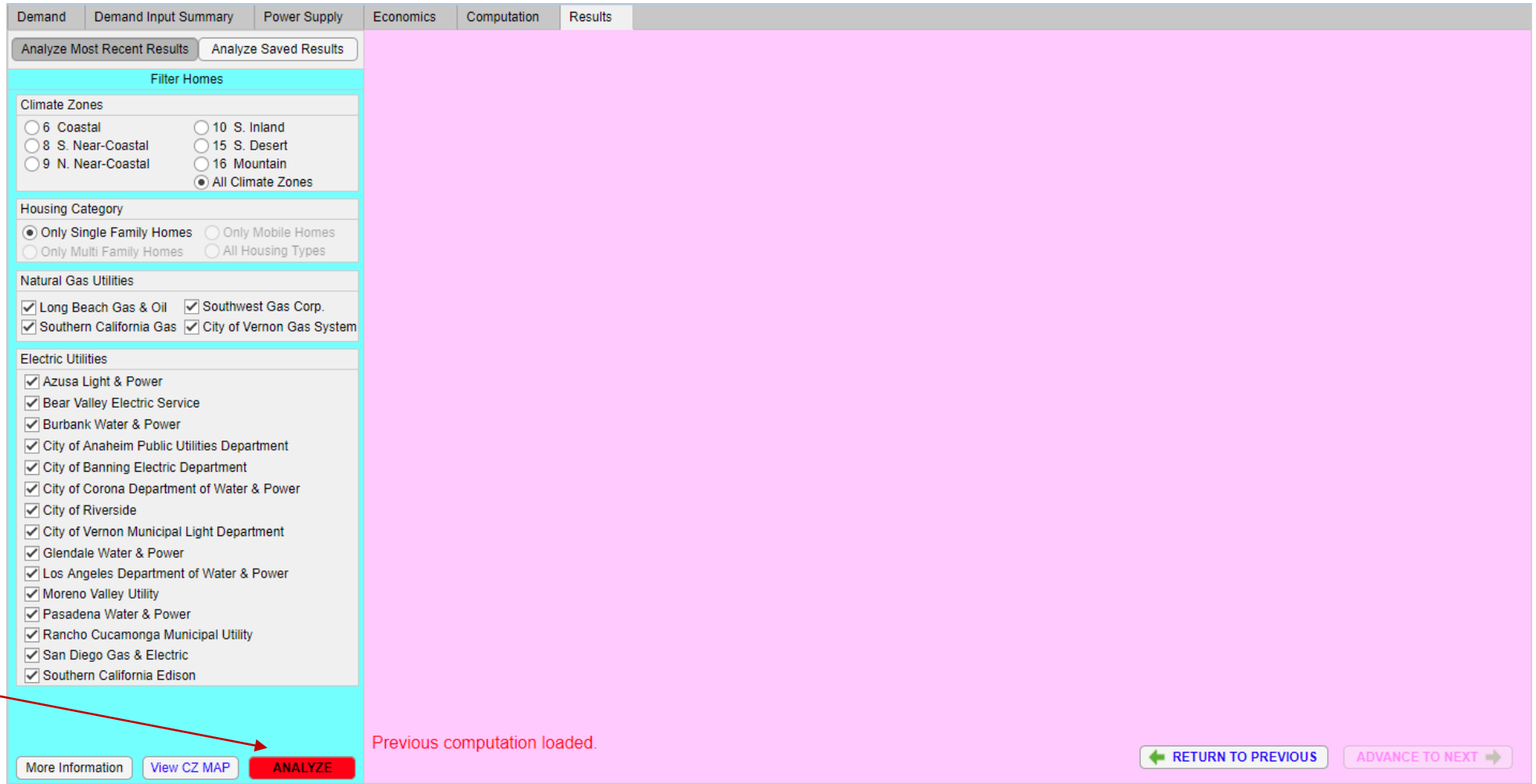
Results Panel (tools for viewing and analyzing simulation)



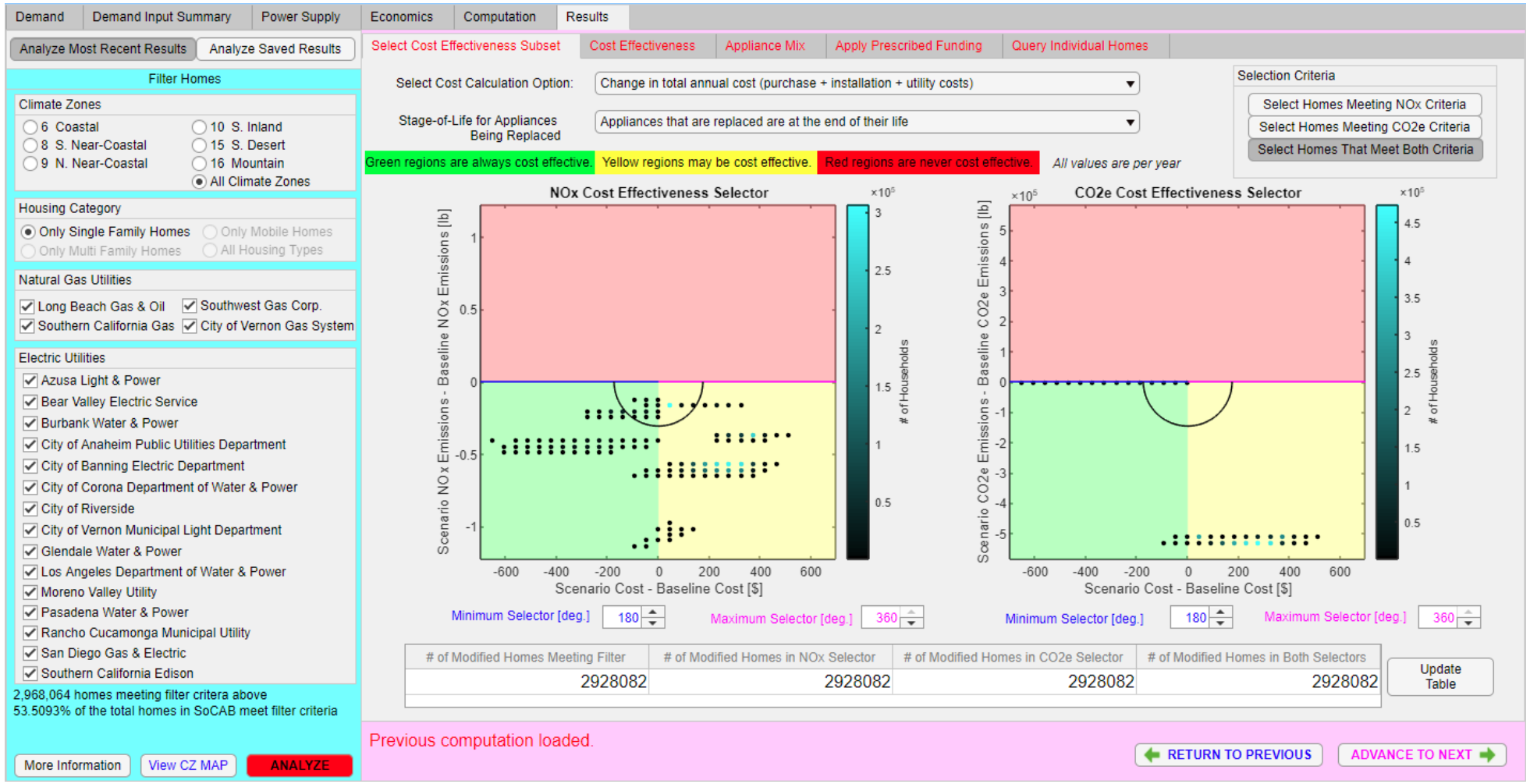
Results Panel (tools for viewing and analyzing simulation)

Option to view specific climate zones, housing categories, and utilities

Press "Analyze" after selections are made



Results Panel (Select Cost Effectiveness Subset)



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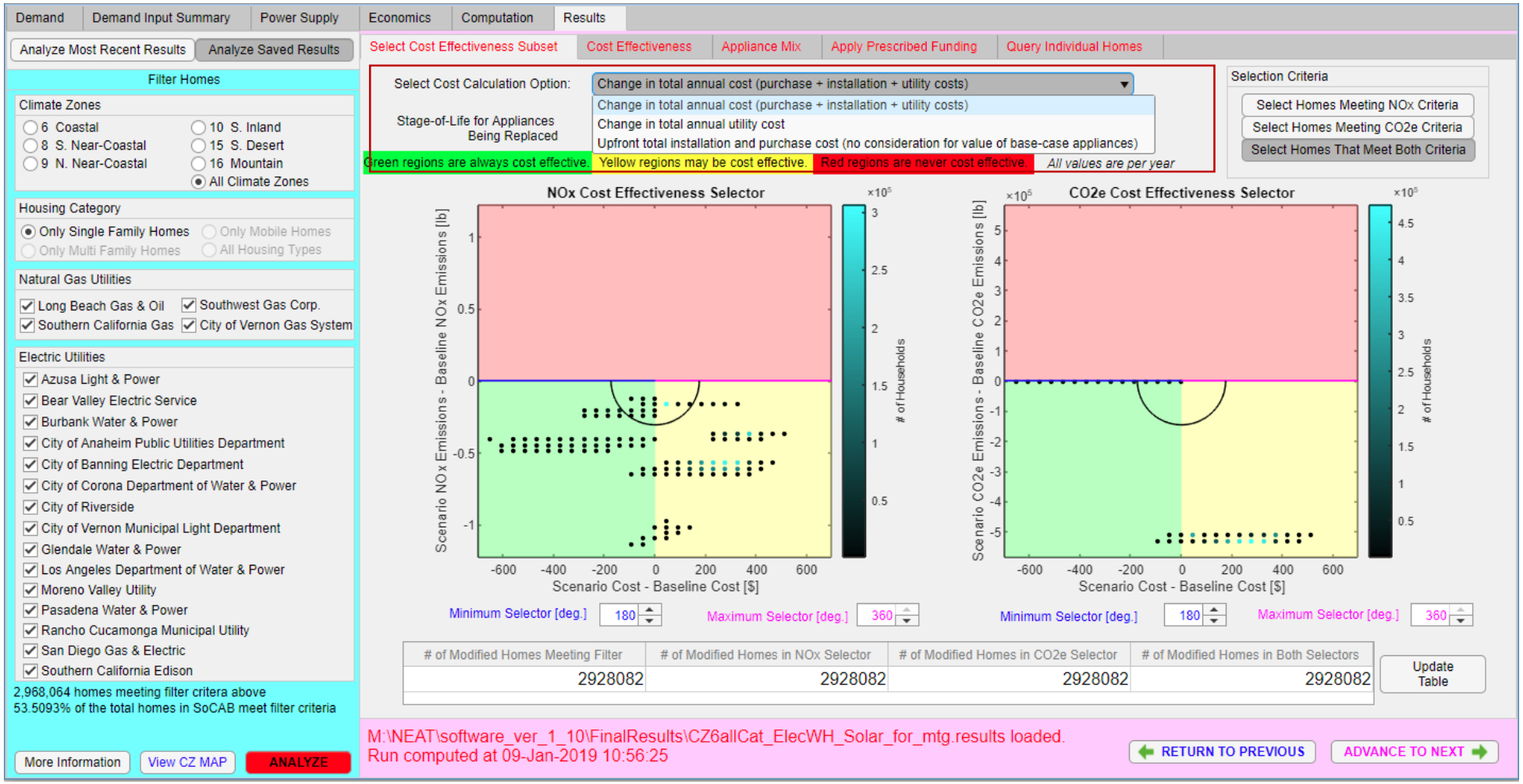
Air Quality Management District

Results Panel (Select Cost Effectiveness Subset)



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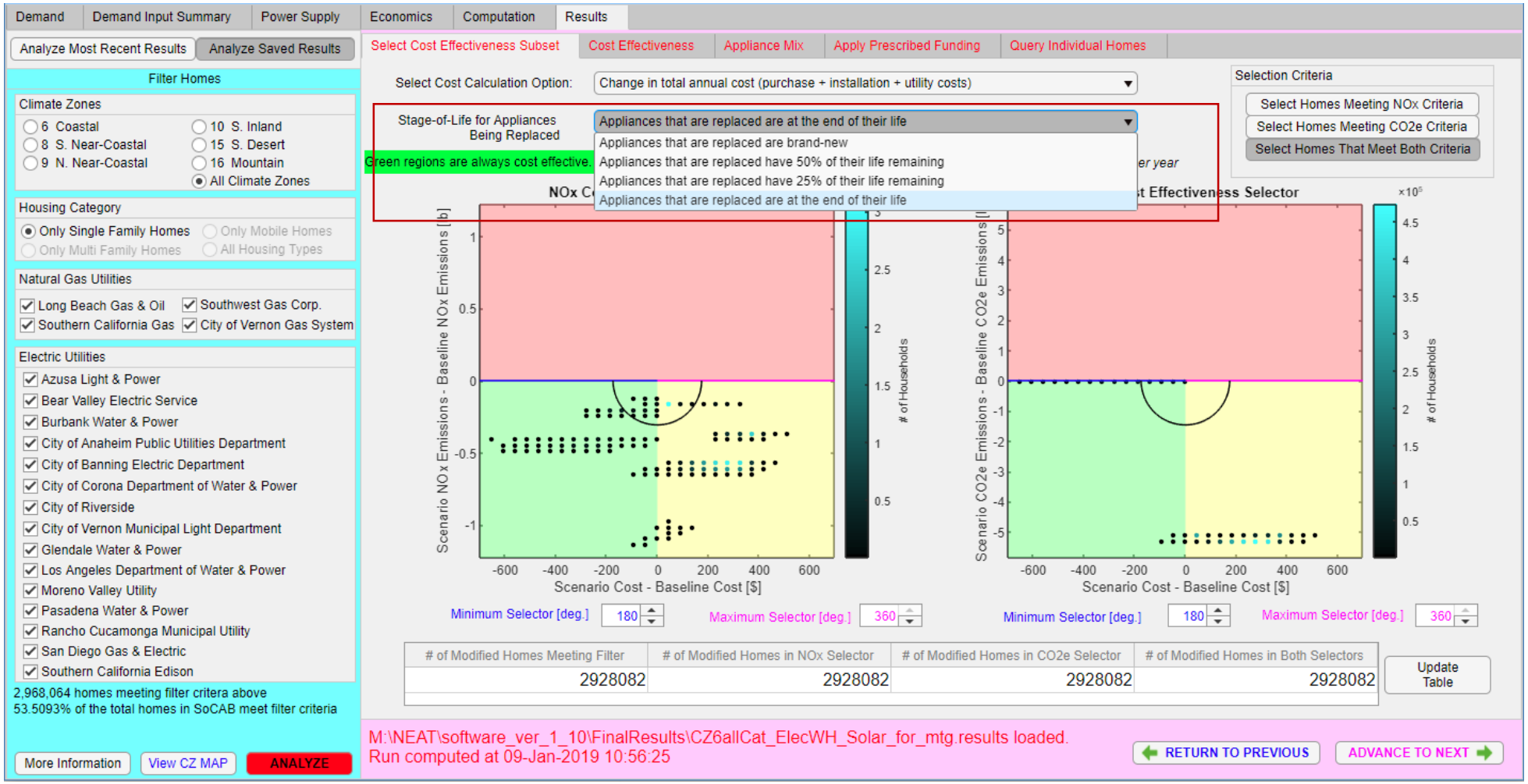
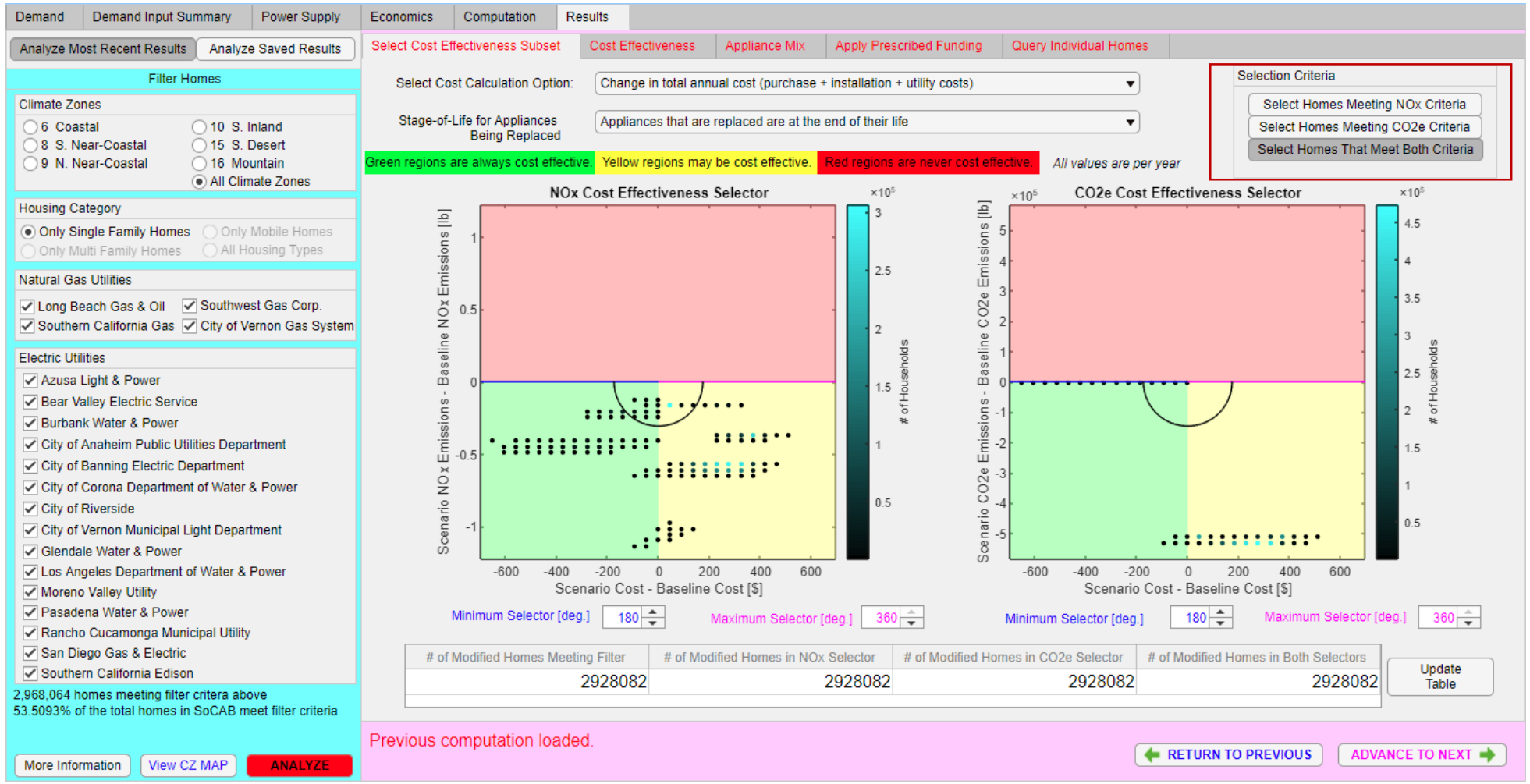
Air Quality Management District

Results Panel (Select Cost Effectiveness Subset)



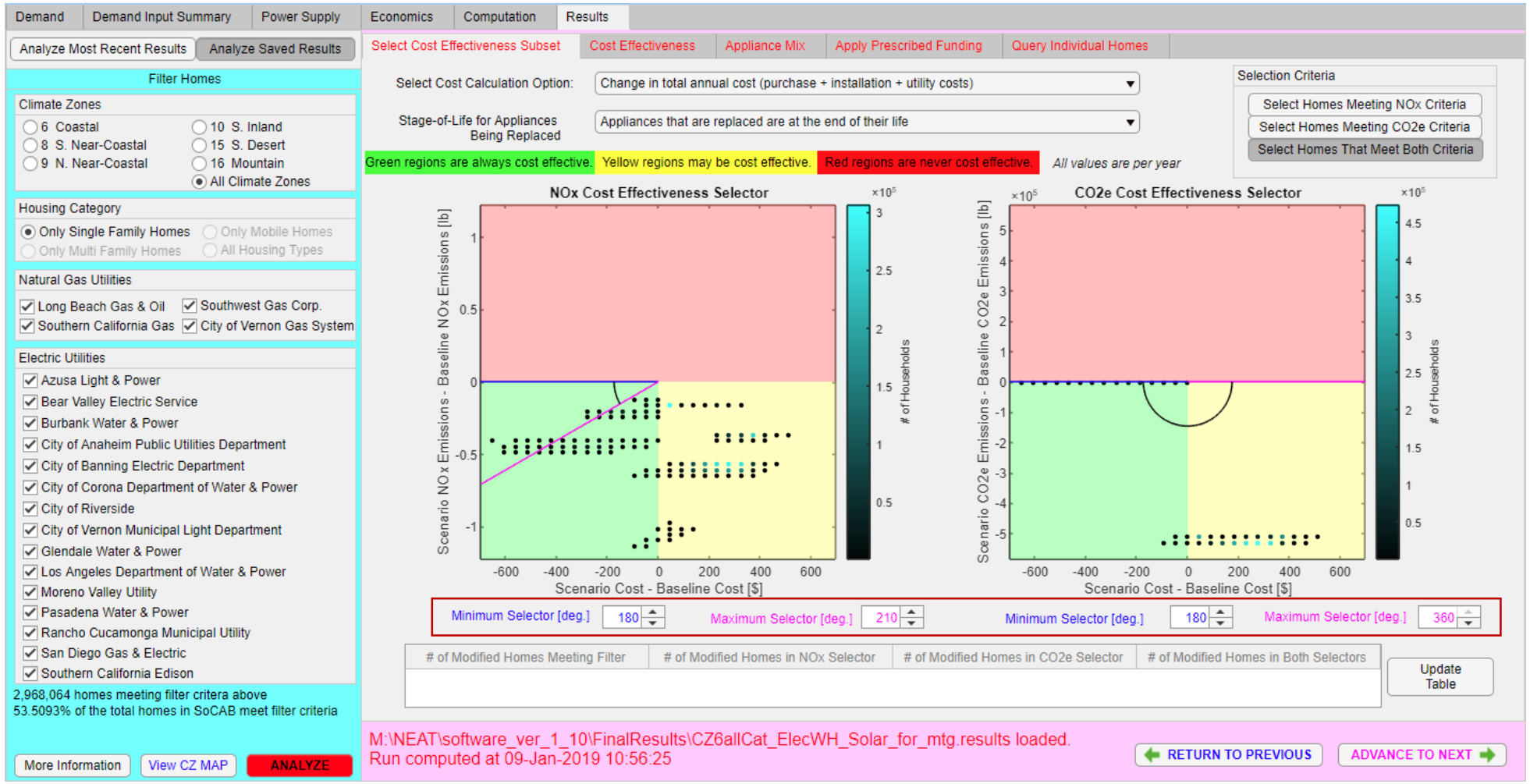
South Coast
Air Quality Management District

Results Panel (Select Cost Effectiveness Subset)



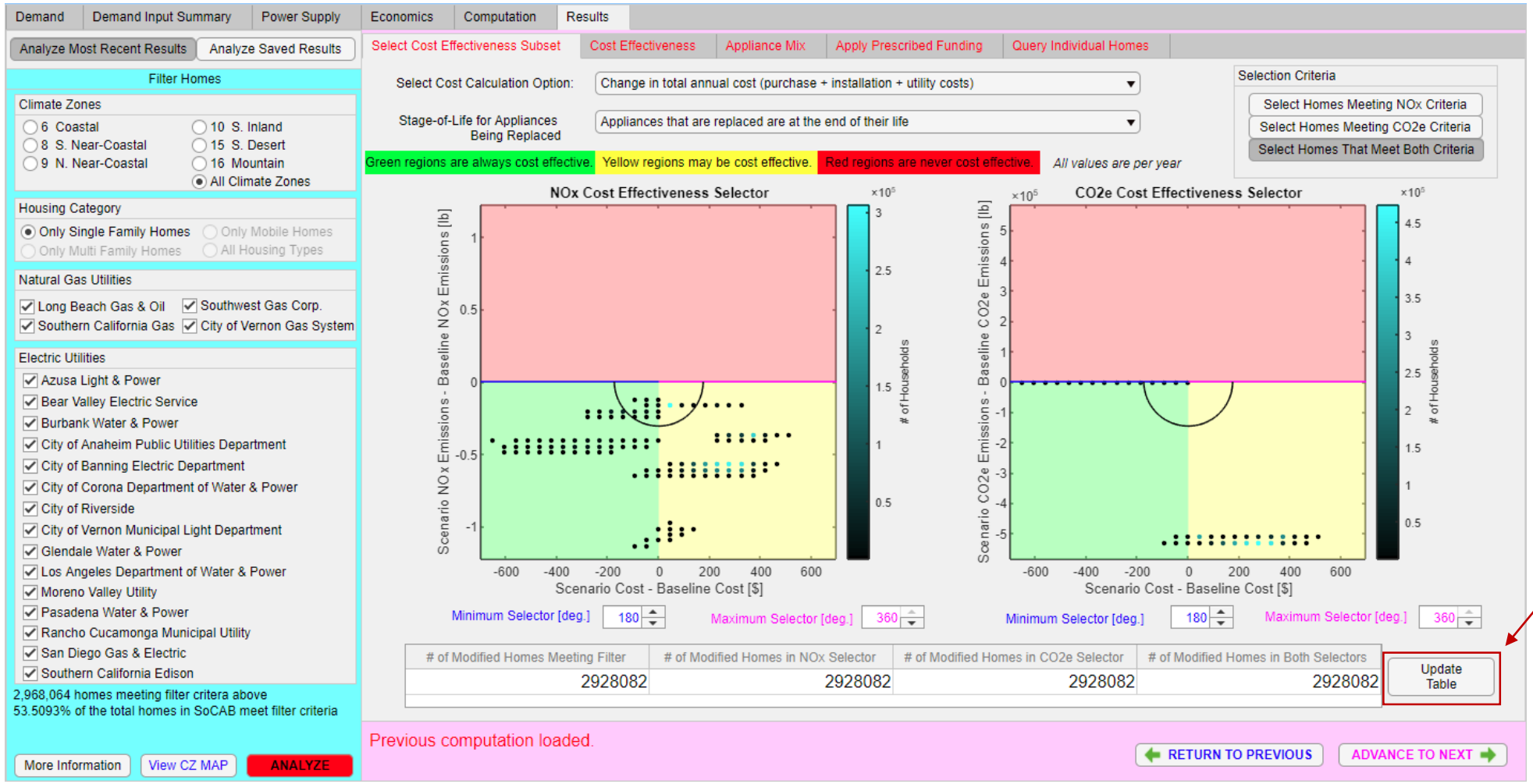
South Coast
Air Quality Management District

Results Panel (Select Cost Effectiveness Subset)



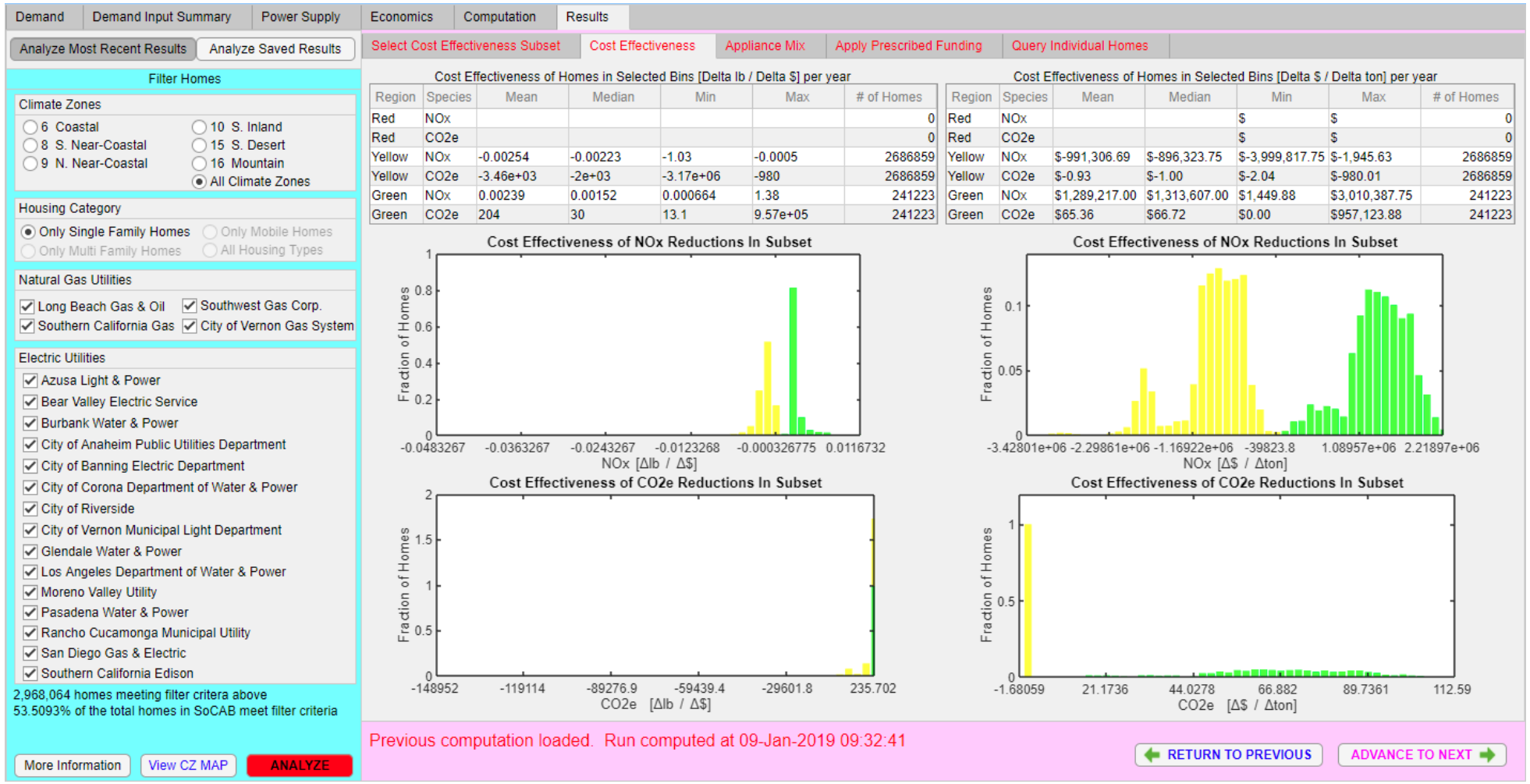
Change subset of homes in CE space to study using dials

Results Panel (Select Cost Effectiveness Subset)



Update table after making changes to see number of homes selected

Results Panel (Cost Effectiveness)



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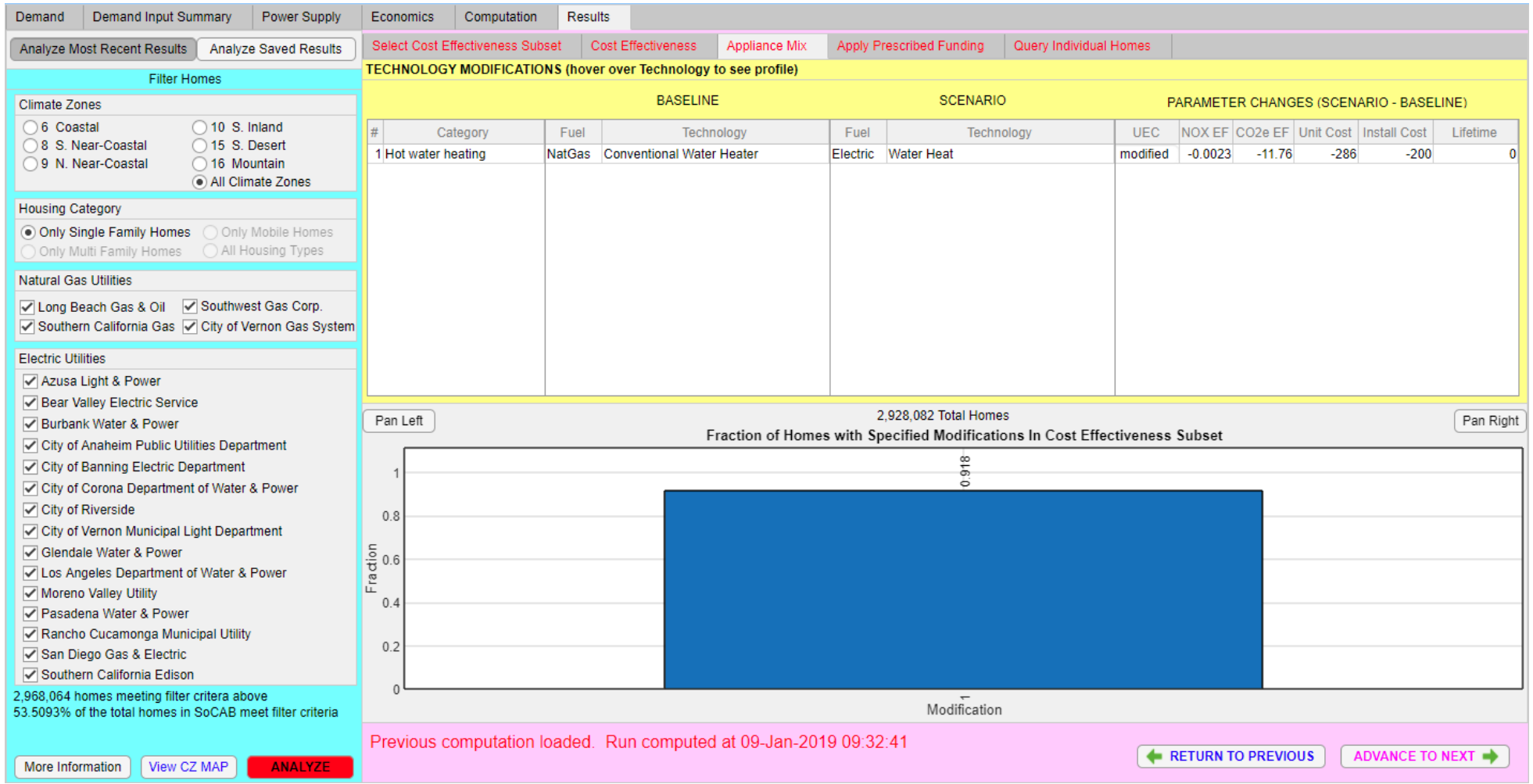
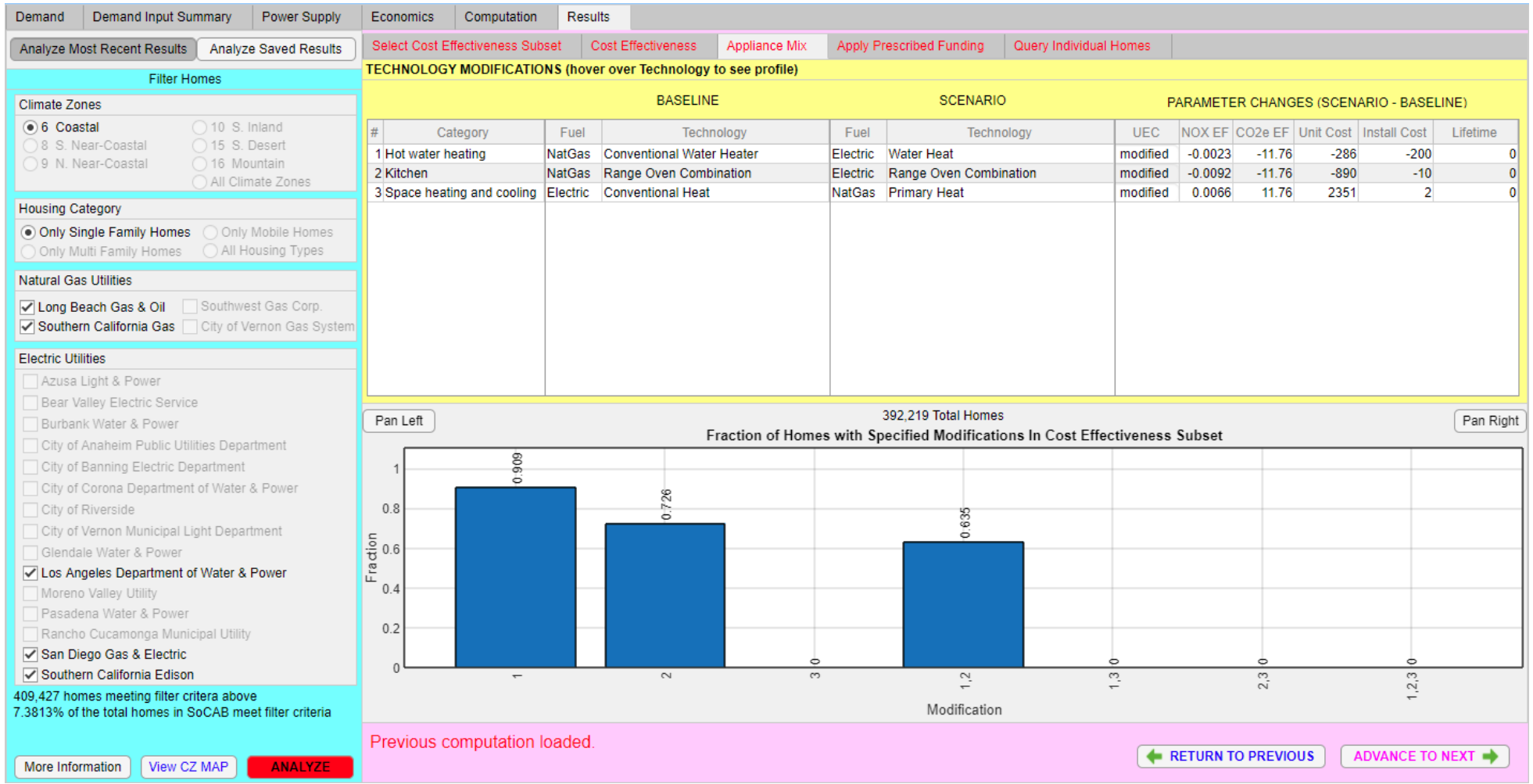
Air Quality Management District

Results Panel (Appliance Mix)

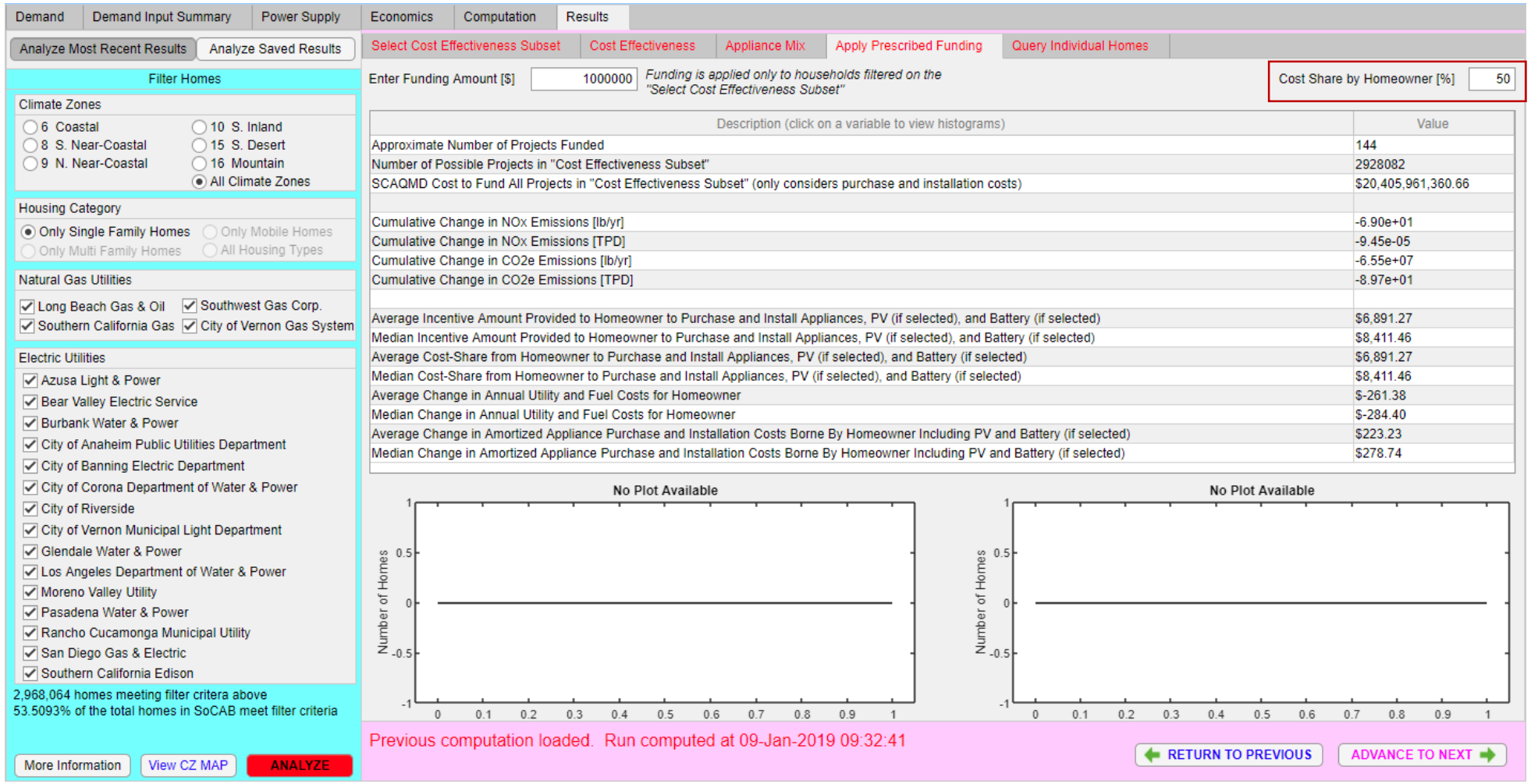


Results Panel (Appliance Mix)

More complex example for this slide only



Results Panel (Apply Prescribed Funding)



Enter funding amount and cost share for calculation

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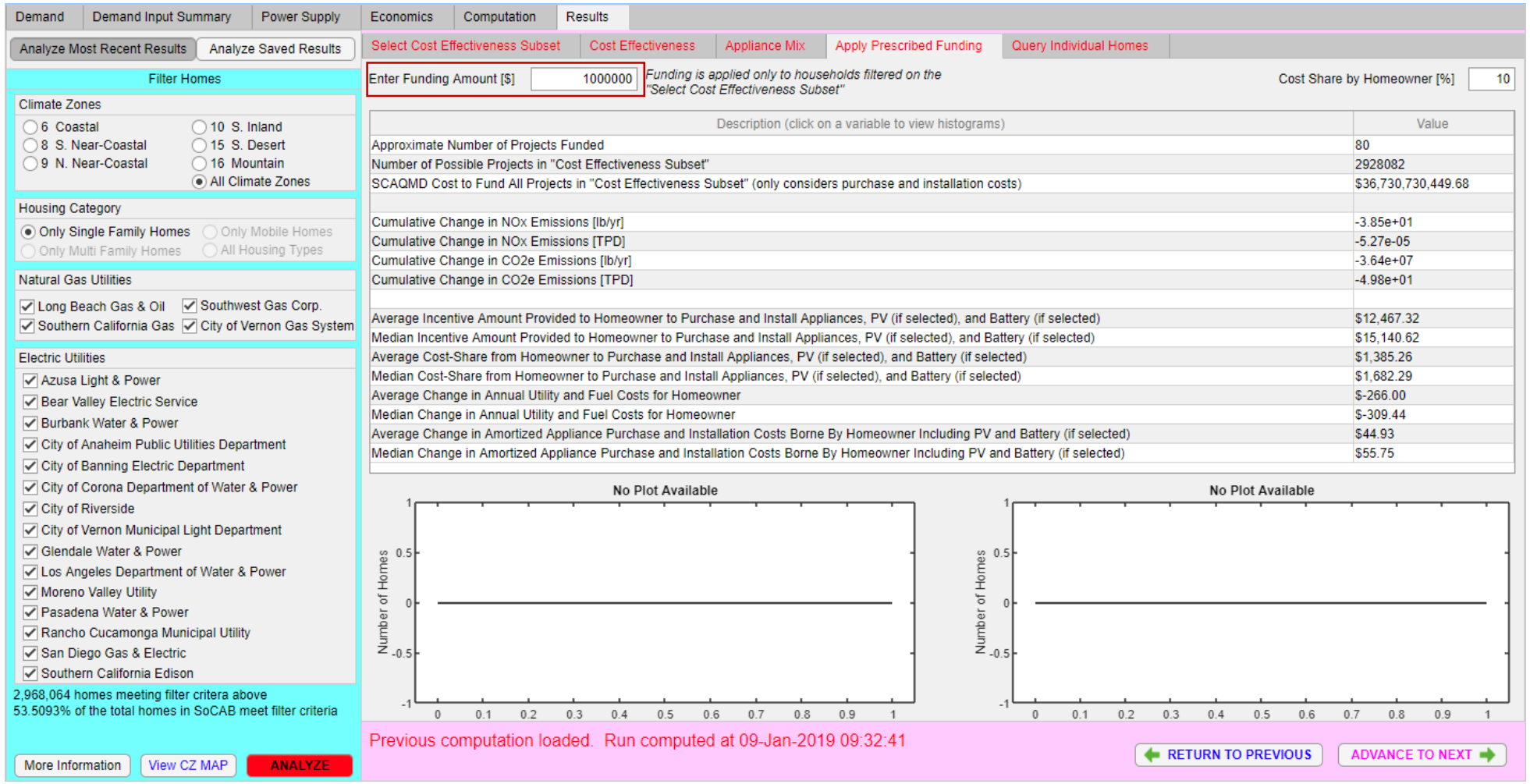
Air Quality Management District

Results Panel (Apply Prescribed Funding)



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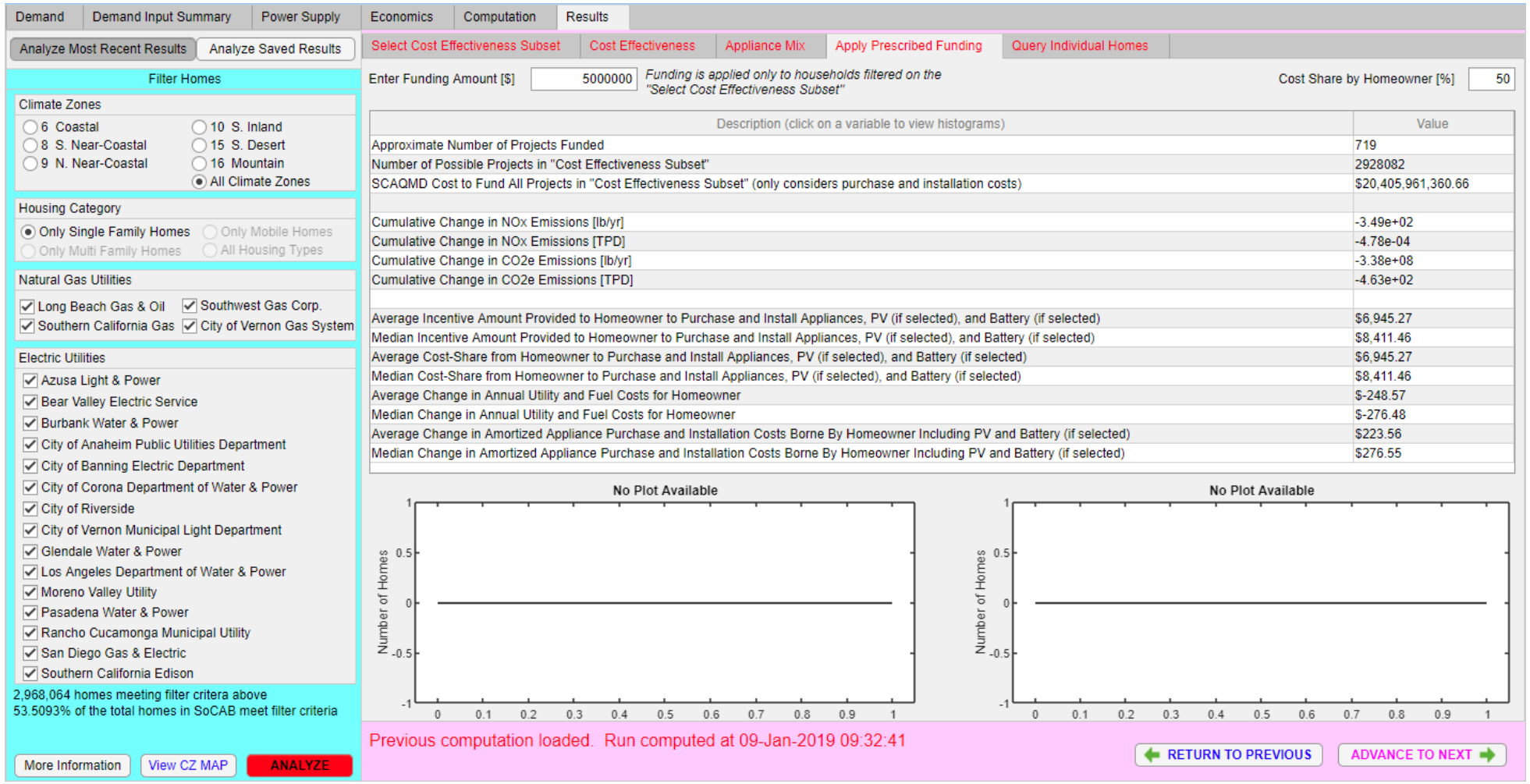
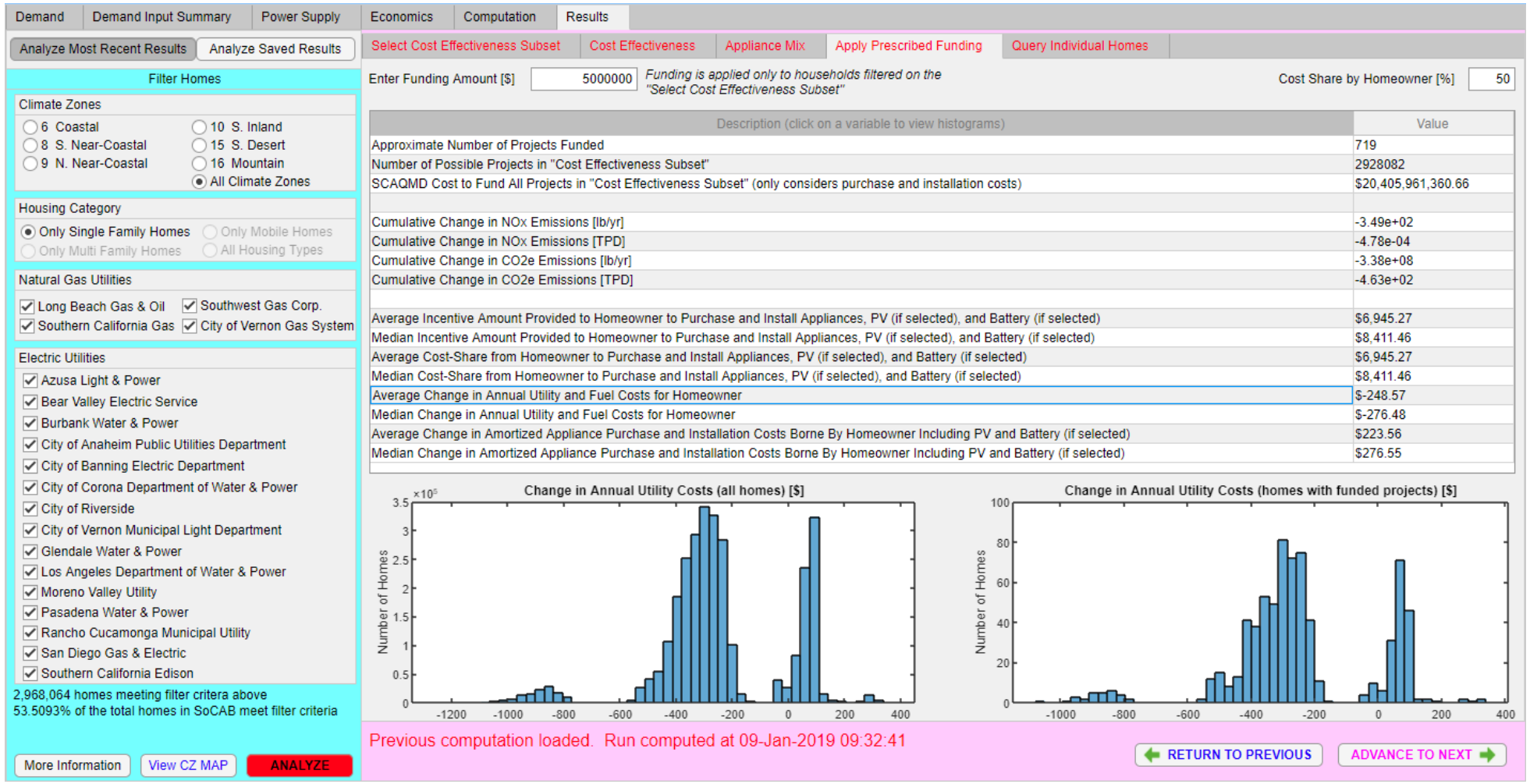
Results Panel (Apply Prescribed Funding)



South Coast
Air Quality Management District

Results Panel (Apply Prescribed Funding)



Click on cost to view histogram

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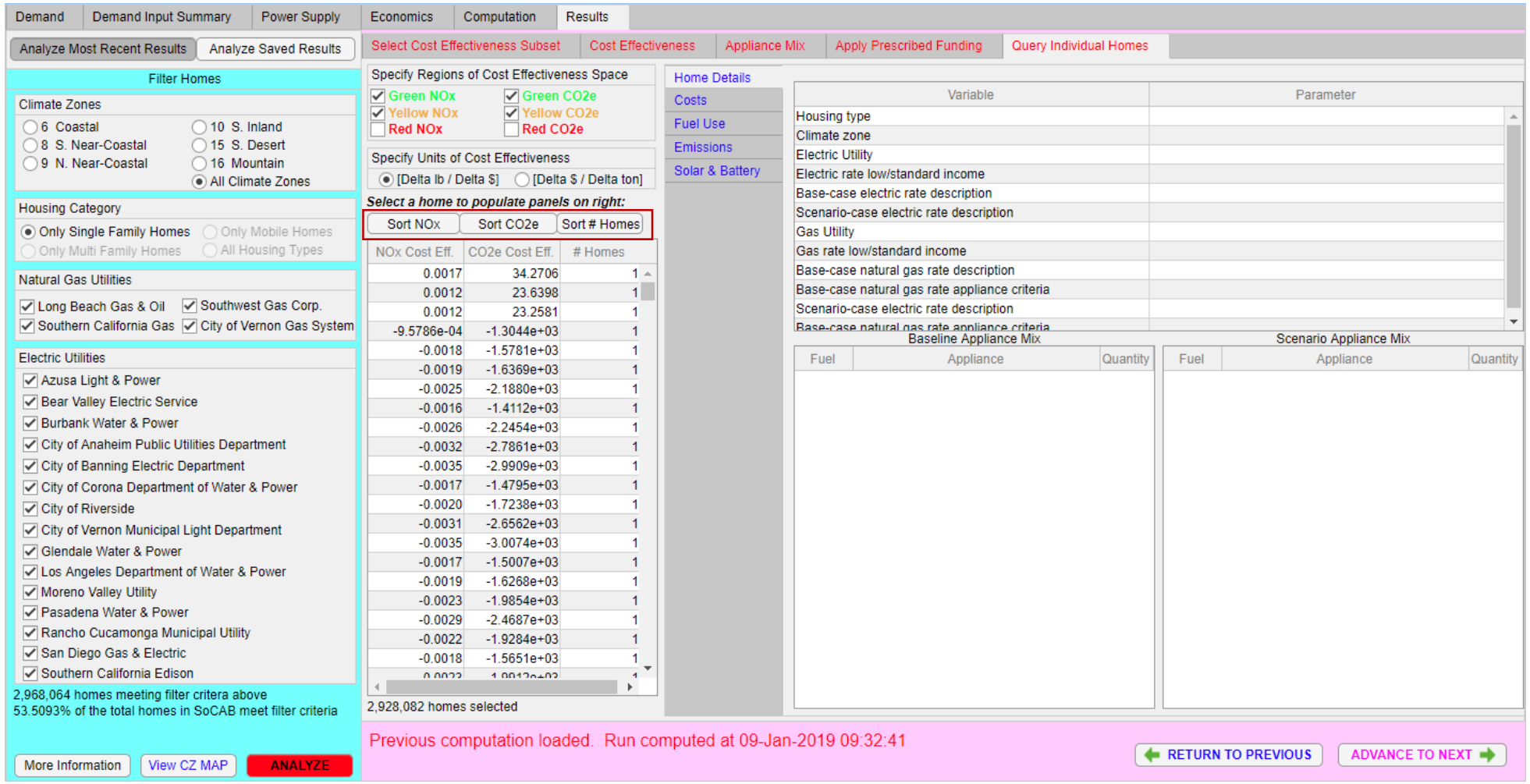
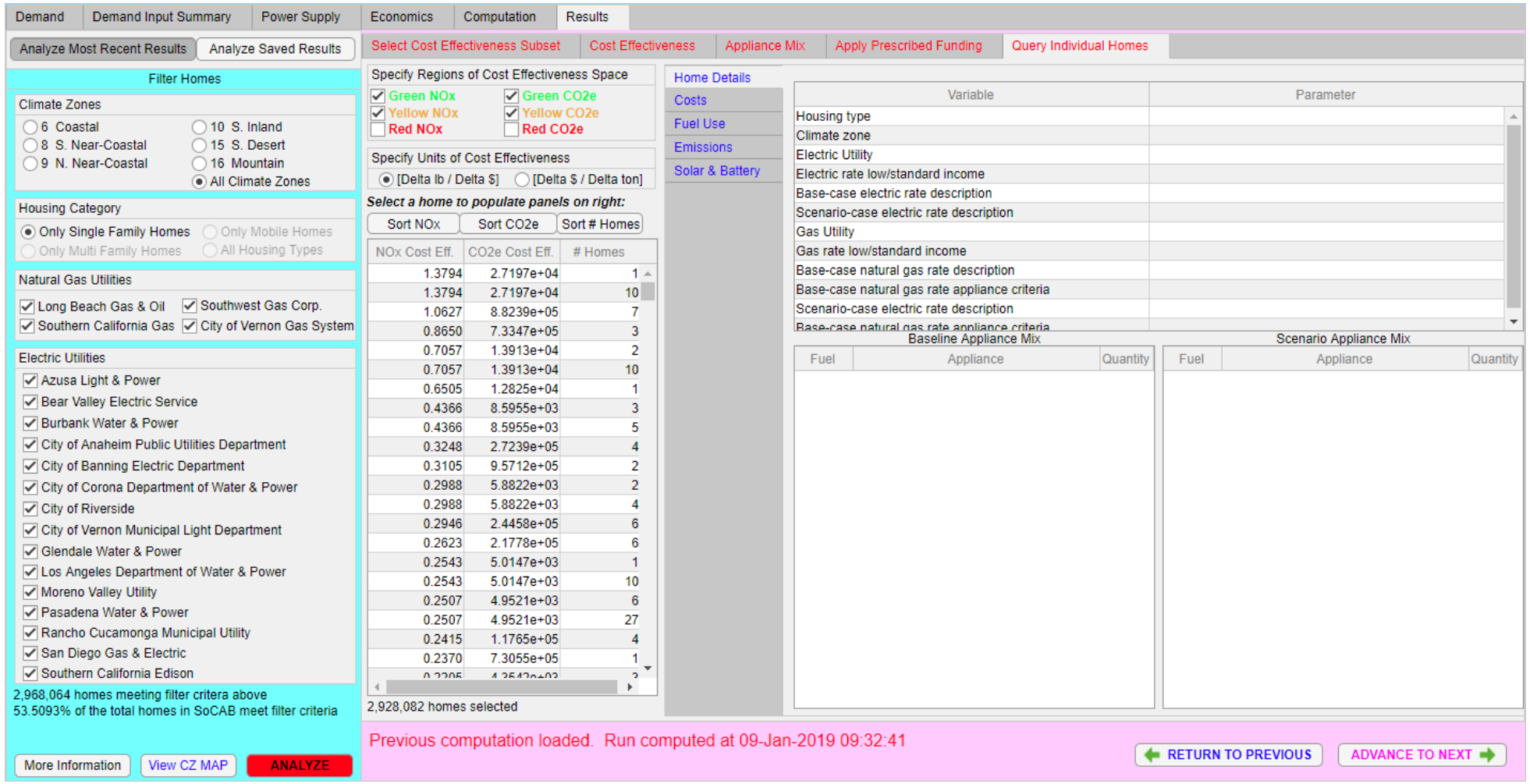
Air Quality Management District

Results Panel (Query Individual Homes)

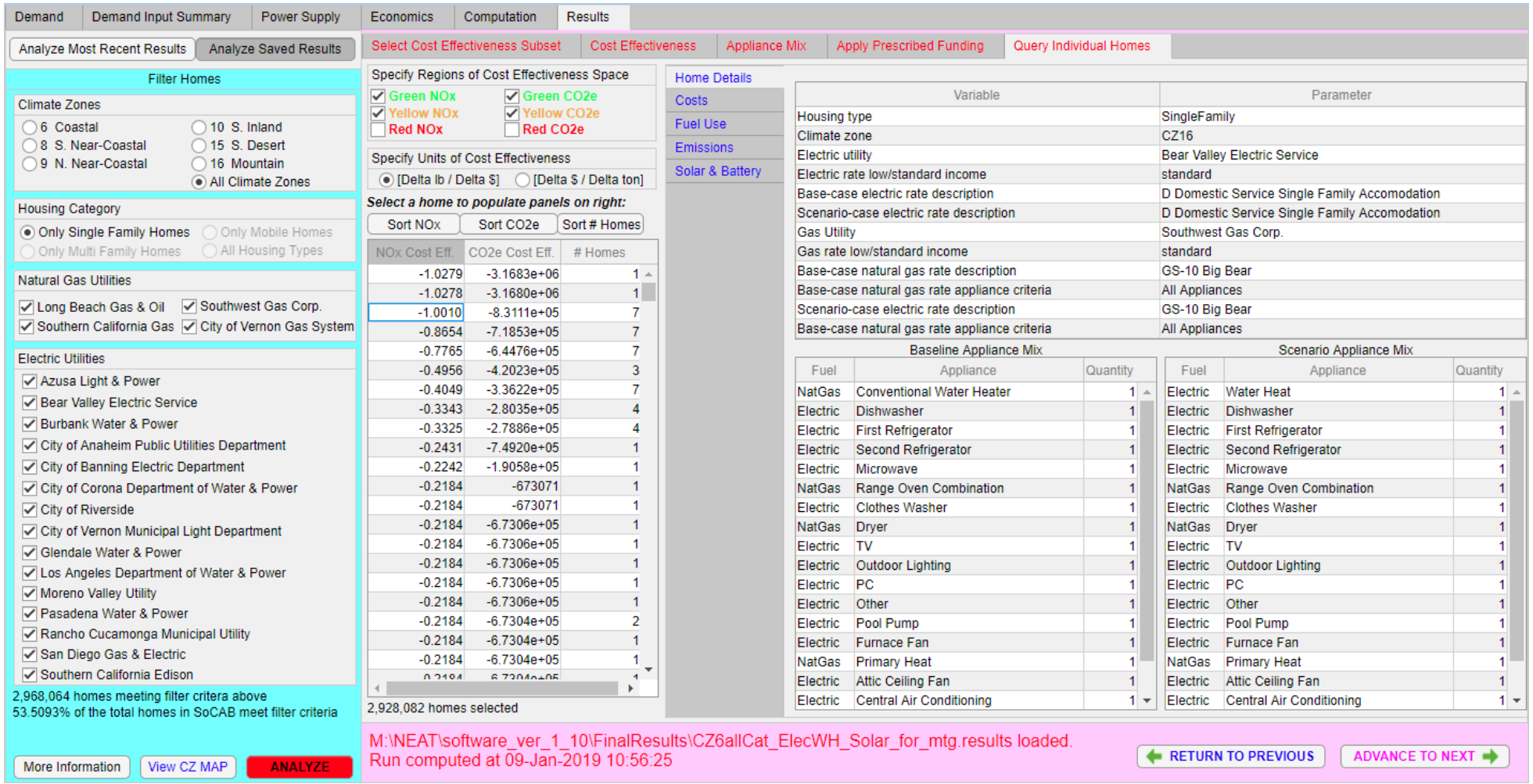


Results Panel (Query Individual Homes)

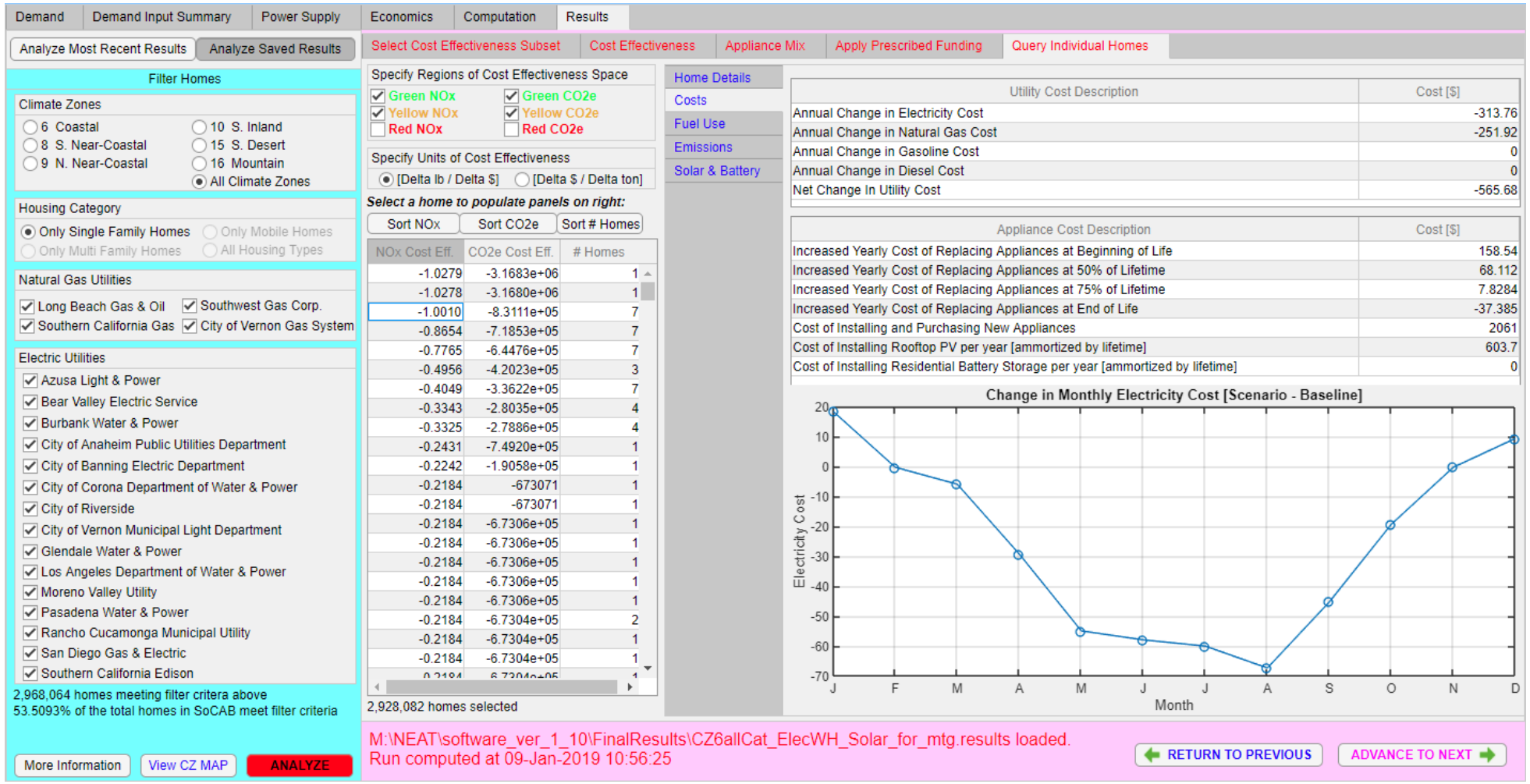


Results Panel (Query Individual Homes)

Click on home to view details

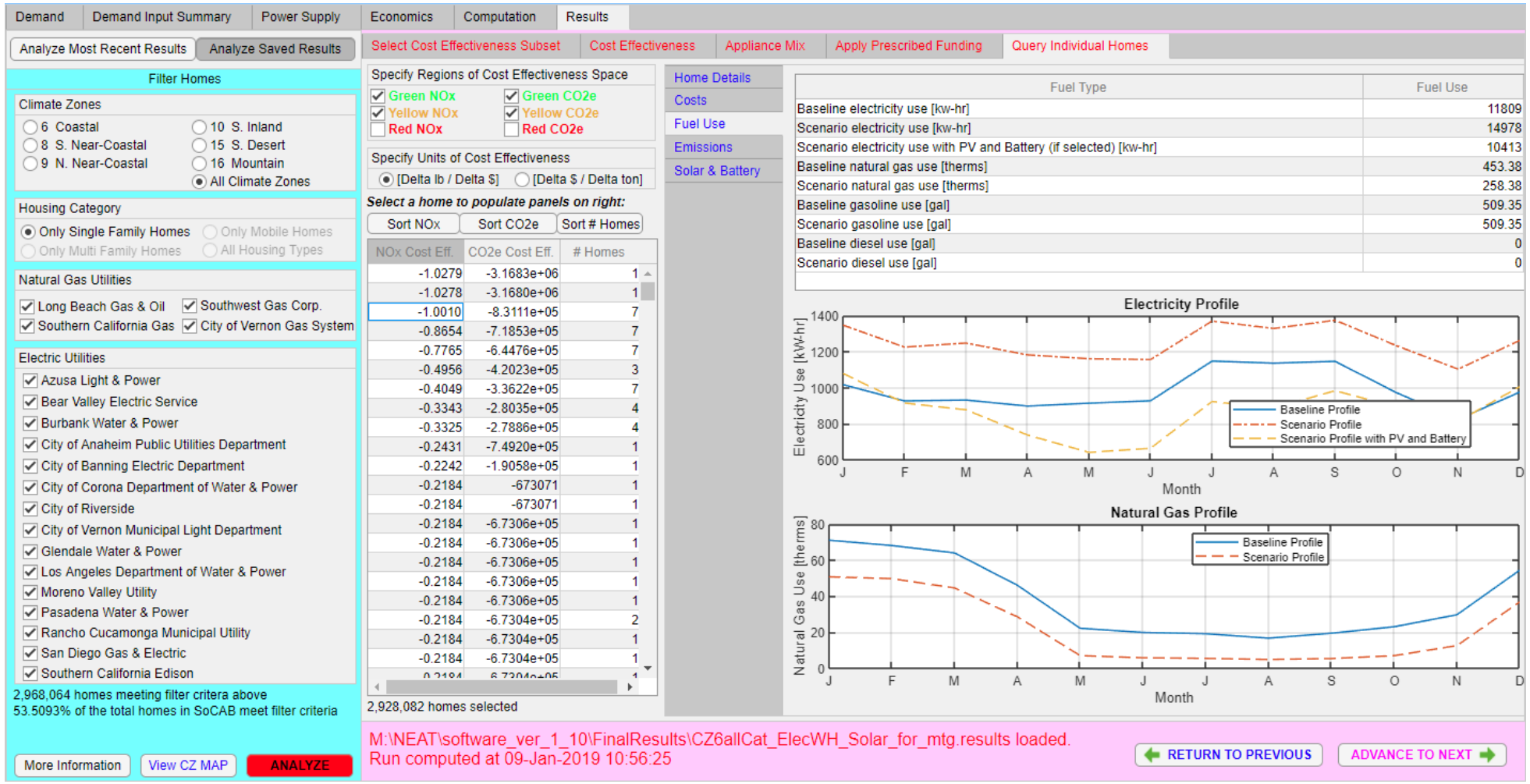


Results Panel (Query Individual Homes)



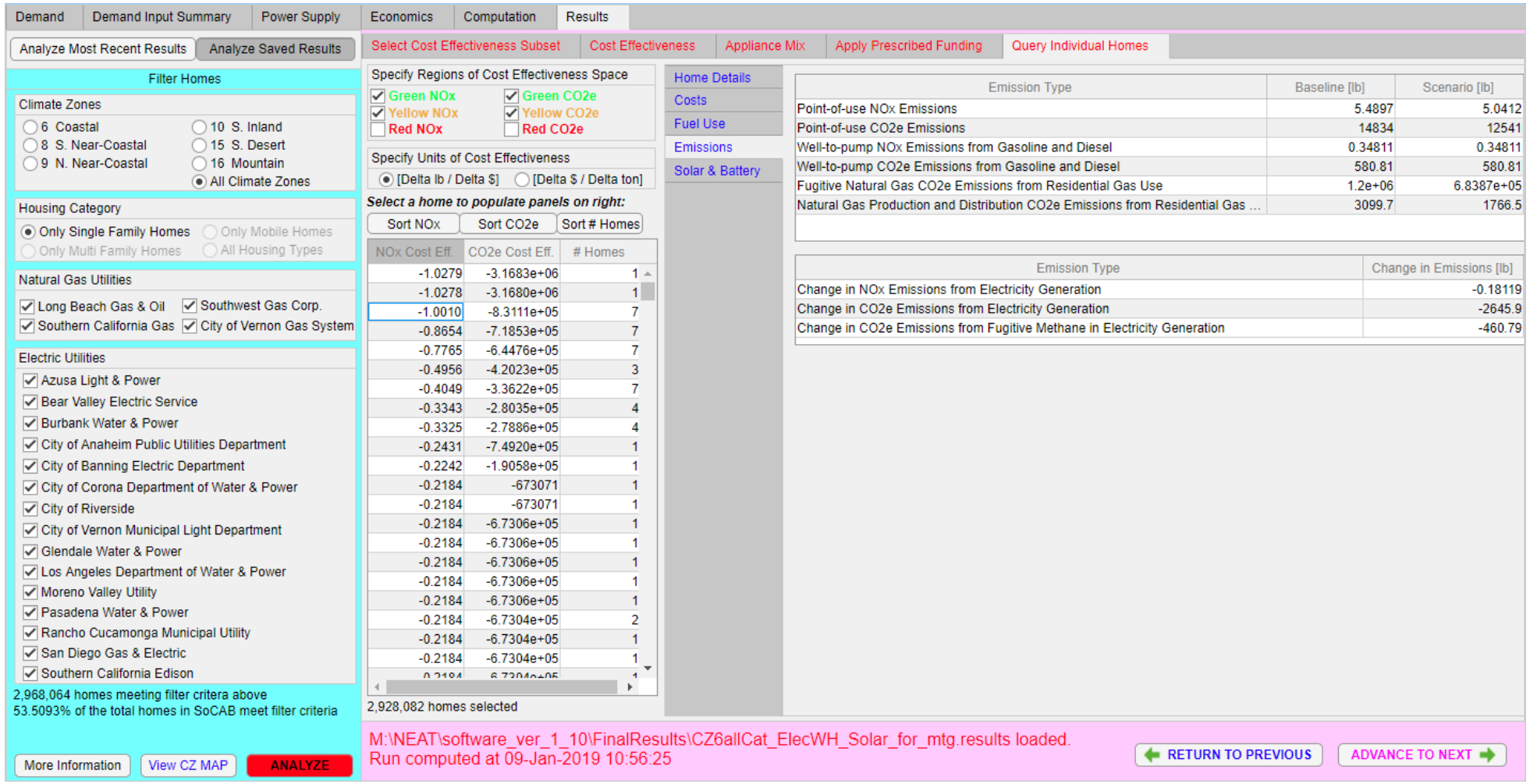
South Coast
Air Quality Management District

Results Panel (Query Individual Homes)

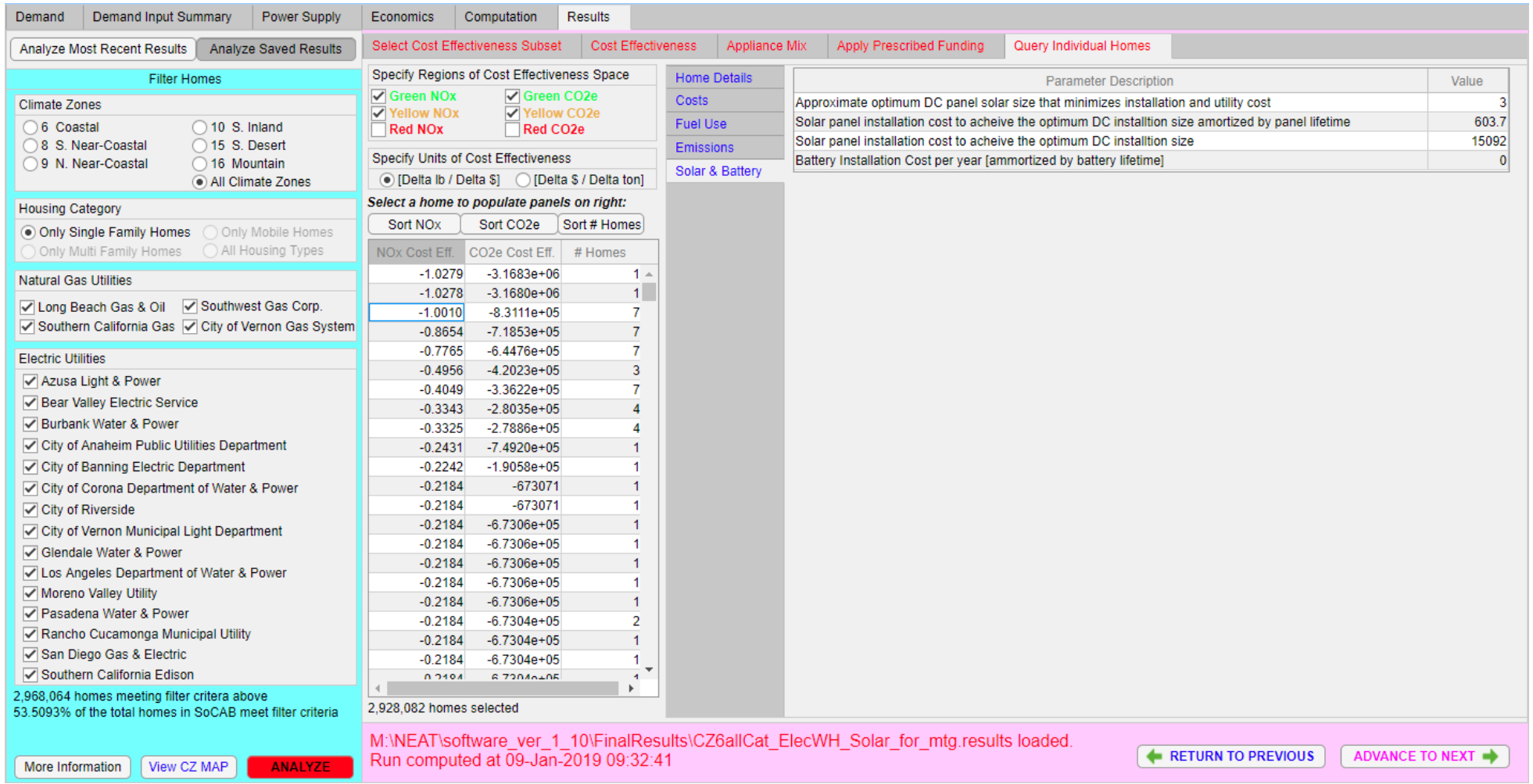


South Coast
Air Quality Management District

Results Panel (Query Individual Homes)



Results Panel (Query Individual Homes)



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Next Steps

- Full integration of battery module
- Intensive QA/QC of the tool
- Beta version to be released to working group members

Discussion and Public Comment