



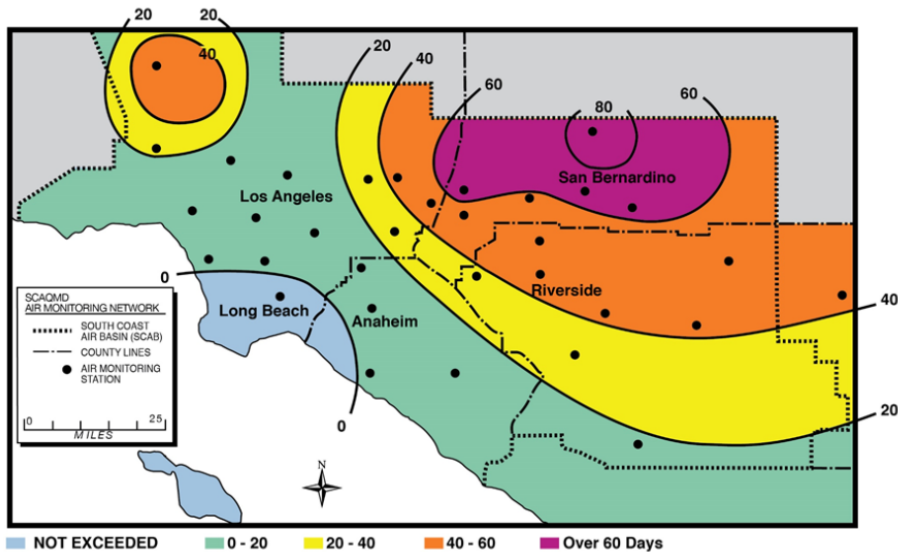
The Net Emissions Analysis Tool: A Holistic Residential Energy and Emission Model for the Development of Regulations and the Allocation of Incentive Funds in the South Coast Air Basin

Scott A. Epstein, Marc Carreras-Sospedra,
Xinqiu Zhang, and Sang-Mi Lee
South Coast Air Quality Management District

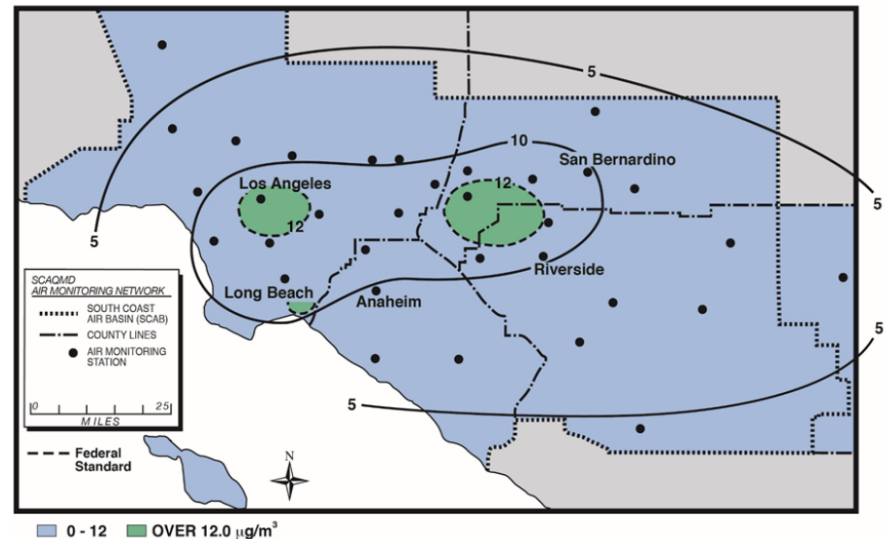
Presented at the 2018 ACEE Conference on Health, Environment and Energy, December 3-5, New Orleans

Despite Improvements in Air Quality, Much Work Remains

Number of Days Exceeding Federal O₃ Standard (2015)

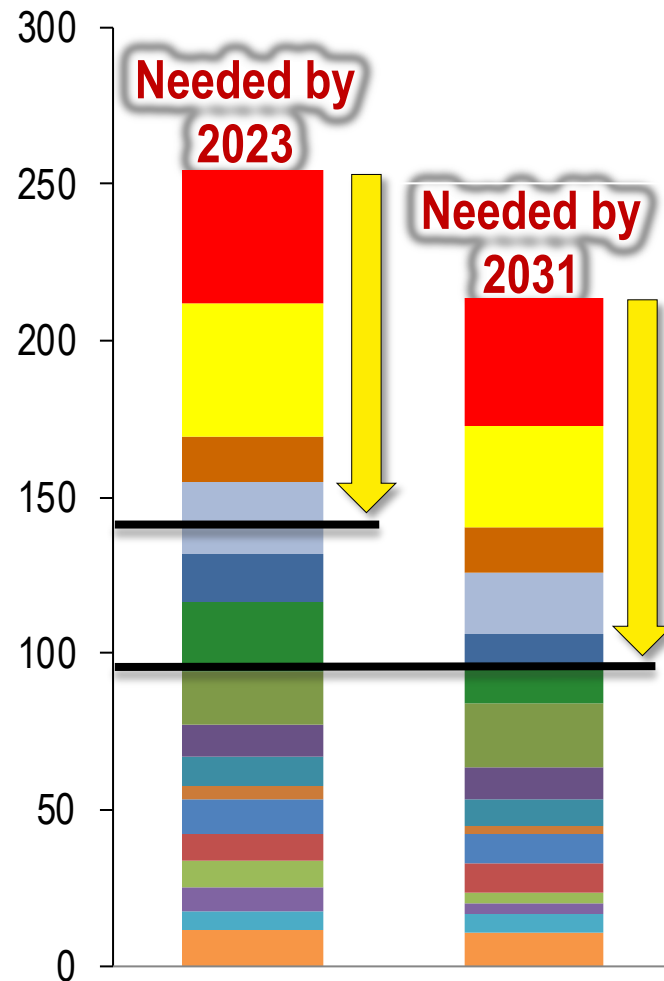


Annual Average PM_{2.5} Concentration Compared to Federal Standard (2015)



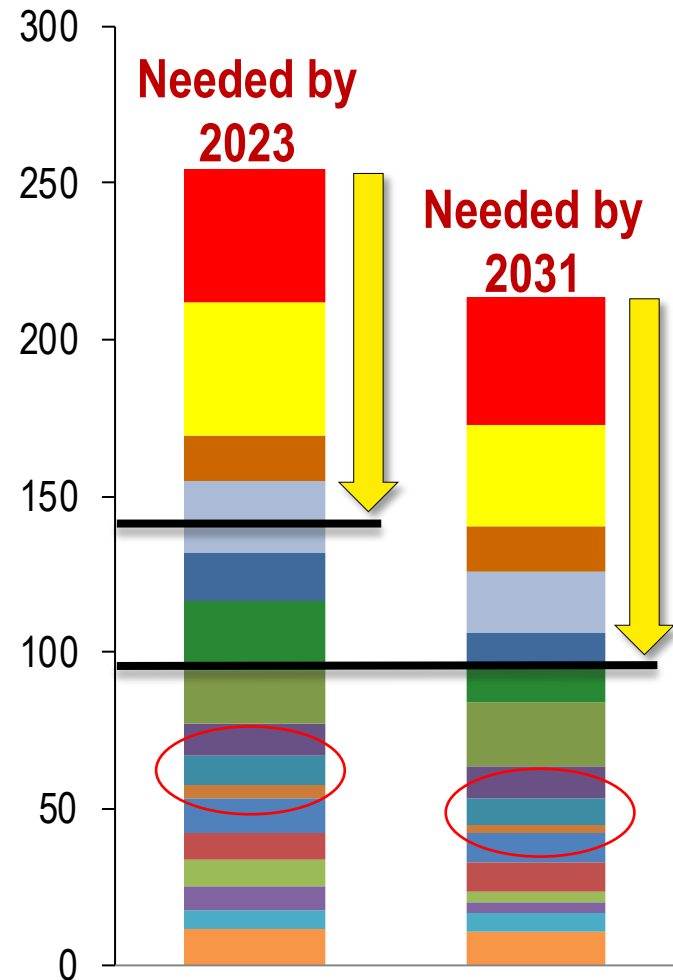
Control Strategy for O₃ and PM_{2.5} Attainment Focused on NO_x Reductions

- Heavy-Duty Diesel Trucks
- Off-Road Mobile Equipment
- RECLAIM
- Ocean Going Vessels
- Locomotives
- Cars/Light-Duty Trucks/SUVs
- Aircraft
- Manufacturing and Industrial
- Residential Fuel Combustion
- Heavy-Duty Gas Trucks
- Commercial Harbor Craft
- Service and Commercial
- Buses
- Medium-Duty Trucks
- Recreational Boats
- Other



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2016 AQMP Measures Related to Residential Appliances

	Title	2023 NOx Emission Reductions (TPD)	2031 NOx Emission Reductions (TPD)
CMB-02	Emission Reductions from Replacement with Zero or Near-Zero NOx Appliances in Commercial and Residential Applications	1.1	2.8
CMB-04	Emission Reductions from Restaurant Burners and Residential Cooking	0.8	1.6
ECC-03	Additional Enhancements in Reducing Existing Residential Building Energy Use	1.2	2.1

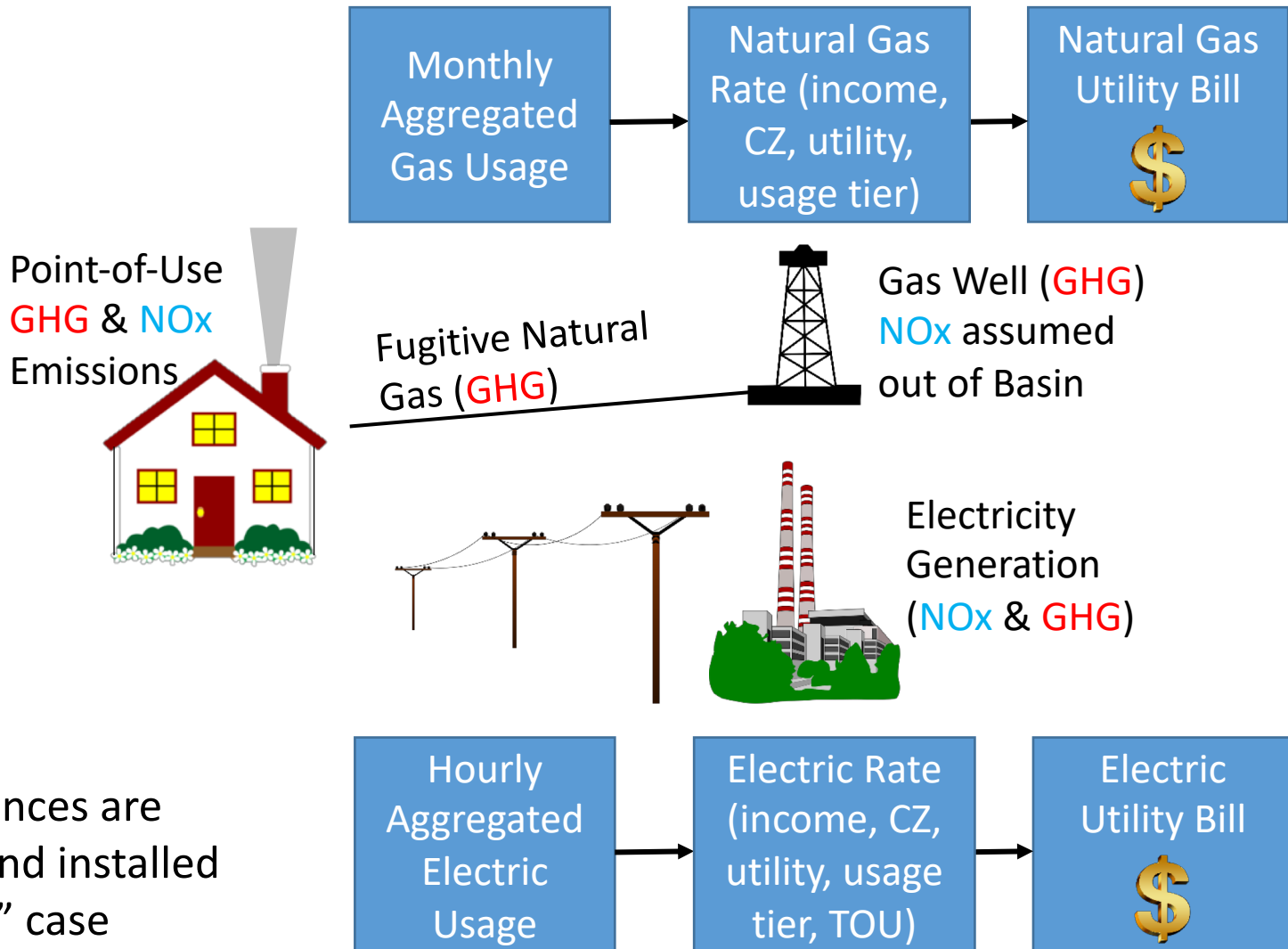
Goals of the Net Emissions Analysis Tool (NEAT)

- Estimate NO_x and GHG emission reductions from the residential sector
- Determine the most cost-effective [\$/ton] strategies to reduce emissions
- Holistically determine where to allocate incentive funds and develop programs to maximize NO_x and GHG benefits and minimize energy costs for the consumer
- Design a publically available graphical tool (GUI) for a wide user-base



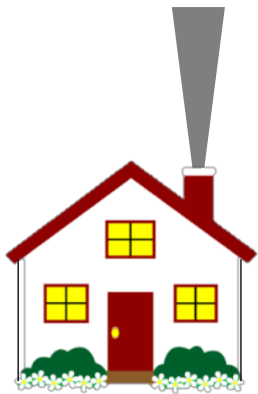
NEAT Calculates Impact of Technology Changes on Emissions and Cost

“Baseline” Case and
“Scenario” Case*



*New appliances are purchased and installed in “Scenario” case

NEAT Simulates the Housing Stock in the South Coast Air Basin



5.5 million households in Basin represented by a sample set of homes (up to 225,000 samples)

Properties of each home:

- Climate Zone (6 categories)
- Housing type (single family, multi-family, mobile homes)
- Income level (used to determine eligibility for utility rate assistance programs)
- Gas and electric utility provider
- Baseline Appliance Mix (Defined by 2009 RASS Study)
- “Scenario” Appliance Mix (Defined by user)
- Solar and/or residential battery storage installed in “Scenario”

NEAT is Capable of a Wide Variety of Analyses (independent or in aggregate)

- Emissions and Cost Impacts (separated by climate zone, housing category, gas utility, and electric utility) of:
 - ✓ Improving efficiency
 - ✓ Fuel switching
 - ✓ Switching to zero and near-zero emission appliances
 - ✓ Increasing penetration of renewable gas and/or electricity
 - ✓ Reducing methane leakage and/or electricity transmission losses
 - ✓ Changing rate structures and utility costs (i.e. switching to TOU rates)
 - ✓ Net metering
 - ✓ Increased penetration of solar, residential battery storage, and/or electric vehicles

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Simple Scenario Demonstration (Installation of more efficient appliances)

Example Scenario: Replace all Electric Dryers with Heat Pump Electric Dryers



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	Dryer	615	0	0	750	100	18	0.289				
B	Electric	Clothes Washer	82	0	0	850	100	13	0.732				
C	NatGas	Dryer	25	0.0136	11.76	800	100	18	0.383				

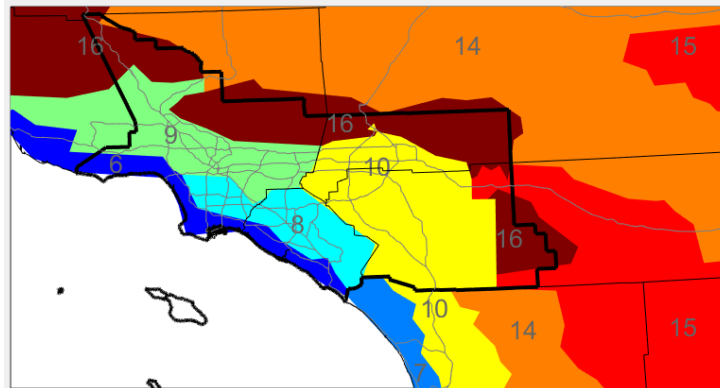
SCENARIO TECHNOLOGY MIX PARAMETERS								View Tech Definitions		Show Column Information	
	Fuel	Technology	UEC	NOX EF	CO2e EF	Unit Cost	Install Cost	Lifetime			
	Electric	Heat Pump Dryer	179	0	0	1263	100	18			
	Electric	Clothes Washer	82	0	0	850	100	13			
	NatGas	Dryer	25	0.0136	11.76	800	100	18			

Baseline parameters calculated from 2009 RASS Study
Scenario parameters calculated from energystar.gov

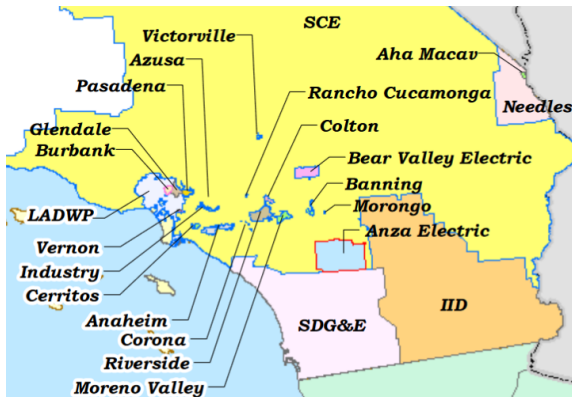
All data is preliminary and for demonstration purposes only. NEAT is currently undergoing comprehensive QA/QC

Determine Subset of Homes to Analyze

Climate Zones



Electric Utilities



Natural Gas Utilities



Source: www.energy.ca.gov

Filter Homes

Climate Zones

<input type="radio"/> 6 Coastal	<input type="radio"/> 10 S. Inland
<input type="radio"/> 8 S. Near-Coastal	<input type="radio"/> 15 S. Desert
<input type="radio"/> 9 N. Near-Coastal	<input type="radio"/> 16 Mountain
<input checked="" type="radio"/> All Climate Zones	

Housing Category

<input type="radio"/> Only Single Family Homes	<input type="radio"/> Only Mobile Homes
<input type="radio"/> Only Multi Family Homes	<input checked="" type="radio"/> All Housing Types

Natural Gas Utilities

<input checked="" type="checkbox"/> Long Beach Gas & Oil	<input checked="" type="checkbox"/> Southwest Gas Corp.
<input checked="" type="checkbox"/> Southern California Gas	<input checked="" type="checkbox"/> 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

5,546,817 homes meeting filter criteria above
100% of the total homes in SoCAB meet filter criteria

More Information

View CZ MAP

ANALYZE

Cost Effectiveness Analysis Tools

Select Cost Effectiveness Subset

Cost Effectiveness

Appliance Mix

Query Individual Homes

Apply Prescribed Funding

Select Cost Calculation Option:

Change in total annual cost (purchase + installation + utility costs)

Stage-of-Life for Appliances Being Replaced

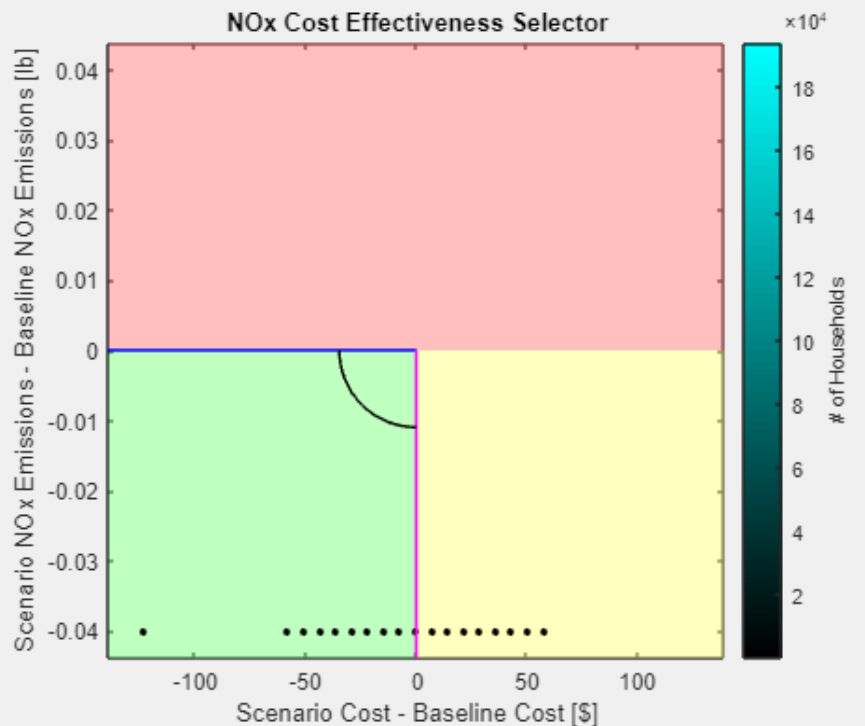
Appliances that are replaced are brand-new

Selection Criteria

Select Homes Meeting NOx Criteria

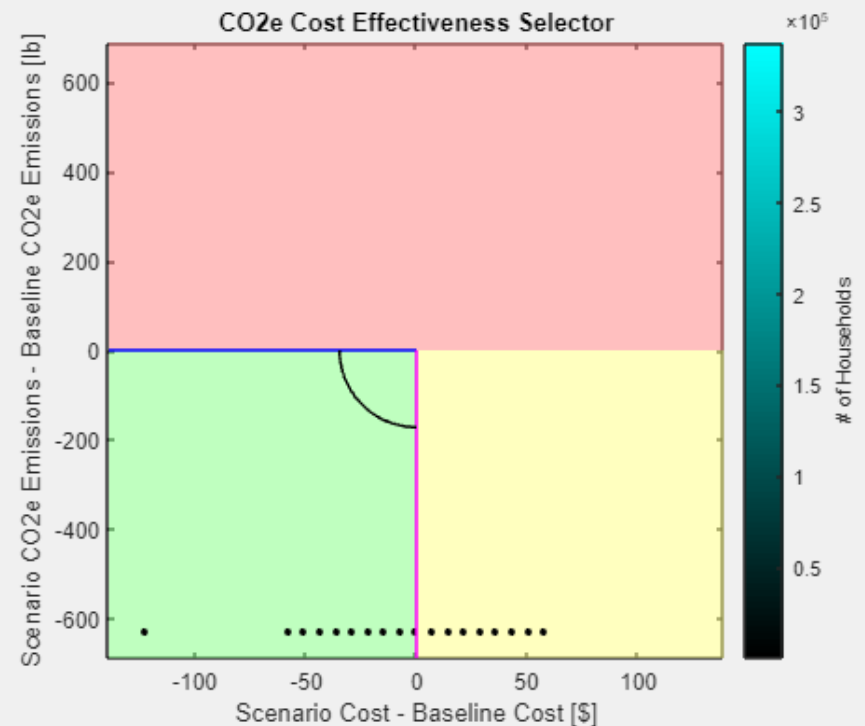
Select Homes Meeting CO2e Criteria

Select Homes That Meet Both Criteria



Minimum Selector [deg.]

Maximum Selector [deg.]



Minimum Selector [deg.]

Maximum Selector [deg.]

# of Modified Homes Meeting Filter	# of Modified Homes in NOx Selector	# of Modified Homes in CO2e Selector	# of Modified Homes in Both Selectors
1600776	1048264	1048264	1048264

Update Table

* All data is preliminary and for demonstration purposes only.

Cost Effectiveness Analysis Tools

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

Select Cost Calculation Option:

Stage-of-Life for Appliances Being Replaced:

Selection Criteria:

NOx Cost Effectiveness Selector

Minimum Selector [deg.] Maximum Selector [deg.]

CO2e Cost Effectiveness Selector

Minimum Selector [deg.] Maximum Selector [deg.]

# of Modified Homes Meeting Filter	# of Modified Homes in NOx Selector	# of Modified Homes in CO2e Selector	# of Modified Homes in Both Selectors
1600776	1048264	1048264	1048264

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Cost Effectiveness Analysis Tools

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

Enter Funding Amount [\$] Funding is applied only to households filtered on the "Select Cost Effectiveness Subset" Cost Share by Homeowner [%]

Stage-of-Life for Appliances Being Replaced: \$1,090,928,844 would fund all projects [More Information](#)

Description (click on a variable to view histograms)	Value
Approximate Number of Projects Funded	14673
Number of Possible Projects in "Cost Effectiveness Subset"	1600776
Cumulative Change in NOx Emissions [lb/yr]	-586.29
Cumulative Change in NOx Emissions [TPD]	-0.00080259
Cumulative Change in CO2e Emissions [lb/yr]	-9.1746e+06
Cumulative Change in CO2e Emissions [TPD]	-12.559
Average Incentive Amount Provided to Homeowner [\$]	681.5
Median Incentive Amount Provided to Homeowner [\$]	681.5
Average Cost-Share from Homeowner [\$]	681.5
Median Cost-Share from Homeowner [\$]	681.5
Average Change in Annual Utility Costs [\$]	-85.389
Median Change in Annual Utility Costs [\$]	-105.28
Average Change in Ammortized Appliance Purchase and Installation Costs Borne By Homeowner [\$]	14.25
Median Change in Ammortized Appliance Purchase and Installation Costs Borne By Homeowner [\$]	14.25

Change in Annual Utility Costs (all homes) [\$]

Change in Annual Utility Costs (homes with funded projects) [\$]

M:\NEAT\software_ver_1_9\DataFiles\AAAR\heatPumpDryerScenario.results loaded.
Run computed at 17-Aug-2018 12:05:26

[← RETURN TO PREVIOUS](#) [ADVANCE TO NEXT →](#)

* All data is preliminary and for demonstration purposes only.

Ongoing Development of NEAT

- <https://www.aqmd.gov/NEAT> for more information
- Workgroup meets regularly to advise on development
 - Join our workgroup
 - Submit a comment letter
- NEAT will be publicly available for free when complete (expected early 2019)



The screenshot shows the website for the Net Emissions Analysis Tool (NEAT) working group. The header includes navigation links for Language, F.I.N.D., About, Contact, Grants & Bids, Online Services, and I'm Looking For, along with a search bar. The main navigation menu includes AIR QUALITY, RULES & COMPLIANCE, INCENTIVES & PROGRAMS, PERMITS, NEWS, AGENDAS, & WEBCASTS, TECHNOLOGY ADVANCEMENT, and RESOURCES. The page title is "Net Emissions Analysis Tool (NEAT), formally known as the LifeCycle Analysis Working Group". The main content area states: "The purpose of this working groups is to assess the cost-effectiveness of technologies and life-cycle emissions." Below this, a paragraph describes the working group's formation and goals. A sidebar on the right titled "YOU MAY ALSO LIKE ..." lists links for Business, Local Government, Rules, and Organization. At the bottom, there are sections for "Working Group Meeting #4" (Wednesday, April 18, 2018) and "Working Group Meeting #3" (Wednesday, January 31, 2018), each with contact information and links to agendas and presentations.