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# Tool to Estimate Cost Effectiveness of Emission Reductions in the Residential and Commercial Sector

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# 2016 AQMP Measures Related to Commercial and Residential Appliances

Number	Title	NOx Emission Reductions (tpd) (2023/2031)
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



# Project Objectives

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- Determine the most cost-effective strategies for NOx and GHG emission reductions from the commercial and residential sector
  - Previous analyses have focused on GHG emissions and energy savings
- Holistically determine where to allocate incentive funds to maximize NOx and GHG benefits and minimize energy costs for the consumer
- Inform potential regulatory approaches for CMB-02 in the commercial and residential sectors



# Implementation

- Create a program with a graphical user interface (GUI) that allows the user to analyze the effects of changing appliance technology penetration
  - Program would be designed in-house with counsel from the advisory group and assistance from technical experts
- Tool inputs
  - User would enter the current and future technology mix, emission factors, efficiency, installation costs, and lifetime (defaults provided)
  - User would select the presence and parameters for rooftop solar, battery storage, net metering, and/or electric vehicle charging
  - User would specify the source of the additional energy requirements
  - Advanced users would be able to modify electric and gas rate schedules



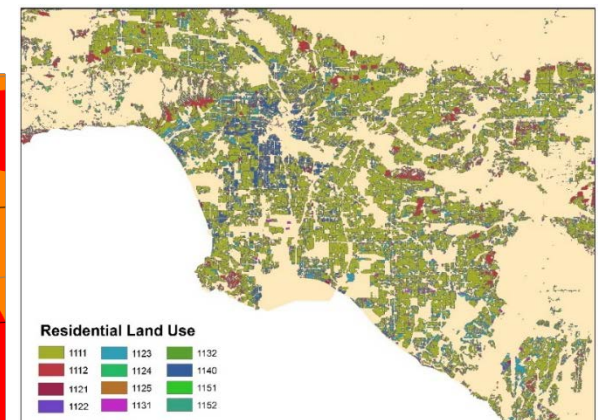
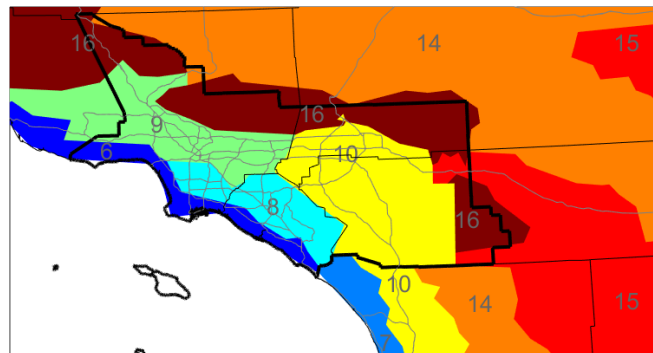
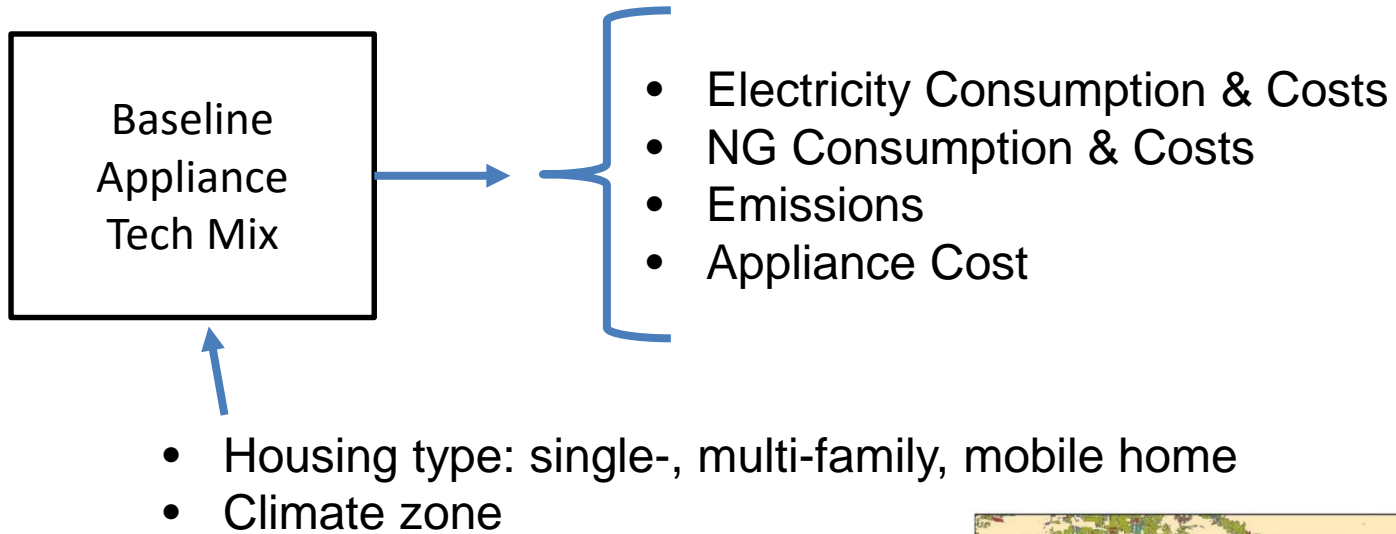
# Implementation

- Tool Outputs
  - Change in NOX (in-Basin) and GHG (life cycle) between baseline and future case
  - Initial costs for appliance replacement
  - Change in energy bills for the consumer
  - Optimal number of solar panels and/or batteries to minimize cost to the consumer
  - Cost effectiveness of NOX and GHG reductions
- Other model applications
  - Determine formulation of electricity rate structures to incentivize specific technologies



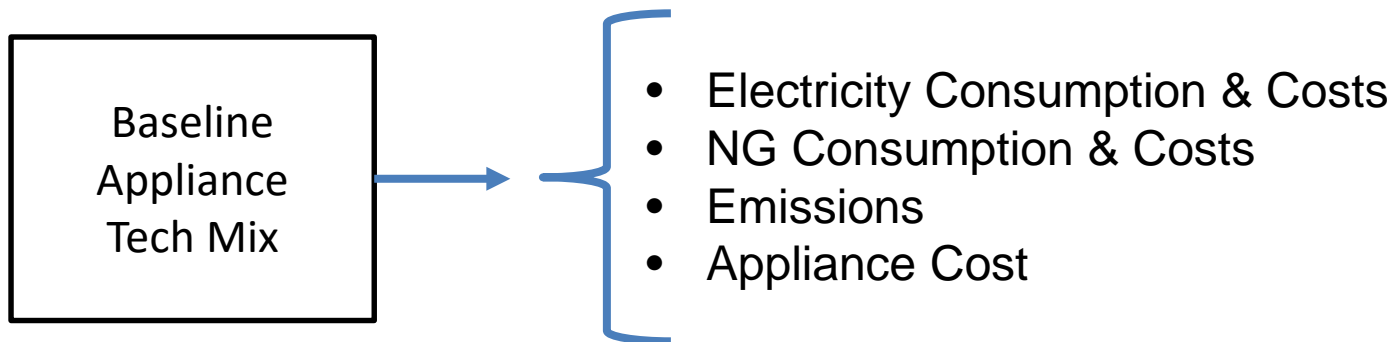
# Impact of Technology Changes

## Baseline Case

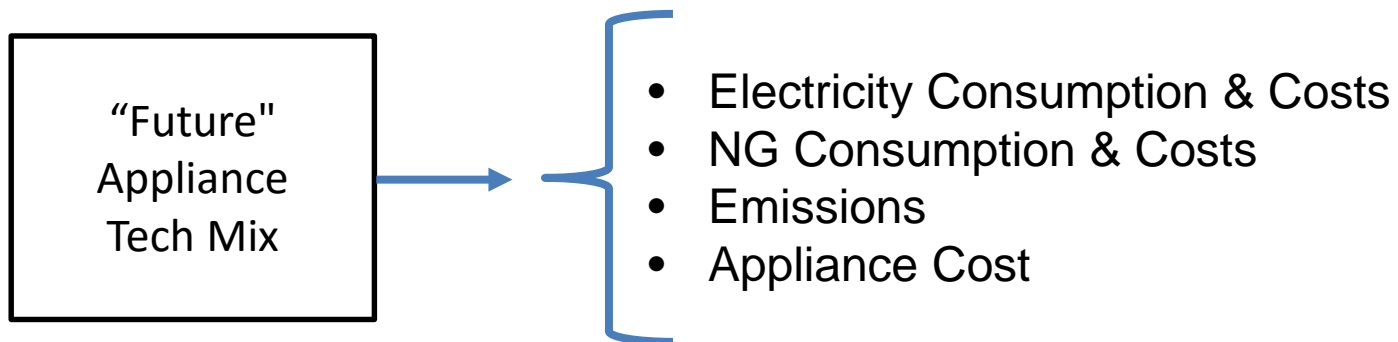


# Impact of Technology Changes

## Baseline Case



## Study Case

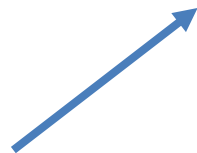
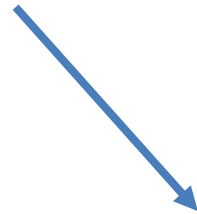


# Impact of Technology Changes

## Baseline Case



## Study Case



## Impact of Study Case

- Change in Electricity Consumption & Costs
- Change in NG Consumption & Costs
- Change in Emissions
- Differences in Appliance Costs



# Impact of Technology Changes

## Impact of Study Case

- Change in Electricity Consumption
- Change in NG Consumption
- Change in Emissions
- Differences in Appliance Costs

- Additional electricity:
  - Peaker plant, grid, solar panel
  - Changes in emissions
- Change in hourly demand?
  - Changes in utility rates
- Additional technology:
  - Battery, fuel cell?

- Changes in NG extraction/transmission/distribution emissions?
- Change in monthly demand: changes in utility rates

- Changes in appliance efficiency
- Changes in emission factors (regulations?)

- Replacement at end of life vs early replacement



# Discussion Topics

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- General suggestions from the workgroup
- Refer to the tool as a Emissions Lifecycle Analysis?
- Potential additions/modifications to the approach?

