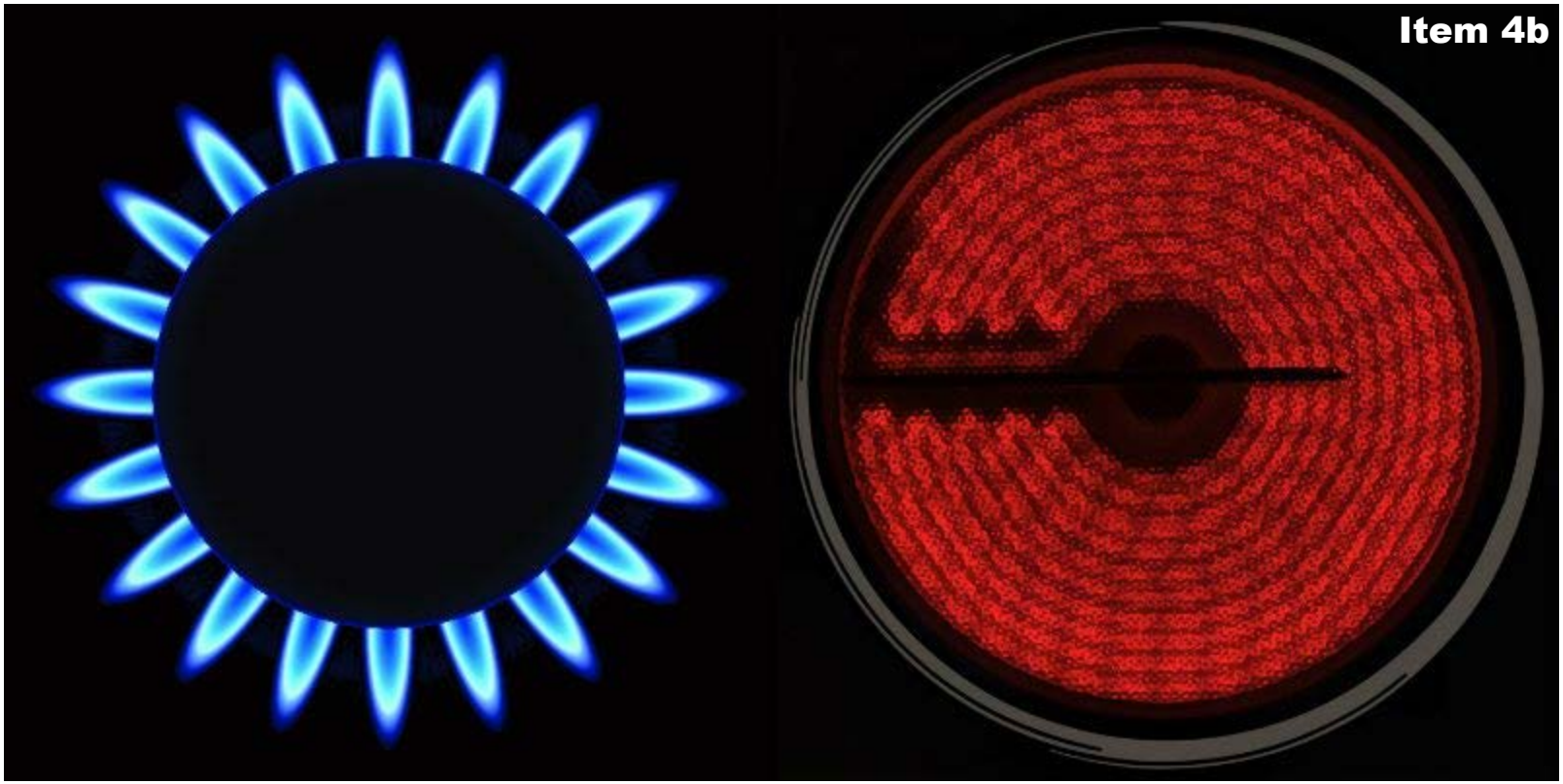


Natural Gas and Electricity Emission Profiles

Office of Sustainability

May 15, 2018

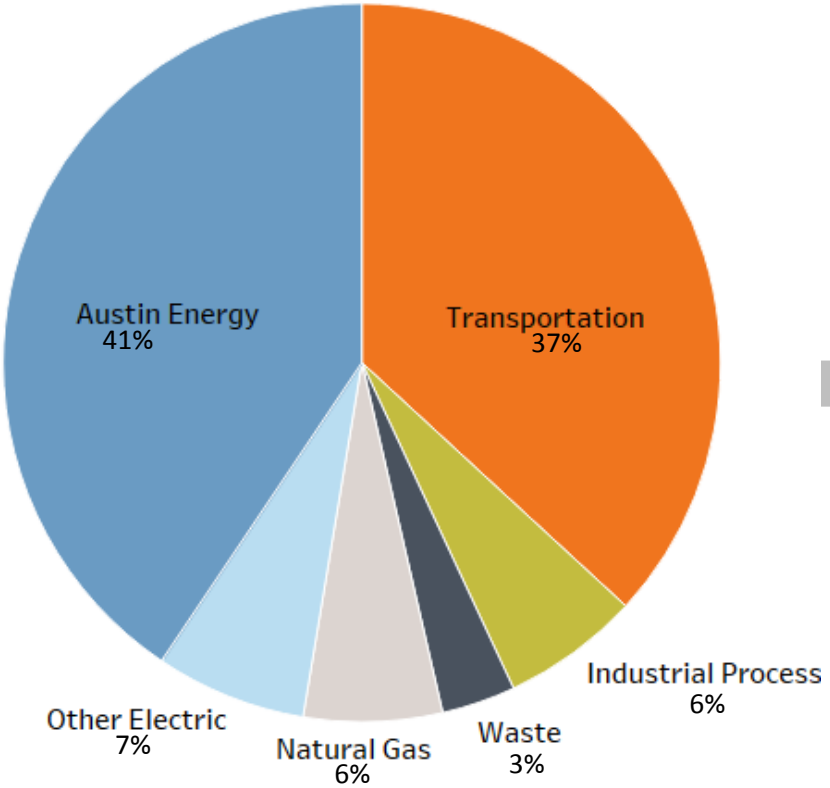
Takeaways

- Renewable energy and coal retirement commitments will dramatically lower Austin Energy user emissions from electricity use.
- New heat pump technology is very energy efficient.
- By 2023, emissions from heating air and water in buildings will be lower using electricity than natural gas for all use cases.

- Further Analysis Needed:
  - Site v. source energy to account for electricity losses as well as upstream gas leakage (less important as renewable energy grows).
  - Operational and capital costs of potential changes for new and existing buildings (important for affordability).

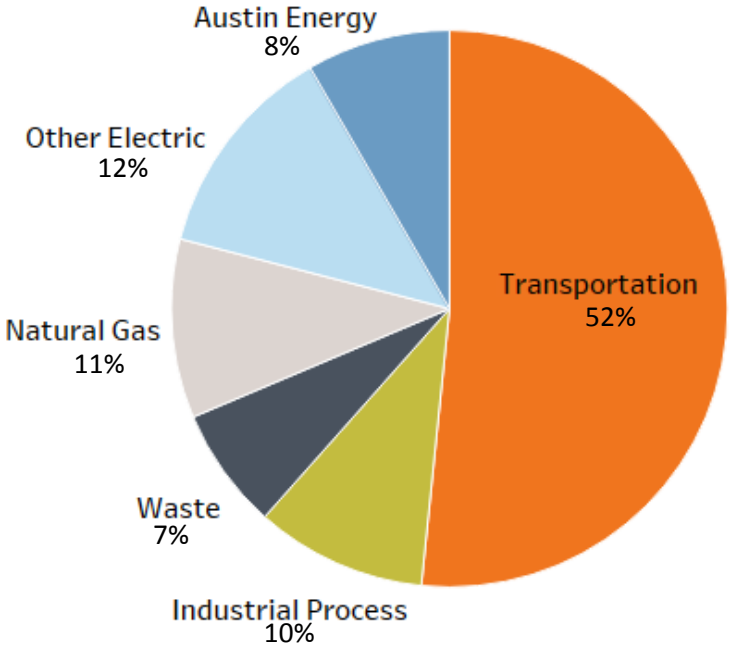
Austin Community GHG Inventory

2016



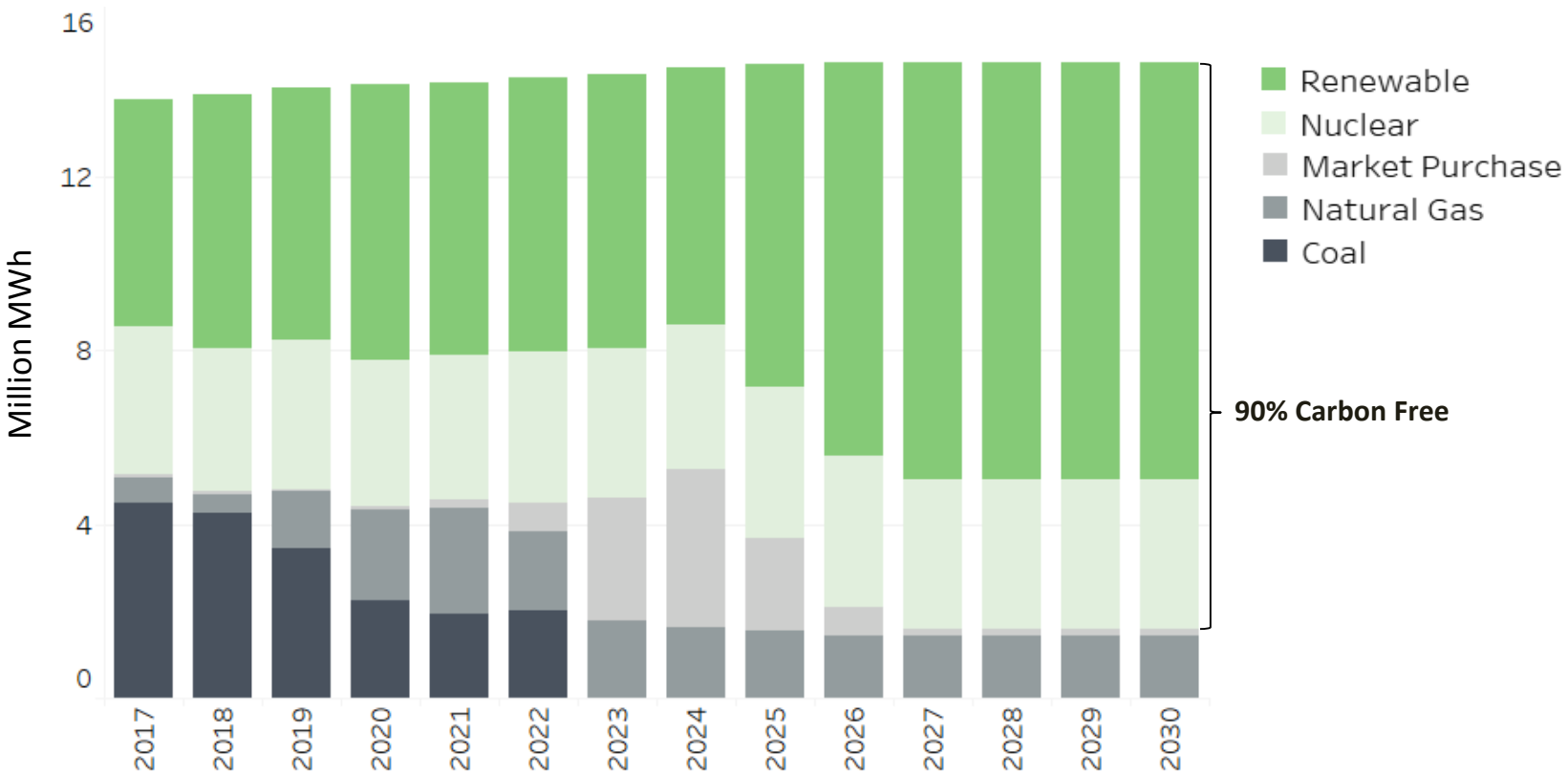
13.4 MMT CO2e

2030



8.0 MMT CO2e

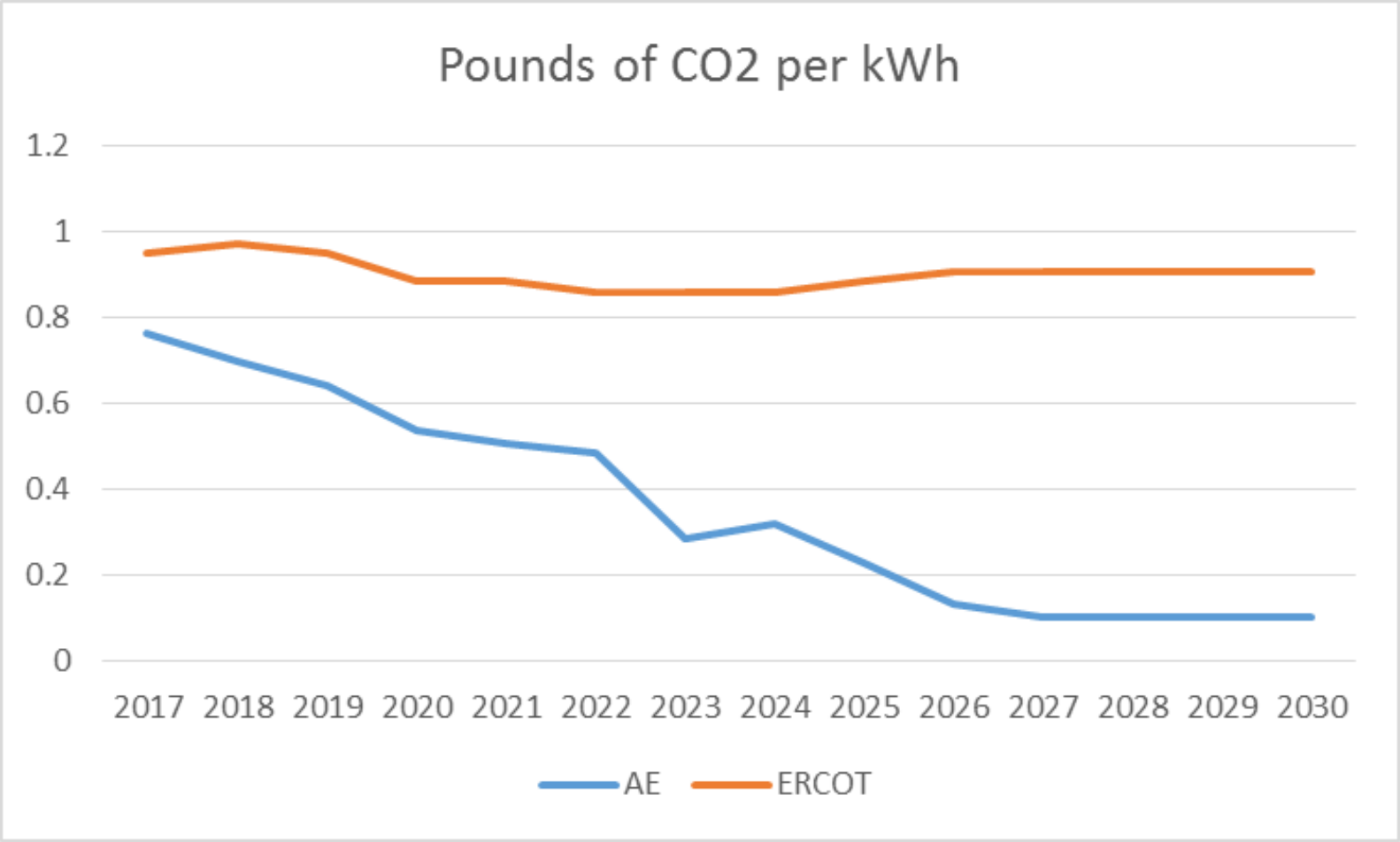
Projected AE Load and Offset by City Generation Resources



2017 Council Adopted Austin Energy Generation Plan Highlights

- Reach 65% renewable energy by 2027
- Target retirement of selected Decker units in 2020 – 2021
- Target retirement of Fayette Power Project beginning in 2022

Electricity Carbon Intensity



Questions For Analysis

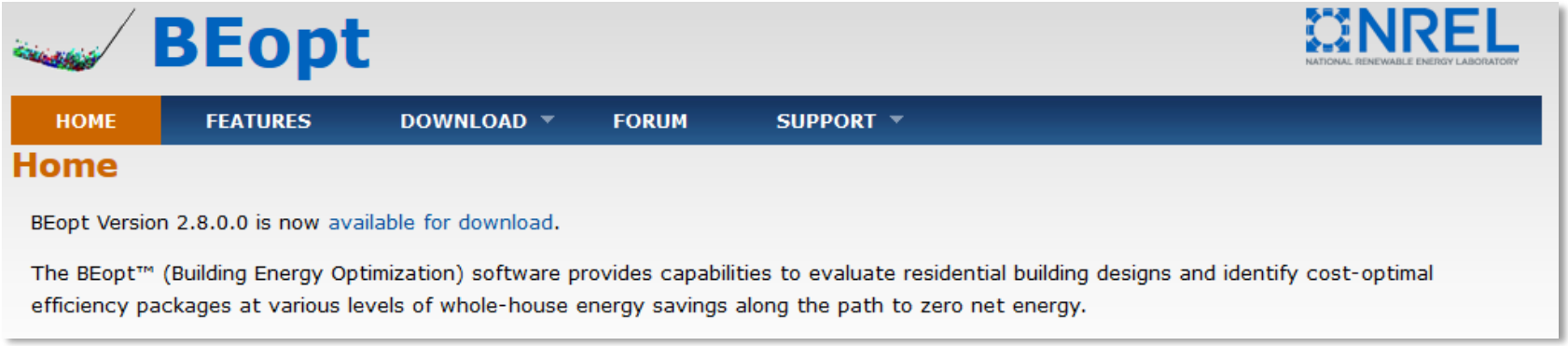
1. How do GHG emissions compare between natural gas and electric home appliances given the changing carbon intensity of Austin Energy's electricity?

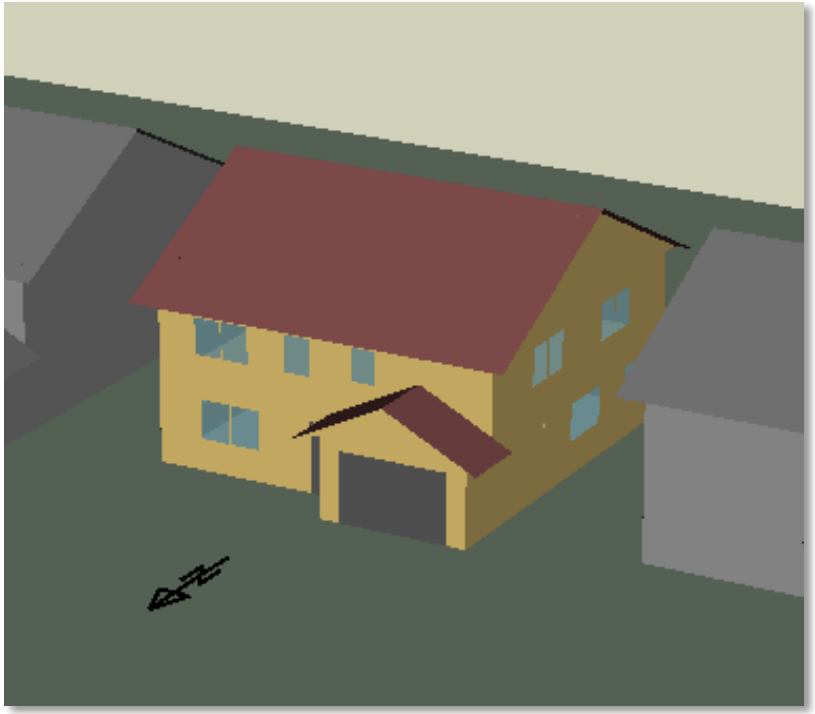
2. How would GHG emissions change if code requirements to include natural gas connections were removed?

Electricity vs. Gas Appliances

Appliance	Electric Case	Natural Gas Case
Space Conditioning	Electric Heat Pump	Gas Furnace + Electric Central Air
Low Efficiency	SEER 14 / HSPF 8.2	SEER 17 / 80% AFUE
High Efficiency	SEER 19 / HSPF 9.5	SEER 17 / 90% AFUE
Water Heating		
Low Efficiency	Electric Tank (92%)	Natural Gas Tank (59%)
High Efficiency	Heat Pump - 50 Gal	Natural Gas Tankless (82%)
Cooking	Electric Range	Natural Gas Range
Clothes Dryer	Electric Dryer	Gas Dryer

Modeling Assumptions





- 3 bed 2 bath 2300 SF
- 10ft lot lines
- OSB sheathing
- Cement Siding
- Fiberglass batt insulation
  - R15 Wall
  - R38 Ceiling (vented)
- Asphalt shingles
- Low-e Double pane windows
- Window Area 300 SF
- 15% Leakage R-8 ducts
- Heat Set point 70 / Cool Set point 75
- Austin climate data
- 15 year project analysis period
- Austin Energy Carbon Intensity

Calculation Methods

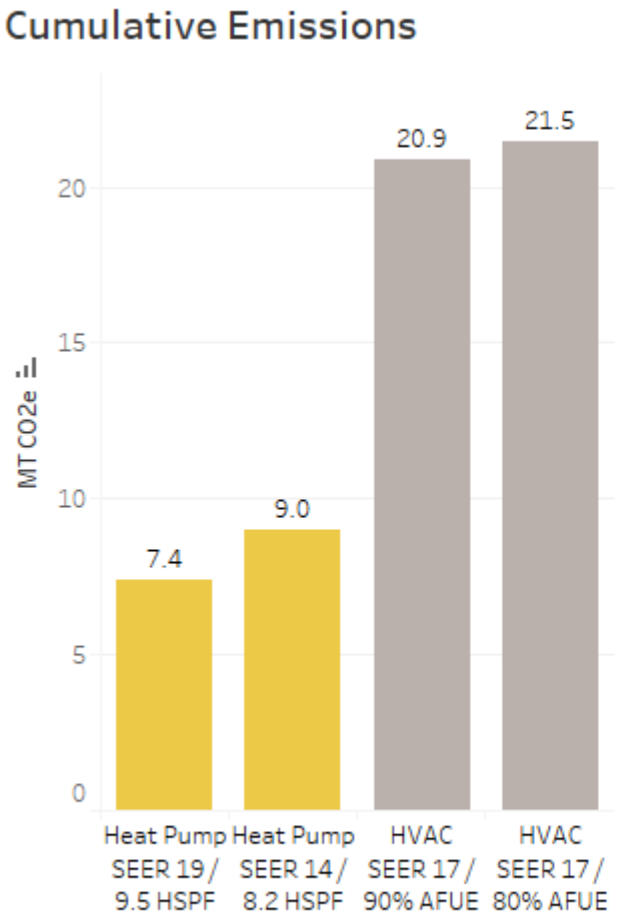
Emissions

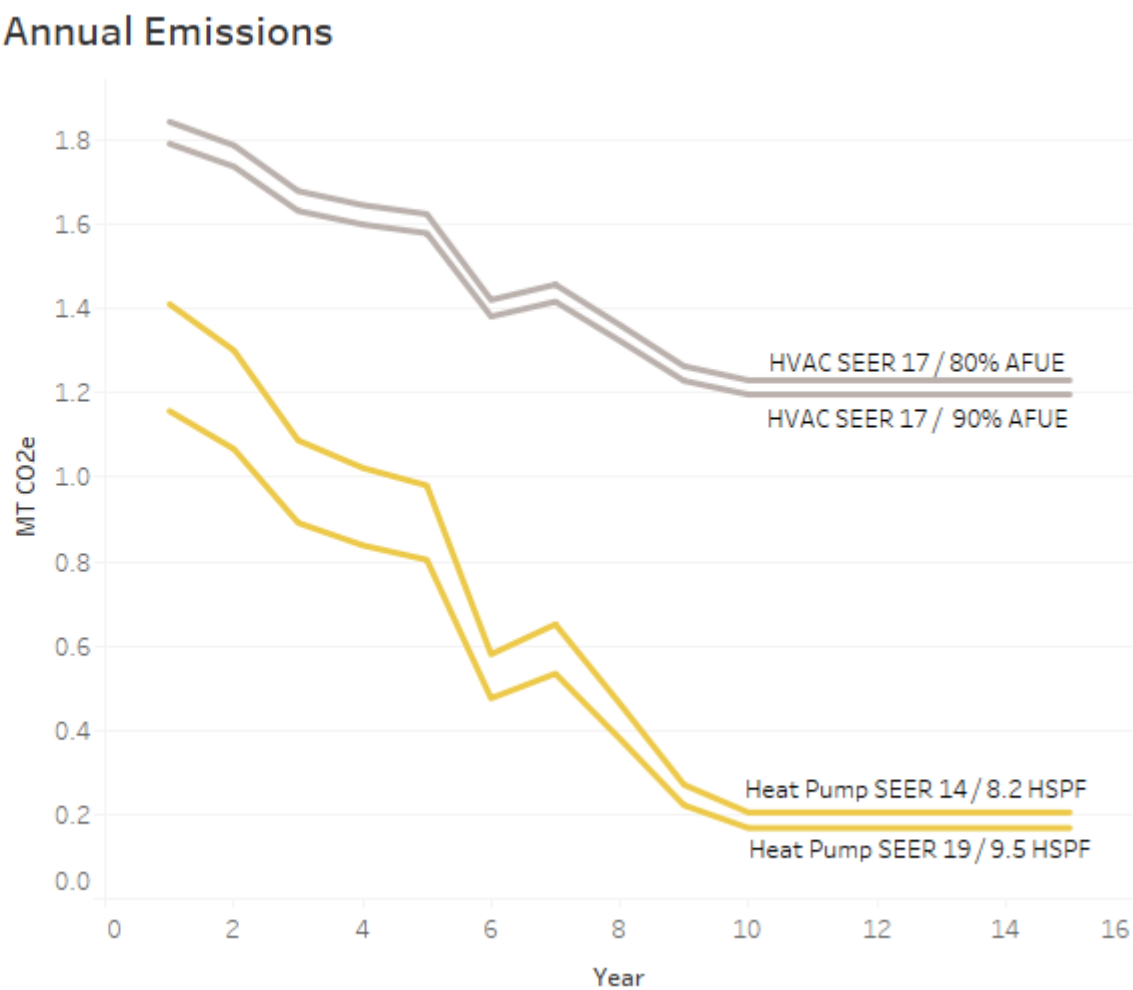
Austin Energy GHG emissions projections (CO_2 / kWh) are based on the adopted 2027 Generation Plan and extrapolated to 2033.

Calculation Method

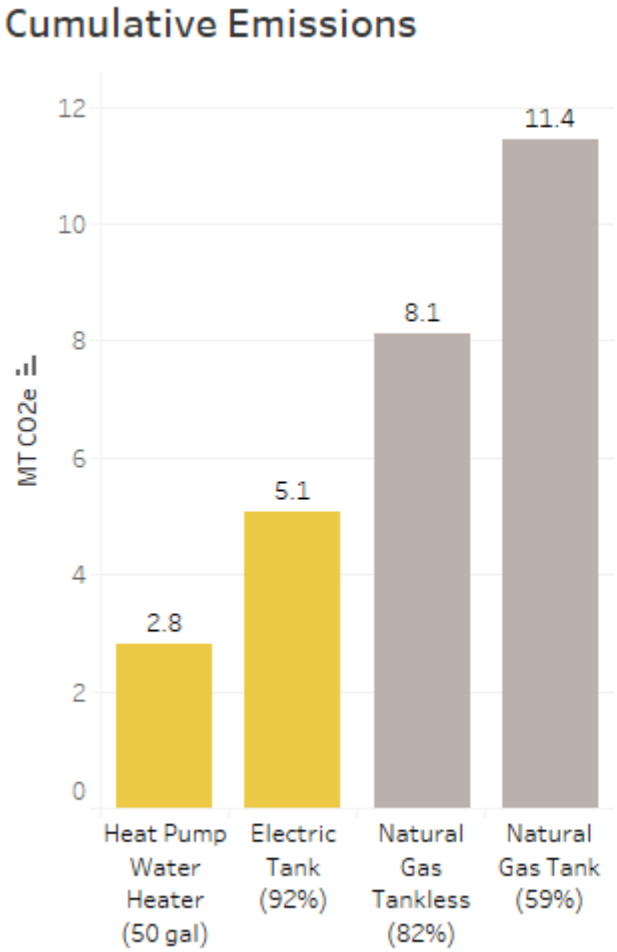
1. BEOpt modeling was run multiple times with fixed input parameters for each appliance / system under evaluation.
2. BEOpt outputs for the site energy used by each system.
3. Site energy outputs are multiplied by annual grid carbon intensity to project GHG emissions.
4. Comparisons include all system energy needed for functional performance. The natural gas case includes electricity consumption when it is required.

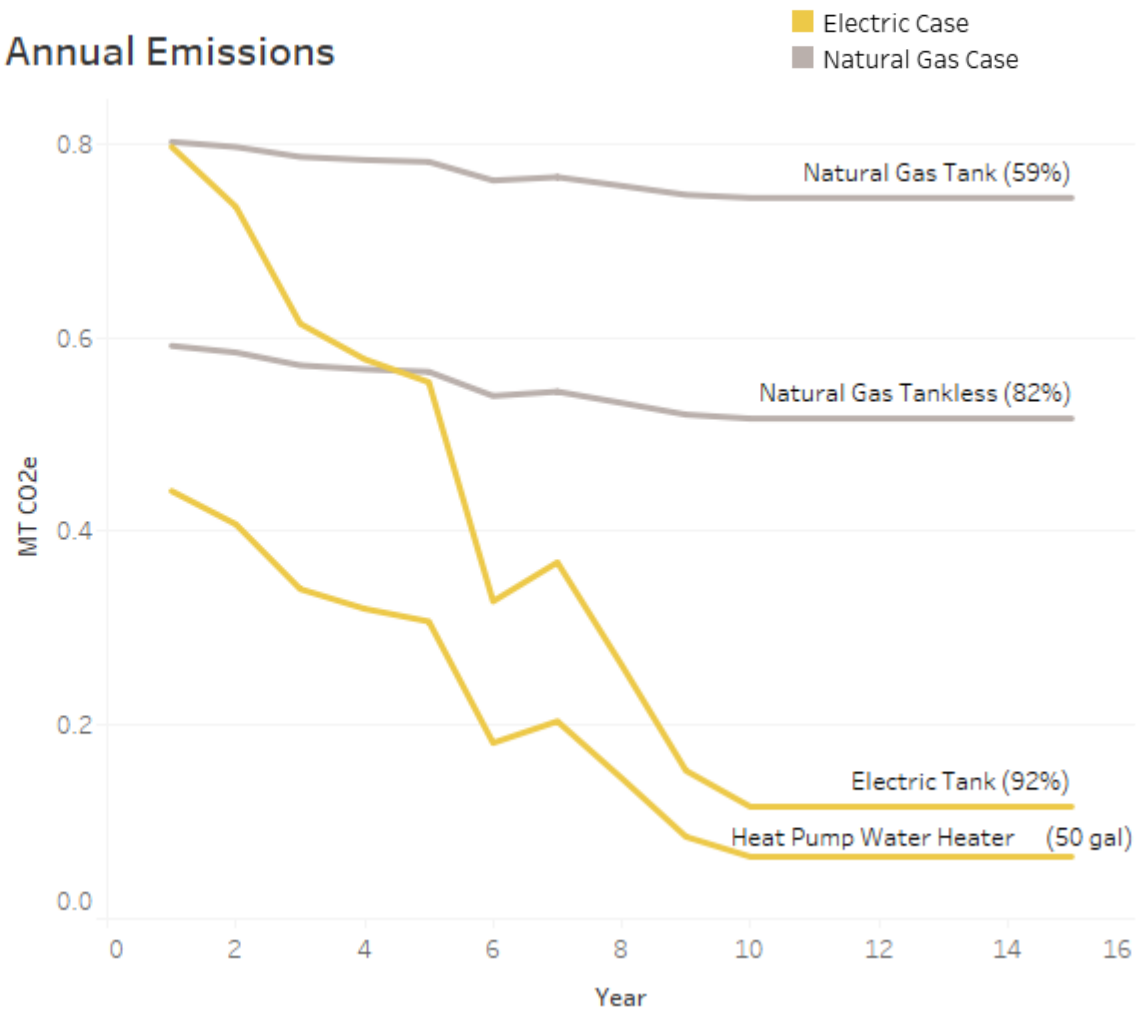
Space Conditioning Summary



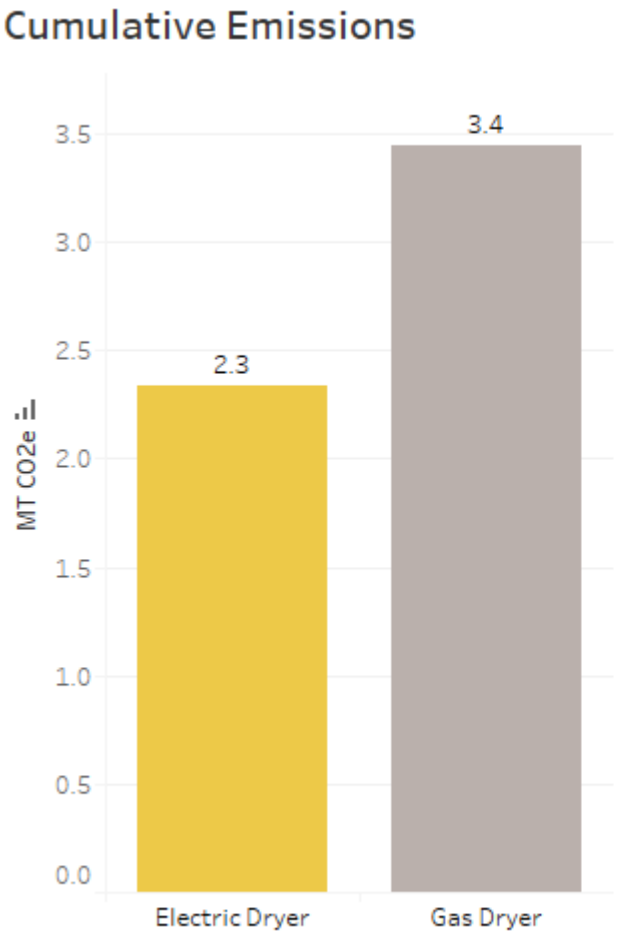


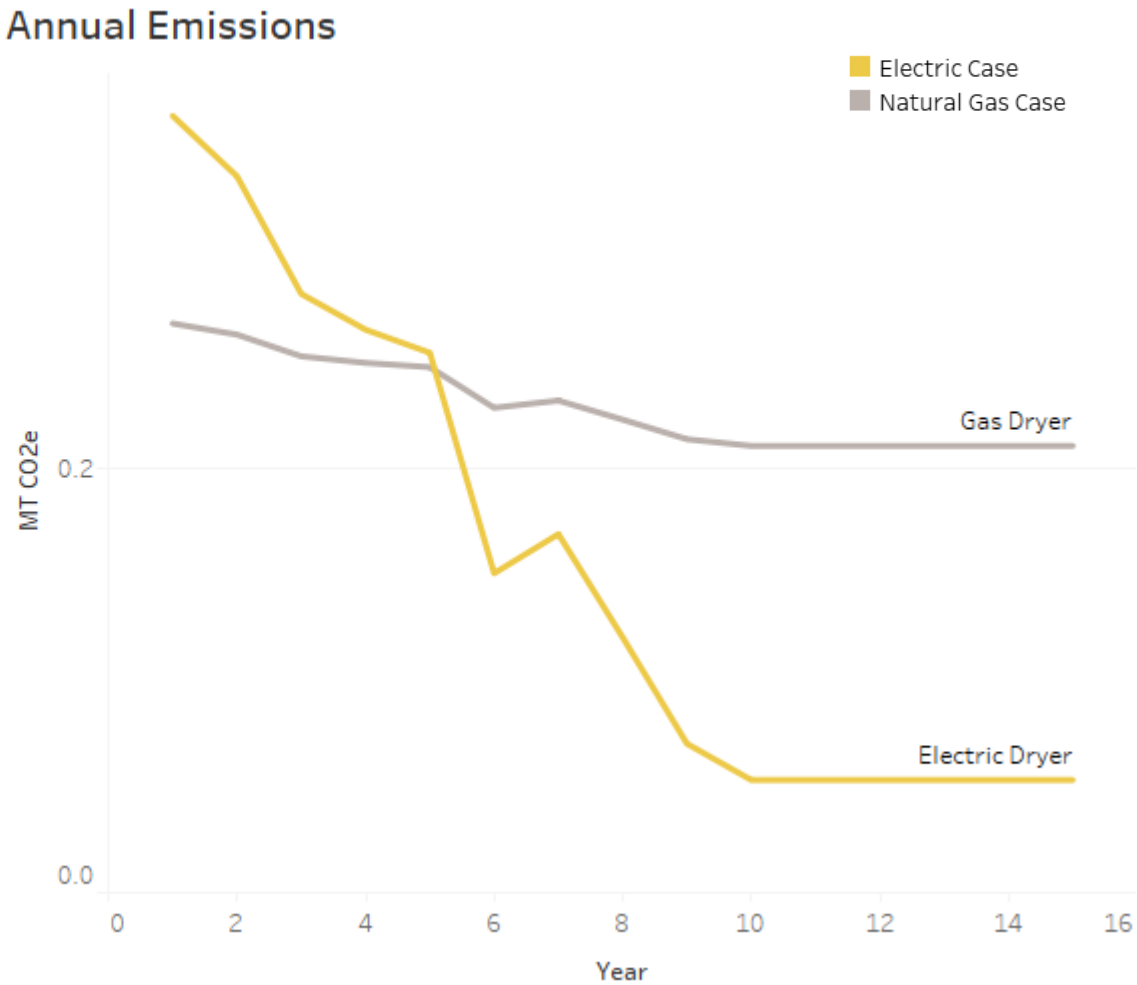
Water Heating Summary



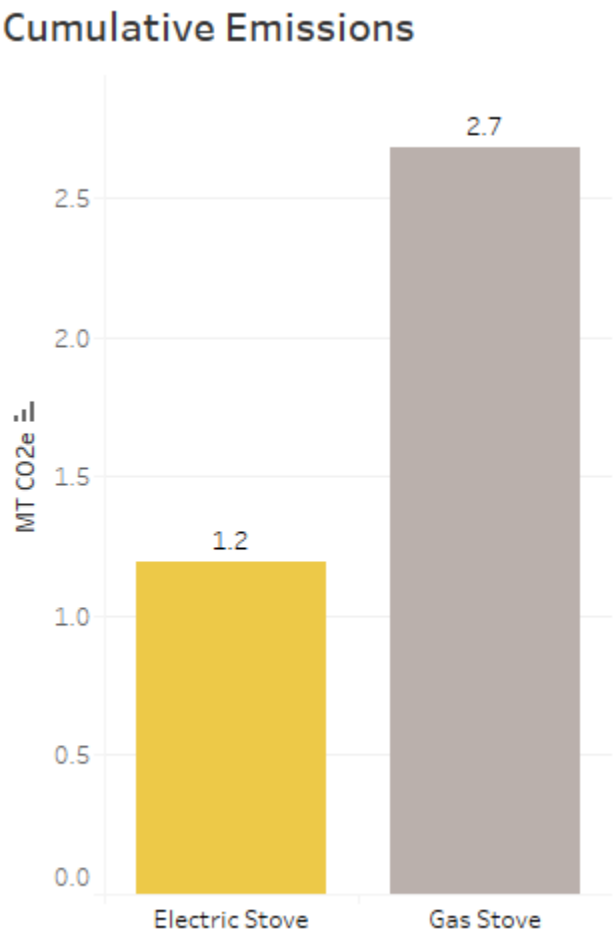


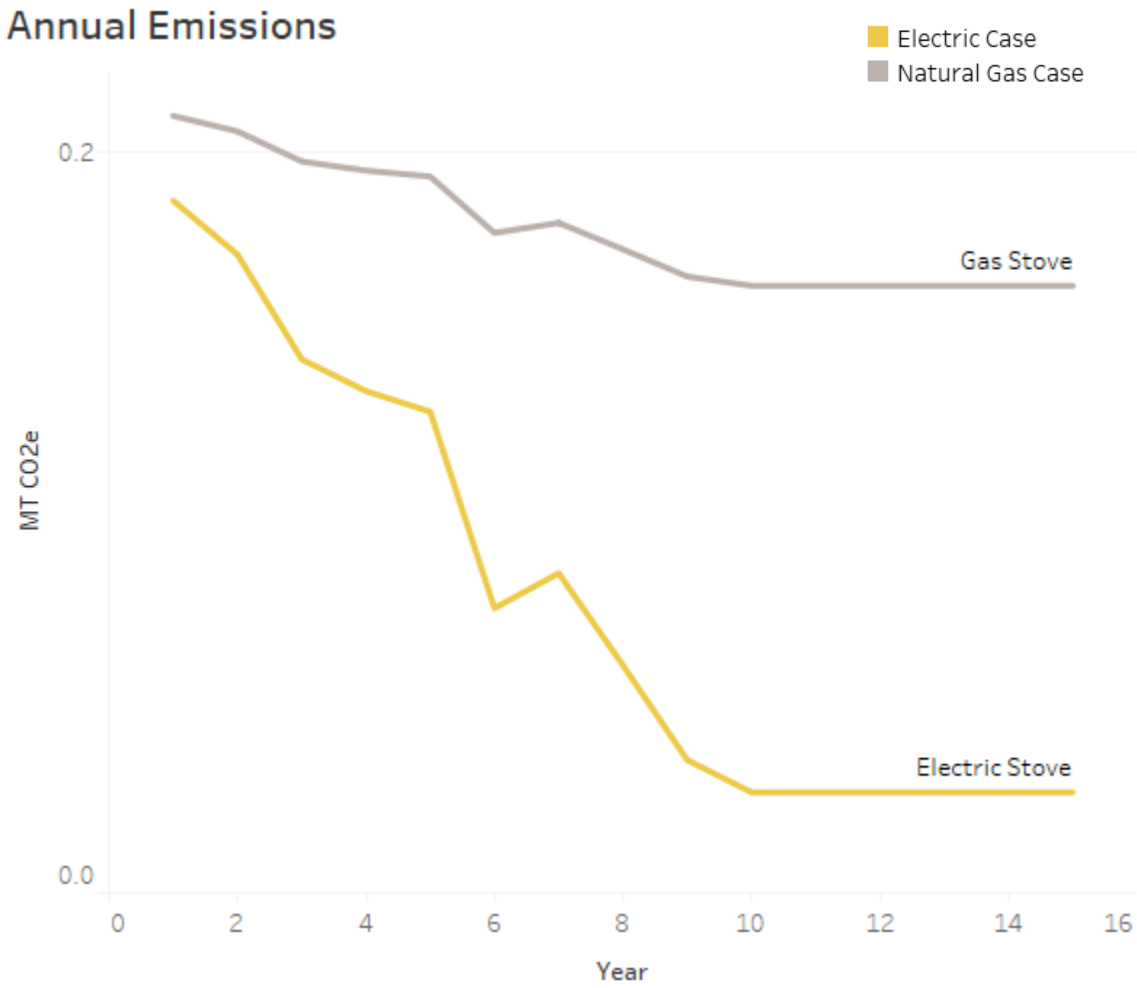
Clothes Dryer Summary





Stove Summary





Question 2 Analysis

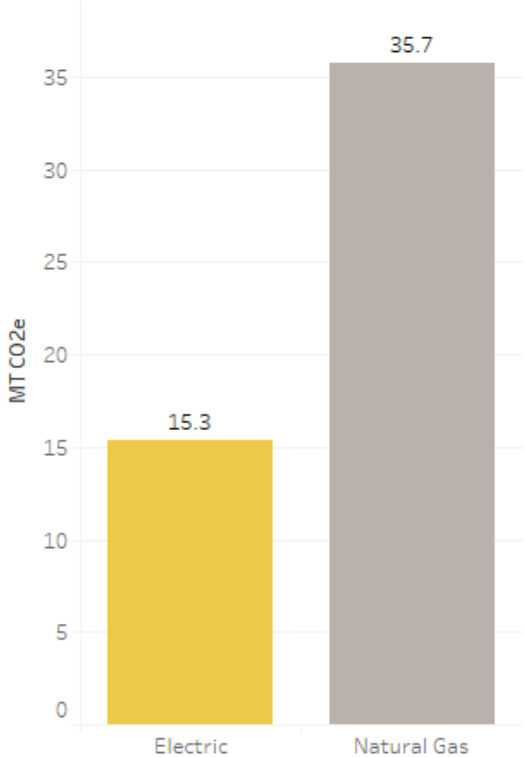
How would GHG emissions change if code requirements to include natural gas connections were removed?

- Many new single family homes will be built over the next 15 years.
- How do emissions compare between an all-electric home and a natural gas-dominant home?
- What are the emissions savings (annually and cumulative) if all new single family homes are built as all-electric?

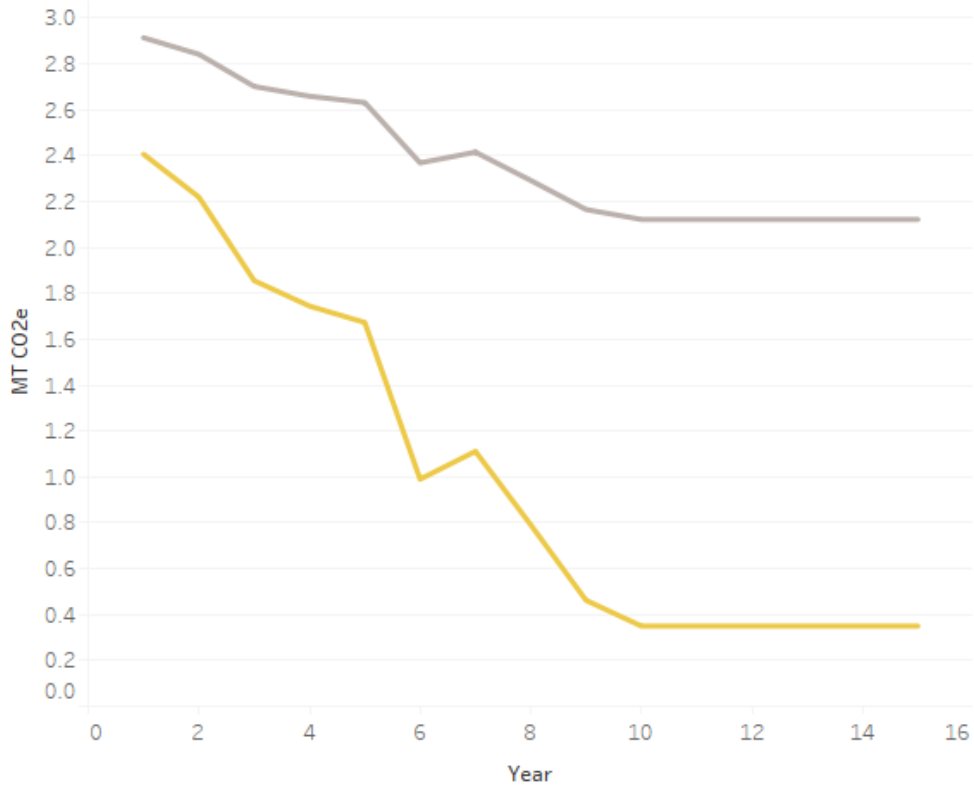
Whole House Comparison

Appliance	Electric Case	Natural Gas Case
Space Conditioning	Heat Pump SEER 14 / HSPF 8.2	HVAC SEER 17 / 80% AFUE
Water Heating	Heat Pump - 50 Gal	Natural Gas Tankless (82%)
Cooking	Electric Range	Natural Gas Range
Clothes Dryer	Electric Dryer	Gas Dryer

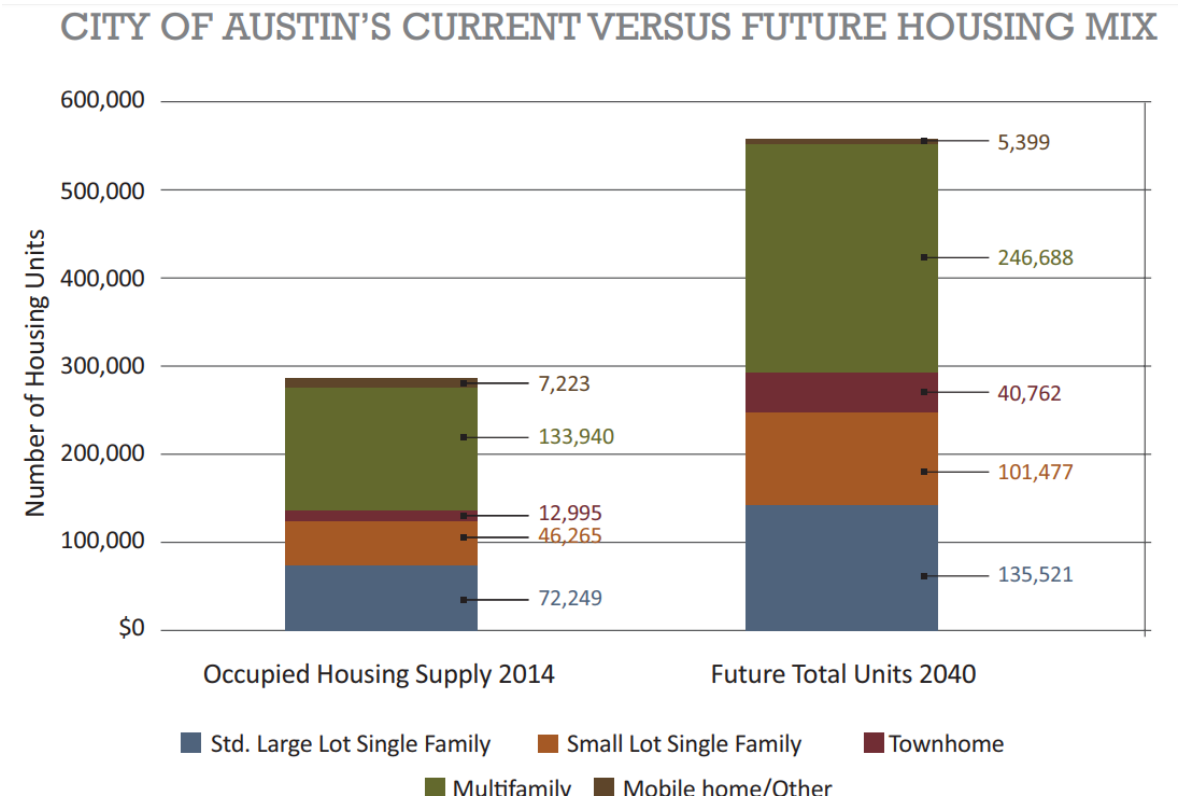
Cumulative Emissions



Annual Emissions

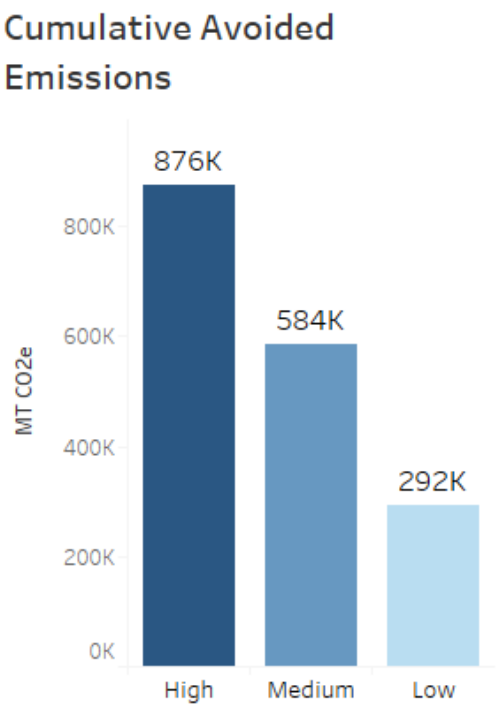


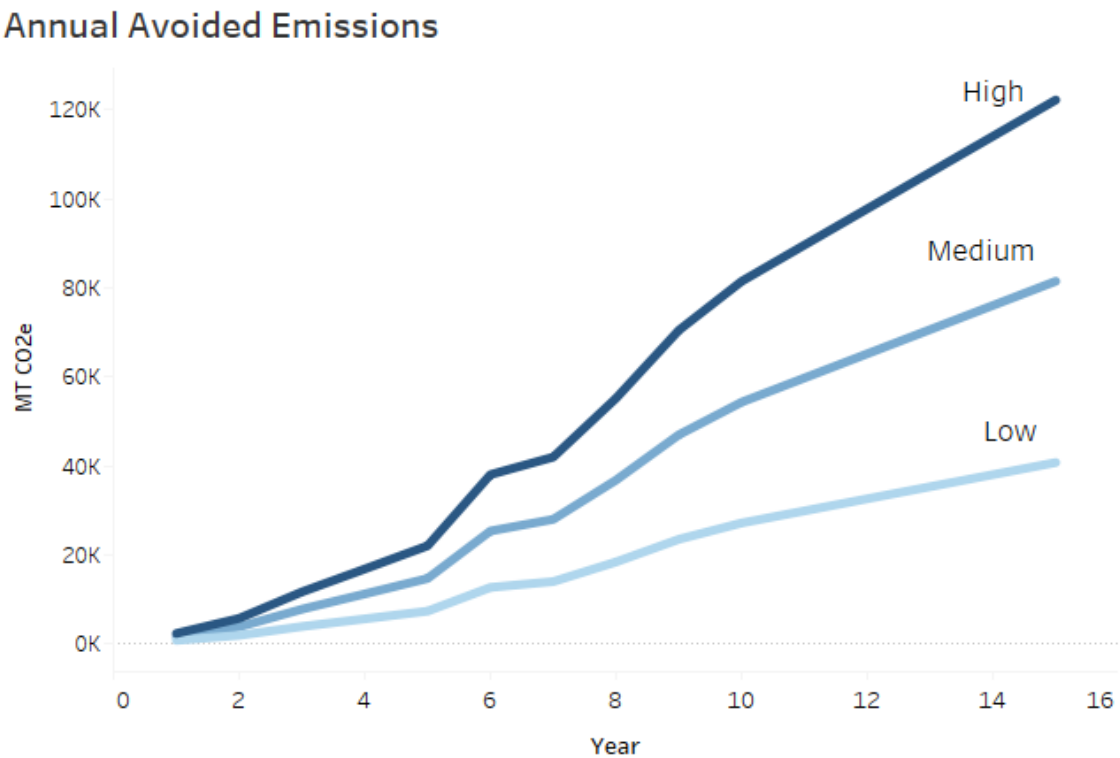
Code and Housing Assumptions



- The Austin Housing Blueprint projects 119k Single Family units will be built over 26 years (4,557 units / year)
- We estimated 68,355 new single family units over the next 15 years as our High scenario and added Medium and Low scenarios to explore a range of outcomes

Whole House Emissions Reduction





These charts show emissions that are avoided in the all electric case vs the natural gas case.

Single Family Homes Built by Scenario

Scenario	Annual	Cumulative Total (15 yrs)
High	4,557	68,355
Medium	3,038	45,570
Low	1,519	22,785

Takeaways

- Renewable energy and coal retirement commitments will dramatically lower Austin Energy user emissions from electricity use.
- New heat pump technology is very energy efficient.
- By 2023, emissions from heating air and water in buildings will be lower using electricity than natural gas.

- Further Analysis Needed:
  - Site v. source energy to account for electricity losses as well as upstream gas leakage (less important as renewable energy grows).
  - Operational and capital costs of potential changes for new and existing buildings (important for affordability).