Financial Impact of Fuel Conversion on Consumer Owned Utilities and Customers in WA

Public Webinar

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Energy+Environmental Economics

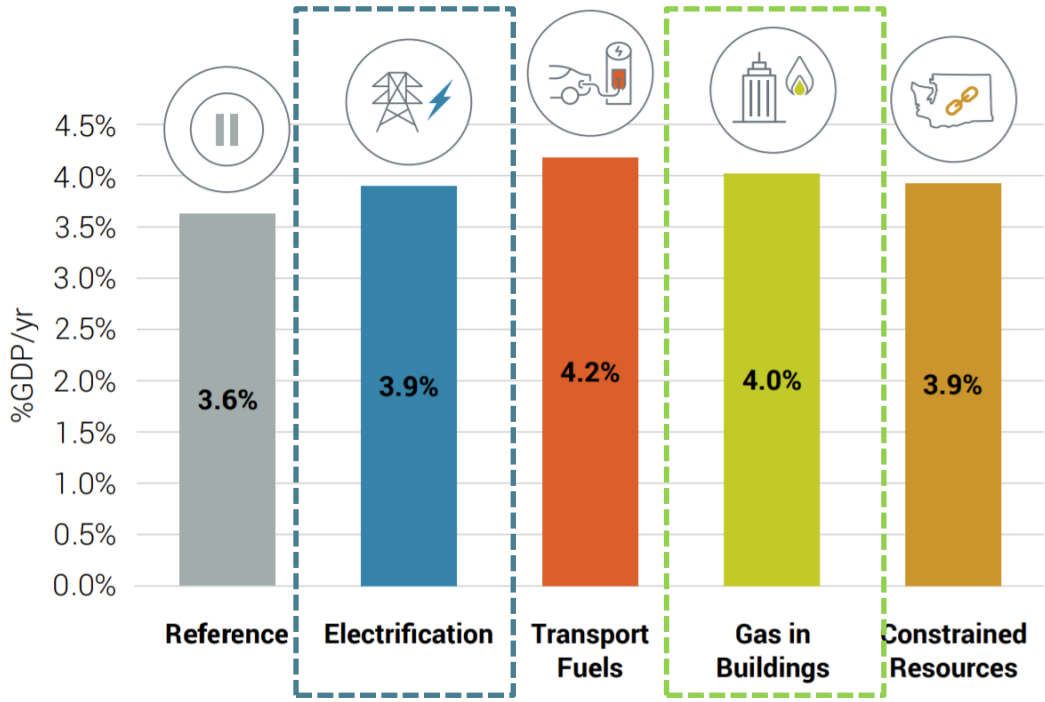
Agenda

- **Remarks by Department of Commerce (15 mins)**
- **E3's Presentation (40 mins)**
  - Background and Study Overview
  - Key Findings
  - Recommendations
- **Q&A (35 mins)**

Washington 2021 State Energy Strategy found that building electrification is a lower-cost solution for decarbonizing Washington's buildings

- **The Washington 2021 State Energy Strategy identified building electrification as a lower-cost solution to achieve the state's greenhouse gas emission targets**
  - Electrification leverages a clean electricity supply to decarbonize building sector
  - Electrification vs. Gas in Buildings scenarios show that electrification of buildings lowers costs over retaining gas uses
- **However, studies have shown that there are also significant barriers to building electrification**
- **This study assesses building electrification cost-effectiveness on the margin and potential system load impacts at scale**
  - This study aims to identify near-term opportunities and challenges

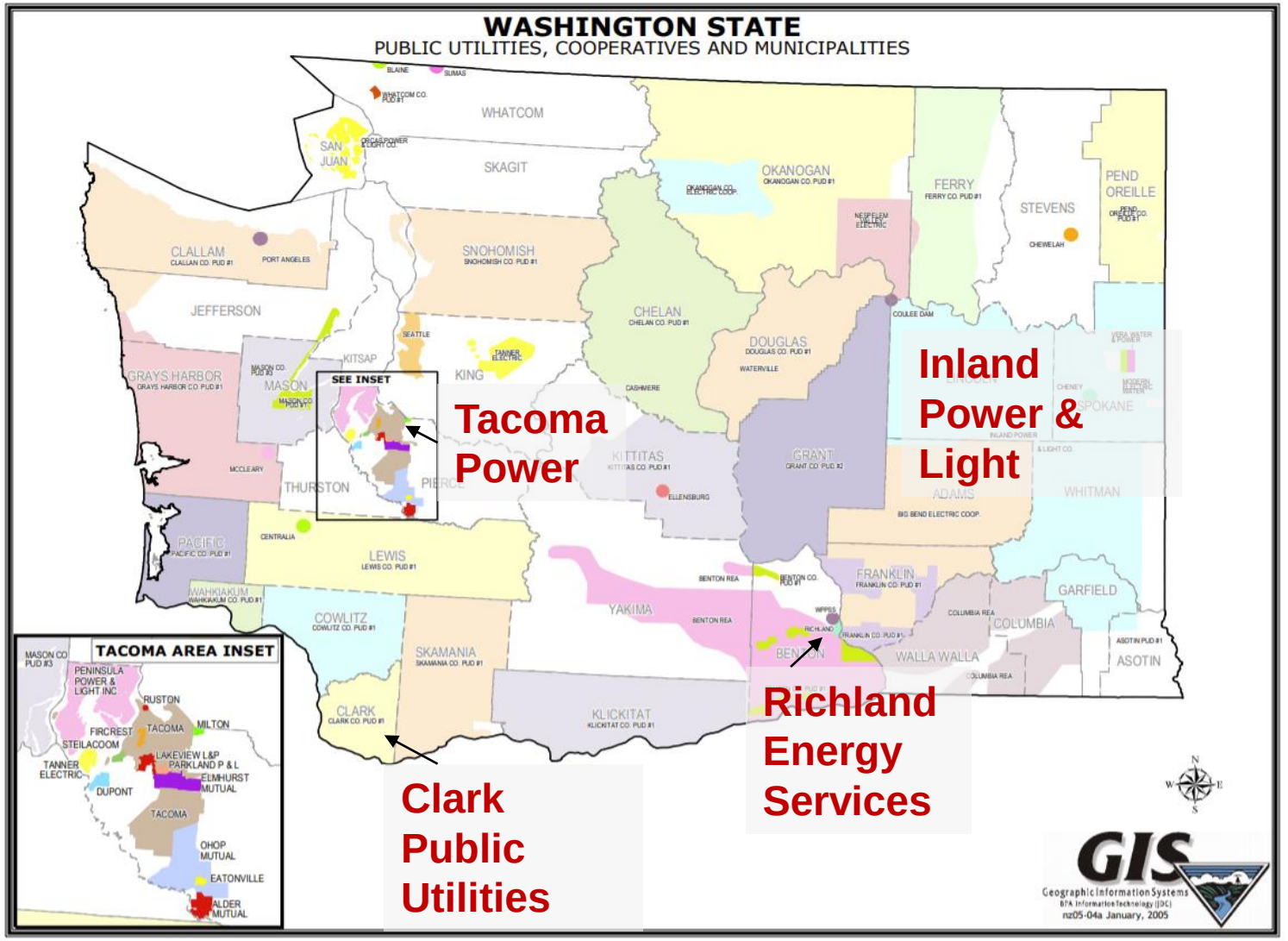
Washington 2021 State Energy Strategy
Average Annual Energy Expenditure by Scenario



Source: Washington 2021 State Energy Strategy Report (p. 39)

E3 and Commerce engaged four consumer-owned utilities (COUs) throughout this study

- E3 worked with Commerce at the outset of the study to select and recruit four COUs, with the goal of having representation of the diverse set of COUs across the state.
- The participating COUs feature different **climates**, **urban and rural settings**, and variation in the **existing technology mix** for heating buildings, among other characteristics.



This study assesses marginal costs and benefits of building electrification and potential system impacts

+ Two Core Approaches:

Benefit Cost Analysis

Assess the **marginal costs and benefits** of electrifying an individual building in each consumer-owned utility's (COU) service area from **customer and ratepayer perspectives** as well as **impacts on GHG emissions**

System Impacts Assessment

Estimate the **aggregated load impact when HVAC electrification happens at scale**; focus specifically on **heating electrification**; additional charging load from transportation electrification is NOT in the scope of this study

Key Findings

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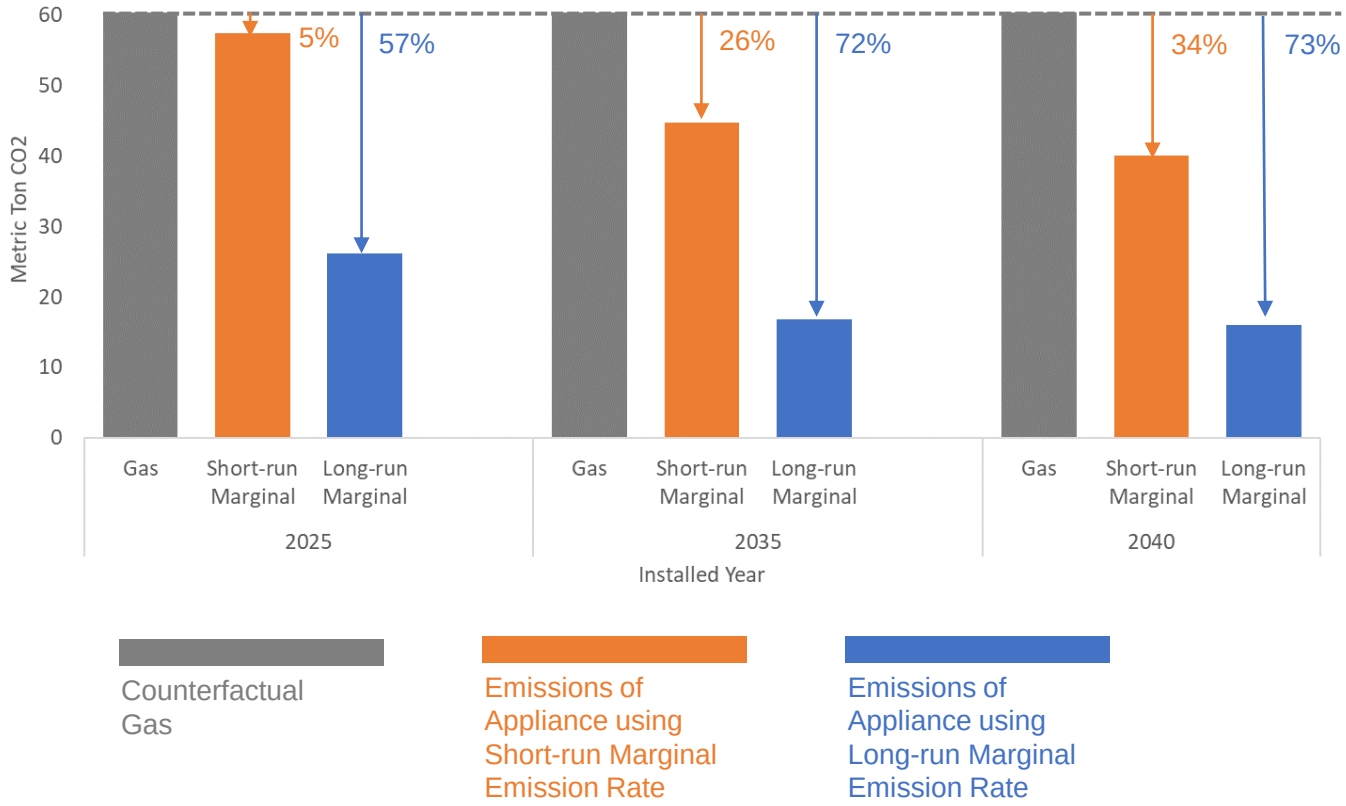
Finding I.
Building electrification reduces GHG emissions

- **Short-run marginal emissions provide the lower-bound estimate on emission savings**
  - In Washington, because incremental heat pump HVAC loads overlap with existing peak system loads, the marginal generators that will serve those incremental loads during peak hours are usually natural gas-fired and emit GHGs
- **Long-run marginal emissions offer a more optimistic view of emission savings (*used for emissions impact analysis in this study*)**
  - Reflective of long-term resource mix to serve the marginal increase in electrification load given CETA requirements.

Lifetime Emissions of Standard Heat Pump, Single-family HVAC Electrification, Richland



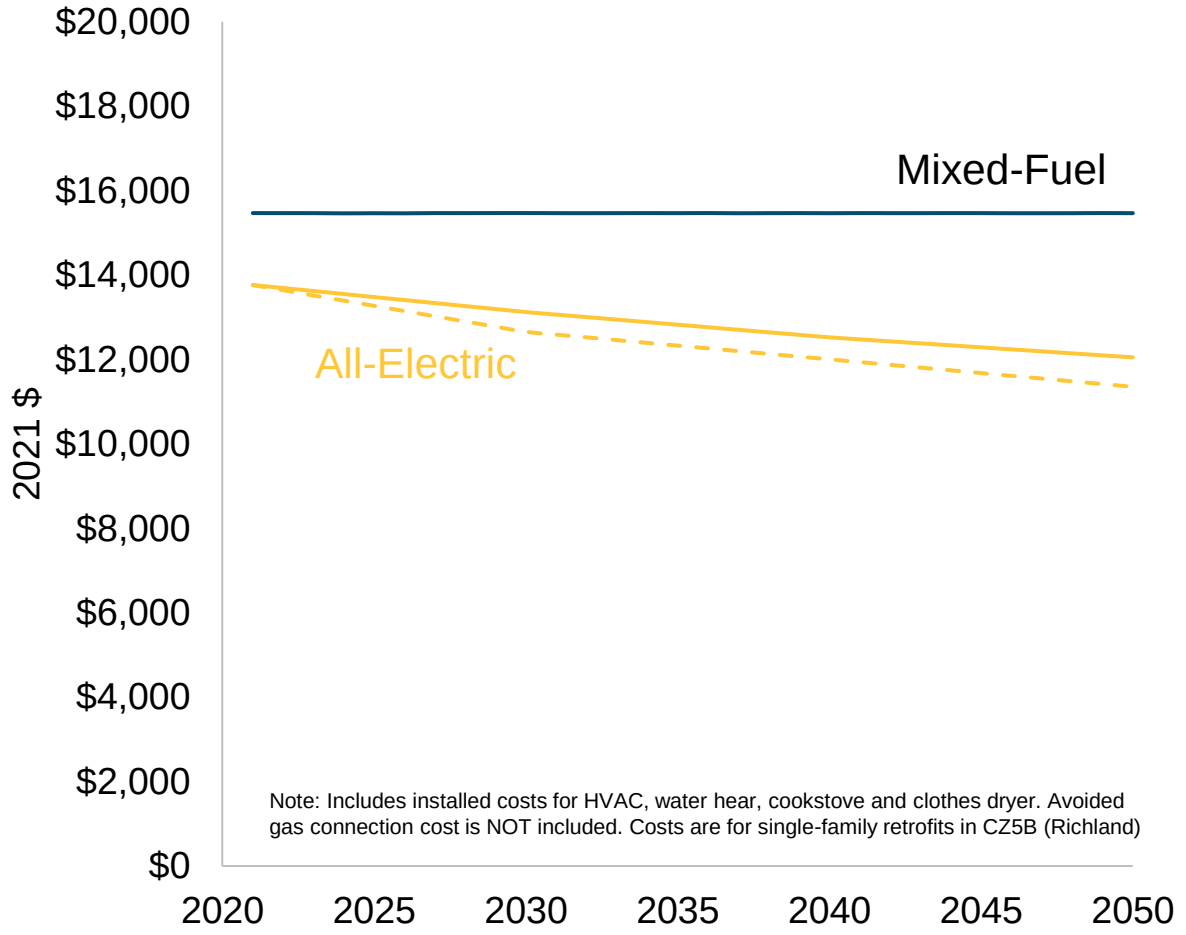
Finding II. There are several near-term opportunities where electrification can deliver cost savings for COU customers

- **All-electric new construction**
- Homes that need a **new air conditioner (A/C)** or a **replacement for an existing A/C** at the same time as a furnace installation
- Homes that currently use **oil- or liquified petroleum gas-fired (propane)** space heaters
- Retrofits to **dual-fuel heat pump** HVAC systems
- Retrofits of **healthcare buildings** to air source heat pump HVAC systems
- **Non-participating electric utility ratepayers** could see a small benefit from building electrification
- Electrification could become cost effective for consumers **if gas prices rise**

All-electric new construction offers one of the most promising near-term opportunities for building electrification

- Compared to a mixed-fuel new home with air conditioning, an all-electric new home **saves ~$2,000 in upfront participant costs**
- Considering both upfront costs and bill savings, all-electric new homes would **save ~$1,000 per year over the lifetime of the equipment**
- **All-electric commercial new construction** was found to require **higher upfront costs**, **but still generates lifecycle savings** for participants due to utility bill savings

Upfront Costs for New Home

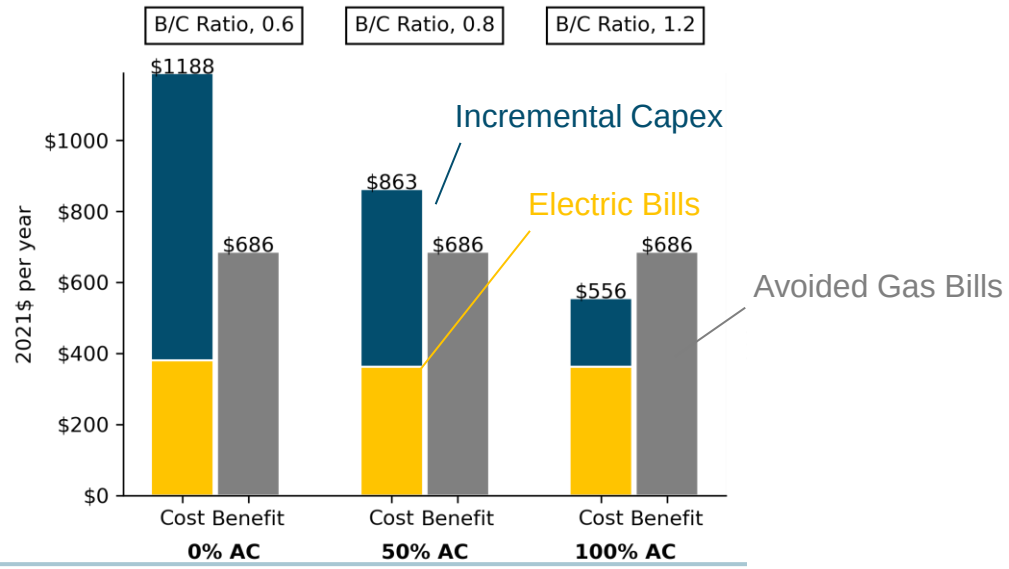


Note: Includes installed costs for HVAC, water hear, cookstove and clothes dryer. Avoided gas connection cost is NOT included. Costs are for single-family retrofits in CZ5B (Richland)

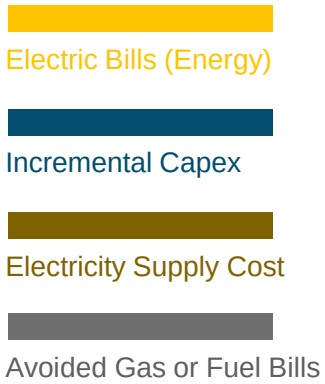
Homes that need a new air conditioner (A/C) or a replacement for an existing A/C represent another savings opportunity

- Heat pumps provide both heating and cooling, so they avoid the cost of both a furnace and an air conditioner in homes that need to replace both at the same time
- In cases where both devices do not need replacement there will be some undepreciated value for either the furnace or the air conditioner (e.g. 50% AC case below)
- Bill savings from switching to heat pumps are higher than upfront cost premium for these customers across three of the four COUs studied and thus generate lifetime savings for them

Participant Levelized Cost & Benefits
Single Family Retrofit, Clark Public Utilities



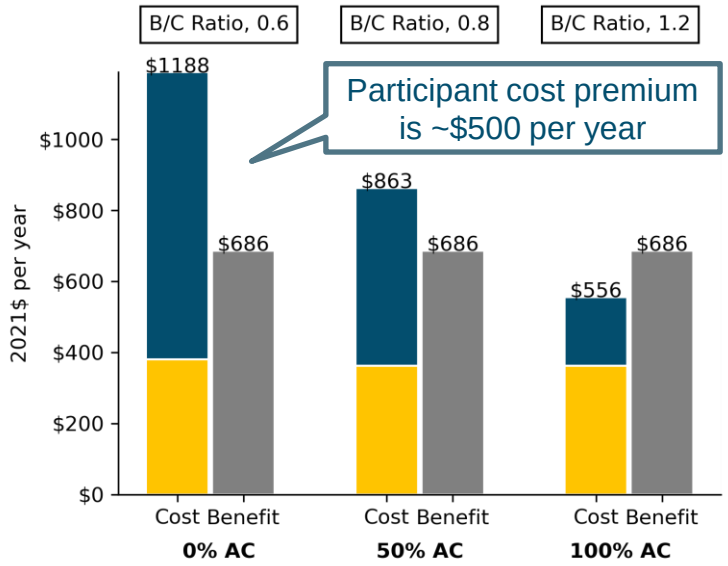
- **"0% AC"** – homes where no A/C is needed
- **"50% AC"** – homes with an existing A/C but is not fully depreciated yet at furnace expiration
- **"100% AC"** – homes where full A/C cost is avoidable at furnace expiration



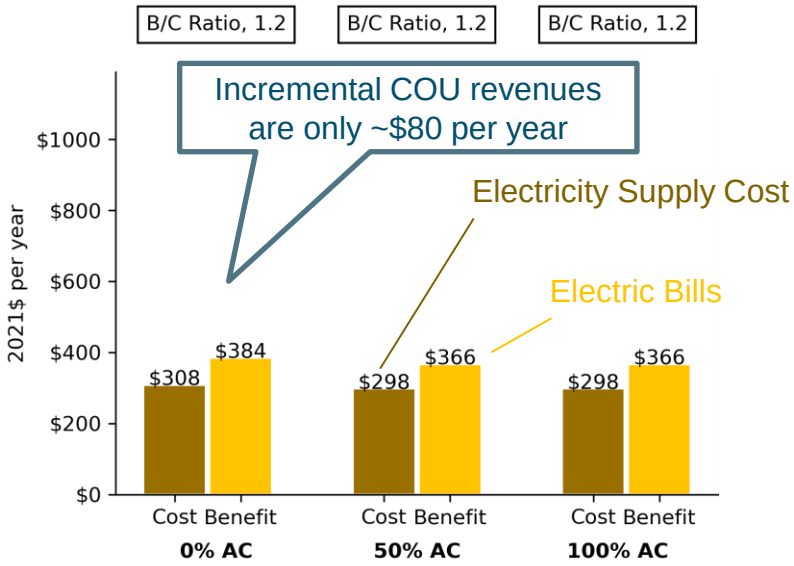
Non-participating electric utility ratepayers could see a small benefit from building electrification

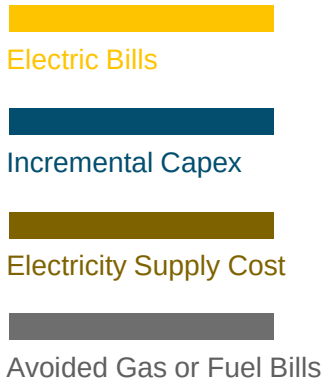
- The increase in COU revenues from those who electrify (participants) will be slightly higher than the COUs' costs to serve incremental loads for three of the four COUs (except Inland)
- Those revenues could be used to provide incentives to partially overcome the incremental upfront and lifecycle costs associated with electrification without raising rates for non-participants
- However, the incremental revenues are unlikely to be sufficient for incentives

Participant Levelized Cost & Benefits
Single Family Retrofit, Clark Public Utilities



Non-participant Levelized Cost & Benefits
Single Family Retrofit, Clark Public Utilities

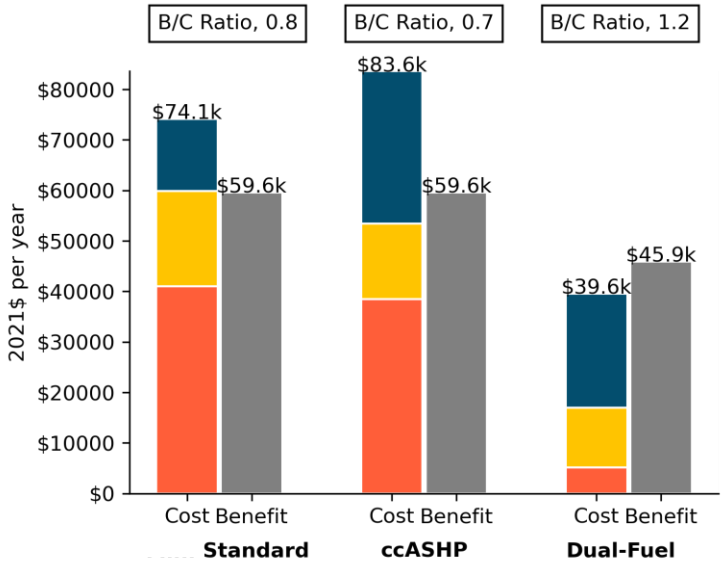




Retrofits to dual-fuel heat pump HVAC systems represent savings opportunities for commercial office buildings

- Office buildings were found to incur large increases in demand charges by switching to all-electric heat pump HVAC systems
- A dual-fuel system, by leveraging the existing gas system as a backup heating source, helps reduce the otherwise significant increase in peak load and resulting demand charges
- It achieves cost parity with a like-for-like replacement of an existing gas system in office buildings while achieving significant GHG savings.

Participant Levelized Cost & Benefits
Large Office Retrofit, Clark Public Utilities



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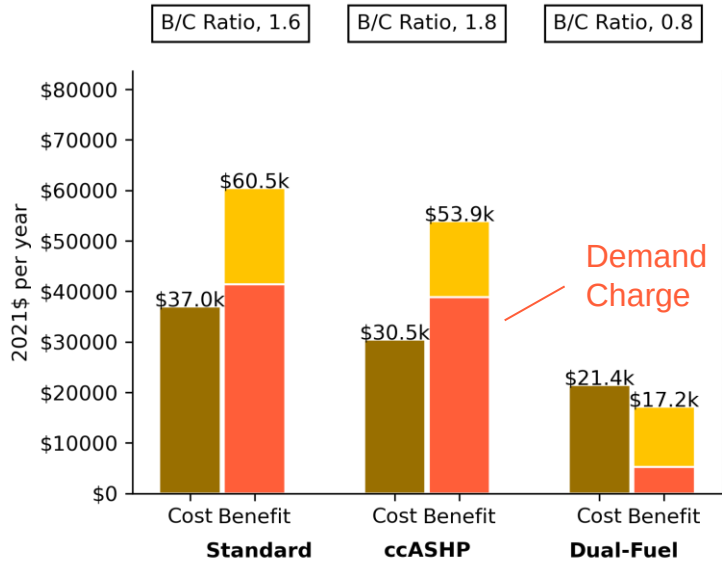
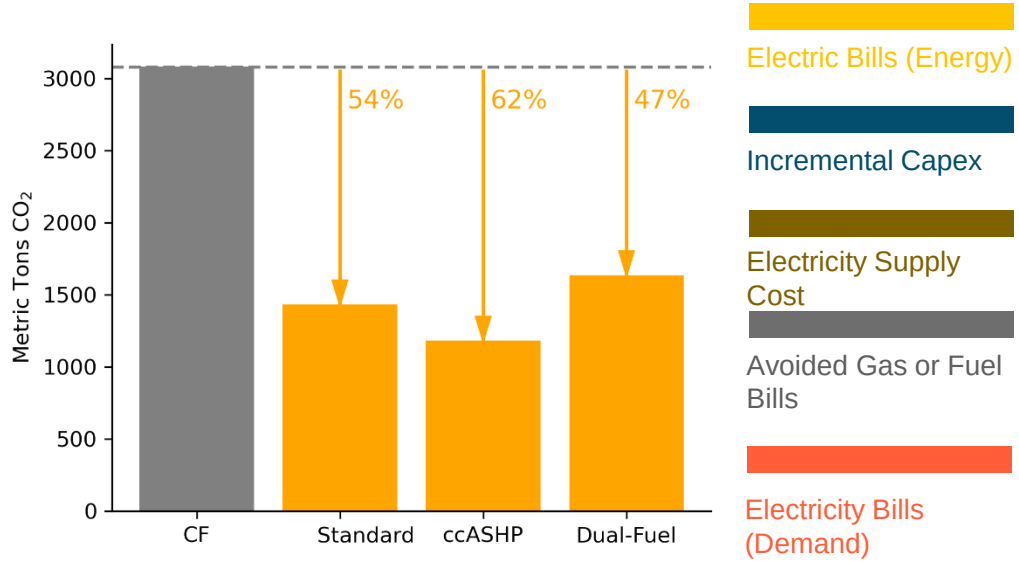


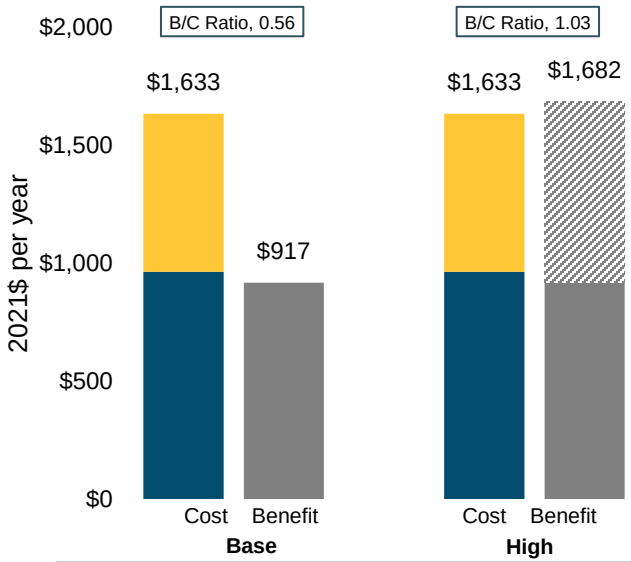
Lifetime Emissions
Large Office Retrofit, Clark Public Utilities



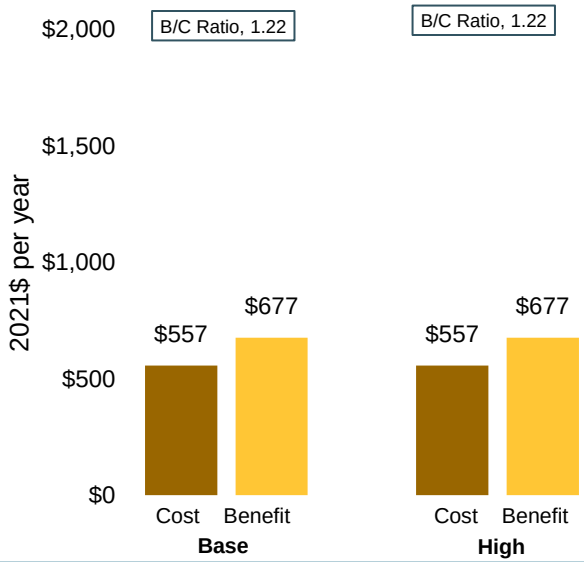
Electrification could become cost effective for consumers if gas prices rise

- **E3 conducted a sensitivity to test what if gas price goes up due to blend of RNG to decarbonize gas supply**
  - We assume renewable natural gas (~$22.5/MMBtu) is blended in the pipeline with natural gas (~$3/MMBtu), ramping up to match electrification emissions by 2030
- **The higher gas costs modeled tilt the scale and makes HVAC electrification a net benefit for participants**

Participant Levelized Cost & Benefits
Single Family Retrofit, Richland



Non-participant Levelized Cost & Benefits
Single Family Retrofit, Richland



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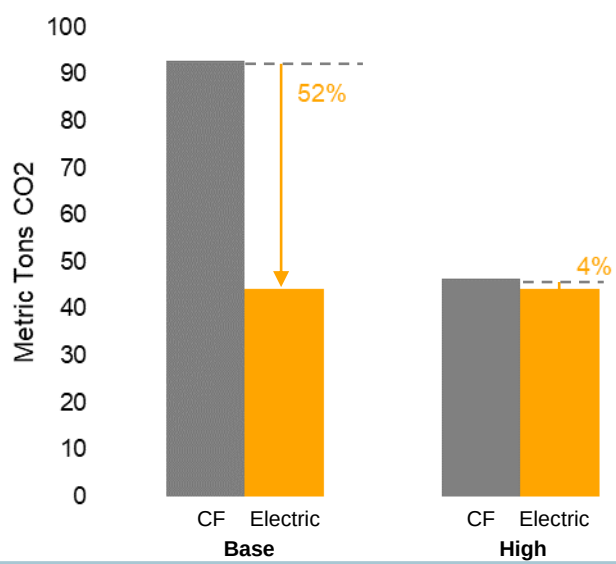
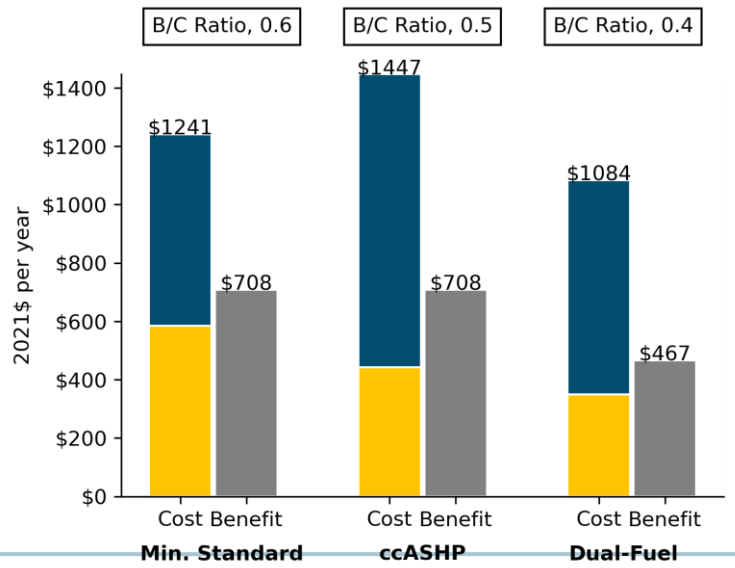


Finding III. Challenges exist for many COU customers to achieve cost savings with building electrification today

- The high incremental first costs of electrification in retrofit buildings were found to be a barrier to electrification
- Low natural gas rates make electrification more challenging for customers, in particular in Richland Energy Services' service area where gas rates are the lowest among the four COUs
- Ratepayer funds from electrification will likely NOT be sufficient to subsize the incremental costs of electrification retrofits

Participant Levelized Cost & Benefits
Single Family Retrofit, Richland



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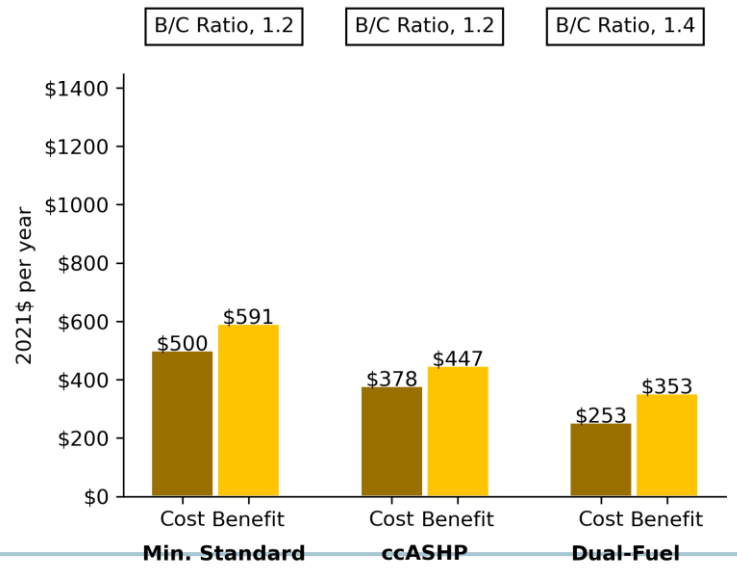
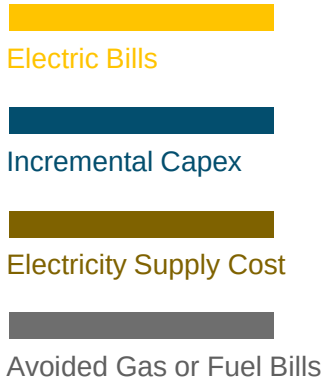
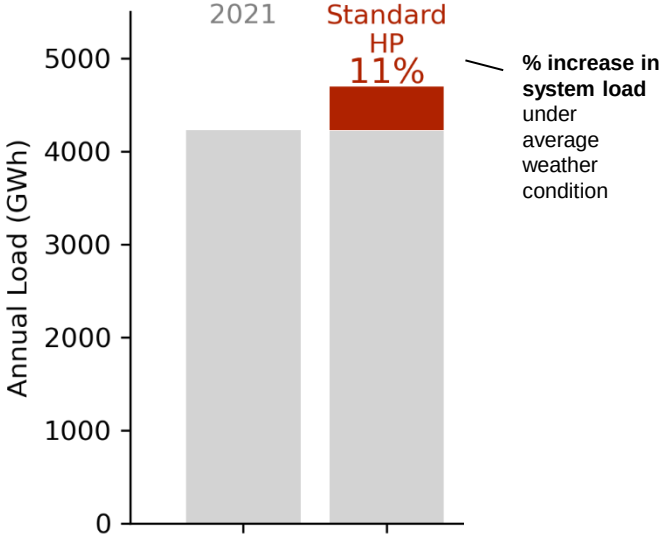


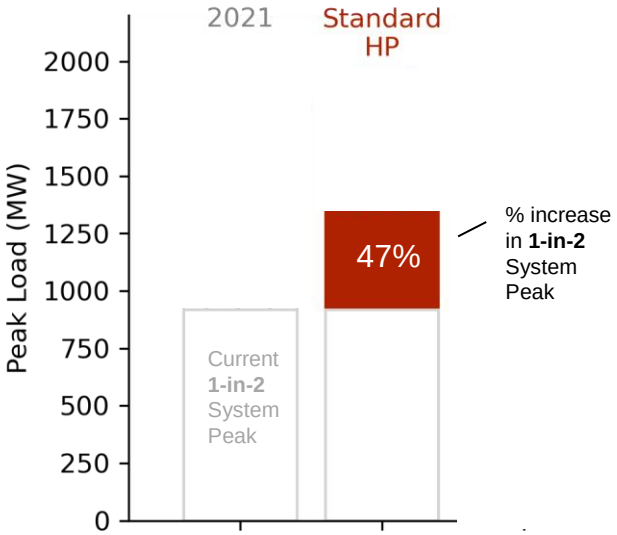


Finding IV. Utilities will likely face challenges with managing the load impact from electrification

2050 Annual Load Growth (Clark Public Utilities)



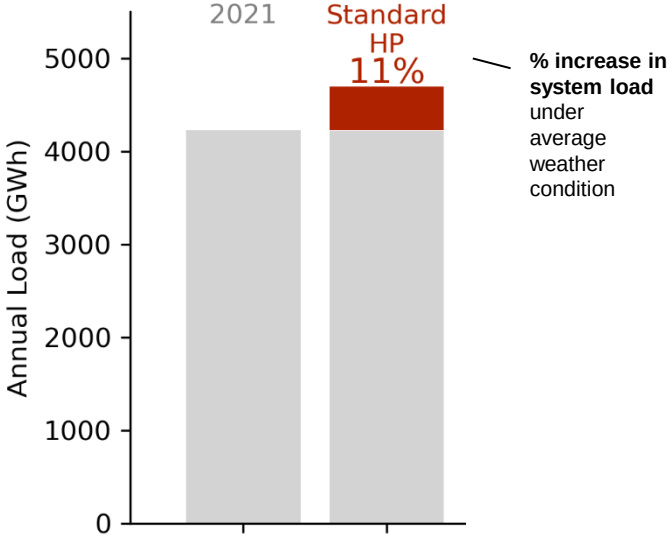
2050 Peak Load Growth (Clark Public Utilities)



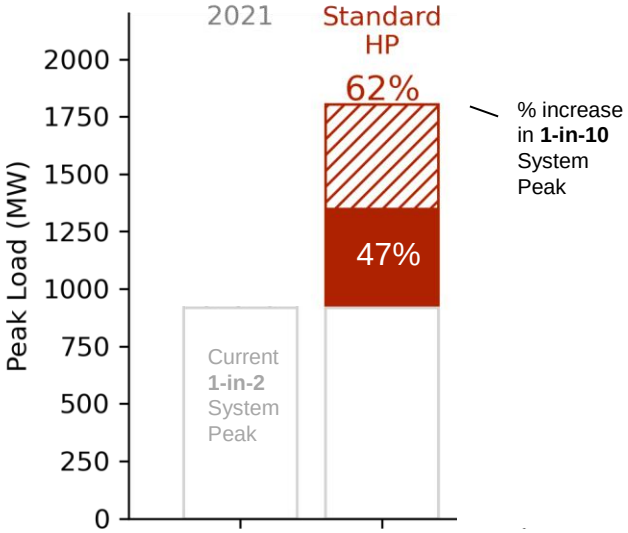
- E3's Benefit Cost Analysis results indicates that customers see the most favorable economics if they adopt lower cost heat pumps with moderate levels of performance, rather than cold climate or dual-fuel systems.
- **Electrifying buildings with those lower-cost heat pumps is found to result in significant increases in electric peak demands for the COUs studied.**
  - Peak electric load would increase by 3-10% by 2030 and 30- 70% by 2050 for the four studied COUs, at the pace of adoption envisioned in the *2021 Washington State Energy Strategy*

Finding IV. Utilities will likely face challenges with managing the load impact from electrification

2050 Annual Load Growth (Clark Public Utilities)

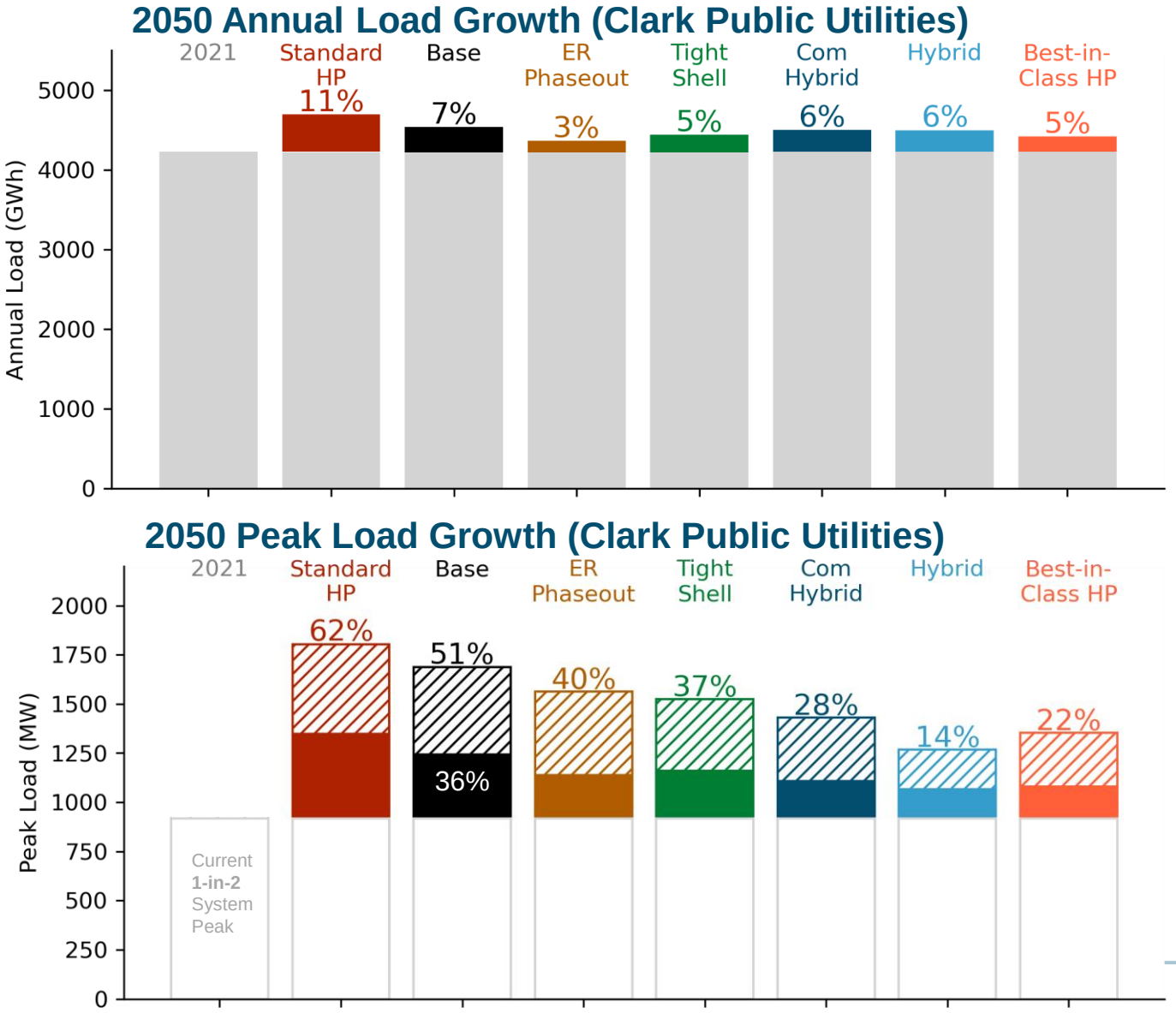


2050 Peak Load Growth (Clark Public Utilities)



- **During extreme cold weather (e.g. a once-in-10-year cold event), peak load impact is particularly large due to the reduced efficiency of heat pump systems**
  - Capacity and efficiency of the compressor becomes lower during cold events
  - The system also relies more on resistance supplemental heat

Finding IV. Utilities will likely face challenges with managing the load impact from electrification



- **Intervention measures** can reduce the system load impacts from electrification **by up to 60% for all-electric systems** and **85% for dual-fuel systems**
- Intervention measures evaluated include incentivizing **best-in-class heat pump** models, encouraging **building shell improvements**, **dual-fuel heating systems** and replacing **electric resistance** heating with heat pumps,
- However, some of the measures evaluated may not be cost effective today.

Recommendations

1. **Incentivize all-electric new construction**
2. **Target heat pump HVAC at customers that need new air conditioners and those currently relying on fuel oil or propane for heating**
3. **Provide subsidies to lower the incremental consumer costs of electrification**
4. **Ensure efficient price signals are conveyed in electric and natural gas rates**
5. **Implement measures to alleviate peak load impact from electrification**
   - Support market transformation of high-efficiency heat pump models to reduce their cost premiums
   - Target replacement of electric resistance heating with more efficient heat pump HVAC systems
   - Incentivize shell improvements for older buildings
   - Leverage demand response (DR) programs to help lower the peak system load and electric bills for commercial customers
   - Encourage customers to install dual-fuel heat pump HVAC systems
6. **Carefully design policies to support the large infrastructure needs for building electrification and potential high capital investments**

Thank You

Q&A Session

Access E3's report here

***Detailed study output will be published soon on Commerce's website**

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