

City of Charlottesville

Natural Gas Decarbonization Study

Disclaimer: Data within this report is still in the analysis phase of this study and should not be considered final.

Prepared By Black & Veatch

October 16, 2023

Agenda

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Goal of this session: To provide a progress update on the decarbonization study. Analysis is still underway and on-track for March 2024 finalization

1. Project Scope & Review Project Progress
2. Initial Benchmarking of CoC System
3. CoC Natural Gas & Emissions Trends
4. Evaluating Decarbonization Solutions: Emissions, Reliability & Affordability
5. Discuss Next Steps

Project Objectives & Scope of Work

City of Charlottesville Goal

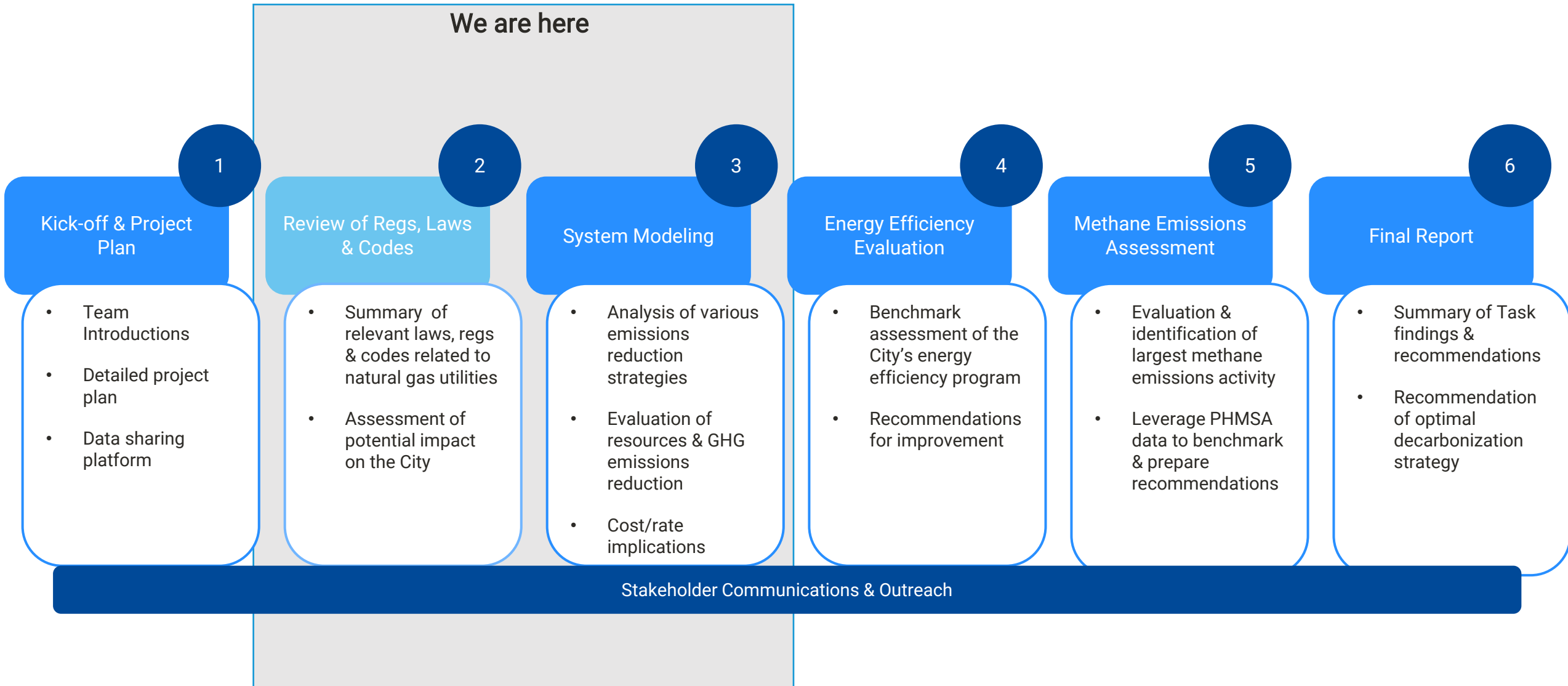
- On July 1, 2019, City Council adopted the goal of a 45% reduction in community-wide greenhouse gas emissions by 2030 and a goal of carbon neutrality by 2050. Both of these reduction measures will be based on the 2011 inventory year

Study Objective

- The City of Charlottesville owns, operates and maintains a natural gas utility. The Department of Utilities has solicited the expertise of Black & Veatch in order to determine how the gas utility can be a part of the solution in achieving and aligning itself with the community's greenhouse gas reduction goals as well as continuing to provide reliable and affordable services to its customers



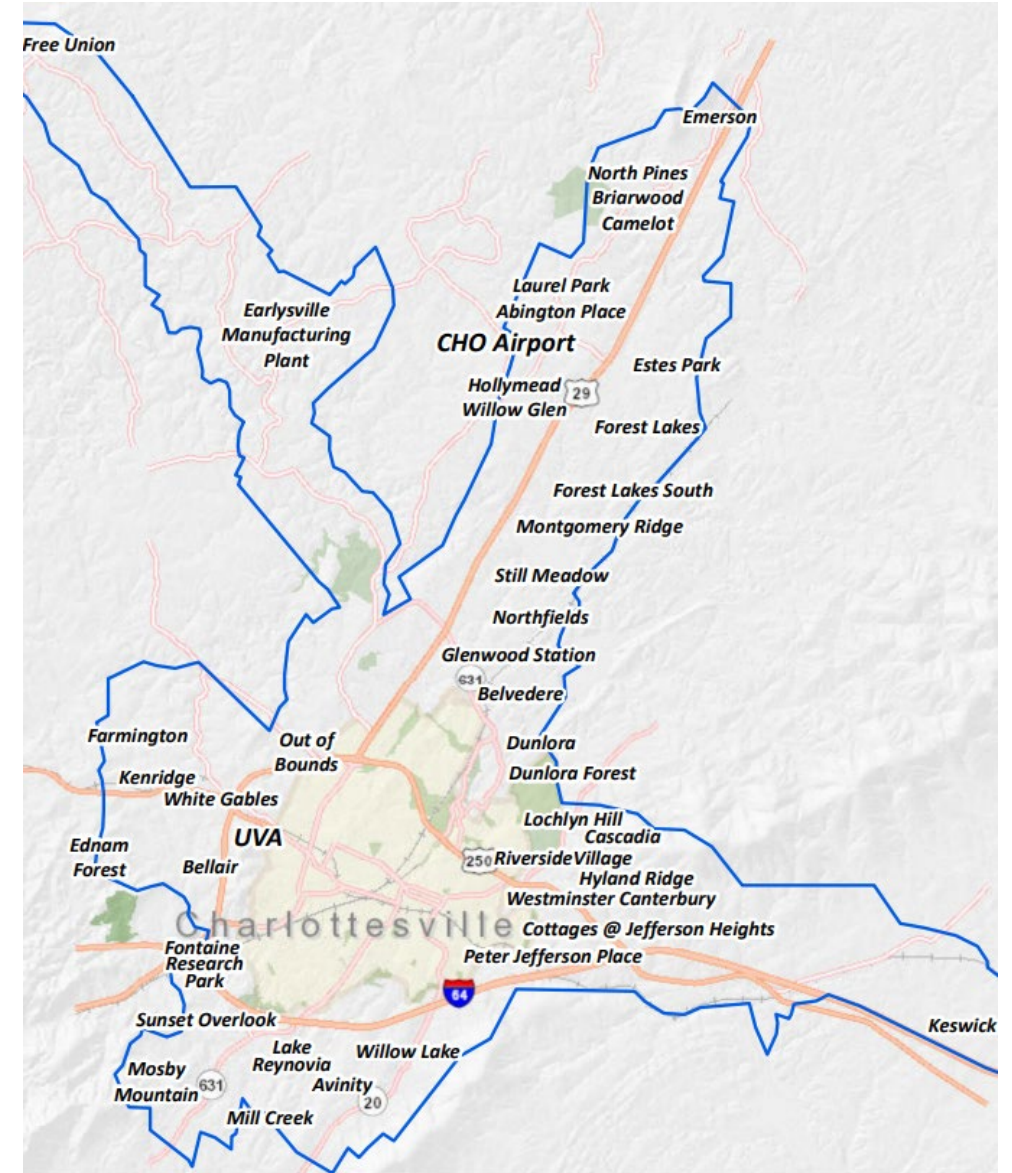
Our Approach: Project Status



The City of Charlottesville Gas System

- Roughly 343 miles of distribution mains & 303 miles of gas service lines
- The City of Charlottesville gas provides natural gas service to approximately 16 industrial customers, 2,411 commercial customers & 18,873 residential customers in both the city & county¹
- System (mains) is comprised of primarily plastic material (79.6%) or cathodically protected coated steel (20.2%). **Only 1 mile of cast iron in the system**
- Relatively new system with the greater majority installed in the 1990s following pipeline replacement. Industry expectation is that plastic pipeline has a useful life well over 100 years
- The average utility in its peer group has distribution services of which approximately 75% are made of plastic and 24% are cathodically protected, coated steel. **CoC's split is more like 99%/1%**

Note: ¹ 12,243 customers are located in the City & 9,057 in the County



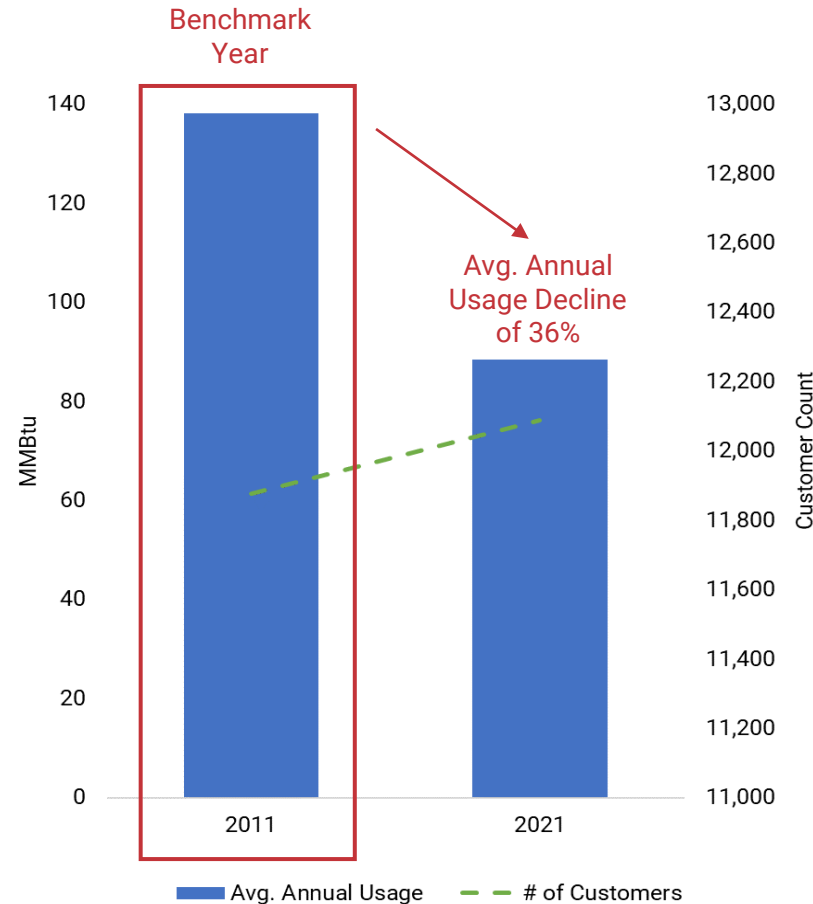
Natural Gas Demand in CoC is Decreasing

And on average customers are using less natural gas

City of Charlottesville Annual Throughput (MMBtu)



Average Annual Usage Per Customer (MMBtu)



Natural gas demand in the City of Charlottesville has **decreased nearly 35%** since 2011, despite only a 1.77% growth in the number of customers, respectively



System-wide, customers used an average of 88.5 MMBtu/year in 2021 **a decline of 36% per customer** as compared to 2011



Natural gas demand is trending down in many U.S. utilities, as energy efficiency opportunities are leveraged & new customer connections slow

The City of Charlottesville is reducing its GHG footprint

Via three different programs

1

Purchase of Carbon Offsets of 7,500 MMBtus per day, **offsetting 25%** of GHG emissions from CoC's natural gas supply, per day

2

Energy Efficiency programs for attic insulation, programmable thermostats, CoC's LEAP program

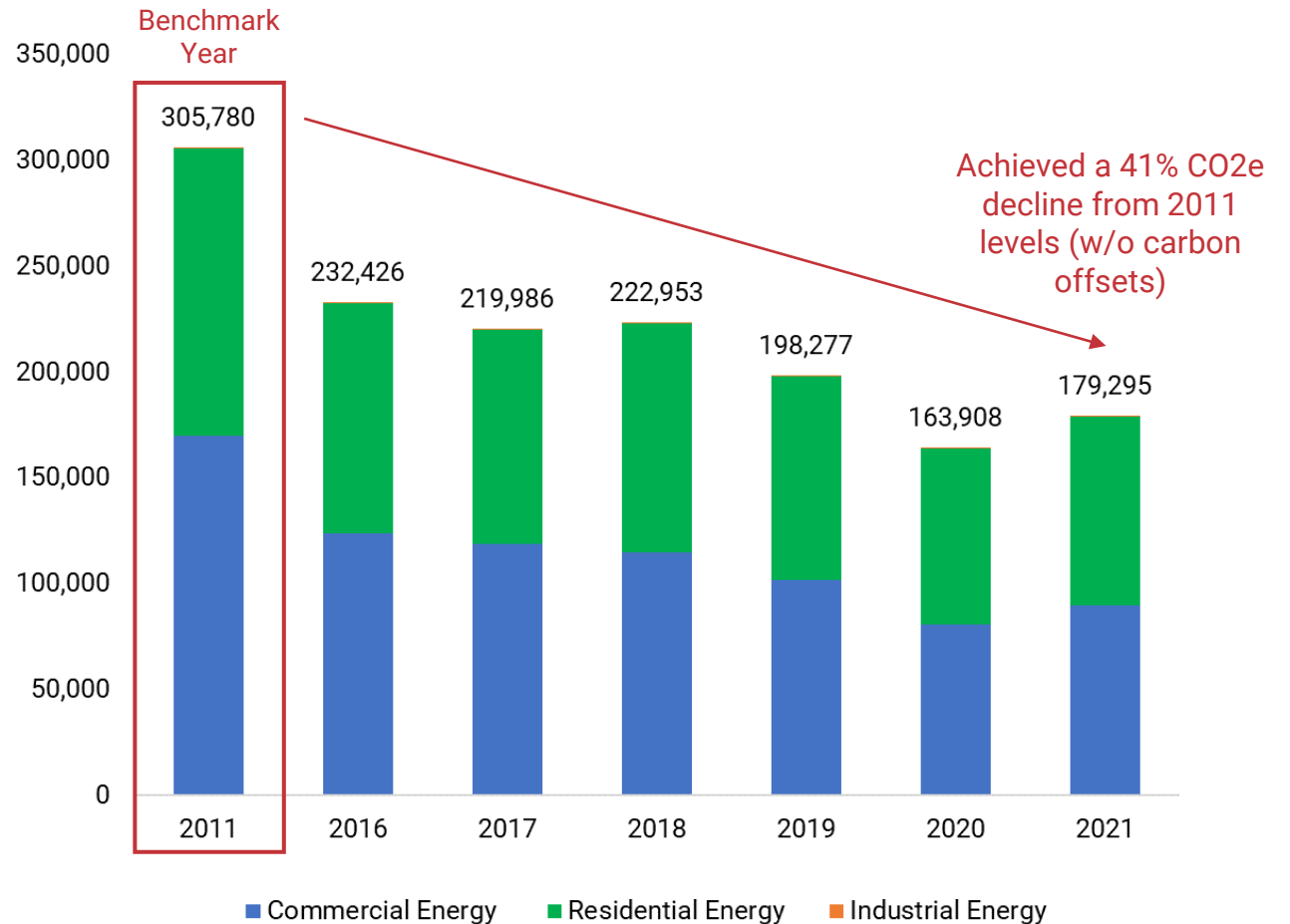
In the Charlottesville Gas Energy Efficiency Program (CGEEP) alone, participants averaged **20% reduction in gas usage** in winter months

3

Replacement of legacy cast iron pipes with HDPE plastic pipe via a \$7.1 M federal grant. EPA estimates the average mile of cast iron distribution main **loses nearly 240 Mscf** of natural gas per year as compared to **9 Mscf** per year for one mile of plastic main¹

Note: ¹ EPA Table W-7 to Subpart W of CFR 98

Energy Emissions Inventory (MT CO2e) Without Carbon Offsets



The City of Charlottesville System: Preliminary Methane Assessment¹

- CoC's average leak rate is below national average of roughly 221 leaks per 1,000 miles of distribution system as per the US Dept of Transportation's PHMSA database
- Since the implementation of the Public Awareness Program in 2007, the number of 3rd Party Excavation incidents dropped by ~76 %
- CoC's top risk ranked under the DIMP is excavation damages caused by third parties, which accounted for 80 leaks over the past 3 years

Year	Leaks on Mains	Leaks on Services	Total CoC Leaks	Total Leaks Eliminated per 1,000 Miles of Distribution System ²
2020	39	80	119	186
2021	22	68	90	139
2022	8	110	118	182

Note: ¹ A more detailed assessment of Methane Emissions will be provided in the Task 5 – Methane Emissions Deliverable

² Calculated as follows: (total system size in miles x total system leaks)*1000.

Remaining Emissions from Natural Gas

Black & Veatch is leveraging its expert approach to evaluate remaining emissions reduction strategies

Our Solution Evaluation Framework

Category	Topic	Deployment Timeframe		
		Short Term (<3 years)	Medium Term (3-10 years)	Long Term (>10 years)
Commercial Accelerators, Risks	Supply chain development & risks			
	Availability, commercialization horizon			
	Feasibility in service territory (viable locations)			
	Regulatory and policy barriers			
Economics	Economic considerations (unit costs and trends)			
	Regulatory and policy incentives (tax credits, funding)			
	Related investment opportunities			
Business Case Applications	Carbon intensity			
	Use cases (efficiency, backup power, offsets, etc.)			

We are evaluating emissions reduction strategies through the following lens:

- 1 Evaluation of maturity and **reliability** of the solution/technology
 - 2 Evaluation of the solution/technology total **emissions reduction** potential
 - 3 Evaluation of **affordability** of the solution/technology for end-users
-
-  An expert, holistic assessment of reliability, emissions reduction potential & affordability, for the best solution for the City of Charlottesville

Range of Solutions

Black & Veatch has identified a broad range of solutions to ensure a thorough assessment of alternatives (& combination of alternatives) in its final recommendations



Low Carbon Fuels

- Low Carbon Hydrogen
- Renewable Natural Gas
- Certified Natural Gas



Energy Efficiency

- Behavior Changes



Renewables

- Onsite renewables; rooftop solar
- Network Geothermal



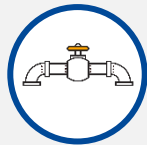
Offsets

- Carbon Offsets
- Direct Air Capture Offsets



Electrification

- Total Building Electrification



Pipeline System Upgrades

- Cast Iron Mains Pipeline Replacement
- Excess Flow Valves

All technologies & solutions will be compared and evaluated based on the framework described, with emphasis on **reliability**, **emissions reduction** potential, and **affordability**

Heating Electrification Example

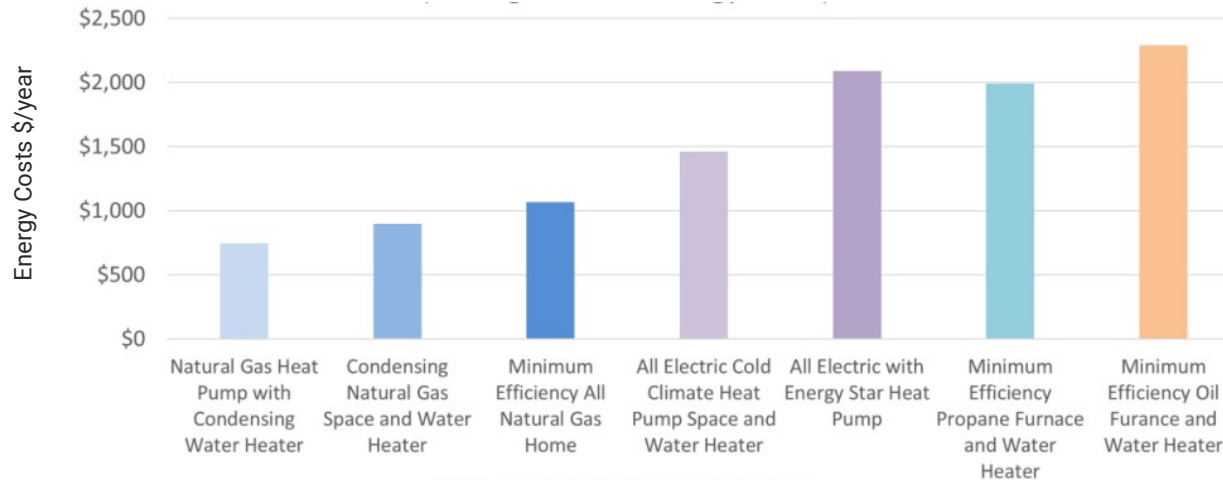
Data is being presented as an example of how evaluations will be completed. This not representative of final results.



Heating Electrification Economic Comparison

Appliance	Avg. Appliance Cost (\$/2023)	Installation Cost (\$/2023)	Existing Rebates	Total Upfront Costs
Electric Water Heater (Heat Pump) – 50 Gal	\$1,781	\$3,750	IRA at 30%: \$1,659	\$3,872 w/ rebate
Natural Gas Heating – 50 Gal	\$1,000	\$1,750	None	\$2,750

Cost Comparison of Home Energy Usage (Average Energy Costs)



2072 sq ft Single Family Home by Fuel Type

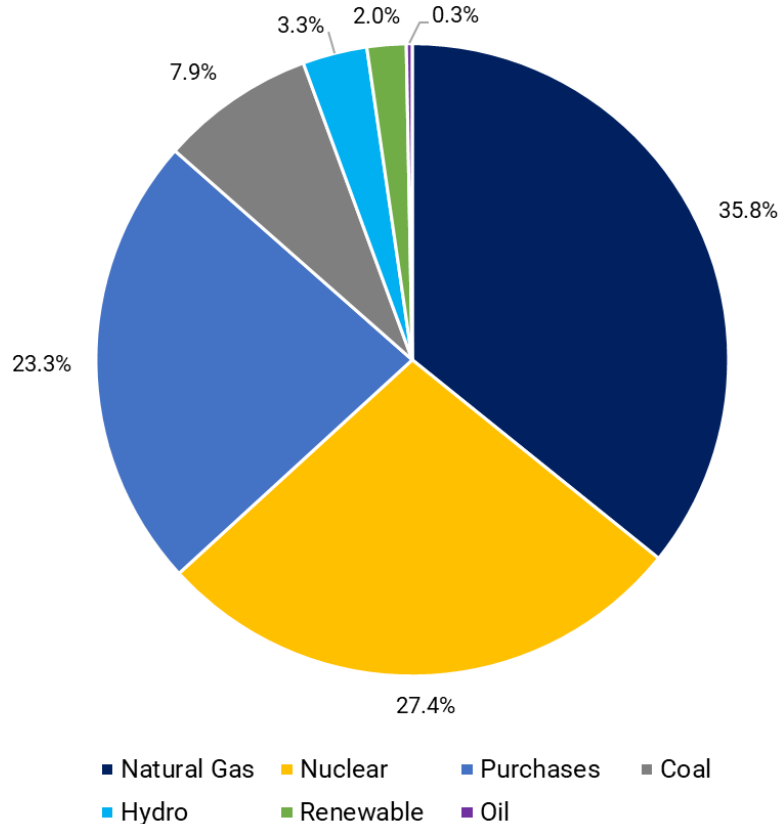
Assumptions and Considerations

- 1 Despite higher upfront costs, fuel efficient electric heat pumps yielded annual energy savings, however cost savings are fully dependent on electricity rates
- 2 Emissions reductions associated with electrification depends on the electricity generation profile of the local utility
- 3 Average annual energy costs are from AGA's March 1, 2023 "Comparison of Home Appliance Energy Use, Operating Costs, and Carbon Dioxide Emissions 2022 Update"

Electrification Driven Emissions Reduction

Total emissions reduction driven by electrification depends on the generation asset creating the electrons

Dominion Energy Virginia's 2022 Fuel Source Mix¹



In 2022, at least 44% of Dominion Energy Virginia's fuel source mix is thermal resources (natural gas, coal, & oil)



Though emissions reductions would be achieved via electrification, unless 100% of electricity is generated from renewables, zero emissions would not be achieved



Dominion Virginia has extensive plans to further decarbonize its generation fleet including its \$9 billion offshore wind project, dramatic increases in solar & wind, energy storage, and advanced nuclear technology, but proposes to maintain some of its natural gas units



Evaluating a balance of electrification & other emissions reduction strategies is important in maintaining reliability & affordability

Important Customer Information from Dominion Energy Virginia

In 2022, the Company served over 2.7 million customers, generated 74,137,444 megawatt-hours (MWh) of electricity and met its 17% Renewable Portfolio Standard requirement. Total direct based on tons per MWh of electricity generated, from Company facilities were 0.00006 tons of sulfur dioxide and 0.00009 tons of nitrogen oxides. The fuel source mix was 35.8% natural gas, 23.3% purchases, 7.9% coal, 3.3% hydro, 2.0% renewable, 0.3% oil.

Source: ¹ Dominion Virginia's Report to the State Corporation Commission of Virginia on Fuel Mix & Emissions Data for 2022

Next Steps & Questions



Evaluate technology/solutions scenarios leveraging the study evaluation framework



Expand stakeholder engagement in study progress & solutions



Complete methane and energy efficiency benchmarking assessment



Draft and issue final report with emission reduction strategy recommendations and estimated impact on costs to rate payers

Thank you!

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