Monterey Bay Community Power
Electrification Forecast and Target Setting

September 2019

Final Report

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Overview

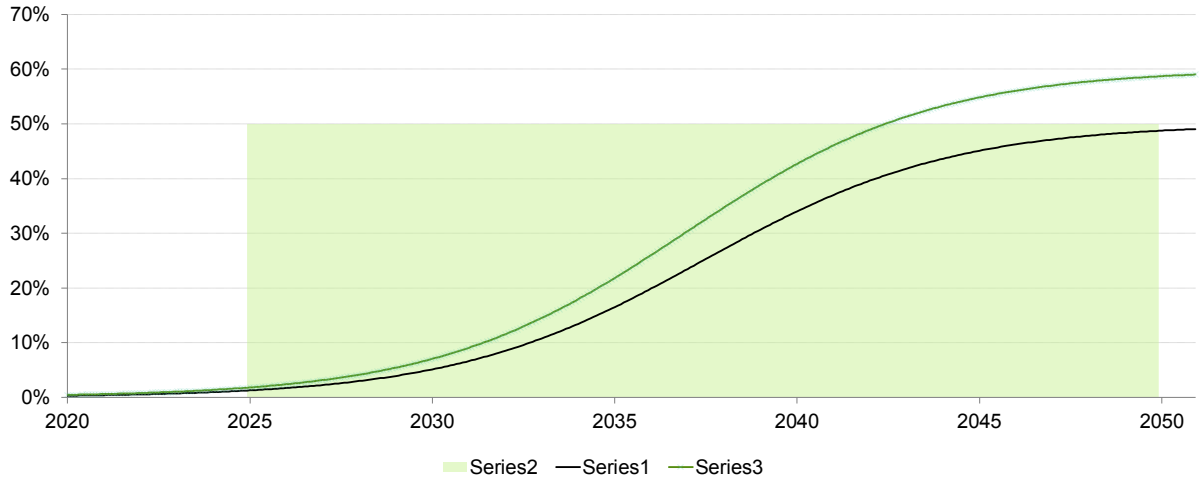
The Electrification Forecast and Target Setting report is task 2 of Monterey Bay Community Power's Electrification Roadmap (the Roadmap).[1] The forecast and targeting setting efforts focused on a set of measures in the residential and commercial built environment and vehicle markets that were first defined in the Inventory and Market Characterization report, task 1 of the Roadmap. The methodology used for the forecasts is based on a diffusion model developed for each of the built environment measures and electric vehicle types analyzed. These models were developed to define a baseline adoption curve, reflecting what the market would do without MBCP program interventions, and how market adoption might change with program funding as defined in the Roadmap report. Assumptions used in each of the diffusion forecast models include:

- Start value: This is when a technology or program is introduced. This defines the starting point from which adoption occurs.
- Target value: This is the maximum expected penetration after the product or service becomes mainstream.
- Start of fast growth: This is the start of the second phase of adoption, rapid growth, that starts at 10% of the saturation value.
- Takeover Time: This is the time duration of the second phase, which is generally when adoption grows from 10% to 90% of saturation limit or target value.
- Baseline Market Adoption: This is the baseline forecast representing market adoption absent of additional market interventions that drive additional adoption, accelerate the time at which adoption begins, or increase the overall market level of adoption. All built environment measures and electric vehicle types for which we developed forecasts have a baseline market adoption forecast that is based on either known forecasts or our interpretation of the baseline based on market research.
- High Market Adoption: This represents faster market adoption than the baseline resulting from factors that drive adoption such as increased available capital or supportive polies and programs that accelerate the time at which adoption begins or increase the overall level of adoption. In our forecasts we consider that the impact of MBCP programs defines the incremental difference between the baseline adoption forecast and the high market adoption forecast.

Figure 1 provides a graphic example of a diffusion curve and a summary of the results for the forecasts for each measures and electric vehicle types modelled is provided in Appendix A, Forecast Details.

[1] 2019 Request for Proposals for Electrification Strategic Plan, 11/26/2019

Figure 1: Example of a Diffusion Based Technology Adoption Forecast



The forecast provides an estimate on the increased electricity supply required to replace the natural gas, propane, gasoline, or diesel fuels being displaced through electrification. Figure 2 shows the cumulative additional kWh that must be supplied to meet the increased demand for electricity resulting from the combined electrification impacts in the residential and commercial built environments and vehicle fleets defined in the task 1 Inventory and Market Characterization report. We forecast that market interventions will increase the cumulative demand for electricity by approximately 94 GWh above baseline needs by 2025, growing to 388 GWh by 2030.

Figure 2: Cumulative Additional kWh Consumption by Market Segment and Program Year

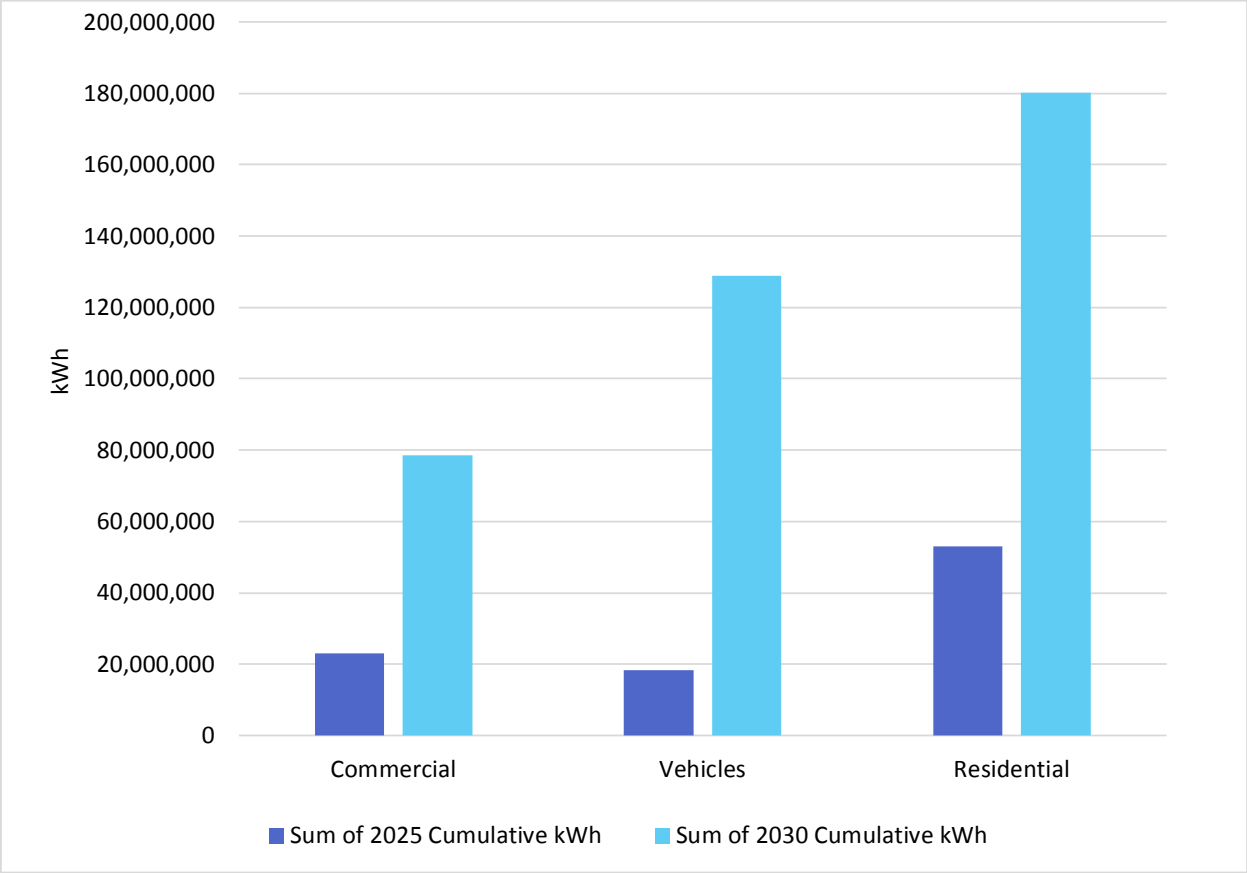


Table 1. Change in Cumulative Program Electricity (kWh)

Measure	2025	2030
Built	76,166,309	258,878,929
Commercial NG Hot Water Heating	14,687,287	49,814,191
Commercial NG Space Heating	8,429,183	28,754,761
Residential NG Hot Water Heating	31,998,641	108,717,326
Residential NG Space Heating	7,942,112	26,456,920
Residential Propane Hot Water Heating	7,801,717	26,758,344
Residential Propane Space Heating	5,307,368	18,377,388
Vehicles	18,307,647	128,881,894
Heavy Duty Trucks	0	0
Light Duty Vehicles	6,037,976	34,631,779
Light-Medium Duty Trucks	11,391,066	89,175,800
School Bus	153,571	508,782
Transit Bus	725,034	4,565,532
Grand Total	94,473,956	387,760,823

Table 2 shows that in 2025 the built environment will account for 81% of additional electricity requirements resulting from MBCP program activity and 19% from vehicles. This will likely shift overtime as new electric vehicles enter the market and sales increase such that by 2030 electric vehicles account for 33% of cumulative new electricity supply requirements. All of the built environment and electric vehicle initiatives defined in our forecast will take place in a broader market that will be adopting these same measures in the absence of any program activities undertaken by MBCP and this is referred to as the baseline forecast, as previously discussed. Table 3 shows the additional electricity sales from the change in baseline consumption, the contribution from MBCP programs and total new cumulative kWh requirements by 2025 and 2030. The forecast estimates that for the measure included in this forecast, the activities undertaken in the program roadmap will increase electricity demand by 22% in 2025, growing to 26% of total new demand, including baseline, by 2030. The forecast does not account for external market factors, such as decreases in the demand for grid supplied electricity from energy efficiency or the installation of distributed generation. Additional details on forecast inputs and assumptions are provided in Appendix A, Forecast Details and Appendix B, Global Forecast Factors.

Table 2. Market Source of Cumulative Program Electricity

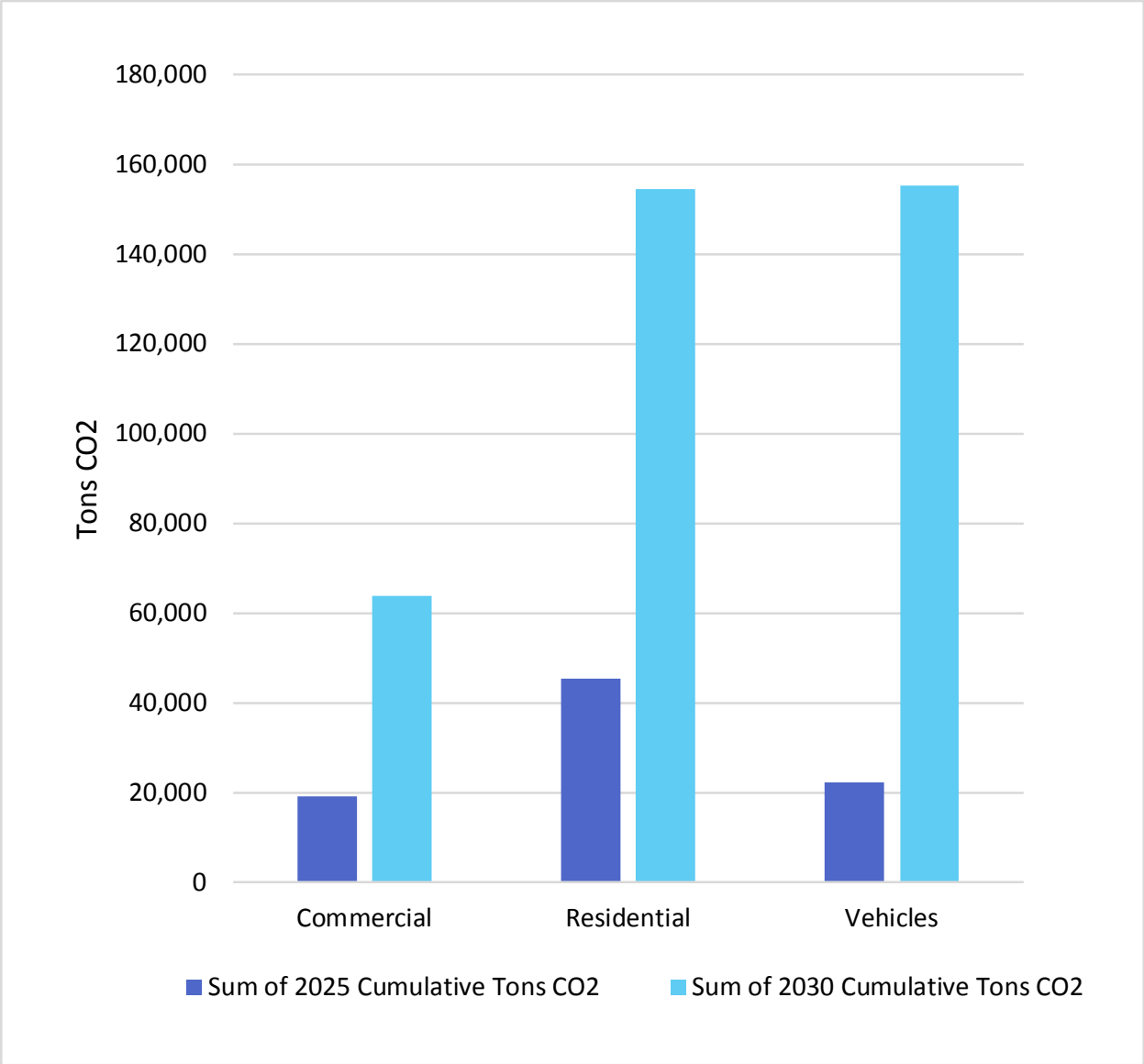
Year	2025	2030
Built Environment	81%	67%
Electric Vehicles	19%	33%

Table 3. Change in Cumulative Electricity Requirements as Percent of Change in Baseline

Year	2025	2030
Baseline kWh	342,684,991	1,131,364,581
Program kWh	94,473,956	387,760,823
Total kWh	437,158,947	1,519,125,404
Programs	22%	26%

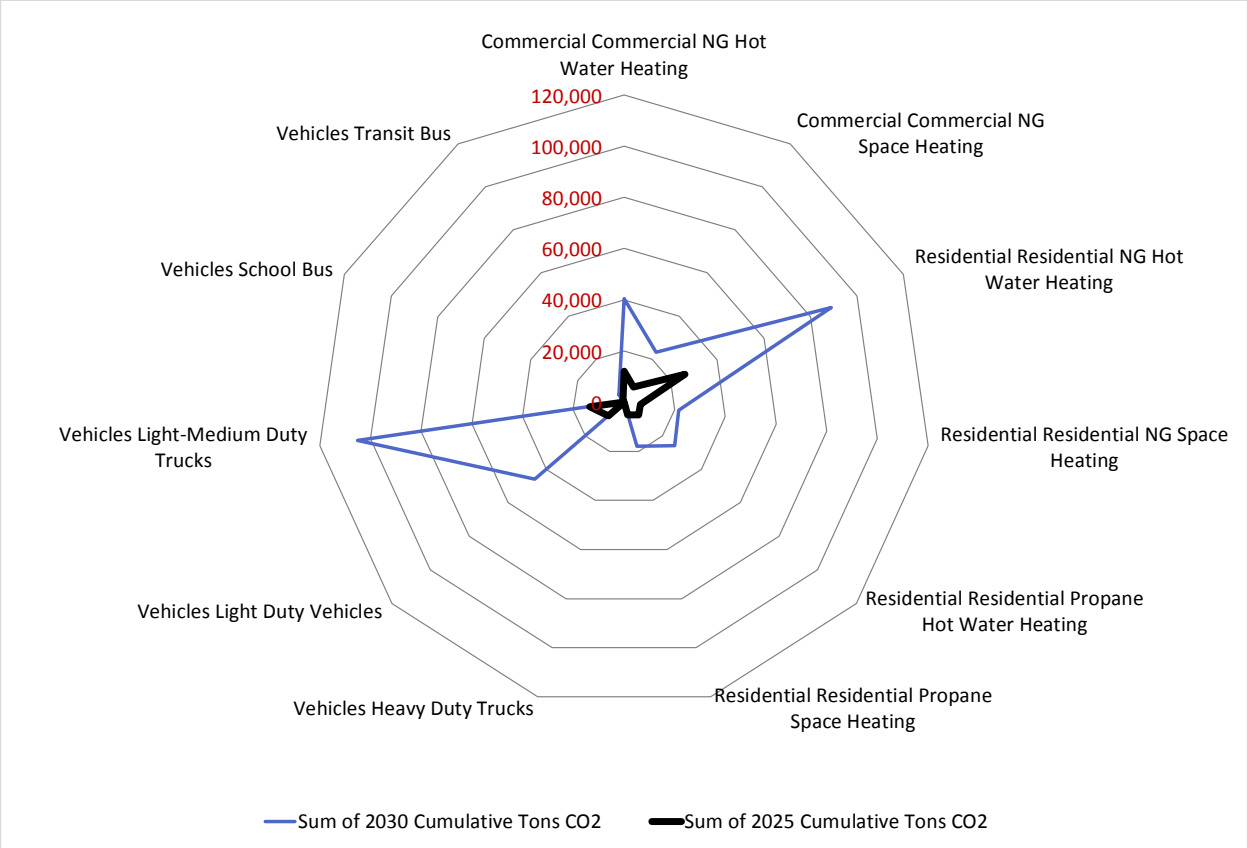
Reductions in natural gas, propane, gasoline, or diesel use will result in a substantial reduction in carbon dioxide (CO_2) outputs. We assume that installations benefitting from program funding will be tied to MBCP zero carbon electricity supply, and so our decrease in carbon includes an assumption the electricity replacing fossil fuels will have no CO_2 content. Figure 3 shows the net change in cumulative CO_2 outputs for the residential and commercial built environment and vehicle market by 2025 and 2030, totaling 86,552 and 373,306 metric tons of CO_2 emissions ($MTCO_2e$), respectively.

Figure 3: Cumulative CO_2 Reduction by Market Segment and Program Year (Tons)



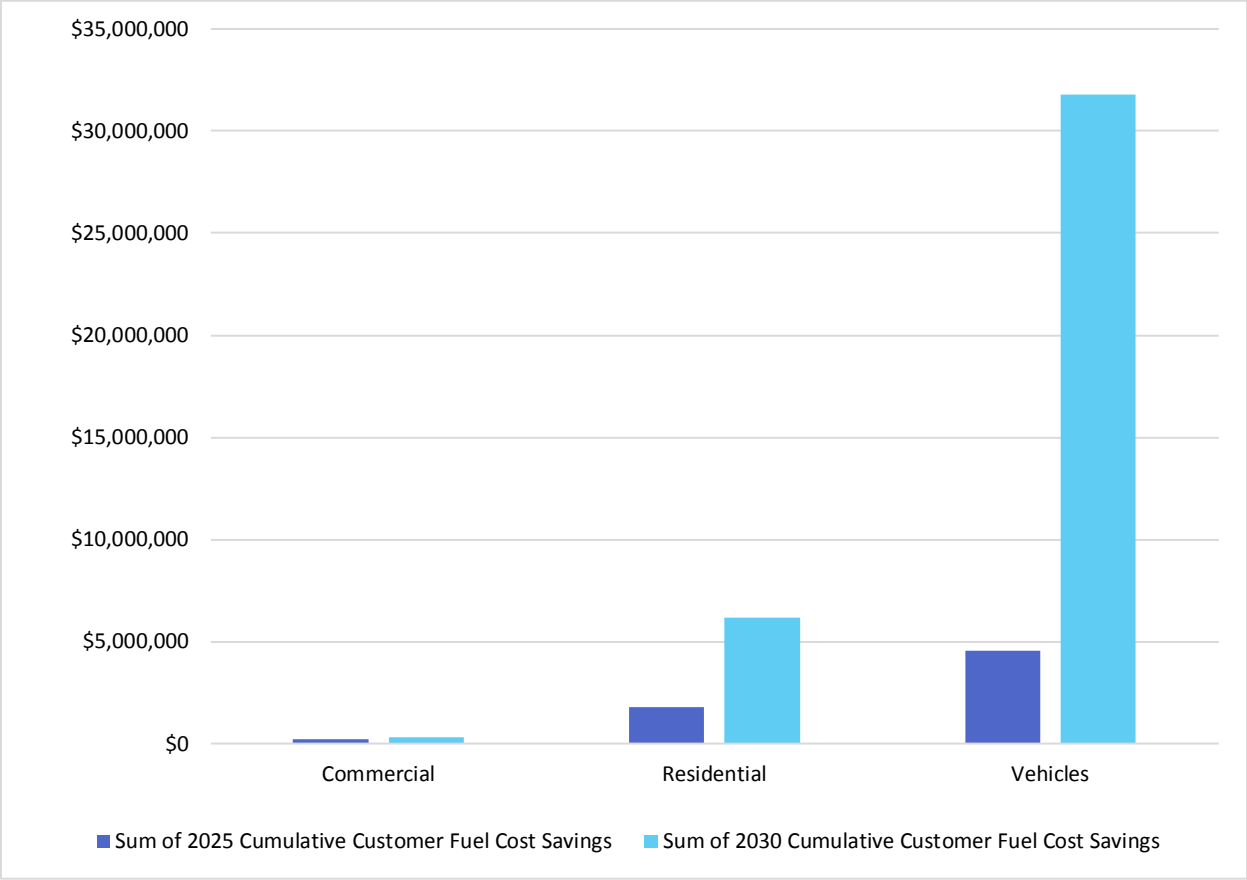
Reductions in CO_2 output are not distributed evenly across all measures and vehicles and depend heavily on the size of the underlying market, efficiency of the existing equipment, and annual amount of fuel used. Figure 4 shows the projected distribution of cumulative $MTCO_2e$ reductions from various built environment measure and vehicles. We expect that the largest reductions will come from the electrification of hot water heating in the commercial and residential market and electric vehicle adoption in the light duty vehicles (i.e. cars) and light to medium duty trucks, such as passenger shuttles or trucks fleets operated by parcel delivery services such as Fed-Ex or UPS.

Figure 4: Distribution of Cumulative CO_2 Reductions by Program Year



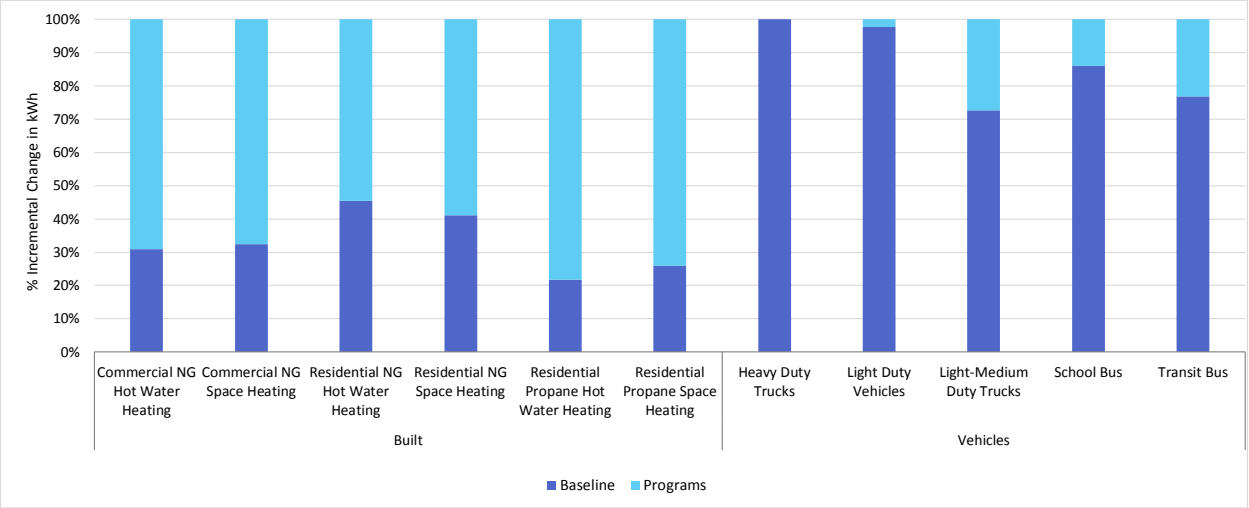
Using current fuel prices, Figure 5 shows that our forecast of cumulative fuel cost savings will grow from about $6.6M in 2025 to over $38.3M in 2030. These savings will continue to grow and accrue annually.

Figure 5: Cumulative Customer Fuel Savings by Market Segment and Program Year



The forecast defines program attribution as the percent increase in electricity sales resulting from technology adoption that results from program interventions as defined in the Roadmap. Some technologies, such as heat pump water heaters, provide significant consumer and societal benefits but require the influence of programs and funding to spur consumer adoption due to barriers such as cost or awareness of benefits. Other technologies, such as electric cars, have inherent benefits that are broadly acknowledged and have increasing market exposure but may require select, targeted market interventions to help certain market sectors to adopt, such as low-income constituents living in multifamily residences who may not have access to vehicle charging infrastructure. Figure 6 provides our forecast results showing that by 2025 the adoption of certain measures, such as residential propane water heating programs, will be substantially influenced by program interventions. In general, program attribution in the built environment is between 30% and 47% of new electricity sales. other measures such as heavy trucks may not benefit because, for example, the vehicles may not be available during this timeline such that program interventions can influence adoption, or the market will readily adopt these on merit alone without the needs for program support. In general, program attribution in the vehicle market is between 0% and 29% of new electricity sales.

Figure 6: Program Attribution to Change in kWh Consumption by End-use in 2025



Built Environment

In the built environment we focused the analysis and forecast on heat pumps for space heating and hot water heating, which comprise the majority of natural gas use in the residential and commercial markets as discussed in more detail in the Inventory and Market Characterization report. While these measures are technically and economically viable, they represent a technology change for many residential and commercial property owners and also for service providers that have historically stocked and installed natural gas equipment. We expect that increased adoption of these measures will be largely attributed to program activities, as shown in Figure 7, and will involve initiatives that engage property owners, equipment distributors, and installation contractors through marketing, education, outreach, technical support and financial incentives.

Figure 7: Built Environment Attribution to Change in kWh Consumption by End-use

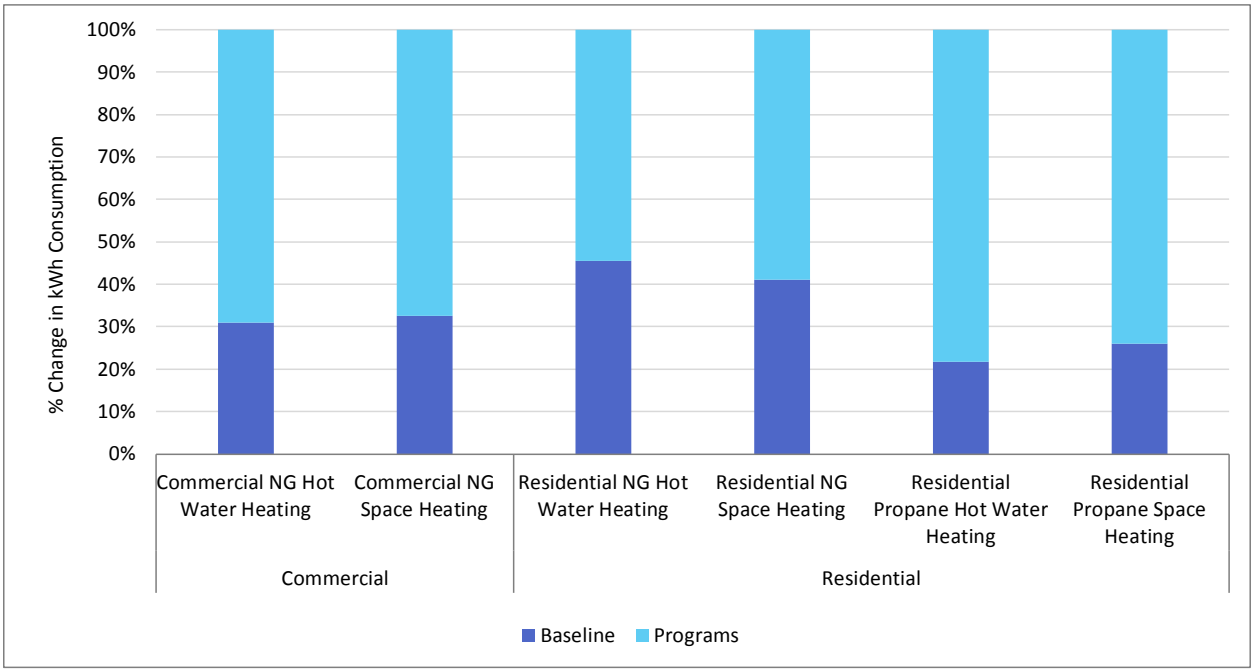


Table 4 shows our cumulative forecast of therm reduction by sector and fuel source for 2025 and 2030, while Figure 8 summarizes this data indicating residential natural gas savings will account for 70% of built environment reductions, and that this will be mostly natural gas with a modest contribution from the electrification of propane measures.

Table 4. Cumulative Therm Reduction by Sector and Fuel

Sector	2025 Therms	Distribution	2030 Therms	Distribution
Commercial	3,244,186	30%	10,723,531	30%
Natural Gas	3,244,186	30%	10,723,531	30%
Residential	7,421,552	70%	25,224,958	70%
Natural Gas	5,587,621	52%	18,910,571	53%
Propane	1,833,931	17%	6,314,387	18%
Grand Total	10,665,738	100%	35,948,489	100%

Figure 8: Built Environment Cumulative Reduction in Therms by Program Year

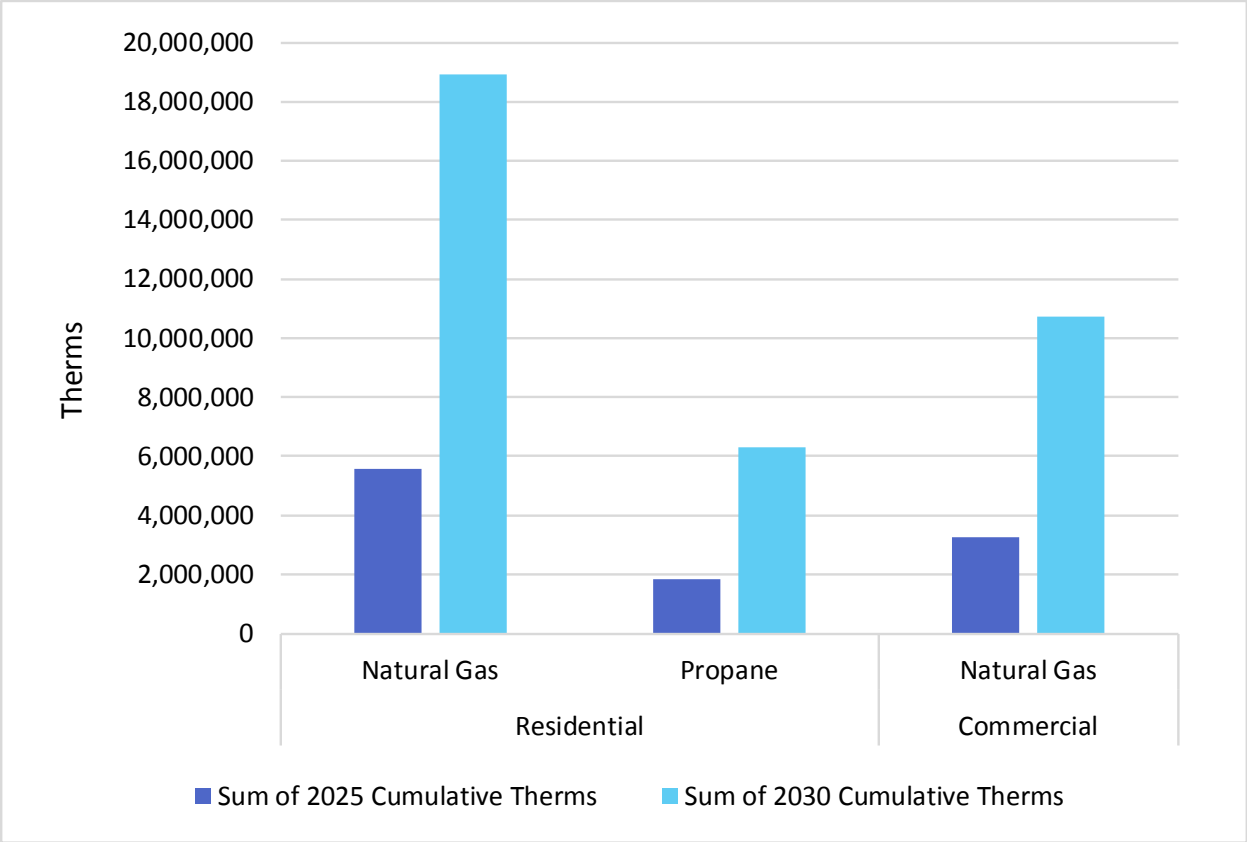


Figure 9 shows the resulting increase in electricity requirements by measure type while Table 5 forecasts cumulative increased sales of 76 GWh in 2025, growing to 243 GWh by 2030. Approximately 72% of will increased electricity requirements will be associated with hot water heating.

Figure 9: Built Environment Additional kWh Consumption by Program Year

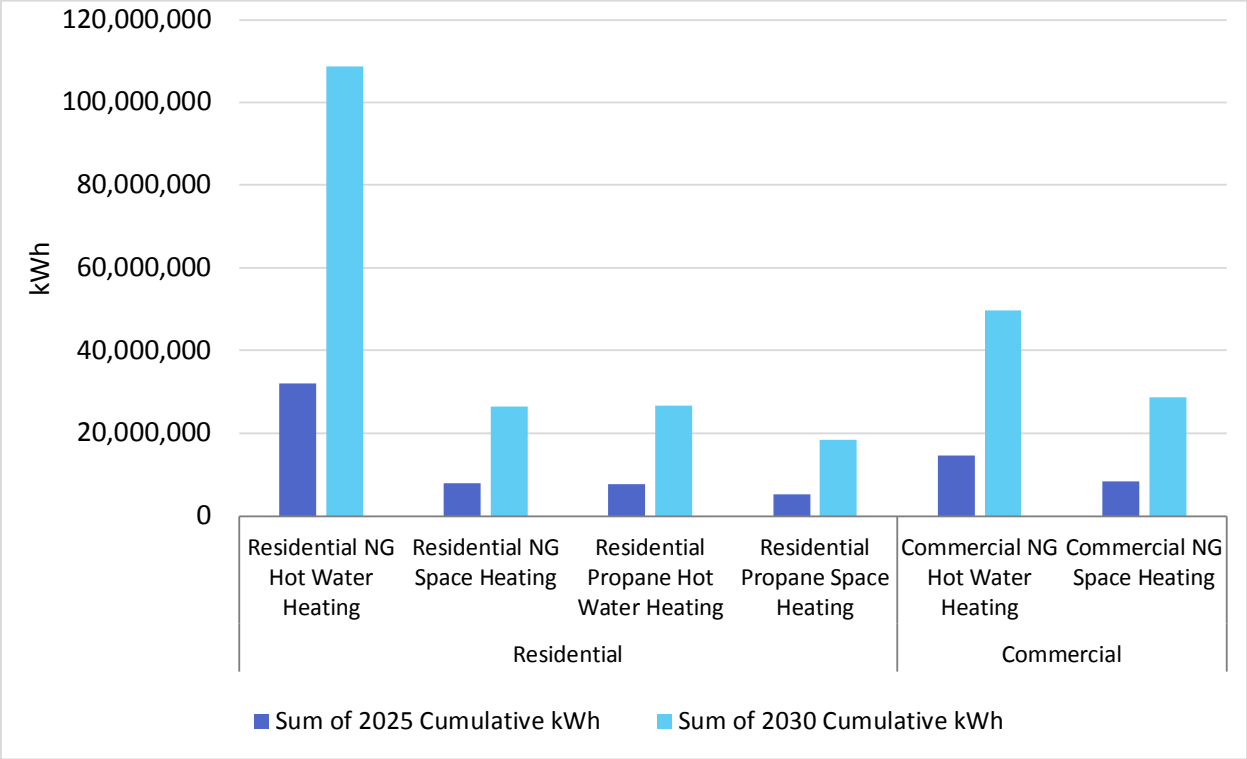


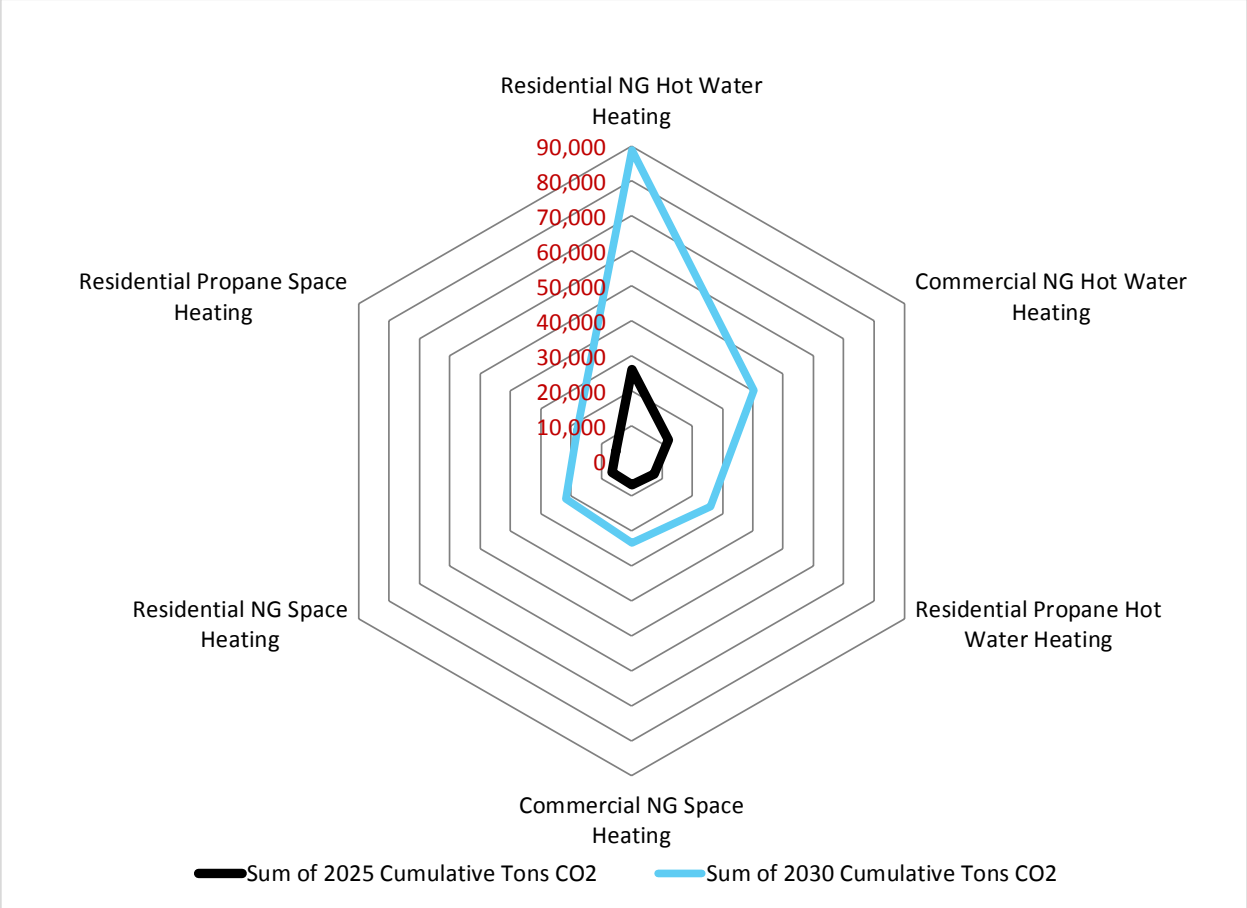
Table 5. Cumulative Increase in Electricity Requirements

Sector	2025 Cumulative kWh	2030 Cumulative kWh
Commercial	23,116,471	78,568,952
Commercial NG Hot Water Heating	14,687,287	49,814,191
Commercial NG Space Heating	8,429,183	28,754,761
Residential	53,049,838	180,309,977
Residential NG Hot Water Heating	31,998,641	108,717,326
Residential NG Space Heating	7,942,112	26,456,920
Residential Propane Hot Water Heating	7,801,717	26,758,344
Residential Propane Space Heating	5,307,368	18,377,388
Grand Total	76,166,309	258,878,929

Consistent with the distribution in reduced therms and increased electricity requirement, Figure 10 shows that CO_2 savings will mostly result from the electrification of hot water heating. As discussed

previously, we are assuming that electricity used to replace fossil fuels is provided from renewable sources and has no CO_2 content.

Figure 10: Distribution of Cumulative Built Environment CO_2 Reductions by Program Year



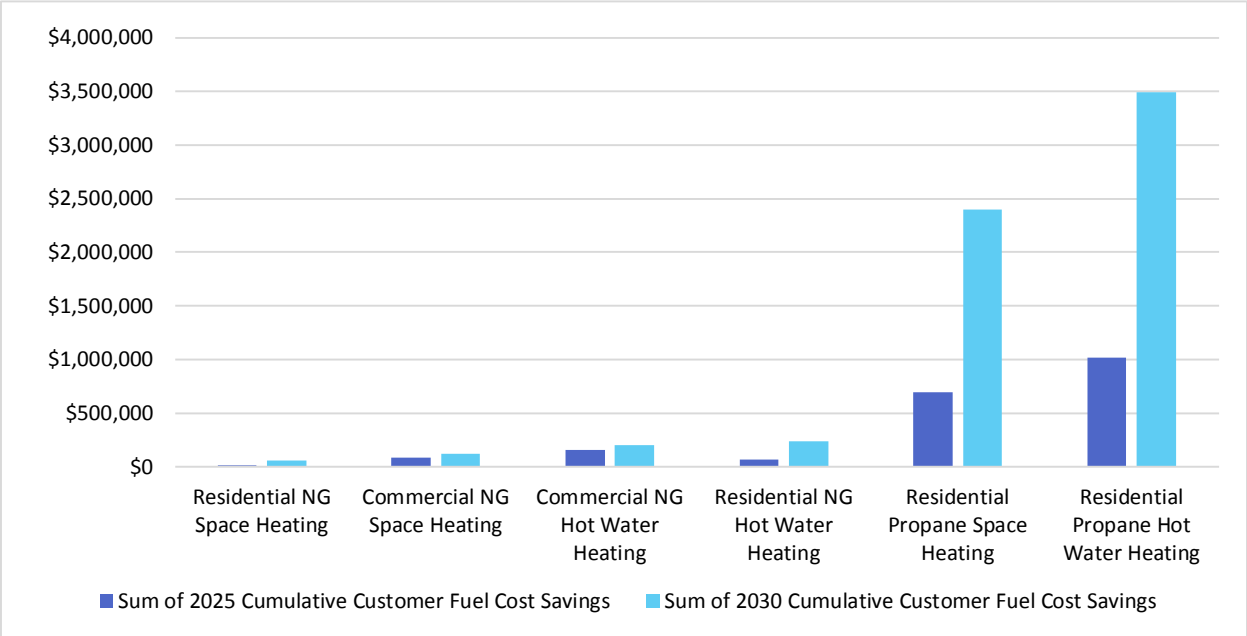
Customer cost savings will be positive for all measures, with cumulative savings of $2.0M in 2025 increasing to $6.5M in cumulative cost savings by 2030, as shown in Figure 11. Much of this value will come from the electrification of propane equipment, largely due to the 50% price premium of propane over natural gas. The forecast used a current price for propane of $2.61 per therm, which represent a 50% price premium on the modelled cost of $1.67 per therm for natural gas. The estimate also assumes that propane equipment is located in rural homes that tend to be larger than the average urban home which includes smaller multifamily dwellings. Appendix E, Program Forecast Details for 2025 and 2030, provides addition details on energy, CO_2, and customer fuel cost savings in the built environment.

Table 6. Cumulative Customer Fuel Cost Savings

Measure	2025 Cumulative Customer Fuel Cost Savings	2030 Cumulative Customer Fuel Cost Savings
Residential NG Space Heating	$17,374	$57,875

Commercial NG Hot Water Heating	$89,719	$117,620
Commercial NG Space Heating	$155,451	$203,763
Residential NG Hot Water Heating	$69,998	$237,822
Residential Propane Space Heating	$693,090	$2,399,906
Residential Propane Hot Water Heating	$1,018,828	$3,494,377
Grand Total	$2,044,460	$6,511,362

Figure 11: Built Environment Cumulative Customer Fuel Savings by Program Year



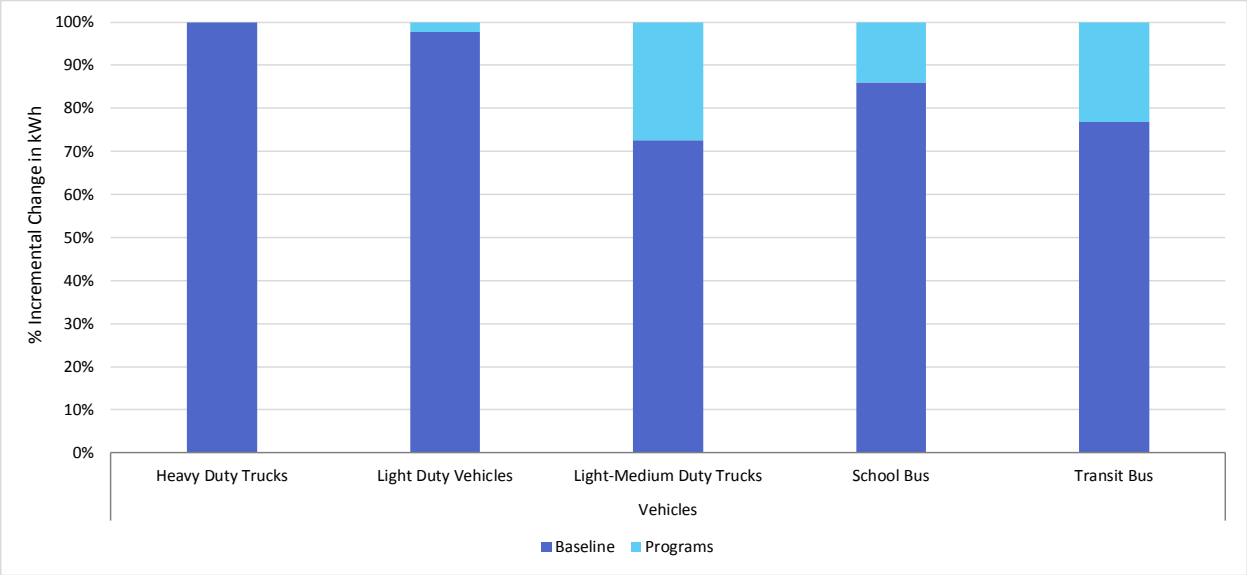
Electric Vehicles

The electric vehicle market analysis and forecast indicates that electric vehicles will largely be adopted through existing manufacturer initiatives and other market supports, however programs may play key roles in several vehicle market initiatives:

- The low-income market accounts for about 23% of the total population for the four counties and is likely to be slower to adopt EVs than the non-low-income market for several reasons, including:
  - Vehicle availability is limited for this market as manufacturers focus on higher margin vehicles, and the availability of attractive and affordable used vehicles is limited.
  - Many of these constituents live in multifamily housing and providing charging infrastructure, or electric vehicle service equipment (EVSE) at multifamily locations is challenging:
    - Recruiting eligible buildings is difficult for a variety of reasons. Specially, lack of awareness and demand for electric vehicles, installation costs, and the disruption to parking operations are the main challenges faced in recruiting buildings.
    - The cost of purchasing and installing electric vehicle service equipment (EVSE), the disruption to parking operations, and lack of demand for EVs are the largest barriers preventing wider adoption of EVSE at multifamily properties.
- Electric transit buses, school buses and light-to-medium duty trucks are entering the market for early adopters and will become more common by 2030. Many of these vehicles are operated by fleet owners and providing EVSE for fleet operators may present opportunities for microgrid applications where fleet storage and charging facilities are co-located with buildings that also provide opportunities to advance the electrification of natural gas equipment, distributed solar, energy efficiency and battery storage prospect.

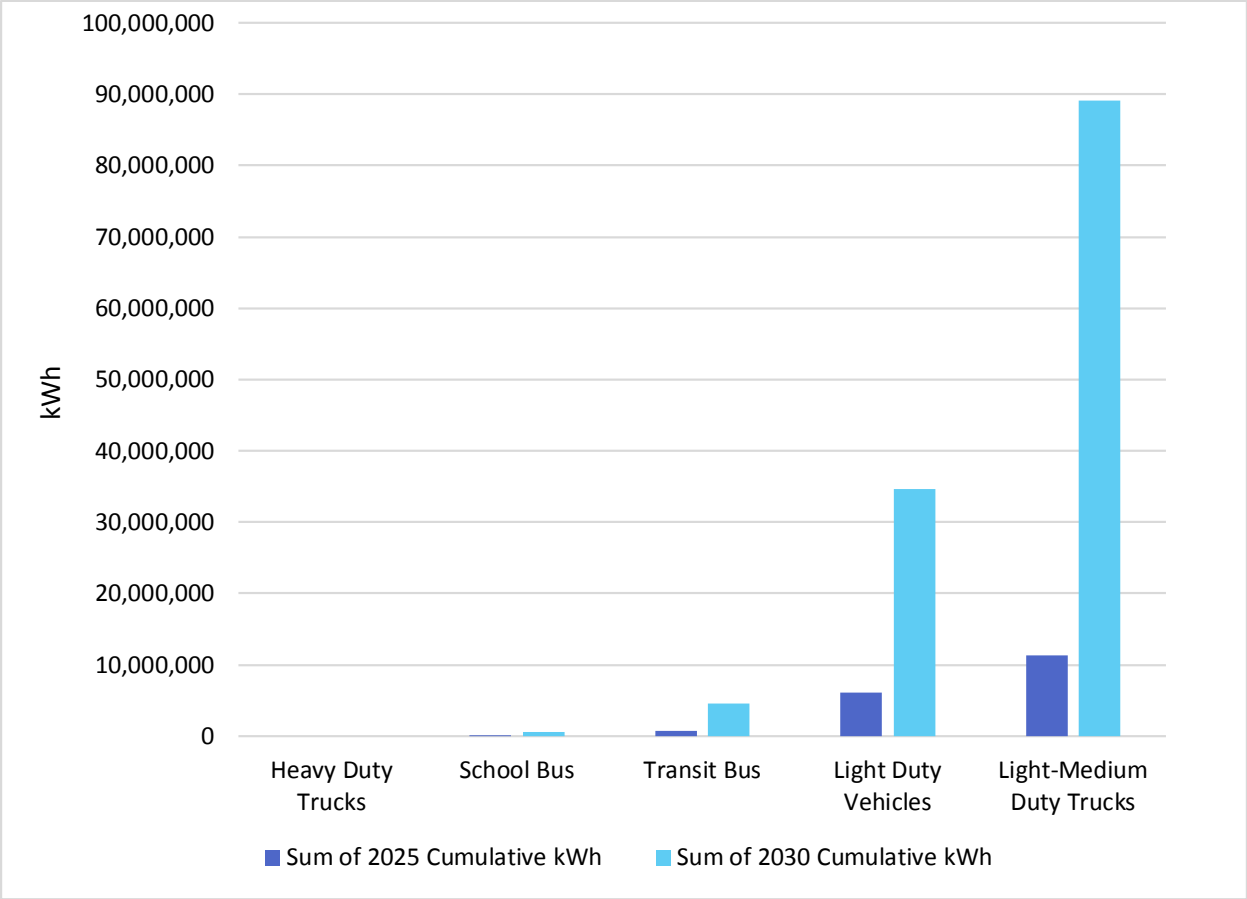
Figure 12 shows how these opportunities may present program attribution opportunities to increase the adoption of electric vehicles over our baseline forecast. We do not see opportunities for the electrification of heavy trucks as yet because these machines are largely in the prototype phase and we are uncertain about their adoption potential by 2030. Key electric vehicle forecast inputs and results are provides in Appendix D, Vehicle Forecast Factors and Appendix E, Program Forecast Details.

Figure 12: Electric Vehicle Attribution to Change in kWh Consumption by Vehicle Type in 2025



Based on our assumption about the potential to influence adoption of light duty vehicles in the low-income market and among fleet operators of light-medium duty trucks, Figure 13 provides our estimate of increased electrify of 18 GWh by 2025, growing to approximately 128 GWh by 2025. Additional details on vehicle fuel reductions can be found in Appendix A, Forecast Details.

Figure 13: Electric Vehicle Additional Cumulative kWh by Program Year



Consistent with our estimate of market opportunities, Figure 14 shows that most CO_2 reductions will be attributable to program interventions focusing on light duty vehicles and light-medium trucks. Figure 15 forecasts $4.5M in cumulative customer fuels savings in 2025, growing to $31.8M by 2030. Additional details on vehicle CO_2 reductions can be found in Appendix A, Forecast Details.

Figure 14: Distribution of Cumulative Electric Vehicle CO_2 Reductions by Program Year

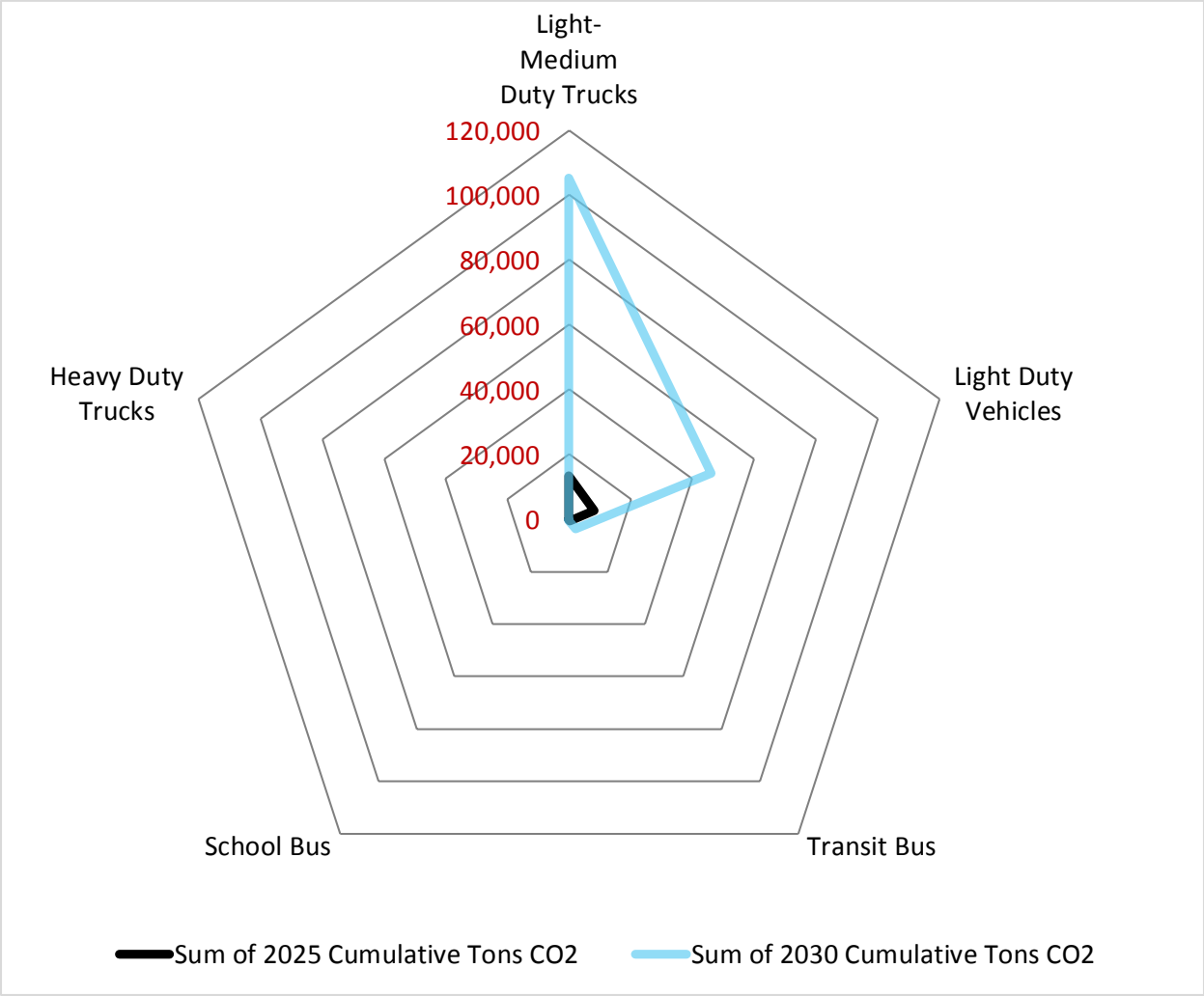
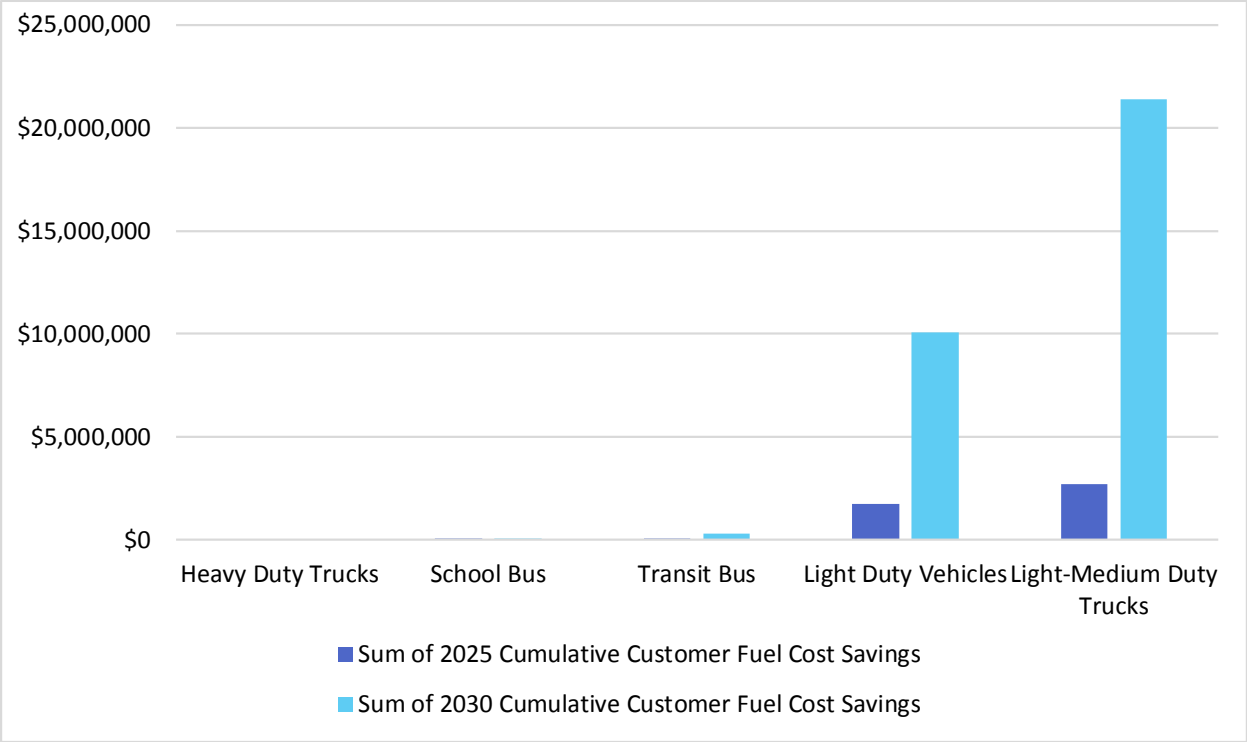


Figure 15: Electric Vehicle Cumulative Customer Fuel Savings by Program Year



Appendix A, Forecast Details

The following appendix proves a summary of forecast outputs for the built environment equipment and vehicle categories reviewed.

Table 7. Additional Baseline, Program, and Total Cumulative kWh by Program Year

	2025			2030		
Measure	Baseline	Programs	Total	Baseline	Programs	Total
Commercial	10,651,664	23,116,471	33,768,135	36,294,069	78,568,952	114,863,021
Commercial NG Hot Water Heating	6,591,231	14,687,287	21,278,519	22,733,521	49,814,191	72,547,712
Commercial NG Space Heating	4,060,433	8,429,183	12,489,617	13,560,548	28,754,761	42,315,309
Residential	36,340,123	53,049,838	89,389,961	122,509,203	180,309,977	302,819,180
Residential NG Hot Water Heating	26,741,524	31,998,641	58,740,164	89,877,047	108,717,326	198,594,373
Residential NG Space Heating	5,558,053	7,942,112	13,500,165	19,229,667	26,456,920	45,686,587
Residential Propane Hot Water Heating	2,176,004	7,801,717	9,977,720	7,061,195	26,758,344	33,819,539
Residential Propane Space Heating	1,864,544	5,307,368	7,171,912	6,341,293	18,377,388	24,718,681
Vehicles	295,693,203	18,307,647	314,000,850	972,561,309	128,881,894	1,101,443,204
Heavy Duty Trucks	5,864,446	0	5,864,446	29,371,822	0	29,371,822
Light Duty Vehicles	256,218,228	6,037,976	262,256,204	692,421,642	34,631,779	727,053,421
Light-Medium Duty Trucks	30,249,961	11,391,066	41,641,026	235,874,993	89,175,800	325,050,793
School Bus	946,608	153,571	1,100,179	3,071,306	508,782	3,580,089
Transit Bus	2,413,960	725,034	3,138,994	11,821,547	4,565,532	16,387,080
Grand Total	342,684,991	94,473,956	437,158,947	1,131,364,581	387,760,823	1,519,125,404

Table 8. Cumulative Program Attributable Vehicle Fuel Reductions by Year

Fuel Reductions	Sum of 2025 Cumulative Gallons	Sum of 2030 Cumulative Gallons
Heavy Duty Trucks	0	0
Light Duty Vehicles	815,579	4,677,886
Light-Medium Duty Trucks	1,364,995	10,685,964
School Bus	11,253	37,281
Transit Bus	54,999	346,331
Grand Total	2,246,827	15,747,461

Table 9. Cumulative Program Attributable Vehicle CO_2 Reductions by Year

Row Labels	Sum of 2025 Cumulative Tons CO_2	Sum of 2030 Cumulative Tons CO_2
Light-Medium Duty Trucks	13,419	105,053
Light Duty Vehicles	8,019	45,995
Transit Bus	579	3,645
School Bus	123	407
Heavy Duty Trucks	0	0
Grand Total	22,140	155,100

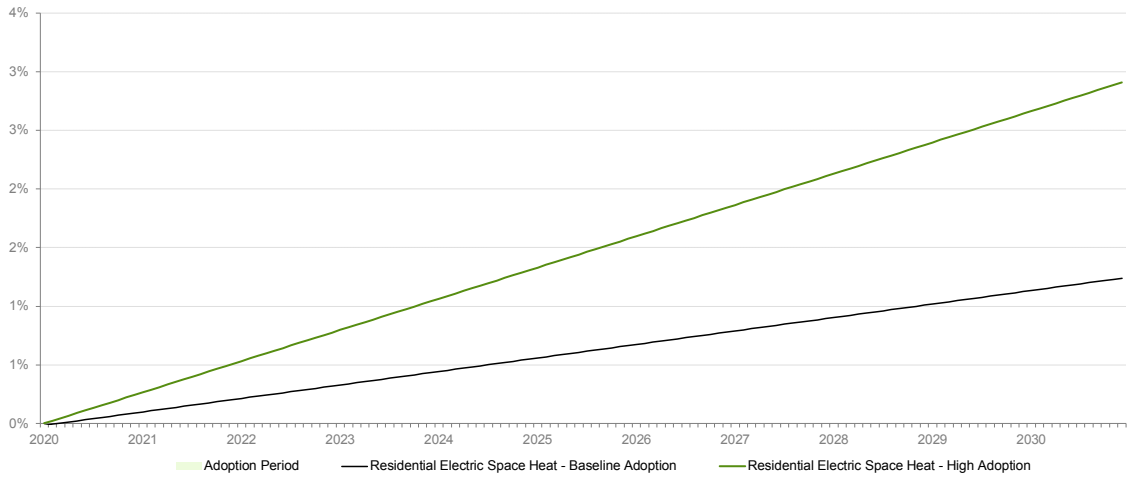
The following discussion provide forecast details for measures analyzed.

Residential Natural Gas Space Heating Impacts

Total market units	270,005
% annual turnover	5.00%
Units replaced each year	13,500
2025 Baseline CO2	1,019
2025 Incremental CO2	1,401

Market Saturations

Adoption Scenario	Cumulative Households Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	1,794	3,347	0.7%	1.2%
High	4,252	7,852	1.6%	2.9%
Program Impact	2,458	4,505	0.9%	1.7%

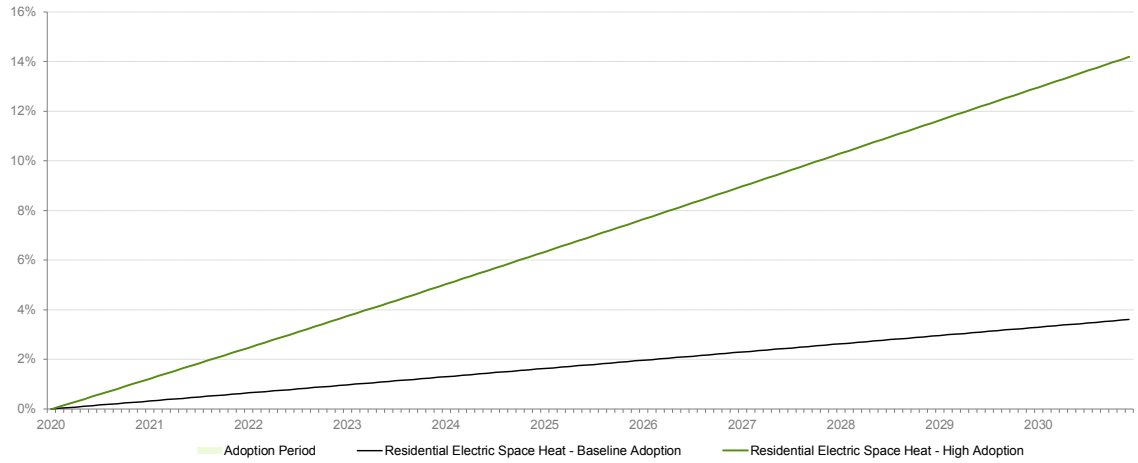


Residential Propane Space Heating Impacts

Total market units	24,578
% annual turnover	5.00%
Units replaced each year	1,229
2025 Baseline CO2	423
2025 Incremental CO2	1,220

Market Saturations

Adoption Scenario	Cumulative Households Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	476	887	1.9%	3.6%
High	1,853	3,487	7.5%	14.2%
Program Impact	1,376	2,600	5.6%	10.6%

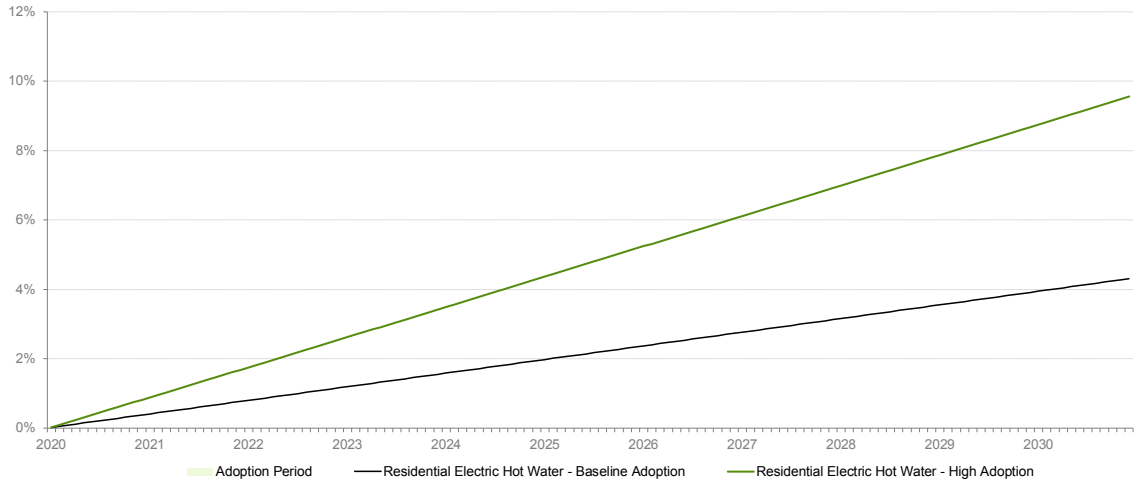


Residential Natural Gas Hot Water Heating Impacts

Total market units	264,726
% annual turnover	12.50%
Units replaced each year	33,091
2025 Baseline CO2	4,759
2025 Incremental CO2	5,748

Market Saturations

Adoption Scenario	Cumulative Households Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	6,192	11,405	2.3%	4.3%
High	13,680	25,297	5.2%	9.6%
Program Impact	7,488	13,891	2.8%	5.2%

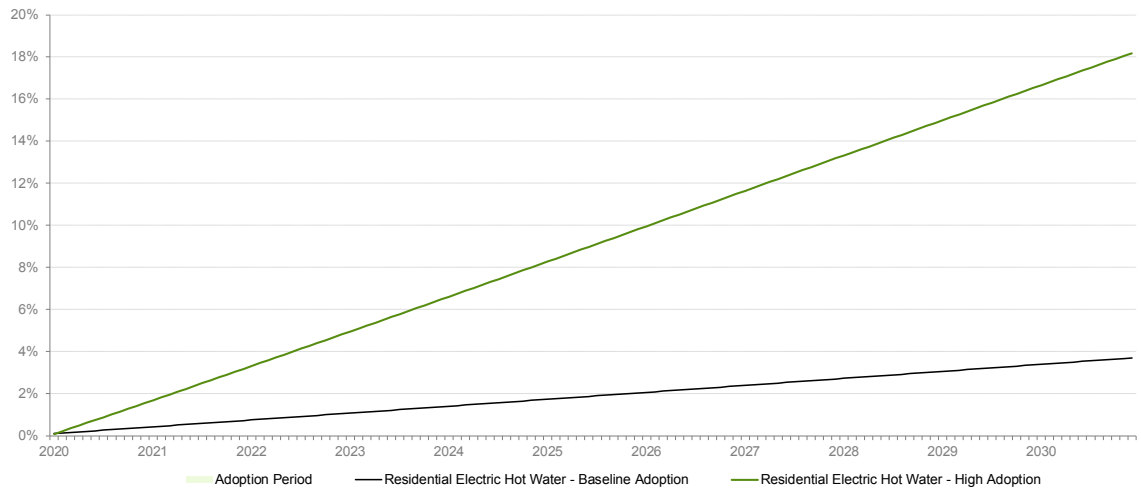


Residential Propane Hot Water Heating Impacts

Total market units	24,578
% annual turnover	12.50%
Units replaced each year	3,072
2025 Baseline CO2	472
2025 Incremental CO2	1,787

Market Saturations

Adoption Scenario	Cumulative Households Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	502	911	2.0%	3.7%
High	2,414	4,468	9.8%	18.2%
Program Impact	1,912	3,557	7.8%	14.5%

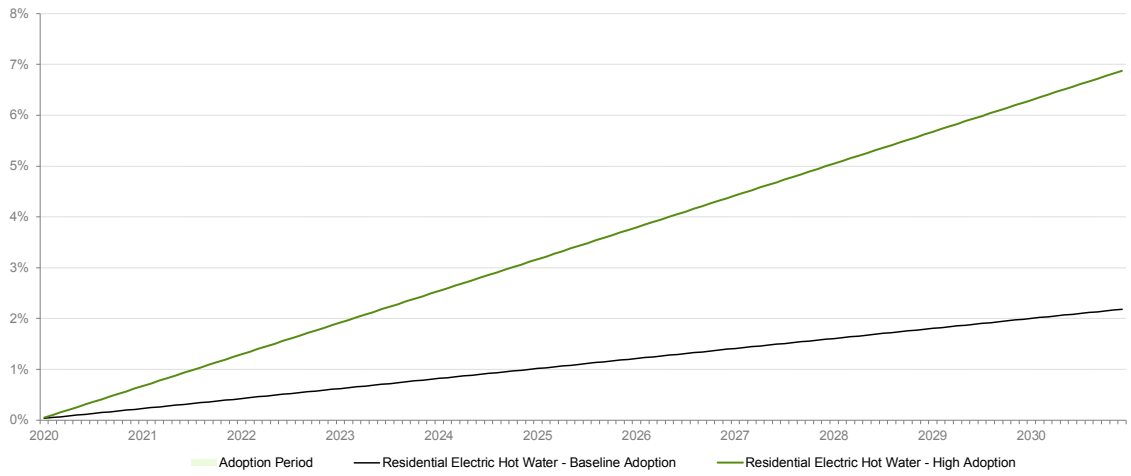


Commercial Natural Gas Space Heating Electrification Impacts

Total market units (building)	8,990
% annual turnover	6.25%
Units replaced each year	562
2025 Baseline CO2	751
2025 Incremental CO2	1,593

Market Saturations

Adoption Scenario	Cumulative Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	107.7	196.4	1.2%	2.2%
High	336.6	618.2	3.7%	6.9%
Program Impact	228.9	421.8	2.5%	4.7%

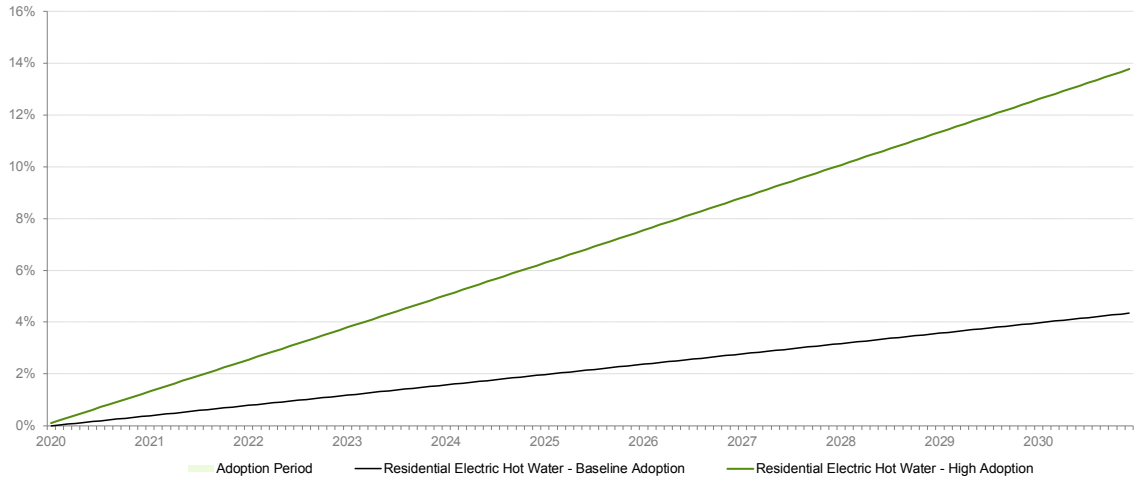


Commercial Natural Gas Hot Water Heating Electrification Impacts

Total market units (building)	12,238
% annual turnover	12.50%
Units replaced each year	1,530
2025 Baseline CO2	1,192
2025 Incremental CO2	2,604

Market Saturations

Adoption Scenario	Cumulative Households Units Replaced		% of Market Units Replaced	
	2025	2030	2025	2030
Baseline	286	531	2.3%	4.3%
High	911	1,685	7.4%	13.8%
Program Impact	625	1,154	5.1%	9.4%

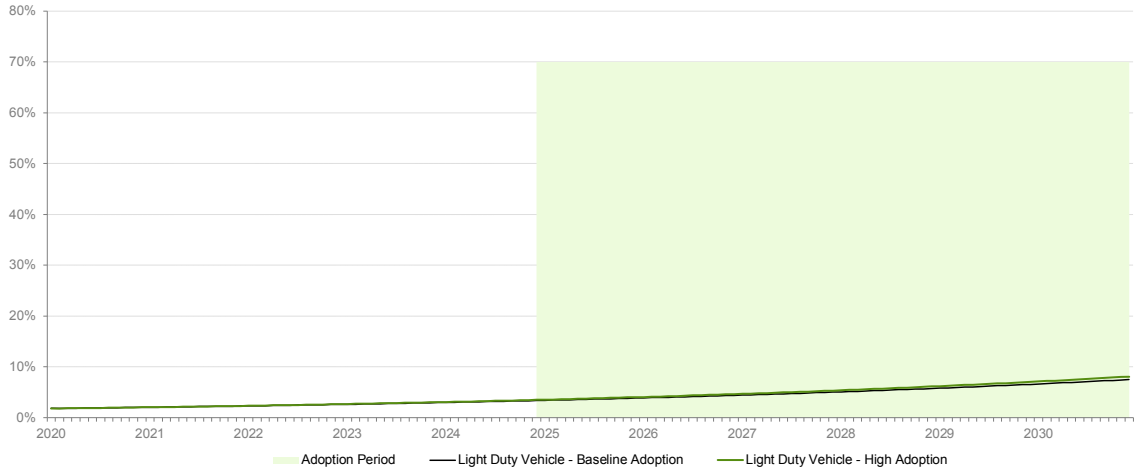


Light Duty Vehicle Impacts

Total market units	490,891
EUL Years	10.6
Annual units turnover	46,204
2025 Baseline CO2	66,153
2025 Incremental CO2	2,799

Market Saturations

Adoption Scenario	Cumulative Vehicle Units		Vehicle Market Saturation	
	2025	2030	2025	2030
Baseline	18,925	36,816	3.9%	7.5%
High	19,793	39,733	4.0%	8.1%
Program Impact	868	2,917	0.2%	0.6%

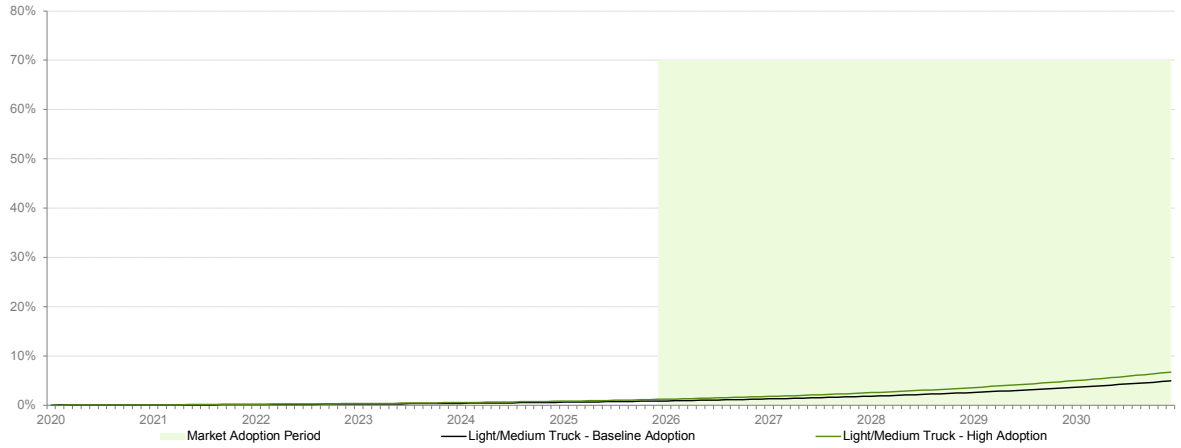


Light-Medium and Medium Truck Impacts

Fleet Size	136,957
EUL Years	11.4
Annual unit turnover	11,976
2025 Baseline CO2	12,174
2025 Incremental CO2	4,736

Market Saturations

Adoption Scenario	Cumulative Vehicle Units		Vehicle Market Saturation	
	2025	2030	2025	2030
Baseline	1161	6745	0.8%	4.9%
High	1238	9205	0.9%	6.7%
Program Impact	77	2,459	0.1%	1.8%

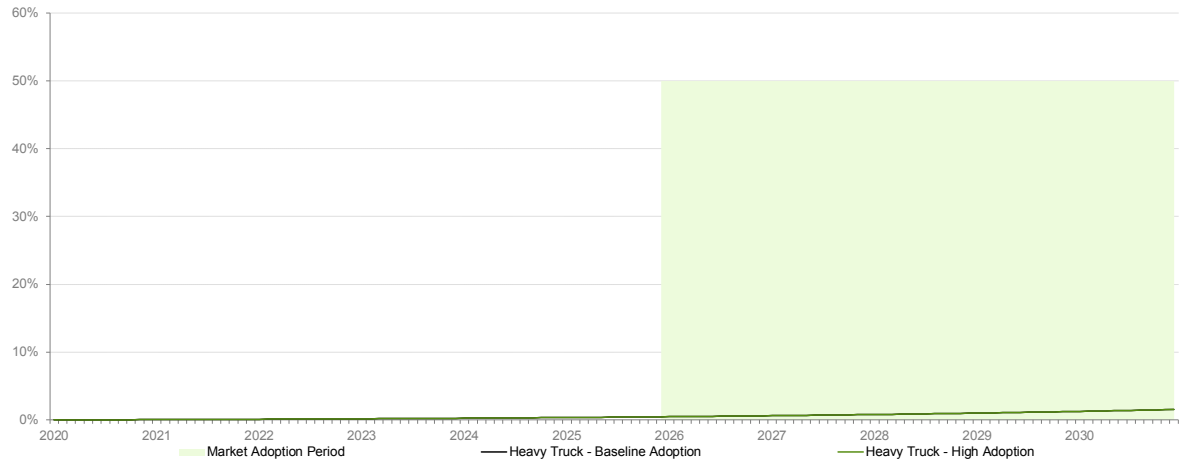


Heavy Duty Truck Impacts

Fleet Size	13,696
EUL Years	11.4
Annual unit turnover	1,199
2025 Baseline CO2	0
2025 Incremental CO2	0

Market Saturations

Adoption Scenario	Cumulative Vehicle Units		Vehicle Market Saturation	
	2025	2030	2025	2030
Baseline	64	210	0.5%	1.5%
High	64	210	0.5%	1.5%
Program Impact	0	0	0.0%	0.0%

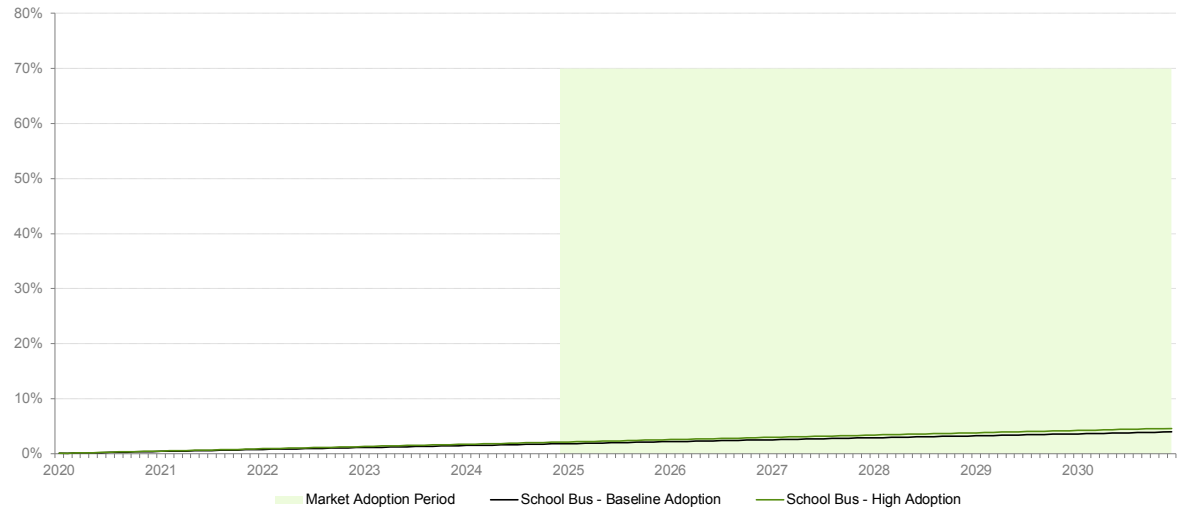


School Bus Impacts

Fleet Size	600
EUL Years	16.7
Annual unit turnover	36
2025 Baseline CO2	173
2025 Incremental CO2	29

Market Saturations

Adoption Scenario	Cumulative Vehicle Units		Vehicle Market Satuation	
	2025	2030	2025	2030
Baseline	13.2	23.9	2.2%	4.0%
High	15.4	27.9	2.6%	4.7%
Program Impact	2	4	0.4%	0.7%

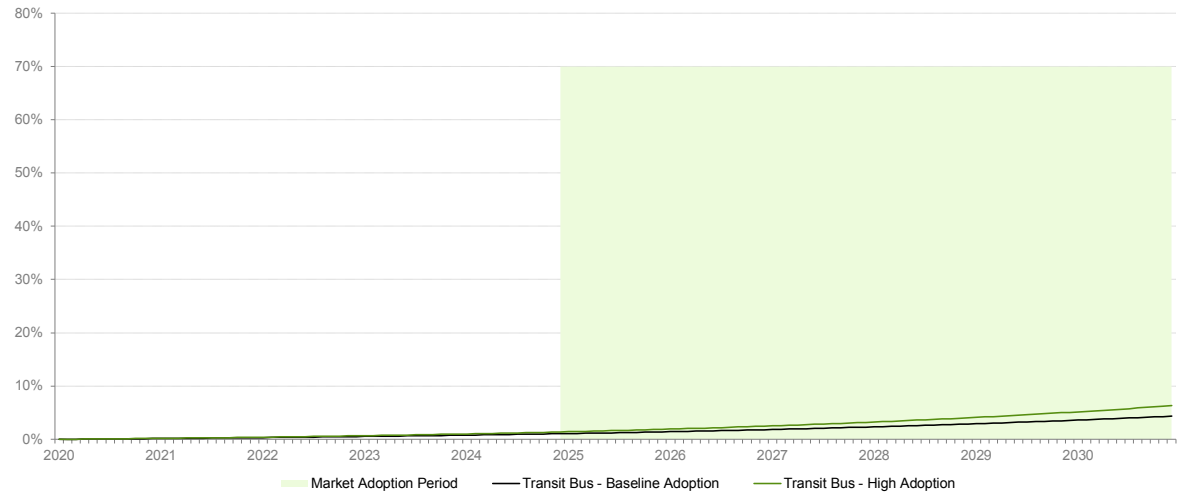


Transit and Shuttle Bus Impacts

Fleet Size	1,189
EUL Years	11.7
Annual unit turnover	101
2025 Baseline CO2	531
2025 Incremental CO2	177

Market Saturations

Adoption Scenario	Cumulative Vehicle Units		Vehicle Market Satuation	
	2025	2030	2025	2030
Baseline	16	52	1.4%	4.3%
High	22	75	1.9%	6.3%
Program Impact	6	23	0.5%	2.0%



Appendix B, Global Forecast Factors

The following appendix proves a key global inputs used in the forecast of electrification potential in the built environment and vehicle markets.

Table 10. Global Forecast Inputs

Category	Value	Units
Energy		
Heat rate (Btu/kWh)	3,412.14	
kWh/Btu	0.000293071	
Therms per ton	39	
Therms / gallon propane	0.91647	
Carbon		
Grid purchased electricity	0.000178	$mTCO_2$/kWh
Natural gas	0.00585	$mTCO_2$/Therm
Propane	0.00695	$mTCO_2$/Therm
Gasoline	19.64	lbs CO2 gallon fuel
Diesel	22.38	lbs CO2 gallon fuel
Fleet average	21.01	lbs CO2 gallon fuel
Gasoline	0.00982	$mTCO_2$ / gallon
Diesel	0.01119	$mTCO_2$ / gallon
Fleet average	0.010505	$mTCO_2$ / gallon
Costs		
Ave residential kWh retail rate	$0.234	2017 $
Ave commercial kWh retail rate	$0.227	2017 $
Ave Ag kWh retail rate	$0.214	2017 $
Marginal cost	$0.0358	2017 $
Natural Gas	$1.69	2017 $
Diesel	$3.99	2017 $
Gasoline	$3.79	2017 $
Ave Fuels	$3.89	2017 $
Gallon of propane	$2.39	2017 $
Propane per therm	$2.61	2017 $
Propane cost premium	154%	2017 $
Carbon value ($/ton)	$35.00	2017 $

Appendix C, Build Environment Forecast Factors

The following appendix proves a key factors used in the forecast of electrification potential in the built environment.

Table 11. Built Environment Unit Forecast Inputs

Segment	Housing Units	NG HWH Saturation	NG SH Saturation	NG HWH Housing Units	NG SH Housing Units	Total Annual NG HWH Units Replaced	Total Annual NG SH Units Replaced
Single Family	224701	86%	85%	193,243	190,996	24,155	9,550
Town Home	24481	77%	80%	18,850	19,585	2,356	979
2-4 Unit Apt	33652	62%	70%	20,864	23,556	2,608	1,178
5+ Unit Apt	51240	62%	70%	31,769	35,868	3,971	1,793
Total	334074			264,726	270,005	33,091	13,500

Table 12. Residential Natural Gas Unit Consumption Forecast Inputs

NG Energy	NG Hot Water Heating	NG Space Heating
Annual therms / unit	199.8	148.1
therms / unit / month	16.7	12.3

Table 13. Residential Propane Unit Consumption Forecast Inputs

Propane Energy	Propane Hot Water Heating	Propane Space Heating
Annual therms / unit	192.7	183.0
therms / unit / month	16.1	15.3

Appendix D, Vehicle Forecast Factors

The following appendix proves a key factors used in the forecast of electrification potential in vehicle market.

Table 14. Electric Vehicle Forecast Inputs

Fleet		Fuel Type		Gallons			kWh		Carbon		Forecast Metrics		EUL	
Vehicle Type	Fleet Size	% Gasoline	% Diesel	Gasoline Gallons	Diesel Gallons	Total Gallons	Annual Gallons / Vehicle	Annual kWh / Vehicle	lbs CO2 Fuel Blend	mTCO2 / gallon	Monthly Gallons / Vehicle	Monthly kWh / Vehicle	Retirement VMT	EUL (Years)
Light Duty Vehicles	490,891	99.1%	0.9%	212,050,865	681,291	212,732,156	436	3,226	19.7	0.0098	36	269	120,000	11
School Buses	600	20.3%	79.7%	231,336	288,383	519,719	1,671	22,800	21.8	0.0109	139	1,900	200,000	17
Transit and Other Buses	1,189	48.6%	51.4%	2,752,015	1,043,139	3,795,155	4,469	58,911	21.0	0.0105	372	4,909	289,758	11
Light-Medium Trucks	136,957	99.2%	0.8%	2,092,103	2,341	202,987,652	1,496	12,481	19.7	0.0098	125	1,040	143,577	12
Heavy Duty Truck	13,696	7.1%	92.9%	4,026,610	22,418,473	26,445,083	3,922	36,794	22.2	0.0111	327	3,066	398,411	11
Total	643,333			221,152,930	24,433,628	446,479,765								

Appendix E, Program Forecast Details for 2025 and 2030

The following appendix proves details of the cumulative forecast output for 2025 and 2030.

Table 15. 2025 Program Forecast Details

Measure	Scenario	2025 Cumulative Units	2025 Saturation	2025 Cumulative Gallons	2025 Cumulative Therms	2025 Cumulative NG Therms	2025 Cumulative Propane Therms	2025 Cumulative kWh	2025 Cumulative Tons CO2	2025 Cumulative Customer Fuel Cost Savings
Transit Bus	Baseline	16.5	1.39%	183,117				2,413,960	1,927	$165,395
Transit Bus	High	22.1	1.86%	238,117				3,138,994	2,506	$215,072
Transit Bus	Programs	5.6	0.48%	54,999				725,034	579	$49,676
School Bus	Baseline	13.2	2.20%	69,362				946,608	757	$55,346
School Bus	High	15.4	2.57%	80,615				1,100,179	880	$64,325
School Bus	Programs	2.2	0.37%	11,253				153,571	123	$8,979
Heavy Duty Trucks	Baseline	64.4	0.47%	625,115				5,864,446	6,821	$1,102,989
Heavy Duty Trucks	High	64.4	0.47%	625,115				5,864,446	6,821	$1,102,989
Heavy Duty Trucks	Programs	0.0	0.00%	0				0	0	$0
Light-Medium Duty Trucks	Baseline	1,161.3	0.85%	3,624,862				30,249,961	35,636	$7,246,974
Light-Medium Duty Trucks	High	1,238.4	0.90%	4,989,857				41,641,026	49,055	$9,975,928
Light-Medium Duty Trucks	Programs	77.1	0.06%	1,364,995				11,391,066	13,419	$2,728,954
Light Duty Vehicles	Baseline	18,925.3	3.86%	34,608,666				256,218,228	340,285	$74,611,239
Light Duty Vehicles	High	19,792.9	4.03%	35,424,245				262,256,204	348,304	$76,369,509
Light Duty Vehicles	Programs	867.7	0.18%	815,579				6,037,976	8,019	$1,758,270
Residential NG Space Heating	Baseline	1,794	0.66%		777,559	777,559		5,558,053	4,549	$12,158
Residential NG Space Heating	High	4,252	1.57%		1,888,643	1,888,643		13,500,165	11,049	$29,532
Residential NG Space Heating	Programs	2,458	0.91%		1,111,084	1,111,084		7,942,112	6,500	$17,374
Residential Propane Space Heating	Baseline	476	1.94%		260,845		260,845	1,864,544	1,813	$243,491
Residential Propane Space Heating	High	1,853	7.54%		1,003,334		1,003,334	7,171,912	6,973	$936,581
Residential Propane Space Heating	Programs	1,376	5.60%		742,489		742,489	5,307,368	5,160	$693,090
Residential NG Hot Water Heating	Baseline	6,192	2.34%		3,741,079	3,741,079		26,741,524	21,885	$58,498
Residential NG Hot Water Heating	High	13,680	5.17%		8,217,616	8,217,616		58,740,164	48,073	$128,495
Residential NG Hot Water Heating	Programs	7,488	2.83%		4,476,538	4,476,538		31,998,641	26,188	$69,998
Residential Propane Hot Water Heating	Baseline	502	2.04%		304,418		304,418	2,176,004	2,116	$284,165
Residential Propane Hot Water Heating	High	2,414	9.82%		1,395,860		1,395,860	9,977,720	9,701	$1,302,992
Residential Propane Hot Water Heating	Programs	1,912	7.78%		1,091,443		1,091,443	7,801,717	7,586	$1,018,828
Commercial NG Space Heating	Baseline	108	1.20%		569,579	569,579		4,060,433	3,332	$42,616
Commercial NG Space Heating	High	108	3.74%		1,752,728	1,752,728		12,489,617	10,253	$132,335
Commercial NG Space Heating	Programs	108	2.55%		1,183,149	1,183,149		8,429,183	6,921	$89,719
Commercial NG Hot Water Heating	Baseline	286	2.34%		925,459	925,459		6,591,231	5,414	$70,649
Commercial NG Hot Water Heating	High	911	7.44%		2,986,496	2,986,496		21,278,519	17,471	$226,100
Commercial NG Hot Water Heating	Programs	625	5.10%		2,061,037	2,061,037		14,687,287	12,057	$155,451

Table 16. 2030 Program Forecast Details

Measure	Scenario	2030 Cumulative Units	2030 Saturation	2030 Cumulative Gallons	2030 Cumulative Therms	2030 Cumulative NG Therms	2030 Cumulative Propane Therms	2030 Cumulative kWh	2030 Cumulative Tons CO2	2030 Cumulative Customer Fuel Cost Savings
Transit Bus	Baseline	51.6	4.34%	896,755				11,821,547	9,437	$809,966
Transit Bus	High	74.8	6.29%	1,243,085				16,387,080	13,082	$1,122,778
Transit Bus	Programs	23.2	1.95%	346,331				4,565,532	3,645	$312,812
School Bus	Baseline	23.9	3.98%	225,049				3,071,306	2,456	$179,573
School Bus	High	27.9	4.65%	262,329				3,580,089	2,862	$209,320
School Bus	Programs	4.0	0.67%	37,281				508,782	407	$29,747
Heavy Duty Trucks	Baseline	210.3	1.54%	3,130,862				29,371,822	34,162	$5,524,272
Heavy Duty Trucks	High	210.3	1.54%	3,130,862				29,371,822	34,162	$5,524,272
Heavy Duty Trucks	Programs	0.0	0.00%	0				0	0	$0
Light-Medium Duty Trucks	Baseline	6,745.2	4.93%	28,264,973				235,874,993	277,872	$56,508,500
Light-Medium Duty Trucks	High	9,204.6	6.72%	38,950,937				325,050,793	382,926	$77,872,320
Light-Medium Duty Trucks	Programs	2,459.5	1.80%	10,685,964				89,175,800	105,053	$21,363,819
Light Duty Vehicles	Baseline	36,815.5	7.50%	93,528,822				692,421,642	919,609	$201,634,509
Light Duty Vehicles	High	39,733.0	8.09%	98,206,708				727,053,421	965,604	$211,719,350
Light Duty Vehicles	Programs	2,917.4	0.59%	4,677,886				34,631,779	45,995	$10,084,841
Residential NG Space Heating	Baseline	3,347	1.24%		2,690,187	2,690,187		19,229,667	15,738	$42,065
Residential NG Space Heating	High	7,852	2.91%		6,391,450	6,391,450		45,686,587	37,390	$99,940
Residential NG Space Heating	Programs	4,505	1.67%		3,701,263	3,701,263		26,456,920	21,652	$57,875
Residential Propane Space Heating	Baseline	887	3.61%		887,133		887,133	6,341,293	6,166	$828,111
Residential Propane Space Heating	High	3,487	14.19%		3,458,088		3,458,088	24,718,681	24,034	$3,228,017
Residential Propane Space Heating	Programs	2,600	10.58%		2,570,955		2,570,955	18,377,388	17,868	$2,399,906
Residential NG Hot Water Heating	Baseline	11,405	4.31%		12,573,596	12,573,596		89,877,047	73,556	$196,608
Residential NG Hot Water Heating	High	25,297	9.56%		27,782,904	27,782,904		198,594,373	162,530	$434,429
Residential NG Hot Water Heating	Programs	13,891	5.25%		15,209,308	15,209,308		108,717,326	88,974	$237,822
Residential Propane Hot Water Heating	Baseline	911	3.71%		987,845		987,845	7,061,195	6,866	$922,123
Residential Propane Hot Water Heating	High	4,468	18.18%		4,731,277		4,731,277	33,819,539	32,882	$4,416,500
Residential Propane Hot Water Heating	Programs	3,557	14.47%		3,743,432		3,743,432	26,758,344	26,017	$3,494,377
Commercial NG Space Heating	Baseline	196	2.18%		1,850,820	1,850,820		13,560,548	10,991	$55,469
Commercial NG Space Heating	High	618	6.88%		5,775,430	5,775,430		42,315,309	34,303	$173,089
Commercial NG Space Heating	Programs	422	4.69%		3,924,611	3,924,611		28,754,761	23,311	$117,620
Commercial NG Hot Water Heating	Baseline	531	4.34%		3,102,798	3,102,798		22,733,521	18,432	$92,990
Commercial NG Hot Water Heating	High	1,685	13.77%		9,901,718	9,901,718		72,547,712	58,815	$296,753
Commercial NG Hot Water Heating	Programs	1,154	9.43%		6,798,920	6,798,920		49,814,191	40,383	$203,763