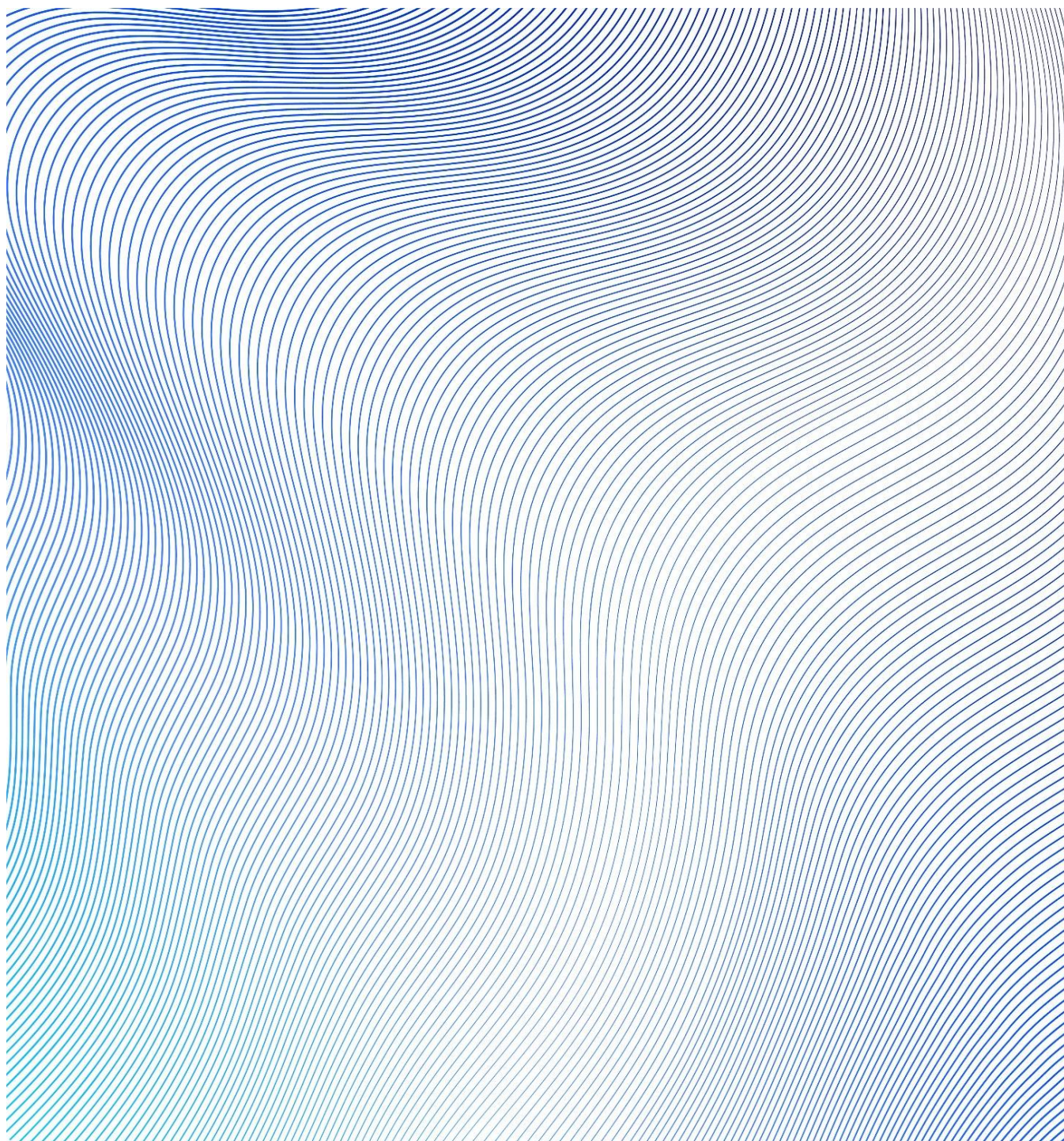


District of Saanich Building Retrofit Strategy

Final Report Appendix

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1 Appendix

1.1 Detailed Assumptions

Modelling assumptions by strategy area are provided below with more detailed assumptions for each policy and action provided in Table 3.

New Construction

It is assumed that from 2025 the Zero Carbon Step Code will apply to all new construction, and as such these buildings will achieve a level of performance that is aligned with Saanich's climate action targets. However, it is assumed that buildings permitted before 2025 will need retrofitting in the future and therefore should be included in the projected baseline. Implementation lags the adoption year by 2 years for Part 9 buildings and by 3 years for Part 3 buildings.

Rates of growth were estimated based on the medium-high growth scenario provided by the District and are provided in Table 1.

BC Step Codes for Redevelopment and Major Renovations

In the BAU and Planned Provincial and Federal Policies scenarios it is assumed that the BC Energy Step Code will apply to redevelopment and major renovations. In the Potential Local Policies scenario it is then assumed that the Zero Carbon Step Code also applies. Implementation lags the adoption year by 2 years for Part 9 buildings and by 3 years for Part 3 buildings.

Rates of redevelopment and major renovations are also provided in Table 1.

Table 1 – Rate of Construction

Building Type	New Construction Growth Rate (2022-2028)	Redevelopment / Major Renovation Rate (2022-2050)	Basis
Single Family Detached	0.0%	0.4%	2021-2031 projected unit demand for detached homes
Single Family Attached	3.8%	0.9%	2021-2031 projected unit demand for attached homes
MURB Rental	3.0%	0.8%	2021-2031 projected unit demand for MURBs
MURB Condo	3.0%	0.8%	2021-2031 projected unit demand for MURBs
Healthcare & Other Institutional	0.7%	0.4%	2021-2050 Population Growth
Government	0.7%	0.4%	2021-2050 Population Growth
Education	0.7%	0.4%	2021-2050 Population Growth
Retail	0.7%	0.4%	2021-2050 Population Growth
Other Commercial	0.7%	0.4%	2021-2050 Population Growth
Office	0.7%	0.4%	2021-2050 Population Growth
Industrial & Farm	0.0%	0/0%	No projected net growth in the sector

Clean Electricity

The Clean Electricity Delivery Standard mandated by the Province and implemented by BC Hydro will ensure that all electricity supply to buildings and vehicles in BC comes from renewable sources by 2030. The model reduces the GHG intensity of electricity from 9.7 tCO₂e/GWh in 2022, and then linearly by 99% to 0.1 tCO₂e/GWh in 2030.

Benchmarking

It is assumed that the energy benchmarking results in energy savings that occur proportionally across all fuel types for any given building type. For any given year, savings due to energy benchmarking are calculated before the savings due to energy efficiency and fuel switching (i.e., savings due to energy efficiency and fuel switching are applied to the energy use that remains after energy benchmarking).

Energy Efficiency

For all policies that trigger energy efficiency improvements, it is assumed that energy savings occur proportionally across all fuel types. Energy savings vary by building type and by policy.

If energy efficiency for any given building type is affected by multiple policies in any given year, then the annual penetration rate for energy efficiency is equal to the annual penetration of the policy with the highest annual penetration for that year plus a percentage of the annual penetration rate for each of the other policies. In the assumptions detailed in Table 3, this percentage is referred to as the additionality of each policy.

For any given year, savings due to energy efficiency across all policies is calculated before the savings due to fuel switching (i.e., savings due to fuel switching are applied to the energy use that remains after energy efficiency).

Fuel Switching

For all policies that trigger fuel switching, it is assumed that fossil fuel burning equipment is replaced with electric, low-carbon technologies, more specifically, that space heating and domestic hot water equipment is replaced with heat pumps that have an effective COP of 2.0 (200% efficient). The increase in electricity use resulting from fuel switching is referred to as an efficiency factor and is calculated through system efficiency assumptions. For example, a 0.4 factor means that for every 1 kWh of natural gas eliminated, 0.4 kWh of electricity use is added. It is assumed that not all fossil fuel is converted to electricity, the remaining fossil fuel use varies by building type and accounts for cooking, fireplaces and industrial loads.

Table 2 - Fuel Switching Efficiencies

Building Type	Natural Gas to Electricity Efficiency Factor	Remaining Natural Gas	Oil to Electricity Efficiency Factor	Remaining Oil
Single Family Detached	0.426	13%	0.484	0%
Single Family Attached	0.426	13%	0.484	0%
MURB Rental	0.460	10%	N/A	N/A
MURB Condo	0.460	10%	N/A	N/A
Healthcare & Other Institutional	0.470	0%	N/A	N/A
Government	0.497	11%	N/A	N/A
Education	0.497	0%	N/A	N/A
Retail	0.499	0%	N/A	N/A
Other Commercial	0.421	0%	N/A	N/A
Office	0.830	0%	N/A	N/A
Industrial & Farm	0.846	21%	N/A	N/A

If fuel switching for any given building type is affected by multiple policies in any given year, then the annual penetration rate for fuel switching is equal to the annual penetration of the policy with the highest annual penetration for that year plus a percentage of the annual penetration rate for each of the other policies. In the assumptions detailed in Table 2, this percentage is referred to as the additionality of each policy.

Renewable Natural Gas

In the 2018 CleanBC Plan, the Province sought to make natural gas consumption cleaner by sourcing 15% from renewable gas. In 2021, the Provincial government released the CleanBC Roadmap, which then introduced an overall emissions cap for gas utilities intended to encourage new investments in low-carbon technologies and fuels (including renewable gases) and energy efficiency.

At this moment in time, local governments do not have control over the supply can RNG to specific sectors (i.e., using RNG for decarbonization in the industrial sector over residential and commercial buildings), they can only encourage and discourage FortisBC customers in their jurisdiction to opt for the voluntary renewable gas blends on offer from FortisBC. There is only a limited supply of RNG for the province and the exact uptake of these voluntary blends (even with targeted programs in place) in Saanich is uncertain. As such, the potential GHG emission reduction from RNG has been modelled as a reduction in the GHG emission intensity of natural gas, based on a weighted average of RNG and conventional natural gas demand on FortisBC's network, and applied across the building stock.

The supply of RNG before 2032 is based on projections from FortisBC and their current RNG supply contracts, many of which are with RNG suppliers outside of the Province. It is assumed that as demand for RNG increases, securing supply from other jurisdictions will be more difficult and therefore FortisBC will only have access to RNG supply within the Province. For more details on these assumptions refer to the *Renewable Natural Gas Memo*.

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Table 3 – Detailed Assumptions for Modelled Policies and Actions

Policy / Action	Building Types	Strategy Area	Scenario	Variation	Assumptions
Clean Electricity Delivery Standard	All Buildings	Clean Electricity	BAU	On	The model reduces the GHG intensity of electricity from 9.7 tCO ₂ e/GWh in 2022, and then linearly by 99% to 0.1 tCO ₂ e/GWh in 2030
			PFP	On	As above.
			LP	On	As above.
Renewable Natural Gas	All Buildings	Renewable Natural Gas	BAU	RNG concurrent with a diversified energy outlook	When fewer policies are driving electrification RNG supply meets 11% of natural gas demand by 2032 and declines to 3% by the 2040s. See <i>RNG Memo</i> for more details.
			PFP	RNG concurrent with deep electrification	When modelled alongside policies which promote deep electrification, RNG supply meets 17% of the supply of natural gas demand by 2032 and declines to 10% by the 2040s. See <i>RNG Memo</i> for more details.
			LP	RNG concurrent with deep electrification	As above.
BC Step Codes for Redevelopment and Major Renovations	All Buildings	BC Step Codes	BAU	BC Energy Step Code	Modelled as the reduction between the baseline EUI and corresponding BC Energy Step Code EUI, for each building type. BC Energy Step Code for each building type increases as currently set out in the code.
			PFP	BC Energy Step Code	As above.
			LP	BC Energy Step Code + Zero Carbon Step Code	Modelled as the reduction between the baseline EUI and corresponding BC Energy Step Code (Highest Step) EUI, for each building type where the Zero Carbon Step Code also applies from 2025.
Provincial and Federal Rebates / Financing and Saanich Top Ups	All Part 9 Buildings. Provincial data shows that rebates are not reaching Part 3 buildings in Saanich.	Part 9 Fuel Switching and Energy Efficiency	BAU	As existing carried on to 2050	Years Applied: 2022 to 2050 Energy Efficiency: <ul style="list-style-type: none"> • Annual Penetration: 0.1% (based on Provincial data for rebates) • Additionality to other Policies: 50% (assumption based on experience) • Average Energy Savings: 25% (based on Provincial data for rebates) Fuel Switching: <ul style="list-style-type: none"> • Annual Penetration: 1% (based on Provincial data for rebates) • Additionality to other Policies: 20% (assumption based on experience)
			PFP	Incentives no longer available after 2031	As above, except rebates and top-ups stop in 2031 when other programs and policies are introduced.
			LP	Incentives no longer available after 2031	As above.
Highest Efficiency Equipment Standard	All Buildings	Part 3 and Part 9 Fuel Switching	BAU	Off	Not Modelled.
			PFP	Starts in 2031	Years Applied: 2031-2050 Fuel Switching: <ul style="list-style-type: none"> • Annual Penetration: Varies between 3% and 7% depending on building type. Penetration is a result of equipment life span and assumed compliance rate. It is

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assumed equipment in Part 9 buildings has a lifespan of 15 years, equipment in Part 3 buildings has a lifespan of 25 years and that the compliance rate is 100% for Part 9 and government buildings and 85% for most other building types.

- Additionality to other Policies: 0% as the policy typically represents the highest penetration rate for fuel switching.

			LP	Starts in 2027	As above except the policy starts in 2027 (still runs to 2050).
Alterations Code	All Buildings	Part 3 and Part 9 Energy Efficiency	BAU	Off	Not Modelled.
			PFP	On	Years Applied: 2025 to 2050 Assumed that policy only triggers energy efficiency improvement as fuel switching is captured by the Highest Efficiency Equipment Standard. Energy Efficiency: <ul style="list-style-type: none"> • Annual Penetration: 0.8%. Penetration is a result of the duration of the policy and the assumption that only 20% of buildings carry out work that triggers energy efficiency improvements. • Additionality to other Policies: 50% (assumption based on experience) • Average Energy Savings: For Part 9 buildings, 25% (based on Provincial data for rebates), and for Part 3 buildings, varies between 35% and 49% (based on previous modelling work).
			LP	On	As above.
Mandatory Part 3 Energy Benchmarking	All Part 3 Buildings	Part 3 Energy Benchmarking	BAU	Increased benchmarking without a local requirement	Applies to buildings over 20,000 SQFT. The compliance rate for municipal buildings is 100% based on current levels of benchmarking. The compliance rate for all other Part 3 building types increases from 30% (current rate based on Building Benchmark BC data) to 50% (assumption based on experience). 10% energy savings over 5 years.
			PFP	Increased benchmarking without a local requirement	As above.
			PL	Increased benchmarking with a local requirement	Applies to buildings over 20,000 SQFT. The local requirement starts in 2025 with a 2-year lag between implementation and when the first energy savings are realized. Compliance rate increases from 30% (current rate) to 85% (assumption based on experience). 10% energy savings over 5 years.
Heat Pump Financing Program Pilot	Part 9 Buildings	Part 9 Fuel Switching	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Years Applied: 2022 to 2025, 3 years. Fuel Switching: <ul style="list-style-type: none"> • Annual Penetration: 0.06% of all single family homes (based on 52 homes over 3 years, as directed by the District of Saanich) • Additionality to other Policies: 10% (assumption based on experience)
Heat Pump Financing Program Expansion	Part 9 Buildings	Part 9 Fuel Switching	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Expansion, 2025 to 2028, 3 years.

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Fuel Switching:
 • Annual Penetration: 0.34% of all single family homes (based on 100 homes per year, as directed by the District of Saanich)
 • Additionality to other Policies: 10% (assumption based on experience)

Requirement to Phase out Oil Heating	Part 9 Buildings	Part 9 Fuel Switching	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Years Applied: 2030 to 2031, 1 year (all savings realized in 2030). Fuel Switching: • Annual Penetration: 100% of oil-heated homes. • Additionality to other Policies: N/A as policy represents full penetration of this portion of the building stock when applied.
Expansion of Home Energy Navigator	Part 9 Buildings	Part 9 Fuel Switching and Energy Efficiency	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Years Applied: 2025 to 2050 Energy Efficiency: • Annual Penetration: 0.75% • Additionality to other Policies: 10% (assumption based on experience) • Average Energy Savings: 25% (based on Provincial data for rebates) Fuel Switching: • Annual Penetration: 2.25% • Additionality to other Policies: 10% (assumption based on experience) As directed by the District of Saanich, the policy is assumed to have an overall penetration of 3%, which is split between fuel switching and energy efficiency, based on the current uptake of different Provincial rebates.
Saanich Building Performance Standard	All Part 3 Buildings	Part 3 Fuel Switching and Energy Efficiency	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Years Applied: 2030 to 2050 Applies to buildings over 20,000 SQFT. Energy Efficiency: • Annual Penetration: Varies between 1% and 1.5% depending on building type. Penetration is a result of the percentage of buildings over 20,000 SQFT, the duration of the policy and the assumption that only 30% of buildings take the route of energy efficiency improvements to meet the Standard. • Additionality to other Policies: 0% as the policy is partially intended as a backstop to the Highest Efficiency Equipment Standard. • Average Energy Savings: Varies between 35% and 49% (based on previous modelling work) Fuel Switching: • Annual Penetration: Varies between 3% and 5% depending on building type. Penetration is a result of the percentage of buildings over 20,000 SQFT and the duration of the policy.

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- Additionality to other Policies: 0% as the policy is partially intended as a backstop to the Highest Efficiency Equipment Standard.

Saanich Revitalization Tax Exemption	All Part 3 Buildings	Part 3 Fuel Switching	BAU	Off	Not Modelled.
			PFP	Off	Not Modelled.
			LP	On	Years Applied: 2024-2030 Fuel Switching: <ul style="list-style-type: none"> • Annual Penetration: 3.4% for MURB Rental buildings (based on 3 buildings per year) and 0.9% for non-resi Part 3 buildings (based on 9 buildings per year). Assumptions provided by the District of Saanich. • Additionality to other Policies: 10% (assumption based on experience)
Strata Energy Advisor Program	MURB Condo	Part 3 Energy Efficiency	BAU	Off	Not Modelled.
			PFP	Off	Not modelled.
			LP	On	Years Applied: 2024 to 2040 Energy Efficiency: <ul style="list-style-type: none"> • Annual Penetration: 3% (assumption based on experience) • Additionality: 20% (assumption based on experience) • Average Energy Savings: 35% (based on previous modelling work) • 2-year lag before the first energy savings are realized.

1.2 Fuel Switches and Energy Efficiency Retrofits

The cumulative penetration, cumulative floor area and cumulative number of homes or units for fuel switching and energy efficiency retrofits by 2030, 2040 and 2050 for each of the three main scenarios explored in the modelling are presented in the tables below. For fuel switches, the cumulative floor area and the cumulative number of homes or units are only given for building types where floor area was broken down by fuel type in Phase 1 of the Final Report. The cumulative number of homes or units is based on the average floor area for the respective building type.

Table 4 – Fuel Switches and Energy Efficient Retrofits, Business-as-Usual

Building Types	Cumulative Penetration (%)			Cumulative Floor Area (m ²)			Cumulative Homes / Units		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Energy Efficiency Retrofits									
Single Family Detached	1%	2%	3%	31221	65912	97133	192	406	599
Single Family Attached	1%	2%	3%	17202	36315	53517	78	164	241
MURB Rental	0%	0%	0%	0	0	0	0	0	0
MURB Condo	0%	0%	0%	0	0	0	0	0	0
Healthcare & Other Institutional	0%	0%	0%	0	0	0			
Government	0%	0%	0%	0	0	0			
Education	0%	0%	0%	0	0	0			
Retail	0%	0%	0%	0	0	0			
Other Commercial	0%	0%	0%	0	0	0			
Office	0%	0%	0%	0	0	0			
Industrial & Farm	0%	0%	0%	0	0	0			
NG to Electric Fuel Switches									
Single Family Detached	9%	19%	28%	97723	206304	304027	602	1272	1874
Single Family Attached	9%	19%	28%	53842	113667	167510	243	513	755
MURB Rental	0%	0%	0%	0	0	0	0	0	0
MURB Condo	0%	0%	0%	0	0	0	0	0	0
Oil to Electric Fuel Switches									
Single Family Detached	9%	19%	28%	26538	56025	82563	164	345	509
Single Family Attached	9%	19%	28%	14622	30868	45490	66	139	205

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Table 5 – Fuel Switches and Energy Efficient Retrofits, Planned Provincial and Federal Policies

Building Types	Cumulative Penetration (%)			Cumulative Floor Area (m ²)			Cumulative Homes / Units		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Energy Efficiency Retrofits									
Single Family Detached	9%	21%	21%	296469	709950	709950	1827	4376	4376
Single Family Attached	9%	21%	21%	163346	391162	391162	737	1764	1764
MURB Rental	5%	13%	20%	15361	40962	64003	185	493	771
MURB Condo	5%	13%	20%	24961	66563	104005	283	755	1180
Healthcare & Other Institutional	5%	13%	20%	13622	36325	56757			
Government	5%	13%	20%	6821	18190	28422			
Education	5%	13%	20%	32906	87749	137108			
Retail	5%	13%	20%	21769	58051	90704			
Other Commercial	5%	13%	20%	14205	37880	59188			
Office	5%	13%	20%	8550	22800	35624			
Industrial & Farm	5%	13%	20%	25171	67122	104879			
NG to Electric Fuel Switches									
Single Family Detached	9%	76%	100%	97723	816721	1078498	602	5034	6647
Single Family Attached	9%	76%	100%	53842	449990	594221	243	2029	2679
MURB Rental	0%	36%	72%	0	70276	140551	0	846	1692
MURB Condo	0%	34%	68%	0	107853	215706	0	1224	2447
Oil to Electric Fuel Switches									
Single Family Detached	9%	76%	100%	26538	221793	292883	164	1367	1805
Single Family Attached	9%	76%	100%	14622	122202	161370	66	551	728

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Table 6 – Fuel Switches and Energy Efficient Retrofits, Potential Local Policies

Building Types	Cumulative Penetration (%)			Cumulative Floor Area (m ²)			Cumulative Homes / Units		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Energy Efficiency Retrofits									
Single Family Detached	9%	21%	28%	296469	735793	968377	1827	4535	5969
Single Family Attached	9%	21%	28%	163346	405400	533547	737	1828	2406
MURB Rental	6%	23%	39%	18363	73987	124049	221	891	1494
MURB Condo	18%	50%	66%	92564	260653	341301	1050	2957	3872
Healthcare & Other Institutional	6%	23%	38%	16232	65037	108961			
Government	6%	23%	39%	8153	32844	55066			
Education	6%	25%	42%	40389	170066	286775			
Retail	6%	22%	37%	25658	100831	168486			
Other Commercial	6%	22%	37%	16737	65730	109824			
Office	5%	20%	33%	9686	35298	58348			
Industrial & Farm	5%	19%	31%	28084	99168	163144			
NG to Electric Fuel Switches									
Single Family Detached	36%	100%	100%	392716	1078498	1078498	2421	6647	6647
Single Family Attached	36%	100%	100%	216375	594221	594221	976	2679	2679
MURB Rental	27%	71%	100%	51751	138825	195210	623	1671	2350
MURB Condo	15%	59%	100%	46347	186257	317215	526	2113	3599
Oil to Electric Fuel Switches									
Single Family Detached	100%	100%	100%	292883	292883	292883	1805	1805	1805
Single Family Attached	100%	100%	100%	161370	161370	161370	728	728	728