



ENERGY SAVINGS ESTIMATES FOR ELIGIBLE CEIP UPGRADES

READ CAREFULLY BEFORE PROCEEDING

- The following energy savings estimates are to be used only as an indication, as actual results will vary. Many factors influence the actual results of an upgrade, such as the location, condition, size and type of the property; heating and cooling loads; weather; relative air humidity; efficiency of existing equipment; and quality of installation.
- The energy savings estimates use assumptions (e.g. baseline equipment and heat and cooling loads) for an average sized home in Alberta. Unless specified otherwise, baseline heating equipment in residential properties is assumed to be a natural gas furnace and natural gas hot water storage tank. No central cooling is factored into the savings calculations with exception of the high-efficiency central air conditioner upgrade. The energy savings estimates are provided on an annual basis, referencing a single piece of equipment installed at a property. For some upgrades, the energy savings are based on the quantity of material installed (e.g. insulation).
- Residential CEIP participants should review their pre-project EnerGuide Home Evaluation report to assess the energy savings potential for each upgrade they are considering installing, and should discuss anticipated impacts of the upgrade(s) with their Energy Advisor.
- Alberta Municipalities is not liable for any direct or indirect loss, expense or cost (including without limitation, any consequential loss or economic loss) that you incur directly or indirectly as a result of, or in connection with, any advice, data, information, estimates, projections, forecasts or forward-looking statements in any way connected to such estimates, projections, forecasts or forward-looking statements.
- The Effective Useful Life (EUL) is the average time in years where the upgrade is expected to result in energy savings and is noted on the on the Residential Eligible CEIP Upgrades webpages and this document.



DOORS, WINDOWS, INSULATION & AIR SEALING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
Attic insulation Upgrade ID R-WB-001 EUL: 20 years	Attic insulation reduces heat loss through the attic area of the building envelope. This reduces the load on the heating and/or cooling system. This upgrade can also improve airtightness.	7.57	Annual savings are based on annual savings per square foot of insulation of 0.01 GJ and an R-value of 10 for existing insulation. For illustrative purposes only, the annual savings per home (estimated) is based on a home of 1,500 square feet. If the R-value of the existing insulation is lower and/or the R-value of the new insulation is greater, the savings may be greater.	IL TRM v8 volume 3 Res 5.6.5 Ceiling/Attic Insulation adapted for Alberta.
Wall insulation Upgrade ID R-WB-002 EUL: 20 years	Wall insulation (installed inside an exterior wall cavity or as part of an added structure on the outside of the building) reduces heat loss through the above-grade wall areas of the building envelope. This reduces the load on the heating and/or cooling system. This upgrade can also improve airtightness.	14.22	Annual savings are based on annual savings per square foot of insulation of 0.01 GJ and an R-value of 8 for existing insulation. For illustrative purposes only, the annual savings per home (estimated) is based on a home of 1,500 square feet. If the R-value of the existing insulation is lower and/or the R-value of the new insulation is greater, the savings may be greater.	IL TRM v8 volume 3 Res 5.6.4 Wall Insulation adapted for Alberta.
Foundation insulation Upgrade ID R-WB-003 EUL: 20 years	Insulation added to the walls and/or ground of the basement or the floor of a crawlspace significantly reduces heat loss through the areas of the building envelope in contact with earth. This upgrade can also improve airtightness.	14.25	Annual savings are based on annual savings per square foot of insulation of 0.02 GJ and an R-value of 5 for existing insulation. For illustrative purposes only, the annual savings per home (estimated) is based on a home of 1,500 square feet. If the R-value of the existing insulation is lower and/or the R-value of the new insulation is greater, the savings may be greater.	IL TRM v8 volume 3 Res 5.6.4 Wall Insulation adapted for Alberta.
Rim joist insulation Upgrade ID R-WB-004 EUL: 20 years	Insulation added to the cavities around rim joists reduces heat loss through these areas of the building envelope. This reduces the load on the heating and/or cooling system. This upgrade can also improve airtightness.	1.45	Annual savings are based on annual savings per square foot of insulation of 0.01 GJ and an R-value of 8 for existing insulation. For illustrative purposes only, the annual savings per home (estimated) is based on a home of 1,500 square feet. If the R-value of the existing insulation is lower and/or the R-value of the new insulation is greater, the savings may be greater.	IL TRM v8 volume 3 Res 5.6.6 Rim/Band Joist Insulation adapted for Alberta.
Energy-efficient window Upgrade ID R-WB-005 EUL: 15 years	Windows with low-e glazing increase airtightness and reduce heat loss and gain through the window. This reduces the load on the heating and/or cooling system and improves energy efficiency in both hot and cool seasons.	0.06	Annual savings are per square foot of window. For an average home (assuming a building size of 1,500 square feet and 200 square feet of windows), the annual savings are equal to 12 GJ. To estimate the savings in your home, for each window, multiply the window's height by its width and add each window's square footage (area) together. Then multiply the area by 0.06 GJ.	PUC TRM Volume 2, 2021: ENERGY STAR Windows adapted for Alberta.

DOORS, WINDOWS, INSULATION & AIR SEALING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
Exterior home wrap Upgrade ID R-WB-006 EUL: 15 years	Reducing air leakage is a cost-effective way to reduce heating and cooling energy consumption, increase comfort, and create a healthier indoor environment. Exterior home wrap goes over the sheathing and behind siding, is made of synthetic and lightweight material and can be both an air and water barrier. This upgrade excludes exterior wall insulation.	1.90	Annual energy savings of 1.90 GJ are based on exterior home wrap that achieves a 15% improvement in airtightness calculated from the NRCAN air sealing infographic, assuming the average house in Alberta was built in the 1970s. ASHRAE Chapter 26 Ventilation and Infiltration states that old buildings may be tightened anywhere from 5% to 50%. Energy savings are calculated assuming baseline heating equipment (natural gas furnace). Houses built before the 1980s are typically built with 2" by 4" walls (3.5" of insulation equates to R12) in earlier releases of the Alberta Building Code. Newer houses are built with 2" by 6" walls (5.5" of insulation equates to R20) as per current building code.	NRCAN - Fix the hole in your wall infographic https://www.nrcan.gc.ca/sites/nrcan/files/canmetenergy/pdf/housing/fixtheholeinyourwall.pdf ASHRAE Chapter 26 Ventilation and Infiltration. Alberta Building Code, 2019. Alberta Building Code, 1990.
Energy-efficient door Upgrade ID R-WB-008 EUL: 15 years	High-efficiency door replacements reduce energy loss through the door and can improve airtightness. This reduces the load on the heating and/or cooling system.	0.40	Annual savings are based on annual savings per square foot of door of 0.02 GJ and assume both the door being replaced and the replacement door are 20-square-foot solid doors without windows. This value assumes a U-value of 2.8 for the existing door and a U-value of 1.6 for the new door.	PUC TRM Volume 2, 2021: ENERGY STAR Windows adapted for Alberta for doors.
Other air sealing Upgrade ID R-WB-009 EUL: 3 years	Reducing air leakage is a cost-effective way to reduce heating and cooling energy consumption, increase comfort, and create a healthier indoor environment. A suite of air sealing upgrades, in addition to exterior home wrap, insulation, windows and doors, can improve airtightness.	*	*Annual energy savings of 1.90 GJ are based on a whole building air sealing approach that achieves a 15% improvement in airtightness calculated from the NRCAN air sealing infographic, assuming the average house in Alberta was built in the 1970s. Whole air sealing can include caulking, weather stripping, outlet plates, the application of expanding foam, doors, windows, exterior home wrap, and insulation. ASHRAE Chapter 26 Ventilation and Infiltration states that old buildings may be tightened anywhere from 5% to 50%. Energy savings are calculated assuming baseline heating equipment (natural gas furnace). Houses built before the 1980s are typically built with 2" by 4" walls (3.5" of insulation equates to R12) in earlier releases of the Alberta Building Code. Newer houses are built with 2" by 6" walls (5.5" of insulation equates to R20) as per current building code.	NRCAN - Fix the hole in your wall infographic https://www.nrcan.gc.ca/sites/nrcan/files/canmetenergy/pdf/housing/fixtheholeinyourwall.pdf ASHRAE Chapter 26 Ventilation and Infiltration. Alberta Building Code, 2019. Alberta Building Code, 1990.

HEATING, VENTILATION & AIR CONDITIONING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
Smart thermostat Upgrade ID R-HC-001 EUL: 11 years	Smart thermostats are used to reduce home cooling and heating loads through a configurable schedule of temperature setpoints (like a programmable thermostat) and automatic scheduling to better match heating and cooling to meet occupant comfort needs. Learning smart thermostats with geofencing contain specialized artificial intelligence that “learns” heating and cooling preferences and can determine when the home is occupied.	8.06	Annual savings are based on annual savings per kBTU per hour of heating of 0.27 GJ. For illustrative purposes only, the annual savings per thermostat are based on the average monthly household natural gas heating consumption for Alberta. Cooling energy savings are not accounted for here; therefore, savings may be higher if there is a cooling system installed in the home.	IL TRM v8 volume 3 Res 5.3.16 Advanced Thermostats adapted for Alberta. Natural Resources Canada Comprehensive Energy Use Database, Residential Sector - Alberta.
High-efficiency central air conditioner Upgrade ID R-HC-002 EUL: 18 years	Eligible air conditioning equipment is centrally installed in the home. High-efficiency technology uses less electricity to move indoor heat to the outside of the home. Air conditioning pipe insulation ensures heat is not gained before the conditioned air is delivered to conditioned spaces. Pipe insulation (required for projects in the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.	0.48	Annual savings are based on annual savings per ton of cooling of 21.23 kWh. For illustrative purposes only, the annual savings per unit is based on an average home (estimated) of 1,500 square feet and a cooling load of 75,000 BTU per hour.	IL TRM v8 volume 3 Res 5.3.3 Central Air Conditioning adapted for Alberta.

HEATING, VENTILATION & AIR CONDITIONING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
<p>High-efficiency gas furnace</p> <p>Upgrade ID R-HC-003</p> <p>EUL: 20 year</p>	<p>A high-efficiency furnace extracts the maximum amount of heat from burning natural gas.</p> <p>Duct insulation ensures minimal heat is lost before conditioned air is delivered to conditioned spaces. Duct insulation (required for projects in the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	10.34	Annual savings are based on annual savings per kBTU per hour of heating of 0.35 GJ. For illustrative purposes only, the annual savings per furnace is based on the average monthly household natural gas heating consumption for Alberta.	<p>IL TRM v8 volume 3 Res 5.3.7 Gas High Efficiency Furnace adapted for Alberta.</p> <p>Natural Resources Canada Comprehensive Energy Use Database, Residential Sector - Alberta.</p>
<p>ECM motor for residential furnace</p> <p>Upgrade ID R-HC-004</p> <p>EUL: 6 years</p>	An efficient fan motor adjusts the rate at which furnace heat is delivered to the home. Efficient fan motors with variable speed control use significantly less electricity.	3.19	Annual savings are per furnace motor.	IL TRM v8 volume 3 Res 5.3.5 Furnace Blower Motor adapted for Alberta.
<p>High-efficiency gas boiler</p> <p>Upgrade ID R-HC-005</p> <p>EUL: 25 years</p>	<p>A high-efficiency boiler extracts the maximum amount of heat from natural gas by using condensing technology. This means heat from condensing water in the exhaust is extracted, in addition to regular combustion.</p> <p>Boiler pipe insulation ensures minimal heat is lost before heated water is delivered to spaces. Pipe insulation (required for projects in the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	9.45	Annual savings are based on annual savings per kBTU per hour of heating of 0.32 GJ. For illustrative purposes only, the annual savings per boiler is based on the average monthly household natural gas heating consumption for Alberta.	<p>IL TRM v7 volume 3 Res Gas High Efficiency Boiler adapted for Alberta.</p> <p>Natural Resources Canada Comprehensive Energy Use Database, Residential Sector - Alberta.</p>

HEATING, VENTILATION & AIR CONDITIONING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
<p>Air source heat pump</p> <p>Upgrade ID R-HC-007</p> <p>EUL: 16 years</p>	<p>A heat pump is a year-round space conditioning system that provides heating and cooling. An air-source heat pump moves heat energy from inside to outside in the summer and outside to inside in the winter.</p> <p>Duct insulation ensures minimal heat is lost before conditioned air is delivered to conditioned spaces. Duct insulation (required for projects in the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	68.15	<p>Annual savings are based on annual natural gas savings and electricity usage per kBTU per hour of heating of 3.47 GJ and 323.19 kWh, respectively. For illustrative purposes only, the annual savings per heat pump is based on the average monthly household natural gas heating consumption for Alberta. The savings are based on the replacement of 100% of the heat load of a gas furnace. Note that, on average, an air source heat pump replaces 60% of the heating load in Alberta, so actual savings achieved may be smaller. If no air conditioning is installed and this upgrade will also be used for cooling, overall savings may be reduced.</p>	<p>IL TRM v8 volume 3 Res 5.3.1 Air Source Heat Pump adapted for Alberta.</p> <p>Natural Resources Canada Comprehensive Energy Use Database, Residential Sector - Alberta.</p>
<p>Heat recovery ventilation or energy recovery ventilation</p> <p>Upgrade ID R-HC-008</p> <p>EUL: 18 years or airtightness upgrade's EUL</p>	<p>Heat and energy recovery equipment extracts heat and/or energy from stale air exhausted to the outside of the home. The recovered energy is used to reduce the heating of fresh air delivered to the home.</p> <p>Duct insulation ensures minimal heat is lost before conditioned air is delivered to conditioned spaces. Duct insulation (required for the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	2.27*	<p>If replacing, the annual energy savings are based on the like-for-like replacement of a heat recovery ventilator with a Sensible Recovery Efficiency of 68% with a unit of 70% in a 1,500 square foot house. Annual savings assume that both units are fully-dedicated installations and are operating 24 hours per day at 0 degrees Celsius.</p> <p>*If installed with an upgrade that improves airtightness, energy savings are associated with the air sealing upgrade that the heat and energy recovery ventilation system is combined with, plus or minus the energy consumed or saved by the ventilation system.</p>	<p>IL TRM Version 10 Volume 3: Residential Measures Section 5.3.20 Residential Energy Recovery Ventilator (ERV) adapted for Alberta.</p> <p>Section III - HRV/ERV Directory Listing</p> <p>https://www.hvi.org/hvi-certified-products-directory/section-iii-hrv-erv-directory-listing/</p>

HEATING, VENTILATION & AIR CONDITIONING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
<p>Ground source heat pump</p> <p>Upgrade ID R-HC-011</p> <p>EUL: 16 years</p>	<p>A ground-source heat pump is a year-round space conditioning system that provides heating and cooling. The heat pump moves heat from the ground to inside air in the winter and from inside air to the ground in the summer.</p> <p>Duct insulation ensures minimal heat is lost before conditioned air is delivered to conditioned spaces. Duct insulation (required for the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	74.64	<p>Annual savings are based on annual natural gas savings and electricity usage per kBTU per hour of heating of 3.69 GJ and 323.19 kWh, respectively. For illustrative purposes only, the annual savings per heat pump is based on the average monthly household natural gas heating consumption for Alberta. The savings are based on the replacement of 100% of the heat load of a gas furnace. A closed-loop ground source heat pump is used to calculate the energy savings. If no air conditioning is installed and this upgrade will also be used for cooling, overall savings will be reduced. Savings calculation inputs from the IL TRM v10 Residential Ground Source model were applied to the IL TRM v8 Air Source Heat Pump and adapted for Alberta.</p>	<p>IL TRM v8 volume 3 Res 5.3.1 Air Source Heat Pump adapted for Alberta.</p> <p>IL TRM Version 10 Volume 3: Residential Measures Section 5.3.8 Ground Source Heat Pump adapted ground source heat pumps for Alberta.</p> <p>Natural Resources Canada Comprehensive Energy Use Database, Residential Sector - Alberta.</p>

LIGHTING



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
Indoor lighting control Upgrade ID R-L-001 EUL: 10 years	Lighting controls use motion and daylight sensing to control indoor lighting. Multiple fixtures may be controlled through one sensor or each fixture may have its own. These sensors are an effective way to control lighting use in low occupancy areas.	0.11	Annual savings are per sensor.	MN TRM v3 Residential Lighting - Controls adapted for Alberta.
Lighting fixture Upgrade ID R-L-002 EUL: 15 years	Eligible lighting fixtures are permanently installed and hardwired LED lighting fixture including downlight, track, ceiling and wall-mounted, or porchlight fixtures.	0.06	Annual savings are per fixture.	IL TRM v8 volume 3 Res 5.5.9 LED Fixtures adapted for Alberta.

RENEWABLE ENERGY, SOLAR PV & THERMAL



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
Solar PV system Upgrade ID DER-001 EUL: 25 years	Solar photovoltaic (PV) systems convert solar energy into electricity for use by the building. The system components work together to optimize electricity generation from the sun, providing renewable electricity for both the building they are connected to and the grid.	4.59	According to data from Natural Resources Canada, the average solar PV system in Alberta can produce 1276 kWh of electricity per kW of solar panels per year. This figure does not represent net energy savings, but electricity consumption that is offset by the generation from the array.	NRCan Photovoltaic potential and solar resource maps of Canada https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/solar-photovoltaic-energy/tools-solar-photovoltaic-energy/photovoltaic-potential-and-solar-resource-maps-canada/18366
Solar thermal water heating Upgrade ID DER-002 EUL: 12 years	Solar thermal water heating includes thermal tubes that capture solar energy and use it to heat water. This may be used for domestic hot water and space heating. Solar thermal pipe insulation ensures minimal heat is lost before heated water is delivered to fixtures. Pipe insulation (required for projects in the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.	13.41*	*Annual energy consumption offset by this upgrade is equal to 13.41 GJ per system, assuming it replaces a natural gas storage water heater. The baseline natural gas hot water tank is assumed to be sized based on the average household size (rounded up from 2.4 to 3 people) in Alberta. The replacement tank is sized for the same capacity as the existing tank. The solar data is calculated as an average of three representative locations shown in Alberta. This figure does not represent net energy savings, but natural gas consumption that is offset by the water heated by the system.	NRCan Solar Water Heating Systems - A Buyer's Guide https://www.nrcan.gc.ca/sites/nrcan/files/canmetenergy/files/pubs/SOLAR-BuyersGuide-SolarWaterHeatingSystems_ENG.pdf
Battery energy storage Upgrade ID DER-005 EUL: 10 years	Battery energy storage systems enable the storage of renewable energy produced on the property, which may be used at a later point in time.	*	*This is not a stand-alone upgrade and savings are tied to the solar PV system's energy savings.	N/A

WATER



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
<p>Drain water heat recovery</p> <p>Upgrade ID R-W-001</p> <p>EUL: 20 years</p>	<p>Drain water heat recovery transfers heat from the shower drain water to pre-warm the cold supply water before it goes into the water heater.</p>	<p>1.62</p>	<p>Annual savings are per installed drain water heat recovery pipe per household. Savings are calculated based on ThermoDrain TD338B.</p>	<p>IL TRM v8 volume 3 Res 5.4.11 Drain Water Heat Recovery adapted for Alberta.</p> <p>Natural Resources Canada; Energy Efficiency Ratings: Search; Drain-water heat recovery</p> <p>https://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=DWHR</p>
<p>Tankless gas water heater</p> <p>Upgrade ID R-W-002</p> <p>EUL: 13 years</p>	<p>Tankless (also called instantaneous or on-demand) water heaters supply domestic hot water to the home without using a storage tank. The tankless system avoids heat loss from water stored in a tank that must be regularly re-heated to maintain a safe water temperature.</p> <p>Pipe insulation ensures minimal heat is lost before heated water is delivered to fixtures. Pipe insulation (required for the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	<p>2.66</p>	<p>Annual savings are per tankless water heater assuming the average household size (2.4 people) in Alberta.</p>	<p>IL TRM v8 volume 3 Res 5.4.2 Gas Water Heater adapted for Alberta.</p>

WATER



Upgrade Name	Description	Estimated Savings (GJ/year)	Energy Savings Assumptions	Reference for Energy Savings
<p>Heat pump water heater</p> <p>Upgrade ID R-W-003</p> <p>EUL: 15 years</p>	<p>A heat pump water heater replaces a conventional storage tank water heater. Rather than the heat coming from burning gas or an electric coil in the tank, heat is sourced from the air around the tank. Heat pump water heaters deliver hot water at a much higher efficiency than conventional water heaters.</p> <p>Pipe insulation ensures minimal heat is lost before heated water is delivered to fixtures. Pipe insulation (required for the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	4.72	Annual savings are per water heater assuming the average household size (2.4 people) in Alberta.	IL TRM v8 volume 3 Res 5.4.3 Heat Pump Water Heaters adapted for Alberta.
<p>High-efficiency storage water heater</p> <p>Upgrade ID R-W-004</p> <p>EUL: 15 years</p>	<p>A high-efficiency storage water heater replaces a conventional gas or electric storage water heater.</p> <p>Pipe insulation ensures minimal heat is lost before heated water is delivered to fixtures. Pipe insulation (required for the City of Edmonton) is an eligible upgrade cost that can be combined with this upgrade to increase energy savings.</p>	3.51	Annual savings are per water heater. The baseline natural gas hot water tank is assumed to be sized based on the average household size (3 people) in Alberta. The replacement tank is sized for the same capacity as the existing tank.	IL TRM Version 10 Volume 3: Residential Measures Section 5.4.2 Gas Water Heater adapted for Alberta.