



ATCO

Energy Efficiency & Emissions Reductions via mCHP

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Alberta Energy Efficiency Alliance Summit
Calgary, May 16 – 17, 2018

Overview

Changes to **policy**

Combined heat and power

COREMO unit

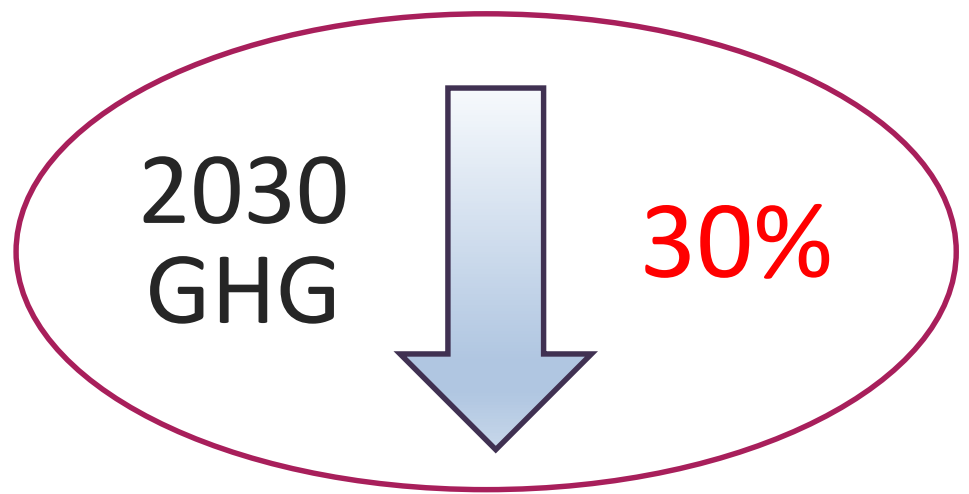
Preliminary **results**

Additional **pilots** installations

Future application

Changes in Policy




Federal Government



Reduce GHG emissions by 30% below the 2005 baseline level: 2030

Provincial Government

Climate Leadership Plan

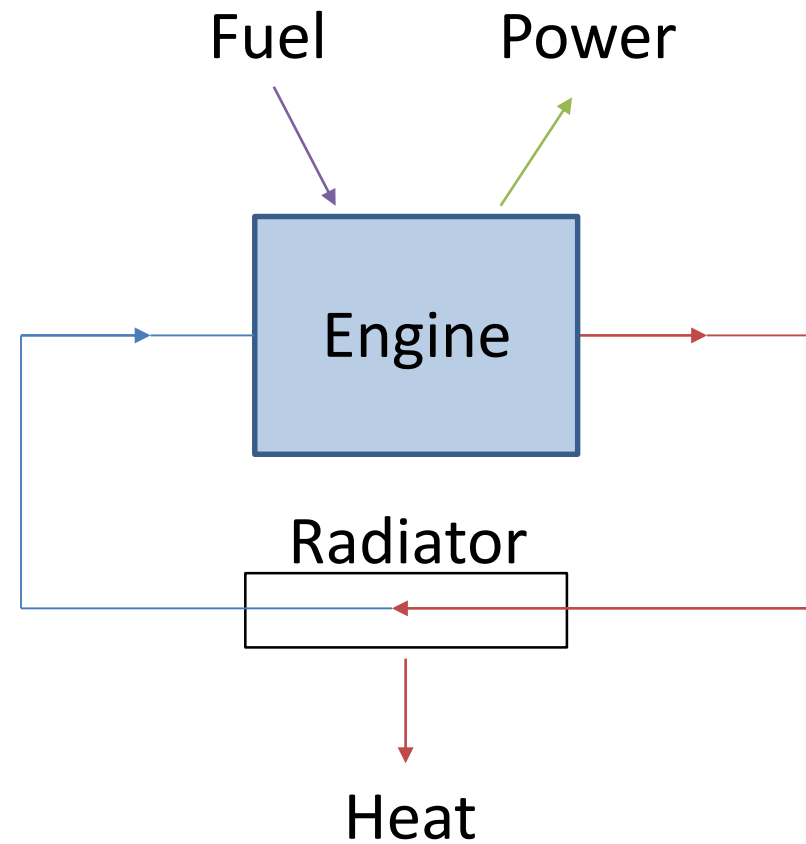
-  Carbon levy
-  Coal-fired generation
-  30% Renewable generation

Objective

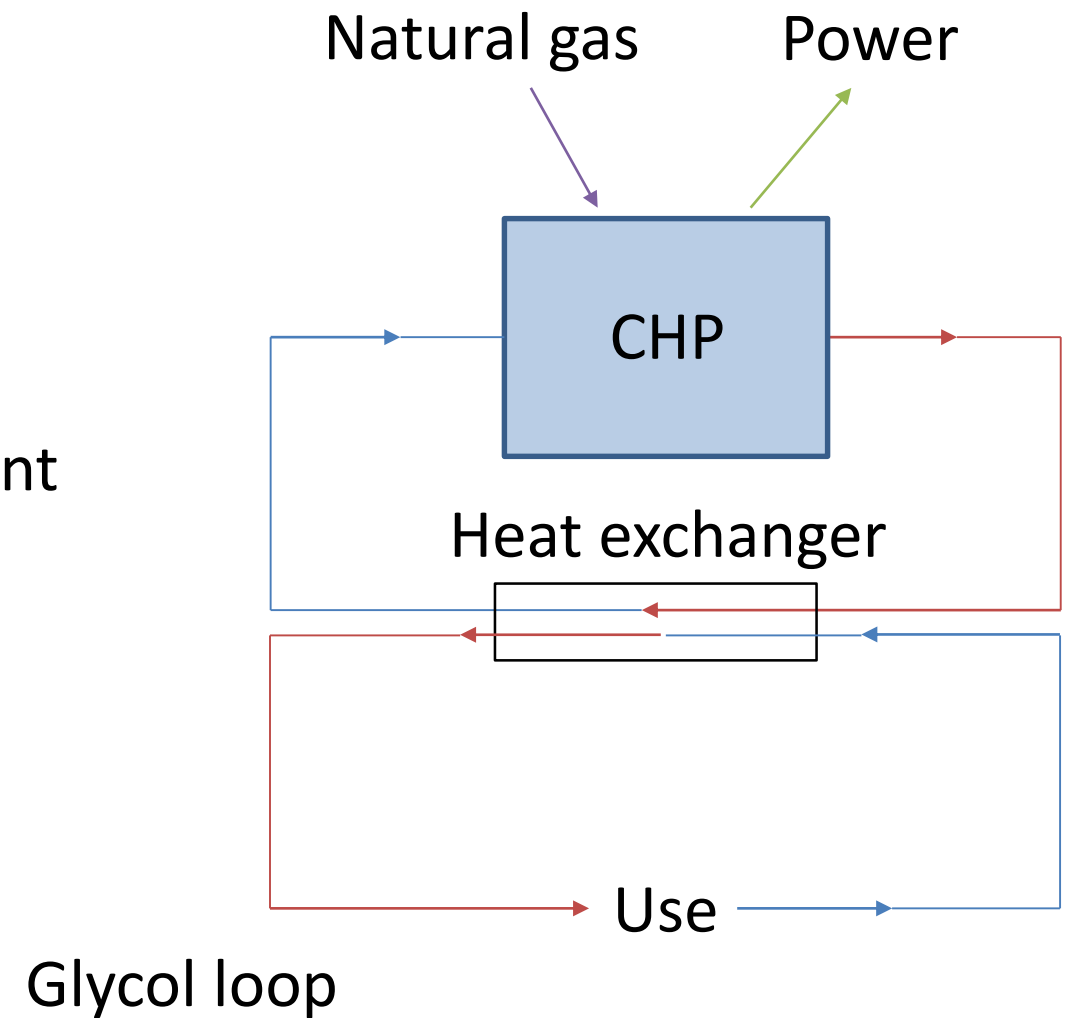
- Explore how combined heat and power (CHP) technology fits into reducing emissions
- Demonstrate application in a residential setting

What is combined heat and power?

Combined Heat and Power (CHP)



Engine coolant loop



Glycol loop

Thermally driven

Micro Combined Heat & Power (mCHP)



Combustion Engine

Natural gas

Liquid cooled

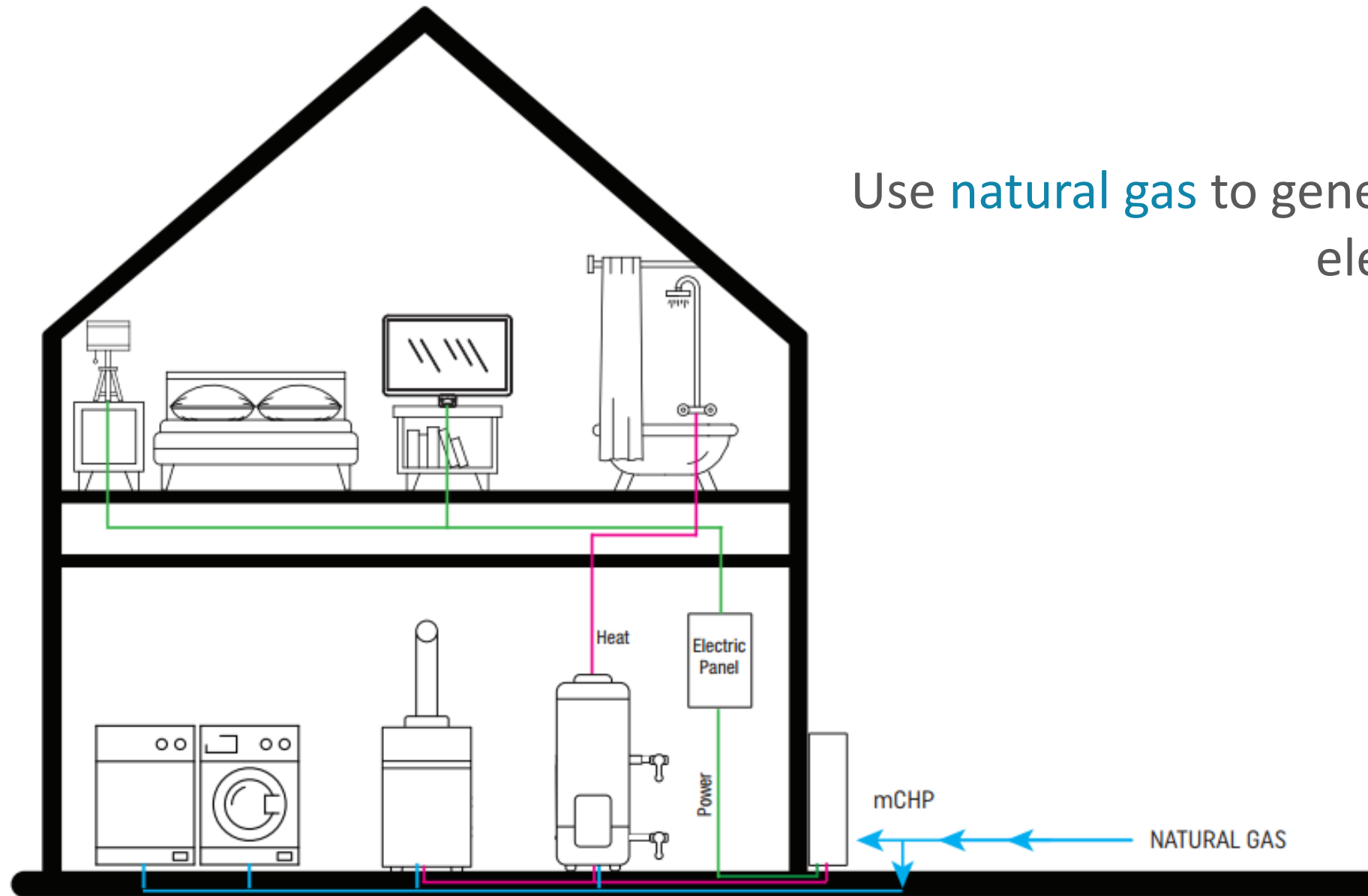
1.5 kW of power

12,600 BTU/hr of heat

Up to 90% efficient



Residential mCHP Application



Use **natural gas** to generate heat and electricity at the **same time**

Pilot Installation

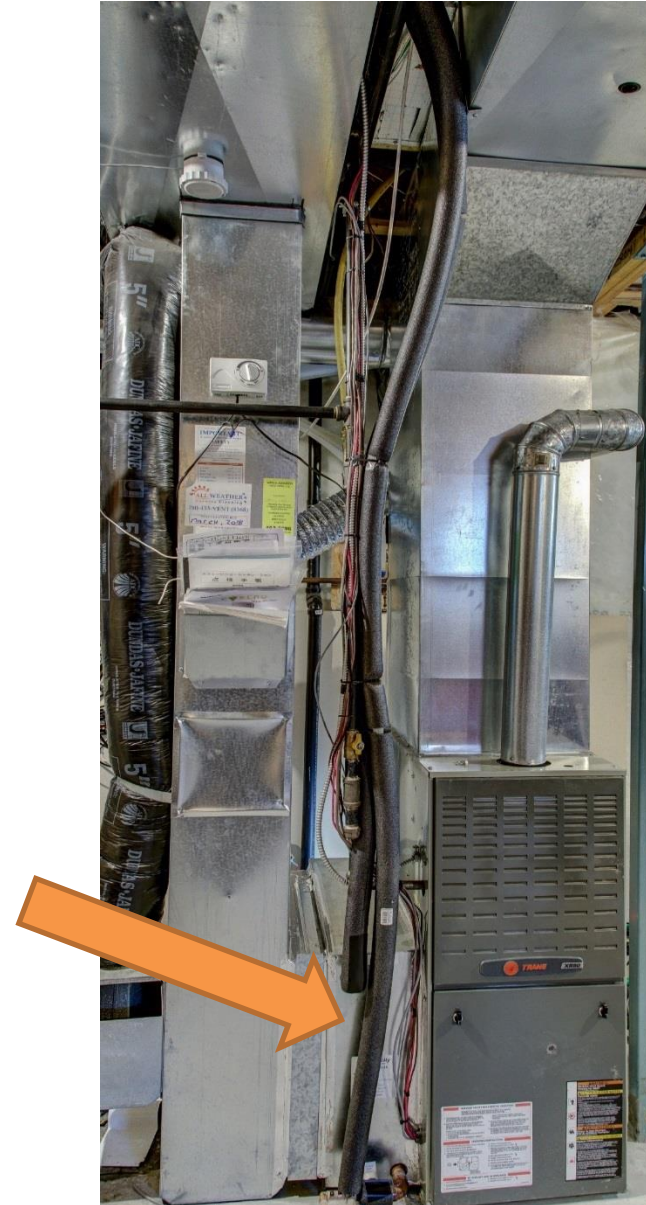


Urban residential retrofit



Size comparison with A/C unit

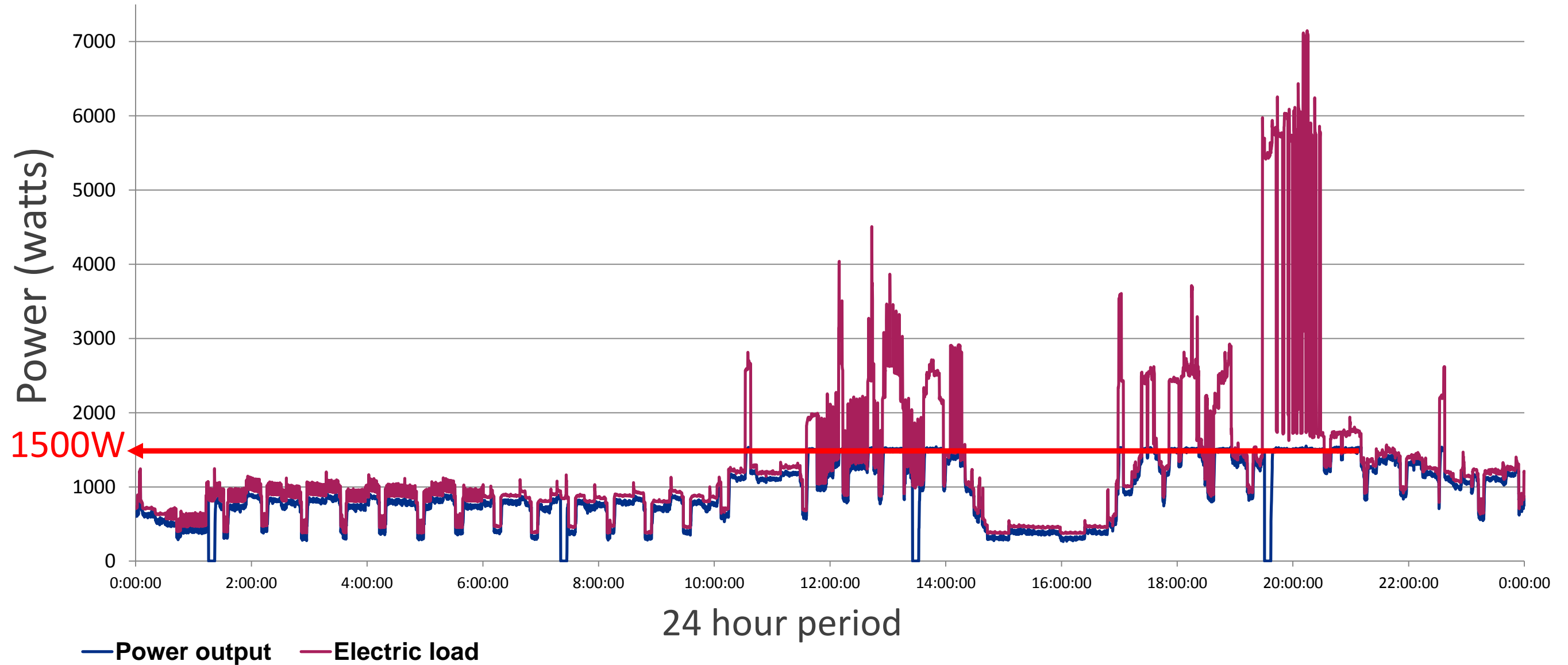
Pilot Installation



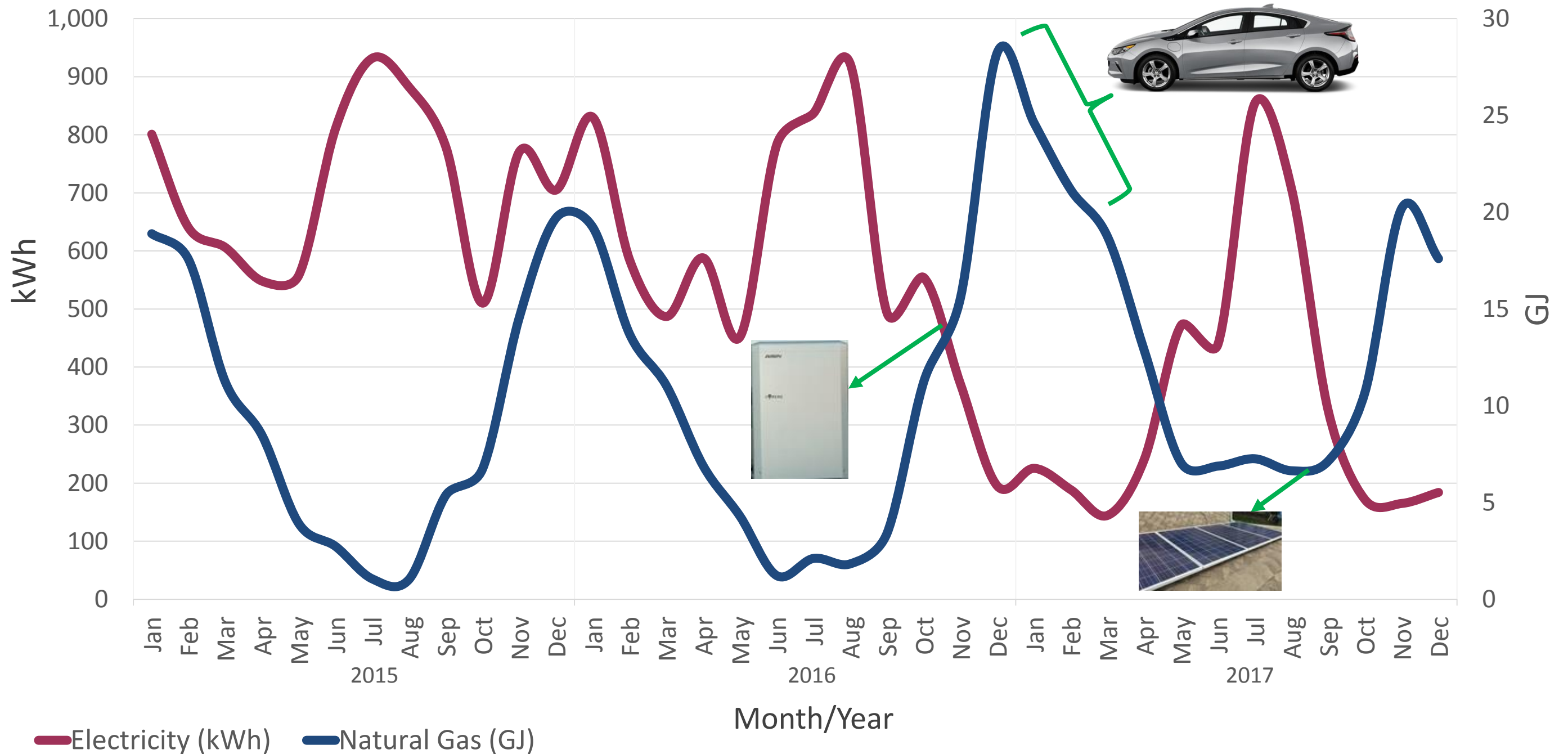
Pilot Installation - Learnings

- Meet domestic hot water needs
 - Family of 4
- Cannot meet space heating demand
 - Avg. furnace: 60-80,000 BTU/hr
 - mCHP: 12,600 BTU/hr
- Space heating = challenging primary heat
 - Increase run-time = add space heating

mCHP Following Electrical Load



Household Gas and Electricity Usage



Solar PV Integration

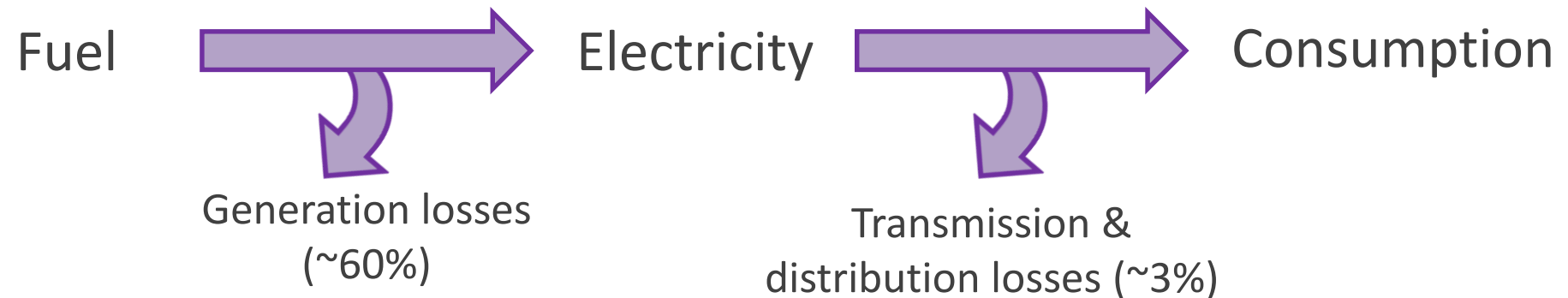
- **Increase** emissions reduction potential
- Provide an affordable way to move towards net-zero energy homes (source energy basis)
- The **cleanest** form of electricity is available when the homeowner needs it



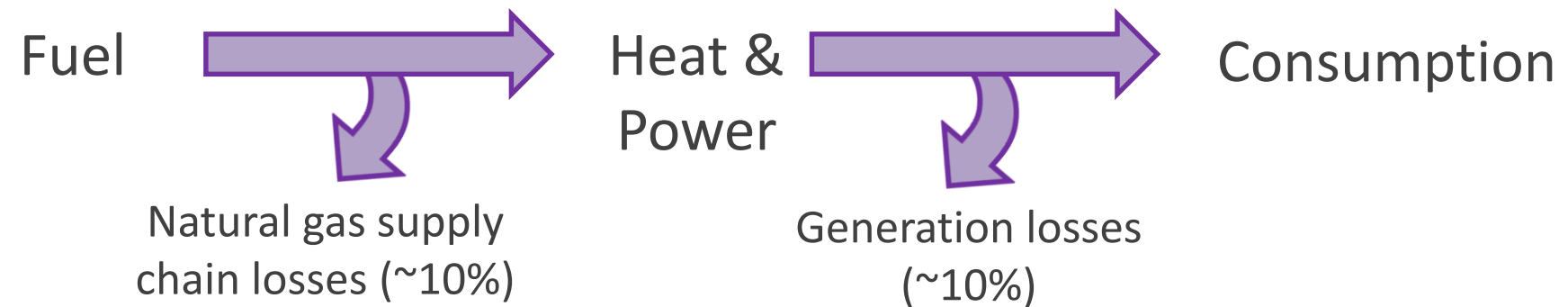
Emissions Reduction Potential

Energy Source	GHG Emission Intensity
Current Alberta Electrical Grid	880 g CO _{2e} /kWh
Future Alberta Electrical Grid	640 g CO _{2e} /kWh
Natural Gas	202 g CO _{2e} /kWh

Conventional Electricity Generation (37%)



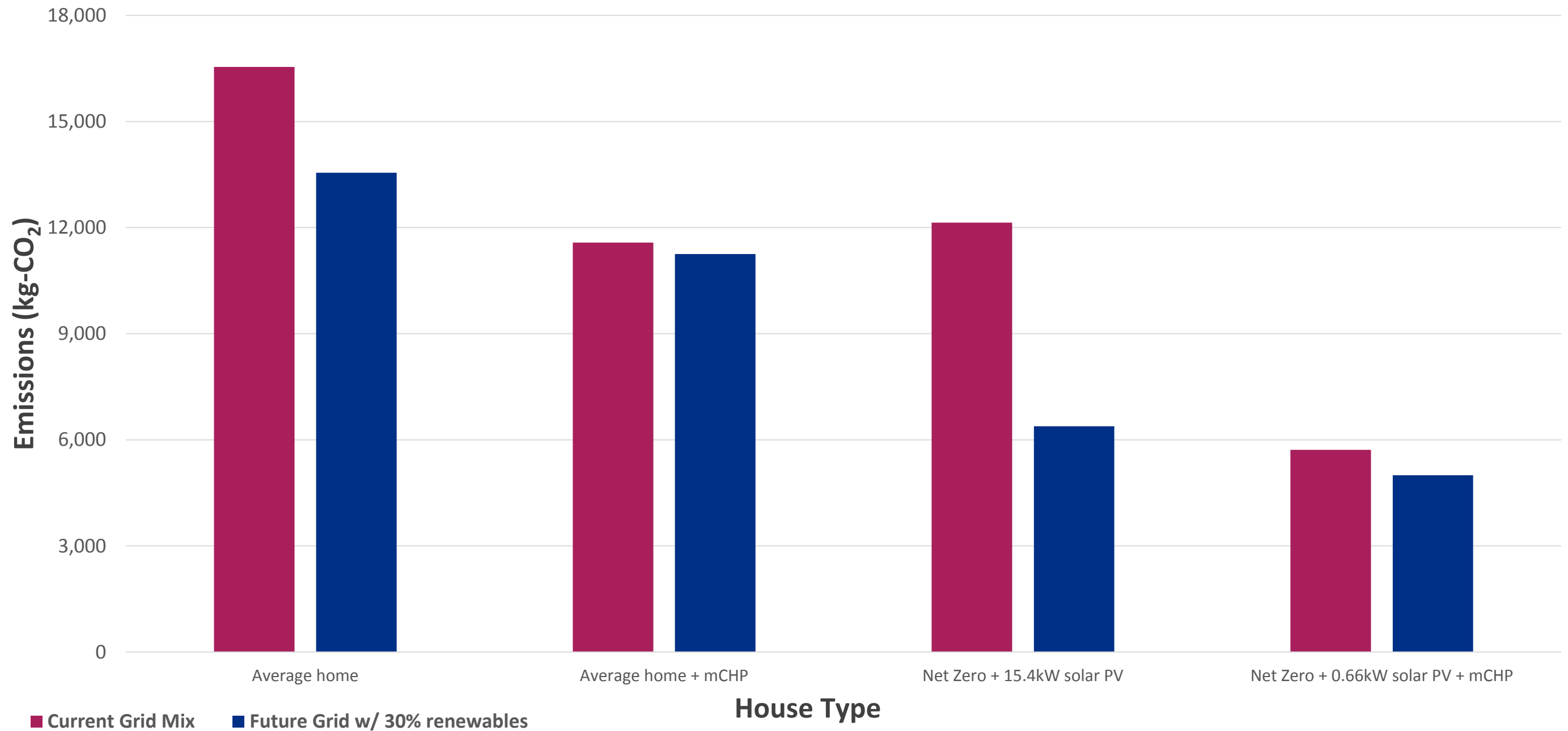
mCHP Distributed Co-Generation (80%)



Initial Pilot Results

	2017 GHG (tonnes)	Emissions Reduction	2030 GHG (tonnes)	Emissions Reduction
Edmonton Residence	11.4		9.5	
Edmonton Residence w/ mCHP	7.9	31%	7.8	19%
Edmonton Residence w/ mCHP & 1.5kW Solar PV	6.6	42%	4.9	49%

CO₂ Produced by Different House Types



Additional Pilot Installations

- 7 more homes (4 Edmonton, 3 Calgary)
 - Commissioned January 2018
 - 1.5kW mCHP & 2.75kW solar PV
- Data collection - confirm emissions reductions potential



Additional Pilots – Calculated Results

January – March, 2018:

- Average across all 6 pilot sites

	mCHP	Solar PV	Total System
Electricity Produced (kWh)	555	263	818
Heat Produced (kWh)	1,584	N/A	1,584
Net Emissions Reduction* (kg CO ₂ -e)	388	232	620

* Per house

Hybrid House Pilot Project

*Estimated emissions reduction of ~12.4 tonnes CO₂:
75% compared to a typical home*



*Off-grid hybrid house east of
Red Deer, AB.*



Aisin COREMO 1.5kW mCHP



Battery bank

Off-Grid Pilot Project



*Off-grid cabin (propane)
Near Mannville, AB.*

Scalability

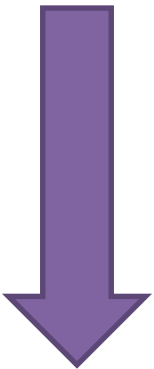
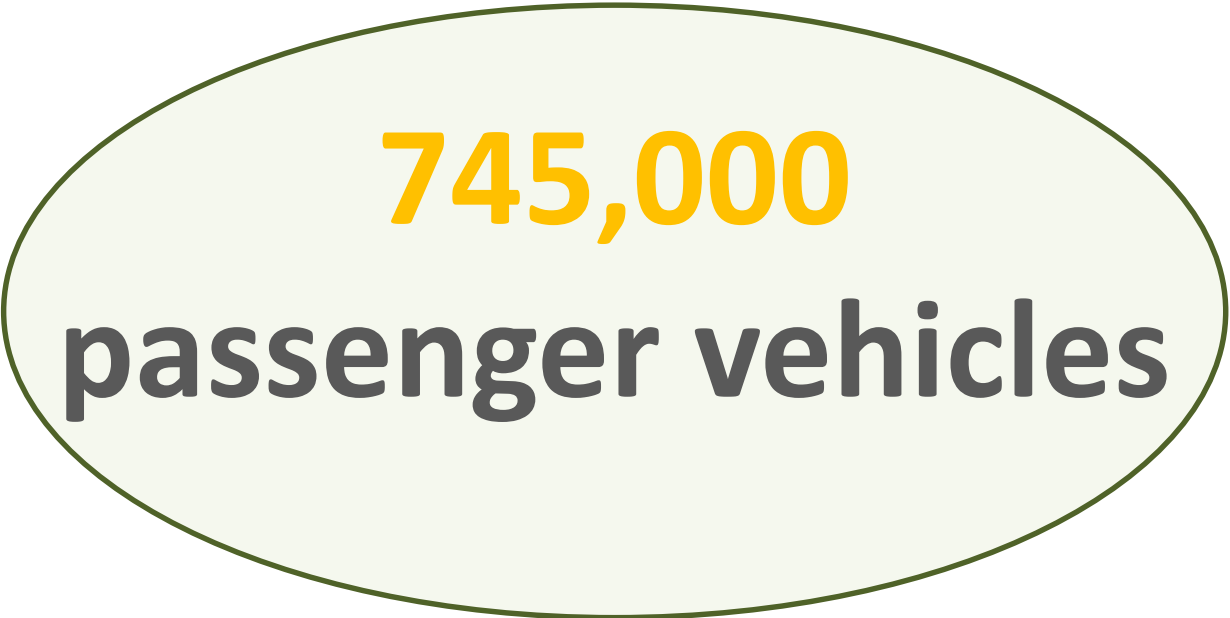
mCHP/solar PV system:

- Retrofits
- New builds

3.5 tonnes CO₂/year

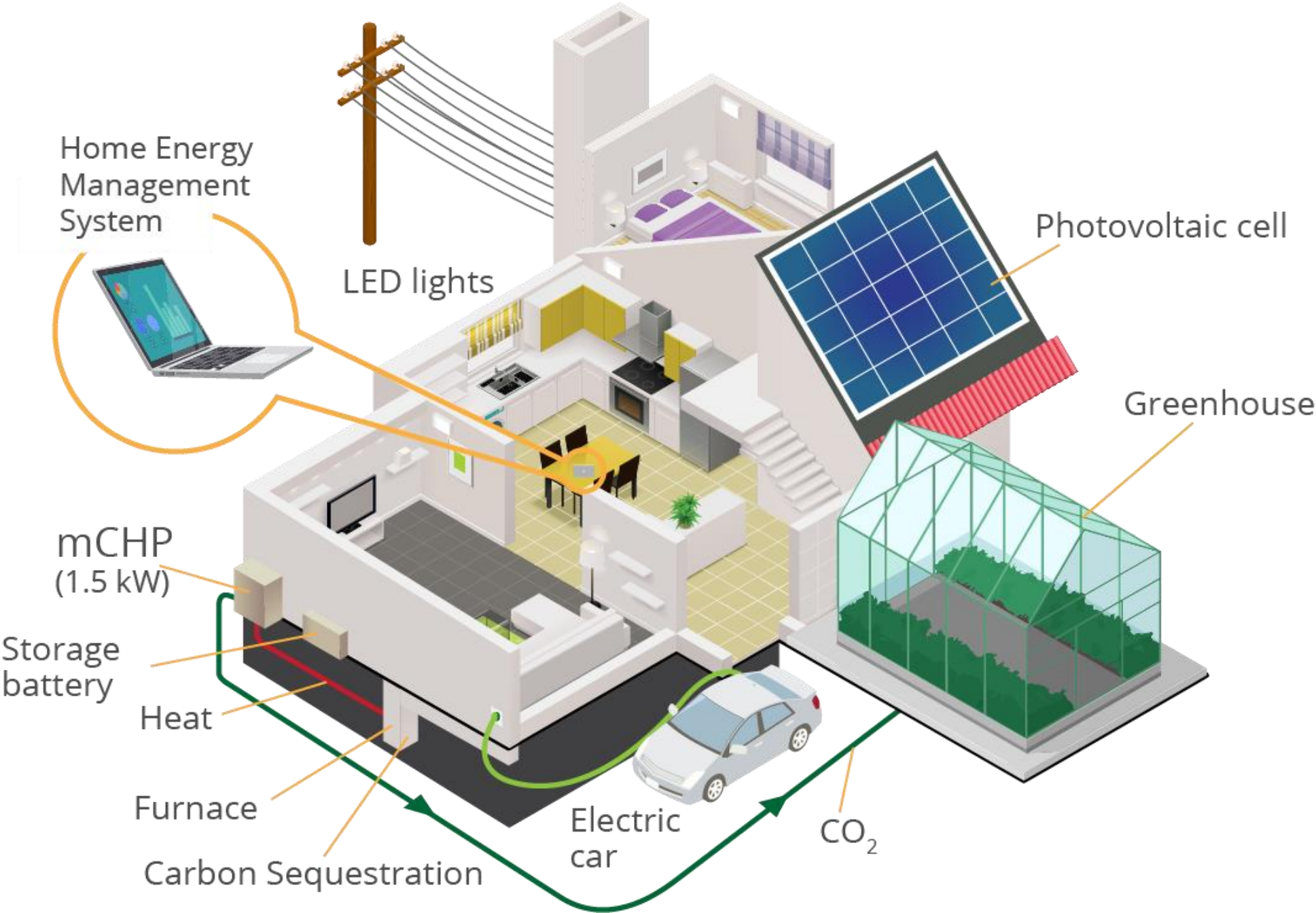


1.1 million customers



3.5 MT CO₂/year

Horizon



The ATCO logo is displayed in a bold, white, italicized sans-serif font. A thick yellow horizontal line is positioned directly beneath the letters. The logo is set against a background of a cornfield under a blue sky with light clouds.

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Thank you