Partners in Project Green

Brought to you by:

Toronto and Region Conservation Authority and Toronto Pearson

ELC Site Visit: Combined Heat and Power System

Energy Leaders Consortium

November 20, 2025

Land Acknowledgement

We respectfully acknowledge that we are situated on the Traditional Territories and Treaty Lands, in particular those of the Mississaugas of the Credit First Nation, as well as the Anishinaabe of the Williams Treaty First Nations, the Huron Wendat, the Haudenosaunee, and the Metis Nation.

As stewards of land and water resources within the Greater Toronto Region, Toronto and Region Conservation Authority appreciates and respects the history and diversity of the land and is grateful to have the opportunity to work and meet on this territory.

Resources

- PPG: Reconciliation in Action
- PPG: Understanding Our Connection with Water
- Native-Land.ca
- Circles for Reconciliation
- EdgeoftheBush
- Text 1-855-917-5263 with your City and Province to learn whose traditional territory you're on
  (standard text messaging rates may apply)

A Collaborative Space for All

Proposed Operative Values for ELC meetings:

1. Balance airtime to hear from as many voices as possible
2. Be curious and challenge our own assumptions and biases
3. Be open to building on each other's suggestions or taking the conversation in another direction

Agenda

Time	Activity
9:00 AM – 9:30 AM	Arrival & Check in With Security
9:30 AM – 9:35 AM	Safety moment (Enbridge)
9:35 AM – 9:45AM	Welcome by Partners in Project Green
9:45 AM- 10:20 AM	Presentation and Q&A Session
10:20 AM – 10:30 AM	Tour rules & groupings explained
10:30 AM - 10:40 AM	Tour Commences
12:00 PM	Tour Ends, Departure

Introduction

Upcoming ELC Sessions & PPG Events

Date	Session
November 27th, 2025 8:30am – 11:00am	Brampton Climate Action Workshop: Building a Sustainable Business Community Rose Theatre, Brampton
December 11th, 2025 1:00 pm - 2:30 pm	ELC Member Roundtable: Year-End Roundtable with Polaris Transportation
January 29, 2026 4:00 PM-6:30 PM	Sustainability Leaders Social: Kick off 2026 with PPG!
June 11th, 2026 9:00am – 4:00pm	PPG 2026 Annual Forum The Courage to Transform: Business Innovation for a Climate Resilient Economy

Tracking ELC 2025 Impact

- Tracking sheets will be shared soon
- ELC member reporting for 2025 due **Dec 31, 2025**:
  - Tracking helps us celebrate our impact as a consortium of energy leaders!

Energy Conservation Measure Description	Utility	Annual Consumption Savings		Monetary Savings ($)
			kWh	
			m3	
			L	
			kW	

PPG Annual Member Survey

Due November 21st

Please take a few minutes to complete our **Year-End Member Survey** to help us understand what's working well, where we can grow, and how we can continue supporting your organization's sustainability journey.

Survey Link: **PPG 2025 Member Survey - Energy Leaders Consortium**

As a thank you, each member organization that completes the survey will be entered into a draw to **win two tickets to PPG's Annual Forum 2026:**

Sustainability Leaders Social

Kick off 2026 with Partners in Project Green

Join our first networking event of the year! A great chance to meet/reconnect with fellow sustainability professionals, exchange ideas, and celebrate the exciting work shaping a greener future.

When: Thursday, January 29, 2026
Time: 4:00pm – 6:30pm
Where: Carbonhound – 2/F 145 St Luke Ln, Toronto

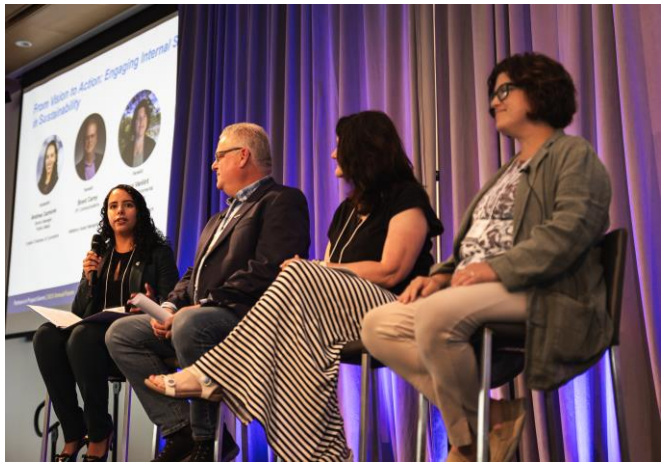
Contact charlotte.hung@trca.ca for more details!

Register here:

PPG 2026 Annual Forum

The Courage to Transform:
Business Innovation for a Climate Resilient Economy

PPG's 2026 Annual Forum will bring together business leaders, sustainability professionals, and innovators to explore how organizations can rethink and reinvent their business models to thrive in a decarbonized future.



When: Thursday, June 11th, 2026

Time: 9:00am – 4:00pm

Where: University of Toronto Mississauga, – Kaneff Centre (1833 1C6 Inner Cir Rd, Mississauga, ON L5L 1C6)

Get your early bird tickets:

If you're a PPG Member, you can access exclusive discounts. Contact charlotte.hung@trca.ca for more details!

Enbridge

Today's Speaker

Sam McDermott

M.Eng., P.Eng.

Technical Manager – Customer Innovation Solutions

Enbridge Gas

Enbridge Hydrogen Production & Dispensing

Business Development & Strategy
Samuel McDermott – Technical Manager, Customer Innovation Solutions (CIS)
Aqeel Zaidi – Manager CIS

ENBRIDGE
Life Takes Energy

Revised: October 3 - 2025

Renewable Assets
Complementary to Hydrogen

North America's First Power-to-Gas Plant

- Enbridge continues to operate North America's first utility-scale PtG plant in Markham, ON
- This 2.5-MW helped to successfully balance Ontario's electricity grid from 2018 to 2021

Source Photo: Enbridge

North America's first H2 blending pilot project

- Operational since October 1, 2021
- Blends up to 2% by volume
- 4200 Customers
- Abated 227 Tonnes CO_2e as at May 2025
- 33,088kg of H2 injected
- 110,000m^3 NG saved
- Blend increasing to up to 5% Q1 – 2026
- Pilot completion October 2026

NA's First Hydrogen CHP at TOC

- In Service Q1-2024
- 115kWe
- Runs on:
  - 100% H2 or
  - 100% NG or
  - NG Blends from 50% to 100% H2
- Abates Scope 2 emissions
- Replaces 92% of electrical load from LDC
- Supply around 60% of heating needs

Coming In 2026

New Hydrogen Compression and Dispensing Facility under construction with scheduled in service date of Q1-2026

Construction of A Compression & Dispensing Facilities

Construction is Underway for New Hydrogen Compression and Dispensing Facility.

Site Location: 101 Honda Blvd, Markham, ON.

Project Description:

- A newly built fenced yard (62m x 62m) hosting:
    1. Tube Trailer with multiple fill posts at (250/520) barg
    2. Hydrogen Dispenser for fuelling heavy duty vehicles all classes 350barg to 520 barg and light duty vehicles rated at 700 barg to 75%.
- Hydrogen will be supplied directly from Enbridge's Power to Gas production facility.

In service Date: Q1-2026

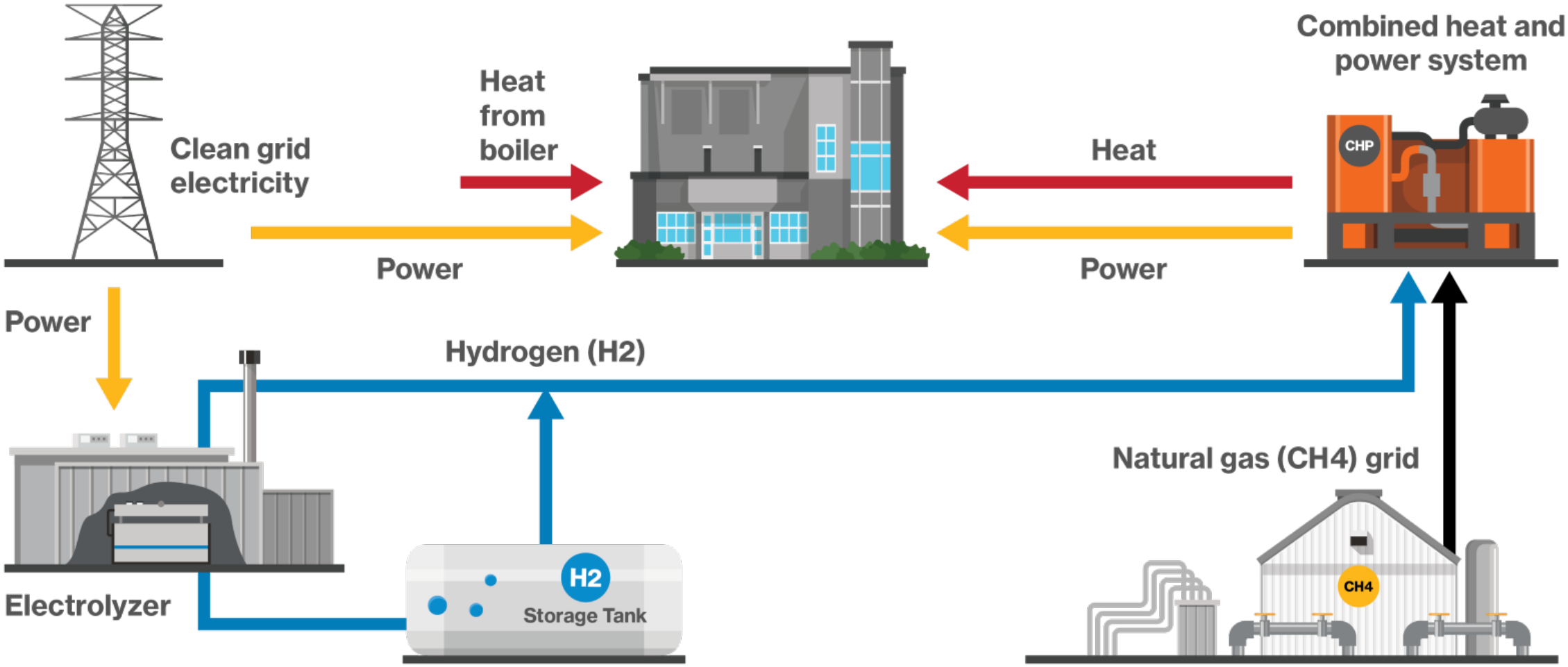
Figure 1 – 101 Honda Blvd – Home of Ontario's Newest Hydrogen Tube Trailer and Dispensing Facilities

NG/Hydrogen Ready IC Engines and Turbines

Credit BH and 2G

Energy Savings – Leveraging our DSM Process…IC Engines hot water, Turbines Steam

Employing NG and Hydrogen via Electrolysis



Start with Gas, Option to use electrolysis which could be driven by low period of power production from a CHP system for resiliency and grid support.

Methane (NG) Pyrolysis The Next Frontier in Hydrogen Production

North America's first 100% hydrogen fueled CHP system

ENBRIDGE

Project team

- Enbridge Gas Inc.
  - Site Host, owner and operator
  - H2 pipeline and sales station supply and installation
  - Commissioning
- 2G Energy Corp.
  - CHP system manufacturer and supplier
  - Commissioning and maintenance contract
- CEM Engineering, St. Catherines, ON
  - Feasibility study and system design
  - Construction Management

Project Objectives

- Demonstrate the potential to offer a reliable emissions-reducing solution using a hydrogen fueled Combined Heat and Power (CHP) system which produces clean electricity and heat while offsetting demand on Ontario's electrical grid
- Reduces Enbridge's scope 2 emissions
- Provide valuable lessons learned regarding the use of clean hydrogen in CHP systems
- Provide a working example or an option for customers who plan to install hydrogen fueled CHP systems to meet ESG targets

CHP System Information

- 115 kW CHP system supplied by 2G Energy
  - Reciprocating engine gen set with heat recovery system and other ancillary equipment
  - Integrated with building hot water space heating loop
- Capable of running on 100% hydrogen (H2) or 100% natural gas (NG) and H2/NG gas blends
- Can switch completely between either fuels in 3 to 5 minutes
- Delivered as a containerized plug and play package
- Footprint: 9.6 m (31.5 ft) x 3 m (9.8 ft)
- NOx control:
  - No Selective Catalytic Reduction (SCR) needed on hydrogen firing
  - SCR required on gas firing

CHP System Specification

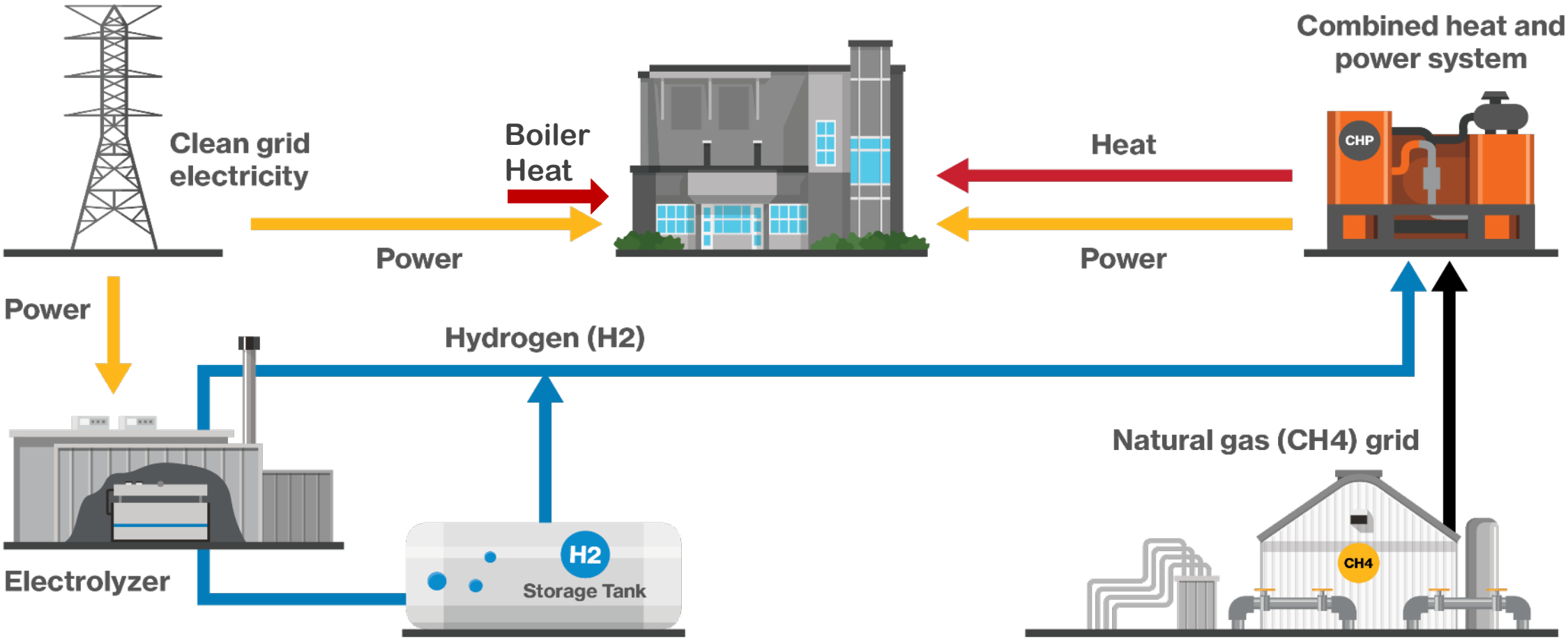
- Agenitor 404c
- 4-cylinder, 1800 rpm, lean burn engine
- Electrical output: 115 kW, both of H2 and NG

1. Genset

	50 %	75 %	100 %	Load
Electrical power	58	86	115	kW (5)
Recoverable thermal output	70	102	134	kW (2)
Fuel cosumption	177	237	304	kW (1)
Efficiency Electrical	32,5	36,3	37,8	% (1)
Efficiency Thermal	39,5	43,0	43,9	% (1), (2)
Efficiency Combined (el. + th.)	72,0	79,3	81,7	% (1), (2)

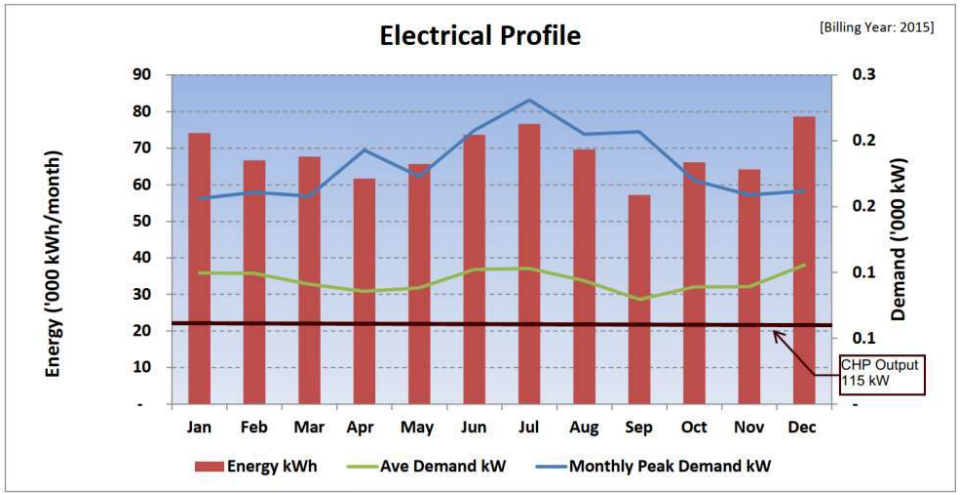
	NOx	CO	
Exh. emissions without catalytic converter	< 94	< 0	mg/Nm³ (4),(6)
	< 46	< 0	ppm (4),(6)

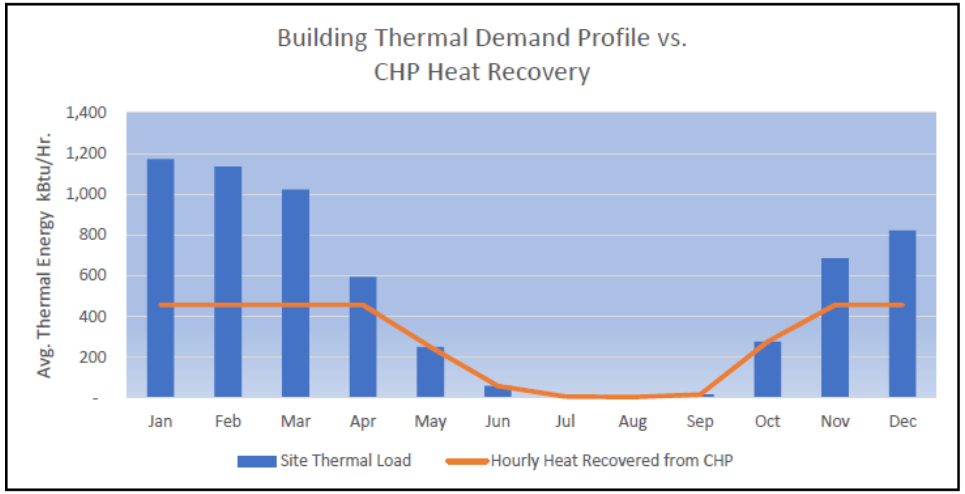
CHP System Schematics



System Design

- Follow electrical load for behind the meter installation:
  - Monthly peak demand: 156 – 231 kW
  - Monthly average demand: 80 – 106 kW
- Analysis confirmed 115 kW engine was a good fit
- Most of the waste heat can be used for space heating
- No heat sink available during summer
- Will use about 60% of available heat annually
- Displace 74,000 m3 (2,750 MMBtu/yr)
- GHG reduction: 140 tonnes/yr





Preliminary Results

Electrical Efficiency

Description	Unit	H2+NG	100% H2
Electricity production	kWh	24,290	14,706
Hydrogen consumption	m3	19,830	14,034
Hydrogen consumption	kg	1,675	1,185
Natural gas consumption	m3	1,323	0
Total input energy (HHV)	kWh	80,983	47,170
Electrical efficiency (HHV)	%	30.0	31.2
Electrical efficiency (LHV)*	%	35.2	37.0

- The Electrical efficiency represents an average of part and full load conditions
- Th efficiency is closer to specification

* Specification values for electrical efficiency range from 32.5% – 37.8%

NOx Emissions

- Selective Catalyst Reduction (SCR) not required on H2 firing
  - H2 firing* = 90 mg/m3
  - Natural gas firing = 450 mg/m3 w/o SCR
    = 90 mg/m3 with SCR
- Possible reasons for lower NOx
  - high Lambda (air fuel ratio) of up to 5, which result in lower combustion temperatures
  - 2G's unique spark plug technology design and air fuel injection system that has been specifically developed for H2 applications.

* Specification values < 94 mg/m3

Acknowledgments

- This project is partially supported by financial contribution of the Ontario Independent Electricity System Operator (IESO) through the Hydrogen Innovation Fund

Pyrolysis of NG to Make Clean H_2 & Carbon

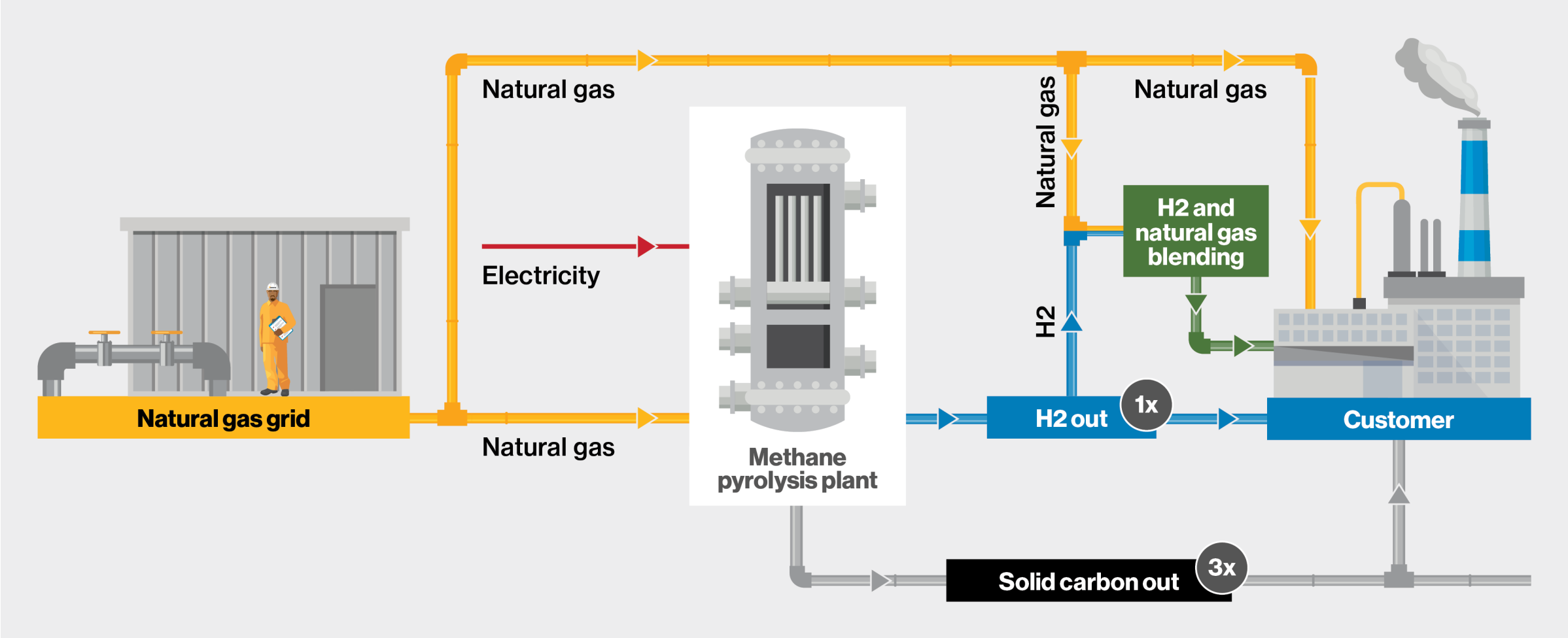
- Methane pyrolysis is an emerging production technology
- It produces clean hydrogen while isolating carbon in solid form
- Significantly reducing greenhouse gas (GHG) emissions without requiring carbon capture and storage (CCS)
- Government of Canada Clean Hydrogen Investment Tax Credit (ITC) to include methane pyrolysis as an eligible production pathway[1] for hydrogen production.
- Qualification for ITC aligns with Canada's climate objectives of reducing GHG emissions and achieving net-zero emissions by 2050" [2]

1, 2. Source: canadah2.ca/canadian-hydrogen-association-welcomes-inclusion-of-methane-pyrolysis-in-the-clean-hydrogen-investment-tax-credit/

Low Carbon Hydrogen

Blue	Produced from steam methane reforming with CO2 capture utilization and storage (CCUS) technologies to reduce carbon intensity
Green	Produced by electrolysis using renewable electricity
Turquoise	Produced from splitting methane into carbon and hydrogen

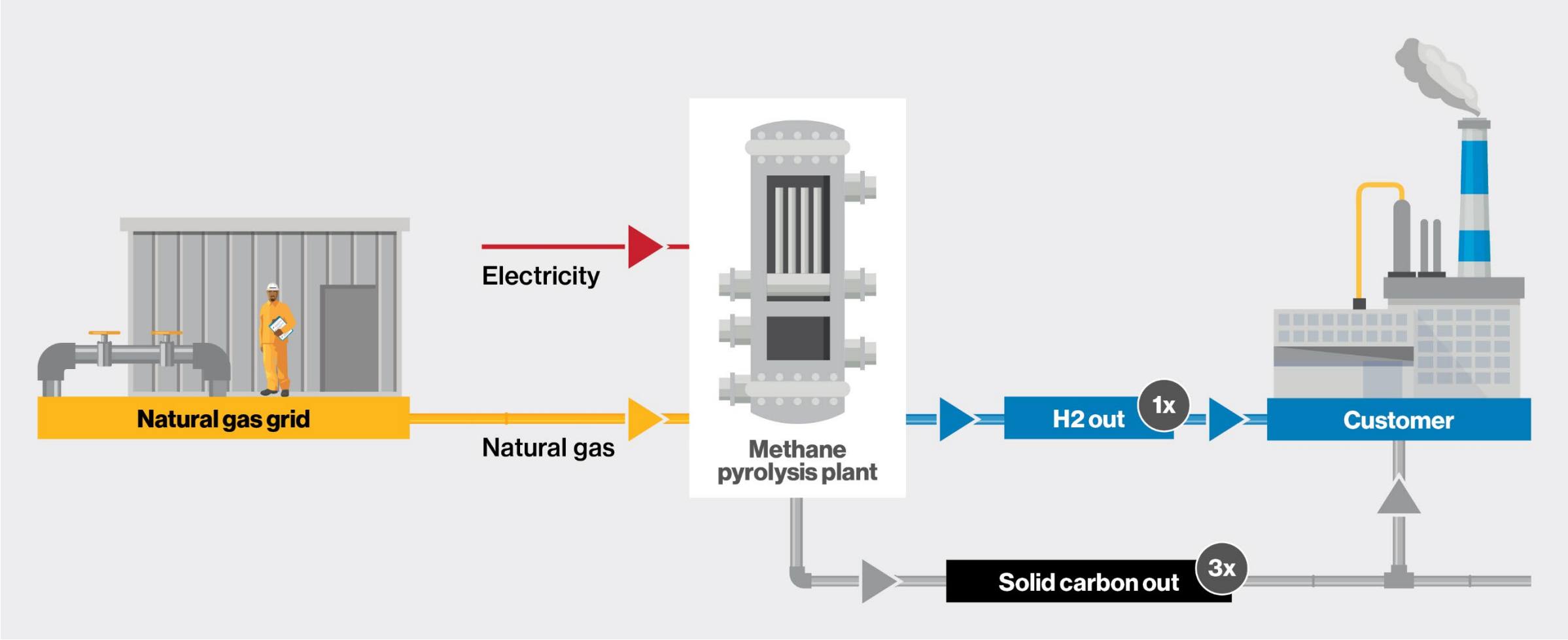
Methane Pyrolysis – Start With NG and Add H_2



Can be done at a lower price point by leveraging the low cost on NG and the lower energy requirement of the process

Vehicle Refueling

Methane Pyrolysis Start With H2 & No Blending



Can be done at a lower price point by leveraging the low cost on NG and the lower energy requirement of the process

Preparing for the energy future

- We strive to make an impact along the entire energy value chain. We do this by:
  - modernizing our assets, investing in renewable power and innovative solutions like renewable natural gas, hydrogen, and carbon capture, utilization and storage, and we are working with our customers to encourage energy efficiency.
- Enbridge is developing cutting-edge, innovative solutions to prepare for the energy transition.

Enbridge is ensuring we will meet the growing energy needs of the future while reducing emissions

Safety is our #1 priority

We invested

US$11.7B

2013 – 2022 to maintain the integrity of our system

We performed

38,242

pipeline integrity inspections in 2022

We monitor our lines

24-7

with people and computerized leak detection systems

We held/participated in

210

emergency exercises and drills in 2022

Above all else, we believe every incident can be prevented. We are always working to ensure the safety of our employees, neighbours, communities and the environment.

Leading with innovation

Enbridge opened Technology and Innovation Labs in Calgary and Houston

Applying technology

- Leading the industry through innovative technologies
- Focus on accelerating technology-driven business solutions

Using cutting edge technology

- Leveraging machine learning and artificial intelligence

Building innovative culture

- Hiring the brightest people and building agile teams
- Developing a culture where all ideas are welcomed and encouraged

Respect for the environment and people

- We are committed to providing energy in a sustainable, socially and environmentally responsible way.
- Our approach to supporting the transition to a low-carbon economy has three key areas:
  1. Reducing greenhouse gas emissions through innovation.
  2. Helping customers reduce their energy use through conservation.
  3. Investing in renewable energy assets and low-carbon solutions.

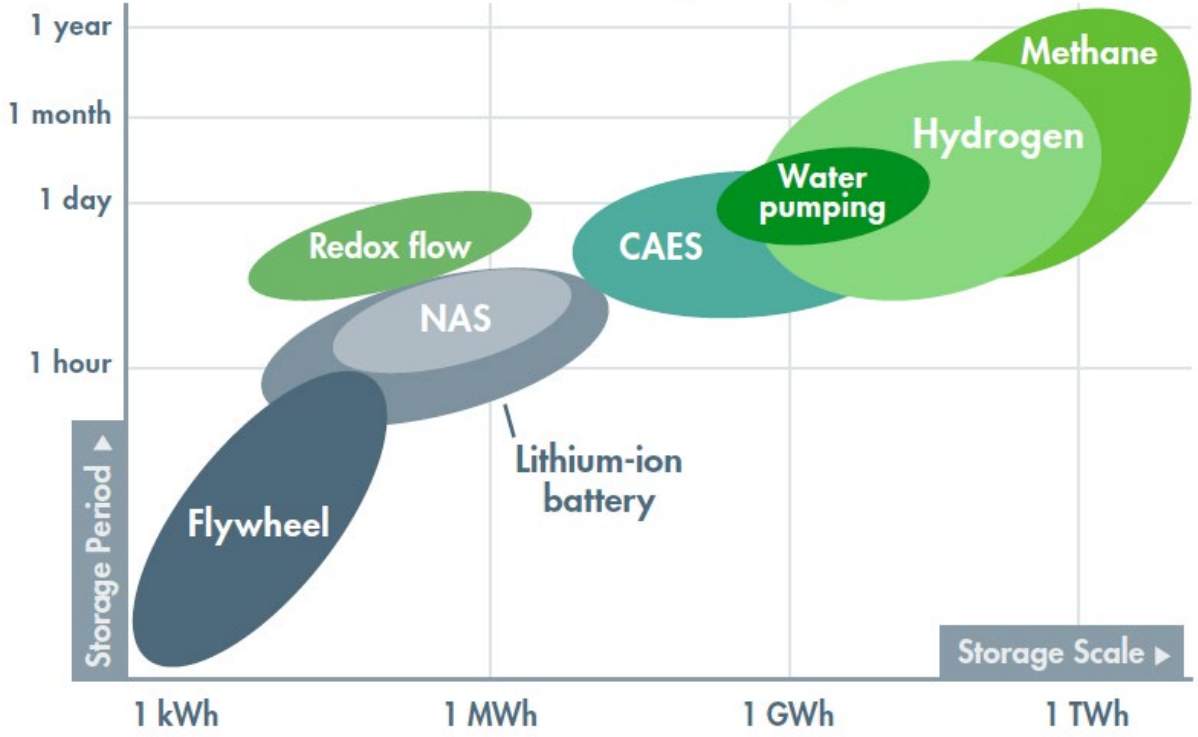
Enbridge is continually innovating to reduce emissions at every step of our energy delivery network

Resiliency of the Gas Grid

Storage Resiliency

Enbridge currently operates one of the largest energy storage hubs in north America with 351.6 BCF of storage

FIGURE 4
Various technologies for electricity storage



Source: Iida and Sakata, 2019

Ref: The hydrogen option for energy: a strategic advantage for Quebec.

How Reliable is Enbridge's Gas Grid?

- The Gas Grid is less susceptible to Adverse weather events.
- Enbridge Gas' distribution system boasts a reliability rate of 99.9993%, ensuring uninterrupted energy availability during extreme weather events that can disrupt the electricity grid.
- We provide this Reliability and Resiliency to all our customers, including you.

We pride ourselves on being reliable and resilient while driving continual safety, quality improvements, environmental stewardship, helping you meet your carbon reduction target while future proofing your investments.

Thank You

Samuel McDermott

Sam.mcdermott@enbridge.com

Q & A Session

CHP Tour


Partners in
Project Green
A Program of Toronto and Region Conservation Authority

Thank You!