EMERSON EXCHANGE 2025

ACCELERATING INNOVATION

ACCELERATING INNOVATION

Power-to-Gas NG/H2 Blending with On-line Gas Chromatograph

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Disclaimer

The information and/or opinions expressed in this presentation are those of the authors and do not necessarily represent official policy or permission of Emerson or Emerson Exchange.

Important Reminders

Photography and audio/video recording is not permitted in any session, or in the exhibition areas, without press credentials or written permission from Emerson or Emerson Exchange.

Inquiries should be directed to:
EmersonExchange@Emerson.com

Cliff Crawford

H2 Specialist / Enbridge Gas Inc

James Lee

Sales Manager / Lakeside Process Controls

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Power-to-Gas NG/H2 Blending with on-line Gas Chromatograph

Intro to Enbridge Gas Inc.

What is Power-to-Gas and NG/H2 blending?

What was the need for the measurement

The Rosemount 770XA Solution

Enbridge Gas Inc

Toronto, Ontario

Enbridge Gas Ontario is Canada’s largest natural gas distribution storage, transmission, and distribution company with a 175 history of serving customers. The distribution business serves 3.9 million customers and is innovating to contribute to a lower-carbon energy future

Lakeside Process Controls

Emerson Impact Partner for Ontario and Manitoba

About us

Enbridge is a first-choice energy provider.

Liquids pipelines

- North America's longest, most complex transportation system
- 29,104 km/18,085 mi. of pipe
- Moving ~5.8 million barrels/day

Natural gas pipelines

- 113,542* km/70,552* mi. of pipe
- Moving 24.6 Bcf/day
- Enough natural gas for >170M people

Natural gas utilities

- 178,002 km/110,606 mi. of pipe
- Delivering energy for more than 175 years
- 7,000+ valued employees

Renewable power

- 37 renewable power facilities
- 6,612 MW generating capacity
- Committed more than US$8 billion (C$12 billion) since 2002

Transports **~30%** of crude oil produced in North America

Delivers **~20%** of the natural gas consumed in the U.S.

Delivering to **7 million** customers in Canada and the U.S.

1.3 million** homes powered by our assets

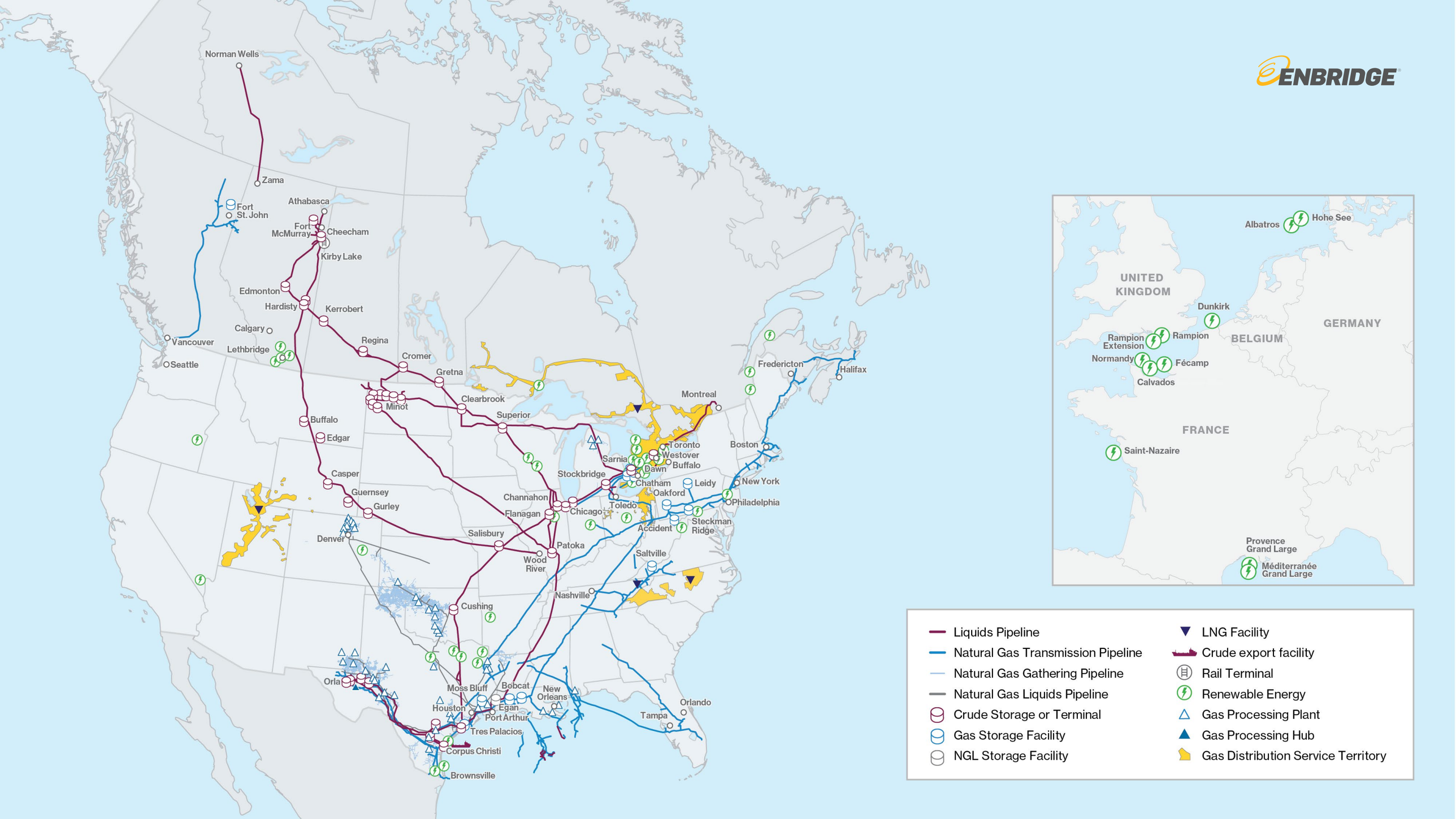
*Includes DCP Midstream assets

**Estimated numbers of households powered calculated using regional energy consumption data: Energy Consumption – U.S. homes and Energy Consumption – Canadian homes.

What we do

We fuel quality of life for millions of people every day

- As the world's population grows, we believe all forms of energy will be needed to meet rising global demand—natural gas, oil and renewable energy such as wind and solar.
- As a diversified energy company, we believe we are uniquely positioned to help accelerate the global energy transition, while at the same time working to deliver reliable and affordable energy.
- We're committed to:
  - Lowering our operating emissions while meeting growing energy demand
  - Supporting our customers today while anticipating their needs tomorrow
  - Developing new energy sources while keeping energy costs in check


ENBRIDGE
Norman Wells
Zama
Fort St. John
Athabasca
Fort McMurray
Cheecham
Kirby Lake
Edmonton
Hardisty
Kerrobert
Calgary
Vancouver
Lethbridge
Seattle
Regina
Cromer
Gretna
Minot
Clearbrook
Superior
Buffalo
Edgar
Casper
Guernsey
Gurley
Denver
Salisbury
Wood River
Patoka
Channahon
Flanagan
Chicago
Stockbridge
Sarnia
Toronto
Westover
Buffalo
Dawn
Chatham
Oakford
Leidy
Toledo
Accident
Steckman Ridge
New York
Philadelphia
Boston
Montreal
Fredericton
Halifax
Saltville
Nashville
Cushing
Orla
Moss Bluff
Bobcat
Houston
Egan
Port Arthur
New Orleans
Tres Palacios
Corpus Christi
Brownsville
Tampa
Orlando
UNITED KINGDOM
GERMANY
BELGIUM
FRANCE
Albatros
Hohe See
Dunkirk
Rampion Extension
Rampion
Normandy
Fécamp
Calvados
Saint-Nazaire
Provence Grand Large
Méditerranée Grand Large
Liquids Pipeline
Natural Gas Transmission Pipeline
Natural Gas Gathering Pipeline
Natural Gas Liquids Pipeline
Crude Storage or Terminal
Gas Storage Facility
NGL Storage Facility
LNG Facility
Crude export facility
Rail Terminal
Renewable Energy
Gas Processing Plant
Gas Processing Hub
Gas Distribution Service Territory

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Power-to-Gas NG/H2 Blending with on-line Gas Chromatograph

Intro to Enbridge Gas Inc.

What is Power-to-Gas and NG/H2 blending?

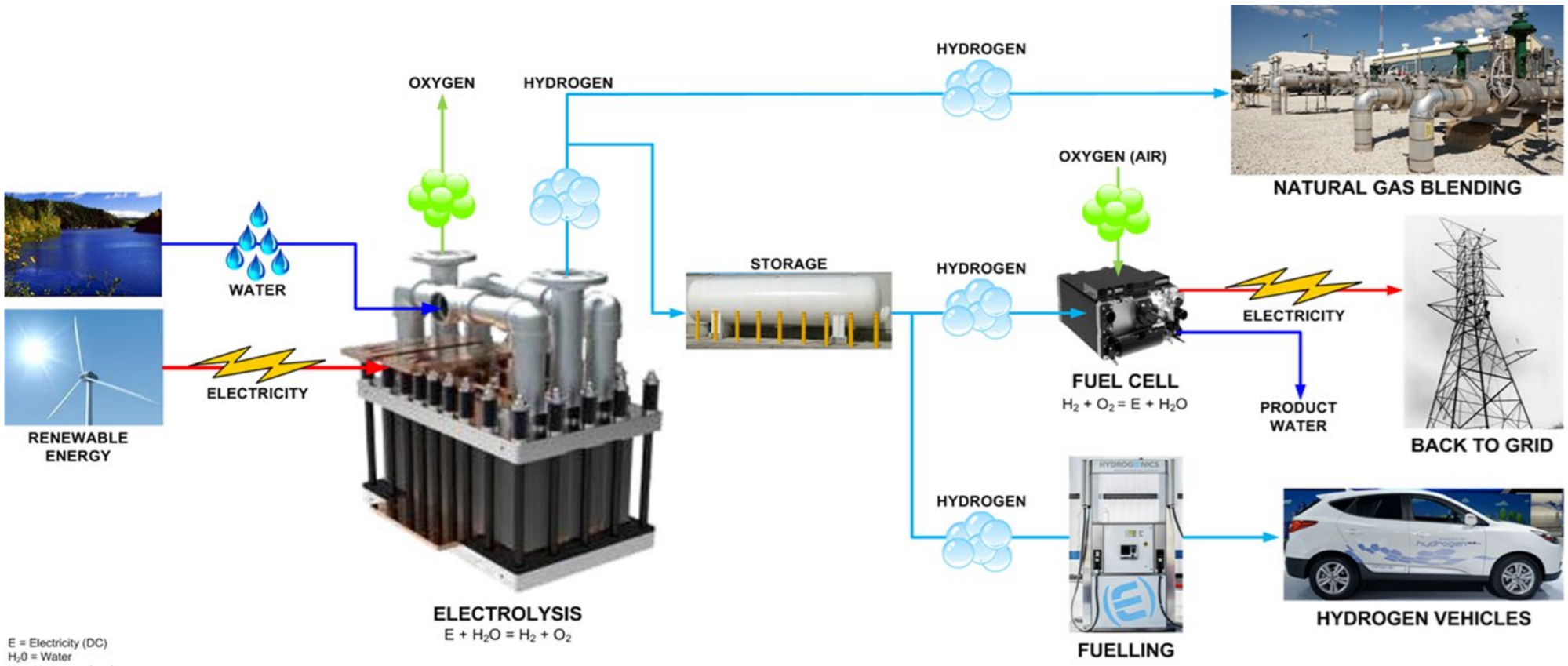
What was the need for the measurement

The Rosemount 770XA Solution

What is Power to Gas?

- Power-to-Gas (PtG) is an innovative energy storage solution using electrolysis which produces renewable hydrogen
- Uses renewable and carbon-free sources of electricity (E) to split water (H2O) into hydrogen (H2) and oxygen (O2).
- Hydrogen will be blended with natural gas as a renewable percentage blend and injected into Enbridge’s natural gas grid

Power to Gas - Process



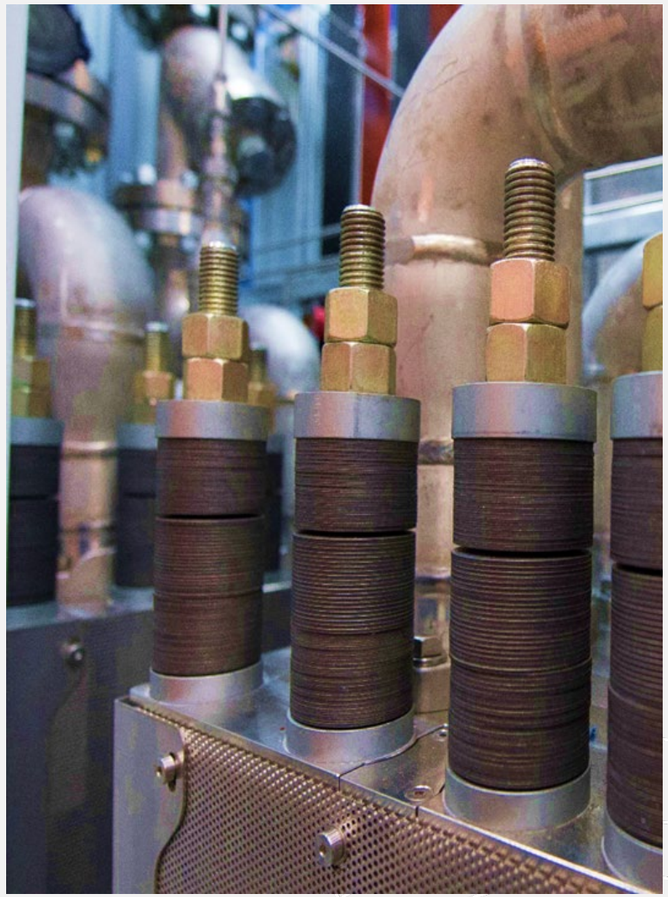
North America's First Utility-Scale PtG Facility

North America’s First Power-to-Gas Plant

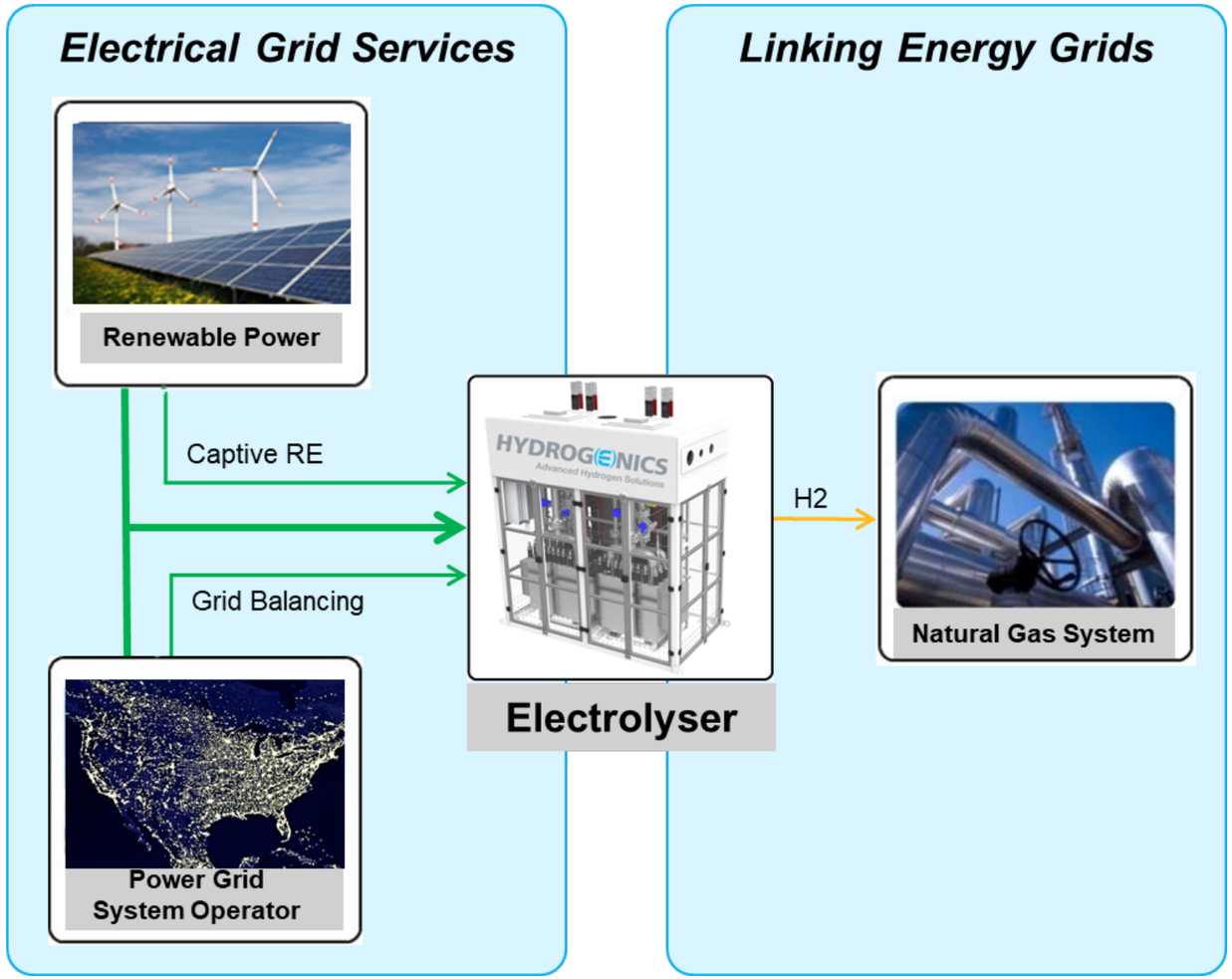
- Built & Operated North America’s First Utility Scale PtG Plant
- Enbridge/Cummins Inc. (Prev. Hydrogenics) Joint Venture
- Concluded a 3-year contract with IESO for electrical Grid balancing
- Exploring future grid services with electrical grid
- Plant to be leveraged for Transportation and other needs

The Power-to-Gas Plant

- 2.5 MW energy storage project expandable to 5MW
- Max theoretical hydrogen output:
- 1,080 kg/day (394,000kg/year) max)
- 12,000 m3-H2/day (4.38M m3-H2/year) max)
- Grid balancing support capable
- Accepts an AGC Signal sent every 2 seconds
- Response time <1ms
- Purity of hydrogen: 99.99%
- Can achieve: SAE 2719 grade hydrogen



Power-to-Gas = Renewable Hydrogen + Grid Balancing



Hydrogen A Storage System of The Future

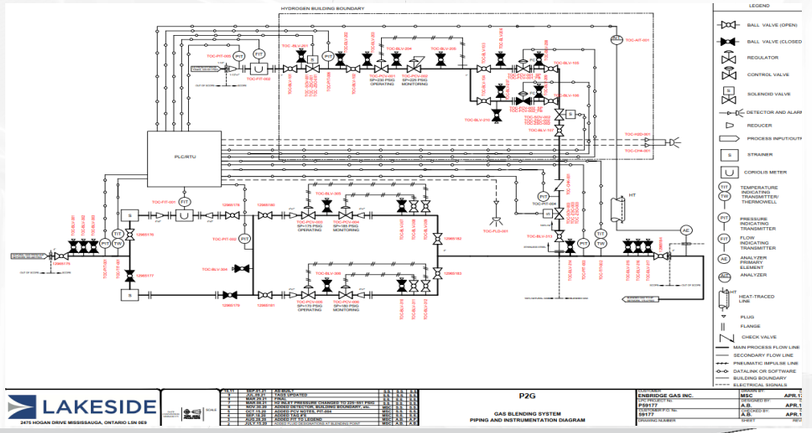
- Hydrogen has the biggest potential to offer year long (electrical) energy storage at the TWh scale.
- Apart from NG, this scale of energy storage cannot be achieved by other technologies
- Enbridge currently operates one of the largest energy storage hubs in north America with 280BCF of storage
- How can we help: Provide Solutions for Storage

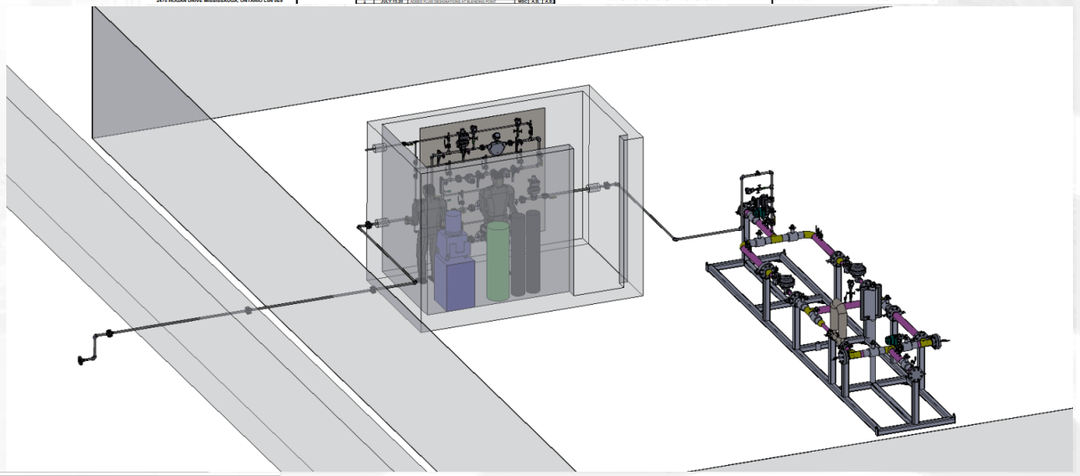
Built & Operates NA's First H2 Blending Project

- Design and build of H2/NG blending facility delivered in partnership with LPC due to expertise in delivering complex turn-key Solutions for Enbridge
- Blending facility takes H2 produced from P2G Plant and blends into the downstream network
- Gas Network feeds 4,200 Residential and Commercial customers
- Current blending rates are at 2% hydrogen by volumetric ratio
  - Elimination of 117 tons of CO2 emissions annually

Final H2 Blending Solution

H2/ NG BLENDING STATION





EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Power-to-Gas NG/H2 Blending with on-line Gas Chromatograph

Intro to Enbridge Gas Inc.

What is Power-to-Gas and NG/H2 blending?

What was the need for the measurement

The Rosemount 770XA Solution

Need for measurement

- A need for verification of the heating value and Wobbe Index required
- Crucial for maintaining a safe h2 concentration to prevent leaks or equipment damage in existing NG distribution network
- A device is needed to validate that the volumetric ratio is correct and confirm the total heating value of new blended gas

Challenges

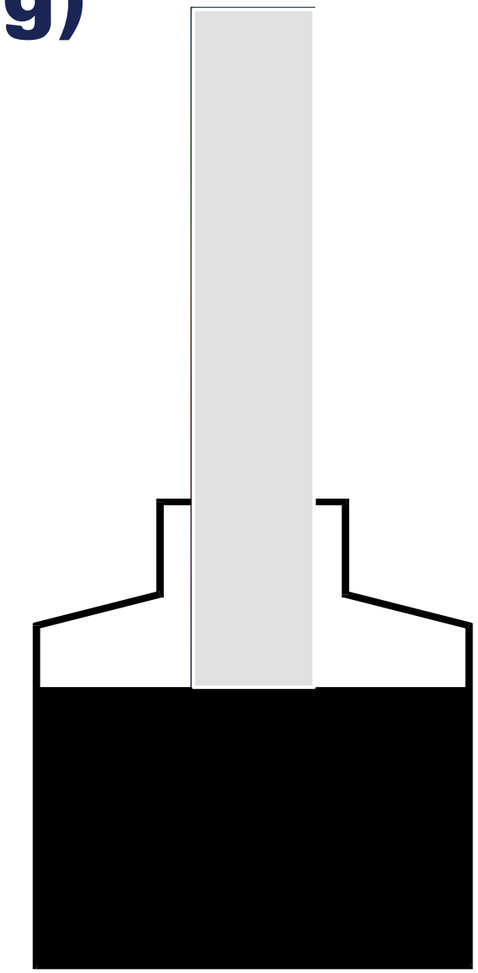
- Measurement
  - Need to measure both BTU heating value and confirmation of h2 concentration within blended gas
  - Costly to maintain several analyzers and deploy training to support new devices
- Process Safety
  - Analyzer need to have accuracy of H2 concentration of the 2% by volume flow within the blended gas stream
  - With an upset process, excessive H2 gas concentration will possibly cause damage to pipeline via corrosion of steel piping
- Commercial impact
  - Gas customers are compensated to the reduced BTU content by volume of 2% h2 blended gas
  - If blended gas is higher than 2%, the heating value drops, and possible commercial impact and billing issues may arise

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

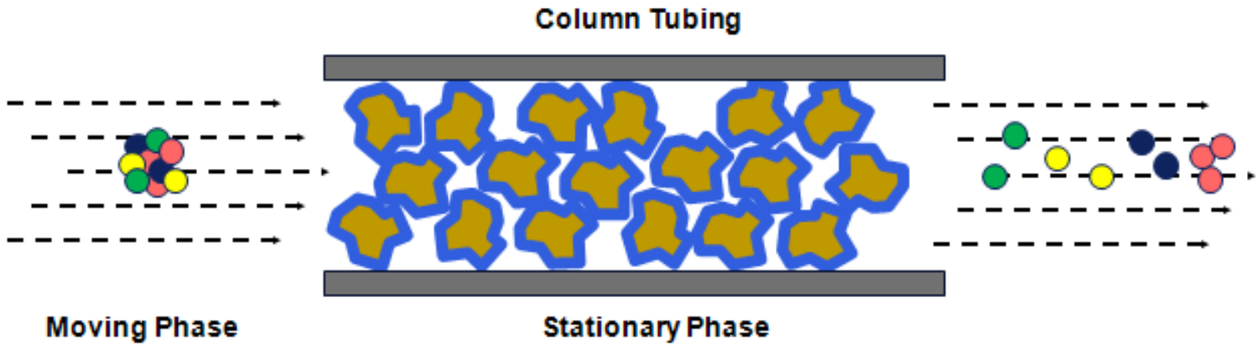
Gas Chromatograph Technology

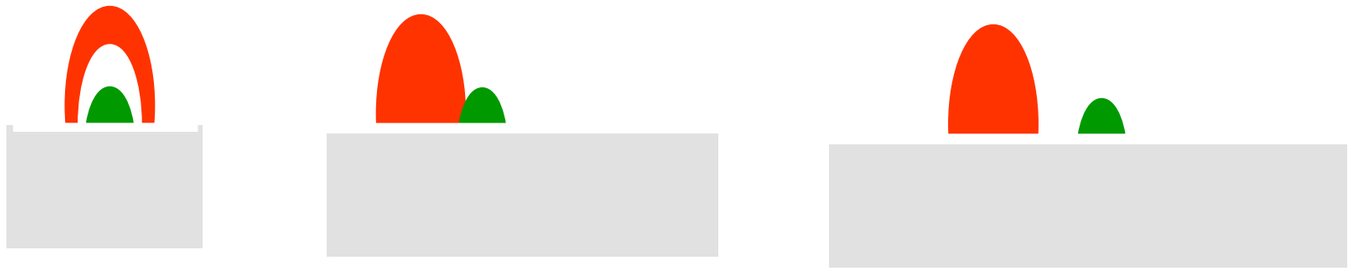
Fundamental Chromatography (Greek: Chromatography – color writing)

- Dipped a piece of absorbent paper into Black Ink
- Capillary action draws liquid through the paper
- The color bands formed from various pigments in the ink absorbing onto the paper at different rates
- This showed that a mixture of compounds could be separated by differences in how fast they moved through the media

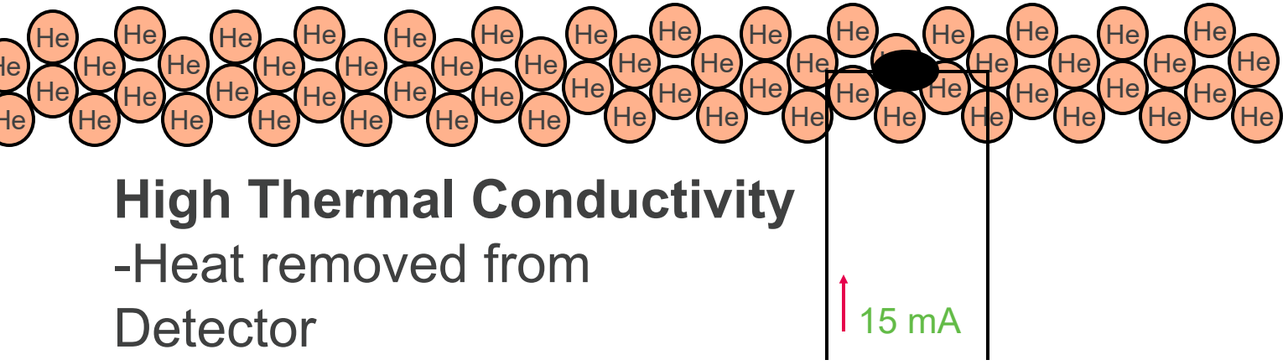


Chromatograph Principle- Separation and Detection





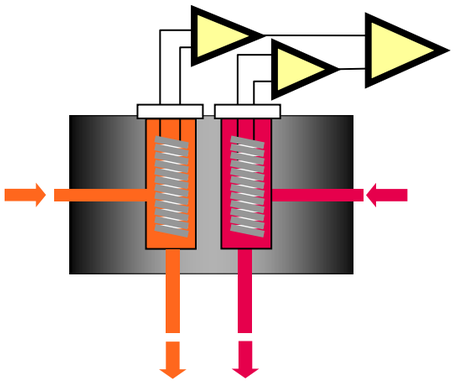
Thermal Conductivity Detector-Principle - Wheatstone bridge



High Thermal Conductivity
-Heat removed from Detector
-Temperature of detector reduced
-Resistance of detector INCREASES

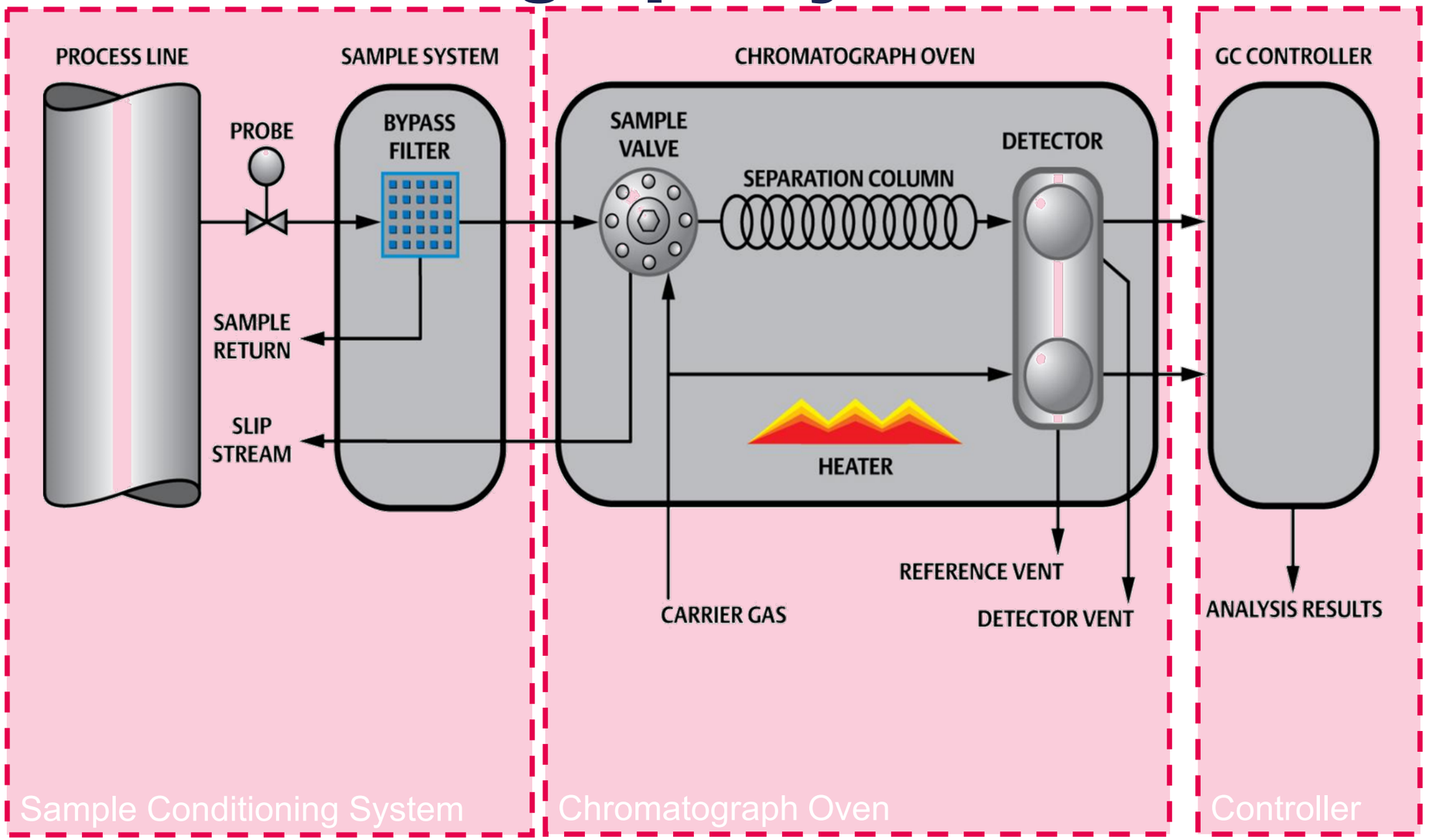
Detector mV output

Lower Thermal Conductivity
-Less Heat removed from Detector
-Temperature of detector increases
-Resistance of Detector DECREASES

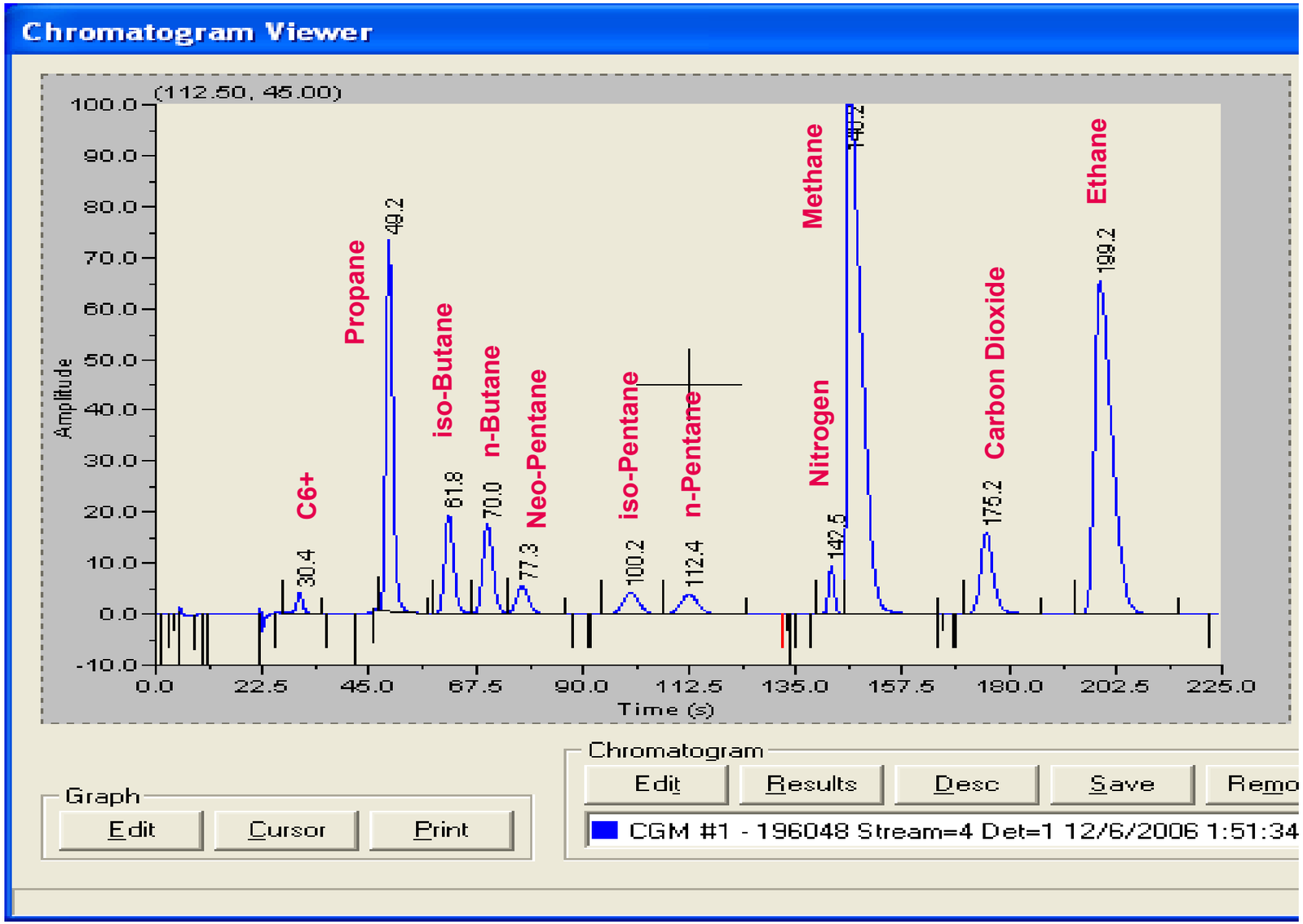


EMERSON

Basic Chromatograph System



Chromatogram Example



GC Analysis Report Example

Analysis Report (GPA)

Date-Time : 01/11/2024 02:26:54 PM Analysis time : 230.00 sec Cycle Time : 240.00 sec
Stream : Stream 1 Mode : Analysis Cycle Start Time : 01/11/2024 02:21:08 PM
Analyzer : 300XA T7 Stream Seq. : 1
Company : ROSEMOUNT ANALYTICAL INC

Firmware Revision, Checksum : 4.0.1, 2020/06/30, 0x62d04932

Component Name	Mole Percent	Dry Gross BTU	Dry Net BTU	Relative Gas Density
C6+ 47/35/17	0.0160%	0.85	0.78	0.0005
Propane	0.4720%	11.90	10.95	0.0072
i-Butane	0.0983%	3.20	2.96	0.0020
n-Butane	0.0994%	3.25	3.00	0.0020
Neopentane	0.0561%	2.24	2.07	0.0014
i-Pentane	0.0515%	2.07	1.91	0.0013
n-Pentane	0.0511%	2.05	1.90	0.0013
Nitrogen	0.5962%	0.00	0.00	0.0058
Methane	97.1385%	983.33	885.42	0.5380
Carbon Dioxide	0.3983%	0.00	0.00	0.0061
Ethane	1.0226%	18.14	16.59	0.0106
TOTALS	100.0000%	1027.03	925.58	0.5761

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Power-to-Gas NG/H2 Blending with on-line Gas Chromatograph

Intro to Enbridge Gas Inc.

What is Power-to-Gas and NG/H2 blending?

What was the need for the measurement

The Rosemount 770XA Solution

Solution

- Rosemount 770XA was selected for it’s ability to measure both BTU content and H2 within the gas stream
- Report analysis is every 5 mins
- Instead of using multiple analyzers, a single GC provides all critical measurements to validate the blend composition
- Blending solution delivers cleaner energy that is delivery safely, consistently and reliably
- Project success highlights opportunity for energy companies to use clean hydrogen on a larger scale to achieve Net Zero goals with no major impact to infrastructure

Rosemount 770XA Solution

Single Analyzer Solution

- Rosemount 770XA can measure BTU heating value, Wobbe Index, and H2 concentration all in one single analyzer reducing complexity in getting key measurements

Cost Reduction

- A single analyzer solution reduces cost and complexity
- Enbridge is already familiar with Rosemount GC technology, and training was quick

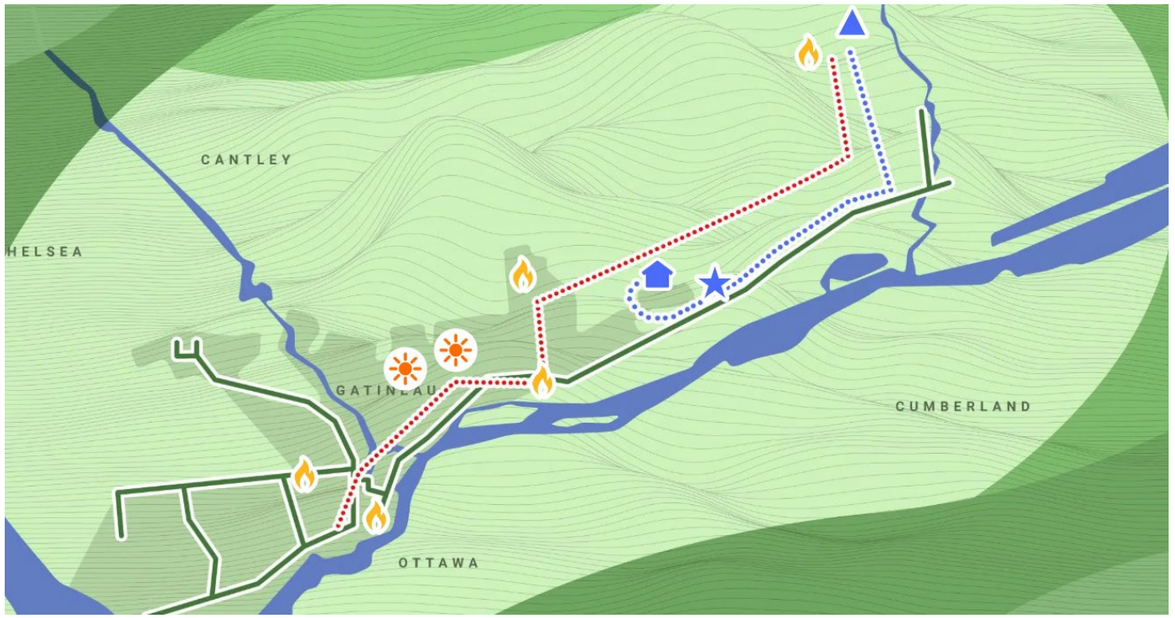
Reliable

- Mature robust technology with proven track record

Historical Reports

- 30 day log that can be used for record keeping and auditing purposes

Future Considerations



- New H2 Pipeline and Blending project in the works at Enbridge Gaz Quebec
- Planned Construction in 2025 and online by 2026
- Rosemount GC technology is being evaluated for use for blends up to 25% H2 by volume
- Potential consideration for different piping configurations or mixing devices before extraction point
  - Will help address H2 stratification and incomplete mixing during low-flow conditions
- Expansion of existing P2G Pilot facility is expanding for H2 Fueling Facility
  - Currently underway

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Want More Info?

SPEAKERS
Bios & LinkedIn Profiles

DOWNLOADS
Presentations Slides

SESSIONS
Abstracts & Topics

CONNECT
Stay In Touch With Our Team

SCAN HERE

Everything you need, one scan away!

EMERSON EXCHANGE 2025
ACCELERATING INNOVATION

Thank You