EBC Energy Resources Webinar:
Future Role of Natural Gas in the New England Region
Welcome

Marc Bergeron

Program Co-Chair

Chair, EBC Energy Resources Committee

Associate, Epsilon Associates, Inc.
Natural Gas and its Role in our Region’s Energy System, Economy & Environment

Steve Leahy
Vice President, Policy
Northeast Gas Association (NGA)
June 18, 2020

Natural Gas in the Region - Current & Future Role

EBC Energy Resources Webinar

Stephen Leahy
Northeast Gas Association
About NGA

- Non-profit trade association
- Local gas utilities (LDCs) serving New England, New York, New Jersey, Pennsylvania
- Several interstate pipeline companies
- LNG & CNG suppliers
- ~ 400 “associate member” companies, from industry suppliers and contractors to electric grid operators
- www.northeastgas.org
NGA’S ANTITRUST COMPLIANCE PROCEDURES

Adopted by the NGA Board of Directors on June 20, 2018

Objective

The Northeast Gas Association (NGA) and its member companies are committed to full compliance with all laws and regulations, and to maintaining the highest ethical standards in the way we conduct our operations and activities. Our commitment includes strict compliance with federal and state antitrust laws, which are designed to protect this country’s free competitive economy.

Responsibility for Antitrust Compliance

Compliance with the antitrust laws is a serious business. Antitrust violations may result in heavy fines for corporations, and in fines and even imprisonment for individuals. While NGA’s attorneys provide guidance on antitrust matters, you bear the ultimate responsibility for assuring that your actions and the actions of any of those under your direction comply with the antitrust laws.

Antitrust Guidelines

In all NGA operations and activities, you must avoid any discussions or conduct that might violate the antitrust laws or even raise an appearance of impropriety. The following guidelines will help you do that:

- **Do** consult counsel about any documents that touch on sensitive antitrust subjects such as pricing, market allocations, anti-employee poaching practices, refusals to deal with any company, and the like.

https://www.northeastgas.org/compliance_docs.php
Topics

- System Overview
- Natural Gas Market Trends
- Utility Approaches to Decarbonization
- Pathways Forward
Key Points

- Natural gas has grown to be a preferred fuel for homes, businesses and the power sector in the last 2 decades.

- The region has made significant advances in reducing air pollution and staying on target for meeting 2020 GHG reduction goals …thanks in large measure to gas.

- Going forward, the gas industry is working to lower its carbon content and reduce its environmental impact, recognizing its environmental responsibility.

- The region’s energy system is in transition; the natural gas pathway remains part of the discussion.
Gas Customers: 13.5 million
% of Home Heating: 59%
% of Power Gen: 52%
Maine has one, in Lewiston.

LNG Imports & Storage

**Everett LNG** has 3.4 Bcf of storage available at its facility in Everett, MA. Trucking terminal as well.

**Northeast Gateway** offshore Cape Ann, MA, can inject gas from vessel to underwater Pipeline.

**LNG plays a key role in balancing the market.**

**LNG trucking** is also a means of deliveries supplies to the region, from Quebec, PA.

Repsol has approx. 10 Bcf of storage available at its **Canaport LNG** facility in Saint John, N.B. Interconnects with M&NE Pipeline.
Compressed natural gas (CNG) stations in several states provide fuel for vehicle/trucks and also fuel supply for truck deliveries to off-system customers – from paper mills to medical centers.

Building the market prior to development of gas distribution or transmission system
  - e.g., Middlebury, Vermont as “gas island” by NG Advantage, with gas sourced at Vermont Gas
REGIONAL MARKET DEVELOPMENTS
U.S. Production & Consumption Set New Records Last Year

U.S. natural gas production in 2019 set new all-time records.

Residential Customer Growth Has Continued in Region

Since 2012, natural gas has added over 1 million new household customers in the Northeast states.
Increasing Peak Day Demand

- Most LDCs in Northeast set multiple sendout records in last few winters.

- New England natural gas utilities collectively set 3 new sendout records the first week of Jan. 2018 – with new all-time peak set on 1-6-18, at close to 4.4 Bcf.

“Supply and demand increasingly out of balance
- ~50% peak growth in last 10 years
- Last new supply added in 2013
- Use of delivered services rising”

Source: Con Edison, 4-25-19, at NGA Forum
ACEEE has released several studies that see value in converting homes heated with heating oil and propane to electricity, but find less value in converting natural gas homes, especially in colder climates: “But for many homes, electrification may not currently make sense and as a result, natural gas use will likely continue for decades, particularly in the North.”

Some Recent Additions to Gas Generation Capacity

Footprint Power
Salem Harbor
Salem, MA
674 MWs
Online June 2018

CPV Towantic Energy Center
Oxford, CT
805 MWs
Online June 2018

PSEG Power
Bridgeport Harbor Station 5
Bridgeport, CT
485 MWs
Online June 2019

NRG Canal 3
Sandwich, MA
333 MWs
Online June 2019

Exelon West Medway
Medway, MA
200 MWs
Online June 2019

Cricket Valley Energy
Dover, NY
1,100 MWs
Online Spring 2020
Tufts University, Medford, MA

New central energy plant that went fully operational in 2018 - providing energy-efficient cogeneration technology to produce electricity as well as steam, fueled by natural gas. The university noted in fall 2018 that the plant is "Sustainable, cost-efficient, and environmentally friendly... a powerful addition to campus."

Harvard University, Allston, MA

New district energy facility will be fully operational in 2020. Harvard: "It has been designed to be as flexible as possible so emerging technologies can be incorporated over time as the University works towards its climate action goals to be fossil fuel-free by 2050 and fossil fuel-neutral by 2026. The facility currently relies on natural gas because that's the dominant lowest carbon fuel source available for this scale of facilities in the New England region."
Northeast States Lead U.S. in Gas Efficiency Investments

9 Northeast states = $572 million investment in 2018, 40% of U.S. total.

Emissions Reductions, Power Sector

New England Grid

Annual Emissions of NOx, SO2, and CO2, 2001 to 2018 (kilotons)

<table>
<thead>
<tr>
<th>Year</th>
<th>NOX</th>
<th>SO2</th>
<th>CO2</th>
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<tr>
<td></td>
<td>kilotons (short)</td>
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<td>kilotons (metric)</td>
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<tr>
<td>2001</td>
<td>69.73</td>
<td>200.01</td>
<td>52.991</td>
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<td>2002</td>
<td>56.40</td>
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<td>60.88</td>
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<td>2013</td>
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<td>18.04</td>
<td>40.901</td>
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<td>2014</td>
<td>20.49</td>
<td>11.67</td>
<td>39.519</td>
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<td>2015</td>
<td>18.86</td>
<td>9.11</td>
<td>40.512</td>
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<td>2016</td>
<td>16.27</td>
<td>4.47</td>
<td>37.487</td>
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<tr>
<td>2017</td>
<td>15.30</td>
<td>4.00</td>
<td>34.959</td>
</tr>
<tr>
<td>2018</td>
<td>15.51</td>
<td>4.95</td>
<td>34.095</td>
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Percent Reduction, 2001-2018: 74, 98, 36, 36

Table: ISO-NE, May 2020

New York Grid

Chart: NY ISO, June 2020
According to MA DEP’s latest GHG inventory report, natural gas systems in MA = 1.1% of total state GHG emissions (it was 2.6% in 1990). Gas system leaks declined by 67% since 1990.
UTILITY APPROACHES TO DECARBONIZATION
Renewable Natural Gas (RNG), also known as bio-methane or biogas, is pipeline quality gas derived from biomass that is fully interchangeable with natural gas. The future natural gas network could include renewable gas from dairy farms, waste water treatment plants, landfills, wood waste and food waste plants.

Several gas utilities in the Northeast are looking to incorporate RNG into their supply mix.

NGA & GTI study:
https://www.northeastgas.org/renewable_natural_gas.php
The Road Ahead

- Massachusetts government looking at **2050 roadmap**, including role of gas.

- Regional policy interest in advancing **electrification in transportation & building sectors**.

- Gas companies continue to advance **decarbonization** measures, system upgrades, and new technologies.
The Future of Natural Gas: Technologies & Pathways

Don Chahbazpour

Director, Gas Utility of the Future
National Grid
Environmental Business Council of New England

The Future of Natural Gas – Technologies & Pathways

Donald Chahbazpour
June 18, 2020
Agenda

➢ Context

➢ Overview of RNG & Hydrogen

➢ Roadmap & Vision
Context
Northeast U.S. Has Reduced Energy-related Emissions By 21%; Further Reductions From Heat & Transport Required to Reach Net Zero

US Northeast energy-related CO₂ emissions¹ and change by sector (million metric tons CO₂)

- Electric power: 380 - 109 = 271 (30% decrease)
- Industrial (heat): 32 - 15 = 17 (50% decrease)
- Commercial (heat): 45 - 16 = 29 (36% decrease)
- Residential (heat): 66 - 143 = -77 (115% increase)
- Transport: 128 - 143 = -15 (23% decrease)

Change 1990-2017

1 Includes only emissions from fossil fuel combustion in the energy sector, which account for ~85% of economy-wide emissions, i.e. excludes agriculture, land use. Sources: US DOE Energy Information Administration.
# National Grid’s Northeast Decarbonization Pathway

## Elements of the National Grid Northeast Decarbonization Pathway

<table>
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<tr>
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<th>40% x 2030</th>
<th>Deep Decarbonization - 2050</th>
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| **Power**            | ▪ 67% zero-carbon electricity supply, supported by a large increase in renewables (vs. 45% in 2017) | ▪ 100% zero-carbon electricity supply, utilizing:  
  - Large-scale renewables  
  - Zero-carbon “firm” capacity, e.g. hydro, nuclear, gas with carbon capture and storage and interconnections (Quebec)  
  - Inter-seasonal energy storage |
| **Transport**        | ▪ >10 million light-duty (passenger) electric vehicles on roads (vs. <75k in 2017) | ▪ >20 million light-duty (passenger) vehicles (100% of the fleet)  
  ▪ Low-carbon technology use in medium and heavy duty vehicles (electric or natural gas)  
  ▪ Efficiency improvement in aviation, shipping |
| **Heat**             | ▪ 2x rate of energy efficiency retrofits  
  ▪ 3x rate of oil-to-gas heating conversions  
  ▪ 10x scale up of oil-to-electric heating conversions | ▪ Tapestry of solutions required:  
  - Energy efficiency investment, esp. insulation  
  - Zero/low carbon molecules – hydrogen, RNG/biomethane  
  - Hybrid heat - natural gas/heat pump including geothermal  
  - Carbon negative technologies/offsetting |
The Northeast Climate Warrants Tailored Heat Solutions

Heat demand in Boston exceeds that of San Francisco by 178%

California heat decarbonization policy will not be our template for Northeast

The Northeast will need to develop its own policy and technical approach to heat decarbonization.

January Heating Degree Days

- San Francisco: 383 HDD
- London: 745 HDD
- Edinburgh: 778 HDD
- NYC: 985 HDD
- Boston: 1,066 HDD
- Buffalo: 1,218 HDD

Fahrenheit-based 5-year-average (2013 to 2017) heating degree days for January (base 65F).
Source: www.degreedays.net (using temperature data from www.wunderground.com)
A Toolkit to Address Heat Sector Emissions Is Developing

- Biomass
- Hydrogen
- Power-to-Gas Methane

Heat Pumps (with renewable power)
- Geothermal Heat Pumps
- Air Source Heat Pumps
- Hybrid Heat Pumps

Energy Efficiency

National Grid

ASHP Image Source: Ways2GoGreen Blog 2017
Insulation Image Source: REenergizeCO
Overview of RNG & Hydrogen
What Is Renewable Natural Gas (RNG)?

RNG is…

• Pipeline-compatible gas derived from biomass or other renewable sources that has lower lifecycle CO$_2$e emissions than geologic natural gas

RNG includes…

Biomass

Electric Grid

Renewables

Electrolysis

Gas Distribution

Power-to-Gas

Hydrogen from Power-to-Gas
What Is Power-to-Gas?

- The conversion of renewable electricity into a gas fuel through electrolysis produces $\text{H}_2$ and can be methanated to produce $\text{CH}_4$. 

![Diagram of Power-to-Gas system]
Multiple Technologies and Feedstocks for RNG Exist; There Is Significant Potential in the US

**Technology/Feedstock**

**Anaerobic Digestion**
- Landfill gas
- Animal manure
- Wastewater
- Food waste

**Thermal Gasification**
- Agricultural residue
- Forestry/forest product residue
- Energy crops
- Municipal solid waste

**Power-to-Gas**
- Renewable electricity

By 2040, RNG has the potential to meet the entire U.S. residential natural gas demand

**Resource Potential**
2019 ICF National Study*

Source: AGF 2019 study – Renewable Sources of Natural Gas

# Hydrogen Sources and Pathways

<table>
<thead>
<tr>
<th>Efficiency, % Energy Conversion</th>
<th>Carbon Intensity, gCO\textsubscript{2}e/MJ</th>
</tr>
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<tbody>
<tr>
<td>75-90%</td>
<td>110</td>
</tr>
<tr>
<td>75-90%</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>57-73%</td>
<td>~ 0</td>
</tr>
<tr>
<td>50-64%</td>
<td>~ 0</td>
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</table>

**Rough Estimates**

CI based on NREL 2013 H2 Pathways Paper

Green H2 and P2M conversions from SoCalGas 2015
Green Hydrogen Via Power-to-Gas Can Provide Long-term Seasonal Energy Storage

Benefits of Green H2 / P2G

- Enables higher penetration of renewables like offshore wind by providing long-term, seasonal storage

Additional Benefits of Methanation

- Recycles CO₂
- Requires no modifications to standards, procedures, or equipment

Source: Moore and Shabani, energies 2016
Our Current Thinking of Integrating Hydrogen in the Future of Heat

Staged Roll-out of Hydrogen into the Network, *Illustrative Example*

Green or blue H$_2$?

2050

2030’s

Nodes
Cities
Regions

2020’s
Clusters
Neighborhoods
C&I, Universities

Blended H$_2$ & biomethane/RNG or 100% H$_2$?
Roadmap & Vision
How the Gas Network Will Help Us Achieve Our Goals

Strategy Roadmap

Future Heating Solutions
- Power-to-gas
- Hydrogen blending
- Geothermal
- CCUS

Decarbonize the Gas Network
- New customer products
- RNG supply goal
- Investing in RNG projects
- Legislative strategy & policy framework

Reduce Methane Emissions
- Modern infrastructure, replace LPP
- Integrate advanced leak detection
- Reduction goal, ONE Future
- Engage entire value chain

Reduce Natural Gas Consumption
- Accelerate EE & DR programs
- “No regrets” electrification
- Geothermal / electrification investments
Moving Toward a Robust Northeast Heat Decarbonization Strategy

Heat pumps, hybrid homes, RNG from biomass, and hydrogen will all play a part.

Sustained building energy efficiency investment is foundational.

To minimize consumer impact, the Northeast decarbonization strategy seeks a balanced mix of strategic electrification, decarbonized gas, and energy efficiency.

Illustrative Pathway to Heat Decarbonization (New York + New England)
Our vision – a Holistic Energy System

A deeply decarbonized gas & electric system is integrated & complementary

“Combining electricity with gas can allow Europe to achieve the Paris Agreement target at the lowest possible cost.”

Ecofys 2018, “Gas for Climate”
Natural Gas Trends & Current Demand at Eversource

David Allain

Director, Gas Sales and Expansion

Eversource Energy
EBC Energy Resources Webinar

Natural Gas Trends & Current Demand @ Eversource

Dave Allain
Director Of Gas Sales & Expansion, Eversource
Eversource Overview

Eversource is New England’s largest energy delivery company and serves approximately 4 million electric, natural gas and water customers in Connecticut, Massachusetts and New Hampshire.

Eversource has approximately 530,000 gas customers in CT and MA.

Eversource and Columbia Gas Massachusetts to join in Fall 2020, an additional 300,000 customers.
Recent Headlines – Anti-Gas Pressure Growing & AG Initiative

Ashland officials challenge Eversource pipe plan

Communities feeling pipeline pressure
By Jon Chestn, Gilea Staff, February 27, 2019, 7:18 p.m.

1. No gas

Cuomo’s Natural Gas Blockade

Berkeley became first US city to ban natural gas. Here’s what that may mean for the future

Brookline Proposal Would Ban New Natural Gas Connections In Town

US cities see blueprint for building electrification in Berkeley gas ban

Cities target gas heaters, stoves in new front of climate fight
“The Death Of NG is Greatly Exaggerated”

Natural Gas is:
- Sustainable
- Low-emitting high-efficiency fuel source
- Cost effective
- Reliable
- Existing customers love NG and are confused about NG ban
conversation? Feel betrayed by leadership??
- No realistic option to NG
- NG in high demand!
- New construction market close to record pace
- Cannot keep up with residential conversion demand
- Distributed generation installations at historic levels
- CMA opens new growth markets for Eversource

Question we should be asking? How do we expand NG infrastructure; i.e.,
converting the 41% of NE residents whom heat with other fuels?
Answer- CT.CES PROGRAM
Natural Gas is the Lowest Cost Heating Source Available to Residential Customers

Estimated Annual Residential Heating Costs

- 92% AFUE Natural Gas: $737
- 85% AFUE Fuel Oil: $1,056
- 92% AFUE Propane: $1,625
- Electric Baseboard: $2,883
- 10 HSPF Heat Pump: $1,621

Numbers produced using the Energy Solutions Center Calculator located at: http://www.energydepot.com/ResidentialEnergyCalculator/ and the following assumptions:

- 1800 sq. ft. of living space
- Electric rate of 24.413 cents/kwh
- Gas rate of $1.366/therm
- Oil cost of $2.49/gallon (https://www.mass.gov/service-details/massachusetts-retail-heating-oil-prices)
- Propane cost of $2.75/gallon (https://www.mass.gov/service-details/massachusetts-retail-propane-prices)
Comprehensive Energy Strategy Impact
CES Executive Summary (Yankee Gas)

With CES, past 5 years Eversource has:

- Provided access to a new clean, lower-cost energy source for almost 33,000 residential, commercial and industrial premises by installing 131 miles of gas main
- Connected approximately 25,000 new customers – the majority of whom were heating with oil
- Converted an additional 5,600 non-heating gas customers to gas heat.
- Connected almost 300 municipal, state and federal facilities
- Expanded into 20 new communities where there was no natural gas available
- Reduced CO2e by potential 146,000 metric tons annually
- Provided existing customers a $4.9 million rate credit with 2019 SER results
- Created $36 million in NFM’S (non firm margin). $3.6 million was used to fund school/public housing conversions and the US Coast Guard conversion
Notable Expansion Projects 2014-2019

**New Service Territory**

- **Eastford**: Estimated 0.5 Miles of Gas Main Installed
- **Windham**: Estimated 0.5 Miles of Gas Main Installed
- **Bozrah**: New Service Territory
- **Lisbon**: New Service Territory
- **Griswold**: New Service Territory, Estimated 3 Miles of Gas Main Installed
- **Ledyard**: New Service Territory
- **Groton**: 4 Expansion Projects, Estimated 12 Miles of Gas Main Installed
- **Waterford**: 3 Expansion Projects, Estimated 12 Miles of Gas Main Installed

**Expansion Projects**

- **Torrington**: 2 Expansion Projects, Estimated 8.5 Miles of Gas Main Installed
- **Cromwell**: Estimated 1 Mile of Gas Main Installed
- **Waterbury**: Estimated 1 Mile of Gas Main Installed
- **Naugatuck**: Estimated 2 Miles of Gas Main Installed
- **Ansonia**: Estimated 4 Miles of Gas Main Installed
- **New Canaan**: 2 Expansion Projects, Estimated 11 Miles of Gas Main Installed
- **Stamford**: Estimated 4 Miles of Gas Main Installed
- **Darien**: Estimated 4 Miles of Gas Main Installed
- **Durham**: New Service Territory, Estimated 5 Miles of Gas Main Installed
- **Shelton**: Estimated 5 Miles of Gas Main Installed
- **South Windsor**: Estimated 2 Miles of Gas Main Installed
- **Vernon**: Estimated 2 Miles of Gas Main Installed
- **Waterford**: 3 Expansion Projects, Estimated 8.5 Miles of Gas Main Installed
- **Vernon**: Estimated 2 Miles of Gas Main Installed
- **Eastford**: New Service Territory

Total of 72 miles related to the specific projects noted above. 8 Miles of Main were installed due to DG/ Fuel Cell Units.
CES Benefits To New Communities

- New low-cost energy source is major incentive for businesses
- Provides economic growth by attracting new businesses
- Provides significant heating-cost savings for residential homeowners
- Provides jobs during construction
- Increases revenue to cities and towns in the form of new or increased property taxes
- Every home converted from oil to natural gas results in a 25% reduction in carbon emissions, 80% reduction in nitrogen oxides, and a 99% reduction in sulfur dioxide.
- Additional energy options-Customer choice!!!!
Customers that require uninterrupted power want more 9’s when it comes to power reliability. A rating of 99.9999% reliable is better than just 99% reliable. The study concludes that natural gas is far more reliable than electric.

Data from GTI Topical Report: Assessment of Natural Gas & Electric Distribution Service Reliability–7/19/18.
Available Technologies

- Prime Movers:
- Engine Drives
- Turbines
- Microturbines
- Fuel Cells
- Heat Recovery Equipment
Over 200 customers with almost 500 MW of clean, resilient CHP/DG generation end of 2020
MA CHP/DG Opportunities

- 120 to 241 DG machines over next five years
- 76 MW to 115 MW
CT - CHP/DG Opportunities

- 135 to 220 DG machines over next five years
- 158 MW to 233 MW
Markets Served - Combined

- Power Plants - 285 MWs
- Biotech – 10 MWs
- Industrial - 100 MWs
- University - 50 MWs
- Muni/Government/WWTP - 30 MWs
- Other - 20 MWs

**Total - 495 MWs**
Our Current Focus

- Aggressive Gas main replacement
  - Approximately 60 miles of main per year
  - Reduces CO2e emissions by 1,500 mT annually

- Gas Conversions
  - On 2019 we added approximately 9,200 new customers, each residence represents a 2.4 mT CO2e annual carbon reduction
  - At reduced cost

- Promote CNGV - a reduced carbon fossil fuel
  - A carbon neutral transportation fuel option (RNG)

- Promote Natural Gas Energy Efficiency Projects
  - Statewide Energy Efficiency programs reduced natural gas use by 1.2% in 2017
Due to gas energy efficiency programs, residential customers today use \( \frac{1}{2} \) of the gas that they used 40 years ago. Since 1970, there has been an 86% increase in residential gas customers, with no increase in overall consumption. (ES #1 EE PROVIDER IN USA)
Eversource Introducing New Clean Energy Concepts (NSTAR rate case)

Filed November 6, 2019 expect to be in place for January 2021.

Focus on greening up operations by reducing emissions and exploring clean energy programs for the natural gas customer:

- **Gas Demand Response:** Demonstration to determine if a gas demand response program would shave peak demand, alleviate physical pipeline constraints, reduce capacity, and reduce overall emissions

- **Geothermal Heating:** Demonstration on deployment and study of geothermal networks in different residential and commercial & industrial scenarios

- **Responsible and Renewable Natural Gas:** Establish criteria to enable Renewable and Responsible Natural Gas supply – a **Carbon Neutral Option**

- **Combined Heat and Power Systems (CHP)**
  - Twice the carbon reduction at half the price as solar

- **Additional Evolving Gas Technologies** – Natural Gas Heat pumps
  - Increased efficiencies during high demand periods
Moderated Discussion

Moderator: Glynn MacKenzie

Program Co-Chair

Senior Project Engineer, Weston & Sampson