NARUC
National Association of Regulatory Utility Commissioners

NARUC TASK FORCE ON NATURAL GAS RESOURCE PLANNING

EXPERT LEARNING SERIES:
Renewable Natural Gas

August 28, 2024

Today's Agenda

Expert Learning Series:

Part 1: Expert speaker presentations *(recorded for website library)*

Moderator: Task Force Co-Chair Zerfuss, PA Public Utility Commission

- **Heather Dziedzic**, Vice President of Policy, American Biogas Council
- **Tommy Oliver**, SVP, Regulatory & External Affairs, Roanoke Gas Company
- **Carl Garofalo**, Director, Sustainability and Renewable Gas Solutions, Southern Company Gas
- **Bob Wilson**, Vice President Special Projects, Northeast Gas Association

Part 2: Q&A with expert speakers *(not recorded)*

Part 3: Lessons learned from Task Force members *(not recorded)*

Additional Topics & Announcements

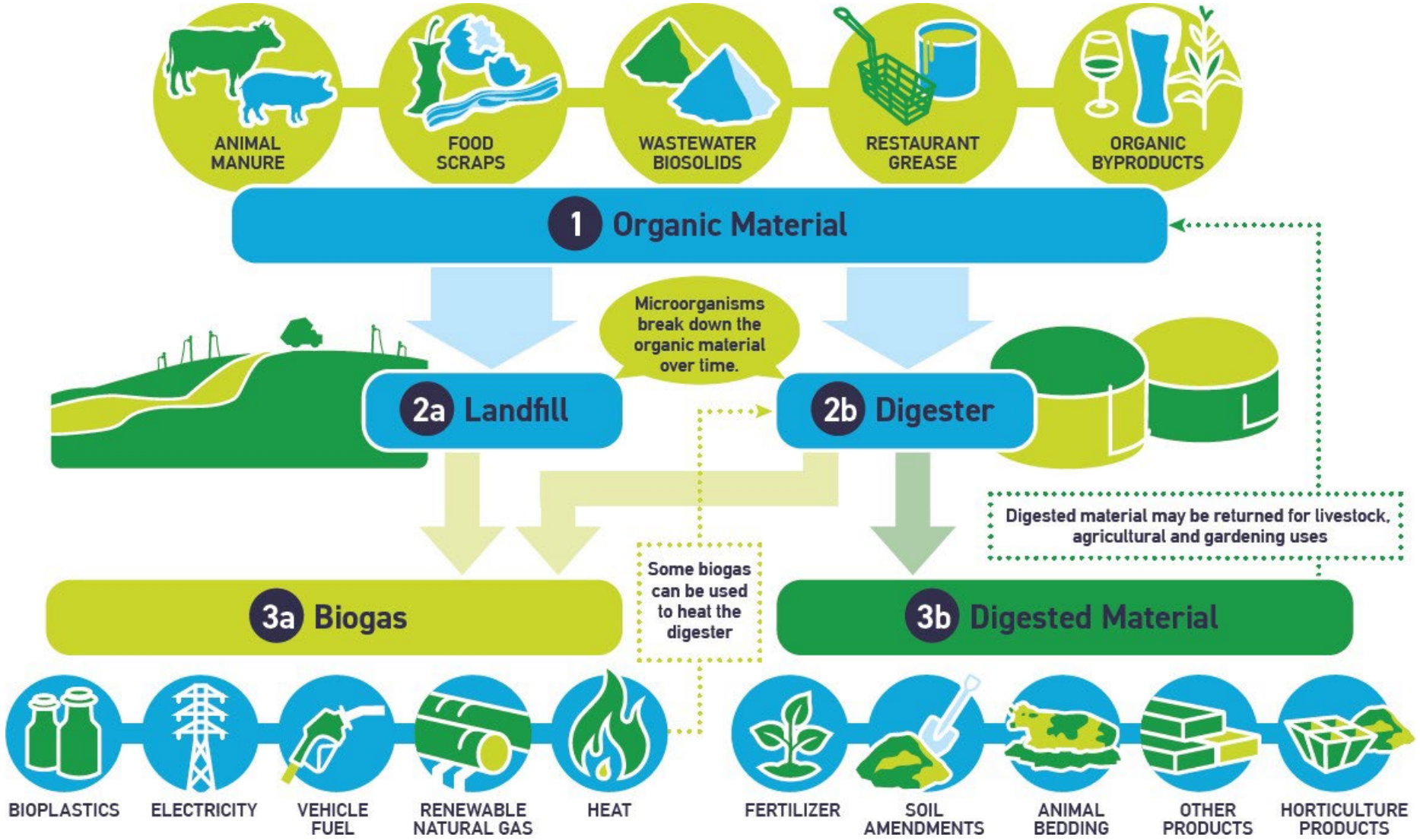
EXPERT SPEAKER PRESENTATIONS

NARUC Taskforce on Natural Gas Resource Planning

Heather Dziedzic, Vice President of Policy

August 28, 2024 | Virtual Learning Session

Biogas as a multi-level policy solution



American Biogas Council
www.americanbiogascouncil.org

The US Biogas Market

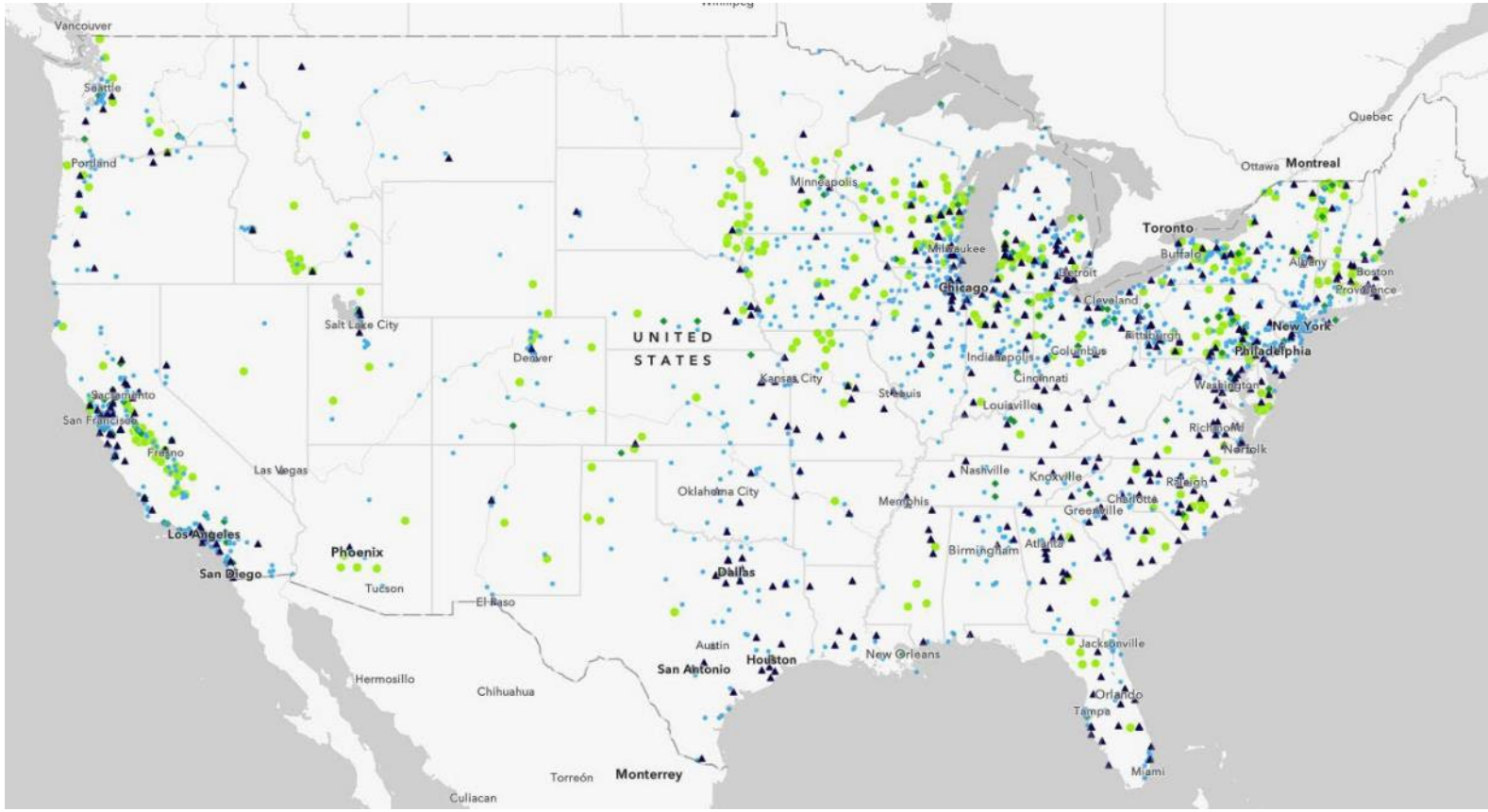
Operational Biogas Systems: 2,251

- 350 RNG
- 1,901 Electricity

- 521 on Farm
- 1,050 Wastewater
- 107 Food Scrap
- 573 at Landfills

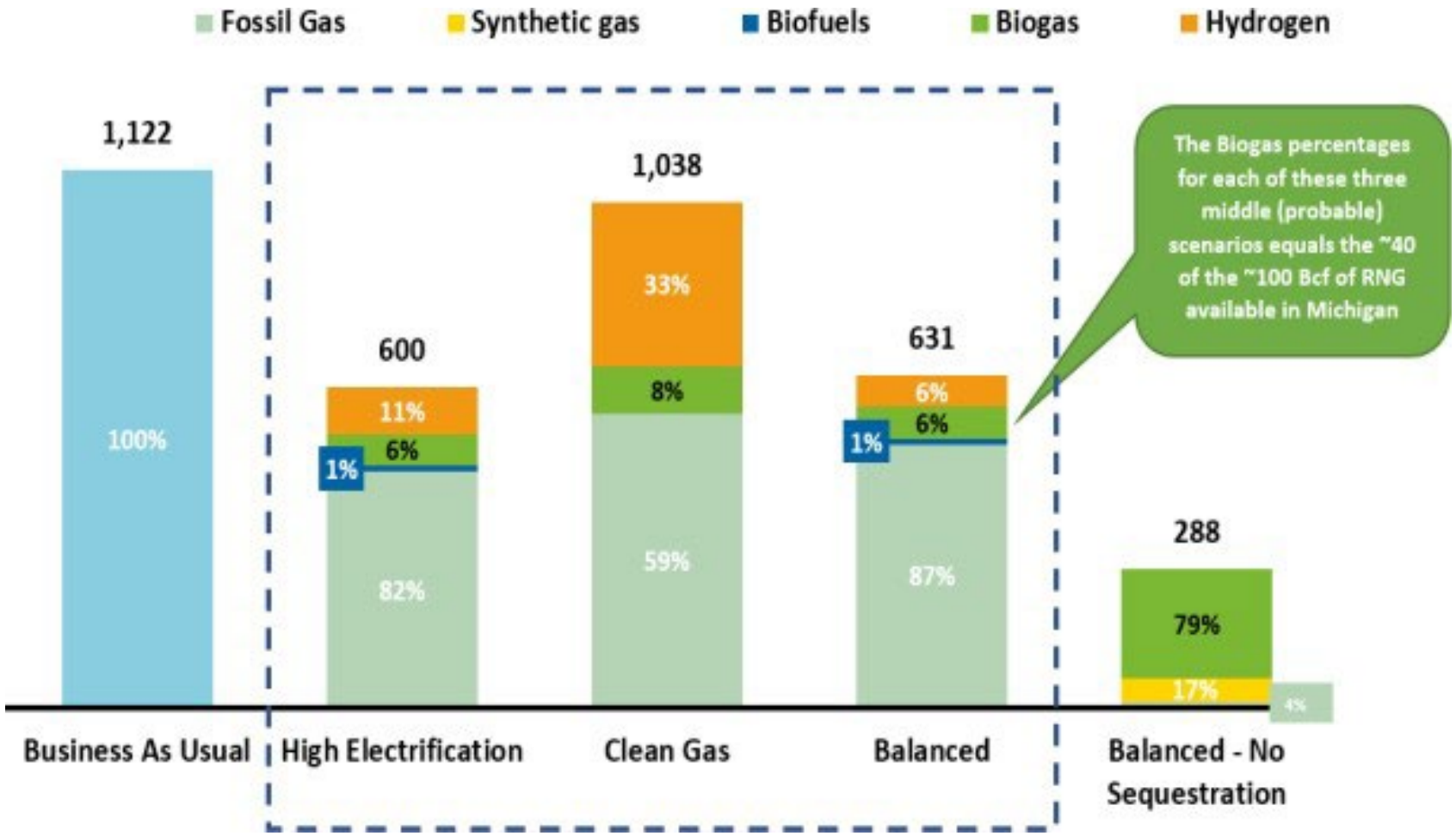
Potential New Biogas Systems: 15,000

- 8,600 on Farm
- 4,000 Wastewater
- 2,000 Food Scrap
- 470 at Landfills



American Biogas Council
www.americanbiogascouncil.org

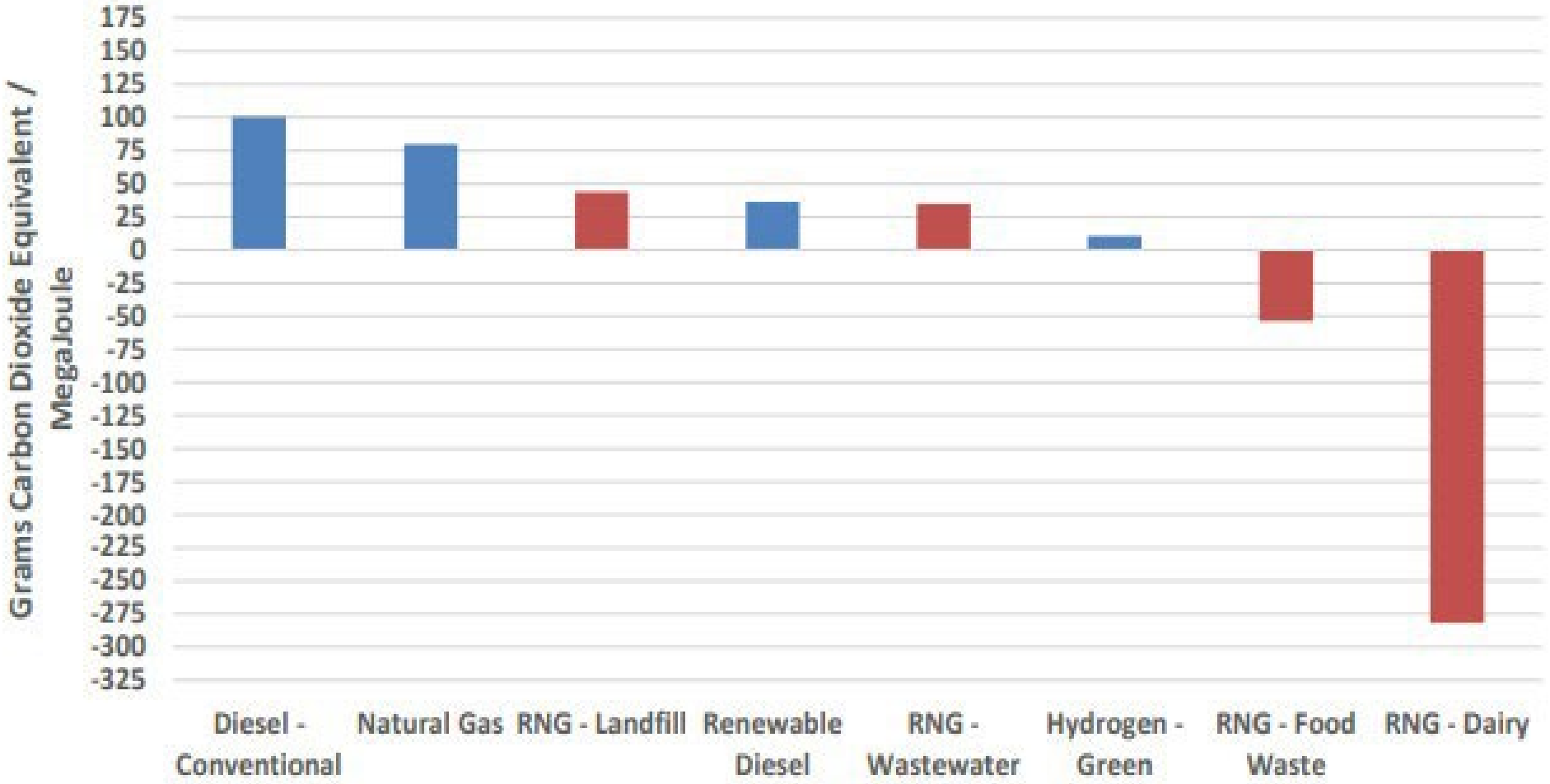
Biogas as a foundational decarbonization pathway



In a modeling of Michigan's natural gas system, a 2050 net-zero system had at least 6% biogas IN EVERY scenario, including high electrification.

Source: https://www.consumersenergy.com/-/media/CE/Documents/company/What%20We%20Do/consumer-energy-natural-gas-delivery-plan-2024-2034.pdf

RNG as “least-cost” decarbonization pathway



Policies influencing project and carbon cost

- Lifecycle Emission Accounting
  - How are methane emissions recognized?
- State LCFS/CFS programs and EPA's RFS program
  - What are the opportunity costs and how well to utilities compete?
  - How do RVOs and D categories affect value via supply/demand?
- Clean Energy Tax Incentives
  - What qualifies, when, and with what GHG performance metric?
- Global GHG Inventory Accounting
  - How to companies report GHG and claim reductions?
- Climate Smart Practices
  - Which practices contribute GHG reductions to RNG supply?
- Co-product market creation
  - How do climate smart commodities, clean buildings,& domestic supply chain priorities add or subtract value from RNG?

Credits for Biogas in the Inflation Reduction Act

Electricity

Sec 45 PTC(+ITC): Renewable Electricity (Biomass)

- Legacy credit structure
  - Begin Construction by: 12/31/2021
- IRA Base Credit/Bonus structure
  - Begin Construction by: 1/1/2023
  - Begin Construction by: 12/31/2024

Sec 45Y Clean Electricity & Transportation Tax Credit or Sec 48E Clean Electricity Investment Credit

- Placed in Service 1/1/2025
- Expiration 12/31/2032 (or US carbon goals met)

RNG

Sec 48 ITC: Renewable Natural Gas

- …Place in Service after: 12/31/2022
- Begin Construction by: 12/31/2024
- Placed in Service by 12/31/2028

Alternative Fuels Excise Tax Credit

- Fuel must be produced before: 12/31/2024

Sec 45Z Clean Fuel Production Tax Credit

- Fuel produced starting 1/1/2025
- Expiration 12/31/2027

Hydrogen

Sec 45V: Clean Hydrogen

- Begin Construction by: 12/31/2033

Carbon

Larger min capture req'd

- Begin Construction by: 12/31/2025

Sec 45Q: Carbon Oxide Sequestration

- Begin Construction by (DAC projects only): 1/1/2026
- Begin Construction by: 12/31/2032

Biogas infrastructure: Why utilities and regulators care?

- Asset Agility
  - Investments in biogas assets are less likely to be stranded given their market agility
    - Multi-functional feedstock to RNG, combustion and non-combustion electricity, hydrogen, advanced liquid fuels, and energy storage
  - Multi-sector revenue opportunities further derisk this asset class
    - Transportation support (similar to regulatory support for EV infrastructure) and co-products
- Net Zero
  - Biogas produced from captured methane is one of the few carbon-negative energy supplies available, a much needed “net” for existing combustion end uses to reduce GHG emissions.
  - Preserves customer choice and reduces customer behavior hurdle for adoption (no retrofit capital)
- Public funding
  - State and federal incentives for RNG specifically, renewable electricity, advanced fuels (SAF, H2, LNG, methanol), recycling infrastructure, climate investments, water quality treatment, organics diversion, EJ improvements, workforce development, among others
  - Financial diversity including debt financing (loan guarantees), tax credits (investment, production, R&D), grants

Biogas as a multi-level policy solution

- Environmental Justice Improvement
  - Reduced nuisance conditions associated with odor
  - Improved local air quality (lower methane, ammonia, CO2, and particulates) at both point of production and point of end use.
  - Reduced risk of runoff to water resources
  - Landfill preservation and management
- Net Zero and Economy-wide Decarbonization
  - Building and transportation decarbonization via drop-in RNG
  - Electric capacity via low and carbon negative generation, non-combustion tech available
  - Electric reliability via 24/7 renewable, dispatchable and distributed supply. ~95% capacity factor
  - EV and fleet electrification via biogas to electricity and hydrogen
- Ecological benefits
  - Additional treatment of discharges (water treatment) via digesters and additional tech (nutrients and contaminants)
  - Improved soil health (nutrient bioavailability and organic content)
- Rural Economy support
  - Diversified revenue for Agriculture and Municipal operations
  - Tax revenue and local job creation
  - Energy infrastructure
- National policy support (with public funding)
  - EPA's food waste hierarchy and recycling
  - USDA's Domestic fertilizer production & Climate Smart Agriculture
  - DOE's Hydrogen Hubs
  - Sustainable aviation fuel (SAF) production
- Efficient use of public and private climate capital
  - Among the lowest marginal abatement costs ($/ton CO2e) in GHG reduction investments. (Only $9/MT CO2e: CARB data)

Heather Dziedzic
Vice President, Policy
American Biogas Council
heather@americanbiogascouncil.org

Roanoke Gas RNG

NARUC: August 28, 2024

Statute

- HB558/SB565 – Relevant section codified as Chapter 30
- Biogas Supply Infrastructure Projects
  - Right to recover the costs of biogas infrastructure project, plus enhanced ROE if:
    - Results in a reduction in methane or CO_2e
    - Additional source of gas; and
    - Beneficial use for gas
  - Limits single project to no more than 3% of firm demand, combined projects to less than 15%
  - Provides option to 1) use RNG in system, or 2) sell the RNG to offset cost

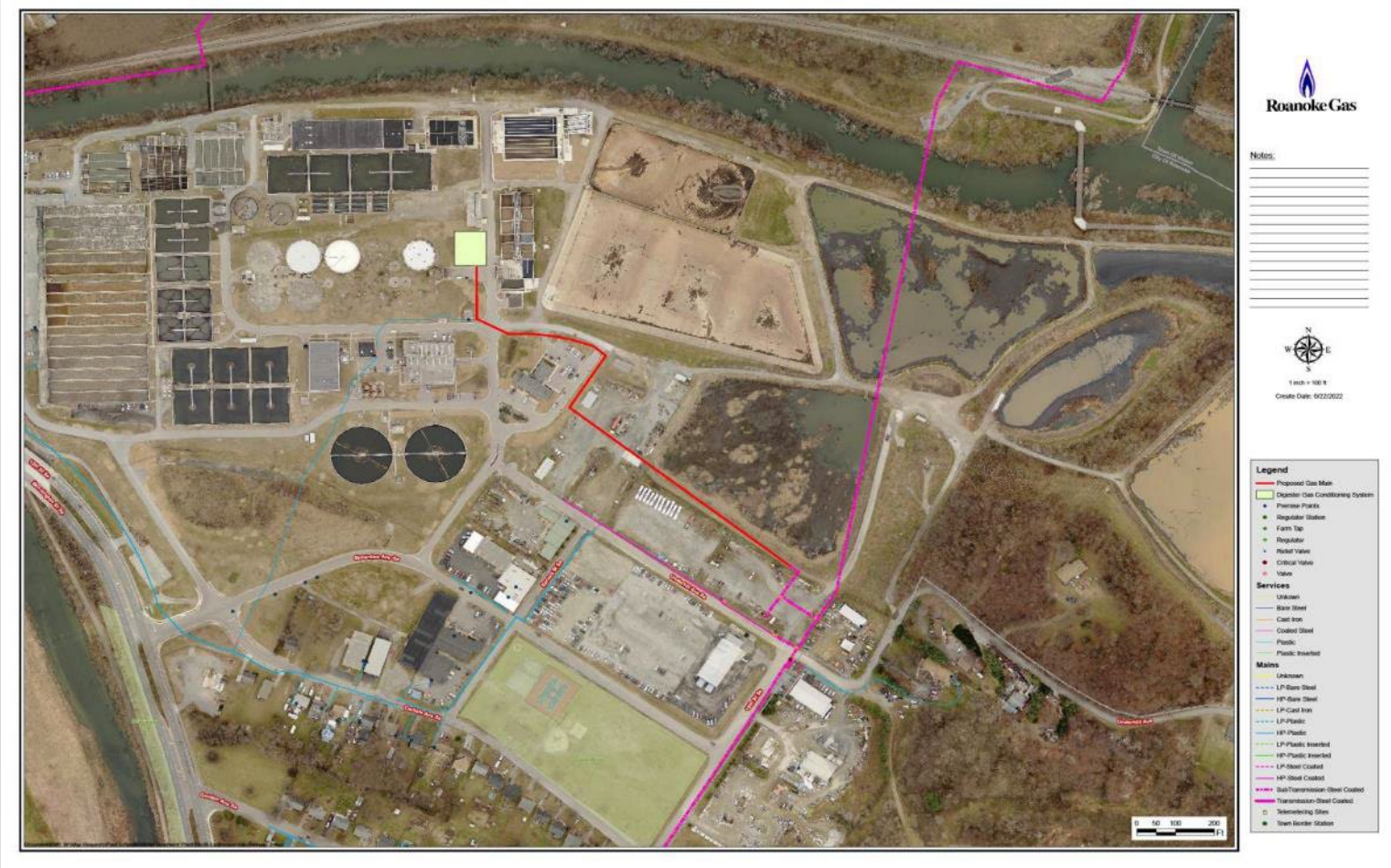
Western Virginia Water Authority

- Partnership
- Rehabilitating its digesters
  - Continue to own digesters
- Roanoke Gas owns the DGCS and interconnecting pipeline
  - Entirely on WVWA property
- Share RIN Proceeds

Footprint

RNG Location

- Located on the Wastewater Treatment Plant property owned by the WVWA



Cost

- Overall cost of approximately $8.6 million, offset by a 30% tax credit on hard costs
- DGCS cost alone is approximately $3 million
- Other capital costs
  - Contractor
  - Metering & Regulation Equipment
  - Kiosk – SCADA & Chromatograph
  - Interconnecting Pipeline
- O&M Costs
  - Electricity
  - Digester Gas / Lease (WVWA)

Gas Volume

- Engineering estimate of 206 to 220 SCFM of digester gas output purchased from the WVWA
- After processing, equals approximately 61,913 to 66,121 Dth/year of RNG
- Additional capital (i.e. new membrane) can upsize to 400 SCFM (120,220 Dth/year)
- Initial volumes will be approximately 1% of firm sales demand, under the 3% statutory threshold

Ratemaking

- Approved by SCC in January 2023
  - $8.6 million rate base; 100bp ROE adder
  - Initial rate to residential customers was a credit
- Emissions reduction: est. 13,700 mts
- Additional supply: up to 200dth/day
- Supported by many leaders
- Environmentalists opposed to project

Environmental Justice

Roanoke Branch
NAACP
Post Office Box 12362 Roanoke, VA 24025
Phone: (540) 344-2424

October 6, 2022

RE: Application of Roanoke Gas Company – Case No. PUR-2022-00125

Dear Mr. Logan,

I am writing to express my support for Roanoke Gas' application for approval of a renewable natural gas facility. I would also like to express my gratitude to Roanoke Gas for meeting with me on a number of occasions to review the project and allow me to ask questions.

My support is rooted in the benefits associated with this project for the marginalized community that surrounds the Western Virginia Water Authority property where the RNG facility will be located. For example:

- Since the facility will be located entirely on the property of the WVWA, Roanoke Gas will not need to acquire private property or rights of way from adjacent landowners;
- The facility will improve the air quality around the project site;
- Roanoke Gas' investment will provide additional tax base within the City of Roanoke;
- The project will provide Roanoke Gas with an additional supply of natural gas supply; the most affordable way to heat homes, heat water and cook food.

I hope the State Corporation Commission does the right thing and approves Roanoke Gas' request for approval of the RNG facility.

Respectfully submitted,

Brenda L. Hale

Dr. Brenda L. Hale, President
Roanoke Branch NAACP

RNG Environmental Attributes

- EPA Renewable Fuel Standard (RFS) Program
  - Renewable Identification Numbers (RINs)
  - Current values
  - Quantity
- California – Low Carbon Fuel Standards (LCFS)
  - May not be attainable
- Hired a RIN Broker
- Have sold RINs and are being used to reduce revenue requirement

Questions

Southern Company Gas

Atlanta-based natural gas services company and subsidiary of Southern Company.

Corporate Headquarters

GAS Distribution Operations

- Atlanta Gas Light
- Chattanooga Gas
- Nicor Gas
- Virginia Natural Gas

GAS Marketing Services

Renewable Natural Gas

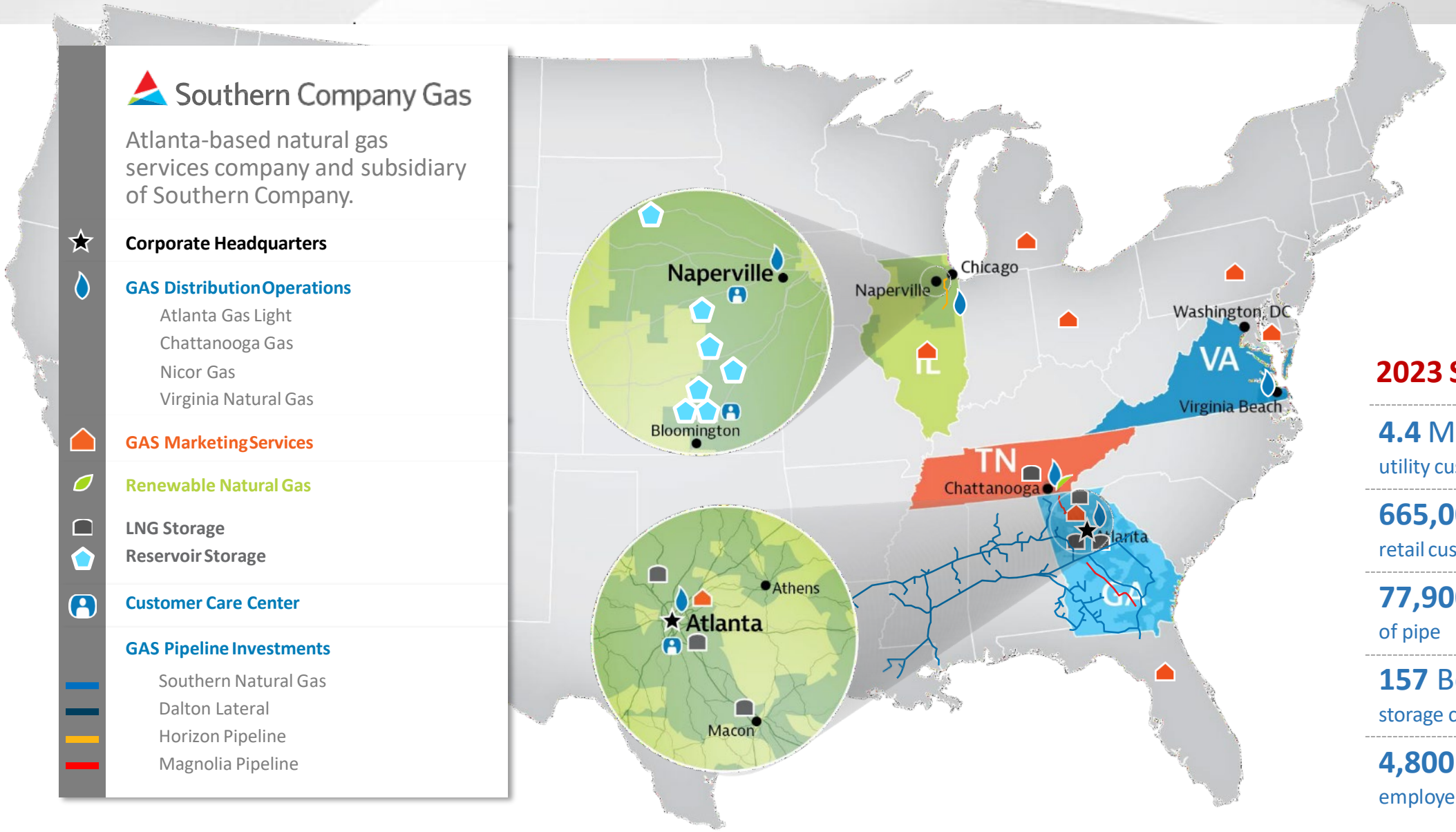
LNG Storage

Reservoir Storage

Customer Care Center

GAS Pipeline Investments

- Southern Natural Gas
- Dalton Lateral
- Horizon Pipeline
- Magnolia Pipeline



2023 Stats

4.4 Million
utility customers

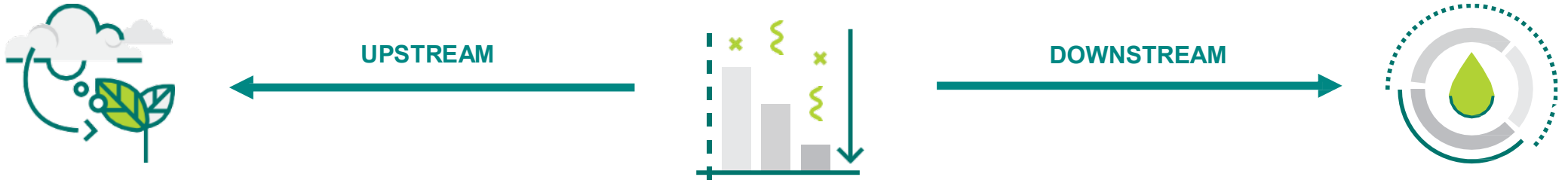
665,000
retail customers

77,900 Miles
of pipe

157 Bcf
storage capacity

4,800
employees

Fueling a Sustainable Future: **Sustainability Pathways**



Next Generation Natural Gas

"Cleaner Molecules"

- ↗ Certified Natural Gas
- ↗ Value chain transparency
- ↗ Renewable Fuels

Net Zero Operational Emissions

"Tighter Pipes"

- ↗ Direct measurement and data
- ↗ Pipeline modernization
- ↗ Advanced leak detection and repair
- ↗ Operationalize emissions reductions

Delivering Customer Solutions and Enriching Communities

"Energy Efficiency"

- ↗ Innovation
- ↗ Affordability and equity
- ↗ Workforce of the future

RNG Benefits

Renewable Natural Gas

is a critical component to our commitment to deliver clean, safe, reliable and affordable energy to our customers. RNG not only provides a sustainable, drop-in alternative source of geologic natural gas, but also provides additional benefits for our customers, the gas distribution system and local economies

Infrastructure. By integrating RNG, customers can reduce their emissions without upgrading equipment or infrastructure, assuming additional maintenance, or disrupting existing operations

Job creation. RNG projects create high-paying, clean-energy jobs, from plant managers and technicians to biologists and more

Environment. Integrating RNG facilities beneficially uses waste methane and can improve local air quality. Acquisition of the Environmental Attributes generated can be used towards emissions reduction for a customer's direct use of natural gas OR towards emissions reduction for their transportation fleet use with NGVs

RNG Investment Example

Southern Company Gas

Interconnections are a Key Component in a Successful RNG Project

The Opportunity:

According to the American Biogas Council there is tremendous opportunity for RNG development in our territories:

- IL: 51.8 billion CUFT of biogas
- GA: 89.75 billion CUFT of biogas
- VA: 40.61 billion CUFT of biogas
- TN: 16.44 billion CUFT of biogas

The Challenge:

Feedstock is often on the periphery of our system leading to challenges with accepting RNG volumes year-around

- Interconnections can add significant cost to a project
- In spec gas can have a lower BTU content (RNG is almost pure methane) this can affect large gas users if significant blending does not occur.

Nicor Gas - RGI Pilot

RGI Pilot – Rate 81

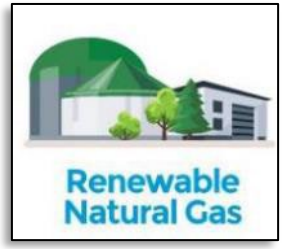
In July 2021, Nicor Gas received approval from the Illinois Commerce Commission ("ICC") for the Renewable Gas Interconnection Pilot Program ("RGI Pilot").

The RGI Pilot, implemented through Rate 81, provided an established, transparent process for Renewable Natural Gas ("RNG") producers to interconnect to the Nicor Gas pipeline system to transport RNG and allowed Nicor to invest in RNG interconnections.

The overall purpose of the pilot was to study RNG producer interest in constructing and operating Renewable Gas Production ("RGP") facilities in the region and to assess environmental and economic-development benefits that could be realized in the Nicor Gas service area.

Two producers executed interconnection agreements with Nicor Gas during the two-year pilot window and have agreed to provide Environmental Attributes to the Company annually over the course of their respective twenty-year agreements.

Nicor Gas will utilize these Environmental Attributes to reduce its operational emissions for the benefit of its customers.



RNG Environmental Benefits

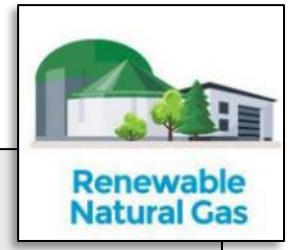
Landfill Gas RNG Facility #1

This LFG facility is expected to produce 4,400 MCFD, or over 1.6 million dekatherms annually of RNG.

Per the EPA Greenhouse Gas Equivalencies Calculator*, the expected environmental equivalencies on an annual basis would be equal to:

- The environmental benefit provided by 98,800 acres of forests.
- The removal of over 20,000 cars from the road.
- The estimated equivalent of the energy usage of over 11,000 home annually.
- Nicor receives 13,900 MMBtu EAs/Year

Landfill Gas RNG Facility #2



This LFG facility is expected to produce 5,709 MCFD, or over 2 million dekatherms annually of RNG.

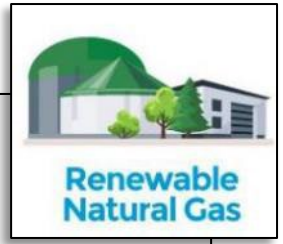
Per the EPA Greenhouse Gas Equivalencies Calculator*, the expected environmental equivalencies on an annual basis would be equal to:

- The environmental benefit provided by 124,000 acres of forests.
- The removal of over 25,000 cars from the road.
- The estimated equivalent of the energy usage of over 14,000 home annually.
- Nicor receives 20,000 MMBtu EAs/Year

*Greenhouse Gases Equivalencies Calculator - Calculations and References | US EPA and Greenhouse Gas Equivalencies Calculator | US EPA

RNG Economic Impact

Landfill Gas RNG Facilities



- Creation of local jobs (both full-time and temporary) during construction and permanent local jobs during operations.
- Multi-million dollar increase in tax receipts over the lives of both project.
- Total economic impact of over $1B million over the lives of both projects.
- Creation of additional local sources of RNG for customers to purchase while also leveraging existing natural gas infrastructure.

*Estimates for both projects were developed by separate third-party consultants performing economic impact studies using projections and estimates provided by the producer. The consultants utilized the IMPLAN and EPA JEDI models for estimating the economic impact of each facility.

Affordability

Southern Company Gas

Affordability: Solar vs. RNG Project Costs

Typical Solar Facility

- Cost per MW:
  - $1.5M/MW (per EIA[1])
- Typical solar capacity factor:
  - 25% (per EIA[2])
- Annual production:
  - 1MW x 8,760hr/yr x 25% = 2,190MWh/yr
- Cost per MWh per year
  - $1.5M/2,190MWh/yr = $685/MWh/yr

Typical RNG Facility

- Cost per MMBtu per year:
  - $66/MMBtu/yr (per RNGC[3])
- Cost per MWh per year:
  - $66/MMBtu/yr x 3.412MMBtu/MWh = $225/MWh/yr
- $685 / $225 = **3x renewable energy produced/dollar invested**

Sources: (1) Electricity - Construction cost data for electric generators - (eia.gov)
(2) Electric Power Monthly - U.S. Energy Information Administration (EIA)
(3) RNG Coalition Economic Analysis of the US Renewable Natural Gas Industry Dec 2022

RNG Compares Favorably to Other Decarbonization Solutions

The study of policy-driven electrification of residential fossil fuel heating load (space and water) indicates that residential electrification would be a more expensive approach to greenhouse gas reduction relative to many of the other options being considered—based on considerations related to the emissions reduction potential and the cost competitiveness of this approach relative to other GHG emission reduction options.

Figure ES-1:
Comparison of Cost Ranges for GHG Emissions by Reduction Mechanism

Sources: Energy Innovations, Energy Policy Simulator; GHG emission credits from the most recent auction for the Regional Greenhouse Gas Initiative (RGGI) and California Cap & Trade program. Estimates for GHG reduction costs for the existing coal generation units are based on the Levelized Cost of Energy (LCOE) consistent with the EIA's 2017 AEO Base Case; New York Public Service Commission's (NYPSC's) adoption of the Social Cost of Carbon (SCC); U.C. Davis, The Feasibility of Renewable Natural Gas as a Large-Scale, Low Carbon Substitute, 2016; Comparison of Greenhouse Gas Abatement Costs in California's Transportation Sector presented at the Center for Research in Regulated Industries - 27th Annual Western Conference (2014); The maximum cost of $10 per MMBtu for any Demand Side Management (DSM) program costs is estimated based on an review of public DSM programs; Carbon Engineering, Keith et al., A Process for Capturing CO_2 from the Atmosphere, Joule (2018), https://doi.org/10.1016/j.joule.2018.05.006

Source: Net-Zero Emissions Opportunities for Gas Utilities. AGA prepared by ICF

Southern Company
Gas

Integration of Emerging Fuels
RNG Gas Quality & Interchangeability

NARUC Task Force on Natural Gas Resource Planning
RNG Expert Learning Session

August 28, 2024

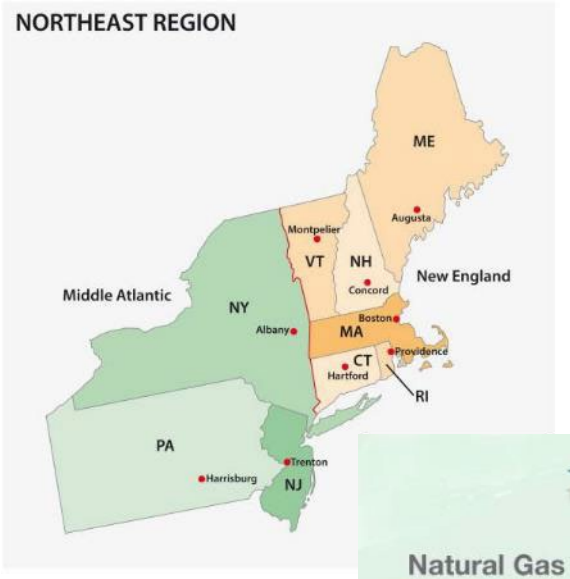
Bob Wilson,
Northeast Gas Association

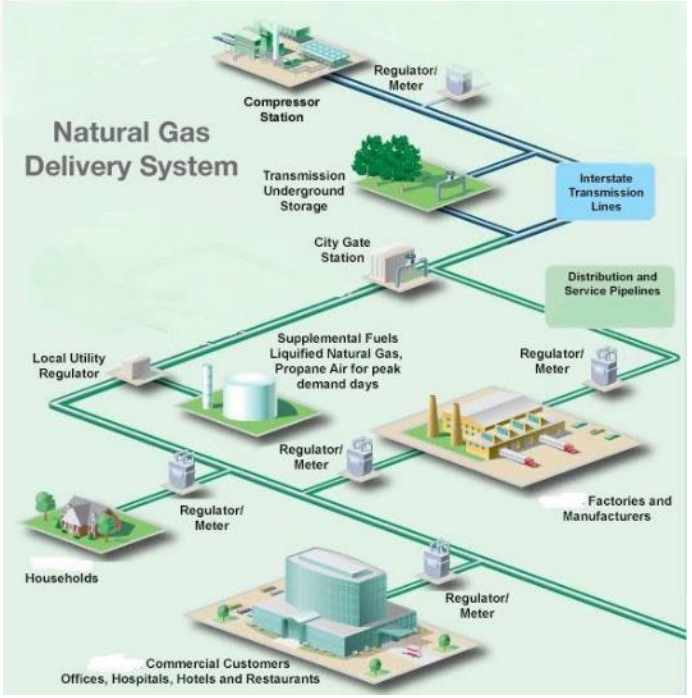
NGA
NORTHEAST GAS ASSOCIATION

NGA

Regional Trade Association Representing

- Local Distribution Companies
- Transmission Companies
- LNG Importers
- 250+ Associate Members
- +13 Million Customers





Overview

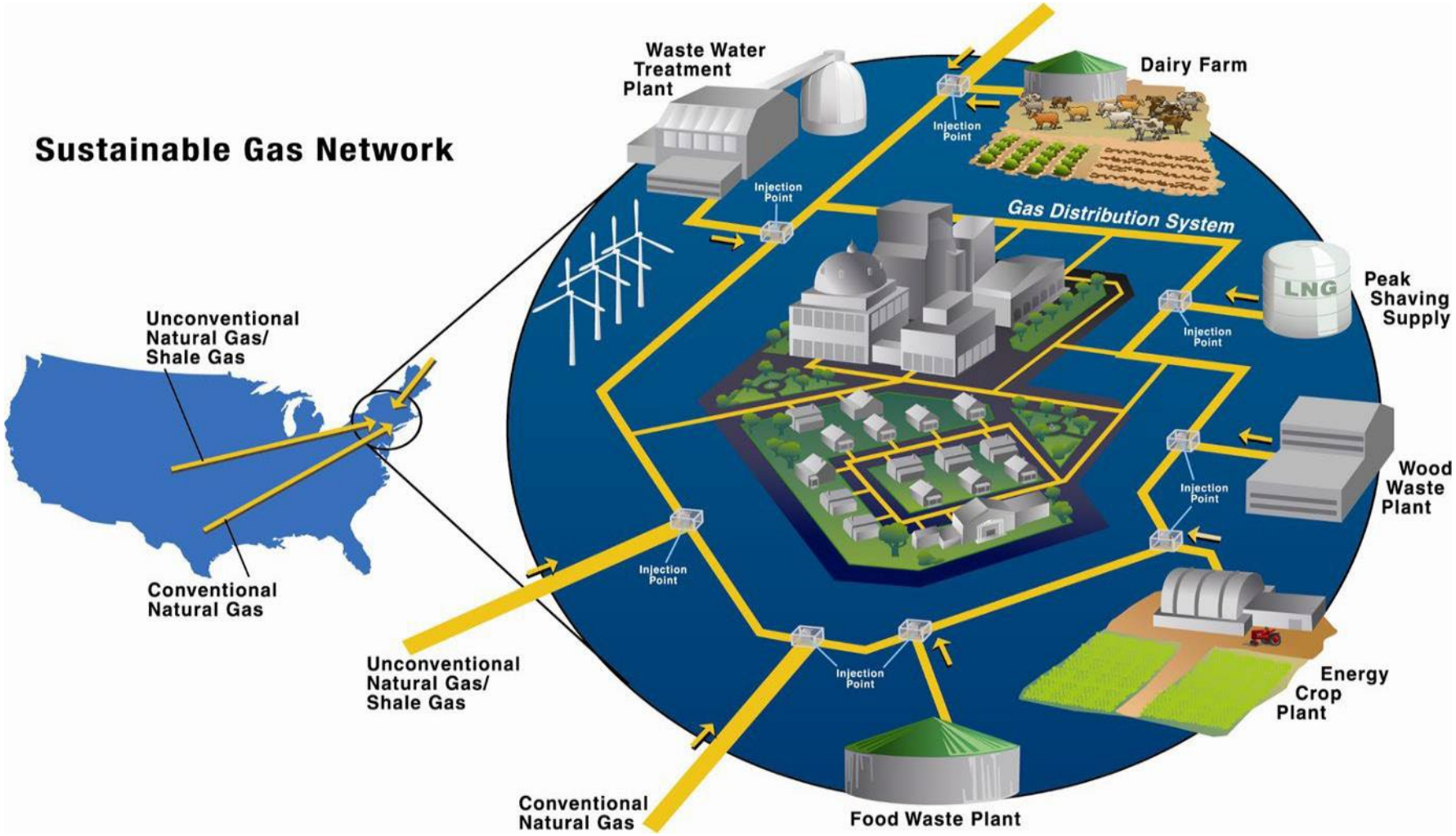
- Emerging Fuels as an Infrastructure Utilization Solution; *Our Second Great Conversion ?*
- Practical Aspects of Gas Quality & Interchangeability; The “What”, “Why” & “How”.
- The Process for *Getting Connected & Staying Connected*

Can We Reasonably & Rationally Meet the Challenges of *The Second Great Conversion* ?

A purge burner igniting manufactured gas being replaced in a main by natural gas during the 'great conversion' in 1952

- Emerging fuels including Renewable Gas are one potential component of meeting our parallel sustainability and carbon reduction goals utilizing existing energy delivery infrastructure.
- RNG Clean-up Technology has evolved significantly, resulting in greater reliability and supply opportunities.
- Production facilities have grown significantly from just 30 in 2011 to over 300 in 2023.
- Recent research suggests that existing organic waste streams are sufficient to eventually produce enough RNG to displace up to 7% of natural gas consumed in the U.S.

Vision for a Sustainable Gas Network



Practical Aspects of RNG
Gas Quality & Interchangeability

Tariffs, Contracts & Interconnect Agreements

- Only natural gas quality specifications contained in a FERC approved tariff can be enforced
- Pipeline tariff provisions on gas quality *need to be flexible*
- Pipelines & customers should develop gas quality specifications based on sound technical engineering and scientific considerations
- Pipelines & customers STRONGLY ENCOURAGED to use the NGC+ White Paper & Interim Guidelines as a common scientific reference point
- Unresolved disputes brought before FERC will be resolved on a case-by-case basis with significant weight given to the NGC+ white paper.

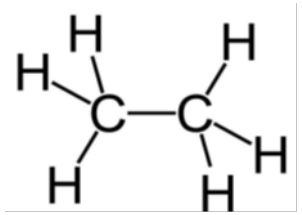
What Are We Concerned About *Regardless of Source*?

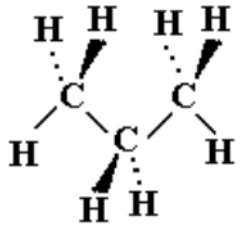
- **Constituents Considered:**

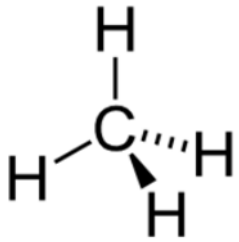
- Non-Methane Hydrocarbons
- Water Vapor
- Hydrogen Sulfide
- Mercaptans
- Total Sulfur
- Carbon Dioxide
- Nitrogen
- Total Inerts
- Oxygen
- **Other Trace Constituents ?**

Parameters & Other Considerations:

- Heating Value
- Specific Gravity
- Temperature
- Hydrocarbon Dew Point
- Interchangeability / Wobbe Number
- Measurement & Analysis (mass, volume, energy)







Why are These Constituents & Parameters Important to Operators

- Nitrogen – liquefaction, fuel cells, pipeline efficiency
- CO2 – liquefaction, system integrity
- Moisture – system integrity, synergistic effects with other constituents
- Interchangeability / Wobbe / HHV – combustion applications
- Sulfur Compounds– system integrity, emissions, odorization
- Oxygen – liquefaction, odorization, system integrity
- Trace Constituents of Concern - system integrity, odorization, feedstock impacts including liquefaction, combustion applications,

How – Understanding Stakeholder Concerns & Needs….

- ✓ Establish trace constituent pipeline/RNG equivalency
- ✓ Consider the NGC+ Interchangeability Operating Envelope
- ✓ Explore opportunities & common ground
- ✓ Willingness to understand each others concerns & work towards solutions
- ✓ Finding ways to say “yes” rather than imposing overly restrictive requirements based on operational uncertainty

How -Emerging Fuels Interconnect Guideline

A user-friendly technical framework for introducing emerging fuels is provided to help ***reduce overall operational risk for the developer and pipeline operator***, thereby minimizing potential impacts to end-use consumers.

Interconnect Guide for Emerging Fuels into Energy Delivery Networks

Introduction of RNG and HENG

RNG / Geological Supply COC Summary Comparison

Constituents found in RNG	Comparison to tariff or specification concentration values when one is stated	Comparison to natural gas
Hydrogen sulfide	✓ Significantly below typical tariff/spec range	✓ RNG has narrower range
Total sulfur	✓ Significantly below typical tariff/spec range	✓ RNG has narrower range
Siloxane	Falls within typical tariff/spec range	RNG slightly higher range
Mercury	Aligns with minimum of typical tariff/spec range	RNG nearly identical range
Vinyl chloride	✓ Below typical tariff/spec range	RNG nearly identical range
1,4-diclorobenzene	✓ Significantly below typical tariff/spec range	✓ Not found in either gas
N-nitroso-di-n-propylamine	✓ Significantly below typical tariff/spec range	✓ Only found in one RNG site, did not replicate
Methacrolein	✓ Significantly below typical tariff/spec range	RNG nearly identical range
Copper	✓ Significantly below typical tariff/spec range	RNG nearly identical range
Arsenic	Aligns with minimum typical tariff/spec range	RNG nearly identical range
Iron-Oxidizing Bacteria	✓ Below typical tariff/spec value	Both RNG and NG have large ranges similar in volume
Acid-Producing Bacteria	✓ Below typical tariff/spec value	Both RNG and NG have large ranges; RNG range broader than NG range
Sulfate-Reducing Bacteria	✓ Below typical tariff/spec value	RNG nearly identical range

Practical Guidelines To Embrace Renewable Gas

- Understand trace constituents of concern
- Model and determine aggregation compositions based on “bookend” flows and assumed end state cleanup criteria
- Evaluate possibility of gas system operations to minimize impacts of anomalies (redirecting flows etc..)
- Optimize design and cleanup strategy based on above
- Establish remote monitoring and shutdown capability
- Ensure you meet all local regulatory requirements for accepting this gas….. May vary by state.

Wrap-Up Questions Discussions