Renewable sources of natural gas:

Supply and Emissions Reduction Assessment

Available online: https://tinyurl.com/AGF-RNG

ICF

AGA
American Gas Association

Overview

The American Gas Association (AGA) defines renewable natural gas as: Pipeline compatible gaseous fuel derived from biogenic or other renewable sources that has lower lifecycle carbon dioxide equivalent (CO2-eq) emissions than geological natural gas.

ICF conducted an assessment to outline the potential for RNG to contribute meaningfully and cost-effectively to greenhouse gas (GHG) emission reduction initiatives across the country.

Study objectives

The primary objective is to characterize the **resource and economic potential** for RNG as a greenhouse gas (GHG) emission reduction strategy. It also seeks to **improve policymakers' understanding** of the extent delivering RNG to all sectors of the economy can contribute to broader GHG emission reduction initiatives.

Broadly speaking, the report seeks to answer three questions:

- What is the potential for RNG? And over what timeline might it be available?
- What are the corresponding GHG emission reductions?
- How much will it cost? And what are the potential areas for cost reductions?

Feedstocks & technologies

Feedstocks: ICF developed low and high resource potential scenarios by considering RNG production from 9 feedstocks: landfill gas, animal manure, water resource recovery facilities (WRRFs), food waste, agricultural residues, forestry and forest product residues, energy crops, the use of renewable electricity, and the non-biogenic fraction of municipal solid waste (MSW).

Production technologies: Feedstocks were assumed to be processed using one of three technologies to produce RNG: 1) anaerobic digesters, 2) thermal gasification systems, and 3) power-to-gas (P2G) in combination with a methanation system.

RNG resource assessment

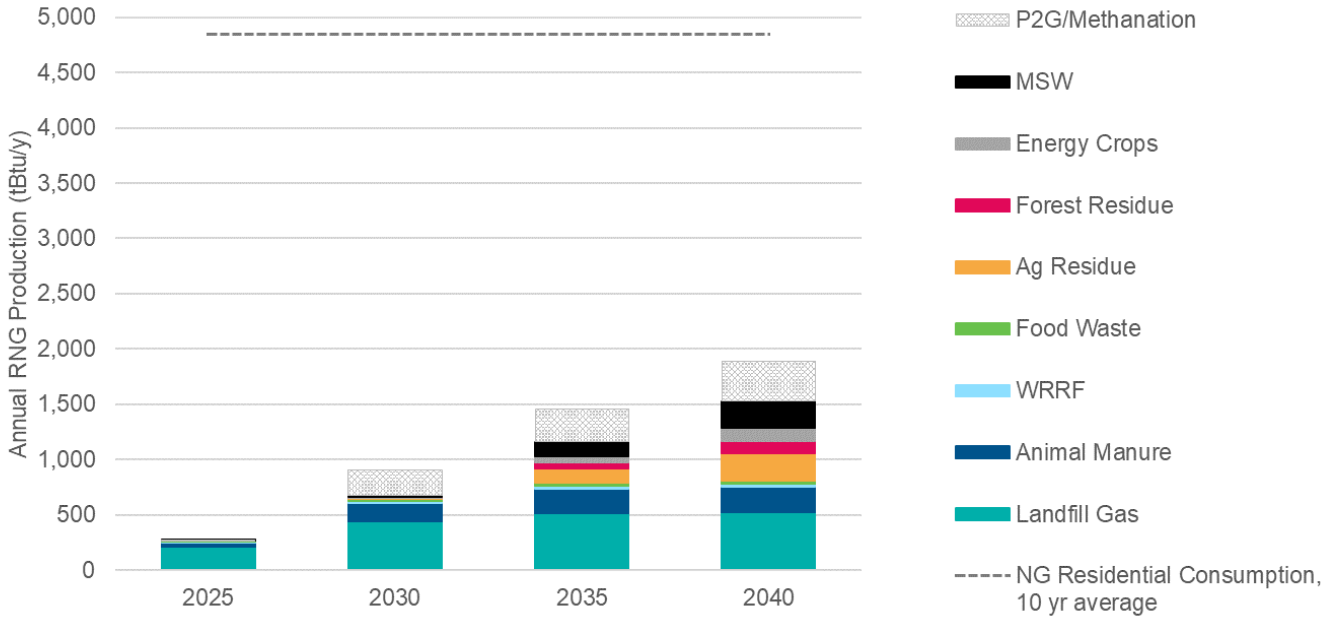
In the **low resource potential scenario**, ICF estimates RNG production potential of 1,660 tBtu per year by 2040; increasing to 1,910 tBtu/year when including the potential for the non-biogenic fraction of MSW.

In the **high resource potential scenario**, ICF estimates that about 3,780 tBtu/year of RNG can be by 2040; increasing to 4,510 tBtu/year when including the potential for the non-biogenic fraction of MSW.

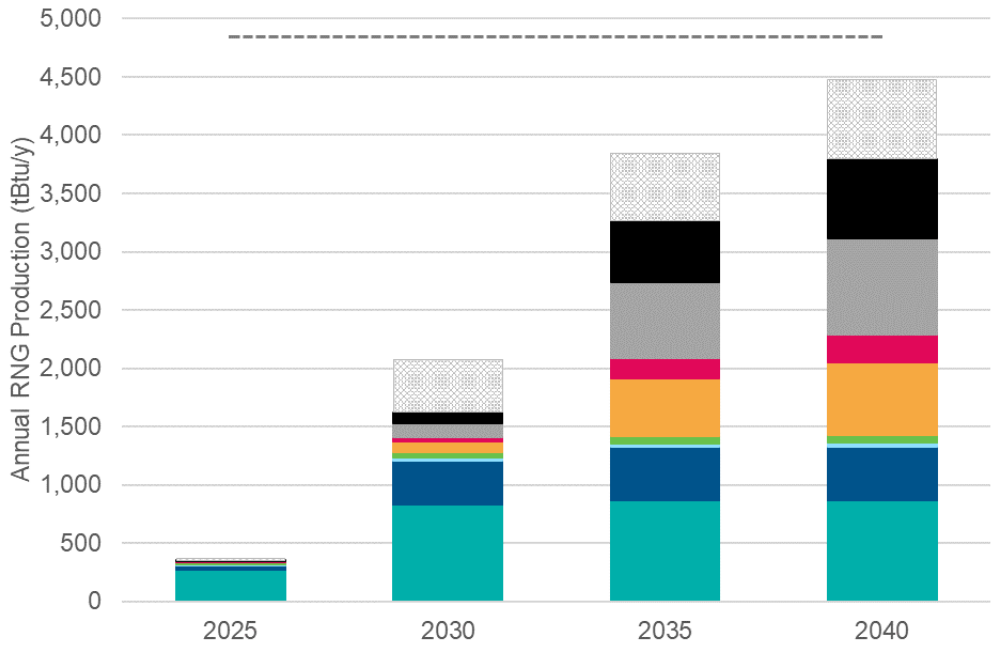
ICF also reports a **technical resource potential scenario** of nearly 13,960 tBtu—a production potential intended to reflect the RNG production potential without any technical or economic constraints.

Estimated annual RNG production

Low Resource Potential Scenario

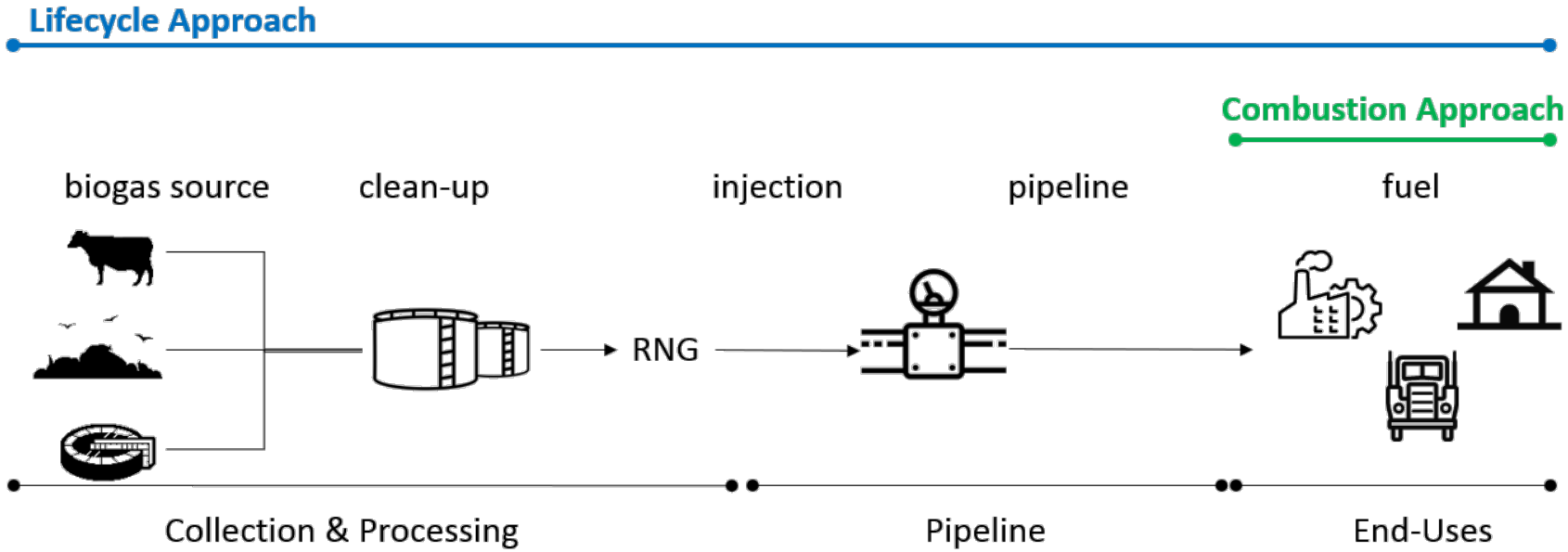


High Resource Potential Scenario



- For comparison, the 10-year average (2009 to 2018) for residential natural gas consumption nationwide is 4,846 tBtu; shown as the **dotted line** in both figures.

GHG emissions of RNG

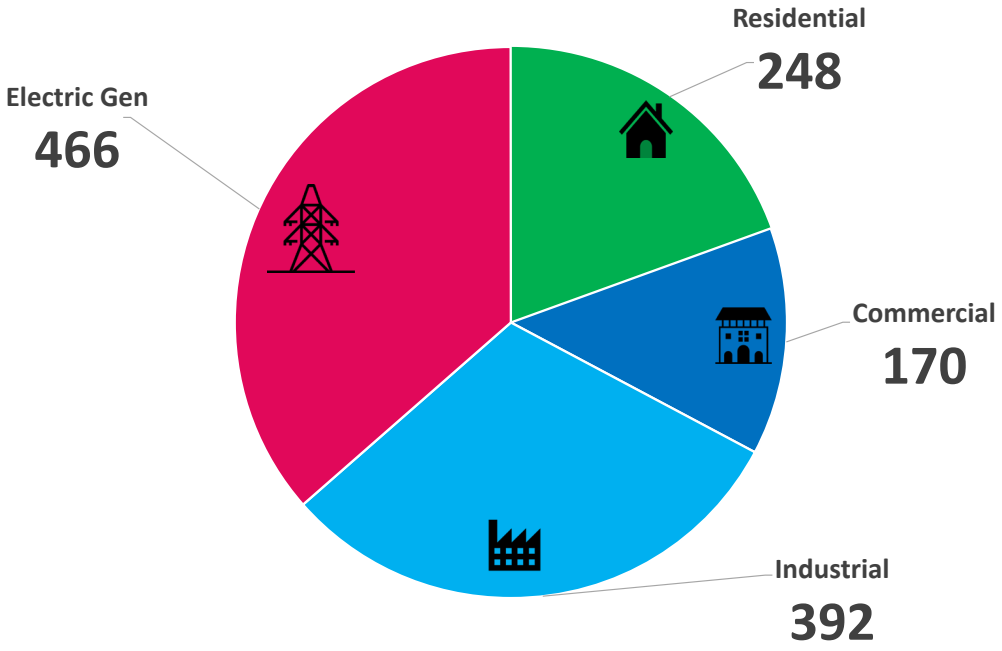


- **Combustion-based accounting** is the standard approach for most volumetric GHG targets, inventories and mitigation measures (e.g., RPS programs, etc.).
- **Lifecycle accounting** for GHG emissions from RNG can vary substantially between feedstocks and production methods.

GHG emissions reductions from RNG

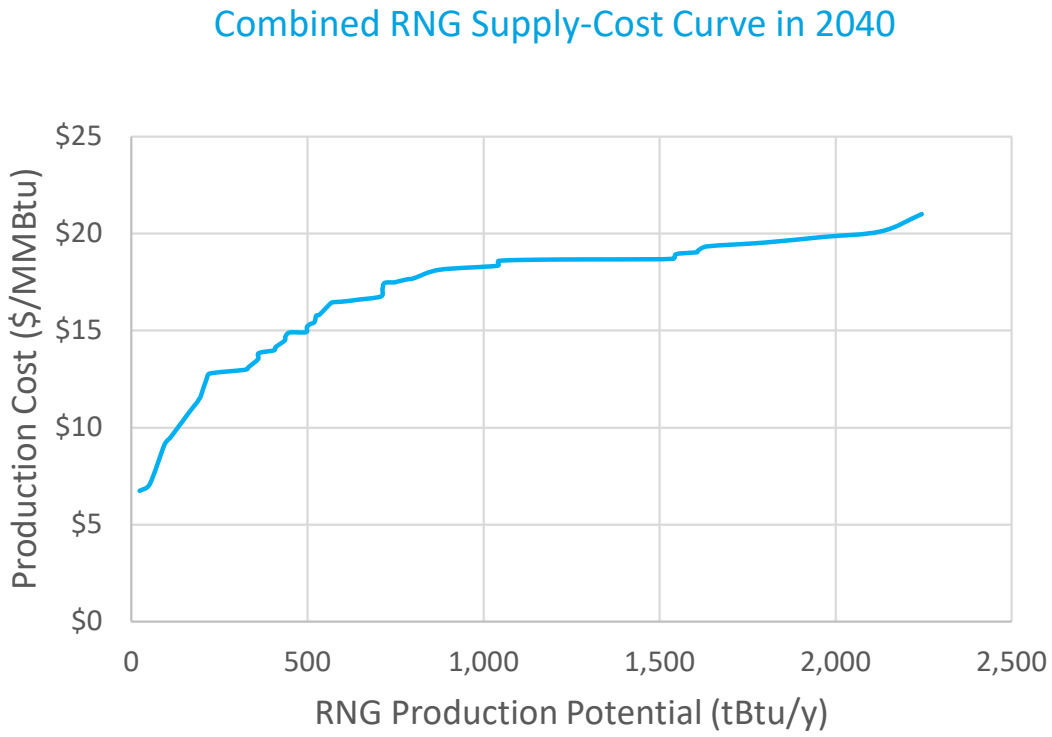
- ICF estimates that RNG deployment could achieve 101 to 235 MMT of GHG emission reductions by 2040.
- The figure to the right shows the average annual CO2 emissions from natural gas across different sectors.
- GHG emission reductions in the high resource potential nearly offset entirely emissions from the consumption of natural gas in the residential sector.

Average Annual CO2 Emissions (in MMT) from Natural Gas Consumption, 2009-2018



RNG cost assessment

- ICF estimates that the majority of the RNG produced in the high resource potential scenario is available in the range of $7-$20/MMBtu, which results in a cost of GHG emission reductions between $55/ton to $300/ton in 2040.
- ICF finds that there is also **potential for cost reductions** as the RNG for pipeline injection market matures, production volumes increase, and the underlying structure of the market evolves.



RNG cost assessment: achieving cost reductions

- Advanced manufacturing plays an important role in making RNG more cost-competitive with geological natural gas and other fossil-based resource.
- To help achieve more significant reductions, the various aspects of RNG production need to be modular, autonomous, process intensive and manufactured in large numbers.
- The DOE's efforts on developing breakthrough technologies could be focused on RNG and other biomass conversion technologies, which could help substantially reduce costs.

Key findings

- **ICF's assessment of RNG potential in the United States demonstrates that there is significant resource potential in both the low and the high cases considered—**and in both, ICF used moderately conservative assumptions with respect to the utilization of feedstocks and technological advancements.

- **ICF's updated assessment also illustrates the diversity of RNG resource potential as a GHG emission reduction strategy—**there is a portfolio of potential feedstocks and technologies that are or will be commercialized in the near-term future that will help realize the potential of the RNG market.

Key findings

- ICF's analysis of the potential for P2G systems paired with methanation suggests that the technology could significantly contribute to RNG production by 2040.
- In both low and high resource potential scenarios, RNG deployment could achieve 101 to 235 MMT of GHG emission reductions by 2040.
- ICF estimates that the majority of the RNG produced in the high resource potential scenario is available in the range of $7-$20/MMBtu, which is equivalent to $55/ton to $300/ton in 2040.

Thank you!

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