Northeast GAS ASSOCIATION
NYSEARCH

Technology Brief

LDC-Focused Gap Analysis and State-of-the-Art Study on Decarbonization

Description: **A state-of-the-art study (SOTA) and R&D gap analysis based on research and member interactions regarding active R & D projects and future needs with recommendations on addressing the LDC-specific challenges in decarbonization.**

Status: **The SOTA study and gap analysis are complete with delivery of technical reports in July 2022.**

BENEFITS

Natural gas utilities in North America are actively engaged in multiple strategic and tactical efforts to embrace and implement emerging fuels. The NYSEARCH consortium defined and initiated innovative R&D projects in the past five years to support this path. This study provides detailed technical information on the current state of technologies for producing, upgrading, and interconnecting Renewable Natural Gas (RNG) and Blending Hydrogen into existing natural gas infrastructure. An LDC-focused SOTA and gap analysis specific to distributing hydrogen blends and RNG provides a robust snapshot on the status of R&D today. It also provides a guide in maximizing R&D opportunities for further research to fully prepare for the clean energy transition. NYSEARCH member LDCs represent a vital part in meeting the low carbon energy goals coming from federal and state regulations. Having a cohesive and aligned understanding of LDC specific challenges and the R&D opportunities to address those challenges educates members to enable decarbonization pathways for the future.

BACKGROUND

Numerous energy organizations and R&D organizations including NYSEARCH have been pursuing research and development of Renewable Natural Gas (RNG), blended hydrogen (H_2), Power-to-Gas (P2G), Direct Carbon Capture (DCC), Carbon Capture Utilization and Storage (CCUS), and other areas related to decarbonization. Internationally and especially in Europe, a large body of work is ongoing with decarbonization of the gas system in its entirety. This shift requires an understanding of the current state and technical gaps associated with the energy transition in the gas distribution sector.

Decarbonization of the gas system is a term used broadly to encompass the methods of lowering the carbon content of natural gas and essentially its impact on the environment. Those methods include introduction of Renewable Natural Gas (RNG) captured and upgraded from wastewater treatment plants, dairy farms, landfills, and power-to-gas (P2G) units, blending hydrogen (H_2) into natural gas pipelines, and generating gas from direct carbon capture or from woody biomass via gasification and pyrolysis. All these methods reduce carbon dioxide from the atmosphere or redirect the carbon produced from certain processes and recycle it through the natural gas system.

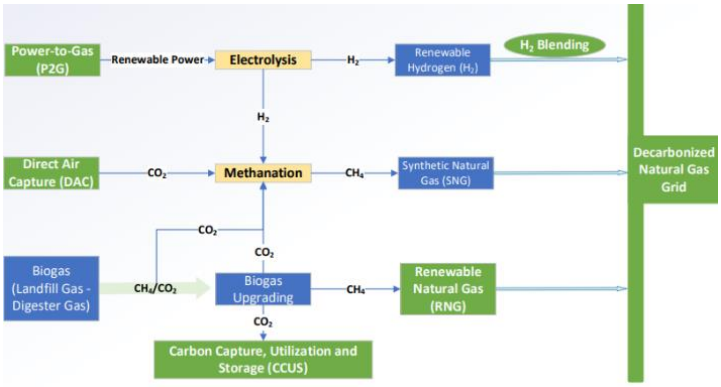

Figure 1. Decarbonization pathways for LDC's to achieve a decarbonized natural gas grid

The SOTA and gap analysis are intended to: 1) identify specific LDC gaps on decarbonization technology development, 2) perform State-of-the-Art analysis that is focused on LDCs, and, 3) formulate a Technology Roadmap for LDC focused decarbonization efforts.

TECHNICAL APPROACH

The project kicked off with a comprehensive literature review of key decarbonization technologies based on industry and technology experiences. The SOTA included descriptions, advantages/disadvantages/technology readiness levels (TRLs) and specific LDC challenges and opportunities for the following decarb technologies: RNG, Hydrogen Blending, Direct Carbon Capture (DCC), Carbon Capture and Sequestration (CCUS), Energy Resiliency / Reliability of Renewable Electricity and Biological Power-to-Gas.

In addition to an expanded literature review, multiple discussions and risk assessment workshops were executed with high participation and engagement by the NYSEARCH funders and subject matter experts within the funding utilities. These engaging workshops identified LDC-specific asset and technical challenges specific to hydrogen blending and RNG transport.

Qualitative Risk Rating Methodology

Figure 2. A qualitative risk assessment matrix used to assign risk rating to potential impacts of emerging fuels

The Technology Roadmap identified R&D activities of other organizations that NYSEARCH could consider supporting and additional R&D activities for NYSEARCH consideration. The roadmap was prioritized based on the most significant challenges and opportunities facing LDCs and provided corresponding timeframes for possible implementation (short term, medium term, long term).

A final deliverable for this project was a GIS, location-based interactive "Story Map" to visualize and track projects in North America or globally. This is a powerful tool, using both open/available and proprietary data to showcase and benchmark the thousands of decarbonization-focused projects around the world.

PROGRAM STATUS

The technical reports for the SOTA and gap analysis on RNG and Hydrogen Blending, the Technology Roadmap, and the Story Map have all been completed, reviewed, approved, and delivered to NYSEARCH funders. Since the efforts around decarbonization can change and progress quickly, NYSEARCH will consider the need to repeat a formal SOTA and Gap Analysis to assess the industry state and prioritize R&D efforts.

Highlights

- An LDC-focused State-of-the-Art Study and Gap Analysis on decarbonization technologies is completed to identify technical gaps and R&D opportunities today and in the future.
- Specific LDC challenges and opportunities are identified for the following decarb pathways: RNG, Hydrogen Blending, Direct Carbon Capture (DCC), Carbon Capture and Sequestration (CCUS), and Biological Power-to-Gas.

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