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a Special Edition on Renewable Natural Gas

NYSEARCH *spotlight*

DEDICATED TO SERVING ITS UTILITY MEMBER COMPANIES WITH
FOCUS ON NATURAL GAS R&D, TECHNOLOGY DEVELOPMENT &
COMMERCIALIZATION, AND JOINT INDUSTRY COLLABORATION



De-carbonization is steadily becoming a common objective among energy companies with interest in leveraging our existing infrastructure. It is thus important for NYSEARCH members to be knowledgeable about new forms of Renewable Natural Gas, innovations that apply RNG in the gas distribution system (including forms such as power-to-gas and blended hydrogen) and lessons learned. RNG is considered gas that is fully interchangeable with pipeline quality natural gas. Sources of RNG such as biogas, syngas, blended hydrogen in natural gas and power-to-gas (using renewable electricity) are not all at the same stage of development.



NYSEARCH has approached this new area of innovation by looking at impacts of RNG, assessing impacts of siloxanes on residential appliances, exploring a microbial Power-to-Gas solution, and implementing a Living Lab at the Newtown Creek Wastewater Plant in NY through a partnership with National Grid (image on right) comparing operation of blended RNG to typical gas supply on equipment. In addition to some general news, this special edition of the newsletter highlights specific ongoing NYSEARCH RNG projects and presents a path forward to continue and develop solutions for the changing landscape of the natural gas industry.



Digestors at Newtown Creek Wastewater Treatment Plant and location of the NYSEARCH Living Lab beyond the walled area

Reflecting on 2019 achievements and looking ahead in 2020

written by Daphne D'Zurko

After several years of development, safety certification and testing, NYSEARCH is pleased to report that its commercial partner, Enetics Inc. introduced the GasComm® product for real time sensing on steel pipe. Also, in 2019, NYSEARCH launched a spin-off project to address design changes for GasComm® for plastic pipe.

Field demonstrations and tech transfer

2019 - Enetics commercialization & plastic pipe configuration

2013 - R&D with NYSEARCH

2019 Year in Review cont'd

During the course of the year, NYSEARCH completed several projects related to de-Carbonization and Renewable Natural Gas. They included: 1) Expansion of NYSEARCH RANGE™ Model & Study of Siloxane Concentration Limits, 2) Assessment of Consequences of RNG on Gas Infrastructure/ Appliances, and, 3) BioMethane Data Collection Project. The updated Version 6 of the NYSEARCH RANGE™ model is available to funders and an updated non-funder version is being made available for annual subscription purchase on the www.nysearch.org website.

As NYSEARCH members continue to support add-on modules and enhancement to Invodane/Pipetel's EXP range of robotic inspection platforms, 2019 resulted in commercial readiness of the EXP 6 product and the Hardness tester.

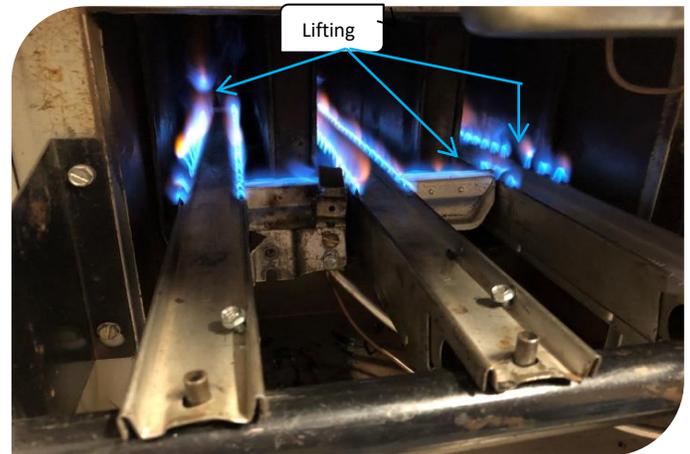
NYSEARCH continues to work closely with members to select valuable R & D initiatives on a project-by-project basis. With the increased size of the staff and earlier directives from its executive group, NYSEARCH had another year of growth in program size.



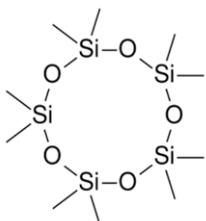
Expansion of the NYSEARCH RANGE™ Model for Gas Interchangeability and Establishing Siloxane Limits for End-Use Equipment

A changing gas landscape requires local distribution companies to understand the effects of gas interchangeability and the ultimate end-use effects to its customers. The NYSEARCH RANGE™ Model was built based on extensive lab and field test data in 2015. It utilizes a “range of acceptability” approach for evaluating residential appliance performance with a range of gas supplies. A spreadsheet and online version of the model were developed from the results of this extensive test program. Recently, the model was updated to a version 5 using appliance test data collected by SoCalGas and FortisBC for blended hydrogen. Additional expansion of the RANGE™ model to a version 6 now adds the ability of the model to establish interchangeability boundaries for bio-derived Renewable Natural Gas. The recent work included studying the flame lifting characteristics using AGA Flame Code. It also incorporated data from a NYSEARCH effort to create actual flame lifting conditions at residential appliances tested in Southwest Gas and Questar/Dominion testing facilities in 2019.

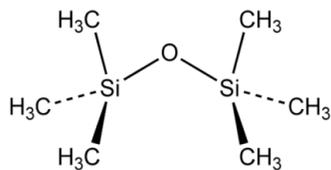
In December 2019, NYSEARCH funders voted to sponsor additional research to determine a concentration limit for silicon-containing molecules in RNG that will preclude significant performance and maintenance impacts for end-use equipment. Siloxanes limits are not specifically defined in North America with current guidance only from California's AB1900. The project will complete field monitoring to determine sensitive equipment. Then, tests will be performed on residential appliance to replicate potential worst-case siloxane conditions and to assess potential impact.



Residential appliance RNG testing with flame lifting identified (above) Siloxane compounds found in RNG (left)



D5: Decamethylcyclopentasiloxane



L2: Hexamethyldisiloxane

DNV-GL Risk Assessment of Consequences of RNG on Gas Infrastructure and Appliances

Likelihood	Impact on Network and/or Appliances
0: Not credible	0: Zero impact
1: Low Less than annual event	1: Minor financial impact
2: Medium 1-6 events per year	2: Medium financial impact
3: High Monthly/Weekly/Daily	3: Major financial impact

This State-of-the-Art Risk assessment serves as a platform for the NYSEARCH committee to build an RNG roadmap and identify technology gaps in North America. The benefits of this study are to: 1) leverage similar work done in Europe, and 2) take actions necessary to protect our pipeline networks and customer appliances. DNV-GL focused the risk assessment in two areas: 1) impact of Siloxanes on gas appliances and engines and 2) impact of corrosive substances on materials in the LDC gas network. NYSEARCH members provided detailed input on pipe systems and feedstocks/biogas supply and DNV-GL used this information along with how the North American systems are different operationally to provide risk ratings and recommendations. The risk assessment highlighted important RNG constituents to consider and evaluated both steel and plastic pipe networks and gas appliances to provide risk impact ratings.

Identifying a Siloxane Analyzer to reliably evaluate siloxane levels in RNG



Renewable Natural Gas brings new challenges in gas quality analysis and a primary constituent of interest is siloxane. Siloxanes are silicone-containing compounds that can be detrimental to certain equipment typically found in LDC infrastructure. The objective of this study is to identify a suitable technology, technology provider, and work to develop a siloxane tool that can measure concentrations of siloxanes at regulated threshold levels. Focusing on advances in Europe, a state-of-the-art technology assessment on current siloxanes measurement techniques was completed. Then, each prospective tool was presented to NYSEARCH funders to evaluate tool capabilities and limitations. The funding members then used a scoring system to rank all identified siloxane analyzers and recently established one analyzer as the closest to meeting all NYSEARCH defined criteria.

The identified siloxane analyzer met most of the criteria defined by NYSEARCH funders but not all criteria were met. The next step is to establish a roadmap for the tasks necessary to potentially further develop the identified siloxane analyzer and test the tool in subsequent project phases.

**NYSEARCH
STAFF IS HERE
FOR YOU!**

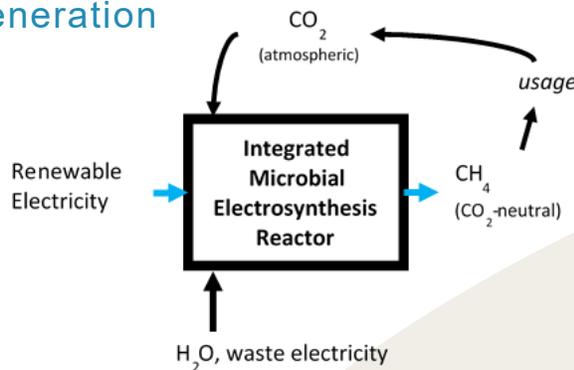
**MEET
Suzanne Hartwell
Project Manager**



Suzy joined NYSEARCH in January 2020. Suzy has masters' and bachelor's degrees in Mechanical Engineering from Stevens Institute. She is a native of NJ and has worked for the last (7) years on various major projects as a Principal Systems engineer for BAE Systems. Suzy now rounds out the NYSEARCH team and we look forward to working closely with our members to deliver R&D solutions. Welcome Suzy!

Exploring power-to-gas using microbes as an energy storage solution and RNG generation

Microbial power-to-gas provides a unique energy storage solution and an unconventional method to produce RNG. In collaboration with Stanford University, NYSEARCH is working to study factors impacting long term performance of a microbial power-to-gas system. The innovation of an integrated microbial electromethanogenesis technology is the direct consumption of hydrogen, which then does not require H₂ to be transferred from a separate electrolysis reactor as seen in other state-of-the-art technologies. The first phase of research focused on assessing microbial viability, longevity, and microbial compatibility with electrodes. The promising



results from Phase I has generated plans for the next steps to evaluate the effects of electricity intermittency and evaluating additional microbe species for a robust reactor performance.