

Renewable Natural Gas Interchangeability Research for Residential Appliances

Description: Evaluation of varying Renewable Natural Gas (RNG) compositions on performance of residential appliances.

Status: Appliance testing is complete. NYSEARCH Range™ *Plus* available on www.nysearch.org

BENEFITS

The addition of new RNG supplies (from aerobic digestion, power-to-gas etc.) is expected to increase, leading to wider range of gas compositions. This NYSEARCH project is performing a comprehensive evaluation of the impact of varying gas composition on the performance of residential appliances to determine the potential extent of sensitive appliances being affected. This can aid gas companies, manufacturers, and installers in optimizing appliance adjustments for current and future RNG supplies and to further promote regular maintenance. This will also help advance a wider range of gas compositions that can be managed through the updated NYSEARCH RANGE™ model.

This projects also aims to address the ongoing dialogue on the technical limits of siloxanes in renewable natural gas. Assessment of siloxane impacts on sensitive natural gas end-use equipment will help to specify technically-sound limits.

BACKGROUND

NYSEARCH has a history of investigating the impacts of changing gas supplies through its project #765 known as the ‘Gas Interchangeability for Residential Appliances’ study. In that project, the goal was to evaluate the impact of changing gas composition on the performance of in-service residential appliances. Through evaluations of the performance of customer appliances’ and subsequent laboratory testing and modeling, the NYSEARCH RANGE™ model (see Figure 1) was

developed. Several gas companies in US and Canada are using this tool as an alternative to various empirical indices to assess performance of appliances with different gas compositions and to aid gas tariff discussions on thresholds when new supplies are offered.

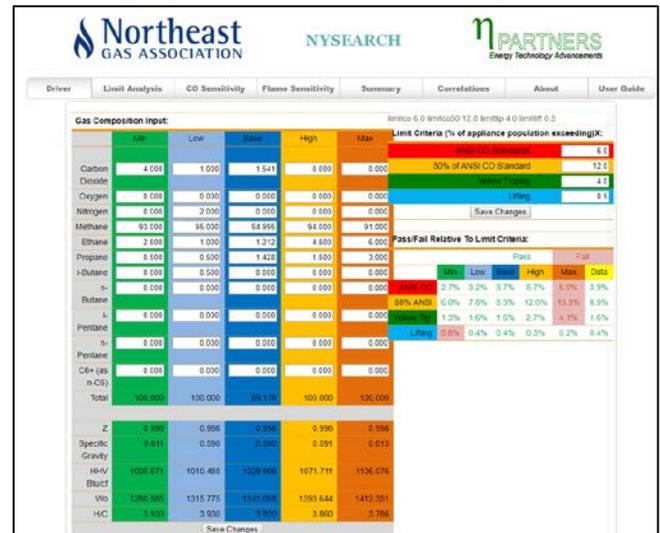


Figure 1: Screenshot of NYSEARCH RANGE™ model

With broader, more widespread interest in the RNG, additional analysis was required to expand the NYSEARCH RANGE™ model. In addition to exploring flashback and lower Wobbe number effects, there is a need to look further at work on blended Hydrogen in power-to-gas applications.

In addition, given the interest in setting up of limits for Siloxane in RNG; there was potential to

address the ongoing dialogue and the technical limits of siloxanes in Renewable Natural Gas.

TECHNICAL APPROACH

The objectives of the project were to improve the ability of the NYSEARCH RANGE™ model by: a) establishing interchangeability boundaries for bio-derived Renewable Natural Gas by characterizing flame lifting, b) determining appliance performance with Hydrogen blends to establish interchangeability boundaries for Power-to-Gas RNG and, c) specifying a concentration limit for silicon-containing molecules in RNG that will preclude significant performance and maintenance impacts for end use equipment.



Figure 2: Stove-top Flame Variations with Wide-Ranging Settings.

Detailed appliance tests were conducted at each of the service training labs at the two participating LDCs. The impact of gas quality on the performance of each appliance was tested using the local gas supply and three defined RNG gas compositions. Effect of different appliance adjustments was also evaluated. As part of the testing, flue gas carbon monoxide and oxygen concentrations were measured. Also, flame appearance was characterized using the AGA flame code, and photos of the flames taken (See Figure 2). The merits of incorporating either a new flashback correlation or variations of the Weaver and AGA flashback indices into the model was evaluated and the best approach selected.

For the 3rd task, Eta Partners reviewed the California Council on Science and Technology report on siloxane limits and other relevant literature. They

defined specific equipment impacts and determined the basis for fuel specification siloxane limits by literature review as well as interviewing Subject Matter Experts (SMEs) at the manufacturing companies. This helped identify any additional testing or monitoring needs. Based on these findings, an interim limit (expressed as mg silicon/nm³) for siloxanes in RNG has been recommended.

PROGRAM STATUS

Appliance testing (See Figure 3) has been completed at NYSEARCH LDC member laboratories. Based on the test results, flame lifting, and flashback correlations have been incorporated into the NYSEARCH RANGE™ model. The new model has been verified by comparing predicted performance to results from the current and prior tests.

The new and improved NYSEARCH Range™ *Plus* model that can define Interchangeability for RNG is available for purchase for non-members on the NYSEARCH website; www.nysearch.org.



Figure 3: Testing at an LDC lab

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