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1700 S Mount Prospect Rd
Des Plaines, IL 60018-1804
+1 847.768.0500

February 11, 2025

Oregon State Legislature
Senate Committee on Energy and Environment

SUBJECT: SB685

Dear Members of the Senate Committee on Energy and Environment:

GTI Energy is a U.S. non-profit energy research & development organization and has extensive experience on the topic of hydrogen energy systems, both involving blending into natural gas grids and with purpose-built hydrogen infrastructure. The published technical information provided here is for consideration by the Committee. Below is a high-level summary of research findings that may be relevant to these proceedings:

Hydrogen as a key decarbonization tool:

- Net Zero Emissions modeling studies see an *increase* in hydrogen's role to decarbonize heat, power, and mobility in the U.S.[1].
- The U.S. Department of Energy has published an update to their *Pathways for Commercial Liftoff for Clean Hydrogen* which includes projections for $0.5 - $1.7 levelized cost of hydrogen (LCOH) per kg, with new information on methane pyrolysis and geologic hydrogen pathways[2].

Utility Customer Impacts:

- GTI Energy published a meta-study regarding the impact of blending hydrogen (H_2) into the gas grid on existing heating equipment in 2024 for residential and light commercial buildings. This study identified the following trends in the aggregated experimental evidence across more than 30 published studies and over a wide range of end use equipment designed for natural gas and operated with a hydrogen/natural gas blend up to 40% by volume[3]:

[1] https://www.gti.energy/wp-content/uploads/2024/02/Meta-Analysis-of-U.S.-Economy-Wide-Decarbonization-Studies_Feb2024.pdf
[2] https://www.energy.gov/lpo/articles/us-department-energy-releases-updated-report-pathways-commercial-liftoff-clean
[3] https://store.accuristech.com/ashrae/standards/ch-24-c035-is-the-heating-industry-hydrogen-ready-a-meta-analysis-of-hydrogen-impact-assessments-on-combustion-equipment-in-buildings?product_id=2904886

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  - Air emissions (NOx and CO) will typically decrease or remain flat with increasing H_2 blends
  - The heating capacity will decline within 5%-10% of rated conditions, more in line with the shift in the Wobbe Index than the higher heating value (HHV)
  - The upper stability limits of equipment, where issues of flame stability and ignition issues may arise, typically occur above 20% by volume (up to 94%)
  - Controlled testing has not observed leakage enhancement for equipment and indoor distribution, for hydrogen blends vs. natural gas at line pressures typical for residential, commercial, and light industrial buildings
  - The efficiency of the appliances may increase or decrease by a small amount, typically within +/- 2% for 30% H_2 by volume
- On commercial and industrial heating equipment, recent studies have concluded that[4]:
  - All major heating equipment categories have equipment available for hydrogen blends, with many manufacturer-certified, and also suitable for 100% H_2
  - Solutions are being developed with GTI Energy and industry to permit 0-100% H_2 fuel-flexibility for industrial processes and commercial boilers, and emerging standards now allow for certifying with a 25% H_2 blend into natural gas[5]
  - From a techno-economic perspective, the decarbonization of industrial boilers with hydrogen may have a lower upfront cost and an equivalent lifecycle cost when compared to full electrification
- For on-site energy and combined heat & power (CHP), a recent demonstration in Ontario of a 0-100% H_2 compatible CHP system measured NOx emissions with H_2 that were less than with natural gas and continued operation across the range of fuel blends[6].

We appreciate the opportunity to contribute current technical and scientific information on the topic of hydrogen systems.

Sincerely,

Dan LeFevers
Director, State and Consumer Programs
GTI Energy

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[4] Summarized by Glanville, P.; Alavandi, S.; Fridlyand, A.; Kar, T.; Zhao, Y.; and Kozlov, A. *Decarbonizing Heating Equipment by Adopting Hydrogen-based Fuels: Review of Recent Progress in North America*", Proceedings of the 2024 International Gas Research Conference, Banff, AB.

[5] https://www.ul.com/news/new-certification-path-boilers-25-hydrogen-blending

[6] Zaidi, A. "*Advancements in Hydrogen-Fueled Combined Heat and Power: An Enbridge Gas Case Study*", Proceedings of the 2024 Canadian Hydrogen Convention, Edmonton, AB.