



An overview of the pipeline blending CRADA - A Hyblend™ Project

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KOGA Hydrogen Summit – Conventional Midstream Panel

June 26, 2024

Sunita Satyapal's Plenary Talk at DOE Hydrogen & Fuel Cell Technologies Office Annual Merit Review (June 2023)

H2 Matchmaker Final Results

H₂ Matchmaker launched to facilitate partnering for Hydrogen Hubs

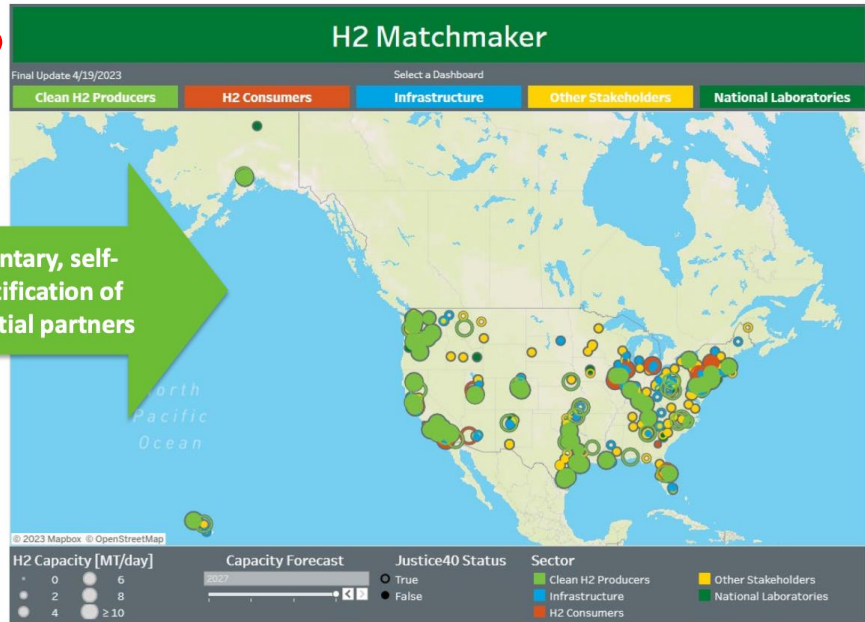
>50X more supply than demand*

Production: ~268,800 MT/day
Demand: ~5,870 MT/day

- 55% Transportation
- 25% Green ammonia
- 20% Industrial & heating

*self-identified values

Voluntary, self-identification of potential partners



Blending H₂ into NG network can provide a short-term sink for excess production of clean H₂ until demand for (pure) H₂ catches up.

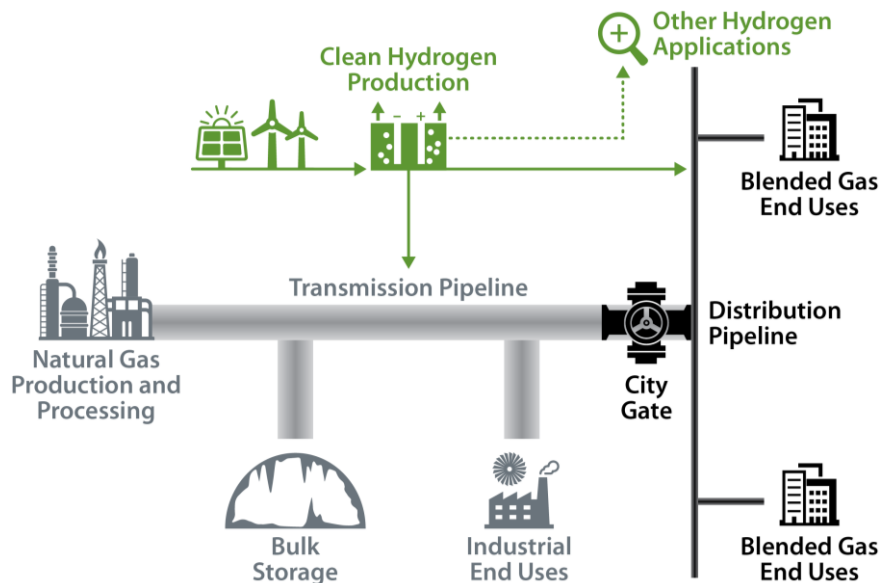
Stakeholder responses from: 105 producers, 43 consumers, 136 infrastructure providers/operators, 21 national lab campuses, 295 other

Final update: 4/19/2023. Application process for the Regional Clean Hydrogen Hubs is closed, and H2 Matchmaker is no longer collecting submissions through the self-identification form.





Reducing the Carbon Intensity of the Natural Gas Grid via Hydrogen Blends

Phase I: Two-year, \$15MM CRADA Project

- 4 National Labs + 31 partners from industry and academia
- Objectives
 - Pipeline materials compatibility R&D
 - Techno-economic and life-cycle analyses



Key Findings and Outputs

- Metals R&D (SNL) 
 - Providing scientific bases and probabilistic tools for structural integrity assessment of H₂ transmission pipelines (HELPR software released Fall 2023)
- Polymer R&D (PNNL) 
 - Blended gases affect the semicrystalline morphology of high-density polyethylene (HDPE), impacting toughness, pipe stability, and outcome depending on polymer chemistry
- Life-cycle Analysis (ANL) 
 - Maintaining energy delivery limits the H₂ blending ratio to ~30%, resulting in ~6% life cycle GHG emissions reduction
- Techno-economic Analysis (NREL) 
 - Open-source software providing case-by-case economic analysis of preparing transmission pipelines to blend H₂ (BlendPATH software released January 2024)

Phase I Summary @ October DOE H2IQ Hour

- Results from first CRADA presented at the webinar
- Recording and slides available (search “H2IQ”)

Visit the HyBlend™ Initiative webpage for details and links to tools and publications



Scope of Work for CRADA Phase II

6-months into a 3-year Phase II CRADA – Enrolling new members

Materials Compatibility –



Metals



- Probabilistic fracture mechanics
- Subscale pipe testing
- Fatigue and fracture testing in gaseous hydrogen

Life-Cycle Assessment



- Assessment of hydrogen and NG blend leakage through the supply chain
- Study of hydrogen global warming potential
- Quantification of embodied emissions for blended gas supply chain

Materials Compatibility –



Polymers

- Aging threats to polymer piping and fused joints
- Materials for mechanical fittings
- Gaskets and seals

Technoeconomic Analysis



- BlendPATH 2.0: Update assumptions and additional capabilities
- Integration of hydrogen blending into existing energy systems assessment

- **Safety, Codes and Standards**
 - Qualitative risk assessment of hydrogen gas distribution to residential sites†
 - Quantitative risk assessment of large-scale hydrogen usage in industrial processes†
 - Code and regulation guidance on polymer pipelines†
 - Gap analysis on regulations, codes and standards for distribution system components and Appliances†
- **Remediation of vintage lines**
 - Coatings
 - Pull-through composite liners
 - Repair technologies
- **Components, sub-assemblies and appliances**
 - Materials in wetted components (for valves, stems, springs, burners, compressors, turbines, seals, etc.)

† over targets in HyBlend Phase II proposal