Blending Hydrogen into Natural Gas pipelines

February 17, 2021
HyBlend

- The National Renewable Energy Laboratory (NREL) will lead a new collaborative research and development (R&D) project known as HyBlendTM to address the technical barriers to blending hydrogen in natural gas pipelines.
- The HyBlend team comprises six national laboratories—NREL, Sandia National Laboratories (SNL), Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), Argonne National Laboratory (ANL), and the National Energy Technology Laboratory (NETL)—and more than 20 participants from industry and academia.

Blending Hydrogen into Natural Gas pipelines

- Blending hydrogen into the existing natural gas infrastructure has national and regional benefits for energy storage, resiliency, and emissions reductions.
- Hydrogen produced from renewable, nuclear, or other resources can be injected into natural gas pipelines, and the blend can then be used by conventional end users of natural gas to generate power and heat.

Compatibility, life-cycle emissions, techno-economic analysis

The HyBlend project is organised into three research tasks, each led by national laboratories with existing research and capabilities in that area:

1. **Hydrogen compatibility of piping and pipelines**: SNL and PNNL will conduct evaluations to estimate the life of metal and polymer piping and pipeline materials (e.g.,

steel and polyethylene) when blends are used. This information will be incorporated into a publicly available model that can be used to estimate pipeline life given key engineering assumptions.

2. **Life-cycle analysis:** ANL will analyse the life-cycle emissions of technologies using hydrogen and natural gas blends, as well as alternative pathways such as synthetic natural gas.
3. **Techno-economic analysis:** NREL will quantify the costs and opportunities for hydrogen production and blending within the natural gas network, as well as alternative pathways such as synthetic natural gas.

Impact on the network not yet understood

- Several projects worldwide are demonstrating blends with hydrogen concentrations as high as 20%, but the long-term impact of hydrogen on materials and equipment is not well understood, which makes it challenging for utilities and industry to plan around blending at a large scale.

  Hydrogen Colour Chart

  Zero/Very Low Carbon

  - **Green hydrogen:** Made through electrolysis using renewable electricity. Electricity is used to split water into hydrogen and oxygen.
  - **Blue hydrogen:** Grey, brown or black hydrogen bit with the carbon dioxide deep underground through carbon capture and storage.
  - **Pink hydrogen:** Similar to green hydrogen but solely using energy from nuclear power.
  - **Yellow hydrogen:** Similar to green hydrogen but solely using energy from solar power.

  Medium To High Carbon Emissions

  - **Turquoise hydrogen:** Produced through pyrolysis. In pyrolysis instead of polluting CO2 gas a solid carbon by-product is produced. The feedstock is methane of even waste plastics. Pyrolysis works by heating products to an extremely high temperature in an inert atmosphere. The emissions relate to the fuel needed to heat the reaction.

High Carbon Emissions

- **Grey hydrogen:** Hydrogen made from natural gas in a process called steam reformation in which high temperature steam is used to split methane gas at high pressures.

Very High Carbon Emissions

- **Black hydrogen**: Made from Coal (in a process like grey hydrogen) with no carbon capture. Even more carbon intensive than grey hydrogen.

Brown hydrogen: Made from Lignite (in a process like grey hydrogen) with no carbon capture. Even more carbon intensive than black and grey hydrogen. Lignite is compressed peat and generates a lot of carbon dioxide when combusted.