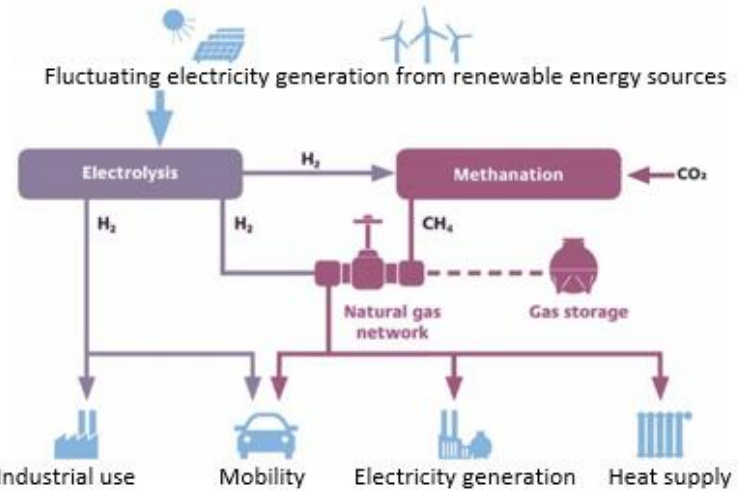
Power-to-Gas (P2G)

Power-to-Gas is an important feature of a low-carbon economy and can help improve the economics of zero-carbon fuels, enhance the resilience of the power grid, and increase the deployment of renewable energy technologies.

What is Power-to-Gas?

Power-to-Gas (P2G) is the process of converting surplus renewable energy into gaseous hydrogen that can be delivered through existing natural gas infrastructure. Hydrogen can be injected into gas pipelines in limited percentages, or it can be converted into methane as a renewable natural gas option.[1] P2G can reduce curtailment of excess renewable energy to maximize utilization of renewable resources. This hydrogen can be stored using existing natural gas infrastructure and used during times of peak energy demand.



Source: MDPI, "A Critical Study of Stationary Energy Storage Policies in Australia in an International Context: The Role of Hydrogen and Battery Technologies"

Natural Gas Compatibility

Hydrogen can be blended with natural gas up to 30% in pipeline equipment designed for natural gas.[2] Some utilities are already safely blending hydrogen into their natural gas pipelines to reduce their greenhouse gas emissions and are funding multiple research and development projects aimed at increasing blend percentages.[3] Hydrogen can also be further processed into methanized hydrogen, able to fully displace geologic natural gas making use of existing infrastructure and equipment. Methanized hydrogen is 100% compatible with natural gas pipelines and combustion processes.

$ By 2050, costs for high-temperature electrolysis could fall by 85%[4]

P2G, Carbon Capture, and CHP

Ultimately, burning synthetic methane produces CO_2 and waste heat; however, adding carbon capture, utilization, and sequestration (CCUS) technology would make P2G a carbon neutral process. The captured carbon could either be stored underground or utilized as a feedstock for numerous products. Combined heat and power (CHP) systems, which produce both electricity and thermal energy at high efficiencies, can be added to these facilities to allow them to capture and harness the waste heat that is produced by burning synthetic methane, increasing the system's efficiency.

[1] The Oxford Institute for Energy Studies, *Power to Gas: Linking Electricity and Gas in a Decarbonizing World*, 2018
[2] U.S. DOE, *HyBlend: Opportunities for Hydrogen Blending in Natural Gas Pipelines*, 2021
[3] Hawaii Gas, *Decarbonization and Energy Innovation*
[4] IRENA, *Green Hydrogen Cost Reduction*, 2020