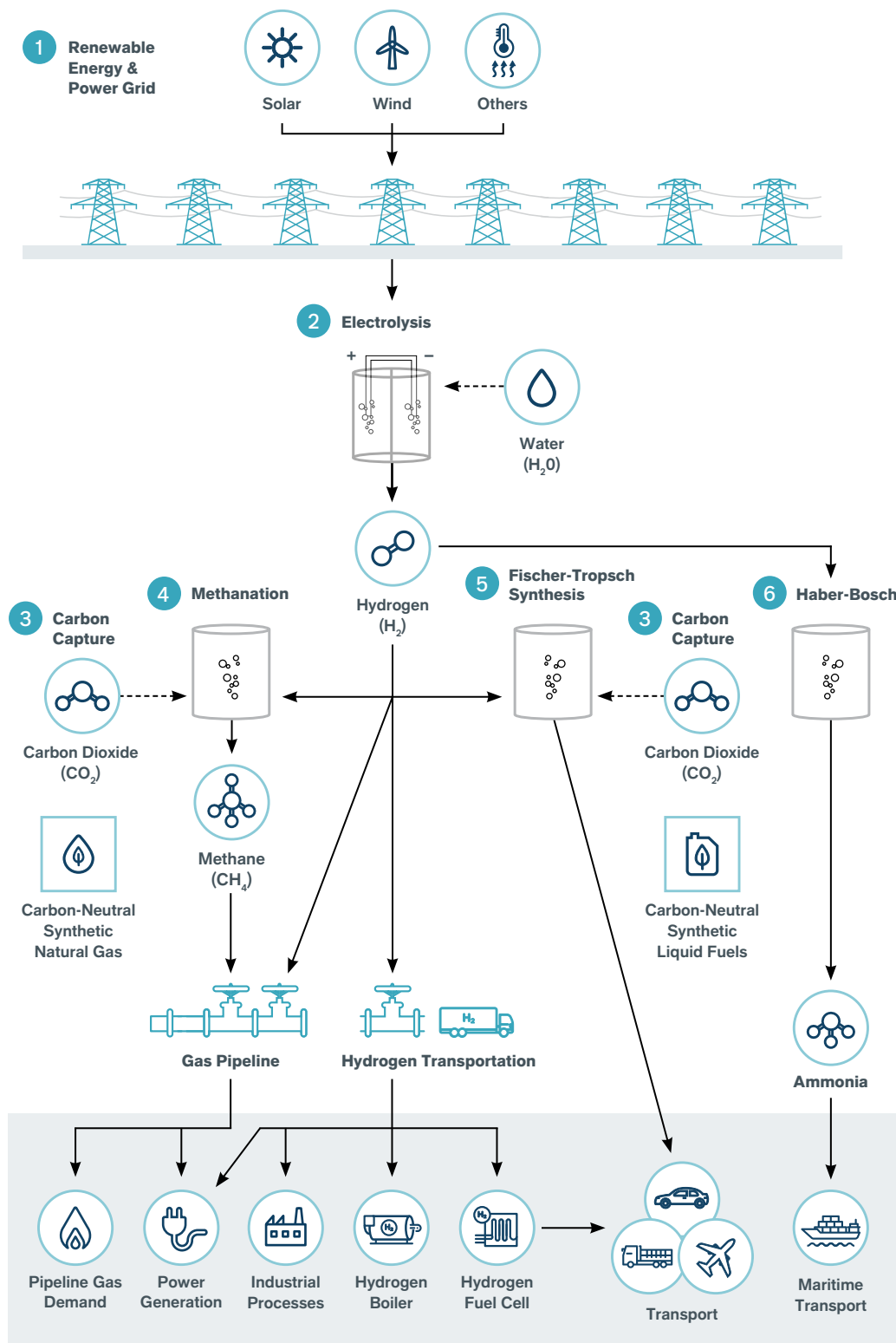


Illustration of Green Electrolytic Hydrogen Pathways

A major finding of *Net-Zero Northwest: Technical and Economic Pathways to 2050* is the crucial role that green electrolytic hydrogen will play in creating synthetic gas or synthetic liquid fuels, using a variety of different technologies and processes that enable clean electric power to be used to produce fuels. Incentives for hydrogen electrolyzers and carbon capture in the Inflation Reduction Act (IRA) make these technologies economic earlier than in previous studies prior to the passage of the IRA.



This infographic shows how clean electricity can power electrolysis to create hydrogen, which is then combined with carbon to produce synthetic gas or liquid fuels; used to produce ammonia; or used directly as a fuel or in fuel-cell vehicles.

Note that while similar drop-in clean fuels can be produced with biomass, this figure focuses on hydrogen and hydrogen-derived fuels, which were the dominant sources of clean fuels in the *Net-Zero Northwest* analysis.

1 Renewable Energy & Power Grid: Clean electricity powered by sources such as solar, wind, and hydroelectricity supplies the power grid. Nuclear energy could also power high-temperature electrolysis.

2 Electrolysis: The process of using electricity, in this case carbon-free, to split water into hydrogen and oxygen.

3 Carbon Capture: Carbon dioxide is captured either through direct air capture powered by carbon-free electricity or from biorefineries, which convert biomass to biogas while capturing the carbon.

4 Methanation: Combines hydrogen with carbon dioxide to produce methane that can be injected into the gas pipeline as carbon-neutral synthetic gas.

5 Fischer-Tropsch Synthesis: Chemical reactions that change a mixture of carbon dioxide gas and hydrogen gas into liquid hydrocarbons, such as gasoline or kerosene, that can be used for transportation.

6 Haber-Bosch: The primary method of producing ammonia from nitrogen and hydrogen. Today, ammonia is mainly used to make fertilizer, cleaning products, and plastics, but is also seen as a promising clean fuel for maritime transport.