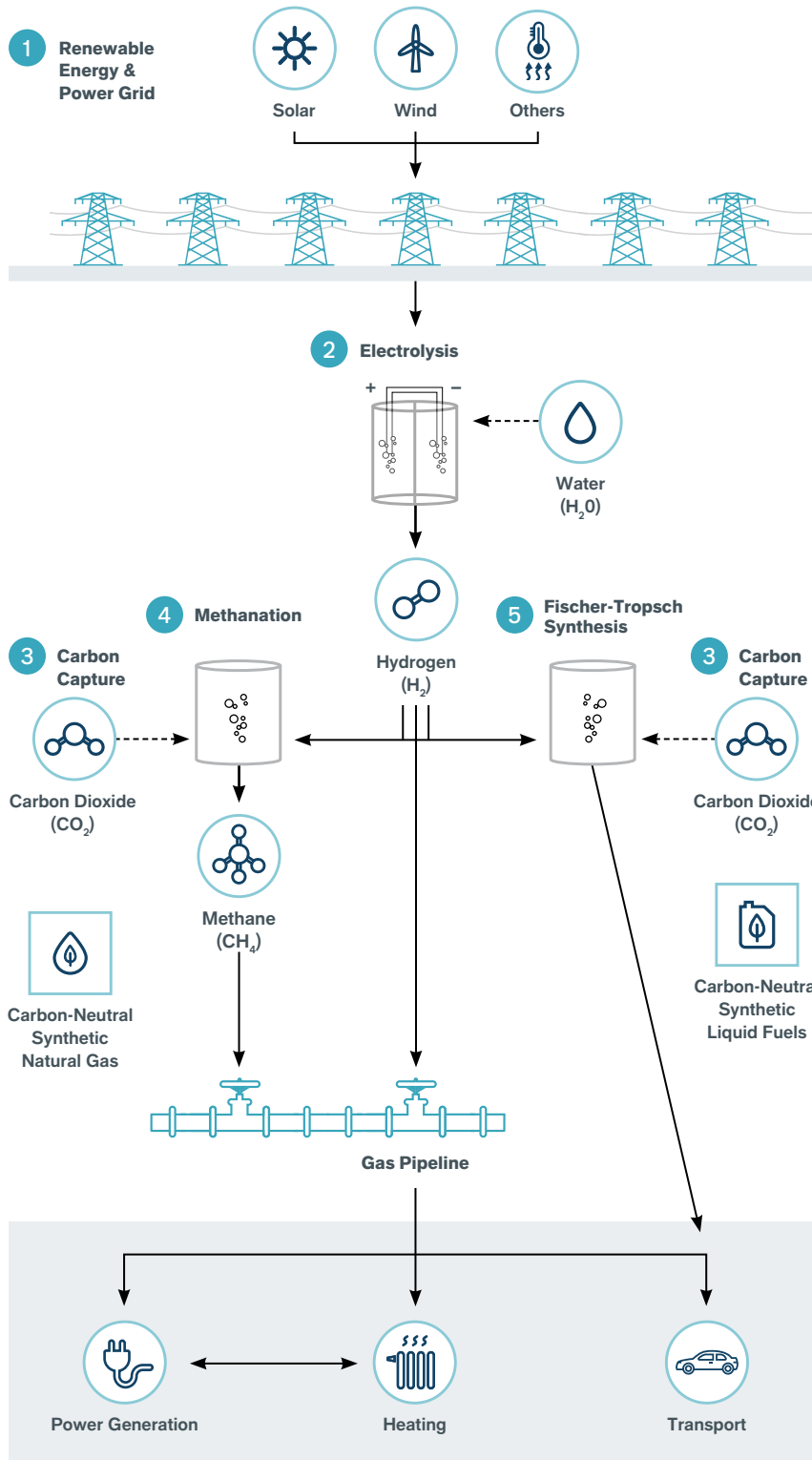


Illustration of power-to-gas and power-to-liquids (P2X).

A major finding of *Meeting the Challenge of Our Time: Pathways to a Clean Energy Future for the Northwest* is the crucial role that power-to-X will play in 2040–50 to create synthetic gas or synthetic liquid fuels. Power-to-X is a term that describes a variety of different technologies and processes that enable surplus electric power to be stored or used to produce fuels.



In the study, power-to-X refers to electrolysis that converts surplus electricity into hydrogen, which then is combined with carbon dioxide, captured either through direct air capture powered by carbon-free electricity, or from biorefineries to produce methane gas (power-to-gas). The Fischer-Tropsch synthesis process can also be used to create synthetic liquid fuels to replace conventional oil based transport fuels (power-to-liquids).

1 Renewable Energy & Power Grid:

Clean electricity powered by sources such as solar, wind, and hydroelectricity supplies the power grid.

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.

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.