

5. Boiler/heat exchanger.

6. Gas turbine

Reasons supporting the use of combined cycles for electricity generation include:

- **Improved Fuel Efficiency and Reduced Consumption:** Through the combining of two or more thermodynamic cycles, these results in improved overall efficiency in fuel use.
- **Lowered Capital Costs:** The fuel cost is also reduced as remaining heat from combustion that is normally wasted is utilized in the generation of energy.
- **Reduced Emissions:** Reduction in carbon footprint for some systems.
- **Commercial Availability:** Combined cycle units are commercially available from suppliers anywhere in the world.
- **Abundant Fuel Source:** The turbines used in combined cycle plants are commonly fuelled with natural gas, which can be found in abundant reserves on most continents.
- **Reduced Distance for Electricity Transmission:** Combined cycle plants can be installed near industry or other demand centres, thereby reducing the need for transmission of electricity over long distances.
- **Decentralized and Flexible Electricity Supply:** The average size of plants is declining shifting towards a more decentralized, flexible generation.

Can you think of any disadvantages of using combined cycles?

Examples of combined cycles.

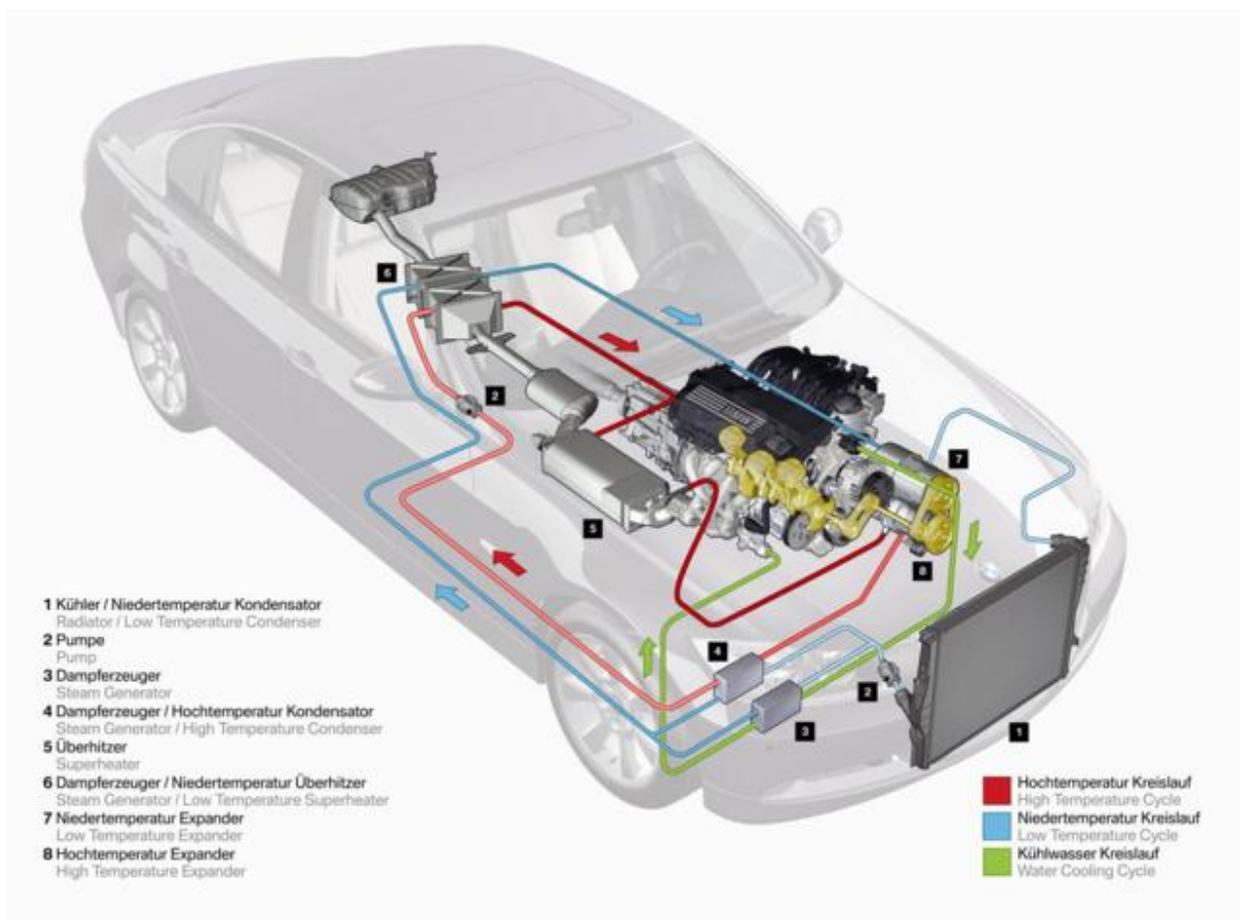
In stationary power plants, a successful, common combination is the **Brayton cycle** (in the form of a turbine burning natural gas or synthesis gas from coal) and the **Rankine cycle** (in the form of a steam power plant).

In a **combined cycle power plant (CCPP)**, or **combined cycle gas turbine (CCGT) plant**, a gas turbine generator generates electricity and heat in the exhaust is used to make steam, which in turn drives a steam turbine to generate additional electricity. This last step enhances the efficiency of electricity generation. Many new gas power plants in North America and Europe are of this type.

The turbines used in Combined Cycle Plants are commonly fuelled with natural gas.

DID YOU KNOW

- BMW has proposed that automobiles use exhaust heat to drive steam turbines. This can even be connected to the car or truck's cooling system to save space and weight, but also to provide a condenser in the same location as the radiator and preheating of the water using heat from the engine block.



New **BMW 5 Series** Touring offers two models of the *520d* and *523i*, BMW 520d is a fuel efficient car. an engine 135kW **four-cylinder turbodiesel**, 520d is capable of consuming as little as 5.3 l/100km on the combined cycle, emits 139g/km of carbon dioxide in the process.

