

Gasification Technology



Gasification – taking the pollution out first

Gasification is a process that converts carbon-based materials, such as coal, petroleum, or biomass, into carbon monoxide and hydrogen by partial oxidation of the material at high temperature and pressure. The resulting gas mixture is called synthesis gas, or syngas, and is itself a fuel. Hydrogen Energy California's (HECA) syngas will be cleaned and mixed with steam to produce carbon dioxide (CO₂) and clean hydrogen fuel.

Gasification has been reliably used on a commercial scale worldwide for many decades in the refining, fertilizer, chemical and electric power industries. HECA will utilize gasification to produce hydrogen-rich fuel from coal and petroleum coke – a common, plentiful refinery by-product.

Feedstock fuels and their components

Petroleum coke and coal consist primarily of carbon, hydrogen, oxygen, nitrogen and ash (silica, alumina and iron clay oxide), but also may contain minor amounts of sulfur, mercury and other trace elements. At HECA, these components of the feedstock fuels will be separated through gasification. Elements other than clean burning hydrogen-rich fuel will be captured and prevented from polluting the environment. For example, the sulfur, which otherwise would end up in the air as harmful sulfur dioxide, will be captured in its elemental form – a benign yellow powder with many industrial uses.

HECA will not only extract hydrogen gas for use as a clean burning fuel, but also capture the carbon dioxide. The CO₂ will be captured and transported to the nearby Elk Hills Oil Field to be used in enhanced oil recovery (EOR). EOR is a process that injects CO₂ into secure, underground geologic formations that contain oil that is unrecoverable through conventional methods. During this process, the hard to get oil is extracted while the CO₂ remains behind, permanently stored deep underground.

Inside the HECA gasifier

The coal and petroleum coke are ground to fine powder and injected with oxygen into the gasifier. The heat and pressure within the gasifier then break apart the chemical bonds of the feedstock, forming a syngas. The syngas is then piped into a scrubber, which will wash out any solid, particulate impurities that may have traveled with it. The remainder of the feedstock's mass – mainly molten ash – will be left at the bottom of the gasifier's chamber as gasifier solids, glass-like material that can be reused for useful purposes such as the production of cement, roofing granules or sandblast grit.

The syngas consists of a combination of hydrogen, hydrogen sulfide, carbon monoxide and carbon dioxide gases which then go into a "shift reactor," which will use water to convert the carbon monoxide into CO₂. The syngas is then cleaned in a "sulfur recovery unit," where hydrogen sulfide is converted into elemental sulfur – a yellow powder commonly used in fertilizers and other products. The resulting syngas is comprised of hydrogen, which will be used to generate clean power and nitrogen-based products. Remaining CO₂ will be captured and stored deep underground.

Because petroleum coke and coal may sometimes contain trace amounts of mercury, special mercury recovery systems will be built into the HECA project's gasification process. Once the "syngas" mixture has passed through the gasifier and scrubber, it passes through a carbon bed that captures the mercury from the syngas. So, while there can be some mercury in feedstock fuels, the amounts are very small, and will be captured and removed.

A Competitive Overall Emissions Profile

The Hydrogen Energy California project gasification technology described above is referred to as an Integrated Gasification Combined Cycle (IGCC) system. In this process, the hydrogen-rich gas produced through gasification is fed directly into the plant's combined cycle power plant in a process very similar to natural gas power plants. However, while standard power plants use natural gas to power their turbines, HECA will use clean hydrogen fuel, which produces fewer emissions overall.

The Hydrogen Energy California project will use universally accepted methods and technologies — gasification and combined cycle turbine generators — to create clean hydrogen power from coal and petroleum coke. The result will be a new standard for low-carbon energy.

For more information please visit our website at www.heca.com

