

Coal Gasification

Cleanly converting coal, petroleum coke and biomass into high-value products and power



Air Products Syngas Solutions
(formerly Shell Coal Gasification Process, SCGP)



Air Products Gasification Process (GP) at a glance

Customer driver

Access to coal, petcoke or biomass; lack of access to oil and gas along with high or volatile prices; sustainable operations (emissions)

Solution

The Air Products Gasification Process, which can convert a wide range of coals, including petcoke and biomass, into syngas

Value delivered

High-value products or power with low emissions

Proof point

Dozens of gasifiers in operation and several more due to start up in the near future

What differentiates us?

- Air Products Syngas Solutions offers complete turnkey gasification complexes under a “Sale of Gas” model where Air Products finances, builds, owns and operates the syngas production facility.
- Our coal gasification experience dates back to the early 1970s; more than 30 SCGP (now Air Products GP) gasification reactors have been developed or are in the planning stage.
- We continuously improve our technologies through research and development and by incorporating lessons learned into our master designs.
- Air Products GP units successfully process a wide range of solid fuels including various types of coal (from lignite to anthracite), petroleum coke (petcoke) and biomass blends.
- Our designs offer performance advantages by helping to minimize oxygen and fresh water consumption and enhance syngas yield.
- Because Air Products is both a gasification technology owner and an operator, we have extensive experience in gasifier start-up, operation and maintenance.

The world's growing appetite for energy and chemicals is increasing the demand for clean coal, particularly in countries with indigenous reserves or access to low-cost imports. However, depletion of the highest quality deposits and increasingly restrictive emission regulations require operators to use lower quality coal in environmentally acceptable ways.

We offer the **Air Products Gasification Process (GP)** in two product configurations (shown below) that can convert a wide range of feeds to synthesis gas (syngas) for:

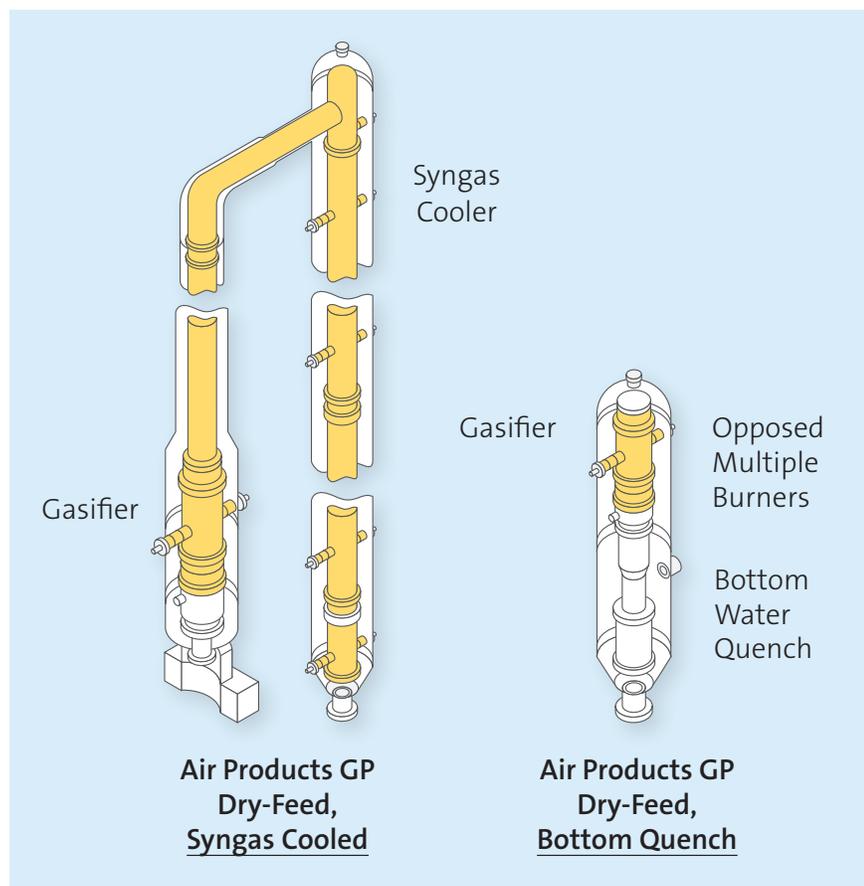
- Integrated gasification combined cycle (IGCC) power generation with optional carbon dioxide capture
- High-value chemical production
- Synthetic hydrocarbon (fuels) production
- Hydrogen production

Air Products Syngas Solutions provides operational support and business and project-execution services from design and engineering through to commissioning and start-up. We can also help with master planning and training.

Process description

Both versions of our proven coal gasification technology use an inert carrier gas to transport dry, pulverized coal into the gasifier, where it contacts oxygen and steam. The gasifiers consist of a membrane wall of high-pressure water/steam tubes and multiple burners designed to separate the syngas from the slag. The slag flows down into a water bath, from where it can be extracted as a solid. Multiple burners provide the potential for easy scale-up.

In the **Air Products Gasification-Dry Syngas Cooler (Air Products-GP-DSC)**, recycled syngas is used to quench the syngas exiting the reactor, which is then cooled further in an external cooler to generate high- and medium-pressure steam as valuable by-products. In the **Air Products Gasification-Dry Bottom Quench (Air Products-GP-DBQ)** process, the syngas is cooled directly in a proven water-quench system.





Performance advantages

Both options offer:

- Low coal and oxygen consumption, 510–615 kg coal and 310–350 Nm³ oxygen per 1,000 Nm³ of effective syngas respectively.
- High throughput and availability and low maintenance costs by using proven reactor membrane wall and burner technology.

The Air Products Gasification Process syngas cooler line-up:

Has a higher thermal efficiency; produces less waste water; and generates high- and medium-pressure steam, which can help to reduce operating expenditure.

Our bottom water-quench line-up:

Requires up to 30% less capital expenditure and offers more stable operation through its simplified configuration—and widens coal suitability by eliminating the fouling risk in the syngas cooler.

Value

Our coal gasification technology can be tailored to meet different needs, including:

- Providing an alternative feedstock for chemical manufacture
- Producing synthetic liquid fuels and lubricants
- Generating power with lower emissions than from burning coal or even natural gas, with the option of high-pressure carbon capture and storage.

The multiple-burner design can be easily scaled up, and its high reliability eliminates the need for a spare gasifier. This enables construction of fewer, larger units, which helps reduce capital and operational costs by requiring fewer operators, less maintenance, and a smaller spare parts inventory. Units with a dry coal intake capacity of 3,200 t/d have already been designed.

More than 100 types of coal have been processed. Using a blend of coal and petcoke greatly increases gasifier reliability and can significantly improve operational stability, efficiency and syngas output, particularly for operators using high-ash coal.

Case Studies

Converting coal to chemicals

Air Products GP syngas cooler technology has been successfully supplying syngas and steam to a Baling fertilizer plant since 2006. The facility processes 2,000 tons of dry pulverised coal per day and produces syngas for urea/fertilizer and caprolactam (nylon) manufacture. In 2012, the first of two plants in Vietnam began commercial operation.

Generating IGCC power

The 2,000-tons/day Willem-Alexander power plant in the Netherlands (formerly owned by Nuon) operated from 1993 to 2013. It demonstrated feedstock flexibility by processing more than 20 different coal types and blends running successfully with up to 30 wt % biomass. Emissions were proven to be less than 30 ppm NO_x and 15 ppm SO_x.

South Korea's first IGCC plant is being built. This facility will use a syngas cooler and Sulfinol*-M gas-treating technologies to produce 300 MW (net) of electric power from 2,670 t/d of bituminous and sub-bituminous coal.

*Sulfinol is a Shell trademark.

Have you considered how you can . . .

- Produce chemicals and hydrocarbon liquids without relying on oil and gas imports?
- Generate power with lower emission levels?
- Adapt to lower-quality coal?
- Reduce risk, save capital by allowing Air Products to finance/run the gasification complex?

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Air Products Syngas Solutions is part of Air Products and Chemicals, Inc.

The Air Products GP technology was acquired from Shell Global Solutions International B.V. by Air Products and Chemicals, Inc. in 2018.

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