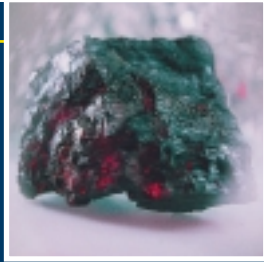


*unlocking the potential
wealth of coal*

introducing Sasol's unique coal-to-liquids technology



a strategic opportunity for coal-rich countries



Coal – a hydrocarbon-rich resource still found in abundant quantities in many parts of the world – provides a key for unlocking many of our future global requirements for high-quality energy and chemical building blocks.



On the basis of current reserve estimates and consumption rates, the world has enough fossil fuels to meet human needs for about 300 years. While crude oil and natural gas reserves are expected to last for about 40 years and 60 years, respectively, coal reserves could be usable for another 200 to 225 years based on current consumption rates. Coal, by far, is the world's most abundant recoverable hydrocarbon resource.

The world's proven coal reserves are estimated to be 985-billion tons, with the largest known reserves being in the United States, Russia, China, India, Australia, Germany and South Africa.

During the twentieth century, research on the extraction of energy from coal was focused on two primary approaches:

- *direct liquefaction by converting coal into liquids with the help of hydrogen and heavy oils; and*
- *indirect liquefaction by first gasifying coal and then converting the resulting gas into liquids through the process of Fischer-Tropsch synthesis.*

The global energy crises of the 1970s, and the associated concerns about the future supplies of affordable crude oil, restimulated international interest in the viability of converting coal into liquid fuels. Between the mid-1970s and the mid-1980s, Sasol developed its second and third coal-based synthetic fuels (synfuels) plants at Secunda in South Africa: Sasol Two and Sasol Three. Today, these plants are operated as an integrated operation by Sasol Synfuels.

In the 1980s, however, much of the international interest in coal gasification waned due to the relative glut of cheap oil.

Since the late-1990s, however, coal gasification and Fischer-Tropsch synthesis have again aroused significant interest because several coal-rich countries have intensified their strategic focus on improving their energy security and achieving energy self-sufficiency. In a few instances, some countries are having to confront the reality of declining domestic crude oil production in the face of increasing domestic consumption. This increases the affected countries' dependency on energy imports and therefore their concerns about their future energy security.

Coal-to-liquids (CTL) conversion may help to provide greater energy self-sufficiency and energy security for countries with sufficient coal reserves and the ability and will to provide the required enabling environment. The viability of CTL technology is more compelling at a time when crude oil prices are trading at high levels and some of the world's oil-rich regions are undergoing political instability and uncertainty. However, this process is still fundamentally capital intensive in comparison to alternatives such as crude oil refining hence the need for the involvement and support of host governments.

Environmental concerns have also helped to bring coal gasification to the forefront of strategically minded energy thinking with the development in more recent years of more environmentally benign coal based technologies. The development of clean coal technologies, such as the integrated gasification combined cycle (IGCC) technology, combined with the potential for the commercial storage of concentrated carbon dioxide (CO₂), for power generation has led to the availability of processes that are considered to be more environmentally desirable than traditional coal-fired power plants.

These clean -coal technologies allow coal-rich countries to benefit from their extensive coal reserves, working with the growing global shift towards more environmentally acceptable technologies and processes.

the south african experience



the world pioneer in commercial CTL technology

The world's only commercial user of CTL technology is Sasol, the international, South African-based company that has been producing synfuels and chemical feedstock from coal for over 50 years.



Sasol's history began in 1927 when a Government White paper was tabled in Parliament for a formal investigation into the merits of establishing an oil-from-coal industry in South Africa. At the time, the Government expressed concerns about South Africa's dependence on imported crude oil while having no known oil reserves of its own. The two biggest concerns were the need to protect the country's balance of payment and to strengthen security of energy supply.

In 1945, a South African industrial company, Anglovaal, asked the South African Government to create a fiscal dispensation to enable oil-from-coal to compete with conventional crude oil refining. After extensive research and negotiations, Anglovaal secured the licence needed to build and operate a Fischer-Tropsch oil-from-coal plant in South Africa. This company, however, was unable to secure a loan from the World Bank and abandoned its plans to develop a commercial oil-from-coal venture in South Africa.

The South African Government, however, continued its investigations into the feasibility of developing an oil-from-coal venture and formed a state-owned enterprise in 1950, the South African Coal, Oil and Gas Corporation (later to be renamed Sasol). Extensive government support at the time – and, again during the 1970s and 1980s – was essential for the establishment of what is still the only commercial coal based synfuels industry in the world.

To ensure a reasonable rate of return for South Africa's emerging synfuels industry particularly during down turns in the crude oil commodity cycles, the Government provided tariff protection and imposed a fuel levy.

To the South African Government's benefit, the establishment of Sasol and the country's synfuels industry increased energy self-sufficiency, provided employment opportunities, reduced crude oil imports and saved foreign exchange. In short, coal-based synfuels enabled the country to fulfil 30% of its fuel requirements.

Sasol has for many years been renowned for pioneering world-leading technologies to produce quality synfuels and petrochemicals from coal.

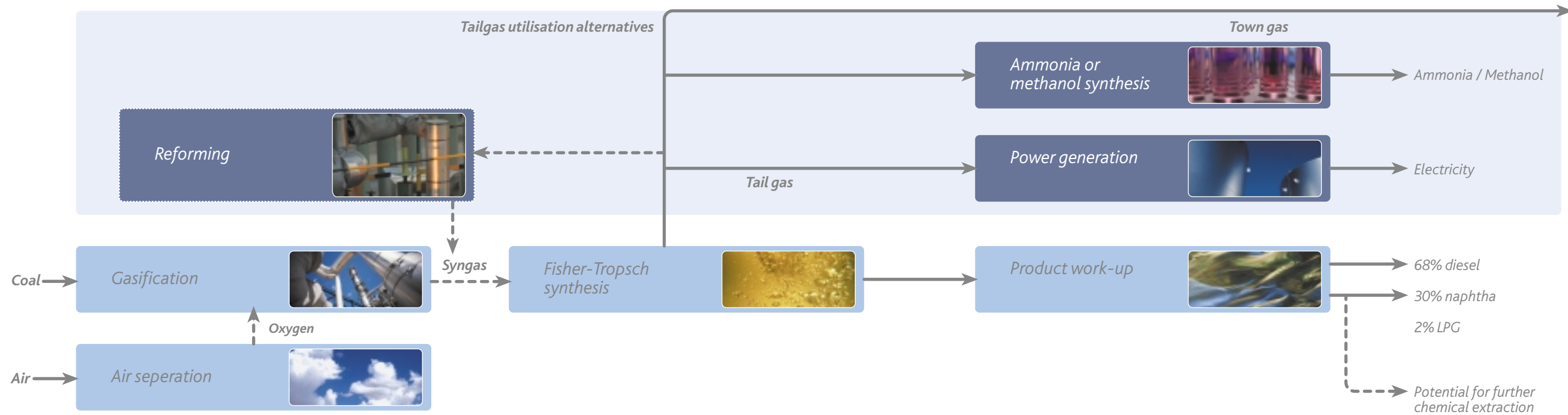
Through Sasol Synfuels International (SSI), Sasol is well positioned to develop and manage international synfuel ventures that incorporate the group's competitive Fischer-Tropsch technology.

SSI continues to advance the development of Sasol's first international gas-to-liquids (GTL) plant for converting natural gas into an ultra-low-sulphur GTL diesel. The US\$950 million project to develop the Oryx GTL plant at Ras Laffan in Qatar is due to be brought on stream during the first quarter of 2006.

Working in partnership with Sasol Technology, SSI also continues to explore new opportunities to commercialise Sasol's Fischer-Tropsch synthesis technology for beneficiating coal and other hydrocarbon resources, including biomass. To this end, for example, SSI is undertaking a pre-feasibility study for the potential development of CTL facilities in the People's Republic of China.

the sasol CTL process

Coal to liquids flow scheme



At its giant synfuels complex at Secunda in South Africa, Sasol converts more than 40-million metric tons of coal a year into liquid fuels, industrial pipeline gas and a range of chemical feedstock, including the building blocks for industrial solvents and polymers. The Secunda site comprises two giant factories with a combined capacity equivalent to about 150,000 barrels a day.

Sasol offers two technologies based on Fischer Tropsch, i.e. the High Temperature Fischer Tropsch (HTFT) process that is applied in Secunda, (a process that produces mainly chemicals and gasoline) and the Low Temperature Fischer Tropsch (LTFT) process that is applied in Sasolburg and is the technology of choice for the GTL global initiative.

Sasol's LTFT process is ideal for producing diesel from coal (through CTL conversion) and is the best option for a plant with a simple footprint. Sasol's HTFT process, however, can be used to produce a slate of white products, as well as the building blocks for high-value chemicals.

The LTFT CTL three step process integrates several proven processes starting with coal gasification and is followed by low-temperature Fischer-Tropsch synthesis – the heart of the process – and then downstream product upgrading.

In using coal as the feedstock, it is important to remember that coal properties can vary extensively between geographic sites and even within the same coal-rich region. It therefore follows that the properties of the targeted coal have a major impact on the choice of a suitable gasification technology.

1 Gasification

Coal is fed into giant gasifiers to produce raw gas, which is then purified into the synthesis gas needed for Fischer-Tropsch synthesis.

2 Fischer-Tropsch synthesis

Through the Fischer-Tropsch conversion process undertaken in unique low-temperature Fischer-Tropsch (LTFT) Slurry Phase reactors developed by Sasol, synthesis gas is converted into heavy hydrocarbons in the presence of a catalyst.

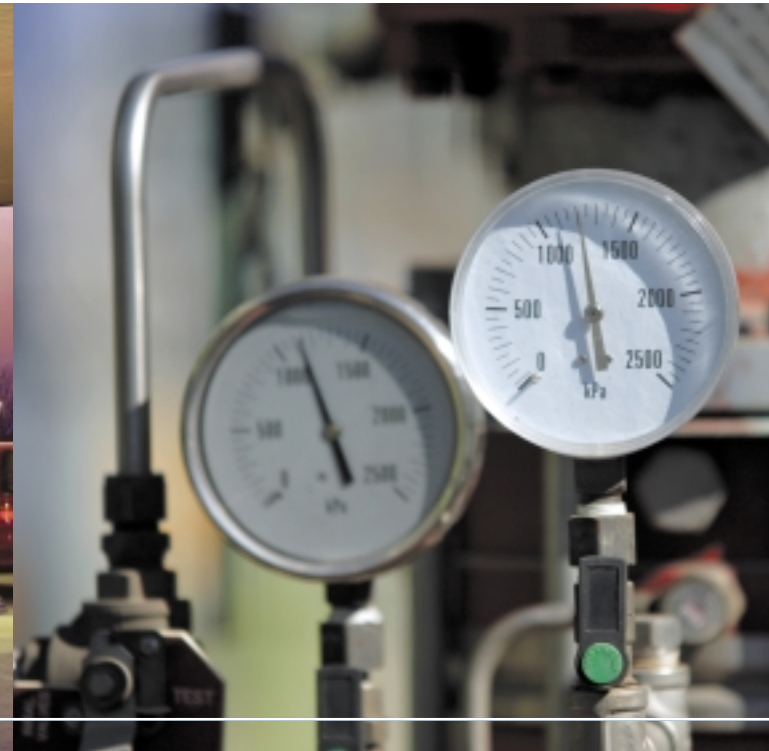
3 Product upgrading

The products created through Fischer-Tropsch synthesis can be upgraded using conventional, product-specific petrochemical upgrading processes, depending on the final slate of products required by the CTL plant operators. These processes include hydrocracking and chemical workup, as well as refining through a conventional petroleum refinery.

sasol CTL products



sasol's unique selling proposition



Sasol's low-temperature Fischer-Tropsch process produces a superior-quality diesel that has virtually no sulphur. This diesel also has a very low aromatic content and a high cetane number, and the naphtha is suitable as a feedstock for a naphtha cracker.

Taking into account the following criteria for a Fischer-Tropsch based CTL venture, Sasol can offer a unique selling proposition:

- access to large reserves of low cost gasifiable coal (approximately 2 – 4 billion tons) at the proposed location for the CTL facility;
- a CTL plant should preferably be based on 'stranded coal' (e.g. due to quality or location) which cannot easily be monetised in other ways;
- the country should be a net importer of energy (crude oil and/or refined products);
- energy self-sufficiency should be of strategic importance to the central government of the country and there should be a willingness/ability to make the necessary incentives available; and
- the site for the CTL facility should preferably have appropriate infrastructure to support such a venture (access to water, roads, railway, etc.).

sasol is an ideal CTL partner

A resourceful company with the proven technology and human capital to help unlock feedstock opportunities that can contribute toward ensuring greater security of clean-fuel supply.



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Sasol offers

- *more than 50 years of commercial experience in the field of indirect coal liquefaction;*
- *the expertise needed to enable a "running plant" project approach;*
- *a proven track record to integrate the technologies associated with these large CTL complexes successfully*
- *extensive experience in marketing Fischer-Tropsch fuels and chemicals; and*
- *the fastest way of developing a viable commercial CTL project.*