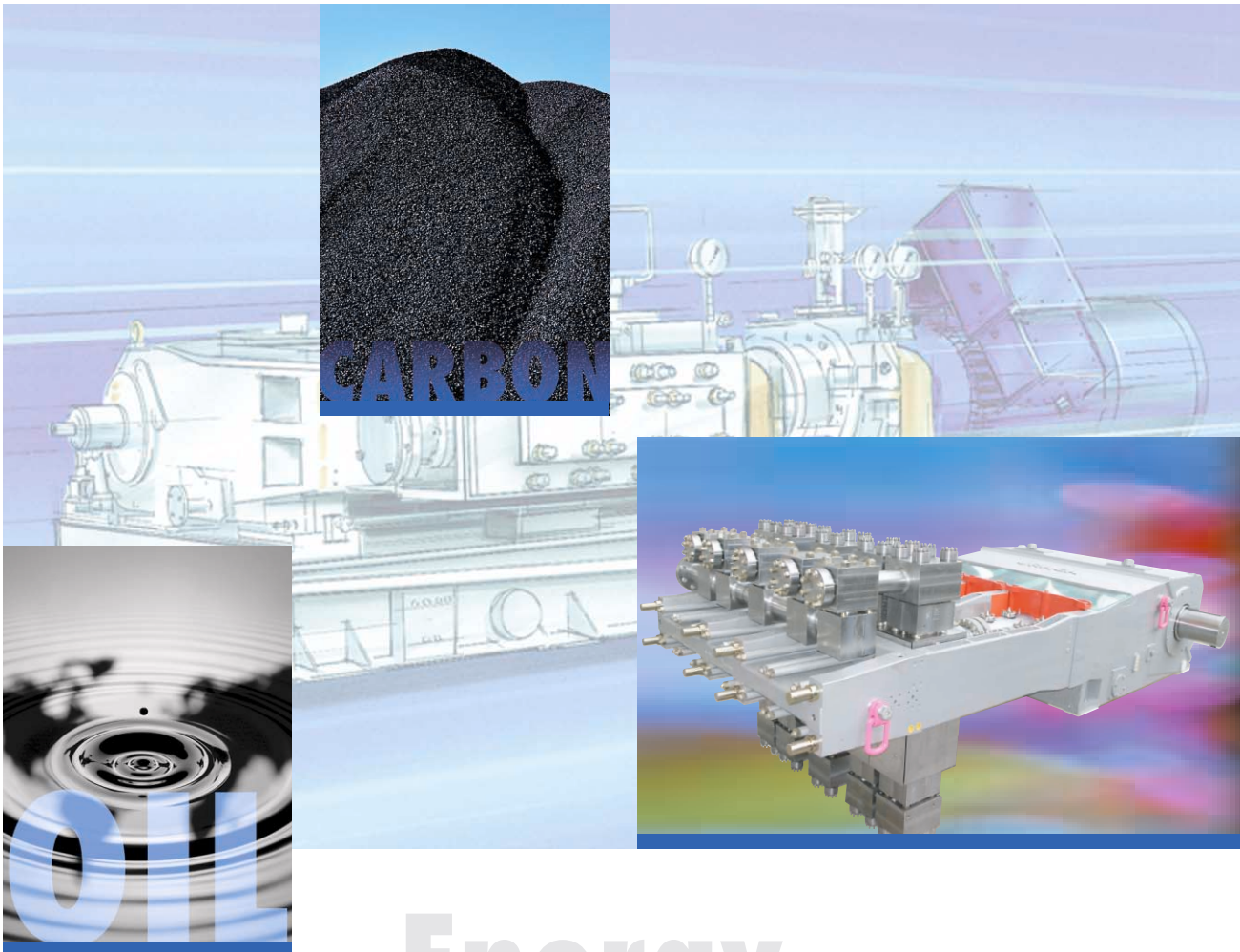


# Coal Liquefaction



## Energy

Maximum temperature version  
High pressure plunger pumps

Bergius-process

Coal  
Profitability  
Oil prices  
Liquefaction

410°C

Coal liquefaction

Naphta  
Petrol

Diesel  
Kerosene

Oil

# Coal liquefaction – a process for the future

## Global energy situation

The currently high and the likelihood of ever-rising oil prices make the process of coal liquefaction a very interesting new technology. China and South Africa are leading the way, but for many other countries with large coal reserves, coal liquefaction is becoming increasingly economical. Given the current oil prices, even the leading industrial nations are starting to find the process economically appealing. We can therefore presume a global growth in demand for the liquefaction of coal.

Besides economic factors it is above all the incentive of being independent of oil imports that plays a major role in energy policy.

## Coal

Coal is a fossil fuel that in the course of millions of years has evolved from dead plants, cut off from air and under the pressure of layers of rock lying on top. Engineers have been changing coal into oil for a long time now without any problems.

In order to generate liquid products from coal ranging from petrol to heavy oil there are two alternative processes:

## Indirect liquefaction

By means of the so called Fischer-Tropsch synthesis, gas is produced with steam from red hot coal, which reacts with catalysts to hydrocarbons. The process is currently only being used in South Africa where 9 m tons of oil products (petrol, chemicals) are produced annually for approx. 25 US-\$/barrel.

## Direct liquefaction

In 1913 Friedrich Bergius invented the process of direct coal high-pressure hydrogenation, for which he was later awarded the Nobel prize. It was widely used as the Pott-Broche or IG-Farben process.

In the Bergius process finely ground coal is suspended in heavy oil. At a pressure of 200 – 300 bar, oxygen is allowed to react at 500°C. The whole process and the desired end product can be controlled by various parameters:

- Sojourn time in the reactor
- Temperature
- Catalyst addition

The first industrial plant worldwide for direct coal hydrogenation is currently under construction in Mongolia. At the first development stage it will produce 0.9 m tons of petrol, kerosene, diesel and other fuels from 2.1 m tons of coal annually. Within four years these figures will be multiplied by five.

Decisive technological components of this plan are the high-pressure plunger pumps from URACA.



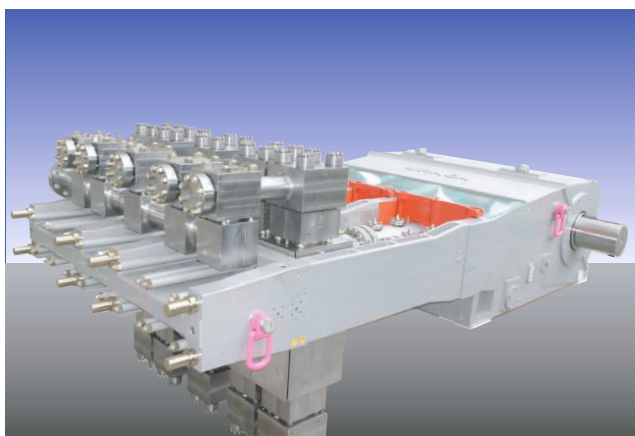
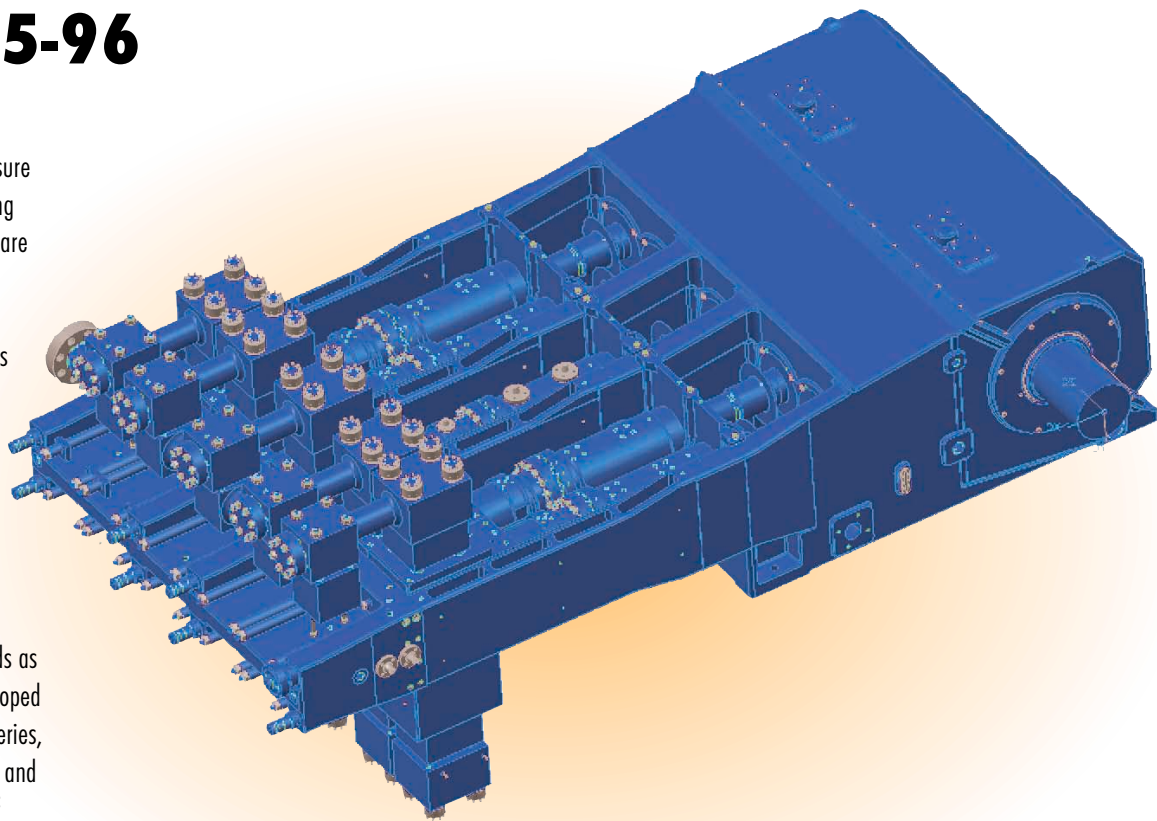
# CARBON OIL

# The Solution – URACA P 5-96

The demands on the high-pressure plunger pump units for handling coal slurry in coal liquefaction are enormous:

- Extremely high temperatures
- High pressures
- Tough, abrasive coal slurry
- Hard continuous operation
- High availability
- High operating safety
- Low operating costs

In order to meet these demands as best possible, URACA has developed a special pump in the P 5-96 series, including periphery equipment and back up units. Characteristic of this high-pressure plunger pump are its special details:



## Design

- Maximum alignment accuracy while operating due to precisely synchronized design to ensure smooth thermal expansions.
- Crankshaft with six-fold slide bearings for maximum stress.
- The patented separation chamber ensures that the high-pressure seal does not touch the abrasive solids.
- The forcibly coupled injection pump which flushes the packing area during every suction stroke.
- High safety to prevent sedimentation by optimized ball valves.

## Easy maintenance

- Long maintenance intervals.
- Easy access to all relevant components.

## Liquid handled

Medium	coal slurry
Carrier oil / coal	50 % / 50 %
Temperature	290°C

## Technical data

Numb. of plungers	5
Pressure	210 bar
Speed	30 - 80 min <sup>-1</sup>
Power requirement	750 kW
Capacity	95 m <sup>3</sup> / h
Weight pump	38 t
Weight unit	75 t

## Low wear and tear

- Low speeds due to particularly large structural shape.
- High service life due to planned realization of low flow speeds in discharge area.

# Reference Project in China

China is currently one of the greatest oil producers in the world, yet due to its high economic growth it is increasingly dependent on oil imports. On the other hand, China has coal reserves of over 1,000 billion tons at its disposal. In order to meet the growing need for oil and to ensure the country's independence, coal liquefaction offers a lucrative alternative.

Moves in this direction are also necessary for China because the growing motorization of the country alone will increase the daily oil needs of the country for traffic from currently one to almost five million barrels in the year 2020 - the present needs



of all the automobiles in western Europe.

Shenhua, one of the greatest Chinese corporations and based in Beijing, is currently constructing a production plant for coal liquefaction which will start operations in 2007. This plant will be the first industrial plant for direct coal hydrogenation worldwide.

The coal needed for the process is being mined in the vicinity of the plant.

The goal is to produce 5 m tons of petrol, kerosene, diesel and other fuels from 9.7 m tons of coal annually. Due to the favourable basic conditions the plant will operate at a profit even at a crude oil price of 20 US-\$ / barrel. The Department of Energy of the State Commission for Development considers this project, which will cost 24.5 billion Yuan (approx. 2.45 billion Euro), to be very important in the role it will play in optimizing the energy structure of China. Further projects of this kind are planned in China.

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 ■ VGB KTA 1401  
 ■ Gost



## 30 years of experience

30 years ago URACA developed and supplied the pumps for extracting oil from coal to a pilot plant in Bottrop.

At that time a time-consuming and costly process, this technology

has now become an economical way of extracting oil in times of scarce raw materials and steeply rising oil and gas prices.

Today URACA's customers are profiting from these many years of experience.

URACA is building for this plant six high-pressure reciprocating pump units. The units, each of which will weigh 75 tons, will be for supplying the reactors with coal slurry. URACA is providing all the engineering know-how for the high-pressure pumps as well as its great experience from other coal-slurry projects.