FOSTER WHEELER

SYDEC℠ delayed coking

Maximize profit from the bottom-of-the-barrel

Delayed coking

- the key benefits

In today's environment, refiners recognize the need for delayed coking to keep pace with the growing demand for transportation fuels, more stringent legislation and the opportunity for significant improvement in refinery profit margins.

Delayed coking is a key technology for residue upgrading or zero fuel oil production.

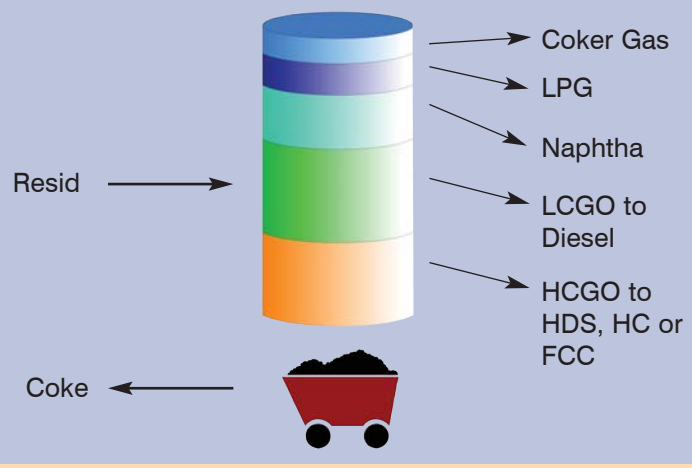
Advantages

- Refiners can process heavier, cheaper crudes to increase their refinery margins
- Converts low-value residues to high-value fuels with moderate capital investment
- Easy integration into existing refinery
- Delayed coking is a safe, reliable and **WELL-PROVEN** technology, meeting all regulatory requirements

From Valero's 2004 Annual Report:

"Valero's $350 million investment in a 45,000 barrel per day coker (complex) at its Texas City refinery increased the plant's ability to process heavy, sour Maya crude.… As a result, the coker generated nearly $200 million in operating income in 2004 alone!"

Typical yield from a barrel of coker feedstock



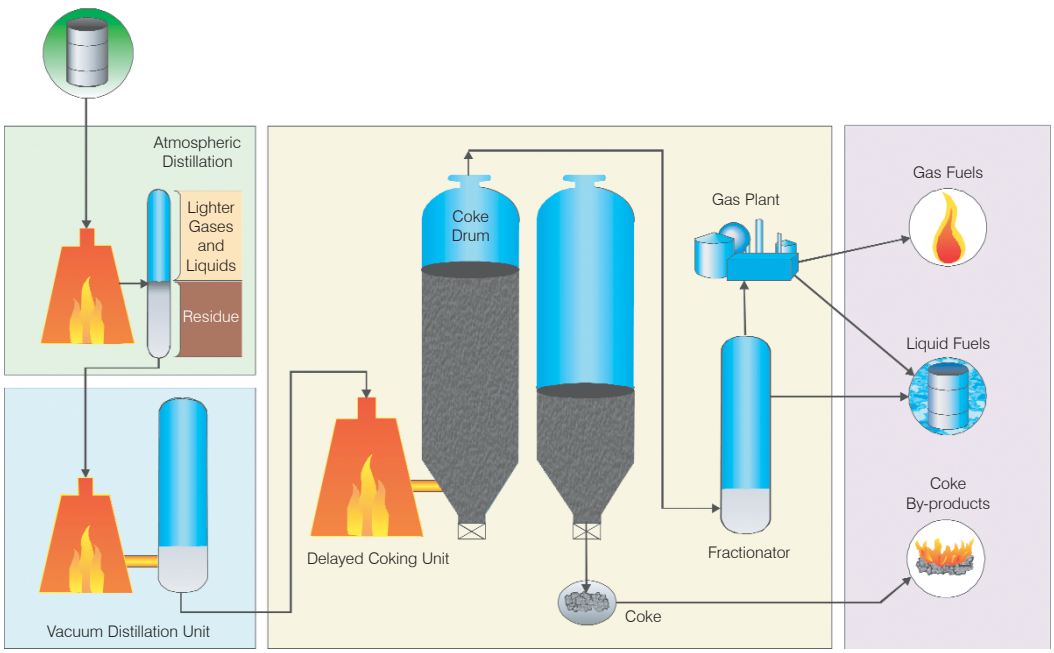
What is the SYDEC℠ process?

Foster Wheeler offers SYDEC℠ (Selective Yield Delayed Coking) under license

Delayed coking is a cyclic process that thermally cracks vacuum residue or other residue feedstocks into gas, light products and petroleum coke.

Key process steps:

- heat residue to about 930 °F (500 °C) in coker furnace
- transfer the hot residue to coke drum before it has formed coke
- fill the drum and allow the heavy tars to coke
- switch the drums on timed cycle (12 to 24 hours)
- decoke the full drum hydraulically
- recover the cut coke, crush and prepare for shipment
- recycle water to eliminate waste
- fractionate cracked products into gas, coker naphtha, light coker gasoil and heavy coker gasoil
- further process fractionated products in downstream units



Foster
- taking

Our coking capability for new plants and revamps

- Feasibility, planning and economic studies
- Process design packages
- EPC
- Commissioning, start-up and operations assistance
- Operator training
- Design and supply of:
  - drum unheading devices
  - coker heaters
- Capacity increases/ revamps:
  - coke drum replacement
  - safety improvement
- API fitness for service evaluation
- Fatigue life evaluation on coke drum support skirts

Class-leading technology

Foster Wheeler has designed and engineered more delayed cokers world-wide than any other technology provider or engineering contractor.

- Over 2.5 million BPSD installed using our technology
- Over 25 revamps designed in the last 10 years
- Over 20 new units designed in the last 5 years
- Our mechanical design expertise and extensive EPC experience enables successful technology transfer
- Proprietary equipment design and supply - drum unheading systems and the all-important coker heater
- Proprietary specification of other critical equipment
- Maximum liquid yields while maximizing operating efficiency

Right people, right expertise

Our people have in-depth technical knowledge and expertise. We have the **largest team of coking experts** in the industry, many of them with over 30 years' experience in all aspects of coker design and project execution.

Seamless EPC execution

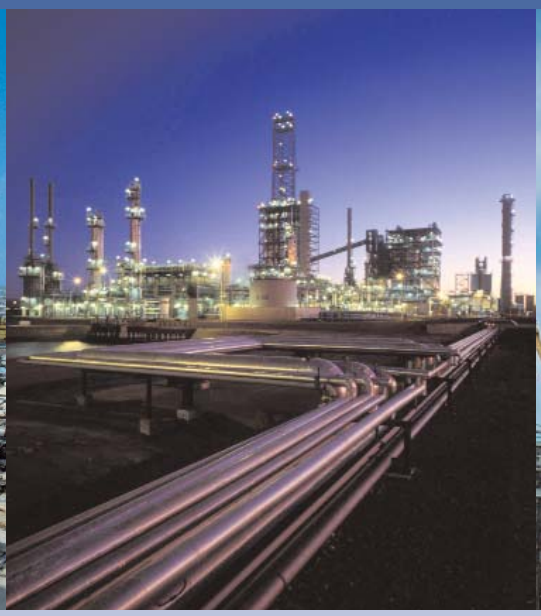
As a world-class **EPC** contractor with a long track record of executing successful major projects and revamps, our clients benefit from our experience of completing projects and revamps that meet aggressive cost and schedule targets.

We are working with a number of clients on coker projects, some at a very early stage, while others have moved into the FEED or EPC phases.

In Chile for instance, having successfully completed the feasibility study and FEED we are now the EPC contractor for the new coker complex at state-owned oil company ENAP's Aconcagua refinery.

Wheeler technology further

Project


"The MOL project has been profitable and allowed MOL to economically reach its goals of exiting the uncertain heavy fuel oil market, improving competitiveness and improving environmental conditions".

MOL / Foster Wheeler paper presented at
ERTC 10th Annual Meeting, Vienna, Austria, 2005

highlights

Valero Texas City - Texas
28-month schedule from process design to 'oil in'. Processed 45,000 barrels per day in four drums.

Petropower™ - Chile
Combination coker/cogeneration facility with delayed coker and circulating fluidized-bed boiler burning petroleum coke to generate steam and power.

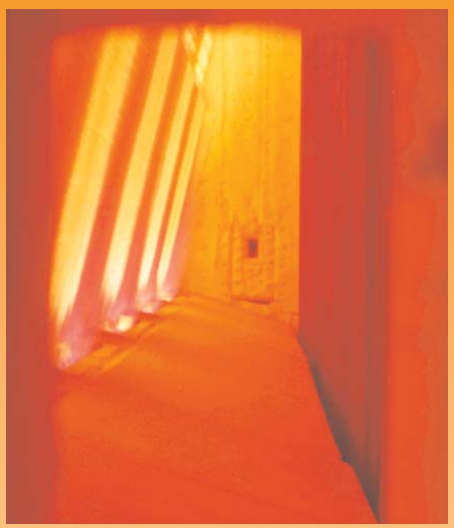
Valero (formerly Premcor) Port Arthur - Texas
Optimized combination of delayed coking and hydrocracking.

Sincor Upgrader - Venezuela
One of four Orinoco upgraders: Foster Wheeler provided delayed coking technology for three.

MOL - Hungary
Built to meet latest European environmental standards at a refinery located near a major European city.

Reliance - India
One of the world's largest single-train delayed cokers, operating at over 150,000 barrels per day. Now awarded contract to design new eight-drum coker for Jamnager Export Refinery project, which will double Reliance's refining capacity.

SYDEC^{SM} - the heart



The fired heater is the heart of the delayed coker, and we can offer:

- Terrace Wall™ double-fired, sloped wall type; and
- single-fired cabin-or box-type with horizontal tubes and bridge wall

Foster Wheeler fired heaters are an integral part of our technology, and ensures economic operation with long on-stream factors.

Our in-house team provides full process, thermal and mechanical design to our stringent specifications and standards, leaving no critical details open to misinterpretation by a third-party designer.

The key advantages of Foster Wheeler's Terrace Wall™ delayed coker heaters:

- Sloped walls provide an extremely uniform heat flux from top to bottom of the radiant coil
- The burners firing up the sloped walls stabilize the coker off-gas fuel and spread the flame evenly along the length of the tube and up the wall
- Grade access permits 360-degree viewing access and easier burner maintenance
- Completely isolated cells allow individual pass firing controls for on-line spalling and turndown abilities, which result in cost savings from increased run length.

of the process

The SYDEC℠ difference

Although coking technology is ‘mature’, we are always looking for ways to make our SYDEC℠ technology even safer and more reliable for our clients.

Key features of the SYDEC℠ process are reliability and efficiency:

- Terrace Wall™ double-fired furnace
- Advanced coke drum design
- Fractionator zone sprays and fines removal
- Low pressure, ultra-low recycle
- On-line spalling/pigging

Safety and Environmental:

- Unheading system improvements
- Safety interlocks
- Unique coke handling systems
- Recovery of blowdown vent vapors

Advantages

- SYDEC℠ is an environmentally friendly process
- There is low-sulfur fuel gas production
- Enclosed blowdown recovery systems
- Clean coke handling

Our units are safe and reliable and customers tell us they achieve successful run lengths of five years or more between turnarounds.

Turning vision into reality

Did you know ?

- Commercial coking first started in 1929
- Since 1994, all residue upgrading in the USA has been based on delayed coking
- Foster Wheeler cokers have the flexibility to produce fuel-grade coke or more valuable anode coke depending on feedstock
- We can integrate delayed coking with
  - solvent deasphalting (SDA) to increase residue conversion
  - circulating fluidized-bed (CFB) technology to produce electricity and/or steam
  - gasification to produce electricity, steam and hydrogen
- Delayed coking can raise refining margins by US$1.50 to US$4.50 per barrel of crude oil.

FOSTER WHEELER

We have the **right people** with a ëcan-doí attitude and the **commitment to deliver**

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