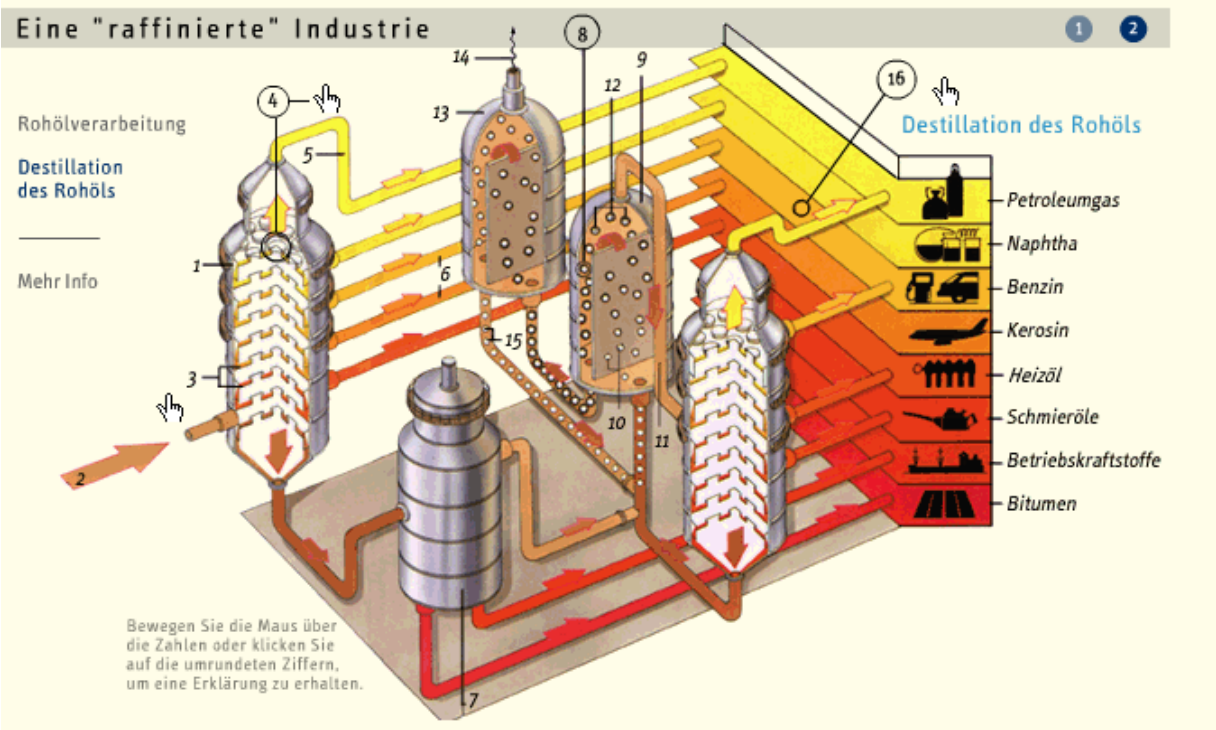
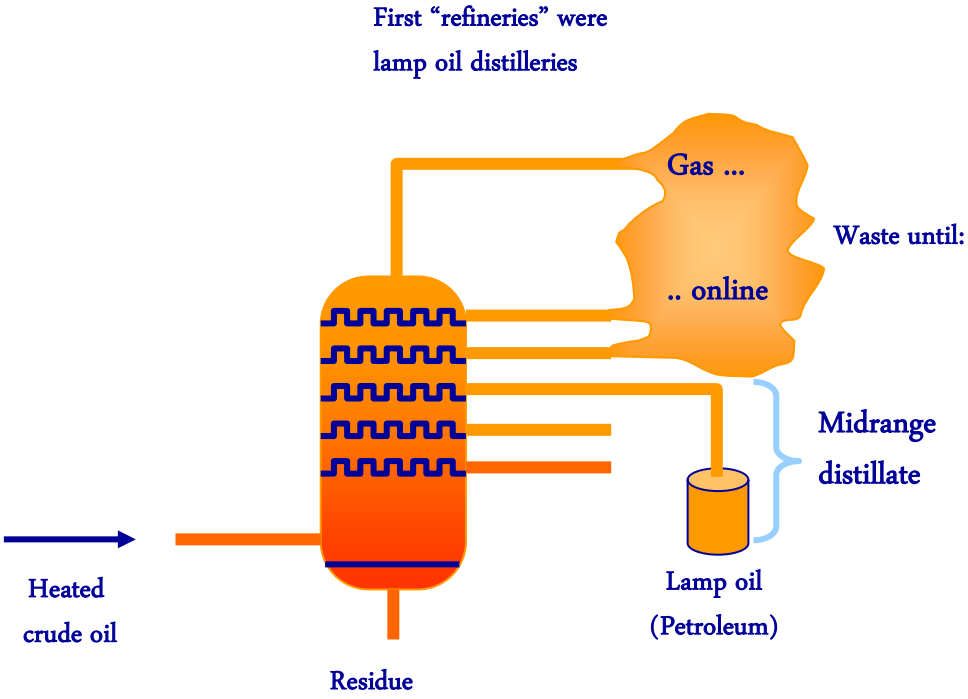
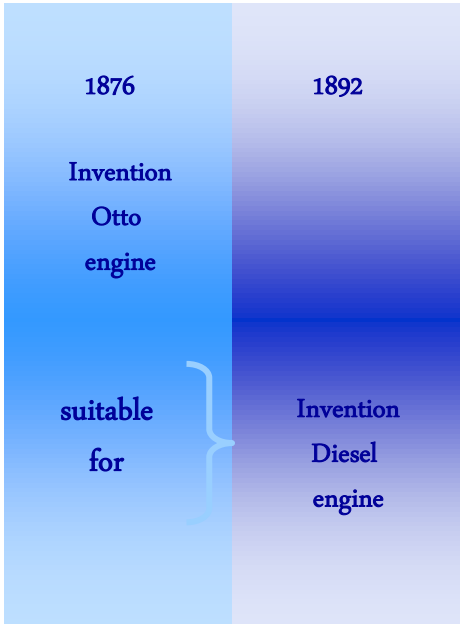
Refinery



All processes and activities described so far happened on the upstream side. The next step to convert crude to e.g. gasoline is happening on the downstream side in refineries.

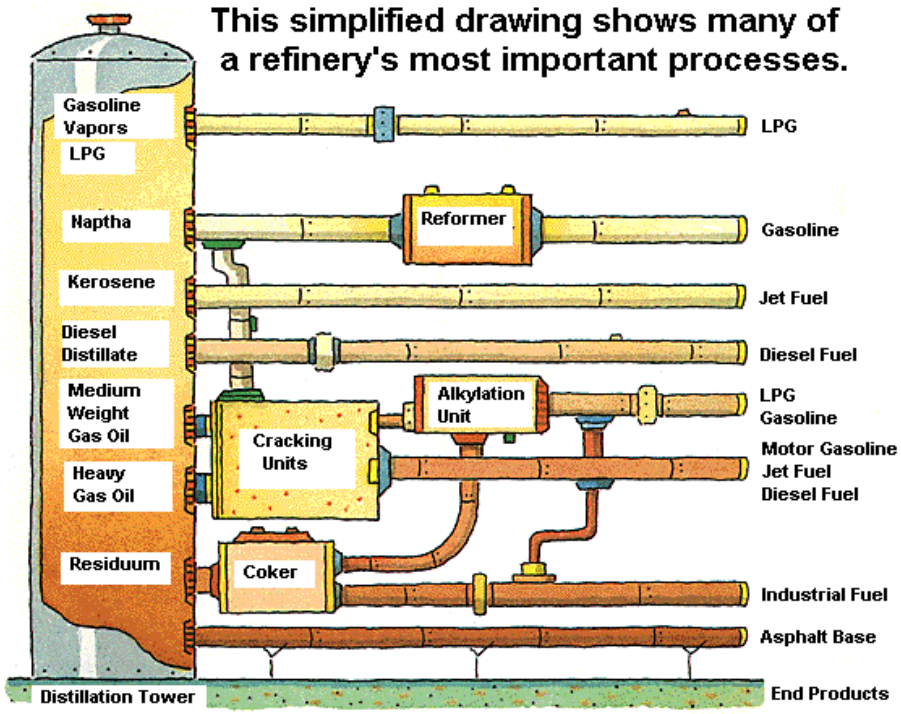
Once a waste of lamp oil production





Early use of petroleum was mainly for fueling oil lamps to illuminate houses and workshops. All lighter and heavy distillatio n products were disposed.

The refining process



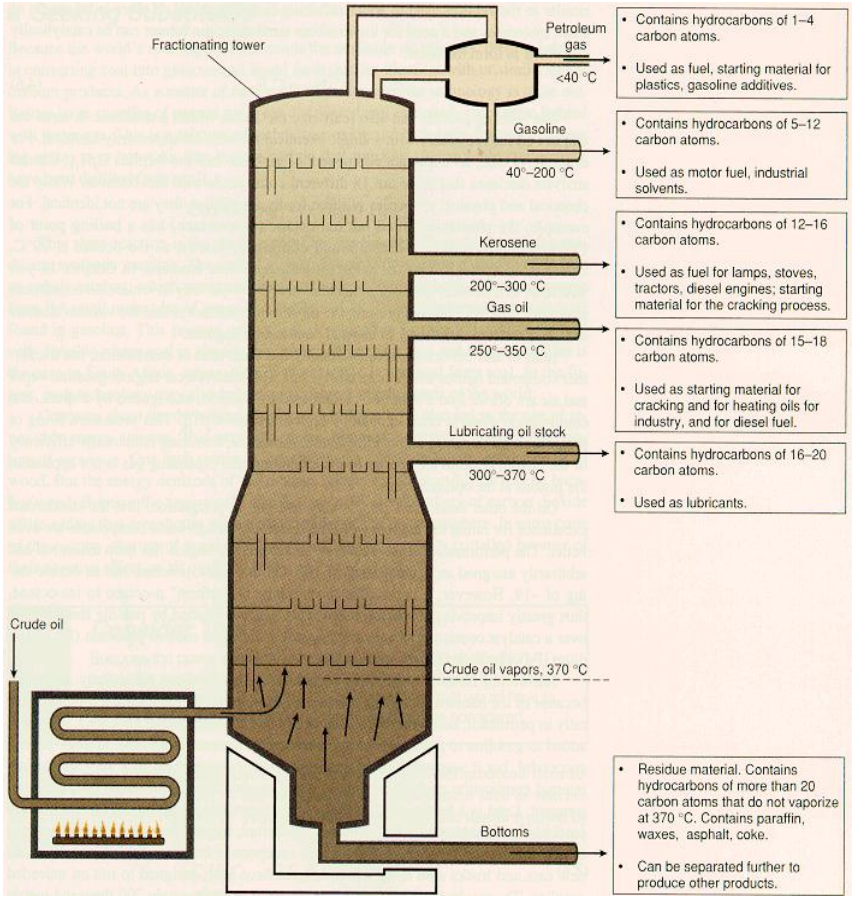
Crude oil is a mixture of petroleum liquids and gases in various combinations. Each of these compounds has some value, but only as they are isolated in the refining process. Essentially, refining breaks crude oil down into its various components, which then are selectively reconfigured into new products. All refineries perform three basic steps: separation, conversion and treatment.

Separation

High pressure separator for a refinery in south Louisiana. Shell Plate 4.375" thick, ASME Section VIII, Div.2 with 13" wall thickness sump. Shipment by rail in early 1993.

Heavy petroleum fractions are on the bottom, light fractions float to the top. This allows the separation of the various petrochemicals. Modern separation involves piping oil through hot furnaces to speed up the process. The resulting liquids and vapours are discharged into distillation towers.

Distillation tower



Inside the towers, the liquids and vapours separate into components or fractions according to weight and boiling point. The lightest fractions, including gasoline and liquid petroleum gas (LPG), vaporise and rise to the top of the tower, where they condense back to liquids. Medium weight liquids, including kerosene and diesel oil distillates, stay in the middle. (Heavier liquids, called gas oils, separate lower down, while the heaviest fractions with the highest boiling points settle at the bottom.)

Conversion

The finishing touches occur during the final treatment. To make gasoline, cracking and rearranging molecules adds value to the products. This is where fractions from the distillation towers are transformed into streams (intermediate components) that eventually become finished products.

The most widely used conversion method is called cracking because it uses heat and pressure to "crack" heavy hydrocarbon molecules into lighter ones. A cracking unit consists of one or more tall, thick-walled, bullet-shaped reactors and a network of furnaces, heat exchangers and other vessels.

Reforming

Cracking and cooking are not the only forms of conversion. Other refinery processes, instead of splitting molecules, rearrange them to add value.

This process, which essentially is cracking in reverse, takes place in a series of large, horizontal vessels and tall, skinny towers that loom above other refinery structures.

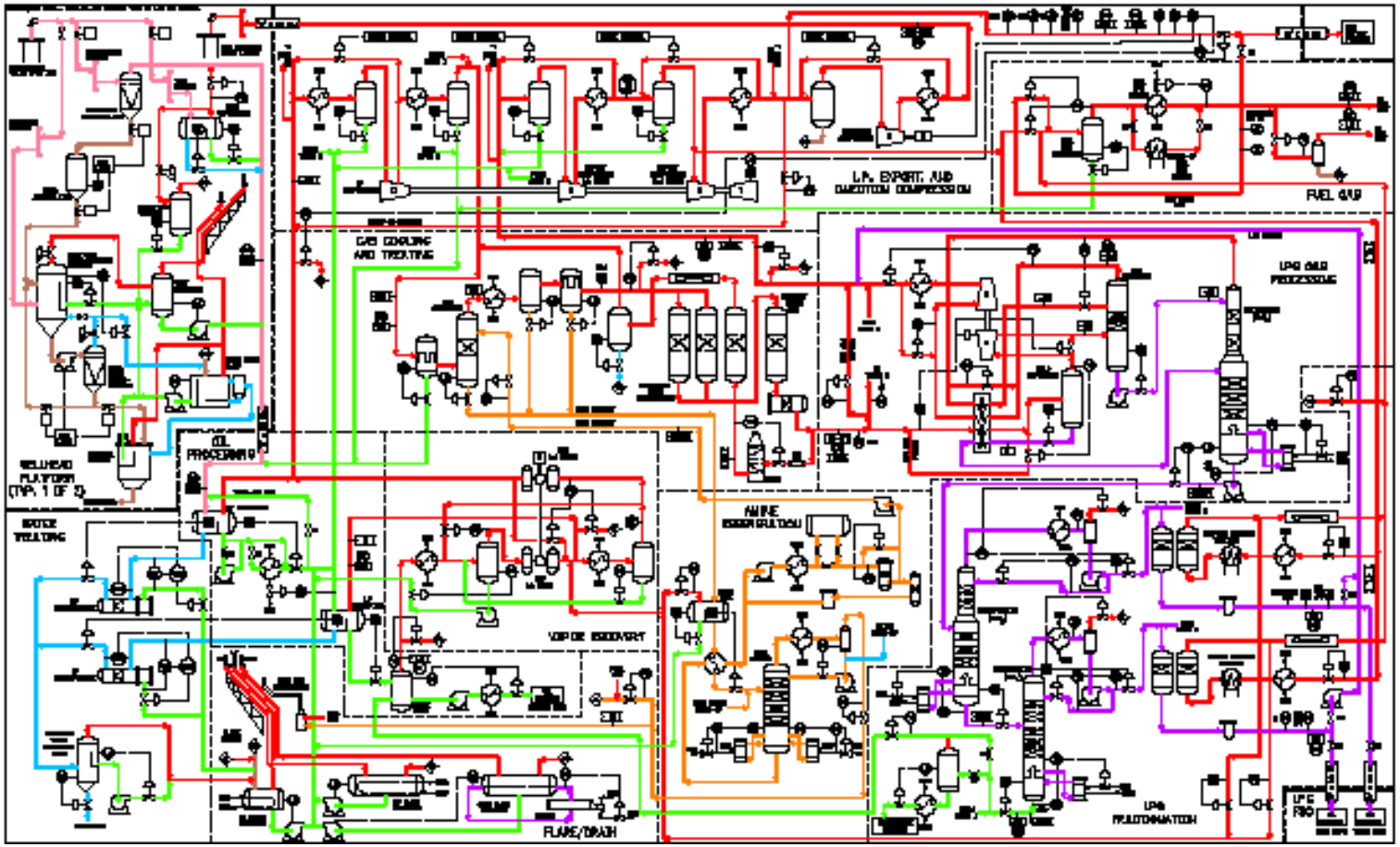
Reforming uses heat, moderate pressure and catalysts to turn naphtha, a light, relatively low-value fraction, into high-octane gasoline components.

Treatment

Mobil Beaumont Tx.

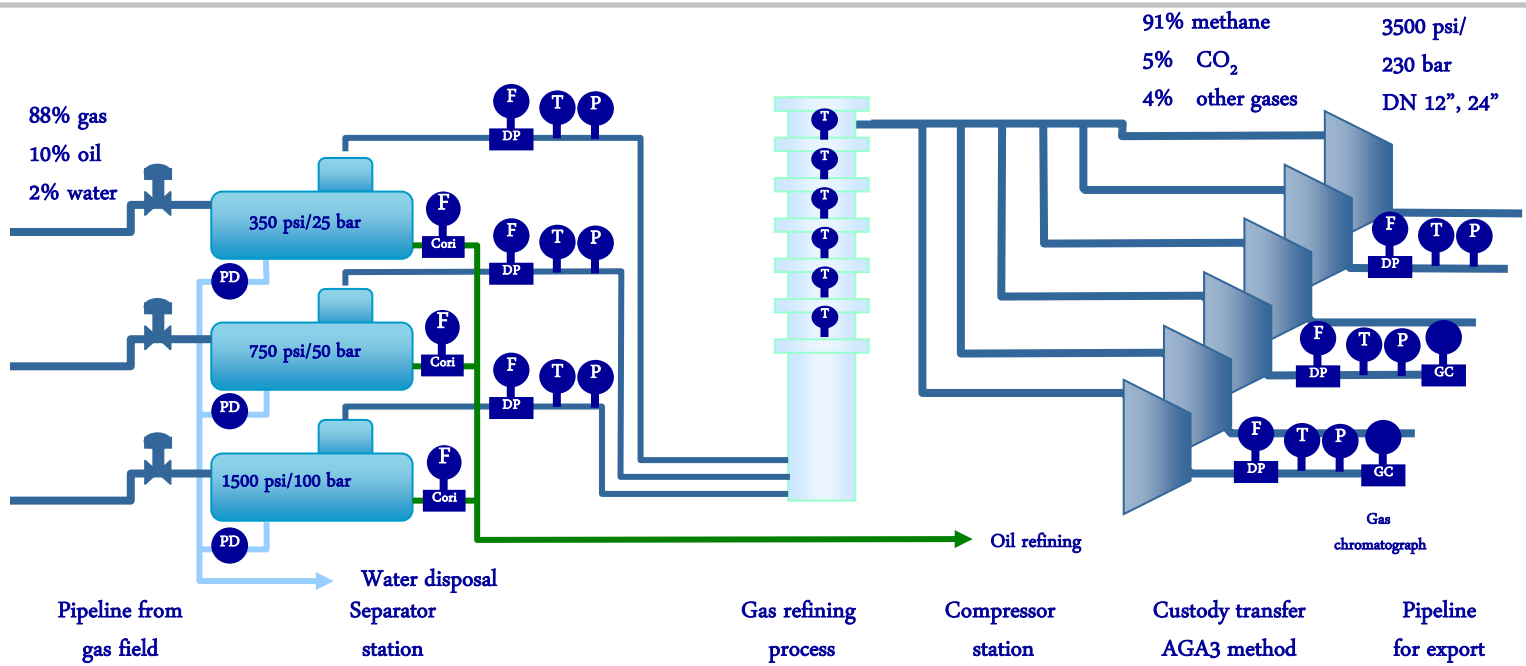
The finishing touches occur during the final treatment. To make gasoline, refinery technicians carefully combine a variety of streams from the processing units. Among the variables that determine the blend are octane level, vapour pressure ratings and special considerations, such as whether the gasoline will be used at high altitudes.

A close look



Although a simple principle, a modern refinery process is a very complicated process requiring know-how, experience and the best measuring instruments available.

Typical gas plant



Natural wet gas arrives at the plant, a choke manifold reduces the pipeline pressure.

Wet gas separates from water and oil in the separator.

Gas flow is measured usually with PD-orifice meters, oil flow with coriolis, water with simple turbine meters. Dried gas is processed before being compressed for further transportation. Custody transfer metering with DP, P, T, gas chromatograph and AGA3 method (density) for flow calculation.

With courtesy of Repsol

Fuel, the main refinery product

Supply of crude

Own requirements

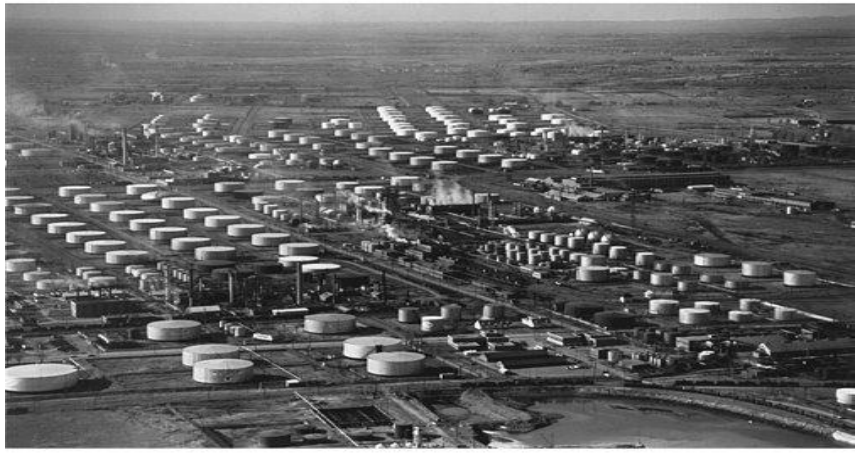
Refined products

Naphtha, raw petrol/gasoline	8%
Petrol/gasoline	20%
Diesel	18%
Light fuel oil	21%
Heavy fuel oil	10%
Other products, bitumen, aviation fuel, LPG	17%

Fuel

Today some refineries turn more than half of every barrel of crude into gasoline.

Storage



Both the incoming crude oil and the outgoing final products need to be stored. These liquids are stored in large tanks on a tank farm. Pipelines carry the final products from the tank farm near the refinery to other tanks all across the country.

All of these activities are required to make the gasoline that powers our cars, the diesel fuel that brings our food to market, and the jet fuel that flies our planes. These provide us with the energy we need to get from place to place quickly and comfortably.

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