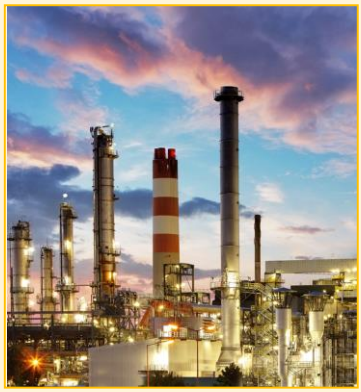
Energy efficiency in European industry

Petroleum & Coke sector

Introduction to the coke and petroleum sector

The coke and petroleum industry often refers to exploration, extraction, refining, transporting, and marketing of coke and petroleum products. This fact sheet focuses specificilly on the refining (manufacturing) activities, i.e. NACE sector code C19 ("*Manufacture of coke and refined petroleum products*"). The key subsector is C19.2 ("*Manufacture of refined petroleum products*"), with the remainder formed by C19.1 (*"Manufacture of coke oven products"*).



GP Intervention in the H_2S absorption plant

0.3 years payback time

The MDEA (methyldiethanolamine) that comes out from the first stage of sour gas cleaning is usually semi-rich: this means that it could be potentially re-used to clean particularly sour gases. The re-use of this semi-rich MDEA in the other gas cleaning equipment reduces the quantity of MDEA that needs to be regenerated, so reducing the steam consumption of the reboilers of the regeneration columns.

The MDEA absorbs the H_2S and, when saturated, it is transferred to the regenerator, where the amine solution is recycled and regenerated to be used again in the absorber, while concentrated H_2S leaves the regenerator. The concentrated H_2S can then be converted into sulphur via additional processes. In the plant in Italy where this practice has been implemented, the energy consumption improvement has been 17%, while payback time was less than 4 months. *more info*

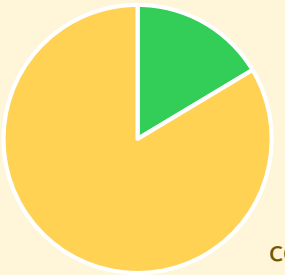
GP Heat recovery interventions

Several Good Practices have been identified related to heat recovery in the coke and petroleum sector.

- Installation of two heat recovery systems on the dematerialised water plant and the fluid catalytic cracking column.
- Heat recovery from the bottom of the fractionator column in the Heavy Cracked Naphtha (HCN) circuit, in order to pre-heat the boiler feed water (BFW)
- Heat recovery in the Fluid Catalytic Cracking (FCC) CO boiler section
- Replacement of medium pressure steam system with heat recovery from vacuum column heavy distillate to pre-heat cold atmospheric residue.
- Installation of a thermal recovery steam generator.

more info

Statistics EU petroleum sector



Coke and petroleum: **16.4%** of EU industry energy consumption

- **412 enterprises**
- **37,000 people employed**
- **Gross added value € 3 billion**
- **Final energy consumption: 44.7 Mtoe per year* (16.4% of total EU industry energy consumption)**

The number of enterprises, persons employed, and value added in the coke and petroleum sector are much lower than in other key industrial sectors, such as iron & steel, pulp & paper, the chemical sector, and the food & beverage industry. However, the energy consumed by the sector is similar to that in these other sectors, as the petroleum sector is the most energy intensive industrial sector.

The production capacity of petroleum refineries is spread fairly evenly across the EU Member States. The coking subsector (C19.1) however is heavily concentrated in Poland.

The sector is dominated by large companies. Over 90% of total production value in each analysed country comes from large enterprises. The average turnover per company is higher than in other sectors.

Recommendations: by-products

For its energy needs, the coke and petroleum industry uses high volumes of by-products produced in its own processes, such as refinery gas. These are generally less expensive fuels, and investments in energy savings in such fuels are often not financially beneficial.

A high share of savings reported have been with regard to energy carriers such as electricity and natural gas, rather than with regard to by-products, which also shows that the petroleum industry has more (price) incentives to invest in energy efficiency for these energy carriers.

Policies focused specifically on energy savings with regard to these by-products would be needed in order to encourage more substantial energy savings, and common policies such as energy taxes are ineffective.

GP **Furnace improvements**

Furnaces are used to produce heat in several stages of a refinery, including during distillation, bitumen production, coking, and catalytic reforming processes. The furnaces are either fired by fuel from the refinery itself, or by externally-produced natural gas. Furnaces are one of the main energy consumers in refinery processes.

Several good practices have been identified, with on average low payback times of less than one year.

- Revamping of the catalytic reforming plant: improvement of the insultation of the radiant tubes improves efficiency and reliability of the furnace, while reducing NO_X emissions.
- Replacement of a furnace in the distillation process: replacing a multi-fuel furnace by a new furnace that only uses fuel and tail gas (no fuel oil) increases efficiency.
- Replacement of the burners of the hot oil circuits.

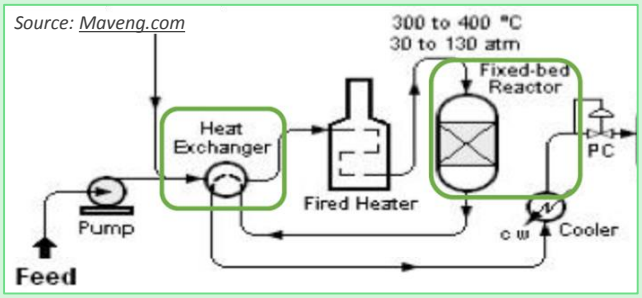
As furnace installations are used in a wide range of industrial processes, also in other sectors, these good practices can be replicated and adapted to many industry plants. *more info*

GP **Catalyst regeneration cooling system**

During the fluid catalytic cracking process, the heavy hydrocarbons found in crude oil are converted into more valuable lower boiling hydrocarbons, such as gasoline. The first stage of the process involves a reactor, in which oil and oil vapor are pre-heated to 250°C to 425°C and mixed with a catalyst. This produces coke, which is collected on the surface of the catalyst. To be able to regenerate the catalyst and prevent coke from diminishing its catalytic properties, the catalyst is regenerated in the regenerator by burning off the coke from the catalyst using air blown into the regenerator. This process produces a large amount of heat, which can be recovered by installing a new catalyst cooling system with a heat exchanger, which maintains the temperature of the catalyst at an optimal level and recovers the excess heat. The recovered heat can be used to produce steam at medium pressure in order to reduce fuel oil consumption in the thermal station of the refinery. *more info*

GP **Revamping of the pre-heating line**

Hydrodesulphurization is a catalytic process typically used in the coke and petroleum industry to remove sulphur from natural gas and refined products. The installation of two new heat exchangers (additional to the pre-existing ones) will improve the pre-heating line of the de-sulphuring unit. This new configuration will increase the amount of thermal energy recovered by the effluent leaving the reactors, enabling an increase in the charging temperature by around 10°C-15°C. Second, the reactor was replaced with a new reactor that has twice the capacity of the previous one. This will increase the catalyst volume, enabling a lower reaction temperature for the same degree of desulphurisation and thus improving plant performance. *more info*



Recommendations: confidentiality

The coke and petroleum sector is dominated by a relatively small number of very large enterprises. The number of energy efficiency interventions as well as the relative amount of energy savings is the lowest of all sectors. This may be related to confidentiality of information.

The way of reporting in all energy efficiency obligation schemes and alternative measures implicates that some details of the energy efficiency measures and investments in the company will have to be published. This may discourage the large companies which may not want to share some of the information with the competitors.

It may be beneficial if (voluntary) agreements in the petroleum industry, with only a few industry members, are designed with a higher level of confidentiality.

Policies

In many EU Member States, the (coke and) petroleum industry is covered by an energy efficiency obligation (EEO) scheme, but also many alternative measures have been implemented, including financial schemes and fiscal measures.

In various countries, voluntary agreements have been made between the government and the petroleum sector (or all energy-intensive sectors). Such agreements have been made for example in Belgium (both Flanders and Wallonia), Finland, the Netherlands, Sweden, and the UK. In voluntary agreements, enterprises often receive tax rebates in return for energy consumption improvements. One of the objectives of such agreements is often also to cut energy use, while protecting the market position of domestic industries in the face of international competition.

The EU-MERCI project

EU-MERCI is an EU-funded project aimed at supporting the growth of energy efficiency in industry processes. The project shares good practices of energy efficiency measures, helps industry actors to overcome expected barriers and maximise benefits, and supports policy makers. → eumerci.eu.

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