



## Recovering and purifying crude oil

**Nitrogen and hydrogen help maximise our return on crude oil by supporting enhanced oil recovery (EOR) and fuel desulphurisation respectively.**

### Enhanced oil recovery (EOR)

The earth's crude oil reserves are finite. And as an oil field becomes depleted, the flow pressure declines, and after a while, the feed rate starts to slow down. However, it is possible to exert some influence over this process using enhanced oil recovery (EOR). This method involves injecting gas or water to heat the oil, or using chemicals to reduce surface tension. This delays or reduces the drop in feed rates.

The most common EOR method is water flooding, which means that water is pumped into the reservoir. However, this method also increases production costs, due to the effort involved in sourcing and disposing of the water.

Carbon dioxide (CO<sub>2</sub>) or nitrogen (N<sub>2</sub>) flooding works along the same lines but is even more efficient. Here, water and CO<sub>2</sub> or N<sub>2</sub> are pumped into the reservoir alternately. This yields significantly better results than water alone, allowing recovery of at least another 10 to 15 percent of the oil reserve. A further benefit is that the gas, injected under high pressure, is easy to separate from the recovered oil and can then be pumped back into the system. Linde supports these EOR processes with air separators that produce the nitrogen required.

### Desulphurising fuel

The desulphurisation of fuel with hydrogen is growing in importance as government authorities tighten environmental regulations covering emissions.

Refineries generally rely on on-site facilities to supply the H<sub>2</sub> they need to desulphurise their petrol and diesel. Customers looking for an on-site supply of H<sub>2</sub> benefit from the synergised, single-source offering of The Linde Group, spanning both engineering and operation of on-site plants.

Our Gases Division placed a major H<sub>2</sub> contract with our US subsidiary Linde Process Plants (LPP). This entails building a second hydrogen plant at our Lemont site in Illinois and then supplying the neighbouring refinery, run by CITGO Petroleum Corporation, with around 1.3 million standard cubic metres (scm) of H<sub>2</sub> per day. CITGO will use the hydrogen to treat high-sulphur (or sour) crude oil from Canadian oil sands.

[HOME](#)

[ABOUT THIS REPORT](#)

[FUNDAMENTALS](#)

[FIELDS OF ACTION](#)

[DIVISIONS](#)

[Gases Division](#)

[Engineering Division](#)

[Solar energy](#)

[Biomass](#)

[Natural gas](#)

[Crude oil](#)

[Coal](#)

[Carbon capture and storage](#)

[ROADMAP](#)

[GRI INDEX](#)

[ASSURANCE REPORT](#)