

McKinsey on Oil & Gas

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Perspectives on
Oil & Gas

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uncertain times

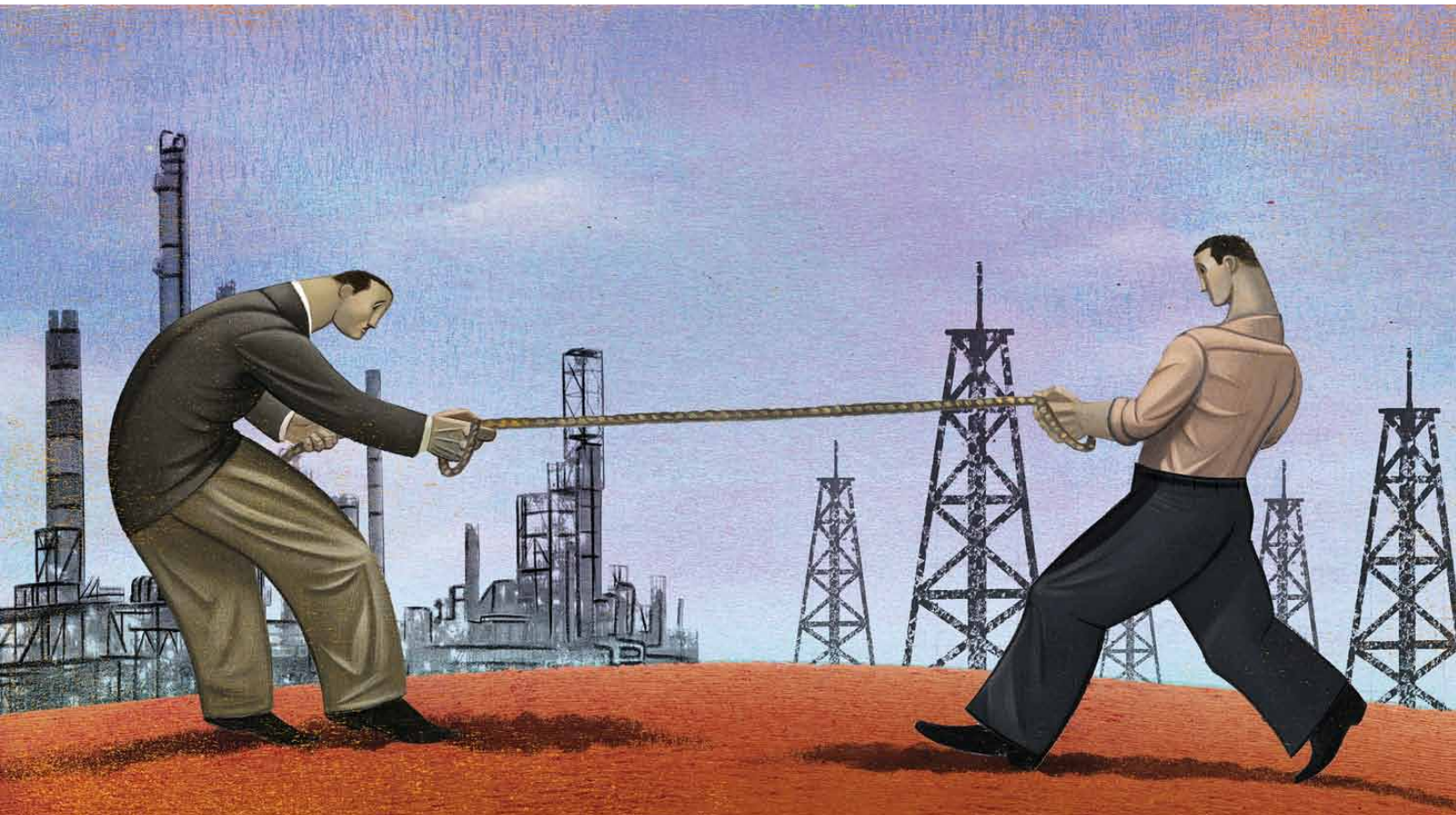
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CO₂ abatement:

Exploring options for oil and natural gas companies

Oil and natural gas companies play a central role in CO₂ emissions. How can the industry meet the challenge from climate change regulations?

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The oil and natural gas industry is directly responsible for just 6 percent of global CO₂ emissions, but the debate over how to reduce the global greenhouse gases (GHG) commonly associated with climate change focuses primarily on oil and natural gas companies. These companies are under constant regulatory and reputational pressure to reduce both upstream and downstream CO₂ emissions, and in the coming years they will increasingly be expected to provide solutions and make investments. The reason for this emphasis on the industry is that when you add the CO₂ emitted in the end uses (transportation, power and heat generation), the petroleum and gas sectors account for almost half of all global emissions.

It is important to understand the position of the oil and gas industry in the context of the larger debate over climate change. By exploring some of the options that the sector has for reducing GHG emissions, oil and natural gas companies can not only stay ahead of regulatory and economic developments but also potentially profit from them.

Current environment

In 2005, direct greenhouse gas emissions from the oil and gas sector totaled 2.9 billion tons CO₂ equivalent (CO₂e), spread equally along the value chain: petroleum upstream and downstream emissions were each about 1.1 billion tons CO₂e per year, and emissions from gas transport totaled

0.7 billion tons per year. Assuming no additional abatement measures, emissions are projected to grow by a third (even allowing for a major reduction of 72 percent in flaring as a result of public pressure and high gas prices). Upstream production and processing are expected to become more energy intensive as a result of more complex operational requirements, while energy intensity downstream is expected to stay relatively constant.

It is safe to assume, however, that the growth predicted in this business-as-usual scenario will not be realized. Political and economic realities will result in reductions of greenhouse gas emissions. Since that is the case, it is useful to have a straightforward way to evaluate the cost and the impact of the various options. The McKinsey abatement curve, which charts total reduction potential per measure versus the euro per ton of CO₂ abated (exhibit), shows that by 2030, an additional 1,100 million tons of CO₂ abated (mmtCO₂e) can be avoided beyond the business-as-usual scenario with investments that cost €60 per ton of CO₂e or less.¹ The key opportunities include increasing energy efficiency through operational changes and small investments, reducing flaring, improving gas pipeline planning, and investing in cogeneration and carbon capture and storage (CCS).

The dominant abatement methods differ significantly by region: for North America, Latin America, Western Europe, and OECD² Pacific, CCS will be the main opportunity through 2030; in Africa, it will be further reduction of flaring; in Eastern Europe and Russia, reducing emissions from the gas pipeline network will have the greatest potential; in China, India, and the rest of developing Asia, energy-efficiency programs and cogeneration will be the most effective levers.

From society's point of view, the average lifetime cost of these measures will be close to zero, as energy savings will on balance pay for the more expensive ones. The challenge is that most of these measures require upfront investments: capital expenditure to implement abatement in 2030 will be approximately 3.5 percent of annual capital expenditure of the combined oil and natural gas industries—the equivalent of approximately €18 billion per year.

Most companies already have plans for reducing emissions. These include measurement and reporting, operational improvement, and incorporating carbon-abatement objectives in investment proposals. Implementation, however, is in an initial stage and faces several barriers: resources are scarce, in terms of both capital and technical capabilities, and CO₂ reduction is not always a top priority. In the near future, however, companies will have to overcome those barriers and move beyond the initial phases of emissions abatement.

Significant regulatory impact

Although climate change regulation is in flux, many countries have concrete regulations or proposals in place. In Europe, the refining industry falls under the cap-and-trade scheme. Credits are auctioned and refineries have to pay for part of their emissions. The United States may soon impose a more rigorous regimen. The Waxman-Markey and Kerry-Boxer bills, currently making their way through the US Congress, would also force refineries to buy credits for the CO₂ emitted in the combustion of fuel they sell.

The benefit of a trading scheme is that it optimizes the abatement cost by realizing the lowest-cost CO₂ reduction first, irrespective of the sector or geography in which it occurs. A drawback is

¹ A threshold of €60/t is applied, as this covers most technical measures available today.

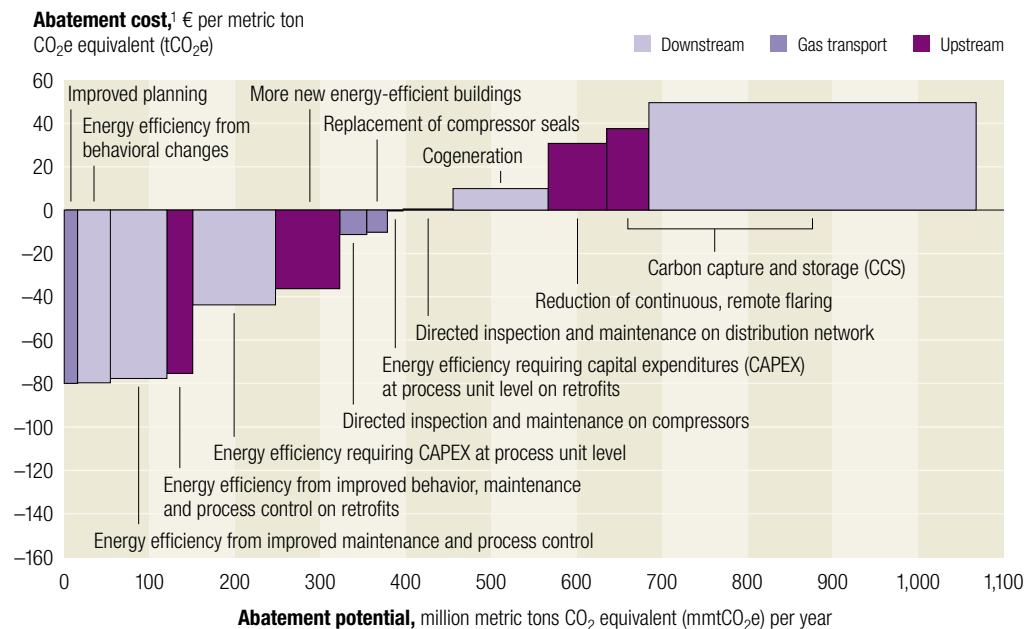
² Organisation for Economic Co-Operation and Development.

Exhibit

What might it cost?

The abatement cost curve displays the reduction potential of measures that cost less than €60 per metric ton of carbon dioxide equivalents.

Societal perspective, 2030



¹The curve presents an estimate of the maximum potential of all technical greenhouse gas (GHG) abatement measures below €60 per tCO₂e if each lever were pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

that the CO₂ price will fluctuate over time, making the return on investments volatile. Should CO₂ prices remain low for a sustained period—caused, for example, by depressed economic activity, softened CO₂ caps, or leakages in the system due to the Clean Development Mechanism (CDM, allowing credits from developing countries)—investments in emission reductions are likely to decline. As a result, some countries, such as Norway, have implemented a straightforward, fixed CO₂ tax. Some economists and oil and gas companies support a tax scheme because it is more predictable and simpler to implement.

Alternative forms of regulation have been implemented or are being considered. California

may impose a CO₂ regulation that accounts for CO₂ emissions through the entire value chain (including upstream). In Australia and Canada, CCS requirements are being discussed for CO₂-intensive upstream operations. Finally, low-carbon fuel standards are being considered in California, and biofuels mandates are being implemented in the European Union and across North America.

For some of the schemes mentioned above, regulators may use benchmarking to steer toward emission improvements. Benchmarking can be done on a product basis (for example, CO₂ content or CO₂ emitted per volume sold) or on a process basis (for example, relative CO₂ emission performance for operating an oil sands asset).



Benchmarking can have a direct implication on the public image of companies, and eventually on company valuations. Some organizations already publish rankings of oil and gas companies, and the results are widely covered in the press. Because of all this attention, oil and gas companies could benefit from a joint approach to determining what the best measures for CO₂ emission performance are.

Silver linings

Despite significant downside risks, the upcoming climate change regulation and trends also provide revenue opportunities, both in improving internal operations and by capturing growth opportunities.

Energy efficiency. Oil and gas companies can continue to take a leading role in identifying and implementing energy-efficiency programs. Good programs should also focus on organizational challenges, particularly how to make the improvements stick. Programs focused on energy efficiency could be justified, at least for the next few years, as most companies can make large improvements and there is specific interest from the outside world for progress in that field.

GHG trading. Oil and gas companies with trading capabilities can make significant profits in the CO₂ markets. Arbitrage opportunities exist for compa-

nies that have both existing CO₂ emissions and abatement opportunities. CDM projects, in which CO₂ reductions are captured in approved projects outside the European Union, can have good returns. Companies with both proprietary views on how CO₂ regulation will be developing and views on the longer-term price development of CO₂ can make portfolio adjustments that could create value if CO₂ regulation continues to strengthen.

Biofuels. Some oil and gas companies are well positioned to become biofuels marketers and even producers. Second-generation biofuels appear to be harder to commercialize than originally anticipated, and it is still unclear which technology or technologies will succeed—for example, enzyme conversion of cellulosic material and algae. Until that time, stakes in first-generation fuels may become attractive again should oil prices rise or biofuel mandates increase.

Other fuels. On the commercial side of the business, retail and B2B customer offerings can be expanded with CO₂-focused solutions. This expansion could include offering fuels and lubricants that yield higher mileage or creating energy-efficiency programs for business-to-business (B2B) customers. Complementing retail sites with electricity or hydrogen fueling stations could become a new source of income, it could also improve the public profile of the brand.

CCS. Carbon capture and storage is likely to become a long-term internal-abatement opportunity (or requirement) for refineries and upstream operations with high CO₂ emissions. Beyond this, oil and gas companies may be well positioned to develop and implement CCS for third parties, since they have the access to and knowledge of depleted oil and gas fields that could become storage sites, and they have experience with handling CO₂ through Enhanced Oil Recovery. They might have additional synergies with liquefied natural gas (LNG) regasification plants to cool and compress CO₂ into the storage locations.

In addition to the list above, investments in renewable power sources such as solar, wind, and geothermal may be more or less attractive

depending on specific company capabilities and the appetite to enter a nascent and not directly related industry.



Oil and natural gas companies play a central role in global emissions both as direct emitters of CO₂ and as suppliers of fossil fuels. Regulation will therefore increasingly affect the profitability of these companies in selected regions, and it will change long-term demand patterns. The top performers in this sector will be the ones that stay ahead of these changes by mitigating the downside risks through internal-abatement efforts and by taking advantage of value creation opportunities that this rapidly changing business environment presents. ○