



OIL AND GAS CLIMATE INITIATIVE

# More energy, lower emissions

Catalyzing practical action on climate change



A report from the  
Oil and Gas Climate Initiative  
October 2015

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# Joint collaborative declaration

As the international community heads towards COP21, we, the member companies of the Oil and Gas Climate initiative (OGCI), who together provide nearly 10% of the world's energy, express our collective support for an effective global climate change agreement.

We recognize the general ambition to limit global average temperature rise to 2°C, and that the existing trend of the world's net greenhouse gas (GHG) emissions is not consistent with this ambition.

OGCI member companies have taken significant actions to reduce our GHG footprint. Over the past ten years, the collective GHG emissions from our operations have decreased by 20%<sup>1</sup>. We have also made significant investments in natural gas, carbon capture and storage (CCS) and renewables, as well as low-GHG research and development (R&D), and innovation. These actions and contributions are the subject of our combined report.

Going forward, we will continue in our efforts to help lower the current global emissions trajectory. However, neither our contributions nor those of any one industrial sector alone will be enough to address the challenge of climate change; it can only be met by each part of society making an appropriate contribution.

Governments face a dual challenge. The world needs more energy as populations and economies grow. Yet this energy has to be provided in a sustainable and affordable manner. For us as energy suppliers, and for energy consumers, the challenge is that meeting growing energy demand with lower emissions is likely to be more complex, at least in the short term. However, investment in gas, renewables and lower GHG technologies like CCS today will contribute greatly to reducing the cost and impact of climate change for future generations. It is our hope that COP21 will help to overcome these challenges and put us on a progressive pathway for addressing climate change.

Governments set the conditions within which we produce and use energy and have a critical role to play in creating clear stable policy frameworks that are consistent with a 2°C future. We will support the implementation of these frameworks because they will help our companies to take informed decisions and make effective and sustainable contributions to addressing climate change. Over the coming years we will collectively strengthen our actions and investments to contribute to reducing the carbon intensity of the global energy mix. Our companies will collaborate in a number of areas among the following, with the aim of going beyond the sum of our individual efforts:

- **Efficiency**
  - Optimising our operations, both upstream and downstream, with a particular focus on energy efficiency
  - Improving the end use efficiency of our fuels and other products to reduce their GHG footprint
  - Working with automakers and consumers to improve the efficiency of road vehicles
- **Natural gas**
  - Contributing to increasing the share of gas in the global energy mix
  - Ensuring that the natural gas we provide for power generation results in significantly lower life cycle emissions than other fossil fuels
  - Eliminating 'routine' flaring from our operations
  - Reducing methane emissions from our operations

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<sup>1</sup> Eight out of ten companies

- **Long-term solutions**

- Investing further in R&D and technology innovation to reduce GHG emissions
- Shaping and participating in public and private partnerships to progress the deployment of CCS
- Contributing to increasing the share of renewables in the global energy mix and exploring new business models

- **Energy access**

- Providing more people with access to energy in partnership with local and national authorities, as well as other stakeholders

- **Partnerships and multi-stakeholder initiatives**

- Seeking opportunities to accelerate climate change solutions by working individually or collectively in collaboration with United Nations, other multilateral organisations, governments and civil society such as:
  - IPIECA, the global oil and gas industry association for environmental and social issues;
  - the Sustainable Energy for All initiative;
  - the Global Methane Initiative;
  - the World Bank, and its Zero Routine Flaring initiative;
  - the Climate and Clean Air Coalition, and its Oil and Gas Methane Partnership;
  - the Carbon Sequestration Leadership Forum;
  - the World Business Council for Sustainable Development and the Low-carbon Technology Partnerships initiative, in particular on Carbon Capture and Storage;
  - the Global Compact and Caring for Climate.

OGCI member companies will regularly and consistently report on our progress. Our shared ambition is for a 2°C future. It is a challenge for the whole of society. We are committed to playing our part.



*Helge Lund,*  
BG Group plc



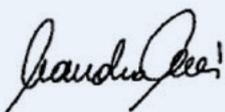
*Josu Jon Imaz,*  
Repsol S.A.



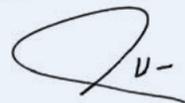
*Bob Dudley,*  
BP plc



*Ben van Beurden,*  
Royal Dutch Shell plc



*Claudio Descalzi,*  
Eni S.p.A.



*Amin H. Nasser,*  
Saudi Aramco



*Emilio Lozoya Austin,*  
Petróleos Mexicanos



*Eldar Saetre,*  
Statoil ASA



*Sh. Mukesh D Ambani,*  
Reliance Industries Limited



*Patrick Pouyanné,*  
Total S.A.

# Summary

**Ambitions for achieving substantive results at the United Nations climate change conference (COP21) in Paris are higher than ever.** The climate change debate has advanced significantly. The science has been recognized for years, but now there is also a general aspiration to try to limit the global average temperature rise to two degrees centigrade in comparison to pre-industrial temperatures, in order to avoid significant climate change. Governments around the world are starting to respond, outlining intended nationally determined contributions and new policies to achieve them.

**The Oil and Gas Climate Initiative (OGCI) – a CEO-led organization currently made up of ten oil and gas companies that want to contribute to climate change solutions – welcomes the move towards greater clarity about the future pace and direction of climate change policy.** The oil and gas sector is an important part of any sustainable attempt to tackle climate change. OGCI member companies produce around one-tenth of the world's energy, so we are well placed to help address the challenge of systematically reducing energy-related emissions, while also meeting rising energy demand. We can better achieve these objectives within comprehensive and stable climate policy frameworks.

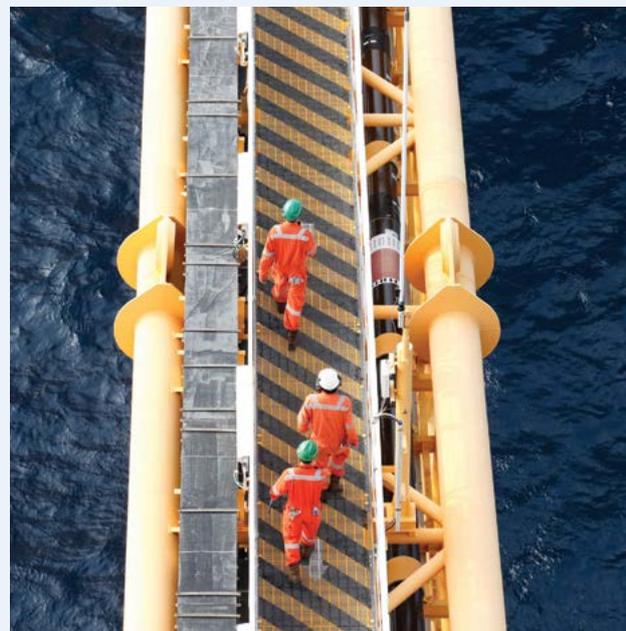
**Simplistic solutions will not work.** Energy demand will continue to grow because the world's population is on the increase and people emerging from poverty need access to electricity and mobility. It will only be possible to reduce greenhouse gas emissions, while continuing to meet growing demand for energy, if we consider every possible avenue.

**Oil and gas companies are already active in developing practical solutions that improve energy efficiency, reduce emissions and facilitate low greenhouse gas technologies.** Data collected from eight OGCI members show that total greenhouse gas emissions from their combined operations have decreased by about 20% since 2005. Within the membership, we have some great examples of efficient operations, some of the pioneers of carbon capture and storage (CCS) technology, and some of today's largest global players in solar, wind and biofuels. OGCI members are also working to ensure that the world can benefit fully from the climate benefits of shifting from coal and other high-emission fuels to natural gas in the power sector, by driving initiatives to reduce methane emissions and minimize flaring.

**OGCI companies are moving beyond their existing core businesses to accelerate their efforts to address climate change.** We all aim to intensify our current initiatives to reduce the impact of our operations and the use of our products on climate change. Some member companies are also already active in renewables and CCS. For the long term, we are also exploring new business models to ensure we can play a competitive and dynamic role in a low greenhouse gas future.

**We set up OGCI to help us, collectively, be a more constructive participant in the response to climate change and to collaborate in reducing the greenhouse gas impact of the world's energy supply.** As an agile and business-focused organization, OGCI members aim to identify and implement the most effective emission-reduction initiatives, and work together where possible on the most important areas of research, development and deployment.

This report is intended to explain what OGCI is doing, and why, and to explore the role oil and gas companies can play to provide more energy with lower emissions.





# 1. How OGCI addresses climate change

The climate science – assessed by the Intergovernmental Panel on Climate Change (IPCC) – is clear.<sup>1</sup> The world has to reduce net greenhouse gas emissions substantially in order to have a chance of limiting the rise in global temperature to two degrees centigrade (2°C) compared to pre-industrial levels, and so avoid significant climate change. The need is urgent, and we are committed to playing our role in responding to this global challenge.

That is why our companies set up the Oil and Gas Climate Initiative (OGCI) in September 2014 to accelerate and guide our collective efforts towards a low greenhouse gas future (Box: *What is OGCI?*). In the first year of activities, our regular meetings have enabled us to build greater levels of trust and understanding, and to move forward quickly in our thinking and engagement. Indeed, OGCI aspires to be a practical means of ensuring that we are an integral part of the global attempt to address climate change – for the future of our planet, as well as for that of our own companies.

## Proactive role

For years, OGCI companies have been proactive in developing and implementing practical solutions to address climate change. Since 2005, data collected from eight OGCI members show that their combined direct greenhouse gas emissions have decreased by 20%. Some of this reduction is due to lower direct production, but it is also a result of the reduction in gas flaring and the implementation of energy efficiency initiatives.

Companies have chosen different routes, some using innovative internal tools to help incentivize the implementation of lower greenhouse gas technologies, others investing in renewables or focusing on developing the potential of carbon capture and storage. We continuously look for opportunities to boost our own operational efficiency, investing heavily in reducing flaring, for example. This contributes towards the mitigation of emissions, while in some cases increasing our own competitiveness and profitability through increased gas sales or lower costs. OGCI members are also involved in conducting specific research and development (R&D) initiatives to nurture early-stage technologies and explore new



Eldar Saetre  
CEO, Statoil

“At Statoil, we don’t question the scientific consensus on human-induced climate change. We embrace the need to meet the 2 degree scenario.”

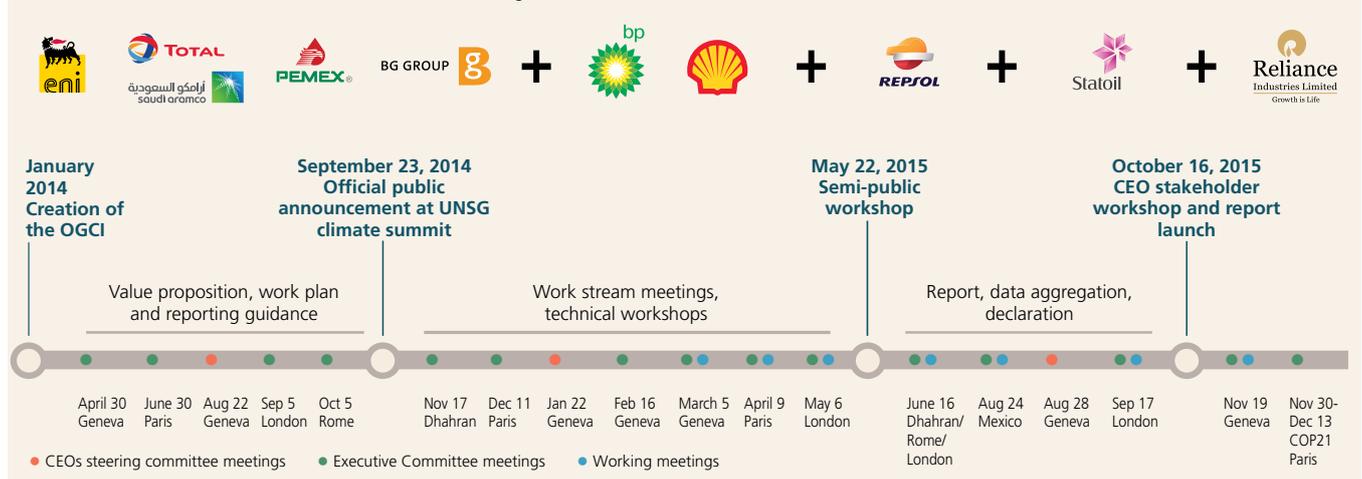
business models.

In terms of the discussion on how to tackle climate change collectively, however, more can be done to rectify the misconception that our industry is not engaged in a constructive way.

We intend to work even more closely with different partners and with govern-

<sup>1</sup> Intergovernmental Panel on Climate Change (IPCC),  
*Fifth Assessment Report, 2013*

## Oil and Gas Climate Initiative – the first year



## What is OGCI?

The OGCI is a voluntary initiative that aims to pool knowledge within the oil and gas production industry, and become a recognized and ambitious provider of practical solutions for climate change mitigation. It began as a conversation between several chief executives at the World Economic Forum Annual Meeting in Davos in January 2014. We announced the formation of OGCI, with seven members, at the United Nations Climate Summit in September 2014. Over its first year, OGCI has expanded to include ten members. Combined, OGCI members produce 29 million barrels of oil equivalent a day, which is around 20% of global oil and gas production and 10% of global energy supply.

OGCI is led by a steering committee comprising member company chief executive officers (CEOs). On a day-to-day basis, it is organized by an executive committee comprising senior representatives of each member company, supported by World Economic Forum energy and climate team representatives. In addition, member companies' technical experts meet regularly to explore specific topics.

OGCI's activities in 2015 have focused primarily on sharing individual experiences with efforts to reduce greenhouse gas footprints and aggregating emissions-related data to better measure our various contributions. Initially, three work streams were created to focus our efforts. One has been analyzing the most effective approaches to reducing methane emissions, minimizing natural gas flaring and boosting energy efficiency in gas operations. Another has been exploring long-term solutions, exchanging

experiences on renewables and other low greenhouse gas technologies, while getting a better understanding of internal and external perceptions on the pace and direction of change. A third has discussed the different internal emission reduction instruments that companies employ to ensure that their activities and projects take climate change concerns on board.

Importantly, OGCI is flexible and voluntary. This allows individual member companies – which have different profiles, global presence, investment portfolios and shareholder demands – to collaborate on joint projects where there are common interests. It also means companies are not obliged to participate in specific areas where they have different views on the appropriate approach. As a result, OGCI's members are able to build mutual confidence in working together and move forwards in different areas to address climate challenge.

The strong working relationships built up over its first year have enabled OGCI to become a springboard that helps members deepen their engagement with outside organizations. OGCI also works with a variety of external stakeholders and experts, in order to test assumptions, provide new insights and open up new opportunities for activity. For example, at the first semi-public meeting in May 2015 – a significant milestone in our development – Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change, challenged us to define ambitious but realistic pathways to a low greenhouse gas economy.

| BG Group   | BP                | Eni                     | Pemex                       | Reliance                   | Repsol               | Saudi Aramco          | Shell                  | Statoil             | Total                   |
|--|-------------------|-------------------------|-----------------------------|----------------------------|----------------------|-----------------------|------------------------|---------------------|-------------------------|
|  |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| <b>Year founded</b>  |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| 1996   | 1909              | 1953                    | 1938                        | 1973                       | 1927                 | 1933                  | 1907                   | 1972                | 1924                    |
| <b>Headquarters</b>  |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| Reading, UK  | London, UK        | Rome, Italy             | Mexico City, Mexico         | Mumbai, India              | Madrid, Spain        | Dharran, Saudi Arabia | The Hague, Netherlands | Stavanger, Norway   | Paris, France           |
| <b>CEO (appointed)</b>   |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| Helge Lund (2015)  | Bob Dudley (2010) | Claudio Descalzi (2014) | Emilio Lozoya Austin (2012) | Sh. Mukesh D Ambani (2002) | Josu Jon Imaz (2014) | Amin H. Nasser (2015) | Ben van Beurden (2014) | Eldar Saetre (2015) | Patrick Pouyanne (2014) |
| <b>Employees, 2014</b>   |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| 5,000  | 84,500            | 84,000                  | 153,000                     | 25,000                     | 27,000               | 60,000                | 94,000                 | 22,500              | 100,000                 |
| <b>Countries with operations</b>                                       |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| 20   | 80                | 83                      | -                           | 8                          | 47                   | -                     | 70                     | 30                  | 130                     |
| <b>Barrels of oil equivalent per day, million, 2014 (equity basis)</b> |                   |                         |                             |                            |                      |                       |                        |                     |                         |
| 0.6  | 3.2               | 1.6                     | 3.7                         | 0.1                        | 0.7                  | 12.1                  | 3.1                    | 1.9                 | 2.1                     |

Note: Reliance joined OGCI in October 2015. It was not involved in developing this report, but supports its conclusions.

# 20% fall in OGCI members' greenhouse gas emissions in the past decade



**Helge Lund**  
CEO, BG Group

“There is no simple solution to climate change or formula to the transition to lower carbon energy. The scale of collaboration required is virtually unprecedented and the OGCI is a valuable platform for committed companies to work together and accelerate progress.”

ments as they shape a long-term policy and develop options to move towards a low greenhouse gas economy.

Companies need to ensure that their activities are commercially viable, by being aligned with customer demand, stakeholder and shareholder concerns and regulatory developments in different countries. We are encouraged to see that:

- Business customers are increasingly interested in working with us to deliver more climate-friendly solutions such as energy-efficient fuels and lubricants, suggesting that market demand is there if we invest more heavily in this direction.
- Influential shareholders are showing greater interest in understanding

the long-term implications of climate change on the oil and gas industry. A number of listed oil and gas companies are working actively to improve disclosures on this topic.

- International momentum is building towards ensuring that the COP21 meeting in Paris achieves an effective global climate change agreement. We want to play a role in helping to achieve the outcomes agreed.

### More energy, lower emissions

OGCI is channeling the technical and organizational resources and capabilities of its members into helping tackle the tough dilemma at the heart of climate change: the need to reduce global greenhouse gas emissions, while at the same time meeting the growing demand for energy, especially in emerging countries. Both access to energy and action to combat climate change are enshrined in the UN's sustainable development goals for 2015-30.

Our industry is key to addressing this complex challenge. It is involved in power and electricity generation to drive all industries, fuelling transport in the air, sea and on land, heating and cooling buildings and

producing feedstock for the petrochemical industry which produces a wide range of goods used by billions of people every day. It is also involved in developing and implementing dozens of practical technologies and processes to reduce emissions.

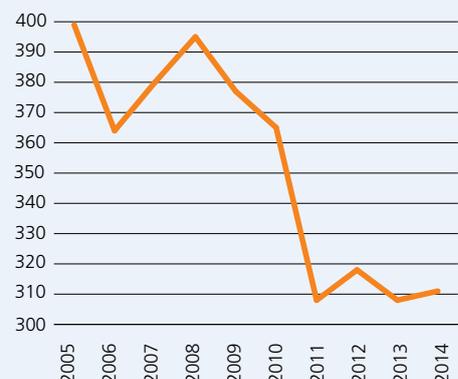
Simplistic solutions that do not recognize the reality and complexity of the challenge will not succeed. This is true for those who argue that investment in oil and gas should stop regardless of the impact on access to electricity and mobility, as well as energy security generally. But it is equally true for those who argue that the need to produce affordable, reliable and viable energy should take precedence over addressing climate change.

We are trying to address the challenges head on by identifying where we can make progress and what the real challenges to further progress are – whether technical, commercial or regulatory. We are identifying potential contributions that would benefit from common effort and those we need to work on as individual companies. In addition, we are also engaging with outside organizations where we see value in collaboration or in getting an external view.

### OGCI data

#### Total greenhouse gas emissions (MtCO<sub>2</sub>e operated basis)

- Greenhouse gas emissions have fallen around 20% since 2005 for the eight OGCI companies reporting data.
- The trend is based on a combination of investments made by companies to reduce greenhouse gas emissions and divestments, as well as other factors that affect performance.



Source: OGCI, derived from eight companies



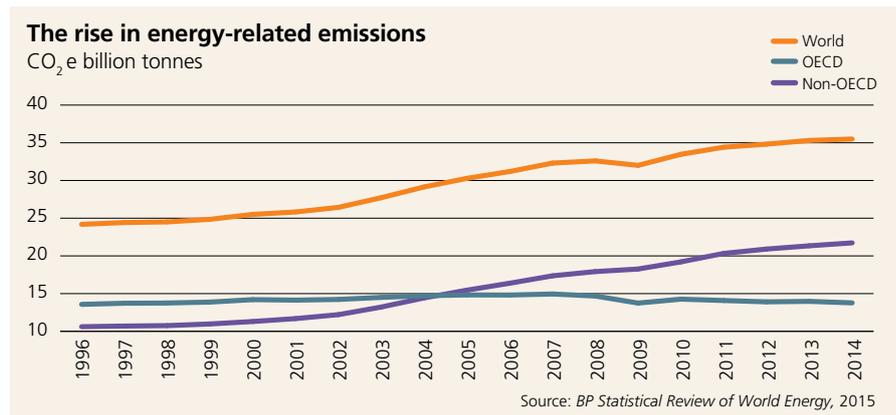
## 2. Reducing greenhouse gas emissions: the role of the oil and gas sector

Energy is at the core of the climate change challenge. Its production and use in industry, transportation and buildings accounts for over two-thirds of anthropogenic greenhouse gas emissions, according to the IEA, with oil and gas accounting for almost half.<sup>1</sup> The level of emissions has risen sharply over the past 20 years as hundreds of millions of people have gained access to energy for the first time. With a further billion or more people poised to escape energy poverty over the next few decades, demand could continue to rise by as much as 33% by 2030 before stabilizing.<sup>2</sup>

The challenge is to supply that growing demand for energy while significantly reducing emissions. It is an enormous task. Despite all the interest in climate change over the past few decades, energy-related greenhouse gas emissions have continued to rise and in 2014 were 39% higher than in 2000. That reflects the rapid growth of developing countries which together account for 61% of emissions, up from 44% just 15 years ago.<sup>3</sup>

### Positive signs

There are positive signs that economic growth is becoming less energy-intensive – and energy less emissions-intensive. In 2014, for the first time, International Energy Agency (IEA) statistics showed that global energy-related carbon dioxide emissions remained flat despite global economic growth of 3%. That small but vital success was due to a combination of many factors – a rapid increase in renewable capacity, improved energy efficiency in China, better vehicle and fuel efficiency in the EU and US, and the shift from coal to gas in the US power sector that has occurred over the



past five years. Securing and accelerating the pace of decline will, however, be a major challenge and will need commitment and effort from all parts of society. Even in OECD countries, where greenhouse gas emissions have fallen in recent years, the reduction has measured just 3% in 15 years.

Renewables will play an increasingly important role, but they are not likely to replace fossil fuels as the dominant component of the primary energy mix in the foreseeable future. Wind and solar represent just 1% of the world's energy use and other renewables like bioenergy and hydro

a further 12%.<sup>4</sup> In the power sector, the shift may be quicker, given climate policy interventions and the falling costs for wind and solar power.<sup>5</sup> But whatever the pace of change, energy systems throughout the world will still use a combination of gas, oil and coal to provide a significant portion of their energy needs over the next few decades. Even under the IEA's most ambitious 2°C pathway, the '450 scenario', oil and gas would still make up 49% of the energy mix in 2030.<sup>6</sup>

1 International Energy Agency (IEA), *CO<sub>2</sub> Overview*, 2014

2 International Energy Agency (IEA), *World Energy Outlook 2014*

3 BP Statistical Review of World Energy, 2015

4 International Energy Agency (IEA), *Energy and Climate Change, World Energy Outlook Special Report 2015*

5 Bloomberg New Energy Finance, *New Energy Outlook, 2015*

6 International Energy Agency (IEA), *Energy and Climate Change, World Energy Outlook Special Report 2015*

Energy demand could  
rise another

**33** % by 2030

That reality underlines an essential point: to bring emissions down sooner rather than later, while continuing to meet the growing demand for energy, it is vital to invest in minimizing the climate impact of fossil fuels. Oil and gas companies have the experience, the long-term and international vision and the technological capabilities to help deliver this. OGCI is focusing on four main levers to reduce the greenhouse gas emissions from fossil fuels, which are analyzed in the rest of the section:

- Promoting the growing use of natural gas in the power sector
- Reducing methane emissions and minimizing flaring
- Improving efficiency in operations and consumption
- Ensuring the viability of carbon capture and storage



## Facilitating the shift from coal to gas

One of the ways to reduce energy emissions without slowing economic growth is for the power sector to use more natural gas and less coal or fuel oil, wherever possible. On average, gas emits around half the carbon dioxide emissions of coal when burned for power generation, and yet globally more than twice as much power is produced by coal. If all existing coal-fired power stations were switched to state-of-the-art gas-fired plants tomorrow, we could avoid around 10% of total energy-related greenhouse gas emissions.<sup>7</sup>

That is not sufficient on its own, but it makes natural gas an important part of the

solution. The shift to gas would also have other benefits, such as helping to improve air quality by reducing the smog that is plaguing people in the fast-growing cities in countries where coal-fired power plants – and typically sulphur dioxide, fine particles and other pollutants – are the norm. Gas-fired power plants can serve as a good partner for intermittent renewables, which are becoming more dominant in the power grid. Gas plants can also be brought online quickly to meet frequently fluctuating power demands.

Shifting from coal to natural gas is technically feasible and gas is available across the world due to advances in liquefied natural gas exports. Many oil and gas companies are, indeed, focused on shifting their portfolios towards a greater emphasis on gas. OGCI data from eight companies shows that the share of natural gas in oil

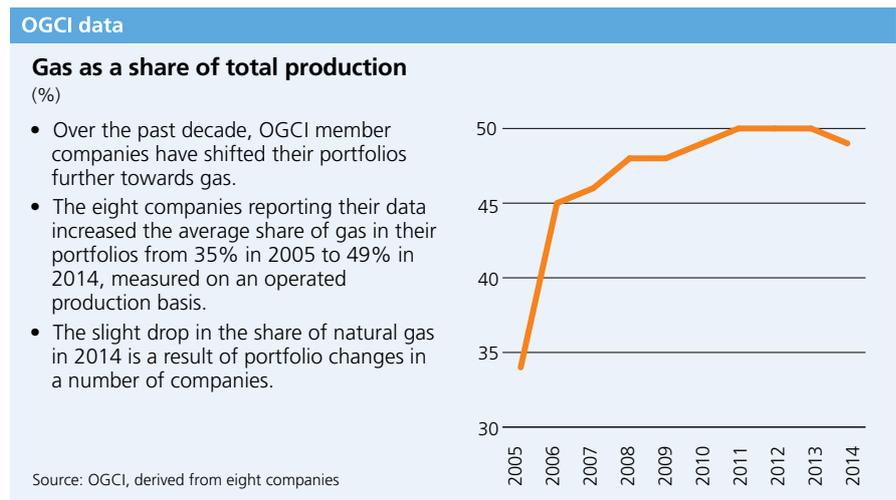
<sup>7</sup> See comments by Laszlo Varro, Head of Gas, Coal and Power Markets Division, IEA to the BBC, 9 June 2015. Total emissions from energy amounted to 34GtCO<sub>2</sub>e in 2010 (IPCC), of which 43% or 14GtCO<sub>2</sub>e was from coal combustion. Since gas emits half as much as coal, a complete switchover would yield a saving of 7GtCO<sub>2</sub>e – rounded down to 5GtCO<sub>2</sub>e to take a conservative estimate – or around 10% of total emissions.

# 99% of new coal capacity will be built in developing economies

and gas production portfolios has risen from just over a third to almost a half over the past decade. There are, however, two main challenges to realizing the full climate benefits of gas.

**Reducing the methane emissions associated with gas:** Natural gas is cleaner than coal, but to maximize the differential, it has to be produced well – and that means limiting methane emissions. This topic is covered in detail in the next section.

**Ensuring gas is competitive and available:** Since 2005, when the shale revolution brought large volumes of gas on stream, US coal consumption has fallen by over 20%. The shift to gas accounted for more than a quarter of the reduction in electricity-related emissions over that time compared to a business-as-usual scenario, according to the US Energy Information Administration.<sup>8</sup> The UK's 'dash for gas' in the 1990s had a similar effect. But in many emerging countries, as well as in Europe today, natural gas is finding it hard to increase its market share. There are different reasons in different countries – the availability of cheap coal, the price of imported



liquefied natural gas or the lack of gas infrastructure.

As a result, coal consumption is now rising faster than gas consumption globally. Renewables will play a significant role in building energy systems around the world, but – if current energy trends continue – so will coal. Bloomberg New Energy Finance estimates that 99% of new coal capacity will be built in developing economies up to

2040.<sup>9</sup> As renewables are rapidly added to the mix, the risk is that utilities will continue to use coal as the back-up fuel of choice.

That could lock in high levels of greenhouse gas emissions and air pollution for decades. Finding ways to accelerate both supply and infrastructure in countries where it is most needed is urgent if the world is to reap the benefits of gas for reducing greenhouse gas emissions.



<sup>8</sup> US Energy Information Administration, *Today in Energy*, October 23, 2014

<sup>9</sup> Bloomberg New Energy Finance, *New Energy Outlook*, 2015

**55%** fall in OGCI members' methane emissions since 2008



**Claudio Descalzi**  
CEO, Eni

“It is crucial to secure a broadbased commitment to chart a low carbon future that will provide an effective response to the climate challenge without stifling the legitimate development aspirations of emerging nations.”

## Minimizing flaring and reducing methane emissions

Climate change research has typically focused on carbon dioxide emissions, but recent work on methane has explored its significant immediate impact on global warming. Clearly, solutions are needed to address both carbon dioxide and methane emissions.

Unlike carbon dioxide emissions, methane emissions are short-lived, but over a 20-year period they can trap up to 84 times more heat in the atmosphere.<sup>10</sup> Consequently, reducing methane emissions now can slow the pace of global warming in the short term, allowing time for other carbon reduction measures to be agreed and put in place as well. While not a solution on its own, it is an essential ingredient to limiting the rise in temperatures. Indeed, the International Energy Agency (IEA) lists reducing methane emissions from the oil and gas sector as one of five urgent ‘game-changing’ measures that could contribute to achieving the 2°C ambition.<sup>11</sup>

Methane emissions in the oil and gas sector come from a variety of different sources. Some are controlled emissions that are the result of venting gas predominantly for safety or operational reasons. Well-run operations have minimized this practice substantially in recent years. In the US, for example, ‘green completions’ – a technology that was pioneered 15 years ago by BP and is now widely used in onshore fields to ensure that gas released between drilling and production is captured and used – have accounted for over a third of avoided methane emissions in the past decade, according to the US Environmental Protection Agency’s Natural Gas STAR programme. The procedure recently became mandatory in the US and is now beginning to be implemented in other parts of the world. Repsol, for example, recently rolled out South America’s first green completion project in Bolivia.

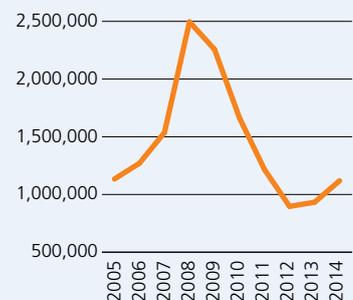
The bigger challenge is fugitive methane emissions that can occur across the gas

### OGCI data

#### Methane emissions

(tonnes)

- Total methane emissions remain at around the same level as a decade ago.
- They rose sharply from 2005 to 2008 due to a number of factors including the development of onshore shale gas.
- Emissions have fallen by 55% since 2008, reflecting attention from companies including the reduction of flaring and venting, investments to reduce methane emissions sources, as well as portfolio changes.
- There is still uncertainty around the measurement of methane emissions, and companies are working to better understand and quantify their emissions.



Source: OGCI, derived from eight companies

<sup>10</sup> Intergovernmental Panel on Climate Change (IPCC), *Fifth Assessment Report*, 2013

<sup>11</sup> International Energy Agency (IEA), *Energy and Climate Change, World Energy Outlook Special Report 2015*

value chain – during production, processing and transport. Monitoring and accurate estimation of emissions from this array of sources is difficult, making it difficult to be precise about the scale of the problem. Much of the new evidence-based research focuses on onshore gas fields in the US, but these new studies could be skewing estimates for other types of facilities such as offshore gas fields, where many of the methane sources identified are not present. It is already clear that methane emissions vary significantly by location and type of field.

OGCI recognizes that action needs to be based on bottom-up data and we are working to find ways to standardize quantification (see: *The data challenge*). Our initial data aggregation exercise, derived from eight OGCI members, shows that after rising sharply until 2008, methane emissions have more than halved over the past six years.

Companies are increasingly using infra-red cameras to quickly identify and subsequently repair equipment leaks as one source of methane emissions in existing operations.<sup>12</sup> BG Group, Shell and Statoil, among other companies, are implementing use of infrared cameras at facilities across the world with pilot projects showing a substantial drop in methane emissions. Locating the small leaks in operations is challenging. That is why, for example, these companies are collaborating with the Environmental Defense Fund and others to accelerate the development and deployment of affordable continuous methane detectors that could be used consistently across operations. For newly established gas operations, different approaches are possible. BP, for example, is

<sup>12</sup> *Measurements of Methane Emissions at Natural Gas Production Sites in the United States*, University of Texas Study, 2013



working on a gas project in Oman which is intended to eliminate potential sources of emissions by changing the design from the outset rather than fixing methane emissions afterwards.

## The data challenge

As a sector, the oil and gas industry collects huge amounts of data on issues related to climate change, some of which is used to provide official statistics. Individual companies, however, may take differing approaches to collecting it from their operations around the world, while some is based on estimates. One of OGCI's first actions was to decide where it could add most value by collecting in-house data in a standardized format, working with our strategic partner the World Economic Forum as a neutral body to receive the data, check it for consistency, aggregate and anonymise it for further analysis. OGCI companies have the flexibility of deciding if they want to share data on a topic-by-topic basis. The data will be published on the OGCI website.

We chose the following priority areas:

- Gas flaring and methane emissions, where the reliability of existing data and models can be improved
- Carbon capture and storage, where data availability is limited
- Energy efficiency where companies have different methodologies

We have already made significant progress on the first two areas. Building on work already done by others,<sup>1</sup> OGCI members agreed on a common methodology to estimate gas flaring. For methane we have decided to find ways to benefit from the work of the Climate and Clean Air Coalition (CCAC) and to optimise quantification methodologies, so as to move towards a more robust picture of emissions.

Over the coming years, we will continue to reinforce our methodologies on existing areas as well as work to streamline approaches to measuring energy efficiency. In CCS, we aim to accurately measure avoided carbon dioxide emissions while taking into account the additional energy required in CCS operations. In the meantime, however, we have also started to collect a broader range of indicators designed to understand where and how companies are investing in lower greenhouse gas alternatives. We will also begin to develop key performance indicators around specific solution areas, such as access to energy or renewable energies.

<sup>1</sup> These include the Global Gas Flaring Reduction Partnership (GGFR), the World Bank and IPIECA, the global oil and gas industry association for environmental and social issues.

# 37% fall in OGCI members' gas flaring over the past decade

## Eliminating routine flaring

Oil and gas companies have made significant efforts over the past few years to reduce flaring across their operations. This controlled burning of gas is sometimes necessary in the initial commissioning of a well, during the start-up of operations, and as a safety release or during maintenance. It is, however, the burning of natural gas associated with oil production – routine flaring – that is the real problem. Measuring overall industry progress is difficult. There is no real agreement on the size of the flaring problem globally, since satellite measurements are merely indicative and there is no high quality global flaring data compilations available. Nevertheless, the World Bank believes the gas routinely flared globally, if used to generate power, would be sufficient to cover Africa's current electricity consumption.

All OGCI members are actively involved in reducing flaring. Our data aggregation, which so far covers seven OGCI companies, shows that the overall volume of gas flared has almost halved over the past six years. Most companies are engaged in the World Bank's zero routine flaring initiative, which commits government, companies and development banks to design new oil facilities to maximize use, re-injection or marketing of associated gas, rather than burning it off,

while working to eliminate routine flaring in existing oil production operations by 2030.

Finding solutions in countries where there is no gas infrastructure present or no market for natural gas is a real challenge. There are three workable approaches:

- capturing the gas for domestic power generation or other uses
- liquefying the gas for export
- re-injecting the gas into reservoirs

Saudi Aramco, for example, has shifted from being one of the world's largest sources of flaring in the 1980s to one of the least now. It achieved that through a systematic programme designed to create a viable domestic market for natural gas, by developing the infrastructure to recover, process and supply natural gas to newly built power plants and petrochemical facilities. With this system in place, it implemented a flare minimization roadmap, comprising plans tailored to each facility.

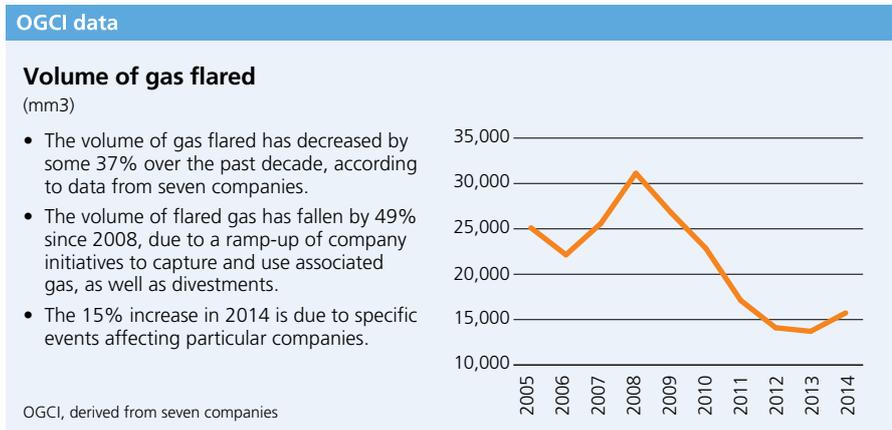
Developing that infrastructure is difficult in locations where governance and security concerns make it difficult for international operating companies to develop and finance the complex projects needed to stop flaring. This is often, however, where routine flaring is most common and therefore the need is the greatest.

There have been some significant recent successes. Total, for example, was able to stop routine flaring at Ofon 2, a Nigerian offshore field at the end of 2014 by piping gas 70km to an offshore hub for export to a liquefied natural gas plant onshore. Eni invested US\$300 million in Congo to double capacity at one power plant and build a new larger one, creating a domestic market for the gas from the M'Boundi field it acquired in 2007. It also worked with the government to provide support to upgrade and expand its electricity grid, with the result that M'Boundi now supplies power to 350,000 people who previously had no access to electricity. With the completion of a gas re-injection train to handle surplus associated gas (and improve oil recovery), Eni was able to eliminate routine flaring entirely at M'Boundi in 2014.

## Impact on emissions

The impact of these kinds of investments is huge. Total was able to reduce the overall volume of gas flared by 10%, as a result of Ofon. Eni set out to radically reduce flaring in 2008, at a time when half of its operational greenhouse gas emissions came from flaring and half from combustion. Now, following total investment of US\$2 billion, less than 15% is from flaring, allowing Eni to halve its greenhouse gas emissions over the past decade.

Flaring reduction involves major investments – but it can also have very clear financial returns, as gas is monetized and oil fields are upgraded. Pemex's recently launched CCAC flaring reduction programme, for example, identified opportunities for savings of more than US\$80 million a year and a payback period of less than a year in some cases, and no more than four years in others. At the same time, the programme is expected to mitigate 8.2 million tonnes of carbon equivalent over its lifetime.



Only **12%** of primary energy is transformed into transport, heat, cooling and light



**Emilio Lozoya Austin**  
CEO, Pemex

“No degree of success in our environmental policies will suffice if we fail to tackle the economic challenges before us. So, when dealing with the crucial question of sustainability over time, a comprehensive approach is the name of the game.”



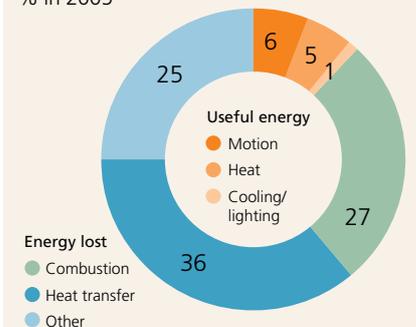
## Improving energy efficiency in operations and product use

Energy efficiency is one of the most cost-effective levers to reduce greenhouse gas emissions – and its potential is significant. Only 12% of primary energy is converted into directly useful transportation, heat, cooling and light – leaving significant room for improvement.<sup>13</sup> Indeed, the IEA estimates that almost half of the emissions savings needed to get back on track for the 2°C scenario by 2030 would have to come from energy efficiency measures.<sup>14</sup> Oil and gas companies have been very active in this area and are ready to play a substantial role in helping to realize this potential, both by accelerating their own energy efficiency and conservation and by making greater strides on the efficiency of products and the way they are used.

### Operational efficiency

Oil and gas companies use a significant amount of energy in their own operations. Since 2000, industry as a whole (including the oil and gas sector) has improved its operational energy efficiency by an average of 1.3% per year.<sup>15</sup> At the same time,

**Share of global energy used and lost**  
% in 2005



Source: Energy, Volume 35, 2010

<sup>13</sup> Jonathan Cullen and Julian Allwood, *Theoretical Efficiency Limits for Energy Conversion Devices*, Energy, Volume 35, Issue 5, 2010

<sup>14</sup> International Energy Agency (IEA), *Energy and Climate Change, World Energy Outlook Special Report 2015*

<sup>15</sup> BP, *Energy Outlook 2035*, 2015

## 60% of produced oil is consumed by transportation



**Bob Dudley**  
CEO, BP

“As oil and gas companies, we can be part of the solution, providing gas as a sustainable fuel for power and industry, pursuing energy efficiency in our operations and products and supporting government efforts to make lower carbon options more competitive.”

however, the difficulty of producing oil and gas from fields that are maturing, less accessible or non-conventional (such as shale and oil sands) has risen, making today's operations one-third more energy-intensive on average.<sup>16</sup> As a result, the industry needs to intensify its efforts to boost its energy efficiency.

When energy efficiency is made a priority – and implemented through strict energy management systems and investment in efficiency-focused technology – companies can accelerate progress. Saudi Aramco, for example, has increased energy efficiency at existing facilities by 2% a year over the past

15 years. BG Group is working on reducing the carbon intensity of its portfolio by 10% between 2013 and 2017 and delivered over one million tonnes of emission reductions between 2007 and 2012. Repsol's energy conservation plan, applied to all its industrial facilities, cut 3.1 million tonnes of carbon dioxide emissions from 2005-13. Eni's energy saving actions have resulted in total greenhouse gas emissions savings of around one million tonnes per year compared to 2008.

Driven by emissions reduction targets and a Norwegian carbon tax that is currently around US\$50 tonne, Statoil has managed to save annual emissions amounting to 640,000 tonnes from operations on the Norwegian continental shelf since 2009. This has involved numerous efficiency projects. Some of these were large-scale initiatives, such as upgrading gas turbines. As important, however were multiple smaller innovations and improvements that led to significant energy savings and reduced carbon intensity.

Identifying and implementing far-reaching changes is crucial. Repsol's energy efficiency technicians, for example, were able to reduce energy use in their main refinery units by 3-10% by developing a monitoring

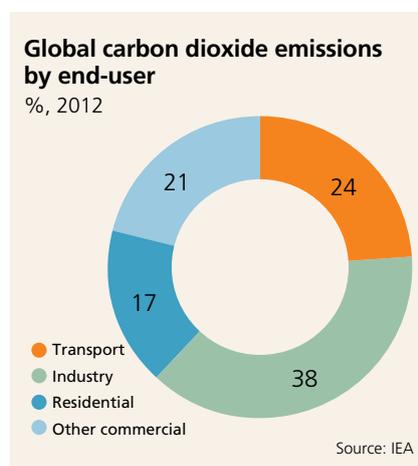
tool to help define the optimum cleaning strategy for heat exchangers. BP was able to reduce the carbon intensity of energy use at Valhall, one of its major North Sea production platforms, by laying a 300km undersea cable to the Norwegian shore. By using hydroelectric onshore power instead of its own power generation facilities, BP reduced annual carbon dioxide emissions from Valhall by 89%.

Pemex is focusing on transforming steam, generated through various industrial processes, into electricity. Since 2014, it has already managed to save 940,000 tonnes of carbon dioxide emissions a year by installing a cogeneration plant in its Nuevo Pemex gas processing centre, producing electricity for 190 Pemex sites. By 2019, the company plans to have 11 cogeneration plants in operation, enough to shift it from being Mexico's main electricity consumer to becoming a net producer – with the aim of avoiding over 13 million tonnes of carbon dioxide emissions a year. The company recently created an affiliate, Pemex Cogeneration and Services, to manage this business.

### Product and user efficiency

Around 10-20% of the total emissions from the oil and gas sector are from operations. The remaining 80-90% comes from the use of our products in industry, power plants, buildings and transportation. In other words, a 1% saving in these areas is equivalent to at least a 4% improvement in operational efficiency. Finding effective ways to continue improving the efficiency of our customers' use of oil and gas products is therefore a key priority for OGCI.

Transportation is an obvious target for collaboration with oil and gas companies. The sector consumes 60% of produced oil and many companies already partner with auto-makers and serve consumers through their service stations. It also accounts for more than a quarter of global energy



<sup>16</sup> IPIECA, *Saving Energy in the Oil and Gas Industry*, 2013



- BG Group and Shell are exploring the future potential for gas-fuelled transportation.
- Eni provides natural gas to over 800,000 gas-powered vehicles in Italy, Europe's largest fleet.

Some oil and gas companies are also starting to look more closely at ways to support the adoption of electric vehicles, car-pooling and vehicle autonomy and to understand the potential of new business models that could significantly impact emissions as they evolve. Repsol, for example, is installing quick-charge 100% renewable-fuelled charging terminals in its service stations in Spain. Eni has developed Enjoy, a car and scooter sharing service operating in the main cities in Italy. Shell, BP, Repsol, Eni, Total and Pemex are developing advanced biofuels, while Saudi Aramco is pioneering vehicle technology that can capture carbon onboard and in motion.

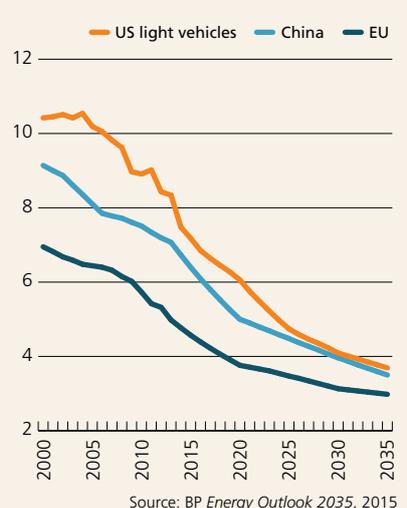
consumption and 24% of energy-related greenhouse gas emissions.<sup>17</sup> As the world's car fleet doubles over the next 15 years and possibly triples by 2050, we want to play our part in helping ensure that overall transport emissions still decline.<sup>18</sup>

Several OGCI members collaborate with automotive manufacturers to improve engine and transmissions design, accelerate hybridization and optimize fuel and lubricant efficiency. For example:

- Repsol has designed a new series of fuels which prolong engine performance and thus maintain the minimum fuel consumption guaranteed by the manufacturer over time.
- BP is currently launching a series of fuels that restore the cleanliness of critical components such as fuel injectors, reducing fuel usage by up to 7%.
- Total has introduced fuel economy oils for 15 different types of vehicles, using

a new technology that reduces friction and reduces fuel consumption by up to 3%. It has also opened a plant to recycle engine oil on a massive scale.

**Vehicle efficiency of new cars**  
litres per 100 km



Efforts to increase the efficiency of transportation are already showing promising results – the fuel economy of new cars has improved at an average of 2% per year over the past decade, according to a study by the Global Fuel Economy Initiative.<sup>19</sup> Since today's developing countries will account for 80% of the world's car fleet in 2050 it is vital to ensure that fuel economy in new fleets continues to improve – as has happened in China.<sup>20</sup> Crucially, solutions need to be relevant for, and developed in, those countries where automotive growth is strongest.

Forging effective efficiency partnerships with other major energy users – from power plants to industry and city developers – could be a useful focus of OGCI's work in the coming years.

17 International Energy Agency, *CO<sub>2</sub> Emissions from Fuel Combustion*, 2014

18 Global Fuel Economy Initiative

19 Global Fuel Economy Initiative, *International Comparison of Light-Duty Vehicle Fuel Economy*, 2015

20 Global Fuel Economy Initiative

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**13** % of greenhouse  
gas mitigation needs to come  
from CCS



**Ben van Beurden**  
CEO, Shell

“The global energy system is moving towards a progressively cleaner, less carbon-intensive model, characterized by a greater share of natural gas and renewables – and a key role for carbon capture and storage.”

## Mitigating emissions through carbon capture and storage

Carbon capture and storage (CCS) technology could play an important role in efforts to limit the global average temperature rise to 2°C, by removing carbon dioxide originating from power generation and industrial plants. To reach this, CCS will need to deliver 13% of required emissions reductions by 2050, according to the IEA.<sup>21</sup> That does not make CCS a single solution that will allow the world to keep using oil, gas and coal in a low greenhouse gas world. However, since fossil fuels will continue to dominate the energy mix for some time to come, it is a key technology that requires more attention, in order to address the challenges to large-scale and widespread deployment.

The main obstacle to CCS is not technology. The different processes involved are relatively straightforward: the carbon dioxide is separated out and then compressed, dehydrated, transported and stored deep

underground. Each of the elements of this technology is already used within the industry. Indeed, a few significant CCS projects have been operating for over 20 years.

A major challenge, however, is the lack of market mechanisms to develop projects that have the prospect of financial returns. Currently, CCS adds a third or more to the cost of producing electricity in a gas plant and around a half in coal-fired plants, which are more carbon-intensive.<sup>22</sup> Widespread deployment of CCS technology by industrial users of fossil fuels would reduce these costs, in part by developing ways to reduce its use of energy. More work is also needed to confirm there is sufficient geological storage capacity in the right locations for large-scale deployment.

In the long run, however, the IPCC calculates that the cost of reaching the 2°C scenario, without the help of CCS, would be substantially higher – by around 140%

– despite the challenges of deploying CCS on a sufficiently large scale.<sup>23</sup>

### Making progress

The gap between potential and reality has led to a perception among some stakeholders that CCS is not viable on a large scale – but that is misleading. CCS is not yet on track to realize its full potential, but it is making progress. The IEA's 2°C scenario calls for 30 large-scale projects to be in operation by 2020:<sup>24</sup> there are 22 projects already underway and a further 35 projects in various stages of development.<sup>25</sup> Importantly, although some of these projects may

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21 International Energy Agency, *Energy Technology Perspectives*, 2015

22 E.S. Rubin et al, *The Cost of CO<sub>2</sub> Capture and Storage*, International Journal of Greenhouse Gas Control, 2015

23 Intergovernmental Panel on Climate Change, *Fifth Assessment Report*, 2013

24 International Energy Agency, *Technology Roadmap: Carbon Capture and Storage*, 2013

25 Global Carbon Capture and Storage Institute

**140%** higher cost of mitigation without CCS



not come to fruition, they are being developed in those countries and sectors where they are needed most:

- Over two-thirds of all projects that are currently operating or under construction are in the US or Canada, but for those under development the largest share is in Asia – with one third of projects in China alone.
- More than half of the upcoming projects are linked to power generation, compared to those underway that are mostly in oil and gas production.
- Over half of the upcoming projects aim to store carbon dioxide rather than using it to enhance oil recovery

The oil and gas sector is very much involved in the development of CCS. It has the technological knowledge and capabilities to further evaluate and develop geological storage, capture technologies and carbon dioxide utilization for enhanced oil or gas recovery, or other purposes. The experience and capabilities of the oil and gas sector give it a strong platform to pursue these objectives. OGCI plans to support initiatives that would accelerate the development of CCS. A large-scale ramp up of CCS plants will be required by 2050 to meet the IEA's carbon avoidance target. To achieve this step change, much work still needs to be done.

## Sharing expertise

Several OGCI members are operating or currently developing large-scale CCS projects. Statoil, a pioneer in the sector, has captured and stored more than 20 million tonnes of carbon dioxide since 1996, with two fields currently using the technology. Shell, another pioneer, is in the process of implementing the first CCS operation associated with an oil sands upgrader, with support from the Alberta government. When fully operational in late 2015, it will store one million tonnes of carbon dioxide per year. Shell is also currently working on a potential CCS project for a gas-fired power plant in Scotland, which could be partially funded by a higher government-imposed clean energy tariff, in addition to being supported by the UK government's CCS commercialization programme. Saudi Aramco is working on a demonstration project that will capture carbon dioxide from a gas treatment plant, transport it 85 km by pipeline and inject it into the Uthmaniyah oil field to assess its potential for enhanced oil recovery.

Alongside these large-scale plants, several companies are experimenting with smaller-scale operations. Total, for example, has tested a carbon capture and storage system using gas oxy-combustion technology, combined with injection in a depleted gas

field in France. Pemex is designing a pilot study to capture carbon dioxide vented from an ammonia plant and send it to a nearby oil well to use it to enhance oil recovery and store it. BP's experience with injection into the In Salah aquifer in Algeria, alongside its partner Sonatrach, provided valuable lessons in proactive reservoir management and planning for decommissioning.

### Roadmaps and action plans

In addition to deployment, several OGCI companies are working closely with governments to develop national CCS strategies and to identify suitable storage reservoirs in the right locations. In 2014, for example, Pemex developed a Roadmap for Carbon Capture Utilization and Storage in Mexico, along with the federal government and other institutions, which are now working together to implement the strategy. BG Group has a technology research partnership in Brazil, focusing on how to improve the efficiency and lower the costs of CCS. OGCI intends to hold a series of dedicated workshops on CCS in 2016 to help companies leverage each other's learnings and develop an action plan to ensure that CCS plays its role in addressing climate change.



## 3. Preparing oil and gas companies for a low greenhouse gas future

The public focus on climate change has returned and governments are starting to act. China has formally pledged to peak its carbon dioxide emissions before 2030, for example, and the G7 members issued a decarbonization declaration, agreeing to cut their own greenhouse gas emissions 40-70% over 2010 levels by 2050. As a result, hopes are high that the COP21 in Paris in December 2015 will achieve concrete results and that the momentum can be sustained.

Expectations for a global climate agreement were also high in 2009, in the run-up to COP15 in Copenhagen. The reality fell short and the financial crisis shifted governments' focus away from the threat of climate change and back to the economy and jobs, especially in the developed world. The bottom-up approach towards COP21, by which each country is defining its own contributions, is more flexible and is helping break down the old divisions. Furthermore, the business community has embraced the need for clear domestic policy frameworks.

OGCI welcomes this progress which

could bring much greater clarity about the future direction of policy after years of uncertainty. For the oil and gas industry, in the short term, the push towards the 2°C ambition will mean intensifying current initiatives to reduce the impact of our operations and products on climate change. Over the long term, it will be transformative, requiring our industry – like other energy-intensive sectors – to adjust its business models in order to remain competitive and valuable in a low greenhouse gas future.

Exactly how major oil and gas players will use their core skills – executing complex projects, managing multiple risks, driving technological innovation – in 50 or 100 years' time is still unknown. There are already differences in direction and focus within the sector. In the future, innovative technologies are likely to disrupt the energy industry further and result in the emergence of new global players. Those companies best able to adapt will survive. Those that are inflexible are likely to disappear.

Our success in redefining ourselves over the decades will be shaped by many



**Josu Jon Imaz**  
CEO, Repsol

**“We must be ambitious in our emission-reduction targets and flexible in how we deliver them. We uphold a new model in which the war on climate change, growth and competitiveness are all mutually reinforcing.”**

factors: technological innovation, market demand, consumer preferences, government action, and shareholder perspectives. But it will also depend heavily on our internal capacity to embed the shift to low emission energy into the heart of our businesses so we can embrace it as an opportunity as well as a challenge.

There are three main ways in which oil and gas companies are preparing their businesses to manage this challenge effectively over the long term:

- Integrating climate change into mainstream corporate strategy
- Pursuing renewable technologies
- Investing in low greenhouse gas R&D and start-ups



Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change, addresses OGCI in May 2015

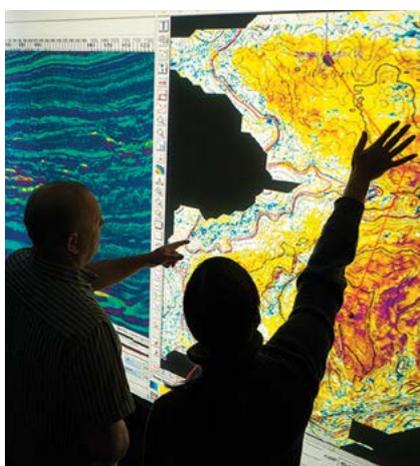
## Integrating climate change into corporate strategy

Most oil and gas companies have been considering climate change risks and opportunities for a decade and more. Following the warning launched by scientists in the first IPCC report in 1990 and the adoption of the UNFCCC's Kyoto Protocol in 1997, they began to look at ways to understand the opportunities and manage the risks that could impact the commercial viability of long-term projects.

Instead of picking up pace, however, the global policy momentum slowed and regulations designed to curb greenhouse gas emissions became more fragmented and regionalized over the years. With new momentum building, companies have been re-evaluating the internal policies they have developed and looking in more detail at the tools available to them.

One OGCI work stream focused on sharing experience of these internal tools to examine what worked well and what not, as well as to brainstorm changes that might be needed in future. There are no standard solutions that work across all company structures and cultures. Companies that work internationally, for example, have to respond to a wide variety of government schemes designed to reduce emissions, as well as working within multiple business and environmental constraints that may also open new business opportunities. Listed companies are increasingly being asked by shareholders for more reporting on emissions management and portfolio resilience, among other areas.

Despite the different environments in which companies operate, this benchmarking exercise generated significant insights and some members of the work stream are already incorporating the learnings into



their management of greenhouse gases. Total, for example, decided to divest completely from its coal activities in August 2015 in coherence with its strategy to be committed to better energy. BG Group has enhanced its model for screening projects to differentiate between developed and emerging countries.

### The corporate tool-kit

Driven by regulations in much of Europe and parts of Asia and North America, companies operating in these regions often use carbon project screening values (PSVs) to test whether new investments and existing assets are likely to remain viable if governments introduce or sharpen schemes that put a value on carbon. Our benchmarking showed that among the European OGCI members, central screening values range from US\$25 to US\$65 per tonne of carbon dioxide equivalent emitted, with upper sensitivities rising as high as US\$140 in 2050.

PSVs slot easily into standard decision-making and risk-management pro-

cesses and can help to justify spending on lower carbon technology choices and, on occasion, to stop projects that are highly carbon-intensive. They are also frequently used within a broader complex of carbon reduction instruments. BG Group and Repsol, for example, use them within energy management systems, designed to build energy efficiency into budget setting, day-to-day management and incentive schemes.

### Target-setting

Work stream participants also shared their experience of setting and publicizing company targets. Some companies find that they galvanize accelerated action, especially if budgets are ring-fenced to achieve the goals set. Other companies' experience is that other project and performance measures, rather than targets, are the most effective way to drive change in a direction and at a pace that is most appropriate for the company.

In some companies, achieving emissions and carbon intensity targets are among the criteria for calculating executive bonuses. BG Group, for example, links pay to emissions performance, with each operation having an annual performance indicator for emissions intensity and energy management plans included on its group-level performance scorecard, and progress reviewed quarterly at board level. Eni has introduced a climate-focused incentive scheme for its CEO and the top managers of its carbon-intensive business operations. According to this, 12.5% of variable compensation in 2015 will be directly linked to a year-on-year reduction of 650,000 tonnes of carbon equivalent.

As the world's climate change policies look set to evolve again following the COP21 meeting in Paris, OGCI members will continue to benchmark and develop the tools they use, to manage new risks and to ensure their strategy remains sustainable both commercially and environmentally.

**\$11** billion invested in  
renewables over the past three  
years

## Investing in renewable technologies

Oil and gas companies are already moving beyond their historic core businesses to invest into those complementary forms of energy that each considers to be among the most viable for the future and that best match individual capabilities, resources and objectives. Most companies have divisions and affiliates focusing on renewables, while some, such as Statoil, have recently set up separate 'new energy' business units,

bringing together low greenhouse gas operations, start-ups and R&D.

Data collected from six OGCI members show that they invested US\$11 billion across the renewables sector in the past three years alone and their renewable energy production has increased by 21% over that time. Collectively, OGCI member companies are sizeable players in all major renewable forms of energy, for example:



Marco Dufour

**Patrick Pouyanné**  
CEO, Total

**“There is no silver bullet solution: a combination of gas, renewables, energy efficiency, CCS, and clean energy for populations who don’t have access today – all of this will be needed to combat climate change.”**

- Total is the world's second largest player in solar PV energy by sales, through its affiliate Sunpower
- Shell is among the largest strategic investors in advanced biofuels
- Statoil, Repsol and Shell are investors in several of Europe's fast-growing offshore wind farms
- BP is one of the top 10 wind businesses in the US with the single largest-build wind farm in the country

Where companies decide to focus is often shaped by their geographical footprint and their existing areas of strength. Some of those that already have large offshore operations in Europe are leveraging their experience with difficult marine environments to accelerate the development of offshore wind farms. A key aim is to ensure that they become competitive with other renewable energy sources, despite high capital costs. Statoil, for example, has been testing float-

**17** % of the R&D budget  
is spent on low greenhouse gas  
technology

ing wind turbines and is planning the first pilot deep-sea wind farm off the coast of Scotland, using larger and more robust turbines to reduce the costs of both installation and maintenance.

### Solar options

Some companies that have operations in desert and sub-tropical regions are focusing on solar power. Total, for example, has developed a wide variety of solar options ranging from roof-top PVs in California, concentrated solar power in Abu Dhabi and a non-subsidized 70MW solar power plant in the Atacama Desert region of Chile, where power prices are high and solar irradiation is particularly intense. Saudi Aramco has built the world's largest solar car park, with enough capacity to supply the entire energy needs of a large office and multiple services complex, and still have excess capacity that gets exported to the grid.

Several companies have developed significant biofuel businesses in Brazil, leveraging the suitability of sugar cane for ethanol-production, mandatory fuel blending regulations and expertise in fuels and blending. Shell, for example, is co-owner of ethanol producer Raizen which operates 24 sugarcane ethanol mills and one of only a handful of industrial-scale second-generation ethanol plants, using waste biomass from sugar and grain production. Raizen has started to export biofuel to Europe; in Brazil, it sells blended fuel through Shell-branded service stations.

BP also operates three sugarcane ethanol mills in Brazil producing low-cost, financially self-sustaining biofuels. In conjunction with Dupont, BP has also developed a second-generation biofuel that can be blended into gasoline in greater proportions. Within Europe, Eni, Total and Repsol have begun conversion of loss-making conventional petroleum refineries into advanced biofuel refineries.



## Investing in future energy research and start-ups

A long-term challenge for oil and gas companies will be defining business models and technologies that help the industry thrive in a low greenhouse gas era. That is why, alongside initiatives to boost energy efficiency, reduce emissions and develop viable and scalable renewable energy businesses, OGCI companies are all individually investing in long-term R&D that not only optimizes the efficiency of current operations but could also identify and develop technologies and models that could reshape or even redefine the future of energy.

Data collected from six OGCI members reveal that they have spent an average of US\$600 million a year, or around 17% of their total R&D budgets, specifically on low greenhouse gas technology research over the past three years, in addition to spending on technology that improves efficiency more generally. These R&D activities fall into three broad areas, each of which complements the other.

**Creating competitive advantage:** The oil and gas industry excels at energy research and companies have substantial internal expertise. Among the OGCI members, we employ thousands of scientists and engineers, and spend millions of dollars a year on proprietary R&D within our own test centres and demonstration projects. Many of the technologies and competences that we have built up from our research around oil and gas can be transferred to low greenhouse gas technologies.

We compete with each other, as well as with other companies, to develop new lower greenhouse gas and energy-efficient technologies and business models. We also focus significant efforts on research programmes intended to reduce the costs of new energies, facilitating their rapid deployment – initially for the advantage of our own companies, but ultimately to the benefit of all.



**Amin H. Nasser**  
CEO, Saudi Aramco

“OGCI puts the oil and gas industry at the forefront of solutions to climate change, demonstrating that a technology-driven, industry-enabled approach is the only viable way forward. OGCI will play an important role in making lower GHG emissions a reality.”

**Developing future visions:** OGCI members partner – individually and with other companies – with many universities and research institutions. These relationships allow us to think more deeply about the impact of climate change science for our business and to develop technology for the future. BG Group, for example, has teamed up with Imperial College in London to create the Sustainable Gas Institute, which aims to answer key research questions on how to optimize the role of natural gas in an emissions-constrained energy mix, through building a novel energy systems model. The company also has several partnerships with universities in Brazil which are focused on improving the efficiency of natural gas as a fuel or a feedstock. BP sponsors the Carbon Mitigation Initiative at Princeton University which studies carbon

capture and storage and other sustainable solutions to the climate change challenge.

Eni is collaborating with a number of Italian and US universities with a focus on solar energy and energy storage: one of the most important is the Eni-MIT Solar Frontiers Center that promotes research in advanced solar technologies. Saudi Aramco is establishing multiple research centres around the world to collaborate with top universities and research institutes such as with the Korean Advanced Institute for Science and Technology (KAIST).

Public private partnerships and joint R&D initiatives are another way to accelerate innovation. Statoil, for example, has set up a joint technology-focused programme with GE to drive an industrial response to some of the biggest challenges facing global oil and gas production, including flaring, carbon dioxide and methane emissions and water usage, while also optimising business operations.

**Commercializing technology:** OGCI members have invested in over 120 start-up companies over the past three years, with a focus on energy efficiency, renewables, biotechnology, energy storage, smart grids, energy demand management and carbon capture and storage or utilization. In most cases, companies have dedicated entrepreneurship funds. These look for two kinds of investment opportunity. The first is companies that are developing or testing new technology that would support emissions reduction in existing businesses, with the aim of getting the technology into the market quickly. The second is to identify potential game-changers and breakthroughs that could disrupt the energy future in big or small ways (see: Selected start-ups). There are no assurances as to whether these initiatives will succeed or not, but the return potential is high, not least in helping us define and shape our future.

## Selected start-ups

### LightSail



Has developed an advanced compressed air energy storage technology using water spray to achieve high thermodynamic efficiency.

### Enjoy



An Italian car and scooter sharing service active in key Italian cities.

### GlassPoint



Designs large-scale solar steam generators to enhance oil recovery.

### Graphenea



Develops graphene materials for use in solar cells, batteries and thermal management.

### Helix Power



Turns waste steam into electricity, boosting energy efficiency in industrial processes.

### Solidia



Makes cement and concrete that consumes carbon dioxide in the production process rather than generating it.

### Utilidata



Enables digital automation for power grids to support integration of intermittent renewables

## 4. Next steps and priorities

**O**GCI was established to illustrate the important role that the oil and gas industry has played and the efforts it will continue to make in helping address the challenges of climate change. The forum is also intended to accompany our long-term efforts to help create a low greenhouse gas world. Whatever the outcome, OGCI member companies will continue to address these issues and work to reduce greenhouse gas emissions from our operations and products. We hope, however, that the UNFCCC discussions at COP21 in Paris will help to build an effective framework within which we can act further and with greater confidence.

Over the next year, OGCI will develop work activities on those topics we have identified in our discussions internally and with stakeholders, while individually implementing some of the good practices and lessons learned. We are planning to hold a series of technical workshops around aspects of CCS, with the aim of leveraging the expertise of some of the member companies to increase the global base of science and technology knowledge in this key area. We also plan to focus on gaining

a better understanding of the climate impact of each step of the gas value chain. Other topics we would like to address are the technical and commercial challenges associated with access to natural gas, the obstacles to greater synergies between gas and renewables and our role in ensuring more emissions-efficient mobility.

In terms of data aggregation, we will continue our work on methane and flaring, and we hope to develop new data on energy efficiency and CCS, as well as gain a better overview on investment in low greenhouse gas areas. We would also like to start creating solution-oriented performance indicators that will help member companies to measure progress. Furthermore, we hope to identify a few pre-competitive areas where we could fruitfully collaborate in R&D to accelerate change. Finally, we hope to work closely with various organizations and initiatives where we see opportunities to accelerate climate change solutions.

Driving change is never simple, but we believe that OGCI – with leadership from our CEOs, strong drive from our executive committee and technical excellence from our experts – is well placed to help its mem-

### OGCI Topics

- gas flaring
- methane
- energy efficiency
- renewable energy
- access to energy
- carbon capture and storage
- role of natural gas
- aggregated greenhouse gas emissions
- emissions reduction technologies and tools
- product efficiency
- education efforts on energy and greenhouse gas footprint

bers implement the right kind of initiatives at the right pace. We will strive, over the coming years, to encourage other oil and gas companies to join our collaborative efforts and align themselves with our aspirations by becoming active OGCI members.



#### Gerard Moutet

*Chairman of the Executive Committee, OGCI*

**“We have different histories, and different approaches, but the will to progress together toward practical solutions is unprecedented and truly inspiring.”**

## Photographs



Cover: Margarita gas processing plant, Bolivia.



Page 12: A green completion at the Margarita-Huacaya gas field in Bolivia.



Page 22: Methane Rita Andrea first LNG loading at Queensland Curtis LNG, Australia.



Page 2: Inside the leg of Troll A platform, Norway (Harald Pettersen)



Page 15: A worker inspects a Leak Detection and Repair tag at Sarnia refinery in Canada.



Page 24: Geoscience TVP.



Page 5: Workers on Bongkot South production platform walkway, Thailand.



Page 17: The Thunderhorse platform in the Gulf of Mexico, USA.



Page 25: Salvador PV solar power plant, in the Atacama Desert region of Chile.



Page 6: Checking gas detectors at Changbei, China.



Page 19: A 100% renewable charging terminal for e-vehicles in Spain.



Page 26: Researchers at the Sustainable Gas Institute.



Page 10: Workers at the Panna/Mukata oil and gas fields in India.



Page 20: Carbon capture and storage facility at an oil sands upgrader in Alberta, Canada.

All photographs courtesy of OGCI member companies.

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