OIL AND GAS CLIMATE INITIATIVE

TAKING ACTION

Accelerating a low emissions future

A report from the
Oil and Gas Climate Initiative
November 2016

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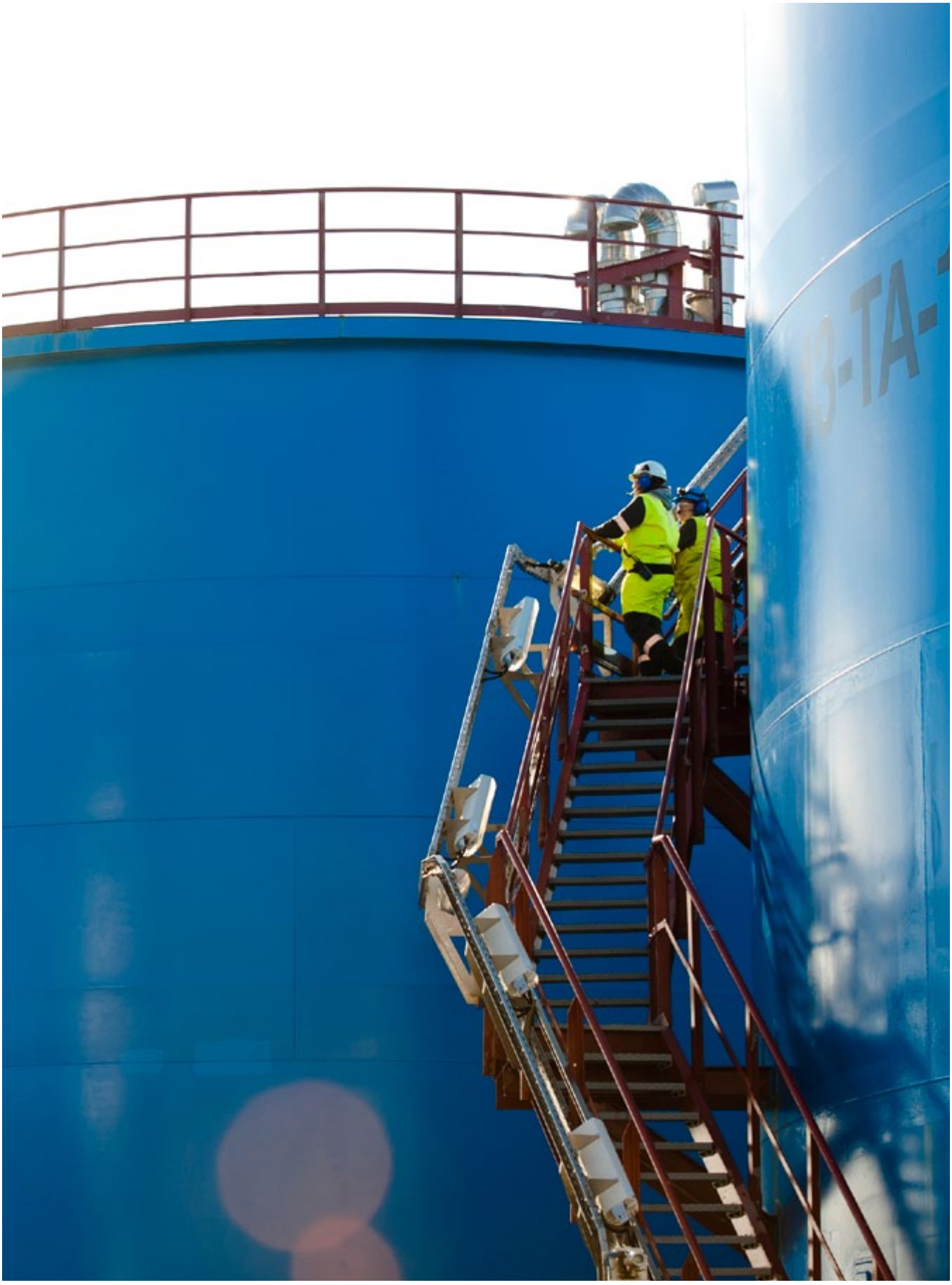


Joint declaration

Today marks a turning point in climate action. Less than a year after it was agreed by almost every nation on earth the Paris Agreement has come into effect. We welcome the agreement and its swift entry into force because it sets a clear direction of travel that will help all actors, governments, industries and individuals, to take appropriate actions and make investments towards a lower emissions future. As CEOs or Chairmen of OGCI member companies we are committed to showing leadership in our industry's response. We believe there is significant need and many opportunities for innovation and investment in solutions that can reduce GHG emissions on a large scale – and we are in action to take them.

We are very proud to announce the formation of OGCI Climate Investments. OGCI Climate Investments has been set up to invest one billion dollars over the next decade to accelerate the development of innovative technologies that, once commercialized, have the potential to reduce greenhouse gas emissions on a significant scale. We believe that collaborative investment – on top of all the work our companies are doing individually – will make a demonstrable difference. We intend to fund development and demonstration projects as well as new businesses.

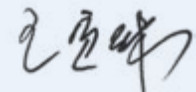
OGCI Climate Investments will focus on climate-related technologies and businesses that can benefit from collaboration across our industry and with related industries that use our products. We have met with many of our stakeholders and undertaken a strategic assessment of activities that are central to emissions reduction and of particular relevance to the oil and gas industry. As a result, we have identified four priority areas in which we believe OGCI Climate Investments can make a real difference in both the near and long term.

The greatest share of our intended investments will focus on maximizing the climate benefits of natural gas by minimizing methane emissions along the gas value chain, and on enabling oil and gas to meet energy demand sustainably in a tightly carbon-constrained world by ensuring that carbon capture, use and storage can be deployed on a much wider scale. Two further areas where we believe collective investment could deliver a step change are improving industrial energy efficiency and reducing the carbon and energy intensity of transportation.

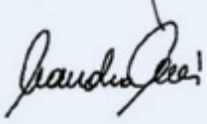
This year we have focused on defining and taking actions that are needed now and out to around 2040. Next year we will look at the technologies and options that could be compatible in the longer term with the very ambitious goal of net zero emissions in the second half of the century.

Our $1 billion commitment is significant in itself but it is just our starting point. It can be amplified in many ways. We will leverage additional funds by working in partnership with like-minded initiatives across all stakeholder groups. We will increase investment ourselves by deploying successful low emissions technologies in our own businesses and operations. We will use the considerable convening and catalytic power of our expertise, facilities and networks to galvanize action both within our industry and beyond. OGCI members produce over one fifth of the world's oil and gas. We can and will make a difference.

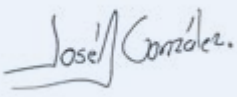
Bob Dudley
BP plc



Wang Yilin
CNPC



Claudio Descalzi
Eni S.p.A.



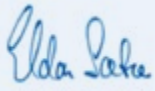
Jose Antonio Gonzalez Anaya
Petróleos Mexicanos

Sh. Mukesh D Ambani
Reliance Industries Limited

Josu Jon Imaz,
Repsol S.A.

Ben van Beurden
Royal Dutch Shell plc

Amin H. Nasser
Saudi Aramco



Eldar Saetre
Statoil ASA

Patrick Pouyanné
Total S.A.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KIMAX
USA

Summary

The ambitious agreement reached by the United Nations climate change conference (COP21) in Paris is an important milestone in the attempt to transform our energy systems. We welcome the result, and recognize that meeting the challenging aim it set will require new approaches, new policies and practical action, both in the energy sector and elsewhere. It will not be easy or cost-free, but it will also open up new opportunities.

Oil and gas producers account for more than half of the energy that powers our economies today. That means we also need to be key players in helping tackle the challenge of climate change. Our sector accounts for about 5% of total manmade greenhouse gas emissions; in addition, the use of our products by other sectors including power, industry and transport accounts for an additional 32%. We are working with governments, international organizations and others to help reduce those emissions.

The Oil and Gas Climate Initiative (OGCI), whose members represent more than one-fifth of the world's oil and gas production, is keen to develop new strategic partnerships with others working to limit climate change and to contribute more to the development and deployment of low emissions technologies. OGCI's mission is to use our collective resources to accelerate actions that mitigate the greenhouse gas emissions from the oil and gas industry's operations and the use of its products, while still meeting the world's energy needs.

We have prioritized our collaborative initiatives based on a strategic assessment of their impact on greenhouse gas emissions, the ability of our industry to help shape the outcome and the urgency required. Our assessment concludes that improving efficiency must be coupled with a strong focus on reducing the greenhouse gas intensity of the energy our sector produces to reduce emissions on the massive scale required.

To help us meet our ambition, **we are launching OGCI Climate Investments, a partnership that will enable us to invest $1 billion** over the coming years to support start-ups and help develop and demonstrate innovative technologies that have the potential to reduce greenhouse gas emissions significantly. Our aim is to multiply the impact of our investments by leveraging funds from other organizations and by deploying new technologies within our own companies.

OUR FOCUS IS ON THE FOLLOWING PRIORITIES:

- **Reducing our methane emissions.** Natural gas can play a role in the fight against climate change by substituting for coal in power generation, industry and heating. It can also provide a flexible back-up to the growing share of intermittent renewable energy. For gas to play its full role, however, we need to understand and control methane emissions more effectively. To do this we are working with expert partners to improve methane data and our understanding of the natural gas life cycle, and to select and deploy cost-effective methane management technologies.

- **Accelerating the deployment of carbon capture, use and storage (CCUS).** Strong action on CCUS is needed to succeed in delivering the long-term goals of the Paris Agreement. Although several pioneering projects are now in place, a number of obstacles must be overcome before CCUS can be deployed on a wide scale. These include high capital and operating costs, the lack of stable policy support or a clear business model, and uncertainty around world storage capacity. We are exploring solutions in each of these areas.

- **Improving industrial energy efficiency.** Improving energy and other operational efficiencies, such as flaring reduction, can save both greenhouse gas emissions and money, so there is a dual incentive. OGCI members are active individually, but our opportunity is to find technologies where collaboration between our companies and others within our industry can deliver a step change at a very large scale. Many solutions applicable in the oil and gas sector will also be relevant to other energy-intensive industries.

- **Contributing to transportation efficiency.** The transportation sector currently uses around one fifth of the world's primary energy and this share will rise as the number of vehicles grows. Our focus is on working closely with manufacturers in all modes of transportation, with the aim of developing more efficient engines and advanced fuel-engine combinations that minimize the sector's greenhouse gas impact.

This report is intended to explain the initiatives and investments OGCI is undertaking and planning, as we aim to provide a leading sector response to the climate change challenge.

1. The Paris climate agreement – OGCI's response

The United Nations COP21 conference in Paris was a major milestone in addressing climate change. For the first time, most of the world's governments affirmed their collective aim to limit the rise in average global temperature. They also agreed to aim for a balance in the second half of the century between greenhouse gas emissions from human activities and emissions removal by sinks, such as forests and oceans – often referred to as net zero emissions.

Achieving this level of consensus was a ground-breaking achievement and swift ratification meant the agreement went into effect in November 2016. That has provided an impetus to introduce effective changes to policy, business strategies and behaviour that can drive more sustainable business and consumer choices, while creating new clean technology opportunities. Nevertheless, the reality of reducing emissions will not be easy. Current national action plans do not go far enough to meet the ambitious goals set. Even if all countries fulfil the contributions they have so far said they intend to make, the global temperature increase would substantially surpass 2°C.[1] As plans are reviewed and revised every five years, faster and more consistent action will be needed from governments, with support and changed behaviour from industry, as well as from business, consumers and society more broadly.

Key player

Today, the oil and gas sector is the primary source of over half of the energy that powers global economies.[2] Its operations also emit around 5% of manmade greenhouse gases, while the use of oil and gas – in power generation, transportation, buildings and industrial operations – contributes around 32% more.[3] OGCI members produce more than a fifth of oil and gas globally.

1 United Nations Framework Convention on Climate Change (UNFCCC) *Aggregate effect of the intended nationally determined contributions: an update*, May 2016

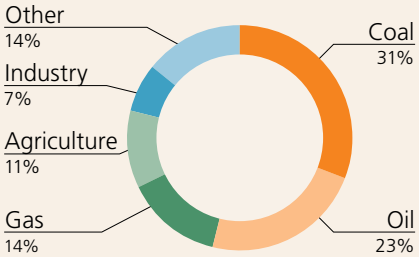
2 International Energy Agency (IEA), *World Energy Outlook*, 2015

3 International Energy Agency, *CO_2 Emissions from Fossil Fuel Combustion*, 2014. The industry's own energy use in production represents around 15% or less of the total produced.

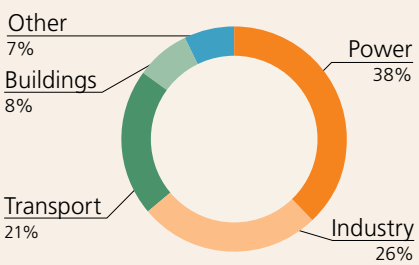
Bob Dudley
CEO, BP and OGCI Chairman

"Climate change is so important for the long term that it justifies our concerted action today. OGCI is adding shared investment to shared action towards a lower carbon future – and I expect opportunities to grow and investments to prosper over time."

MANMADE GREENHOUSE GAS EMISSIONS, by source, %



CARBON DIOXIDE EMISSIONS, by use, %

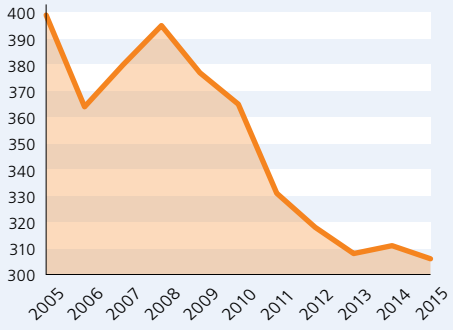


Source: IEA

GREENHOUSE GAS EMISSIONS — OGCI DATA

- Greenhouse gas emissions fell by 1% in 2015, according to data from seven OGCI members.
- Over the past decade, emissions have fallen by 23%, with an 8% reduction over the past five years.
- The trend is shaped by a combination of divestments and investments, largely in energy efficiency, made to reduce greenhouse gas emissions.[4]

Total GHG emissions ($MtCO_2eq$ operated basis)



Source: OGCI

4 OGCI data is provided by individual member companies according to a common methodology to ensure comparability. The data is on an operated basis, which excludes non-operated joint ventures. Not all member companies are, as yet, able to report at this level of detail. In some cases, historical data has been revised since last year's report. Two companies merged last year and are counted as one in this data.

We have reduced our greenhouse gas emissions by almost a quarter over the past decade. We recognize, however, that our sector can intensify collaboration with multiple partners in both the public and private sectors to substantially increase our contribution to emissions reduction, while still producing the energy that global economies need.

Some think the oil and gas industry has been slow to embrace the need for the transformation of global energy systems, but perspectives are changing fast. More and more oil and gas companies are explicitly integrating climate change into their business strategies. A growing number of stakeholders – including shareholders – are encouraging us to reduce our greenhouse gas intensity as we reshape our companies over the next few decades.

OGCI aims to show leadership in the industry's response to the climate change challenge. We want to contribute towards the solution, as key players that can help tackle the twin mission of providing more energy with lower greenhouse gas emissions. To realize this aim, we are pulling together our collective resources – human, financial and organizational – to play our part in supporting the implementation of the Paris Agreement.

OGCI in 2016

OGCI has matured rapidly in its second year. The CEOs or Chairmen of member companies have personally held nine steering committee meetings in order to achieve a step change in the scale of our activities, especially through the creation of OGCI Climate Investments. The idea for this collaborative investment vehicle was sparked during a meeting at Davos in January 2016 and fast-tracked to its official launch planned for January 1, 2017. Working groups covering methane management, carbon capture, use and storage and the low emissions roadmap are in regular contact, reporting to an Executive Committee that meets monthly. This year, we have also welcomed a new member, China National Petroleum Corporation (CNPC) which has enlarged the international footprint of our initiative. Shell's acquisition of BG earlier this year keeps the number of OGCI members at 10.

BP	CNPC	Eni	Pemex	Reliance	Repsol	Saudi Aramco	Shell	Statoil	Total
Year founded									
1908	1988	1953	1938	1973	1927	1933	1907	1972	1924
Headquarters									
UK	China	Italy	Mexico	India	Spain	Saudi Arabia	Netherlands	Norway	France
CEO or Chairman (appointed)									
Bob Dudley (2010)	Wang Yilin (2015)	Claudio Descalzi (2014)	Jose Antonio Gonzalez Anaya (2016)	Sh. Mukesh D Ambani (2002)	Josu Jon Imaz (2014)	Amin H. Nasser (2015)	Ben van Beurden (2014)	Eldar Saetre (2015)	Patrick Pouyanne (2014)
Employees, 2015									
80,000	1,460,000	34,000	138,000	25,000	27,000	65,000	93,000	21,000	96,000
Countries with operations									
80	-	69	-	8	40	-	70	36	130
Barrels of oil equivalent per day, million, 2015									
3.3	5.5	1.8	3.3	0.1	0.6	12.1	3.0	1.9	2.3

Note: Data for Shell does not cover BG, which had 4,000 employees and 0.7 million boe/day in 2015.

2. Priorities for action

It is not yet clear that the world is ready to realise the 2°C goal. It will require a transformation – of our energy systems, agriculture, land use and consumer behaviour – far beyond anything that has been achieved in the past two decades. The IEA's scenario targeting 2°C, for example, indicates that economies will need to have cut carbon dioxide emissions by almost 60% by 2050 (compared with 2013) – just over 30 years away.[1]

That would mean an annual 3% drop in the energy intensity of the global economy, more than double the progress achieved since 1990. It would also entail reducing the carbon dioxide intensity of global energy systems by well over 2% a year, a process that has hardly begun despite the very rapid growth in renewables over the past few years (see chart). To subsequently reach net-zero emissions in the second half of the century implies a significant pick-up in the pace of change over the coming decades.

Step change needed

Achieving this kind of step change is an enormous task. It won't happen unless all the key players increase action in the areas they can change or influence. For the past two decades, the oil and gas industry has focused many of its climate efforts on energy efficiency within its own operations and energy conservation through initiatives around flaring and methane emissions. Companies have also reduced their carbon dioxide intensity by investing in natural gas and renewables. Gas now accounts for just over half of the total production of the seven OGCI companies reporting data, compared to just over a third 10 years ago; those same companies have invested almost $15 billion in renewables over the past four years, plus almost $3 billion in research and development on low greenhouse gas technologies.[2]

Nevertheless, our industry needs to do more to reduce the greenhouse gas intensity of our energy products and help boost the efficiency of oil and gas both in production and consumption. Achieving these aims will entail new technologies and investments, as well as support for effective policies that encourage companies to reduce their greenhouse gas emissions while continuing to deliver financial returns to shareholders.

1 International Energy Agency, *Energy Technology Perspectives 2016*. The IEA's 450 scenario sets out one pathway to a 2°C climate goal through limiting atmospheric greenhouse gas concentration to 450 ppm. The current policies scenario represents a baseline benchmark and corresponds roughly to an outcome of around 6°C. The new policies scenario takes into account policies and measures planned up to mid-2015 along with obstacles for implementation – it is broadly in line with a 4°C outcome. In the Bridge Scenario, greenhouse gas emissions from the energy sector peak by 2020.

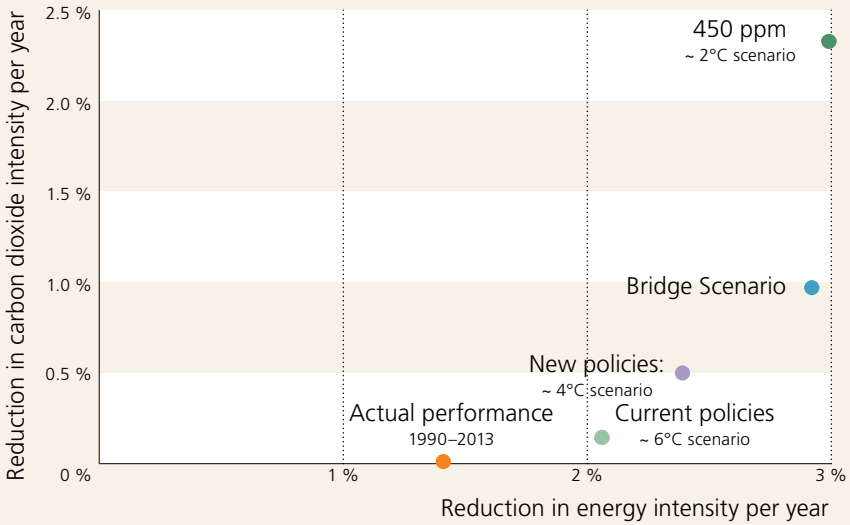
2 For a broader discussion of climate-relevant initiatives undertaken individually by members, see OGCI's 2015 report, *More energy, lower emissions*.

Patrick Pouyanné
Chairman and CEO, Total

"The time is now. OGCI is taking action, investing in low emissions technology and working together to make these solutions commercially viable to ensure a long term, sustainable energy future."

ANNUAL AVERAGE REDUCTION IN CARBON DIOXIDE AND ENERGY INTENSITIES 2013–40*

IEA's scenarios show that while the energy intensity of growth must improve at a far faster pace than in the past, a step change will be required to decouple energy demand from growth in carbon dioxide emissions.



* Energy intensity is the amount of energy needed to produce a unit of GDP. Carbon dioxide intensity is the amount of carbon emitted per unit of primary energy use.

Source: IEA, OGCI

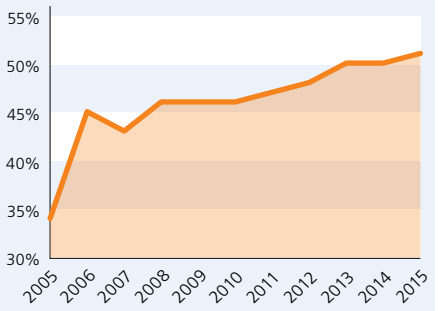
51 % of OGCI members' production is now natural gas

Sh. Mukesh D Ambani
CEO, Reliance

"There is a business and societal case for increasing the use of natural gas in the energy mix of growing economies, as it is the most secure, affordable energy source that not only meets the energy demand but also helps limit GHG emissions."

GAS AS A SHARE OF TOTAL PRODUCTION — OGCI DATA

- Gas now represents half (51%) of the output of the seven OGCI member companies reporting data.
- Ten years ago that share was just a third (34%).
- As companies increase the share of gas in their production, they reduce the carbon intensity of their overall portfolios.



Source: OGCI

Each oil and gas company is already developing its own specific strategic approach to remaining competitive in a low emissions future. OGCI's strategic assessment has a different purpose. Based on discussions with stakeholders and detailed technical work around the implications for oil and gas of the IEA's 2°C scenario, it aims to prioritize practical actions that we can undertake collectively to accelerate the reduction of greenhouse gas emissions, initially in the period up to 2040. Next year we will launch a similar exercise looking at what could contribute to achieving net zero emissions in the second half of the century.

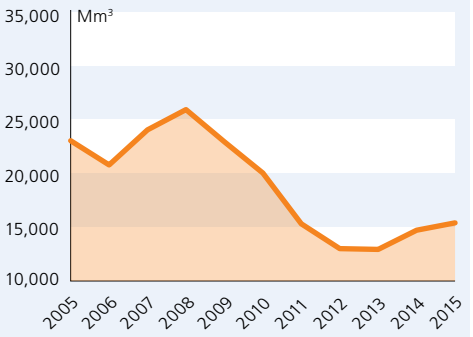
Our initial efforts have focused primarily on measuring and minimizing methane emissions and on removing the barriers to the mass deployment of carbon capture, use and storage. Both of these areas could have a substantial impact on greenhouse gas emissions and are of core relevance to our industry. They can also be tackled better collectively – together, we have the skills and knowledge to help find innovative solutions.

We see energy efficiency, the reduction of flaring and fuel switching as areas that OGCI members should continue to work on, while exploring collaborative opportunities to accelerate capacity for reducing emissions. OGCI members have reduced their volume of flaring by a third over the past decade, despite a significant increase in gas production. We are also trying to identify areas in which we could invest with our end-users to improve the efficiency of industry, power generation and transportation.

VOLUME OF GAS FLARED — OGCI DATA

- The overall volume of gas flaring grew 5% in 2015, largely due to acquisitions.
- Over the past decade, flaring has fallen by 33% as companies have built the infrastructure to capture associated gas for domestic power generation, liquefy it for export or re-inject it into reservoirs.

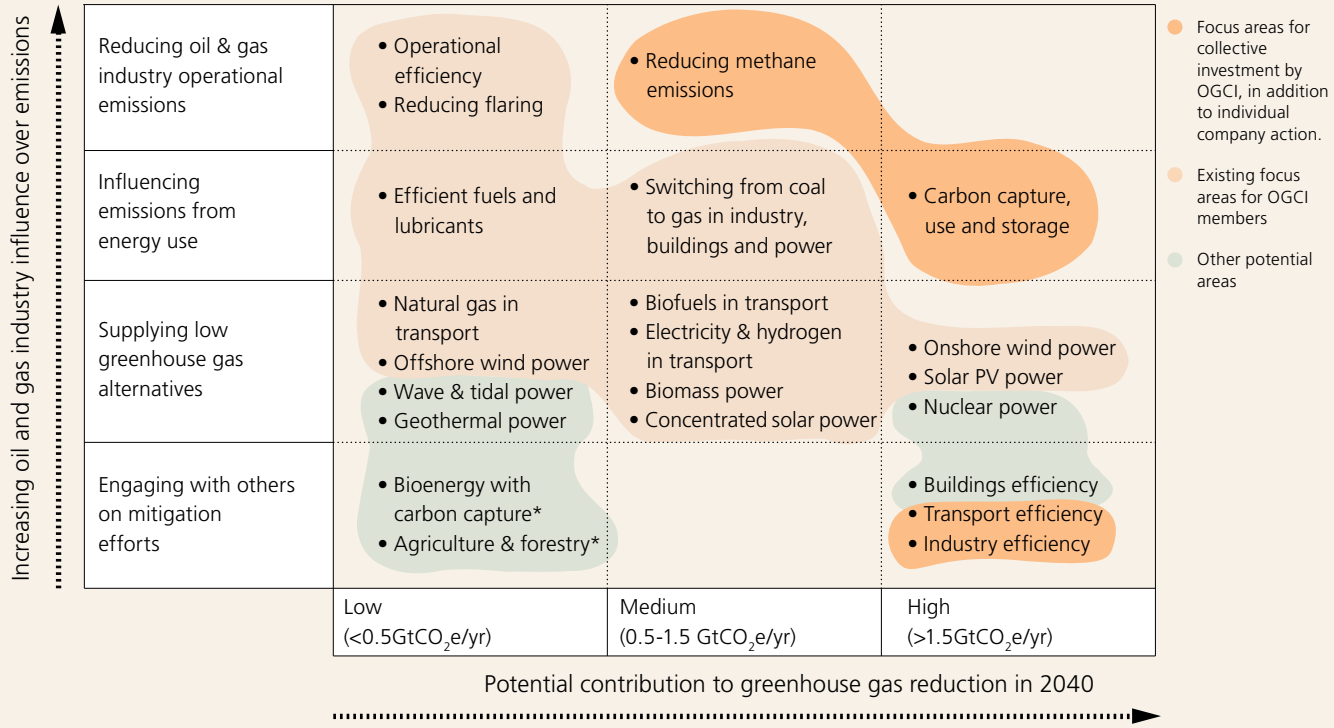
Natural gas flared (Mm^3), without inerts



Source: OGCI

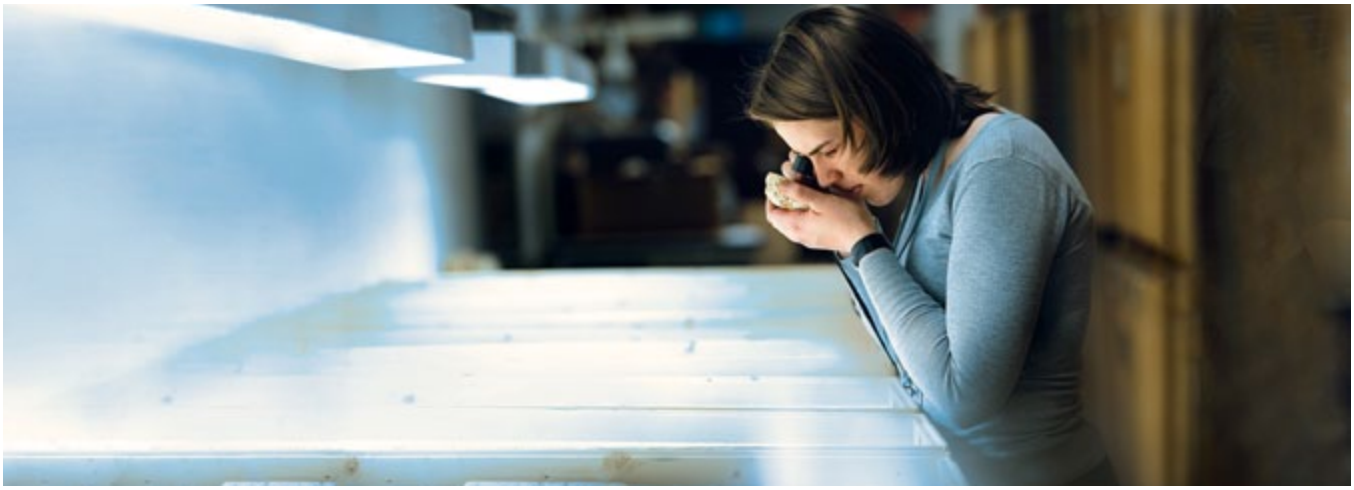
REDUCING GREENHOUSE GAS EMISSIONS - POSSIBLE ACTIONS

Our strategic assessment explored the actions identified by the IEA and others as having the potential to reduce greenhouse gas emissions sufficiently by 2040 to remain on track for a 2°C scenario. We mapped these actions on a matrix showing the emissions reduction potential (horizontal) and the oil and industry's ability to influence the activity (vertical). Actions located in the upper right-hand half of the matrix are the most relevant, with some more appropriate for individual companies and some for collaborative OGCI initiatives.



Source: OGCI

* These actions could have a more significant impact even before 2040, but will both be crucial elements of emissions reduction in the second half of the century.



Reducing methane emissions to maximize the potential of gas

Claudio Descalzi
CEO, Eni

"Natural gas will play a major role in the future energy transition. To boost its climate advantages we are working in partnership with leading institutions to minimize greenhouse gas emissions along the entire value chain of natural gas."

Natural gas has an important role to play in achieving a rapid reduction in greenhouse gas emissions over the next few decades. Modern gas-fired plants have around half the carbon intensity of coal-fired power stations.[1] Gas is also a flexible partner for intermittent renewables as wind and solar become more dominant in the power grid, since gas-fired plants can be switched on and off quickly as needed. The IEA also expects gas usage to increase in industry and households in the coming decades.

Methane management

What?
We need to more fully understand and reduce methane emissions across the natural gas supply chain.
Why?
Urgent short-term climate priority to ensure that the full climate benefits of gas can be realised.

Some climate experts, however, remain skeptical about the role of gas, for two reasons: first, that investing in new gas-fired power plants will not in itself reduce emissions enough to reach the 2°C ambition and will lock greenhouse gas emissions into the energy system for decades; and secondly, that methane emissions from the gas supply chain could offset the benefit of halving carbon reduction compared to coal.

Both arguments are important, but we believe they do not reflect the complexities of the energy transition. The current reality is that the investment choice for many new power plants is not renewables or gas – it is coal or gas. This is a particularly urgent matter for non-OECD countries that will account for almost all global energy demand growth over the next 20 years. Despite fast growth in renewables, high energy demand in emerging markets will largely be met by coal plants unless gas is rapidly embraced as a lower-greenhouse gas alternative that can be combined with intermittent power generation by renewables.

Shifting from coal to gas

China has implemented new policies to control total coal consumption. As a result, the use of coal has been falling since 2014, with renewables and gas filling the gap. That will accelerate the reduction of carbon dioxide emissions, while meeting energy demand. In due course, high efficiency gas plants could be retrofitted with carbon capture technology, allowing abated gas to continue to play a key role in the future in a low emissions energy system.

To help ensure a global environment that is supportive of this shift, we need to tackle methane emissions from the natural gas supply chain head-on. Over the past eight years, OGCI member companies have cut their methane emissions in half, but that followed a surge in the two previous years. Last year we saw a drop of just 1%. We clearly need to do more.

The largest share of methane emissions comes from agriculture and waste, but natural gas is a significant source. The difficulty for all stakeholders, however, is that in some locations there is insufficient detail about the scale and sources of methane emissions from the gas value chain.

Based on new data from field research in North American shale gas fields, the US Environmental Protection Agency recently revised its assumptions upwards and now estimates that around a third of methane emitted in the USA

1 Intergovernmental Panel on Climate Change (IPCC), *Contribution of Working Group III to the Fifth Assessment Report*, 2013

55% drop in OGCI members' methane emissions since 2008

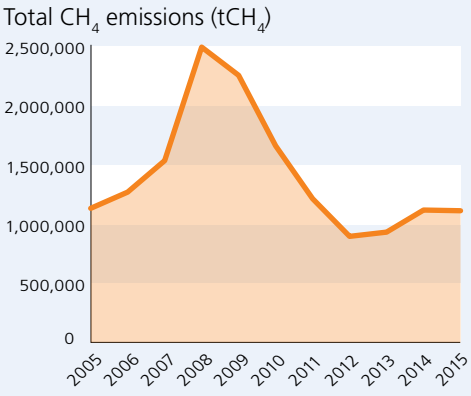
comes from oil and gas operations.[2] North American fields are not necessarily representative of the global picture, however. In Europe and the Middle East, where the bulk of gas production is from large-scale fields, OGCI members' own estimates suggest methane intensity is significantly lower. Until measurement is standardized and comprehensive across different types of production, geographies and parts of the value chain, however, there will continue to be uncertainty – and that is holding back the introduction of policies that could help reap the climate benefits of gas.

2 US Environmental Protection Agency, *Inventory of Greenhouse Gas Emissions and Sinks 1990-2015*, April 2016

METHANE EMISSIONS — OGCI DATA

- Methane emissions from the seven companies reporting fell 1% in 2015, putting an end to a rising trend in the previous three years.
- Over the five years from 2011, methane emissions have fallen by more than 8%.
- Since the peak in 2008, methane emissions have fallen 55%.

Source: OGCI



Wang Yilin
Chairman, CNPC

"Implementing the Paris Agreement requires the further promotion of energy supply-side structural reform. OGCI provides an ideal collaborative platform for the world petroleum industry's low carbon transformation."

33% drop in flaring by OGCI members over 10 years

Taking action on methane

Getting robust data

We are collaborating with the Environmental Defense Fund (EDF), the UNEP Climate and Clean Air Coalition and others to agree a study that will establish a robust and credible set of global data on methane emissions from the gas supply chain, categorized by different types of fields and operations. EDF is conducting a preliminary gap analysis to identify the types of operations and areas of the world where measurement of methane emissions is missing or not reliable. Some OGCI members intend to open facilities to measurement, and help with field studies and other surveys focused on filling in the gaps. Results will be shared publicly so that companies and policy-makers can make well-informed decisions and prioritize areas for action.

Clarifying emission profiles

To develop a full understanding of the emission profiles of gas and coal, we are supporting research at Imperial College London. This will compare the carbon and methane intensity of gas and coal over the full life cycle from exploration and production to power generation, and analyze the mitigation potential. External experts will act as third-party challengers, helping to ensure that the findings are robust. We will leverage this research to assess the best options and solutions for reducing both carbon dioxide and methane emissions within each type of gas supply chain operation.

Unblocking the path to carbon capture

Carbon capture is at a crucial juncture. The capacity to separate out and store or utilize[1] the carbon dioxide generated by the use of oil and gas in power generation, energy-intensive industries and heating/cooling, rather than emitting it into the atmosphere, makes the technology a powerful tool for reducing carbon intensity. The IEA says carbon capture, use and storage (CCUS) could account for 13% of the emissions reduction needed by 2050 to keep to 2°C,[2] and estimates that without it, the cost of reaching that goal could rise by 40%,[3] if at all possible.

To pursue the ambitions agreed by the COP21 in Paris, the IEA says CCUS would need considerably faster and more sizeable deployment, especially in industries where there are few existing alternatives to fossil fuels.[4] Industrial processes, such as the production of iron, cement and steel, require extremely high temperatures and dense energy sources, while oil and gas will still be needed for the production of many plastics, solvents and materials. Looking beyond 2050, achieving net zero emissions within the second half of the century would need low greenhouse gas and renewable energy combined with carbon capture.[5]

Realizing the promise of CCUS is clearly a first-level priority, but progress has been slow. Just 15 large-scale capture projects are currently operating, with a further 17 under construction or in advanced planning. In total, these 32 projects have a capture capacity of around 46 million tonnes per year – less than 1% of the 6.1 billion tonnes a year that the IEA targets by 2050 to be on track to meet 2°C.[6] Even taking all anticipated projects into account, the IEA estimates combined capacity to be just 70 million tonnes a year.

Pioneering projects

Nevertheless, these pioneering projects do provide clear evidence of the technology's potential.

- Norway's two offshore injection wells are commercially viable without subsidies and have stored carbon dioxide safely over two decades.
- Enhanced oil recovery (EOR) projects in oilfields such as China's Jilin and Saudi Arabia's Uthmaniya are now storing injected carbon dioxide on a large scale.
- Quest in Canada is the first CCUS proj-

Carbon capture, use and storage

What?

We need to start investing heavily for carbon capture, utilization and storage (CCUS) to have a demonstrable impact on reducing carbon dioxide emissions in our industry and for those that use our products.

Why?

Transforming energy systems will be too slow and costly without CCUS, if the foundations are not built now – and reaching net zero emissions will be difficult. The oil and gas industry has the technical ability and motivation to help solve the obstacles to widespread deployment, in conjunction with supportive governments and society.

Ben van Beurden
CEO, Shell

"We need to offer practical solutions that will help shape the energy transition. Carbon capture and storage is one of these solutions. CCS can capture CO_2 from power plants and industrial sites and store it safely underground."

1 Two-thirds of CCUS projects today are designed to supply carbon dioxide for enhanced oil recovery. Researchers are currently looking at ways to convert captured carbon dioxide into different products, such as cement, fuels and chemicals.

2 International Energy Agency, *Energy Technology Perspectives 2016*

3 International Energy Agency, *Technology Roadmap, Carbon Capture and Storage–2013*. The IPCC calculates that, without CCUS, it would cost 138% more to reach the 2°C scenario by 2100.

4 Communication from the IEA to OGCI CCUS working group

5 Intergovernmental Panel on Climate Change (IPCC), *Fifth Assessment Report*, 2013

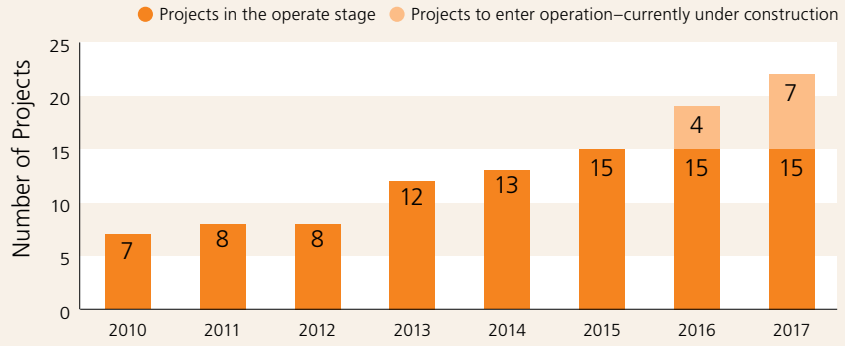
6 International Energy Agency, *Energy Technology Perspectives 2016*

13% of emissions reduction needs to come from CCUS by 2040

ect to capture and store carbon from an oil sands upgrader.

- Canada's Boundary Dam is the world's first large-scale carbon capture project in the power sector.
- Abu Dhabi is about to launch the world's first large-scale CCUS project in the iron and steel sector.
- The world's first large-scale bioenergy CCUS project is starting up in Illinois, USA, bringing the prospect of negative emissions closer to reality.

LARGE-SCALE CARBON CAPTURE PROJECTS



Source: Global CCS Institute

Removing obstacles

The pick-up in pace and breadth of projects is welcome, but solutions are needed to remove the obstacles to its wider deployment – including the initial high cost of capture, the lack of market mechanisms and the shortage of information about storage capacity. Solving these issues and enabling the deployment of this technology requires collaboration among many partners, both public and private, but the oil and gas industry has a key role to play.

First, the deployment of CCUS at scale is in the interests of our sector. Finding a cost-effective way to abate emissions from oil and gas would enable our industry to radically reduce emissions while continuing to meet the world's energy needs.

Secondly, the experience and skills that are inherent to oil and gas companies make them key contributors across the CCUS process from capture technologies, to transport, utilization and storage, all of which are part of current operations. Oil and gas companies are familiar with the technologies, and know what is needed to make CCUS work well. Given its importance, OGCI has decided to focus a large share of its efforts on finding concrete solutions to the barriers that are holding back the widespread deployment of CCUS.

Taking action on carbon capture

Identifying market-based policies to make CCUS commercially viable
OGCI member experts are analyzing existing and innovative mechanisms that could incentivize industry investment into CCUS, with the aim of creating real markets for its deployment. We will narrow these down to a shortlist appropriate to different regions and phases of development and explore these in greater detail. Our aim is to reach a common recommendation on the key enablers needed to make CCUS markets investable. We will share this with governments, regulators and industry stakeholders.

Reducing the cost of carbon capture technology
Carbon capture accounts for around 70% of total CCUS costs due to high initial capital costs and the large amounts of energy needed to make the process work. Developing and deploying capture technologies are crucial to cost reductions on the road to commerciality. Additionally, research and development is needed into alternative technologies to use the captured carbon dioxide in value-added products, which can be achieved using different techniques and materials at different stages of operations. Since it is not yet clear if these technologies could be commercially viable on an industrial scale, there is insufficient financing available to shift the research from the laboratory into the development, demonstration and deployment stages.

OGCI is using the combined knowledge of its members to find and invest in technologies that are most likely to be able to reduce the cost of capture in gas-fired power generation or offset it through usage. We have screened an initial list of around 200 new technologies according to a rigorous catalogue of criteria, including ambitious targets to reduce energy usage and ensure a high capture rate. We are now evaluating the most promising technologies in detail, with the aim of progressing one or more to a commercial scale pilot that would demonstrate the cost reduction achieved.

Understanding storage capacity in key markets
If CCUS is to be deployed on the scale needed, there is an urgent need to get a better grasp of storage availability, both globally and on a regional basis. Most CCUS projects are currently in North America and Europe, but the future need will be even higher in Asia. The IEA forecasts that two-thirds of carbon dioxide would have to be captured in non-OECD countries by 2050 to stay within 2°C.[1] There is currently a good system of classifying the carbon dioxide that is being stored, but there is no globally standardized classification of potential aquifers for storage. As a result, estimates vary widely.

OGCI is sharing its collective expertise with the Society of Petroleum Engineers (SPE). Our aim is to catalyze SPE's efforts to create a globally usable storage resource management system by mid-2017. We have contributed to SPE's work by developing solutions to the technical complexities around classification that had stymied previous attempts to fill this gap. We plan to work with local institutions in China and India to ensure they are able to use the system to adequately monitor their own storage capacity.

1 International Energy Agency, *World Energy Outlook 2015*

Jose Antonio Gonzalez Anaya
CEO, Pemex

"The industry shall tackle climate change issues from a preventive, lawful and value generation perspective. This means considering the protection and preservation of the ecosystems as core matters in the decision making process of each line of business."

3. OGCI Climate Investments – accelerating a low emissions future

OGCI was launched to focus on initiatives that would benefit most from a cross-industry and collaborative approach. Over the past two years, we have shared our experience, developed joint initiatives and invested in research programmes to tackle gaps in our knowledge about how best to approach, measure and prioritize climate change actions.

Now, we are launching OGCI Climate Investments to invest $1 billion over the coming years. Our aim is to collectively support innovative technologies and business models that we expect to have a material impact on greenhouse gas emissions. We expect to invest in start-ups and fund development and demonstration projects, leveraging our own investment through partnerships with other organizations and funds, without duplicating their activities. This collaborative investment will supplement our existing activity as well as the technology development currently being undertaken by member companies individually. In addition, each of our companies will be able to invest more as we deploy the successful technologies in our own operations.

Wider impact

We expect to announce our initial investments in the first half of 2017. Within 10 years, we aim to have demonstrated commercial acceptance of technologies which have the potential to reduce emissions on the scale we are trying to address. We are on the look-out for potentially game-changing technologies that could have a long-term impact on greenhouse gas reduction; but we are also looking to achieve quick wins by supporting commercially viable solutions that accelerate the scale-up of low greenhouse gas technologies and business models.

Eldar Saetre
CEO, Statoil

"For me, the most powerful thing about the OGCI is the spirit of cooperation. Our companies' individual efforts are multiplied when we work collaboratively, pooling the best of our expertise and technology to catalyze results."

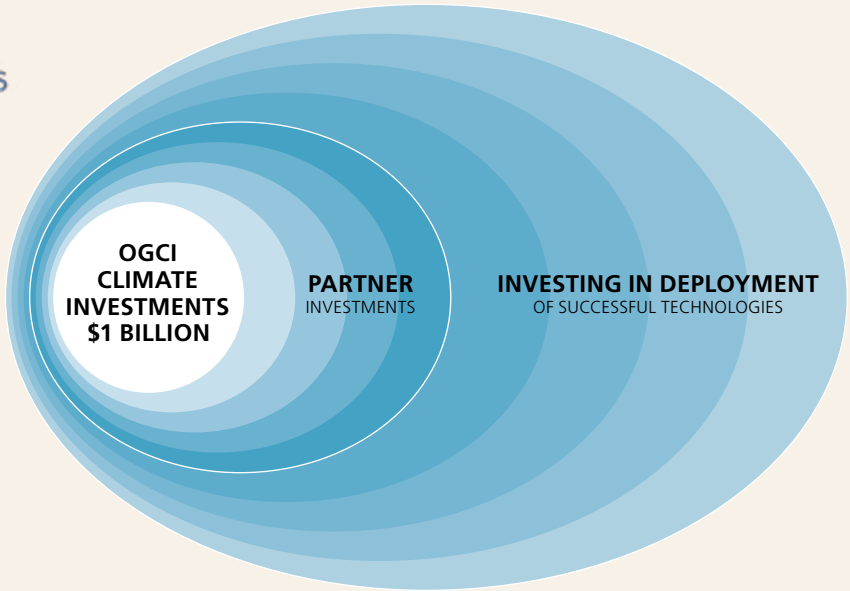
OGCI CLIMATE INVESTMENTS - THE MULTIPLIER EFFECT

OGCI CLIMATE INVESTMENTS
OIL AND GAS CLIMATE INITIATIVE

We expect our investments to have a considerable multiplier effect.

This will come from partners investing alongside OGCI Climate Investments, as well as our own and other companies' investments in deploying commercialized technologies.

The overall impact on reducing emissions will be on the scale of a gigatonne or more over the decade.



Source: OGCI

$1 billion

collective investment in climate solutions

Amin H. Nasser
CEO, Saudi Aramco

"The launch of OGCI Climate Investments clearly demonstrates our industry's climate and environmental stewardship and our resolve to deliver secure, affordable and sustainable energy to the world while significantly reducing greenhouse gas emissions."

OUR INITIAL FOCUS IS IN THE FOLLOWING AREAS:

Carbon capture, use and storage

Aim: We plan to use a substantial part of our resources to develop and demonstrate the economic potential of carbon capture, use and storage technologies.

Work in progress: We are working to evaluate promising new technologies for carbon capture and storage in gas-fired power plants, as well as for productive usage of carbon dioxide waste streams. The aim is to select a number of these technologies and invest in commercial scale projects, through start-ups or directly, that would demonstrate significant cost reduction along the entire value chain.

Gas and methane management

Aim: Around a third of our investments is provisionally allocated to develop and demonstrate cost-effective technologies for minimizing the greenhouse gas footprint and maximizing the transparency of the natural gas supply chain

Work in progress: We are identifying new cost-effective detection technologies that could be used to help substantially reduce methane emissions at oil and gas facilities. If successful, we would support a strategy for large-scale commercialization.

Industrial efficiency

Aim: We are on the lookout for opportunities collectively to develop and demonstrate technologies and systems for increasing industrial energy efficiency – in our own industry, beyond what we do individually, and in partnership with our end-users.

Work in progress: There are numerous barriers to lowering energy consumption in industrial operations. In 2017 and beyond, we will be looking at a variety of areas that can improve efficiency in our upstream, plants, pipelines, and shipping operations, many of which are applicable more broadly outside our industry.

Transportation efficiency

Aim: It is our intention to develop and demonstrate technologies that can cost-effectively minimize the greenhouse gas footprint in transportation.

Work in progress: We are exploring ways to work with automotive and other manufacturers to improve engine and vehicle efficiency, as well as innovations in other modes of transportation. This will be an area of increasing focus over 2017.

4. Next steps

OGCI has taken a major step over the past 12 months. Recognizing the need for all actors to play a constructive and meaningful part in reducing greenhouse gas emissions and inspired by the ambition shown at the COP21 conference in Paris, we have accelerated the mobilization of our collective resources. We have started technical work on a number of specific challenges that are holding back the reduction of emissions in areas that are both material to tackling climate change and within our collective power to address. We have also broken new ground in agreeing to create a collective investment vehicle, OGCI Climate Investments, to invest $1 billion in developing innovative technologies and solutions that we can then deploy in our companies.

In 2017, we will begin with our programme of investments, welcoming a new team who will lead OGCI Climate Investments, while leveraging the preparatory work we have done this year. We will also actively explore the further potential for partnership with other commercial and government organizations, whether to co-invest with them or to support joint activities in areas such as effective policy mechanisms or improved standards of measurement or classification.

The challenge of net zero

We have also identified an additional strategic focus for 2017. We intend to begin work analyzing how OGCI could best be involved in realizing the kinds of approaches that will be required to achieve net zero emissions in the second half of the century. Our aim is to start creating the foundations to enable these solutions to be developed in time to be effective.

OGCI is a young organization with just two years of experience behind it. We have shown, however, that our common focus on practical action to reduce emissions enables us to move quickly, despite the differences between our companies – in geography, ownership and approach. We will strive over the coming years to encourage other like-minded oil and gas companies to join our collaborative efforts and investments, and to persuade a broad range of partners to work with us in tackling one of the greatest challenges of the twenty-first century.

Josu Jon Imaz
CEO, Repsol

"Decisive and collaborative action is the key to solving one of the greatest challenges humanity has ever faced – meeting the planet's ever-greater energy needs while ensuring sustainability."

Photographs

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Engineer on oil platform
(Øyvind Hagen)

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Storage tanks
(Ole Jørgen Bratland)

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Testing of motor oils

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Quest carbon and capture storage project

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Gas field reservoir
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BP Remote Operations Centre

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Engineer onsite
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Processing plant
(Manfred Jarisch)

All photographs courtesy of OGCI member companies.

What is OGCI?

The Oil and Gas Climate Initiative is a voluntary, CEO-led initiative which aims to show sector leadership in the response to climate change. Launched in 2014, OGCI is currently made up of ten oil and gas companies that pool expert knowledge and collaborate on action to reduce greenhouse gas emissions. OGCI Climate Investments is being launched to invest $1 billion in developing and demonstrating low emissions technology for deployment and scale-up over the coming years.

OIL AND GAS CLIMATE INITIATIVE

oilandgasclimateinitiative.com