

SCALING UP ACTION

Aiming for net zero emissions



OGCI AT A GLANCE



ENERGY PRODUCTION

**49
million**

barrels of oil equivalent
per day¹



GREENHOUSE GAS EMISSIONS

**724
million**

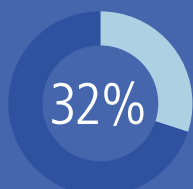
tonnes of carbon dioxide
equivalent per year²



LOW CARBON INVESTMENTS

**US\$6.5
billion**

aggregate investment in low-
carbon technologies and R&D³



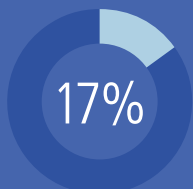
of global oil and gas
production



share of global
greenhouse gas
emissions²



collective commitment
through OGCI Climate
Investments



of global energy
demand



drop in upstream methane
emissions in 2018



investments in
portfolio of OGCI
Climate Investments

¹ Operated production 2018 for
13 member companies

² Member companies' aggregated upstream
and downstream emissions (Scope 1)

³ Data from seven companies

CONTENTS

	Foreword by Thelma Krug, Vice Chair, IPCC	2
	Foreword from the CEOs	5
1	SCALING UP ACTION	9
	What it means to be an OGCI member company	10
	Accelerating the transition	11
	OGCI Climate Investments – aiming for high impact	13
	OGCI member companies in 2019	14
2	AIMING FOR NET ZERO EMISSIONS	17
	Responding to the climate challenge	19
	Providing clean and affordable energy	19
	Improving energy efficiency	21
	Capturing, using and storing carbon dioxide	21
	Joint declaration with Clean Energy Ministerial	23
	Balancing remaining emissions	25
	OGCI's stakeholder engagement	26
3	TARGETS AND ASPIRATIONS	27
	Making progress on our methane target	29
	Expanding to a carbon intensity target	31
	Company case studies	32
	Our aspiration to kickstart CCUS	41
	Priority CCUS hubs	45
4	OGCI PERFORMANCE DATA 2018	53
	APPENDIX	62
	Statement on Responding to the Climate Challenge and Stakeholder Engagement	62
	OGCI workstreams	65
	Glossary	68

FOREWORD

Thelma Krug
Vice Chair, Intergovernmental Panel on Climate Change



Thelma Krug
IPCC

**"The changes
needed
are urgent,
unprecedented
and systemic."**

The recognition of the need to strengthen the global response to the threat of climate change was vital to the adoption of the Paris Agreement in December 2015. In the context of sustainable development and efforts to eradicate poverty, it called for "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels", recognizing that this would significantly reduce the risks and impacts of climate change.

Understanding risks

Given the gap in available scientific literature, the Intergovernmental Panel on Climate Change (IPCC) was invited by the 195 governments of the UN Climate Change Convention to assess the risks of global warming above 1.5°C and define emission pathways compatible with limiting warming to that level by the end of the century. The IPCC has been responsible for providing the most up-to-date scientific knowledge on all issues related to climate change for over 30 years, so as to support science-based policy

decisions by governments.

Unprecedented changes

The IPCC's 1.5°C report, approved in October 2018 by all member governments, emphasizes the unprecedented, systemic changes necessary in all areas of society to limit global warming to 1.5°C above pre-industrial levels. Whatever pathway is chosen, greenhouse gas emissions are projected to reach net zero by mid-century to achieve this goal. In addition, the report points to the urgency of action, indicating that at the present level of anthropogenic global warming of approximately 1°C, impacts attributable to climate change have already been observed, and are projected to be higher at 1.5°C and even more so at 2°C or above. Many land and ocean ecosystems and some of the services they provide have already changed due to global warming.

To achieve these urgent, unprecedented, systemic changes, the IPCC assessed mitigation and adaptation options for all sectors. For energy, the broad message is clear – greenhouse gases from the production and use of energy must be drastically reduced over the coming decades,

recognizing the major contribution to greenhouse gas, particularly carbon dioxide, originates in the energy value chain.

For land use, detailed pathways were spelled out in another IPCC special report on Climate Change and Land, approved in August 2019. This showed the extent to which land is under growing human pressure – reducing its potential to be part of the climate solution and turning it into a growing part of the problem.

Far-reaching action

Although part of the solution, land on its own will not solve the problem. “The land that we are already using could feed the world in a changing climate and provide biomass for renewable energy,” the report says, “but it would require early, far-reaching action across several fronts.”

I am pleased that OGCI, representing 30% of the oil and gas industry, has been working since its creation to support the achievement of a net zero emissions economy, notably this year by scaling up carbon dioxide removal measures, both directly through accelerated deployment of carbon capture and storage, and in-

directly through efforts to support nature-based solutions. This last area is close to my heart.

Measures like reforestation and afforestation are likely to be necessary to compensate for unavoidable emissions from other sectors. Better land management can play a key role in tackling climate change through actions designed to protect, sustainably manage and restore natural or modified ecosystems, addressing societal challenges – climate change, food and water security or natural disasters – effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits.

Coordinated action

Businesses that recognize the need for change, like those joined together in OGCI, are key actors in the coordinated action that can enable ambitious mitigation and adaptation options – along with policymakers, indigenous and local communities, non-governmental organizations and consumers.

I look forward to further engagement and action in the coming years.

Thelma Krug, a Brazilian mathematician, is a world expert on forests and climate. She co-chaired the Task Force on National Greenhouse Gas Inventories of the IPCC, and was elected as one of IPCC's Vice Chairs in 2015.

CEOs at the OGCI event in New York 2018

From left to right: Bob Dudley (BP), Zhang Jianhua (CNPC), Claudio Descalzi (Eni), Eldar Sætre (Equinor), Vicki Hollub (Occidental), Amin Nasser (Saudi Aramco), Josu Jon Imaz (Repsol), Ben van Beurden (Shell), Patrick Pouyanné (Total)



OIL AND GAS CLIMATE INITIATIVE



FOREWORD FROM THE CEOS

Energy companies have an important role to play in accelerating the energy system transition required to tackle the climate challenge urgently, alongside governments, civil society and other key stakeholders, while continuing to provide reliable, accessible and affordable energy for all.

Since OGCI's launch five years ago, we – as CEOs of the member companies – have aimed to take a lead in facilitating this transition in the energy industry and along our value chains, while encouraging other emitting sectors to take action. In 2019 and onwards, OGCI is working to increase the speed, scale and impact of our actions as the world aims for net zero emissions as early as possible.

New members

We are growing in both size and scope. Our three new member companies – Chevron, Exxon-Mobil and Occidental – have brought their unique experiences, resources and perspectives to the group, enriching our dialogue as we steer OGCI together.

OGCI Climate Investments, our US\$1 billion plus fund, has doubled the number of companies and projects it has invested in over the past year.

Progress on methane

Reducing methane emissions has remained a priority for OGCI as we work to achieve our methane intensity target and ambition, aiming to push methane emissions in OGCI member companies' operations to near zero.

With companies closely focused on implementing measures to reduce emissions, we are proud to show a 9% reduction in OGCI member companies' aggregate upstream methane emissions in 2018, pushing the collective methane intensity of the 13 OGCI member companies to 0.29% from a 2017 baseline of 0.32%. We are continuing to work to push the intensity below 0.25% by 2025, with the ambition to achieve 0.20%.

As part of our engagement to support reductions across the gas value chain and expand the impact of our action, we have this year formed a strategic part-

nership with Methane Guiding Principles and joined the Global Methane Alliance¹ together with the United Nations and Environmental Defense Fund.

Focusing on carbon intensity

Encouraged by our experience of working together on reducing methane emissions, we are now working on a target to reduce by 2025 the collective average carbon intensity of our aggregated upstream oil and gas emissions, in support of the Paris Agreement.

Our baseline in 2017 is 24kg CO₂e/boe, taking into account our total upstream carbon dioxide and methane emissions from all operated oil and gas assets, calculated as a share of marketed oil and gas production.

Estimates based on IEA and IPCC data lead to a carbon intensity average for the industry of approximately 49kg CO₂e/boe for oil and 67 kg CO₂e/boe for gas.

We are also expanding progressively the scope of our collective efforts in downstream operations.

1 "A Global Alliance to Significantly Reduce Methane Emissions in the Oil and Gas Sector by 2030" is a joint initiative from UN Environment / Climate and Clean Air Coalition; European Bank for Reconstruction and Development, Environmental Defense Fund; Oil and Gas Climate Initiative, Clean Air Task Force

CCUS KickStarter

A key focus for OGCI this year has been carbon capture, use and storage (CCUS). We are delighted to be launching CCUS KickStarter, a major new initiative designed to facilitate large-scale commercial investment in CCUS, by enabling multiple low-carbon industrial hubs. These hubs capture carbon dioxide from several industrial companies and bring economies of scale by sharing transport and storage infrastructure.

We aim to work with governments and other industries to facilitate the necessary market conditions for investment in CCUS hubs and projects by OGCI member companies, OGCI Climate Investments, governments and other investors.

To this end we have developed a strategic cooperation with the Clean Energy Ministerial CCUS Initiative to facilitate the market conditions for commercial scale investment in CCUS around the world.

Moving forward

Over the next year, we are focusing more closely on several additional areas of action.

- Launching in 2020 an action plan to deliver greenhouse gas emissions reductions in the transport sector, in order to facilitate climate-responsible transport.
- Actively exploring measures to catalyze natural climate solutions at scale, noting their significance to many developing regions and their contribution to the achievement of several Sustainable Development Goals. We are supporting the Natural Climate Solutions Vision, convened by the World Economic Forum and the World Business Council for Sustainable Development.
- Exploring together whether OGCI can play a role in the potential of emerging carbon removal technologies to accelerate progress towards the aim of net zero emissions, potentially building on synergies with our CCUS initiatives.

Expanding engagement

While we expand the scope and impact of our collective action, we are also working to reinforce our engagement and collaboration. The global climate challenge requires a new level of cooper-

ative leadership, trust-building, and commitment.

We embrace this challenge and, as leaders in our industry, we aim to continually improve, recognizing the importance of frank, transparent and constructive dialogue with stakeholders. We welcome constructive engagement and encourage challenge on a broad range of issues – and aim, in particular, to expand our engagement with young voices.

A value for carbon

We aim to engage stakeholders and constructively influence multiple issues, especially those that consider an explicit or implicit value for carbon. Attributing a value to carbon is recognized as one of the most cost-efficient ways to achieve low carbon transitions as early as possible.

As such, OGCI member companies support the consideration and introduction by governments of appropriate policies or carbon valuation mechanisms, such as through tax, trading systems, incentives or other market-based instruments appropriate to the profile of emissions, to the carbon mitigation oppor-

tunities and to the socio-economic situation of each jurisdiction. These should allow a fair, transparent and stable business environment for all to enhance investment and promote innovation in the aspiration towards

lower and zero carbon solutions, without hindering social and economic development.

Together, and in support of the Paris Agreement and its aims, we have drawn up a collective statement outlining our

common response to the climate challenge and to stakeholder engagement (see page 62).

We look forward to working further with you as we move towards a net zero future.

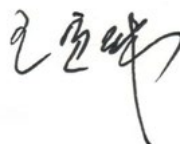
New York, September 23, 2019



Bob Dudley
BP plc



Michael K. Wirth
Chevron Corporation



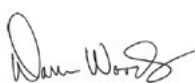
Wang Yilin
CNPC



Claudio Descalzi
Eni S.p.A.



Eldar Sætre
Equinor ASA



Darren W. Woods
ExxonMobil Corporation



Vicki Hollub
Occidental Petroleum Corporation



Roberto Castello Branco
Petroleo Brasileiro SA



Josu Jon Imaz
Repsol S.A.



Ben van Beurden
Royal Dutch Shell plc



Amin H. Nasser
Saudi Aramco



Patrick Pouyanné
Total S.A.



1

SCALING UP ACTION





Amin H. Nasser
CEO, Saudi Aramco

"The OGCI is leading an all-out industry response to the climate challenge."

WHAT IT MEANS TO BE AN OGCI MEMBER

OGCI has a set of guiding principles and commitments to help member companies contribute towards the ambitions of the Paris Agreement.

As OGCI member companies, we:

- Support the Paris Agreement and its aims.
- Seek to reduce further the carbon intensity of our operations.
- Seek to be a catalyst for reducing emissions in our industry and the wider economy.
- Assess climate change risks and opportunities in our business planning.
- Support government policies that consider a value for carbon, explicitly or implicitly.
- Publish accurate and consistent indicators and utilize third-party data review.
- Engage responsibly with stakeholders.
- Foster candid and constructive dialogue with a broad range of stakeholders.

As OGCI member companies, we contribute to the following collective targets and initiatives:

- By 2025, reduce the collective average methane intensity of aggregated upstream gas and oil operations to below 0.25%, from a baseline of 0.32%, with the ambition to achieve 0.20%.
- By 2030, help to decarbonize multiple industrial hubs and kickstart a commercial CCUS industry that can have a substantial impact on greenhouse gas emissions (see pages 41-49).
- Support OGCI Climate Investments over a ten-year period to deliver a tangible impact on greenhouse gas emissions through accelerated innovation across the energy and industrial sectors.
- Support explicitly the aims of Zero Routine Flaring by 2030.

ACCELERATING THE TRANSITION

There is growing awareness around the world of the need for urgent action to tackle the climate challenge. The Intergovernmental Panel on Climate Change set out the probable consequences of failing to stop the rising concentration of greenhouse gases in the atmosphere over the next decade.¹ Governments are accelerating plans to decarbonize their economies – shifting their efforts beyond power generation to industry, transport, buildings, land use and agriculture.² An increasing number of companies are setting ambitious goals to reduce emissions and taking meaningful steps towards implementing them. Meanwhile, people in many parts of the world are becoming increasingly concerned about the impacts of climate change.

Despite this greater focus, 2018 saw the fastest rise in human-caused carbon dioxide emissions in seven years. This was driven by global economic growth and increasing energy demand, which exceeded the impact of expansion in renewables and the shift from coal to natural gas.³ Global efforts have helped to decouple economic growth and emissions,⁴ but have not been enough to bend

the emissions curve. Numerous additional ambitious measures are needed to reduce emissions to net zero – the point at which there is no further addition to global greenhouse gas levels in the atmosphere – as early as possible.

Scope and impact

In response to the challenge of fast-tracking the transition to a net zero carbon economy, the Oil and Gas Climate Initiative (OGCI) is expanding the scope and impact of the actions we undertake. Since setting up OGCI five years ago, we have facilitated engagement and action around the energy transition in our industry and beyond, while continuing to meet growing energy demand.

We have added new members – welcoming Chevron, ExxonMobil and Occidental in September 2018. Our 13 member companies now represent 32% of global operated oil and gas production, including both state-owned national and international oil companies. OGCI's Climate Investments impact fund of over US\$1 billion now has a portfolio of 15 innovative companies and projects and is gearing up to accel-

1 Intergovernmental Panel on Climate Change, Global warming of 1.5°C. An IPCC special report, 2018

2 In 2019, the UK became the first G20 economy to pass a law setting a binding target of net zero emissions by 2050, followed closely by France. Sweden and California introduced targets for 2045 (in 2017 and 2018 respectively). Chile, Denmark, Germany, New Zealand and the EU are in advanced discussions to introduce binding net zero targets. Governments in several other countries, including Costa Rica, Portugal and Finland support net zero by 2050.

3 International Energy Agency, Global Energy and CO₂ Status Report, 2019. Carbon dioxide emissions rose more than 2% in 2018. Greenhouse gas emissions data is not yet available for 2018.

4 Greenhouse gas emissions rose less than 0.5% for every 1% gain in global economic output, according to the International Energy Agency.



Pratima Rangarajan
CEO, OGCI Climate Investments

"We invest in solutions to lower the carbon footprint of energy, industry and transport, which represent 3/4 of global emissions."

erate its impact, with additional investments, further deployments and work underway jointly with CNPC on the creation of a CNPC-led, China-focused Climate Investments fund.

OGCI recognizes that accelerating the pace and scale of action is not only crucial to address global warming, but also critical to each of our

businesses. Faster action will help the industry to evolve so we can meet the growing demand for clean, reliable and affordable energy. It also opens up opportunities in areas from hydrogen and batteries, to carbon management services. Our aim is to play an active role in shaping the global pathway to net zero emissions.



Photo: CNPC and OGCI Climate Investments are partnering on a climate impact fund for China



OGCI Climate Investments – aiming for high impact

OGCI Climate Investments is a US\$1 billion-plus fund set up by the OGCI member companies to lower the carbon footprint of the energy and industrial sectors. The fund is patient capital, focusing on long-term impact. We invest in innovative, commercially viable and scalable technologies and solutions.

As an independent fund with a dedicated team of investment and technical professionals based around the world, OGCI Climate Investments collaborates with other investors and companies to achieve speed and scale in the roll out of emission reduction technologies. We also work to bring our portfolio companies and OGCI member companies together to accelerate the piloting and deployment of new technologies.

In our first two years of activity, we have identified and invested in technologies around our three core areas – reducing methane emissions, reducing carbon dioxide emissions through energy, industrial and transport efficiency, and recycling and storing carbon dioxide. We have rapidly built up teams to focus attention on specific

We focus on three objectives



Reduce methane emissions

during the production, delivery and usage of oil and gas



Reduce carbon dioxide emissions

by increasing energy efficiency in power, industry and transport



Recycle and store carbon dioxide

produced during power generation or industrial processes by using it in products or storing it (CCUS)

areas where we see the biggest impact on greenhouse gas emissions. These are frequently outside the oil and gas industry itself – in buildings, industry and transport – and require moving beyond traditional venture capital investing to tackle specific constraints to technology deployment such as markets, supply chains and local regulatory challenges.

Our work in carbon capture, use and storage (CCUS) is a case in point. Following our investment in the UK's Clean Gas Project (see page 24), which we are now progressing with several OGCI member companies, we have created a team to accelerate the deployment of CCUS in the USA, building on the opportunities emerging from the 2018 expansion of the 45Q tax credit.

For our CCUS Investments Day in September 2019, we searched for projects and technologies to expand the pipeline, looking to seed early stage investment to demonstrate effective business models. We expect to invest more strongly in CCUS in the coming year.

If you have an inquiry for our investments team, please contact: investments@climateinvestments.energy

OGCI MEMBER COMPANIES IN 2019



Occidental**
Headquarters: USA
Output*: 0.7
Countries with operations: 8
Employees: 11,000
President and CEO:
Vicki Hollub



ExxonMobil
Headquarters: USA
Output*: 3.8
Countries with operations: 54
Employees: 71,000
Chairman and CEO:
Darren W. Woods



Shell
Headquarters:
The Netherlands
Output*: 3.7
Countries with operations: 70
Employees: 82,000
CEO: Ben van Beurden



Chevron
Headquarters: USA
Output*: 2.9
Countries with operations: 55
Employees: 49,000
Chairman and CEO:
Michael K. Wirth



Pemex***
Headquarters: Mexico
Output*: 2.5
Countries with operations: na
Employees: 132,000
CEO: Octavio Romero Oropeza



PETROBRAS
Petrobras
Headquarters: Brazil
Output*: 2.6
Countries with operations: 9
Employees: 63,000
CEO: Roberto Castello Branco



REPSOL
Repsol
Headquarters: Spain
Output*: 0.7
Countries with operations: 35
Employees: 25,000
CEO: Josu Jon Imaz



* Million barrels of oil equivalent per day
**Data does not include Anadarko, which Occidental acquired in August 2019. Anadarko had production of 0.7 mboe/day and around 5,000 employees in 2018
***Due to extraordinary circumstances, this year's report does not cover Pemex's activities.



Equinor
Headquarters: Norway
Output*: 2.1
Countries with operations: 30
Employees: 21,000
CEO: Eldar Sætre



BP
Headquarters: UK
Output*: 3.7
Countries with operations: 78
Employees: 73,000
CEO: Bob Dudley
OGCI Chairman



CNPC
Headquarters: China
Output*: 6.0
Countries with operations: 34
Employees: 1,270,000
Chairman: Wang Yilin



Eni
Headquarters: Italy
Output*: 1.9
Countries with operations: 67
Employees: 31,000
CEO: Claudio Descalzi



Total
Headquarters: France
Output*: 2.8
Countries with operations: 130
Employees: 100,000
Chairman and CEO: Patrick Pouyanné

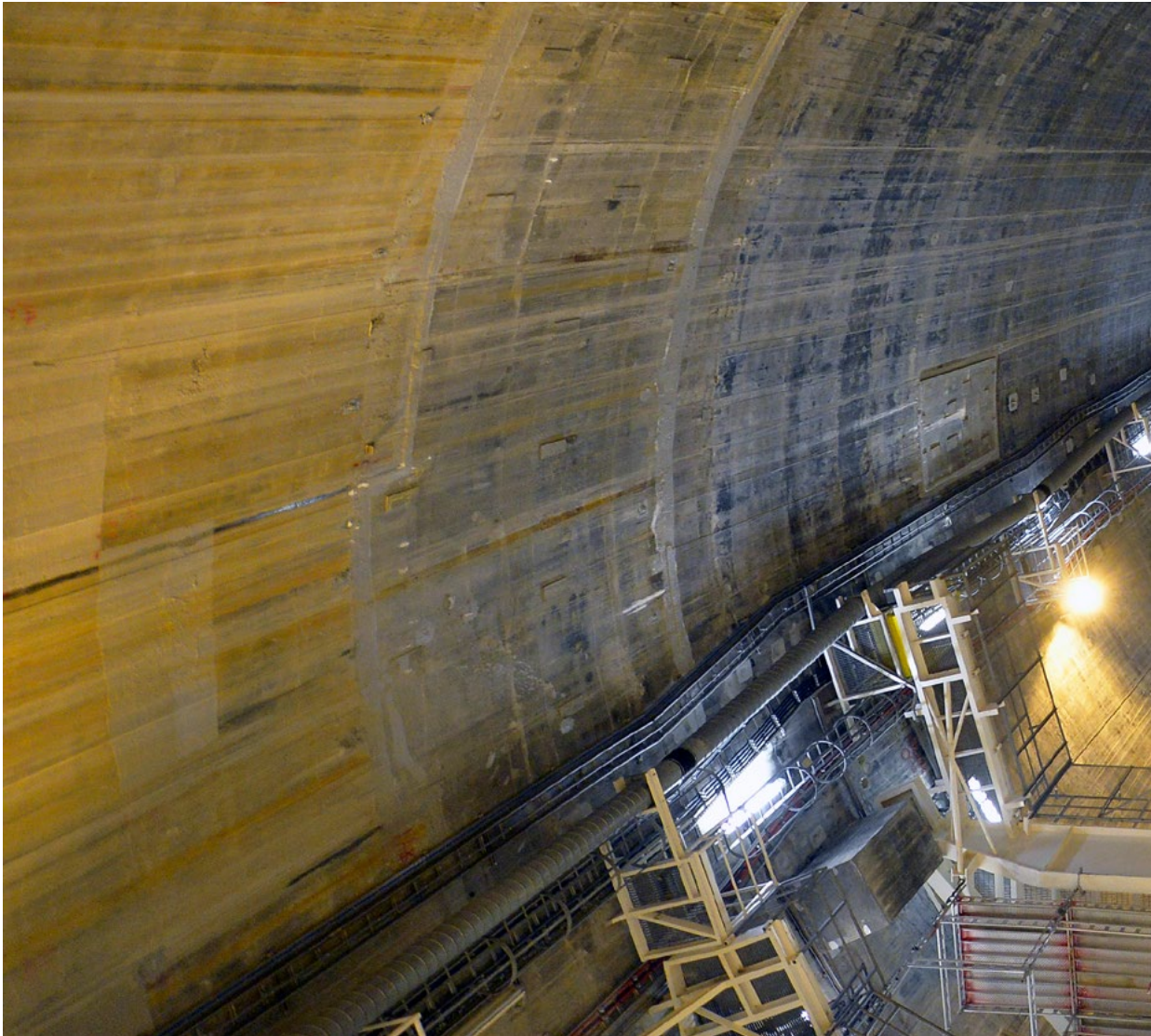


أرامكو السعودية
 saudi aramco



Saudi Aramco
Headquarters: Saudi Arabia
Output*: 13.6
Countries with operations: 6
Employees: 76,000
CEO: Amin H. Nasser

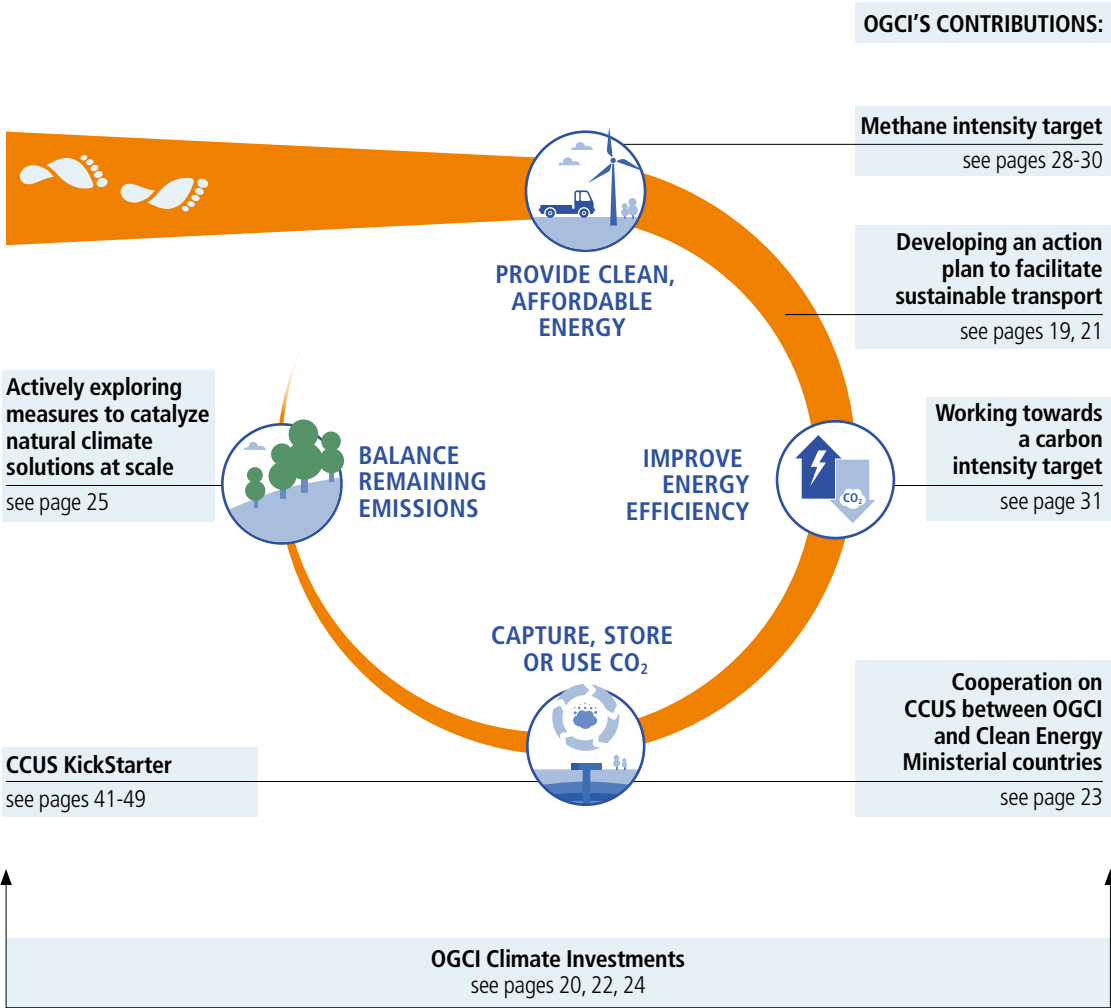




AIMING FOR NET ZERO 2



A GLOBAL NET ZERO PATHWAY



RESPONDING TO THE CLIMATE CHALLENGE

The scale of the climate challenge facing society is enormous, which is why all options need to be considered. OGCI has identified areas where action is urgently needed, by the energy industry and others, to contribute towards achieving net zero emissions.¹ OGCI is working systematically within these areas to identify where we can have maximal impact and act as a catalyst, as member companies and through OGCI Climate Investments. We will continue setting ourselves collective targets and aspirations, and follow through with investments and actions to help us deliver with impact.



Providing clean, affordable energy

When people think of clean energy, they tend to focus on the power sector – the central focus of global decarbonization efforts over the past decade. However, electricity makes up less than 20% of final energy consumption in industry, transport – road, rail, marine and aviation – and in the heating and cooling of buildings.² OGCI aims to help facilitate a progressive shift towards ever lower carbon

energy sources throughout the economy, at a cost that still enables access to energy for all.

OGCI's actions

- Making progress towards our methane target, with a reduction of 9% in upstream methane emissions intensity in 2018 against the 2017 baseline (including the methane emissions of our new members, Chevron, Exxon-Mobil and Occidental).
- Engaging proactively across the value chain and in collaboration with others to share knowledge as our methane intensity target increasingly acts as a reference for the oil and gas industry.
- Exploring the potential of low carbon liquid fuels to address emissions from the existing global fleet of light- and heavy-duty vehicles, as well as options for reducing the carbon intensity of marine and aviation propulsion.
- Through OGCI Climate Investments, investing in companies that have developed innovative methane detection, measurement and mitigation technologies, aiming for deployment by member companies and the broader industry.

¹ In OGCI's 2018 report, we introduced the net zero pathway under the title 'Towards Circular Carbon'. As we explored how we could contribute to shifting from a largely linear approach to carbon resources – extract, use and emit – towards a more circular approach, we realized the pathway we had developed was the start of a framework to help us contribute towards net zero emissions. While we still strive for greater circularity, we see this as part of our efforts to aim for net zero.

² Power accounted for 19% of total final energy consumption in 2017 and 38% of total primary energy demand (International Energy Agency, World Energy Outlook, 2018)



OGCI Climate Investments has made the following investments to detect, measure and mitigate methane emissions.



Global satellite remote sensing and emissions analysis

GHGSat provides low-cost greenhouse gas monitoring data and services covering sites around the world. GHGSat launched its first demonstration satellite in 2016, proving the potential to accurately measure facility-level emissions of both carbon dioxide and methane. In 2019, GHGSat is launching a new high-resolution satellite, building on lessons learned from its demonstration satellite to provide an order-of-magnitude improvement in measurements of facility-level greenhouse gas emissions.

Joined portfolio: 2018



Large, cost-effective aerial surveys of sites to detect leaks

Kairos Aerospace provides actionable data on major sources of methane emissions from aerial surveys. Their patented sensors and proprietary software make regular monitoring of methane emissions over large areas of land cost-effective. Kairos is starting to work with OGCI members to pilot aerial surveys of assets.

Joined portfolio: 2018



Advanced sensors for fugitive methane emissions measurement

SeekOps develops and fields advanced sensor technology for the energy sector to detect, localize, and quantify natural gas emissions through integrated drone-based systems. SeekOps' unique sensor design eliminates false positive readings and localizes emissions source detection to provide actionable data to oil and gas operators.

Joined portfolio: 2019



Shutter valves with low fugitives for flow control

Clarke Valve designs and manufactures proprietary control valves for the industrial market. Its patented Shutter Valve is cost-effective, energy efficient and virtually eliminates process methane emissions. Clarke Valve is working on a series of pilot projects with OGCI member companies.

Joined portfolio: 2018



Intelligent control systems for methane emissions reduction

Kelvin uses artificial intelligence to deliver safe, secure and smart control of complex physical systems. Kelvin is working with oil and gas companies to transform processes and systems in drilling, well completions and production, to reduce methane emissions, while improving economic performance. Kelvin has reduced methane emissions by reducing the frequency of venting actions from artificial lift systems by an average of 10-15% in thousands of wells across major basins in the US, Canada and Australia.

Joined portfolio: 2018



Improving energy efficiency

Since almost two-thirds of primary energy is lost from production to end-use,¹ a net zero pathway has to focus on improving energy efficiency and reducing wasted energy. The International Energy Agency describes efficiency measures as the “first fuel” of a sustainable global energy system, potentially providing over 40% of the abatement required by 2040 to meet the Paris Agreement goals given the right policies.² OGCI member companies are continuing to leverage our experience of increasing energy efficiency in our operations to help accelerate progress in the wider industry and beyond.

OGCI's actions

- Working towards a carbon intensity target on upstream operated activity, with energy efficiency as a key lever for removing emissions.
- Identifying and sharing good practices to increase energy efficiency through deployment of technology, systems and improved designs and operations.
- Exploring how OGCI can support

efficiency initiatives across the transport sector.

- Through OGCI Climate Investments, investing in companies that are focused on innovative energy efficiency technologies in transport, industry and buildings.



Capturing, using and storing CO₂

The ability to capture and store carbon emissions from fuel combustion and industrial processes is widely regarded as an essential element in achieving net zero emissions.³ That is why national and regional governments are beginning to explore new technology and policy options to accelerate CCUS deployment, as they ramp up their climate action plans, and consider the value of capturing and storing future emissions from heavy industry to preserve and create well-paying jobs and boost growth. To address economic challenges, we are working with governments and other stakeholders in industrial areas to help achieve the benefits of CCUS at scale and at an affordable cost, while making it investable and attractive to capital.

1 Based on 2017 primary energy demand and final consumption from IEA World Energy Outlook 2018, and estimations of energy efficiency per sector as detailed in the 2018 IEA Energy Efficiency report.

www.iea.org/efficiency 2018

2 International Energy Agency, Energy Efficiency 2018

3 CCUS accounts for 7% of cumulative emissions mitigation by 2040, in the International Energy Agency's Sustainable Development Scenario.



OGCI Climate Investments has made the following investments to improve efficiency and reduce carbon dioxide emissions.



Getting to emissions-free steel manufacturing

Boston Metal has developed a modular, electrochemical manufacturing process for high-value ferroalloys and, ultimately, for steel. The objective of the company is to cost-competitively produce emissions-free steel. Boston Metal was the first company added to Climate Investments' portfolio following the 2019 Energy Efficiency Venture Day. The company aims to have an industrial scale ferrovanadium plant running in 2022.

Joined portfolio: 2019



Step change in engine efficiency

Achates is developing high fuel-efficiency opposed-piston engines that aim to significantly reduce carbon dioxide, particulate and nitrogen oxide emissions. Achates is currently demonstrating and testing its engines, while accelerating its technology deployment worldwide. The Achates engine is designed to cut fuel use by 20%.

Joined portfolio: 2017



Hybridization of medium and heavy-duty fleet vehicles

XL provides hybrid and plug-in hybrid vehicle solutions that bring the advantages of hybrid vehicle performance to medium and heavy-duty commercial vehicles. The solution is a minimally invasive upgrade that can be ordered on new units or installed on existing fleets. Currently over 100 million miles have been driven using XL's technology, providing a 20% reduction in carbon emissions relative to traditional internal combustion engines.

Joined portfolio: 2019



Modern mechanical sails providing propulsion power

Norsepower designs and manufactures mechanical rotor sails that provide auxiliary propulsion power for large ships. The offering combines a Flettner rotor with machine learning, resulting in a fully autonomous device that is easily installed and operated. The device is currently installed on three ships with reported availability of above 98% and significant fuel savings of at least 5% annually.

Joined portfolio: 2019



Smart controls enabling energy savings from heating, cooling and lighting

75F provides a joint hardware and software product to manage the energy consumption of heating, ventilation and air conditioning (HVAC) systems and lighting in commercial buildings. The low cost solution can be installed quickly in new and existing commercial buildings of any size. The solution is driven by machine learning algorithms to optimize HVAC and lighting. The company has a growing portfolio of over 400 buildings, including a presence in Asia where a significant increase in demand for cooling is expected. It aims to reduce energy in commercial buildings by 30-50%.

Joined portfolio: 2019

OGCI's actions

- Launching CCUS KickStarter to help decarbonize multiple industrial hubs around the world, with the aim of creating the necessary commercial conditions for substantial investments by OGCI member companies, other energy producers, governments, OGCI Climate Investments and other investors. This work builds on our collaboration with national and regional stakeholders in the UK, the Netherlands, Norway, China, Saudi Arabia and the USA to accelerate action plans for CCUS.
- Launching a joint CCUS Acceleration Framework with the Clean Energy Ministerial (CEM) to further the development of CCUS.
- Through OGCI Climate Investments, developing and expanding the scope of CCUS hubs and projects, while also investing in technologies to improve capture and accelerate carbon utilization in products. The portfolio already includes an anchor project in the UK and investment in an ammonia storage project in the USA, along with investments in capture technology and utilization.

CEM-OGCI joint declaration on accelerating the CCUS industry

The 11 countries¹ supporting the CEM CCUS Initiative and OGCI have agreed to explore ways to work together to drive CCUS deployment, building on the KickStarter initiative. Our cooperation is designed to be flexible and voluntary, recognizing that collaboration will take different forms in different jurisdictions. The framework for cooperation brings governments and industries together to create viable market conditions to accelerate the progress of potential CCUS hubs and projects.

CEM CCUS Initiative countries' intention is to facilitate CCUS by providing:

- General policy and strategic support for CCUS in their national strategies.
- Stable and predictable regulatory frameworks.
- Policy mechanisms needed to underpin commerciality of CCUS deployment.
- Support for, and enablement of, specific CCUS hubs and projects at national and local levels.

OGCI member companies intend to provide:

- Technical and business expertise in CCUS development and operation.
- Clarity from industry on what is needed to make CCUS commercially viable.
- Facilitation of investment and corporate financing.
- Engagement with stakeholders, such as emitting industries, investors and lenders, technology providers and civil society.

1 Canada, China, Japan, Mexico, Netherlands, Norway, Saudi Arabia, South Africa, UAE, UK, USA.



OGCI Climate Investments has made the following investments in recycling and storing carbon dioxide.



Commercializing low-carbon capture

Inventys aims to halve the capital cost of carbon capture through its modular, scalable technology, while creating demand for carbon dioxide on a gigatonne scale by building a physical marketplace. In 2019, Inventys will commence the operation of a 30 tonne per day carbon capture plant in Canada in conjunction with Husky Energy. This project will demonstrate the company's breakthrough low-cost capture technology for storage in an enhanced oil recovery field.

Joined portfolio: 2018



Using carbon dioxide to produce lower-carbon cement

Solidia is scaling its patented systems for producing lower-carbon cement and concrete cured with carbon dioxide instead of water. It can reduce the carbon footprint of cement and concrete by up to 70%. Solidia Cement is produced by one of the world's largest cement manufacturers. Solidia Concrete is produced by precast concrete manufacturers in North America and Europe, with a leading US manufacturer now converting an entire production line to Solidia's low-carbon technology. Solidia's R&D focus includes expansion to the full range of precast and ready-mix applications.

Joined portfolio: 2017



Catalysts that incorporate carbon dioxide into polyols

Econic uses pioneering catalyst technology to incorporate carbon dioxide as a raw material into polyols, the basis of all polyurethanes. Econic is moving towards adoption of this technology by existing polyol producers at scale.

Joined portfolio: 2018



Accelerating decarbonization in UK energy and industry

A UK-based CCUS hub project that aims to build the world's first commercial abated gas power plant, while providing collective carbon transport and storage infrastructure to enable decarbonization of the Teesside industrial hub. OGCI Climate Investments has been instrumental in developing a commercially viable concept, bringing on six OGCI member companies, under the operational leadership of BP, to develop the engineering design, and working with the UK government to get support for CCUS industrial hubs. Read more about the Teesside hub on page 45.

Joined portfolio: 2017



Capturing and storing carbon dioxide from ammonia production

A project to capture and store carbon dioxide from Wabash Valley Resources' co-located ammonia plant. This is expected to be the largest carbon storage project to date in the USA and the first ammonia produced with a near zero carbon footprint.

Joined portfolio: 2019



Balancing remaining emissions

A global net zero carbon pathway necessarily includes a role for removing carbon dioxide from the atmosphere, both through natural mechanisms such as reforestation and afforestation, and by deploying technologies such as direct air capture or biomass with carbon capture, to balance remaining emissions.

OGCI's actions

- Actively exploring ways to enhance and catalyze natural climate solutions on a scale that will have

a meaningful impact on climate change.

- Supporting the Natural Climate Solutions Vision, convened by the World Economic Forum and the World Business Council for Sustainable Development. Focusing on how to enhance natural climate solutions and create a credible market to facilitate their uptake.
- Exploring together whether OGCI can play a role in realizing the potential of emerging carbon removal technologies, such as direct air capture, potentially building on synergies with our CCUS initiatives.



Photo: Mangrove restoration in Saudi Arabia



Jerome Schmitt
Chairman, OGCI Executive
Committee

"The energy industry is key to tackling climate change, and we aim to amplify our impact by working with others."

OGCI's stakeholder engagement

OGCI welcomes constructive engagement and dialogue with key stakeholders concerned about climate change, in order to shape our views, learn from offered expertise and perspectives and enable deeper and more impactful action. We believe collaboration and partnership are crucial to tackling the climate challenge, as embedded in the United Nations' Sustainable Development Goal 17, Partnership for the Goals.

We are proud to be engaging in particular with:

- Breakthrough Energy Coalition
- Clean Energy Ministerial
- Center on Global Energy Policy, Columbia University
- Climate and Clean Air Coalition
- Environmental Defense Fund
- GIE Marcogaz
- Global Carbon Capture and Storage Institute
- Imperial College London
- International Energy Agency
- Intergovernmental Panel on Climate Change
- Methane Guiding Principles
- King Abdullah Petroleum Studies and Research Center
- SEforALL
- Stanford University
- UN Economic Commission for Europe
- UN Environment
- UN Framework Convention on Climate Change
- World Energy Council
- World Bank-managed Global Gas Flaring Reduction Partnership
- World Business Council for Sustainable Development
- World Economic Forum

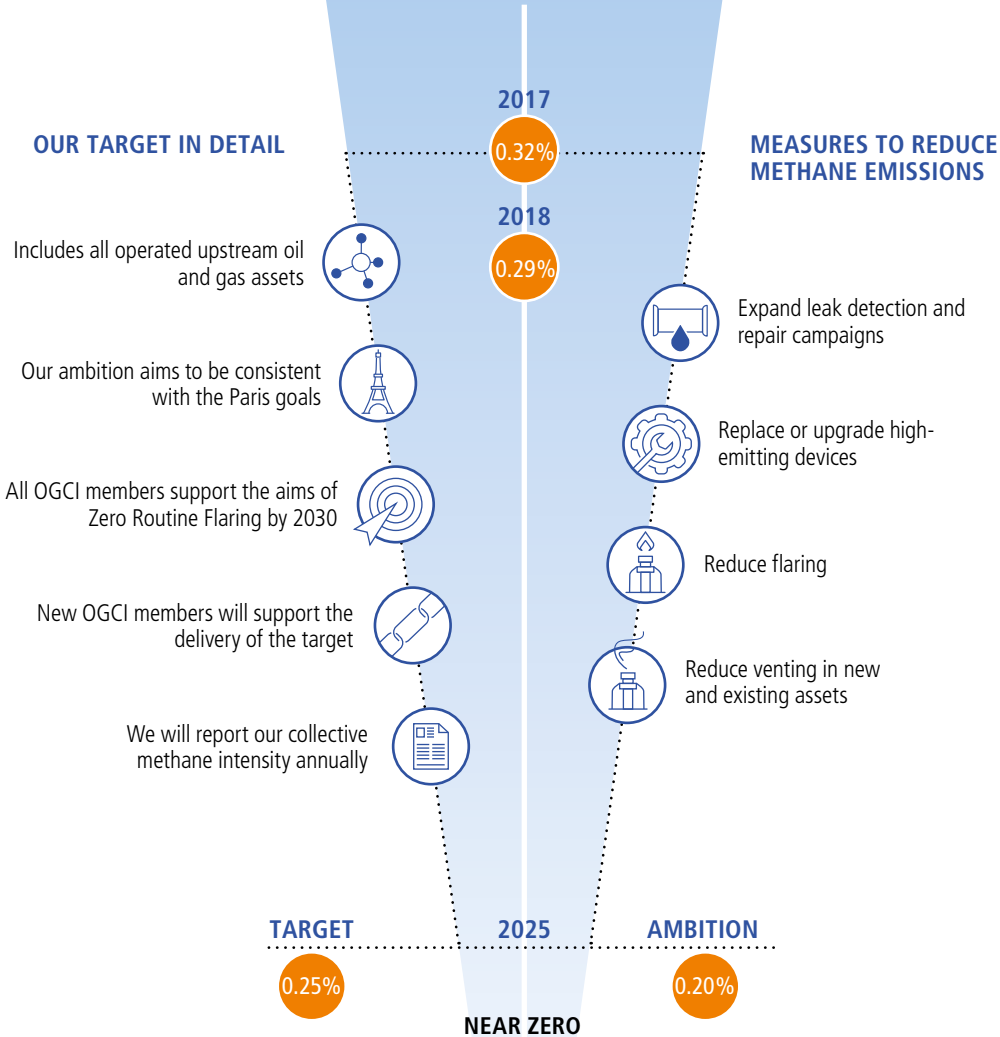


TARGETS AND ASPIRATIONS

3



OGCI'S METHANE INTENSITY TARGET



Source: OGCI

MAKING PROGRESS ON OUR METHANE TARGET



Eldar Sætre
CEO, Equinor

"The industry must proactively address climate change. OGCI has an important role to play."

Note: full methodology and data is available at

oilandgasclimateinitiative.com/methodology

1 Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Working Group 1, The Physical Science Basis, Chapter 8: Anthropogenic and Natural Radiative Forcing, pages 697-698.

Reducing methane emissions to near zero continues to be a top priority for OGCI. As a powerful but short-lived greenhouse gas, meaningful reductions in methane emissions can have a quick impact on global warming. Based on IPCC data, methane in the atmosphere causes around a quarter of the global warming we are currently experiencing.¹

Since the energy industry is one of the largest emitters of human-caused methane (along with agriculture), this is an area our member companies can address directly and cost-effectively, while working to influence the entire value chain.

In 2018, we announced a target, aiming to reduce the collective average methane intensity of our member companies' upstream natural gas and oil operations. From a baseline of 0.32% in 2017, we set a 2025 target of 0.25%, with an ambition to achieve 0.20%. Achieving this would mean reducing methane emissions by up to one-third, on a consistent production basis.

As a result of the measures undertaken by companies in preparation for the target, we were able to reduce the collective methane intensi-

ty level to 0.29% in 2018, a drop of 9%, while bringing three new member companies into the effort. Absolute methane emissions across member companies' upstream operations fell by 12%.

On track

This pace of reduction shows we are on track to meet our 0.25% target. We are now working to sustain momentum so we can reach our ambition of 0.20%, recognizing that progress becomes more difficult over time, since the most effective measures are taken first.

The drop in methane intensity last year was largely a result of expanded leak, detection and repair campaigns, introduced by several companies in 2018. Significant equipment upgrades and continued investments in reducing flaring also contributed to the result. The reduction also reflected more accurate quantification and reporting of emissions. The addition of three new member companies made no material difference to the baseline.

Amplifying the impact

The OGCI methane intensity target



Mark Brownstein
SVP Energy, Environmental
Defense Fund

"OGCI's methane target shows real climate leadership, but must be backed by tangible actions to measure, report and reduce emissions."

¹ The UN-Environment's Global Methane Alliance, for example, references the target in identifying how member countries can set meaningful targets for the oil and gas industry.

is increasingly being perceived as the standard for companies across the energy sector.¹ This amplifies our climate impact by facilitating reduction from non-members. We welcome other companies wishing to align with our efforts and generate a greater positive climate impact.

This year, OGCI has also launched a collaborative relationship with the Methane Guiding Principles (MGP) – an initiative made up of some 30 organizations, including oil and gas companies, as well as non-governmental organizations, international institutions and academics. It is focused on reducing methane emissions across the natural gas value chain. OGCI and MGP are coordinating work programmes and resources to strengthen our joint ability to support the industry in reducing its emissions. OGCI has made a financial provision to support the secretariat of the MGP.

MGP key priorities this year have included:

- the development of a Methane Emissions Information Portal
- the development of a set of best practices

- the development of a practical training programme, targeting executives and practitioners
- the establishment of a policy framework that supports methane reduction.

Sharing learnings

This MGP partnership is an important step in accelerating change across the industry by sharing non-proprietary learnings as we move towards our own target.

We are continuing to strengthen our engagement with the downstream industry to tackle methane emissions that happen during the transportation, distribution and end use of natural gas.

In Europe we are working closely with Marcogaz and Gas Infrastructure Europe and we will expand co-operation elsewhere in 2020, with the aim of setting specific objectives to reduce emissions. We have joined the UN-Environment Global Methane Alliance, which aims to work with countries to include methane emission reductions in their nationally determined contributions, by reducing methane emissions from the oil and gas sector.

Expanding to a carbon intensity target

Building on the experience we gained in setting the methane intensity target, we are now working on an additional carbon intensity target. This target will take into account carbon dioxide and methane emissions from member companies' aggregated upstream operated oil and gas operations.

In line with the methane measure, the carbon intensity target will also be focused on achieving a 2025 target from a 2017 baseline. We will continue to report on the methane intensity target in parallel, to retain focus specifically on actions required for methane management.

To set a clear and meaningful carbon intensity indicator, we have developed transparent aggregate reporting principles and an aligned methodology and assumptions, with data consolidated and reviewed by a third party.¹

Our methodology uses a more comprehensive definition than similar intensity indicators,² taking into account upstream direct carbon dioxide and methane emissions from all OGCI-member operated oil and gas assets, and including emissions from drilling activities, production and liquefaction of natural gas, as well as emissions from imports of electricity and steam. Emissions intensity is calculated as a share of marketed oil and gas production. Our 2017 baseline is 24kg CO₂e/boe.³

Data is currently being collected and evaluated so as to provide a collective target, in support of the Paris Agreement goals. We aim progressively to expand the scope of our collective efforts to downstream operations, such as refineries and petrochemical plants. These are being evaluated separately, since defining and quantifying emissions in these facilities is significantly more challenging to align across all the member companies.

Reducing carbon intensity involves improving energy efficiency, minimizing flaring, upgrading facilities, co-generating electricity and useful heat, and deploying CCUS. Member companies are already focused on putting such initiatives in place, and as a result, in 2018, OGCI's collective carbon intensity was already 4% lower than the 2017 baseline, with around 20% of this improvement explained by reduced methane emissions.

1 The data and methodology is available at:

oilandgasclimateinitiative.com/methodology

2 The indicator used by the International Association of Oil and Gas Producers (IOGP), for example, excludes Scope 2 and emissions from LNG.

3 OGCI carbon intensity is based on a bottom-up approach. The average industry carbon intensity has been estimated for a similar perimeter as the one used by OGCI, based on global energy-related carbon dioxide emissions and total primary energy demand, using top-down assessments. We used data from the International Energy Agency's World Energy Outlook 2018 (tables 1.2 and 1.5, pages 40 and 46), as well as the Representative Concentration Pathway Database, from the Intergovernmental Panel on Climate Change. These estimates lead to a carbon intensity average for the industry of approximately 49kgCO₂e/boe for oil and 67kgCO₂e/boe for gas. For full methodology see:

oilandgasclimateinitiative.com/methodology

SAUDI ARAMCO Getting results with leak detection and repair

Throughout 2018, Saudi Aramco implemented a comprehensive leak detection and repair (LDAR) programme, enabling further reductions in emissions through the identification and mitigation of fugitive leaks, one of the largest sources of methane emissions in the oil and gas industry. LDAR programmes are designed to systematically identify and repair leaking equipment and components, such as valves, flanges, connectors, pumps, compressors and tanks.

Saudi Aramco's programme is exhaustive by design. It covers all operating facilities in Saudi Arabia, and requires a detailed process analysis, tagging millions of components, performing field surveys on all equipment, repairing leaks, upgrading equipment, changing processes and verifying the results.

Its 2018 LDAR field measurements were assessed by an independent reviewer and have affirmed Saudi Aramco's strong performance at the asset level. The company's total measured methane emissions for oil and gas assets in Saudi Arabia were significantly less than those estimated using desktop calculations for prior years, bringing a significant boost to OGCI's efforts to meet its aggregate upstream methane intensity target.

Saudi Aramco is now revising its LDAR protocol to improve monitoring, definitions and repair enforcement, and expects to deploy new technologies in monitoring and minimizing fugitive emissions, such as specialized drones for methane detection and quantification, as well as next generation valves.



© Saudi Aramco



Darren W. Woods
Chairman and CEO,
ExxonMobil

"This comprehensive initiative is part of our commitment to addressing society's dual challenge of providing affordable energy while reducing environmental impacts."

left: Saudi Aramco's Shaybah facility.

right: Checking devices at an ExxonMobil field.

EXXONMOBIL

Methane management in unconventional operations

ExxonMobil is progressing a comprehensive methane management programme which is on track to meet its goal of reducing methane emissions by 15% in 2020, compared to 2016. It comprises leak detection and repair (LDAR) efforts, a phase-out of high bleed pneumatic devices, revised operating procedures and personnel training. The programme involves substantial data gathering, research, and technology development. While global in nature, a significant effort is focused on ExxonMobil's unconventional oil and gas operations in the USA. The programme has already shown significant progress. Since 2016, methane emissions from unconventional operations have been reduced by 20%.

Data gathered during LDAR efforts in the Permian Basin in Texas and in New Mexico have allowed us to deploy new low-emission design technologies to components with a high potential to leak. These technologies include improved designs for controlling tank emissions and instrument air packages, which use compressed air instead of natural gas to power controllers.

ExxonMobil is also pursuing an extensive research and technology development programme devoted to more effectively reducing methane emissions and advancing cost-effective mitigation policies through engagements with governments and other stakeholders. The company is also a founding member of the Methane Guiding Principles – now working together with OGCI – to advance methane emissions reduction initiatives.



© ExxonMobil

REPSOL New generation membrane technology reduces emissions

In 2018, Repsol introduced a comprehensive set of internal metrics, targets and action plans to ensure meaningful progress towards climate change mitigation. By 2025, Repsol aims to reduce annual upstream greenhouse gas emissions by 3 MtCO₂e per year, reduce upstream operated methane emissions intensity by 25% and halve routine flaring. In addition, Repsol is committed to reducing its carbon intensity by 3% by 2020, compared to 2016, with the ambition to reach a reduction of 40% by 2040, in line with the Paris Agreement.

With methane emissions reduction core to these programmes, Repsol has successfully piloted new-generation membranes in one of its offshore assets in South East Asia. Due to high carbon dioxide content in the gas produced from the reservoir, several membrane separation trains are required to purify the natural gas to meet quality specifications. By upgrading the membranes, Repsol was able to increase the membrane system selectivity, while also increasing the methane recovery rate.

A membrane skids replacement schedule has now been established, and Repsol has already achieved a reduction of more than 70,000 tonnes of carbon dioxide equivalent. Repsol is sharing its experience as companies strive to reduce methane emissions in their operations.





Mike Wirth
Chairman and CEO, Chevron

"Every day, we work to make the world's energy ever-cleaner and our environmental footprint smaller."

left: Repsol has piloted new membrane technologies in Malaysia.

right: Upgrading devices in Chevron's onshore facilities.

CHEVRON

Reducing methane emissions in the USA

Chevron continues to grow its commitment to reducing emissions and established two equity-based performance measures to reduce greenhouse gas emissions intensity from 2016 to 2023: a 25-30% flaring intensity reduction and a 20-25% methane emissions intensity reduction. Through its Leak Detection and Repair (LDAR) programme, Chevron uses prior experience to drive a continuous learning process. In some areas, Integrated Operations Centers are used with systems that remotely detect leaks and losses from equipment.

In addition, Chevron has removed or retrofitted all continuous high-bleed pneumatic controllers from its onshore US facilities and now uses low-emitting or non-continuous-bleed technologies to reduce emissions. Where electricity is available, electric and air-driven controllers and pumps are used, which do not emit methane when actuated. Chevron has piloted several emerging technologies and remains encouraged that more effective and efficient tools will improve LDAR performance in the future. In addition to proprietary testing, Chevron serves on the Industrial Advisory Board of the Methane Emissions Technology Evaluation Center, which tests emerging methane-sensing technologies and evaluates their performance. Chevron is leveraging its experience in methane emissions reduction to contribute to OGCI's collective progress in its methane intensity target.



TOTAL Energy efficiency in action

Total launched its US\$300 million Energy Efficiency Plan in 2018, aiming to reduce greenhouse gas emissions in its refining and chemicals operations by around one million tonnes of carbon dioxide per year. That should support the company's ambition to improve energy efficiency by 1% per year, over the next five years. Several high-impact projects, costing up to US\$15 million each to implement, were selected across 20 downstream plants on the basis of greenhouse gas reduction and energy cost savings, using an internal carbon price of US\$30-40 per tonne of carbon dioxide. In addition, the plan creates a structure to identify multiple energy and/or emissions savings opportunities at low or no investment cost.

The plan starts with a renewed focus on getting the basics right, introducing new measurement, maintenance and monitoring approaches that together build an energy efficiency culture. It provides investment for improved asset designs, energy management systems and optimized tools.

Several plants have already started to prepare for the next wave of energy saving actions.

As OGCI looks to expand its carbon intensity efforts to downstream operations, Total's experience will be key to understanding the opportunities.





Claudio Descalzi
CEO, Eni

"Reducing carbon intensity is a key priority for OGCI, as a concrete action to produce energy responsibly."

ENI Investing in flaring reduction

Having reduced upstream operated carbon intensity by 20% since 2014, Eni is on track to achieve its company target of 43% reduction by 2025. The company is pursuing a broad set of initiatives to achieve this goal, focusing on efficiency gains, methane emissions reduction, portfolio shifts towards lower and zero carbon energy sources, and carbon capture and storage.

The main driver to reduce carbon intensity over the next five years, however, is cutting flaring, which in 2018 accounted for 27% of emissions from production. With the aim of achieving Zero Routine Flaring by 2025, Eni has completed a number of projects over the past 10 years to recover and use the gas produced in association with oil. In 2018, process flaring volumes were cut by more than 9% as Eni achieved zero flaring in Turkmenistan. Eni also invested around US\$130 million in flaring reduction projects in its Nigerian assets. It completed a new 18km pipeline from the Akri oil producer to Kwale, where it is conveyed into the existing gas network. Work is also ongoing to install low-pressure compression trains to collect, compress and transport atmospheric and low-pressure flared gas in Kwale.

Eni's experience in creating alternatives to flaring in developing markets will be crucial for other companies to draw on as they focus on reducing carbon intensity.

left: Total's Leuna refinery is one of the most energy efficient refineries in the world.

right: Building the Akri-Kwale pipeline to recover and use offshore gas.



EQUINOR A world leader in carbon efficiency

Equinor has focused on energy efficiency, technical design and flaring reductions for decades, spurred on by a Norwegian carbon tax, introduced in 1991, along with national policies to ban routine flaring and ensure utilization of gas. In 2008, enforced by national targets and the introduction of the EU's Emissions Trading Scheme, Equinor embarked on a series of energy efficiency initiatives that produced results far faster than expected, encouraging greater ambition. The company has eliminated about 1.8 million tonnes of carbon dioxide per year since 2008. It is accelerating its commitment to achieve further reductions of three million tonnes per year from its global operations by 2030, compared to a 2017 baseline.

Equinor pursues a raft of measures to reach these targets. At its heart is a continuous focus on measuring, monitoring and optimizing energy management. Workers engage on this as a priority, and facilities are compared to share good practice. There have also been a series of large-scale investments. Electrification from hydropower and wind is being installed at a number of offshore fields in Norway. Technical design improvements have enabled compressors to be removed or upgraded. Further flaring reductions are underway. As OGCI works towards a carbon intensity target that is consistent with the Paris goals, member companies are drawing on the lessons of Equinor's experience.



© Equinor / Espen Rønnevik/Øyvind Gravås



Roberto Castello Branco
CEO, Petrobras

"Once you incorporate carbon in your business thinking, you realize it is a great contribution to shareholder value creation."

left: Equinor's Johan Sverdrup, one of its most energy efficient platforms.

right: Carbon dioxide separation module on a Petrobras offshore production platform in ultra deep water

PETROBRAS

Step change in carbon efficiency

In 2018, when Petrobras announced its support for the World Bank's Zero Routine Flaring by 2030 initiative, it simultaneously announced that all assets under the company's operational control were already exporting or reinjecting gas, and therefore did not require routine flaring of gas production. Average gas use in 2018 was 97%, an improvement of 23% in just 10 years. As a result of reduced flaring and other initiatives, upstream carbon intensity was reduced by 25% from 2009 to 2015, and a further improvement of more than 32% is expected by 2025, through a carbon mitigation programme linked to public targets.

Petrobras has also applied a number of innovative technologies to enable the separation of carbon dioxide from natural gas in key pre-salt areas, so that it is reinjected into the reservoir in ultra deep waters, rather than being vented. Petrobras won an award for this at the offshore technology conference 2015. Almost 10 million tonnes of carbon dioxide have already been reinjected between 2008 and 2018. Petrobras estimates that total accumulated reinjection will amount to more than 40 million tonnes of carbon dioxide by 2025.

Petrobras is sharing its experiences in these areas to accelerate progress in reducing the carbon intensity of both oil and gas production.

For more information, see Petrobras's Climate Change Supplement petrobras.com.br/en/climate



OGCI'S CCUS KICKSTARTER

OGCI EFFORTS

Help 5 emerging CCUS hubs to reach operation

Identify and develop multiple potential hubs around the world

Work with governments to create conditions for commercial investment

Engage with emitters, other investors and community organizations

Invest in anchor projects to enable hubs

Share learnings proactively between hubs

OUR OBJECTIVES

Help develop the necessary market conditions for CCUS

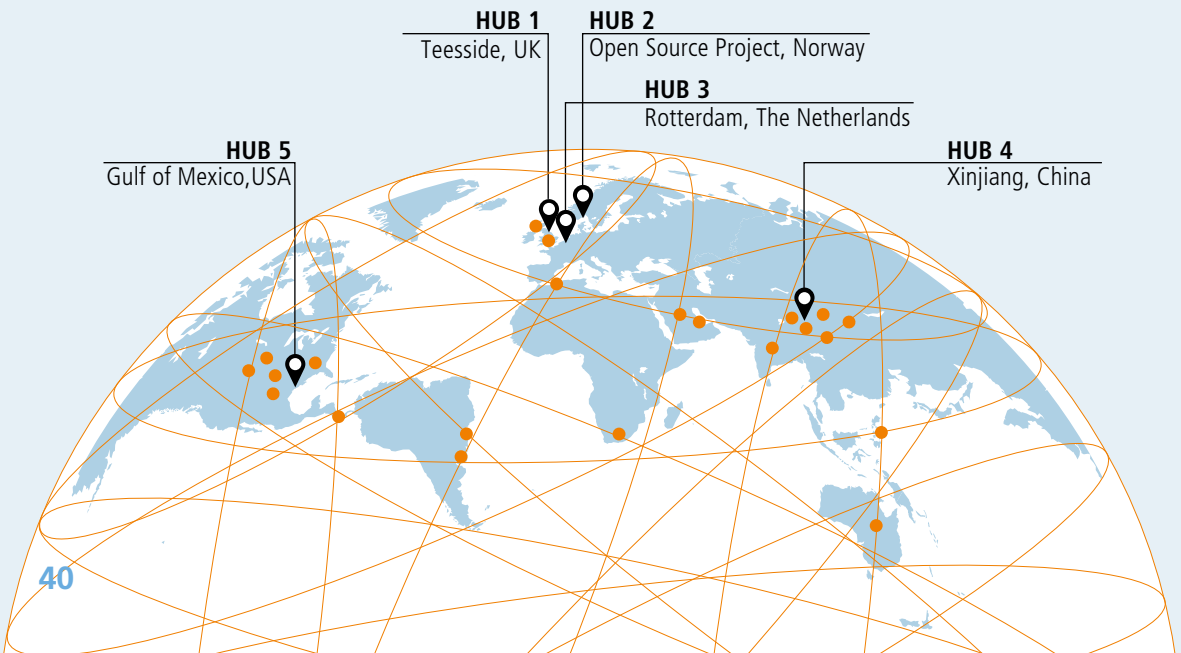
Facilitate large-scale commercial investment in CCUS

Bring economies of scale by sharing transport and storage infrastructure

Play our part in the emergence of a commercially viable, safe and environmentally responsible CCUS industry.

Facilitate the decarbonization of multiple industrial sectors

Enable multiple low-carbon industrial hubs



OUR ASPIRATION TO KICKSTART CCUS



Wang Yilin
Chairman, CNPC

"We will firmly advance the energy transition and create a sustainable future for the community of mankind."

1 According to the IEA, 30 mtCO₂ are currently stored per year. Tracking Clean Energy Progress, 2019

2 International Energy Agency, Tracking Clean Energy Progress, 2019

3 International Energy Agency, Transforming Industry through CCUS, 2019

www.iea.org/publications/reports/TransformingIndustrythroughCCUS/

OGCI launched CCUS KickStarter in 2019, a major new initiative designed to facilitate large-scale commercial investment in CCUS, by enabling multiple low-carbon industrial hubs. These hubs will capture carbon dioxide from several industrial sources within one region and bring economies of scale by sharing transport and storage infrastructure. They also provide opportunities to use carbon dioxide in products.

We aim to work with governments and across industry to facilitate the necessary market conditions for investment in hubs and projects by our member companies, governments, OGCI Climate Investments and other independent investors. We want to play our part in the emergence of a commercially viable, safe and environmentally responsible CCUS industry that can contribute at the scale needed to help meet the aims of the Paris Agreement, while supporting economic growth.

To achieve this, we will build on the work of many others to jointly kickstart high-potential CCUS hubs in both developed and developing regions. We will work with them to get five emerging hubs into operation,

aspiring to double the amount of carbon dioxide that is currently stored globally.¹ At the same time, we are building a pipeline of potential future hubs that, if successful, could multiply our impact by 2030.

The action on the ground in the five priority hubs, the identification and maturation of future hubs, and the investments by OGCI Climate Investments and our member companies will together work towards delivering our aspiration.

Why KickStarter?

The 20 or so large-scale CCUS facilities in operation today, while successful in their own right, have not kickstarted a marketplace. In order to meet the Paris Agreement goals, the International Energy Agency estimates, around 25 times more carbon dioxide must be captured and stored annually by 2030, than takes place today.² Most of these captured emissions will need to come from industrial sectors such as cement, steel and chemicals, where alternative abatement pathways are especially challenging.³

That is why we are joining forces with national and regional authorities, other industrial emitters and a

range of organizations to help accelerate industrial decarbonization, using a hub concept to reduce costs by leveraging shared infrastructure and learnings. Our aim is to help create the necessary commercial and market conditions for a CCUS industry to expand at the scale required.

Many organizations in Norway, the UK, the Netherlands, the USA and China are already working hard to encourage the deployment of CCUS in industrial hubs, and we are working with them wherever practical. But a stronger signal of commitment is needed from governments, the private sector and the oil and gas industry, in particular, to accelerate momentum, unlock investment and achieve global impact. This is what we are addressing with KickStarter.

What OGCI brings to the table

KickStarter aims to accelerate the process of getting hubs off the ground, recognizing that a 'one size fits all' approach is impossible. Each potential CCUS hub has different needs. Some struggle to convene all the players or lack well-designed policy and regulations that are both workable for industry and meet the needs

WHY IS OGCI FOCUSING ON CCUS?

1

CCUS is an essential part of a broad package of solutions needed to reach the Paris climate goals.

2

OGCI member companies have the expertise, the experience and the balance sheets to make a meaningful contribution to the global deployment of CCUS.

3

CCUS is important to our commercial future, and that of our industrial customers, as the world transitions to a net zero emissions future.

of the community. Others have neither the expertise nor the resources to build confidence in the availability and permanence of storage – or lack the investors and financiers willing to finance and operate collective transport and infrastructure or commit to capturing emissions.

We can support in three key areas:

Consensus-building: Getting a CCUS hub off the ground requires extensive engagement among government, industrial emitters, lenders, NGOs, local communities and other organizations. This is necessary to identify common goals, build trust and identify the value that the deployment of CCUS enables in each specific region.

Detailed stakeholder engagement is also needed to create enabling policy and regulatory frameworks that unlock investment capacity by clarifying commercial viability and responsibilities. KickStarter and our member companies can support this process as needed to help stakeholders move faster together – and share the learnings with others.

Credibility: Many potential CCUS hubs have been under discussion for years without maturing into commercially viable concepts. What has often been missing are the relevant stakeholders willing both to commit to investment and to work with other stakeholders to develop the right conditions for that investment.

Our KickStarter initiative aims to provide the impetus for member companies, or any other investors, including OGCI Climate Investments, to get involved, creating a virtuous circle

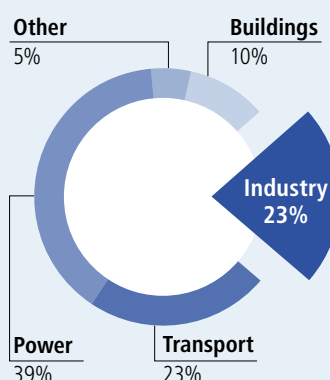
that attracts investment from governments, international bodies and across the private sector.

Capabilities: Most potential hubs struggle to access the expertise and data resources needed to create confidence in the availability, safety and permanence of storage over an extended period. KickStarter draws on the deep expertise of our companies and can provide access to non-proprietary resources to fill this gap.

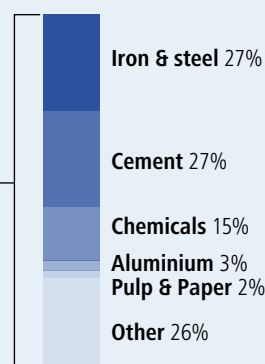
TACKLING INDUSTRIAL CARBON DIOXIDE EMISSIONS

Industry accounts for almost a quarter of global carbon dioxide emissions directly – and for nearly 40% if indirect emissions from industrial power and heat are included. Three subsectors – iron & steel, cement and chemicals – make up almost 70% of the total industry emissions. The IEA estimates that CCUS would need to mitigate over a quarter of industrial emissions by 2060 – eliminating a total of 21 GtCO₂ – to ensure climate goals are not derailed.

Share of global direct carbon dioxide emissions by sector, 2017



Share of global direct carbon dioxide emissions from industry by subsector, 2017



Source: IEA, Transforming Industry Through CCUS, 2019



Bob Dudley
Chairman of OGCI

"Getting CCUS to scale requires collaboration between industry and governments and involves multi-billion dollar, multi-year investments. OGCI sees this as crucial for tackling climate change."

What makes for a CCUS hub?

Regions with high potential have:

- Significant carbon dioxide emissions and several emitting companies situated in an area so that carbon transport and storage infrastructure can be shared to reduce costs.
- National and/or regional government authorities that are committed to decarbonizing heavy industry.
- Significant storage resources in the region or the ability to connect to storage or usage demand elsewhere by ship or pipeline.

OGCI KickStarter will work with selected high potential regions to help put the right conditions for investment in place:

Policies: Getting CCUS off the ground depends on having the right policy framework in place, and that will remain important, even as costs fall. Governmental bodies need to identify policy tools that meet their overall objectives, while incentivizing carbon capture, and the development of collective transport and storage infrastructure. Policies fall into five broad categories: tax or other credits for storing carbon, clean product standards, a sufficiently high carbon price, mandates and interim subsidies.

Regulations: Many practical issues need to be resolved before a hub can get started. These include storage characterization, reporting requirements, access to pore space and accepted methodologies for quantifying containment risks. Clear regulations are needed to clarify operating standards and post-closure management. Given the complexity of CCUS, it is essential that these are tested in an open dialogue with operators so that compliance is feasible and risk management is clear.

Organization: Close communication between diverse stakeholders over many years is essential to move ahead with a hub. Local coalitions are needed that are willing to put in the effort to bring all the stakeholders together, in an open and accessible way, from industrial emitters and potential investors to an operator that can provide transport and verified storage resources – all while building community support.

HUB 1



Potential impact by 2030:

over 6 mtCO₂/year

Potential emitters:

biomass power, gas power, fertilizers, petrochemicals, hydrogen, CO₂ imports

OGCI's role:

- Develop anchor project with collective pipeline and storage
- Work with UK government on policies
- Engage with other emitters
- Share knowledge with other hubs



© Tees Valley Combined Authority

Teesside, UK – Getting to net zero

The Teesside industrial hub was the spark for OGCI's KickStarter initiative. Teesside has long been a preferred location for the UK government's attempts to deploy CCUS at scale. Following the failure of previous efforts, OGCI Climate Investments acquired the Teesside industrial hub project, and worked to commercialize and rethink the concept, focusing less on building a large, CCUS-enabled gas power plant and more on creating an anchor project for the hub with transport and storage infrastructure that could service other industries and emitters.

Working closely with the UK government, OGCI has helped to steer and build on the collaboration between government and industry to develop new business models, manage risk, and make CCUS more affordable. A UK government-led task force, highlighted the significant value that CCUS hubs could bring – from industrial regeneration, regional investment and good jobs to helping meet ambitious national decarbonization goals.

With government expressing growing interest, OGCI Climate Investments brought on BP, Eni, Equinor, Occidental, Shell and Total to drive the project, creating a strategic alliance with BP as the principal operator. The government's recent commitment to achieve net zero emissions in the UK by 2050 has accelerated the momentum. It is defining business models and policy to support capture in power, industry, hydrogen and biomass, and clarifying regulations around storage infrastructure. That, along with the presence of operators willing to invest heavily in the hub is attracting interest from potential emitters who would like to feed their carbon into the Teesside store.

OGCI was instrumental in refining the concept of an anchor project for this hub, and in building support around it. With a dedicated team of engineers and project specialists from the six member companies, the project is working with the UK government to ensure policies are in place to allow us to enter the front-end engineering and design phase in 2020. As the hub readies itself for operation, requiring investment of around US\$3 billion, KickStarter will leverage the learnings from this process to help advance other CCUS hubs.



The Full-Scale Open Source CCS Project, Norway

When the Norwegian government launched its full-scale CCS project in 2016, its aim was to test new ways of getting the industry to function at scale. It opted to create an open source transport and storage service that can store significant volumes of carbon dioxide from across Europe's industrial hubs. It also worked to define and develop the value chain that could drive CCUS from capture to storage monitoring – as well as the regulatory and institutional structure that might support it.

In its first phase, heading for investment decision by the end of 2020 and operations launched by the end of 2023, the project aims to capture emissions from a cement plant and a waste incinerator in eastern Norway. The carbon transport and storage service will collect the carbon dioxide and transport it to western Norway for temporary storage, from where it is piped to and stored permanently in a depleted reservoir 3km under the seabed and 110km from shore. The Northern Lights consortium leading on the transport and storage component is made up of three OGCI members: Equinor, Shell and Total. Gassnova, the state-owned company overseeing the project, will ensure that the links in the value chain fit together.

The first two industrial users of this service will capture just 800,000 tonnes of carbon dioxide per year, but the infrastructure is built to accommodate 5 million tonnes a year for 20 years. The project has already elicited interest from around a dozen industrial sites across eight countries, ranging from steel to biomass and waste paper. Norway, the United Kingdom and the Netherlands are already discussing how they could collaborate to create a seamless carbon storage operation in the North Sea.

With a joint team of 160 people in Oslo, Stavanger and other locations, Northern Lights is one of the more developed KickStarter hubs. Our role as OGCI is to share the learnings widely, help facilitate the open access strategy, and ensure that the hub is the start of a commercially viable industry that can help Europe reach its long-term climate goals.

HUB2



Potential impact by 2030:

5 mtCO₂/year

Potential emitters:

cement, waste incineration, hydrogen, bio-mass. steel, refineries

OGCI's role:

- Member companies Equinor, Shell and Total responsible for transport and storage operations
- Convene governments and industries interested in leveraging CCUS
- Share knowledge with other hubs

HUB3



Potential impact by 2030:

10 mtCO₂/year

Potential emitters:

refineries, hydrogen production, CO₂ imports from Antwerp and Germany

OGCI's role:

- Provide storage expertise
- As member companies, develop capture options
- Engage with other emitters
- Share knowledge with other hubs



© ExxonMobil

Rotterdam Hub, The Netherlands

The Port of Rotterdam is Europe's largest port, the heart of an industrial area that emits around 28 million tonnes of carbon dioxide per year. Decarbonizing these industries without pushing them out of the country is a major concern for both the Dutch government and the Port of Rotterdam authority. That's why, despite popular unease at the idea of CCUS in the Netherlands, the Port and two state-owned energy companies (Gasunie and EBN) have joined forces to enable the storage 2-5 million tonnes of carbon dioxide from the immediate port area and store it in empty gasfields below the North Sea. Their ambitious expansion plan aims to extend storage up to 10 mtCO₂/year – and if the conditions are right, to expand further and import carbon dioxide from other European regions to be stored.

The Rotterdam hub has been in the works since 2017, with initial plans to develop transport and storage infrastructure driven by Porthos, a small, dedicated team. Porthos became eligible for substantial EU funding in 2018 and was recognized as an EU Project of Common Interest. It has now started detailed planning of the pipeline. With greater government clarity on CCUS policy and funding mechanisms, three of port's largest emitters – OGCI member companies BP, ExxonMobil and Shell – began to study capture options for the collective store.

What the project still lacked, however, was access to specialized technical expertise and resources. As we developed the KickStarter initiative, OGCI storage experts began to work closely with the Porthos team, identifying a number of technical issues that needed to be resolved to move forward confidently with storage plans. OGCI is now starting to provide support with reservoir modelling, flow assurance, carbon dioxide plant operational experience, peer assist reviews and ad hoc technical feedback.

The development of the Rotterdam CCUS hub has accelerated over the past two years – and OGCI hopes to help it sustain that momentum as the government finalizes its policy and allocation of funding and the first storage site becomes available in 2023.



The Xinjiang CCUS Hub, China

CCUS is one of the main elements of CNPC's Green Action Plan, planned in early 2019 and designed to secure energy supply while helping to decarbonize Chinese industry. In its Jilin oilfield, CNPC has been using carbon dioxide for enhanced oil recovery and safely storing 150,000 tonnes per year since 2008. It also has three pilot projects in operation in the northeast and northwest of China, each injecting 100,000 tonnes of carbon dioxide captured from diverse industrial sources into oilfields in each area.

From these, CNPC has selected Xinjiang in the Junggar Basin in north western China to be included among OGCI's five priority KickStarter hubs. In the demonstration project underway, carbon dioxide comes from the hydrogen production units of refineries, with a preliminary storage volume of around 3 million tonnes per year by 2025. The carbon dioxide is transported to nearby oil fields by truck and then injected into the ground to improve the oil recovery rate, with an expected carbon dioxide storage rate of above 93%. Once at scale, CNPC plans to expand capture to the chemical industry and power, constructing an exclusive carbon dioxide transport pipeline.

The project has the engagement of senior CNPC executives and is supported by the Xinjiang local government, the Ministry of Science and Technology and the Ministry of Ecology and Environment. Working together, they aim to use the hub – and the cooperation with OGCI – to develop robust policy mechanisms and regulations that can support the development of a CCUS industry at scale. To this end, OGCI held a workshop on CCUS bringing together key industry, regulatory and academic stakeholders in June 2019. A white paper is currently being written by experts from CNPC and the China University of Petroleum on the commercialization of CCUS in China.

HUB 4



Potential impact by 2030:
over 3 mtCO₂/year

Potential emitters:
refineries, chemicals, power

OGCI's role:

- CNPC to invest in transport and storage infrastructure
- Work with Chinese ministries on policies
- Support R&D on storage and EOR
- Convene and co-operate with other emitters
- Share knowledge with other hubs

HUB5



Total CO₂ emissions:
 200 mtCO₂/year
 of which 35mtCO₂/year
 is pure streams

Potential emitters:
 power plants, refineries, chemical plants, fertilizers, hydrogen

OGCI's role:

- Convene and engage with stakeholders
- Identify commercialization pathways
- Identify investments
- Work on policies and regulations
- Share knowledge with other hubs



© Gulf Coast Carbon Center, Texas Bureau of Economic Geology

CCUS Hubs in the Gulf of Mexico, USA

The Gulf of Mexico presents an exciting opportunity for the creation of a CCUS marketplace, potentially containing several hubs. The region has a wide range of industries that can capture carbon dioxide, many with highly concentrated streams. There is already some pipeline infrastructure for carbon dioxide transport, several capture plants, and the area has multiple options for storage. Enablers in place include the 45Q tax credit and the existence of a commercial value in enhanced oil recovery operations. Organizations active in the area include many OGCI member companies, multiple universities, foundations, NGOs and state governments.

No surprise, then, that many groups are talking about the potential for using CCUS to help decarbonize the region. The big question for KickStarter is, given the excellent conditions, why is it not happening on a large scale and what could OGCI bring to the table to help get a hub off the ground?

Under the leadership of Occidental and OGCI Climate Investments, OGCI has begun to work closely with existing stakeholders on the ground to help identify and fill the gaps, with the aim of supporting a pathway to realization. We are helping a broader range of emitters to understand the new opportunities opened by CCUS and engaging with authorities in Texas and Louisiana, identifying specific policy and regulatory issues and opportunities. This has helped to jumpstart a second phase of work to realize CCUS at scale in the Gulf of Mexico.

A key role for OGCI and other potential investors is to identify a commercialization roadmap, with viable business models and service offerings that leverage tax credits, alongside other carbon-valuation mechanisms such as enhanced oil recovery and other utilization projects. OGCI's leadership can help to reduce investment risk and drive down the cost of CCUS for other companies, so they can participate in the marketplace.

SHELL The lessons of Quest

In May 2019, just four years after its launch shortly before the signing of the Paris Agreement, Shell announced that its Quest facility in Alberta, Canada, had captured and safely stored 4 million tonnes of carbon dioxide. Ahead of schedule and at a lower cost than expected, it is the largest onshore capture facility in the world with dedicated geological storage. That marks a significant step forward in demonstrating the value of carbon capture and storage as part of a global climate solution.

It is, however, the lessons that Shell has learned from getting Quest off the ground – and shared with others – that are likely to be its major legacy. Two stand out. First, costs would be around 30% less, if Quest were to be built again, providing a basis for new carbon and capture projects to be more cost-effective. Secondly, close engagement with policymakers, other industrial emitters and regional organizations is key. This ensures that oversized transport and storage infrastructure is fully used, as other emitters are incentivized and encouraged to capture and supply carbon dioxide.

That lesson is at the heart of OGCI's KickStarter initiative designed to shift from one-off facilities to low-carbon industrial hubs – and to the emergence of an industry that can store carbon dioxide on the scale needed to meet Paris climate goals.



© Shell



Vicki Hollub
President and CEO,
Occidental

"We cannot achieve global climate targets or carbon neutrality without large-scale implementation of CCUS."

left: Shell's Quest carbon capture and storage facility in Canada

right: Occidental carbon capture and storage facility in Texas

OCCIDENTAL Getting to carbon neutrality

When Occidental announced it aspired to carbon neutrality, it pointed to CCUS projects as critical to making this vision a reality. For decades, Occidental has injected naturally occurring carbon dioxide into its Permian Basin reservoirs to enhance oil recovery (EOR), becoming a global leader in the technology while safely and permanently storing about 20 million tonnes of carbon dioxide a year. Occidental received approval from the US Environment Protection Agency for the first two plans for quantifying the amount of human-caused carbon dioxide permanently stored in its oil and gas reservoirs. Occidental was a key supporter of legislation expanding the 45Q tax credit, enacted in February 2018 to incentivize the capture and geologic storage of human-caused carbon dioxide.

In 2018, Occidental and White Energy announced a project to install carbon capture equipment at the two White Energy ethanol plants in Texas. The captured carbon dioxide will be transported via pipeline to the Permian, where it will be injected and permanently stored as part of Occidental's EOR operations, qualifying the project for 45Q tax credits.

There is tremendous capacity available in the Permian, other areas of the USA and across the world to safely and permanently store carbon dioxide, and Occidental is a leader in implementing CCUS partnerships, like the one with White Energy, in pursuit of carbon neutrality.

OGCI's KickStarter project draws on the success of policies such as those in the USA to incentivize commercial investment in CCUS.





OGCI PERFORMANCE DATA: 2018

4



OGCI DATA REPORTING

OGCI has focused this year on consolidating data reporting to include our three new member companies, improving our indicators and introducing a systematic third-party review of the aggregate data we publish.

A key achievement has been to develop with an independent third party, an innovative data review model appropriate to both state-owned national oil companies and investor-owned companies. From 2019, all data published by OGCI is collected using consistent methodologies, independently reviewed and anonymized by using internationally recognized practices for greenhouse gas accounting and reporting. For more details on this process, see page 60.

For 2017 and 2018, we have

worked with our new member companies to develop a full data set¹ in production, greenhouse gas emissions, methane emissions and flaring. We have worked on the methodology for the carbon intensity indicator to bring it into alignment with our methane intensity indicator and ensure it is consistent across all companies, providing a solid basis for OGCI to measure its impact.

The one area where we are still in the early stages of being able to provide full and consistent data is low carbon investments and research and development spend, since member companies capture this data in very different ways. Over the next year, we are working to develop consistent and detailed definitions that enable more companies to provide data.

OGCI's Reporting Framework and methodologies are available at: oilandgasclimateinitiative.com/methodology

Note: Figures may not add up exactly due to rounding effects. 2017 data differs from last year's report due to the addition of three new member companies.

¹ One company was unable to provide 2018 data, so 2017 data were used for all categories except low-carbon investments and R&D.

NOTES:	
Mboe/day	Million barrels of oil equivalent per day
Mtoe	Million tonnes of oil equivalent
MtCO ₂	Million tonnes of carbon dioxide
MtCH ₄	Million tonnes of methane
Mm ³	Million cubic metres
Bcm	Billion cubic metres



PRODUCTION

The aggregate oil and gas production of OGCI member companies has risen along with our membership. The 13 OGCI members produced 49 million barrels of oil equivalent (boe) a day in 2018, an increase of 2% compared to 2017. Operated oil production rose 3% to reach 33 million boe/day, while gas production rose 1% to reach 16 million boe/day. OGCI member companies now operate 32% of global oil and gas production and represent 17% of total primary energy demand.¹

The gas share in OGCI's operated portfolio was 33% in 2018, showing a slight decline over 2017, due to divestments from certain regions. OGCI member companies represented over 25% of global natural gas production in 2018.

Notes:

1 According to data from IEA World Energy Outlook 2018 data for 2017: global oil and gas production was 161 mboe/day; oil production was 95 mboe/day, and natural gas production was 62 mboe/day. Total global energy consumption was 151 mboe/day. OGCI member companies' share of oil and gas production is 32% on an operated basis and 28% on an equity basis. The share of total global energy consumption is 17% on an operated basis and 16% on an equity basis.

2 Operated production refers to total output that is produced under a company's control and responsibility.

3 Equity production means total output in operations that are owned by a company (calculated according to its ownership share).

4 From 2017, OGCI member company production data is at point of sale (rather than wellhead), to exclude companies' own consumption of energy and enhance consistency for current and upcoming targets.

OGCI Indicators	Unit	2016	2017	2018
	(number of companies providing data if not all 13)			
Total OGCI oil production (operated)	M boe/day	29.7 (10)	31.9	32.7
Total OGCI gas production (operated)	M boe/day	11.7 (10)	15.9	16.0
Total OGCI oil and gas production (operated) ²	M boe/day	41.4 (10)	47.8	48.7
Share of natural gas in OGCI operated portfolio	%	28.3 (10)	33.3	32.9
Total OGCI oil and gas production (equity) ³	M boe/day	36.9 (10)	45.6	46.7



GREENHOUSE GAS EMISSIONS

For greenhouse gas emissions, all member companies provided data for the past two years. This year, we have further aligned methodology to enhance consistency in how we calculate our upstream carbon intensity, as we work on a 2025 target. We have included in our definition emissions from exploration, direct operations, LNG liquefaction and imports of electricity and steam (Scope 1 and 2). In 2018 our collective carbon intensity fell 4%, largely due to a significant reduction in the volume of flaring and programmes to reduce methane emissions.

Scope 1 operated greenhouse gas emissions fell in both upstream (4%) and downstream (2%) operations in 2018. Scope 2 emissions rose as several companies decreased their own power and steam generation in favour of imports.

Notes:

- 1 Upstream Carbon Intensity is calculated on the basis of upstream carbon dioxide and methane emissions, both Scope 1 & 2, on an operated basis.
- 2 This figure includes direct (Scope 1) emissions of carbon dioxide, methane and nitrogen oxide from all operated activities (upstream, as well as downstream, which includes refineries and petrochemicals).
- 3 Upstream activities comprise all operations from exploration to production and gas processing (up to the point of sale), including LNG liquefaction plant.

OGCI Indicators	Unit	2016	2017	2018
	(number of companies providing data if not all 13)			
Upstream Carbon Intensity ¹	kgCO ₂ e/boe	na	23.7	22.7
Total operated greenhouse gas emissions - all sectors (Scope 1) ²	MtCO ₂ e	362 (8)	749	724
<i>of which: upstream greenhouse gas emissions (Scope 1)³</i>	MtCO ₂ e	184 (8)	379	363
Upstream operated greenhouse gas emissions (Scope 2)	MtCO ₂ e	na	41.5	47.4



METHANE EMISSIONS

As part of our work in setting a methane intensity target last year, we aligned data collection on operated upstream methane emissions from both oil and gas production. This data is now available for all 13 member companies from 2017. Taking into account the three new companies that joined in late 2018, the 2017 baseline remained at 0.32.

Methane intensity fell by 9% in 2018, dropping to 0.29% over the year. That provides confidence that the actions we are taking are on track to reach our target of 0.25% by 2025, and also our ambition of 0.20%. While a small part of the reduction is due to improved quantification, total upstream methane emissions fell in most member companies and matched the intensity reduction at 12%. This was largely due to leak detection and repair campaigns and equipment upgrades beginning to have an impact. Methane emissions from all sectors, including downstream, have fallen even more sharply at 15%.

Notes:

1 This is the key performance indicator for OGCI's 2025 upstream methane target. It includes total upstream methane emissions from all operated gas and oil assets. Emissions intensity is calculated as a share of marketed gas.

2 This figure includes relevant operated activities (upstream, refineries, petrochemical, power generation etc, where these are operated by the company). Since the share of non-upstream activities varies strongly from company to company, we aim to separate out upstream and downstream data.

OGCI Indicators	Unit	2016	2017	2018
	(number of companies providing data if not all 13)			
Upstream Methane Intensity ¹	%	na	0.32	0.29
Total operated methane emissions - upstream	MtCH ₄	na	2.20	1.93
Total operated methane emissions - all sectors ²	MtCH ₄	1.23(8)	2.42	2.06



FLARING

Upstream flaring intensity has continued to fall, this year as a result of lower flaring volumes which fell 11% in 2018. The decrease was largely due to companies putting in place programmes to stop both routine and non-routine flaring, but it was also influenced to a smaller extent by divestment from regions with a high flaring rate. Greenhouse gas emissions from flaring fell by a lower level of 8%, reflecting a correction in a flaring efficiency (oxidation) factor to align with OGCI’s reporting framework.

OGCI Indicators	Unit	2016	2017	2018
	(number of companies providing data if not all 13)			
Upstream Flaring Intensity ¹	Mm ³ /Mtoe	16 (8)	10	9
Total natural gas flared - upstream	Mm ³	17,257 (8)	25,889	23,517
Flaring greenhouse gas emissions - upstream	MtCO ₂ e	53 (8)	70	64

Notes:
1 Upstream Flaring Intensity is calculated on the basis of the volume of gas flared per million tonnes of oil equivalent produced on an operated basis.



INVESTMENT AND R&D IN LOW CARBON TECHNOLOGIES

In 2018, the seven OGCI companies that provided information on lower and zero carbon technologies invested US\$5.5 billion in projects and acquisitions (in addition to OGCI Climate Investments). Significant areas of spending were energy efficiency, renewable energy, CCUS, hydrogen and storage.

In addition to investment, research & development (R&D) spending in lower carbon energy (reported by nine companies) rose by 38% to more than US\$1 billion in 2018 – amounting to 15% of total R&D spend for those companies. Over a quarter of low carbon R&D focuses on renewables technologies. Over the next year, we will focus on clarifying and aligning companies' definitions of lower carbon investment and R&D to improve our ability to track this indicator.

Notes:

1 Low carbon energy technologies include but are not limited to: energy efficiency, wind, solar and other renewables, CCUS, hydrogen, biofuels, energy storage and sustainable mobility

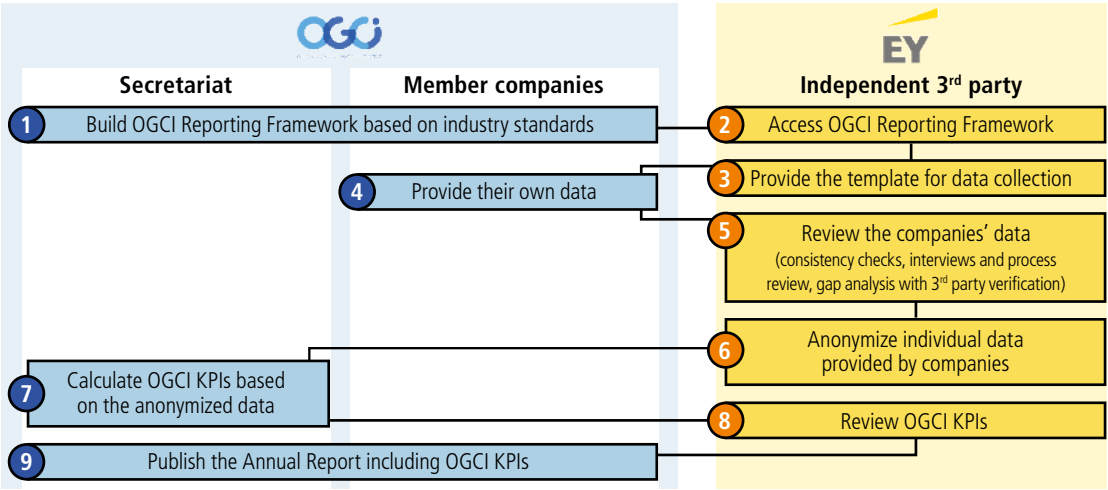
2 R&D spending is additional to investment

OGCI Indicators	Unit	2016	2017	2018
	(number of companies providing data if not all 13)			
Total investment in low carbon energy technologies ¹	\$ million	4,859 (5)	4,706 (7)	5,518 (7)
of which: acquisitions	\$ million	na	260 (4)	875 (4)
R&D expenditures on low carbon technologies ²	\$ million	640 (7)	737 (9)	1,019 (9)
Low-carbon R&D as a share of total R&D spend	%	24 (7)	19 (9)	15 (9)

OGCI and EY data consolidation and review process

Since 2016, OGCI has been working with EY & Associés (EY), as an independent third party, to collect and check data consistency, and guarantee the confidentiality of member companies’ data. In 2019, we developed together with EY an innovative process, applicable to both listed and state-owned national oil companies, to aggregate information about the level of third-party assurance that member companies apply individually into OGCI data reporting. Most OGCI member companies already ensure that data reported to OGCI are independently verified. From 2019, we confirm that OGCI data, as well as information about third-party data assurance, are consolidated, reviewed and challenged in order to increase the reliability of the aggregate data we publish.

Our process for data consolidation and review



The following description of the data consolidation and review process was provided by EY

1. Work done by OGCI member companies

The OGCI Reporting Framework has been developed by OGCI member companies based on oil and gas industry standards. This framework was established to enable alignment of member companies on metrics and data reporting. Each OGCI member company provides, as appropriate:

- Company performance indicators based on the OGCI Reporting Framework
- Information on the level of assurance obtained on those indicators where they are covered by an existing third-party verification (outcomes presented in the table next page).

2. Work done by the OGCI Secretariat

The OGCI Secretariat:

- Maintains (on an annual basis) the OGCI Reporting Framework following OGCI member companies' feedback
- Receives the anonymized individual indicators sent by EY and ensures the consistency of units
- Consolidates the anonymized individual indicators of each company to calculate a global OGCI indicator.

3. Work done by EY (ISRS 4400 standard)¹

EY assessed the relevance of the OGCI Reporting Framework against oil and gas industry standards.

EY conducted the following work related to consistency and arithmetical accuracy of indicators reported by each member company with the OGCI Reporting Framework:

- Assessment of the appropriate implementation of the OGCI Reporting Framework to the company data
- Analysis and investigation of indicators' value change in 2018 compared to 2017
- Calculation of consistency ratios to identify potential outliers
- Reconciliation between indicators reported to OGCI and, as available, any company-specific internal indicators that are subject to third-party verification (see table below)
- Anonymization of companies' individual indicators

These aspects have been addressed through the consultation of publicly available information as well as bilateral interviews between EY and 12 out of the 13 member companies of the OGCI. In addition, EY carried out consistency checks (conversion factors and formulas used) for the OGCI consolidation process.

Percentage of indicators considered as reviewed² by an external third-party

Category of indicators	Indicator name	Total as a percentage of 2018 data
Greenhouse gas emissions	Total operated greenhouse gas emissions - all sectors (Scope 1)	72%
	<i>of which: upstream³ (Scope 1)</i>	74%
	Upstream greenhouse gas emissions (Scope 2) ⁴	49%
Methane emissions	Total operated methane emissions - all sectors ³	57%
	Total operated methane emissions – upstream ³	56%
Flaring	Total natural gas flared – upstream ³	84%
	Flaring greenhouse gas emissions – upstream ³	82%

1 These are agreed-upon procedures aligned with the ISRS 4400 standard, aiming to consider the data reported (OGCI consolidation process and consistency between companies' data and the OGCI Reporting Framework). Since the above procedures do not constitute either an audit or a review made in accordance with International Standards on Auditing ("ISA") or International Standards on Review Engagements ("ISRE"), EY does not express any assurance on the indicators reported by each member company.

2 An indicator is considered as "reviewed" if it is published in a publicly available document and if it is covered by an opinion or conclusion statement provided by an external third party or is reported to a governmental authority and available for public review. None of the opinion/conclusion statements consulted contained any qualification. All levels of opinion and conclusion statements have been considered (reasonable assurance, limited assurance and assurance on implementation of processes).

3 "Upstream operated greenhouse gas emissions", "Total operated methane emissions – all sectors", "Total operated methane emissions - upstream", "Total natural gas flared – upstream" and "Flaring GHG emissions – upstream" indicators are considered reviewed if the "total operated greenhouse gas emissions - all sectors" are reviewed, as they are part of the overall GHG emissions review.

4 The sum of "Upstream GHG emissions (Scope 1)" and "Upstream GHG emissions (Scope 2)" indicators correspond to the numerator of the carbon intensity indicator.

OGCI MEMBER COMPANIES' STATEMENT: Responding to the climate challenge and stakeholder engagement

The climate challenge demands urgent action.

As leaders in the energy sector, we recognize that a significant acceleration of transitions to a low-carbon future beyond current projections requires sustainable large-scale actions, different pathways and innovative technological solutions to keep global warming well below 2°C. We believe this is best pursued by balancing a range of mitigation actions while providing cleaner, reliable and affordable energy for human and economic prosperity. To play a positive role in achieving a low-carbon future, we recognize the importance of responsible and transparent stakeholder engagement.

OGCI member companies:

- Engage in frank, transparent and constructive dialogue with stakeholders including our shareholders, employees, business partners, civil society,

NGOs, investors and interested multilateral institutions. We welcome their constructive engagement and offered expertise and perspectives, and encourage challenge on a broad range of issues so as to enhance the development and implementation of our related individual and collective actions.

- Clarify for stakeholders our plans and investments for lower-carbon transitions, following different pathways in accordance to circumstances. This includes issuing disclosures that provide meaningful and relevant information, transparently and consistent with the reporting obligations in our particular jurisdictions.
- Enhance climate-related governance, strategy, risk management, and performance metrics and targets. We support the use of scenario analysis as an important and useful tool for assessing how resilient company strategies are to cli-

mate-related risks and opportunities pertaining to the 2°C or lower scenarios.

- Assess climate-related issues as part of risk oversight functions. These include sector and company-specific transitional risks incorporating financial, policy and legal, technology, market, reputation and physical risks, both acute and chronic. Opportunities such as those leading to greenhouse gas avoidance and reduction, resource efficiencies, new energy sources, new products and services are also important.

Co-operative leadership needed

The global climate challenge requires a new level of cooperative leadership, trust-building, and commitment. We embrace this challenge and, as leaders in our industry, we aim to continually improve, building on good international corporate practices including by leveraging the strengths of OGCI and OGCI



CEOs discuss with stakeholders in New York, 2018

member companies.

We aim to engage stakeholders and constructively influence multiple issues, especially those that consider an explicit or implicit value for carbon. Attributing a value to carbon is recognized as one of the most cost-efficient ways to achieve low carbon transitions as early as possible.

As such, OGCI member companies support the consideration and introduction by governments of appropriate policies or carbon valuation mechanisms, such as through tax, trading systems, incentives or other market-based instruments appropriate to the profile of emissions, to the carbon mitigation oppor-

tunities and to the socio-economic situation of each jurisdiction. These should allow a fair, transparent and stable business environment for all to enhance investment and promote innovation in the aspiration towards lower and zero carbon solutions, without hindering social and economic development.



© OGC/Jon Challicom

OGCI WORKSTREAMS

ROLE OF GAS

FOCUS Actions that help to improve the climate performance of natural gas across the gas value chain.

AIM Optimize the ability of natural gas to play a positive role in the energy transition, in the short and long term.

WHY? Natural gas can immediately lower greenhouse gas emissions by replacing coal in the energy mix. It can support intermittent renewables by providing sufficient flexible and base-load power. Longer-term, it can be used as a feedstock for zero-carbon hydrogen, when combined with CCUS.

1. METHANE INTENSITY TARGET Brought new member companies into OGCI's 2025 methane intensity target and worked on an action plan to sustain progress.

2. ZERO ROUTINE FLARING Working with member companies to align definitions in order to enable aggregated reporting and accelerate progress.

3. PARTNERSHIPS Launched a strategic partnership with the Methane Guiding Principles, which moved its secretariat to OGCI in 2019. Joined the UN-Environment Global Alliance to reduce methane emissions in the oil and gas sector.

4. TECHNOLOGY Developing an action plan to facilitate the deployment of new technologies supported by OGCI Climate Investments.

5. METHANE Supporting a Stanford University-led research programme to update the 'Global Methane Budget' and quantify emissions more accurately. Continuing to advance a series of independent studies, with UN-Environment, Environmental Defense Fund and the European Commission. Studies have been completed on methane emissions from oil and gas facilities in the Gulf of Mexico, European MidStream, North Sea and Australia, and complementary work is underway to fine-tune models. Peer-reviewed publication is expected in 2020. Work with Imperial College London continued to identify action areas through lifecycle analysis.

ENERGY EFFICIENCY

FOCUS Identify and prioritize opportunities for energy efficiency in the energy sector through deployment of high-impact technologies and systems.

AIM Maximize the potential of energy efficiency to reduce greenhouse gas emissions and support OGCI's efforts to reduce carbon intensity.

WHY? The power, industrial and transport sectors emit around three-quarters of global greenhouse gas emissions, but a significant proportion of this energy is lost due to inefficiencies. Reducing this energy waste is critical to achieving global climate goals.

1. ANALYSIS Surveyed OGCI member companies' practices in energy efficiency in order to identify priority areas where OGCI can deliver the greatest impact and define a pathway and enablers to achieve it.

2. CARBON INTENSITY Supporting the development of a carbon intensity target by identifying the potential of energy efficiency initiatives.

3. ENGAGEMENT Continuing engagement with energy efficiency experts, solutions providers, governmental agencies and independent entities that could provide collaboration opportunities with OGCI to maximize the potential of energy efficiency.

CARBON CAPTURE, USE AND STORAGE (CCUS)

FOCUS Detailed work on economic assessments, policies and regulations at global, country and regional level, as well as storage characterization. to unlock substantial investment in CCUS.

AIM Play a major role in the emergence of a commercially viable, safe and environmentally responsible CCUS industry, capable of mitigating carbon dioxide emissions on the scale required, while supporting economic growth, jobs and industrial competitiveness.

WHY? CCUS is an essential part of a broad package of solutions needed to reach the Paris Agreement climate goals. It is vital for the decarbonization of heavy industries like steel, cement, refineries and chemical complexes, and it supports the emergence of technologies such as hydrogen production, direct air capture and biomass with CCS.

1. CCUS KICKSTARTER Launched a major initiative to facilitate commercial investment in CCUS in industrial hubs around the world.

2. STAKEHOLDER ENGAGEMENT Launched a joint strategic collaboration with the Clean Energy Ministerial to further the development of CCUS. Continuing to work closely with national and regional stakeholders in the UK, the Netherlands, Norway, China, Saudi Arabia and the USA to identify how OGCI can help to accelerate progress on the commercialization of CCUS, focusing on policies, regulations and value. This work is complementary to the CCUS KickStarter.

3. CCUS DEPLOYMENT Supporting the Alliance of Champions project to identify, activate and energize CCUS supporters, including non-governmental organizations, policymakers, industrial companies, financiers and expert organizations in order to develop a common understanding of the potential of CCUS as a climate solution and as an enabler for the development of low-carbon industry.

4. STORAGE Re-assessing and categorizing global carbon storage resources using the storage resource management system developed with the Society of Petroleum Engineers. The Storage Working Group is engaging with the CCUS KickStarter to provide expertise and resources as required to accelerate the progress of CCUS hubs.

LOW EMISSIONS OPPORTUNITIES

FOCUS OGCI's think-tank, exploring issues of relevance to mid- and long-term global emissions reduction.

AIM Provide OGCI member companies with a deeper understanding of key medium-and long-term issues, and raise the level of awareness to facilitate both individual and collective action to tackle climate change.

WHY? As one of the Sustainable Development Goals, climate mitigation requires a range of actions that collectively move towards the goal of achieving net zero emissions, while coordinating with the other goals. OGCI aims to be a catalyst, achieving additional impact by contributing to substantial and sustainable emissions reduction in the short, medium and long term.

1. PRIORITIZING ACTIONS Deepened our understanding of how to prioritize decarbonization actions, where OGCI can play a catalytic role.

2. LONG-TERM CARBON INTENSITIES Reviewed methodologies for assessing the greenhouse gas footprint of energy products.

3. SUSTAINABLE DEVELOPMENT GOALS Engaged with stakeholders in Asia, Latin America and Europe to improve the collective understanding of how OGCI and its members affect and can further contribute to the United Nation's Sustainable Development Goals.

TRANSPORT

FOCUS How OGCI can be a catalyst for reducing carbon dioxide emissions from transport on a significant scale.

AIM Develop and implement a set of initiatives to reduce greenhouse gas emissions in the transport sector by 2025, as part of an action plan to facilitate climate-responsible transport.

WHY? The transport sector accounts for 25% of global energy-related carbon dioxide emissions. It will take time to introduce hybrid and electric vehicles at scale and especially to shift away from oil in heavy-duty, air or marine transport. What we do in the next five years will be critical to reducing the sector's carbon footprint.

1. LOW CARBON VISION Developing a low-carbon vision for transport with the aim to translate it into a set of practical initiatives, to be initiated in 2020, to deliver short and long-term emissions reductions across light, medium and heavy-duty, marine and aviation transport sectors.

2. LOW CARBON FUEL INITIATIVE Identified a range of low carbon liquid fuels that can address emissions from the existing global fleet of light and heavy vehicles. Evaluating the potential of co-optimized engines and fuels to reduce future emissions.

4. MARINE SECTOR FOCUS Engaged with several maritime organizations to identify potential collaborative activities to address the International Maritime Organization's goal of 50% reduction in carbon emissions in shipping by 2050.

4. STAKEHOLDER ENGAGEMENT Convened OGCI and transport sector stakeholders to identify meaningful actions to address emissions.

NATURAL CLIMATE SOLUTIONS

FOCUS Identify and prioritize opportunities for OGCI to contribute to improving the capacity of oceans, forests, grasslands, peat, mangroves and soil to act as natural sinks for carbon dioxide.

AIM To maximize the potential of natural climate solutions to reduce atmospheric greenhouse gas concentration, especially in the short term, while other low carbon solutions scale up. OGCI believes all options to mitigate climate change need to be deployed to achieve net zero emissions with minimum costs and maximum benefits to society. We understand that focusing on natural climate solutions does not take away the urgent need for transition to a low carbon economy.

WHY? Enhancing the capacity of natural sinks to absorb carbon dioxide from the atmosphere is an essential component of tackling climate change. In addition, natural climate solutions often bring environmental and social co-benefits, such as biodiversity, water security and adaptation to climate change, supporting the attainment of the United Nations Sustainable Development Goals.

1. BASELINE ASSESSMENT Analyzed existing natural climate solution projects and technical applications, including carbon offset activities.

2. BARRIERS AND OPPORTUNITIES Identified potential barriers to natural climate solutions, particularly in terms of policies, mitigation potential and cost range. Analyzed opportunities for OGCI to play an impactful role, leveraging capabilities, in terms of large natural resource projects, experience and data on marine and coastal systems, geographical presence in regions with high potential, financial resources and outreach.

3. ENGAGEMENT Joined the Natural Climate Solutions Vision, convened by the World Business Council for Sustainable Development and the World Economic Forum, to support the integrity of natural climate solutions and create a credible market to facilitate their uptake. Engaging with key stakeholders to identify the catalytic role that OGCI could play in this area.

GLOSSARY

Carbon Capture, Use and Storage (CCUS)

A set of technologies that prevent carbon dioxide from reaching the atmosphere. Carbon dioxide is emitted by the burning of fuels and from some industrial processes like curing cement or making steel. With CCUS, the carbon dioxide is separated from other emissions (capture) and can be locked into products (use) or transported and stored safely and securely underground (storage). CCUS is sometimes called CCS when it focuses on capture and storage, excluding the potential for use.

Carbon intensity

Carbon intensity refers to the amount of greenhouse gas emitted per unit of activity. In the carbon intensity target that OGCI is developing, it refers to the volume of carbon dioxide and methane emissions per unit of production of oil and gas.

Decarbonization

The process by which countries and companies aim to reduce human-caused greenhouse gas emissions across all sectors and so limit the irreversible impacts of global warming, in line with the aims of the Paris Agreement.

Energy transition

The transformation of the energy system required to decarbonize the economy and tackle the climate challenge, while continuing to provide reliable, accessible and affordable energy.

Flaring

Combustion of excess gas during production for safety reasons, operational needs (such as start-up and maintenance) or in the absence of sufficient facilities or amenable geology to re-inject the produced gas, use it on-site, or dispatch it to a market.

Global warming

Global warming is the gradual increase in surface temperature as a result of the radiative or “greenhouse” effect of human-caused emissions. Global Warming Potential (GWP) is a way of expressing the warming impact of different greenhouse gases, relative to carbon dioxide.

Greenhouse gases (GHG)

The key energy-related greenhouse gases are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). They are measured in carbon dioxide equivalents, using GWPs of 25 for methane and 298 for nitrous oxide. GHG Intensity measures the volume of greenhouse gas emissions as a share of hydrocarbon production.

Leak Detection and Repair (LDAR)

Methane emissions reduction programmes that detect leakage points, perform necessary repairs and monitor performance. In some countries, LDAR is obligatory, but in most it is a voluntary effort.

Methane emissions

Natural gas is primarily composed of methane, so when we quantify methane emissions intensities, we are evaluating how much of the natural gas that we produce is lost to the atmosphere rather than marketed or used. Methane emissions can come from leakages from equipment, planned venting and incomplete combustion. Although methane has a relatively short life time in the atmosphere (around a decade) it has a high Global Warming Potential.

Negative emissions technologies (NETs)

Technologies that remove carbon dioxide from the atmosphere. They include technologies that capture carbon dioxide directly from the air or from the combustion of biomass, as well as natural climate solutions such as afforestation or forest restoration. They are considered to have a negative impact if more greenhouse gases are stored than released into the atmosphere through the use of the technology. They are also called carbon dioxide removal (CDR) technologies.

Net zero emissions

The Paris Agreement set the goal of reaching a balance between the flow of human-caused greenhouse gases into the atmosphere and the capacity of manmade sinks to absorb them. Net zero emissions implies that in order to reach that balance – or carbon neutrality – any emissions that cannot be avoided or captured at source must be removed from the air.

Net positive

Climate actions that deliver a range of co-benefits, such as biodiversity, improved access to affordable energy, clean water, industrial innovation, good jobs or less pollution. Often linked to the global agenda of the UN's Sustainable Development Goals.

Operated production

Oil and gas production coming from assets that are under the operational control of the relevant company, which has reporting routines and standards on the asset. Equity production is based on the actual ownership share of an asset, whether or not it is operated by the relevant company.

NOTES

Legal disclaimer

While all OGCI member companies have contributed to the development of this report, the views or positions it contains may not fully reflect the views of a particular OGCI member company. Similarly, this report does not cover all relevant activities of OGCI member companies; nor do all member companies participate in all of the activities described.

Cautionary statement

This document contains certain forward-looking statements – that is, statements related to future, not past events and circumstances – which may relate to the ambitions, aims, targets, plans and objectives of OGCI, as well as statements related to the future energy mix. Any such statement is made on behalf of OGCI, not its member companies. Forward-looking statements involve risk and uncertainty because they relate to events and depend on circumstances that will or may occur in the future and are outside of the control of OGCI and/or its member companies. Actual results or outcomes may differ from those expressed in such statements, depending on a variety of factors.

What is OGCi?

The Oil and Gas Climate Initiative is a CEO-led initiative which aims to drive the industry response to climate change. Launched in 2014, our members engage together on action to accelerate the reduction of greenhouse gas emissions. We explicitly support the Paris Agreement and its aims, and we act with integrity to accelerate and participate in the energy transition. Our US\$1 billion-plus fund, OGCi Climate Investments, supports the development, deployment and scale-up of technologies and business models that can significantly reduce greenhouse gas emissions. Our 13 members account for 32% of global operated oil and gas production.



oilandgasclimateinitiative.com