

# OIL & GAS Decarbonization

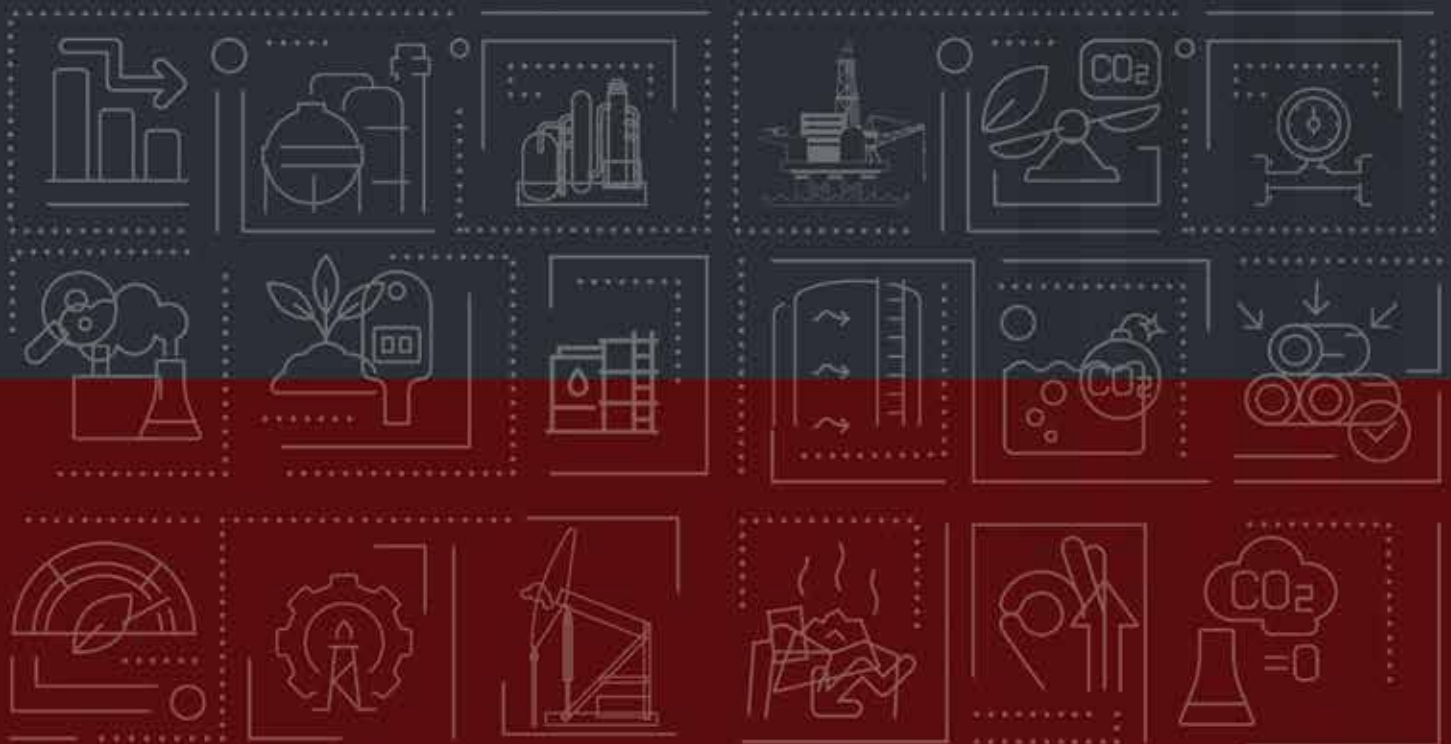
November 2022

## Supplement

In Preparation for



**COP27**  
SHARM EL-SHEIKH  
EGYPT 2022



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# ABOUT THIS SUPPLEMENT

Never has our planet faced a greater existential threat than climate change. It is both a danger and a challenge that is pushing human societies and our planet's rich biosphere to the brink of disaster.

As global problems call for global solutions, the international community has come together to collectively commit to working towards the common goal of preventing global temperatures from rising more than 1.5 degrees Celsius by reducing harmful carbon emissions in every possible way. For this reason, many countries, global corporations, and even concerned citizens have agreed to take part in humanity's great push to reach net-zero emissions by 2050.

The energy sector, most notably the oil and gas industry, has become a fundamental part of this worldwide effort. The Decarbonization supplement by Egypt Oil & Gas is made to shed light on the various activities and projects global energy giants are involved in to reduce carbon emissions and improve the environment.

This supplement also seeks to highlight how Egypt has also lived up to its name as OumelDunya 'the mother of the planet' for its compassion for the planet as a whole, working to promote decarbonization, renewable energies, as well as a just and fair energy transition that will guarantee all African nations the promise of sustainable growth and opportunity. This supplement will shed light on the efforts of the Egyptian Ministry of Petroleum and Mineral Resources in cooperation with various multinational energy giants in achieving its decarbonization objectives. It will also emphasize Egypt's role in global climate action as the esteemed host of COP27.

Most importantly, the main message of this supplement is that decarbonization is not only an ambitious scientific, technological, and commercial endeavor, but stands as a test for humanity, as climate change is a crisis that affects us all regardless of race, color, or creed. It is a test to see if global citizens can set their differences aside and work towards a common goal. If humanity succeeds, then we will live and prosper. If humanity fails, then all people from every corner of the globe will have to watch as the planet's weather patterns spiral out of control unleashing a perilous series of natural disasters.

Prepare to meet the global leaders and innovators who are paving the way for our planet's carbon-free future.

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# Addressing Energy Transition, Security, and Affordability



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## A Commitment to a Lower Carbon Future



To support this commitment we are aligned with the World Bank Zero Routine Flaring by 2030 Initiative. All our companies are conducting detailed GHG emission reduction and energy efficiency opportunity assessments, including a focus on methane reduction, to understand Group wide reduction potential. This is being done with an expansion of the number of companies certified to ISO 50001 (for Energy Management). In 2022 we set our first GHG reduction target and have achieved substantial reductions to date in collaboration with EGPC. Cheiron, in conjunction with our partners Capricorn and the leadership team of Bapetco, have been delighted to describe within this publication Bapetco's own Greenhouse Gas reduction pathway towards Net Zero. Focus areas include:

- ✦ New Assets Design and Field Redevelopment
- ✦ Fuel Substitution (replacing diesel with gas)
- ✦ Eliminating Flaring and Venting
- ✦ Minimising Fugitive Releases
- ✦ Centralised Power Generation and Electrification
- ✦ Integration of Renewables

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# TURNING DECARBONIZATION AMBITIONS INTO ACTION IN OIL & GAS SECTOR



## AN INTERVIEW WITH H.E. MINISTER OF PETROLEUM AND MINERAL RESOURCES **TAREK EL MOLLA**

### **What is the Ministry of Petroleum and Mineral Resources (MoPMR) doing to reduce greenhouse gas emissions?**

Egypt is working, through a national strategy, to confront climate change and reduce emissions. Decarbonization and transition to low-carbon energy sources are core elements of this strategy. Hence comes the role of MoPMR to support this strategy through several projects and initiatives.

The ministry's efforts to support emissions reduction are based on 6 main pillars including, gas as the fuel of choice, energy efficiency, decarbonization, green petrochemicals, and hydrogen.

In this respect, several projects were implemented along these pillars that collectively resulted in annual savings of 1.4 million tons of CO<sub>2</sub>.

The ministry will certainly continue working to execute specific projects to realize its vision and strategy for emission reduction beyond COP27.

### **Egypt is going to be the voice of Africa during the COP27, in your opinion how is this important for the African continent?**

We are a few weeks away from COP 27, which Egypt is hosting on behalf of the African continent, carrying and expressing the voices of the African countries, their rights, and aspirations for sustainable inclusive socio-economic development and well-being for all.

Although the African continent is not responsible for the climate change crisis, it is facing its most negative impacts. Nevertheless, the continent is considered a model for serious climate action, as much as its capabilities and the support that it receives allow.

Despite being blessed with a wealth of natural resources and significant renewable energy potential, the African continent is lagging in economic development and welfare, and over 600 million citizens suffer from energy poverty.

Accordingly, Egypt is leading efforts to develop an African Energy initiative to be launched during COP27 with due

consideration to the continent's differentiated responsibility and respective capabilities.

### **What will be the significance of the Decarbonization Day for the participants at COP 27?**

This day will highlight efforts and showcase local, regional and global success of decarbonization in the oil and gas sector and hard-to-abate industries. The day's events will feature progress, best practices, and policy actions and inspire further action for accelerating decarbonization with the engagement of all stakeholders, including the oil & gas global industry. The EMGF decarbonization initiative will also be announced during the day, which is a leading model for regional cooperation across countries to drive further decarbonization of the natural gas resources in the region.

### **How significant is the role of the EMGF in global decarbonization efforts?**

Egypt has always believed in the benefit of cooperation, and always aspired for collaboration instead of competition for the welfare of the whole region.

The East Mediterranean region has always played a prominent role in the Gas industry, we recognize the vast resource prospects and opportunities of the East-Med basin and we were also aware of the common energy challenges and interests among the East Mediterranean countries.

Within this context, EMGF was established as an intergovernmental organization with the purpose of "Cooperating for a Sustainable Future". Since its inception, the EMGF succeeded in attracting worldwide attention in a short time and succeeded to shift the perception around Energy to be a catalyst for peace and flourishing.

Stemming from EMGF's commitment to play a pivotal role to coordinate and accompany Member Countries toward a regional low-carbon natural gas, the EMGF developed a leading decarbonization initiative that will be announced at COP27 during the decarbonization day.



تحت رعاية فخامة الرئيس عبد الفتاح السيسي رئيس جمهورية مصر العربية  
HELD UNDER THE PATRONAGE OF HIS EXCELLENCY ABDEL FATTAH EL SISI, PRESIDENT OF THE ARAB REPUBLIC OF EGYPT



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## COLLABORATION, COMMITMENT AND DECARBONIZATION: SUPPORTING THE OIL AND GAS INDUSTRY IN ITS PATH TO NET ZERO

With COP27 on the horizon, all eyes are on the oil and gas sector and our vital role in delivering safe, reliable energy with net zero emissions and playing a leading role in the energy transition. Both subjects are top of our agenda, and IOGP has been working with industry, helping operators to develop their action plans for the decarbonization of their facilities and products. Sharing knowledge and learnings from the industry journey so far and promoting standardization.



In a nutshell, the Paris goals are achievable with the technologies that exist today, but we need to acknowledge that the oil and gas sector has a key role in securing energy demand and that collaboration is needed across industry, governments, consumers, and society in general.

If we wait for silver bullet solutions we can miss the opportunities to make progress with what we already have. And as we sit and wait around for game-changing solutions to solve everything, it will ultimately lead to 'game over'.

Take nuclear fusion, for example. Some see this as something of a holy grail in energy. But it is unlikely to be deployed at scale before 2050, and we can't afford to wait that long.

That's why technologies like CCUS and hydrogen are so important. They offer an opportunity to make a difference now, in our transition to a low-carbon system.

The IEA forecasts that the world needs to capture 4 GT of CO<sub>2</sub> by 2030 and 7.6 GT CO<sub>2</sub> by 2050, yet today we only capture 40 MPTA. Put simply, by 2030, which is only 8 years away, we need to store 100 times more CO<sub>2</sub> globally than we have already! Achieving that goal is a very tall order.

IOGP has been supporting its members for some years on greenhouse gas reduction, which loosely shaped itself into a low-carbon agenda in 2020/21. However, in last year's strategic review, our members made clear that they wanted us to be more ambitious, and we are now working on our four prioritized themes: carbon capture and storage (CCS), electrification, energy efficiency, and flaring and venting. Our work on hydrogen is also ramping up.

Globally, the industry's CCUS progress is varied. In Europe, CCUS is a proven technology, but it has struggled to scale up despite past EU support and many now prefer to invest in renewables. We now need practical actions, such as an alliance with industrial partners to show that this is a way to keep industry – steel, fertilizer, cement – in Europe. We also need to address the wider value chain; especially CO<sub>2</sub> capture and transport.

In Australia, we see a push for CCUS for oil and gas, but also for other industries, including coal and hydrogen, and the government has an AUD 250 million program to deploy CCUS at scale.

There is a critical role for governments in creating a framework to let, for example, CO<sub>2</sub>

captured in Singapore to be shipped to Australia for sequestration. But there are challenges, including some resistance to CO<sub>2</sub> storage as a long-term process and, for regulators, the long-term liability of sequestration.

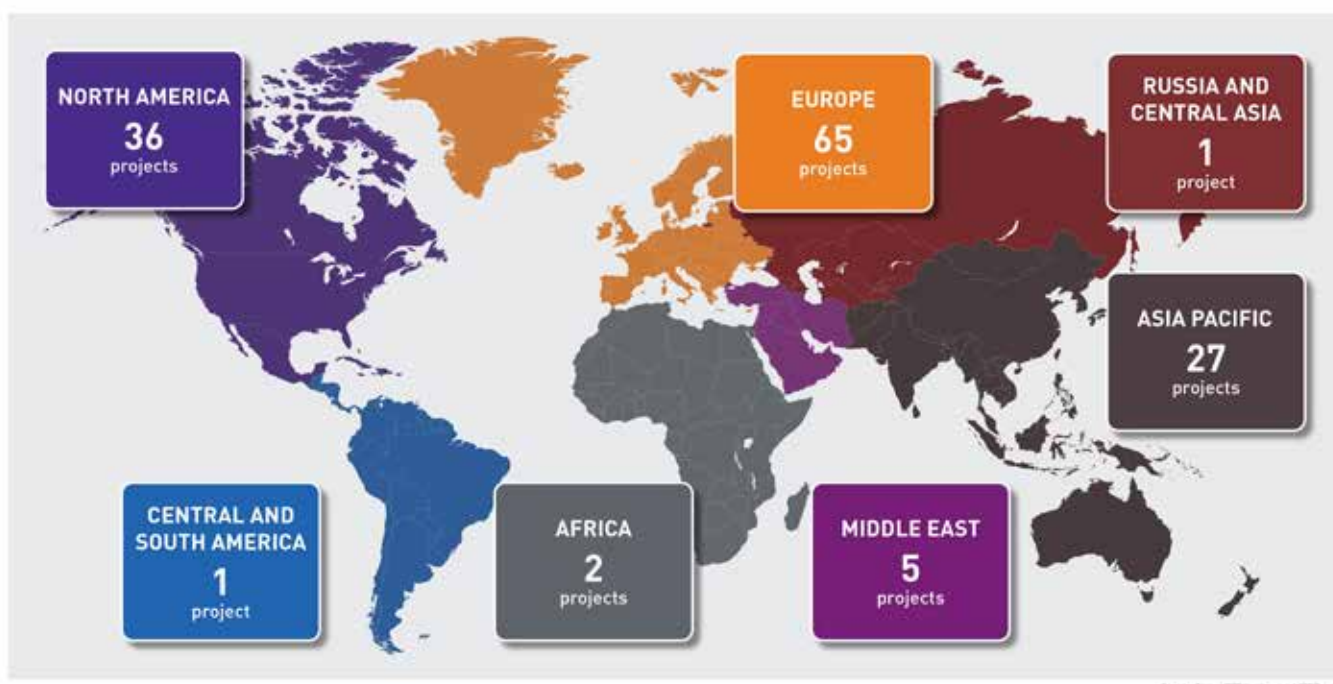
The US, the world's second-largest CO<sub>2</sub> emitter after China, is in the spotlight to demonstrate its commitment to its 2030 and 2050 pledges. The US Department of Energy has dedicated USD 10 billion to CCUS projects; in parallel, ExxonMobil's proposal to build a \$100 billion CCUS hub in Houston has attracted a coalition of 14 companies. These significant investments should give rise to diverse public-private partnerships (PPPs), fostering and enabling innovations in CCS.

IOGP's Energy Transition directorate is also pursuing initiatives for working closer with other associations such as OGCI, API, SPE, etc., on CCS good practices in order to avoid duplication of efforts and maximize synergies.

Central and South America have a CO<sub>2</sub> emission per capita that is already close to (and some even less than) the average global net zero 2030 pledge, or below three tonnes of CO<sub>2</sub> per capita. Individual countries do have CCS projects, but their deployment effort is expected

### Global CCUS projects

Overview of existing and planned CCUS facilities



to be relatively less stringent compared to their northern neighbors.

Hydrogen is another key technology that requires mobilizing to ensure that the energy supply remains secure and affordable whilst we transition towards a lower carbon emissions future.

Many operators see hydrogen as a way to be part of the energy transition. But it's not without its challenges. Hydrogen is the smallest molecule with the smallest element, so it can escape from places that larger molecules cannot. It's also expensive, but because blue hydrogen is significantly cheaper than green, it could help to kickstart the hydrogen economy while the costs associated with green hydrogen are driven down.

Japan has been one of the first countries to adopt a really focused approach to developing a hydrogen economy. They released a hydrogen strategy in 2017 and recently announced an initiative to help other Association of Southeast Asian Nations members decarbonize and hydrogen is part of that.

Singapore's green plan is also seeing it explore hydrogen's role in its economy, while China's latest five-year plan highlighted hydrogen. The Australian government is also promoting a blue hydrogen project, fuelled by the vast amounts of natural gas present here.

In Europe, IOGP has advocated for a rebalancing of the EU's approach to hydrogen and for the inclusion of provisions to help accelerate and scale up the production of low-carbon hydrogen as a launchpad for the deployment of renewables-based green hydrogen.

To support our advocacy and provide EU policymakers with a clear view of hydrogen deployment pathways to help reach climate neutrality, we - with 15 other partners - published the Hydrogen for Europe study, a unique research work carried out by a research consortium bringing together IPEN and SINTEF under the direction of Deloitte. Policymakers' feedback to the study was, overall, extremely positive.

But, in order to deliver net zero, the real change that needs to occur is not in the technology itself, but in the ecosystem that supports it, and that's where IOGP comes in.

Working with a global membership that develops a good practice that can be instantly deployed, we believe we provide the shortest and fastest route to the adoption of tech innovation and recommended practice on the energy frontline. To help these technologies deliver on their promise we're following three principles.

### 1. Commitment is key

For the industry at large to successfully decarbonize, the oil and gas industry needs to lead by example. It has both the technical expertise and financial strength to execute effectively but we need to commit to action.

Commitment from government and global regulatory bodies will also be just as important. Policy and regulatory support have a huge role to play, and will also help facilitate even more financial investment, which is needed for bigger infrastructure projects.

It is great to see operators move into action, showing the attitude we need to keep to our decarbonization roadmap.

### 2. We must be willing to share and adopt best practices

There is a need for a cultural shift across all activities within the oil and gas industry in order to consider the low-carbon agenda in routine activities. Achieving this culture shift will involve sharing experiences and raising awareness of existing resources and tools to formulate best practices.

There are many long-lived organizations in the oil and gas industry with a great depth of experience. And while this brings some cooperation across the sector, it has also brought fixed practices. Yet for the industry to effectively progress, many need to be improved.

IOGP is working to facilitate improvement in practices in two ways.

Firstly, in developing the energy transition framework which builds on the foundational work done by IOGP's member companies and outlines crucial first steps for the energy transition, based on four disciplines:

- » Carbon capture transportation storage
- » Flaring and venting

- » Energy efficiency
- » Electrification

Secondly, we have launched several task forces with a range of engineering and operational subject experts in the four key disciplines. These task forces consolidated a list of lessons learned from early low-carbon projects and are currently drafting recommended practices and technical guidelines for operators in the design, execution, and operation of low-carbon investment.

### 3. Standardization and knowledge sharing are crucial

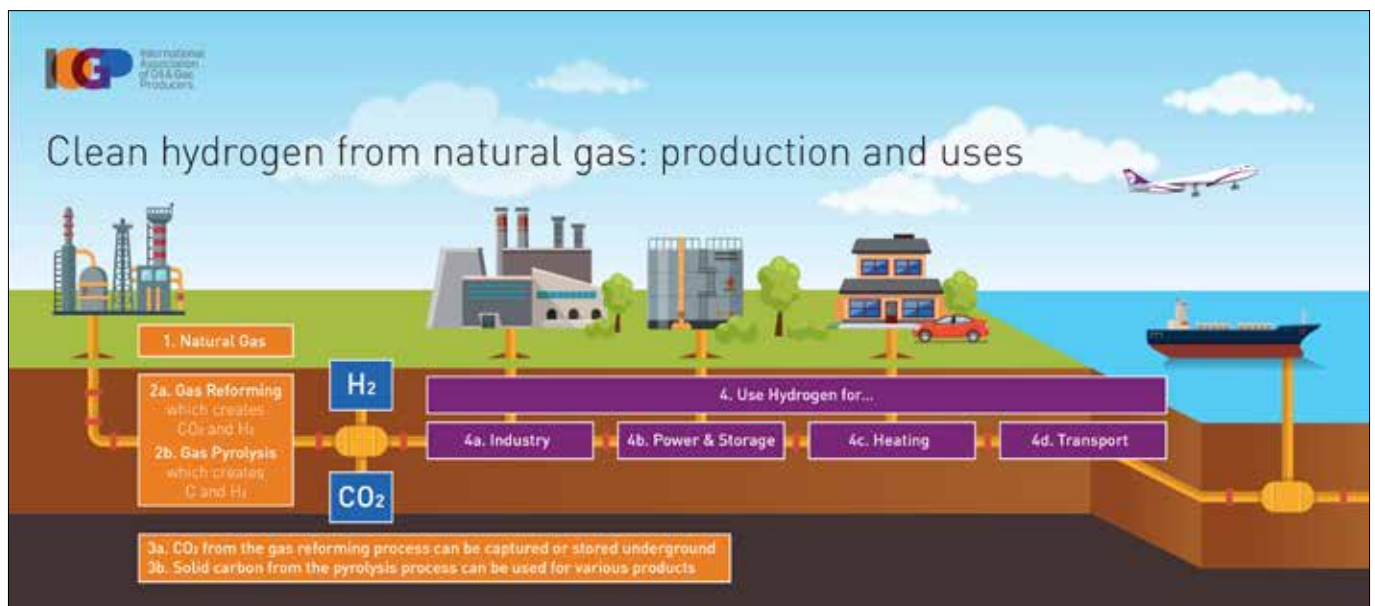
One of the key challenges to the decarbonization of oil and gas operations is the lack of Standardization. This is a gap that IOGP is trying to fill, and we are running workshops and events that can help the network of oil and gas producers focus on consistent consumption targets, approaches to low-carbon projects, and broader best practices.

However, IOGP can only do so much. It is up to the attendees and to the industry to share this knowledge across their networks and to ensure they become industry standards.

One recent workshop saw intense discussion and produced an action plan for the energy transition and the oil and gas road to net zero that will be pursued over the coming months.

Any good project needs clear milestones to mark progress against. For the oil and gas industry, this means ensuring decarbonization projects are consistently mapping out the trajectory of emissions reductions to ensure they are working towards clear targets.

With the collaboration, knowledge sharing, and willingness to implement Standardization we have seen to date, we are hopeful that by the time we convene in Egypt for COP27, the industry will have much progress to celebrate.



# WHY DECARBONIZE THE UPSTREAM SECTOR?

By Jessica Brewer – Principal Analyst Upstream, Elena Belletti – Head of Carbon

As the energy transition unfolds, upstream companies are coming under increasing pressure to decarbonize. Governments, investors, financial markets, society, and other stakeholders are pushing for change. Companies need to define their transition strategies, future-proof their business, and protect their social license to operate.



There are strategic advantages to producing less carbon-intensive hydrocarbons. Some consumers are looking for a cleaner end product and may be prepared to pay a premium. Lower emissions operations not only offer environmental gains, but many of the steps are value accretive. This includes greater production efficiency, reduced leakage, and the capture – and monetization – of flare gas and methane fugitives.

More and more companies are announcing bold commitments via carbon reduction, net zero, and/or Scope 3 targets. Divestment is one way to help meet these goals, but for many assets, especially those on production, this simply passes the problem down the line. Applying decarbonization solutions can reduce operating emissions where operators do want to retain their portfolio of assets.

## Where do upstream emissions come from?

Emissions occur throughout the whole hydrocarbon value chain – from wellhead to end-use. Some upstream companies are taking the bold step to tackle Scope 3, which accounts for around 90% of all emissions in the value chain of a hydrocarbon. The majority are generated by combustion in power generation, transportation, and other final consumption.

But there is much still to do on scopes 1 and 2 at upstream installations, which currently generate around 1.3 billion tons of CO<sub>2</sub>e per year (approximately 3.6% of global emissions). These are the operational emissions that upstream producers have control over.

Each asset is different, so it will come as no surprise that there are regional variations. Oceania is heavily influenced by Australian LNG projects, high

CO<sub>2</sub> projects in Asia drive up venting to over 10% of total emissions, and flaring contributes a third of Africa's output.

Source: Wood Mackenzie Lens Upstream, Emissions Benchmarking Tool. Emissions are aggregated globally in the charts, but based on underlying asset-by-asset data and models. Excludes transportation emissions (not all oil and gas companies own pipelines and/or tankers, hence they are not considered Scope 1 and 2 here).

## What are some of the solutions?

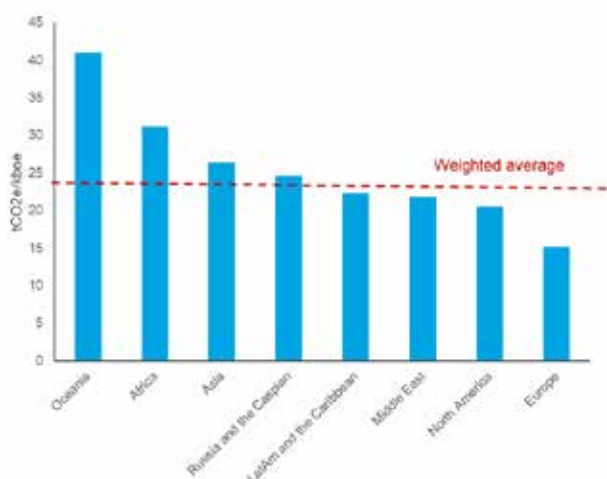
Solutions to reduce Scope 1 and 2 carbon emissions range in cost and complexity, from smaller-scale operational efficiency solutions and best practices to transforming power generation.

### Low-carbon power

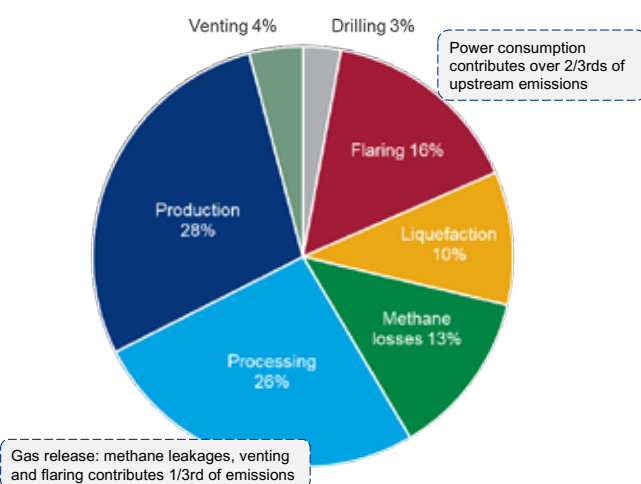
Around 70% of emissions are produced to power oil and gas operations – production, processing, liquefaction, and drilling. The type of fuel used to generate power is crucial. Most assets are powered by fossil fuels – using a portion of the produced hydrocarbons. Electrification gives operators the option to move to low-carbon power, either directly from renewables or by connecting to the grid where the grid mix is cleaner than the alternative fuel supply.

As well as lower emissions, electrification reduces maintenance, lowers fuel requirements, increases uptime, and frees up more molecules for sale. But there are challenges:

Carbon intensity by region: average 2022-2031

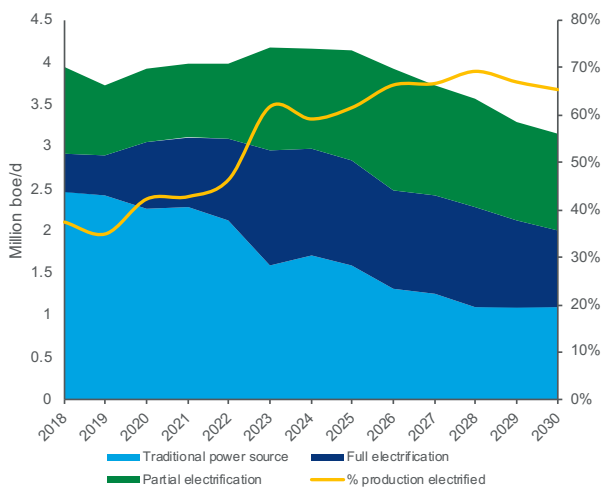


Global upstream emissions by source: average 2022-2031



Source: Wood Mackenzie Lens Upstream, Emissions Benchmarking Tool. Emissions are aggregated globally in the charts, but based on underlying asset-by-asset data and models. Excludes transportation emissions (not all oil and gas companies own pipelines and/or tankers, hence they are not considered Scope 1 and 2 here).

- **Intermittency issues:** renewable power may require backup generation. If hooking up to the grid, the power mix will determine the scale of emissions reduction;
- **Retrofitting onstream projects:** not all installations can be electrified. Of those that can, some may only be able to handle partial electrification over full;
- **Space and weight restrictions:** electric motors can have a greater footprint and weight than the existing drive mechanisms, potentially limiting options offshore;
- **Field maturity:** capital outlay required makes electrification of most late-life assets uneconomic.



Source: Wood Mackenzie Lens Upstream, North Sea electrification tracker

Norway is the global leader in low-carbon upstream electrification. Its power mix is predominantly hydroelectric (90%+) – a renewable energy source without any corresponding intermittency issues. This, combined

with the highest carbon taxes for E&Ps globally, has helped advance decarbonization efforts. By next year, over half of Norway's production will be either fully or partially electrified.

## Flaring reduction

Essential flaring is hard to avoid, but many companies are now signed up to the World Bank's Zero Routine Flaring by 2030 initiative, which targets an end to the practice of routine flaring no later than 2030. However, in some countries, large-scale flaring is a function of the reliance on income from oil exports. Gas is a by-product and is more economic to flare as building the necessary commercialization infrastructure can be very expensive.

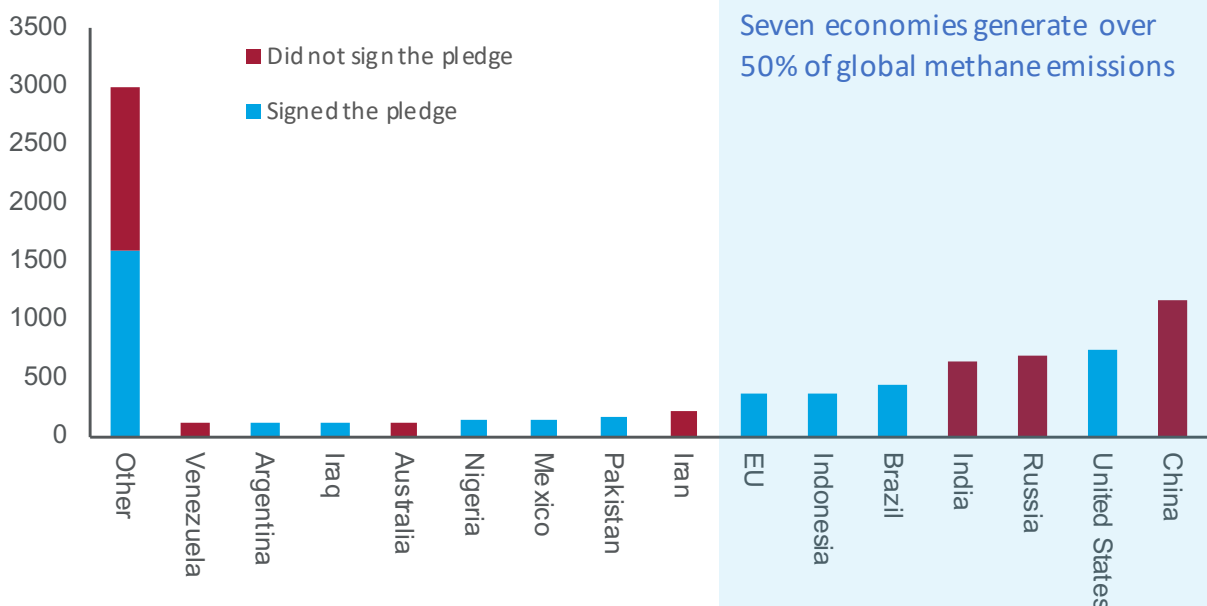
Where feasible, gas capture projects offer an option for the large-scale flarers to limit emissions. Gas capture can provide an additional revenue stream for the companies involved, greater income via taxes for governments and help satisfy unmet power demand, as well as have environmental benefits. Key considerations include:

- **Gas markets:** either domestic or export;
- **Project economics:** resource scale, capital outlay, and fiscal terms determine viability;
- **Number and size of flares:** capturing from multiple sources can be a deterrent for flare-gas collection, even where local markets exist;
- **Location of point sources:** multiple small-scale emitting point sources with a large dispersion range are more challenging than a single large-scale point source;
- **Midstream infrastructure:** requirement for gas transport.

## Reducing fugitive (methane) losses

Methane is the molecule that packs a punch – it is 28 times more potent (over a 100-year horizon) than its carbon counterpart according to the 5<sup>th</sup> IPCC Assessment Report (2014). The oil and gas sector contributes

## Methane emissions including LUCF (MtCO<sub>2</sub>e)



Source: Wood Mackenzie, CAIT

almost 25% of global methane emissions, and as such, it has a key role to play. Many companies and governments have already signed up to reduction pledges, including:

**Global Methane Pledge:** announced at COP26 with the target to cut methane emissions by 30% by 2030. Over 120 parties signed pledges covering nearly 50% of global methane emissions;

**Oil and Gas Climate Initiative (OGCI):** members, comprising over one-third of global operated production, have pledged net-zero methane emissions by 2030, in which Wood Mackenzie is a supporter and has endorsed this commitment.

Upstream methane losses are primarily via three sources – equipment leaks (valves, pipes, compressors etc.), incomplete flare combustion and venting. To address these losses, there are three steps to follow:

- **Identify, measure, monitor:** methane leaks are often small and difficult to detect. Understanding areas to target helps determine the best solution;
- **Flaring and venting reductions:** prevents methane release but the same challenges for reducing these sources apply;
- **Replace high bleed devices:** plug/remove the leaks.

## Decarbonization – drivers for change

The pace of decarbonization varies from region to region, and asset to asset. One of the key differentiators is the level of government support. 130 countries have made pledges to reach net zero by 2050 to 2070, covering almost 90% of global emissions. However, no major economy is on track to achieve these very challenging goals.

Commitments that have been translated into law only cover around 16% of the total 36 gigatons of CO<sub>2</sub> emitted in 2021, meaning that pressure to decarbonize will increase significantly as governments work pledges into legislation. So far, 72 national and sub-national carbon prices and markets are in place, covering around 26% of global carbon emissions (of these, China is around one-third), and another 49 are under consideration. We expect a significant global expansion of carbon prices, and increased prices aimed at meeting 2050 goals.

Some countries have also been exploring carbon border taxes. The European Union (EU) is due to introduce one in 2023, which will be fully effective by 2027. At that point, importers of certain commodities, including refined products, will need to pay carbon prices aligned with the ones paid by EU producers (which have been over US\$80/ton CO<sub>2</sub>e for most of 2022).

Most countries' oil and gas upstream operations are not directly subject to carbon prices yet. Carbon pricing mechanisms typically encompass Scope 1 emissions in specific sectors directly, such as power generation first, followed by some industrial sectors.

Integrated companies can be impacted directly, while independent upstream producers will be indirectly affected by lower demand down the value chain and by carbon prices passing on higher power prices to the grid.

Tackling Scope 1 and 2 emissions is fast becoming the minimum requirement for upstream operators, as they face increasing stakeholder pressure to decarbonize. Even if they do not have any direct value at risk from carbon prices today, due to the location of their operations, they may not be able to attract investment unless they show structured and realistic plans for decarbonizing their operations.

For this reason, many companies have taken bold initiatives to reduce Scope 3 emissions, not just Scope 1 and 2. Given the lack of direct control, upstream operators can change their vendors and buyers towards lower-carbon value chains, for example, or take a more hands-off approach by buying carbon offsets to compensate for emissions down the value chain.

The most successful strategies will employ a mix of approaches that leverage their existing subsurface and market capabilities and employ them in areas such as carbon capture and storage. Taking bold, decisive action on decarbonization is the only way to create sustainable business models that will continue to attract investment.

WM Global carbon, base case price overview  
(2022, US\$/tCO<sub>2</sub>e)



WM Global carbon base case price overview  
(2050, US\$/tCO<sub>2</sub>e)



Source: Wood Mackenzie

# Navigating the ENERGY TRANSITION



*Climate action and greenhouse gas reduction targets are accelerating investment in decarbonization solutions, particularly for carbon intensive industries and processes.*

Babcock & Wilcox can help you navigate the transition. Since 1867, we've engineered innovative solutions for the changing energy landscape.

Our ClimateBright™ suite of decarbonization technologies is backed by more than 90 patents and four decades of research, development and demonstration. These include OxyBright™ carbon capture technology, BrightGen™ hydrogen and hydrogen-blend combustion boilers, and other solutions.

Adopting an incremental strategy can help plants optimize operations and leverage existing assets while investing in new technologies. For example, B&W is providing advanced combustion systems to convert a Middle East chemical plant's boilers from oil to natural gas – a cleaner, lower emissions fuel. And, our SPIG® cooling systems are working every day throughout the region and beyond, reducing environmental impact through water conservation.

Our vast experience providing clean power production solutions is wide and varied. It includes technologies that have been around for decades and those much newer. But, each contributes to transformative change which can make a positive impact on your decarbonization journey.

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# PARTNERING TO PAVE THE ENERGY TRANSITION PATHWAY FOR EGYPT

Interview with Karim El-Dessouky, Bechtel Vice President and General Manager, Egypt



**As the world is trending towards emission reduction, what is Bechtel's strategy and initiatives in this regard?**

Bechtel is committed to achieving net zero emissions by 2050, and we are currently in the process of setting interim targets that align with the findings of the UN Intergovernmental Panel on Climate Change. To meet the world's climate change agenda, our primary focus is on targeting and reducing emissions, rather than offsetting them, followed by carbon removal to counteract remaining emissions and get us closer to our net zero goal. Each project we build from now on has a role to play in our greater carbon footprint, so we align with our customers and work with our partners and suppliers to make sure we, and the industry, achieve sustainable results.

**How can Bechtel help its customers and partners to realize their decarbonization targets?**

We're helping our partners deliver projects with a purpose that increase energy security and affordability, advance decarbonization targets, and lay the foundation of a net zero future. By integrating our knowledge and capabilities in engineering, technology, and construction, we develop innovative and sustainable solutions to turn ambitious concepts into real projects and help our partners achieve their goals.

Carbon capture, hydrogen, and circular economy solutions, including bioenergy, are helping our partners meet the growing demand for downstream products in a cleaner and more sustainable way, and our Bechtel Energy Technologies & Solutions team is continually focused on the application of proven and emerging technologies to lower carbon emissions.

We also help retrofit existing assets to make them more energy efficient or convert them to alternative power sources. Whether implementing new technology to convert gas to electric drives, adding carbon capture systems to existing fossil fuel plants, prolonging the life of nuclear power plants, or industrial-scale production of renewable fuel, our solutions help to deliver on our partners' sustainability commitments.

**Could you highlight your role in supporting Egypt's decarbonization ambitions?**

Bechtel is proud of our long association with Egypt and the surrounding regions – a partnership of more than 45 years in helping to create access and opportunity, shape the path toward net zero, protect people and the planet, and accelerate progress to connect communities to resources and opportunities.

Bechtel is leading a Coalition of Energy Transition companies to deliver a program to decarbonize onshore downstream facilities by proposing facility modifications that provide meaningful emissions reduction, energy efficiency, and operating cost savings. It started as an idea, using the Bechtel, Enppi, and Petrojet consortium to work on Energy Transition, and has now gained a lot of momentum and interest from other companies. This is a perfect example of private-public sector collaboration to tackle the climate challenge.

Furthermore, Bechtel has been designated as the East Mediterranean Gas Forum (EMGF) working group lead to develop the decarbonization of the East Mediterranean region report. The objective is to develop specific actionable recommendations for policies and regulations, financing, technologies, and capacities for harmonizing and developing a common unified regional East Mediterranean market promoting decarbonization.

**As a leader of the Decarbonization Coalition to support Egypt's climate change agenda, how successful is this agenda so far, and what challenges do you see?**

The Coalition has developed an economically viable six-year master plan to decarbonize onshore downstream facilities across the country by implementing decarbonization modifications for gas plants, LNG plants, refineries, and petrochemicals. We identified the targeted facilities' design information and studied and developed a precise list of modifications based on emerging technologies that bring emissions savings and, most importantly, bring operating cost savings to support funding of the modifications.

The Coalition has been awarded its first project, the "Idku Energy Hub" by Shell, Petronas, and EGAS to study a proposed power system between the onshore gas processing plant of the West Delta Deep Marine (WDDM) gas fields in the Mediterranean Sea off the coast of Egypt, and the Egyptian LNG export terminal (ELNG) in Idku, east of Alexandria.

The Idku Energy Hub project will explore the benefits of a One Power Hub concept, integrating the electrical power systems at the WDDM and ELNG, as opposed to having two separate systems. The main goal is to increase the power saving and greenhouse gas (GHG) abatement benefits of unifying the electrical power systems of the onshore plants. The synergies will include optimization of the number of running gas turbine generators, modeling the most efficient operating mode for both plants, reducing GHG emissions, and economizing the fuel consumption in the entire hub.



I am also happy to share that we are working with Shell and Egyptian LNG on the second Coalition project, which is to achieve zero routine flaring for the Egyptian LNG plant to support the Methane Global Pledge signed by H.E. President Al Sisi last June. We are hoping that there will be another announcement soon, confirming the award of this scope to the Coalition.

We have identified energy efficiency and flaring reduction as low-hanging fruit to achieve our energy transition goals. These projects are generally economically viable as they bring operational cost savings to their owners, which promotes their implementation.

Carbon capture and storage is a greater challenge to economic viability and financing, requiring policies, regulations, and carbon pricing schemes to be put in place.

**In your opinion, is it possible to achieve decarbonization targets while providing crucial energy needs for economic growth?**

Achieving near-term energy security is fundamental, particularly at this moment with governments around the world committing to ambitious targets. At the same time, the energy transition is here to stay.

The Ministry of Petroleum, under Minister El Molla's wise leadership, has welcomed and encouraged the private sector and Egyptian and international companies to partner in developing innovative solutions to decarbonize this key sector. With this strong commitment to public-private collaboration, we are moving ahead quickly and efficiently to assess the requirements to decarbonize the sector and develop effective solutions to address it. This example demonstrates how quickly we can move, if we do so in partnership, and it stands as a model that other governments,

perhaps beginning with those across the East Mediterranean region, can emulate.

Energy plays a key role in promoting social and economic progress — and technological advancements have created new opportunities to improve how we bring energy to communities worldwide. Any transitions in the energy sector should be compatible with social needs while protecting the climate.

Our customers are accelerating their efforts to reduce carbon emissions and achieve a future of net zero emissions. Today, more than half of the global gross domestic product is produced in countries and regions that have committed to decarbonization targets.

### **How can Bechtel's outstanding technologies help in accelerating the energy transition path?**

Our Bechtel Energy Technologies & Solutions group provides technology and subject matter experts focused on delivering for our customers as they tackle the challenges of the energy transition. Bechtel delivers optimized solutions to help our customers realize lower capital costs, shorter time-to-market, and projects with lower carbon emissions.

Supported by world-renowned experts, our depth of technology experience and technology development capabilities, and a suite of in-house licensed technologies, we examine innovative solutions and identify the best solution for each customer's needs. We evaluate the application of proven technologies, emerging technologies, and innovative combinations of both to lower carbon emissions for our customers.

We apply technology, economic analysis, and complex process systems analysis to the energy transition challenge including concept definition, emerging technology advice and

selection services, feasibility studies, technology licensing, process design basis and pre-front-end engineering and design (FEED) services in olefins, chemicals, water treatment, advanced fuels, sulfur, carbon capture, and hydrogen.

We provide expert solutions for industrial facilities to become greener, smarter, and more resilient. Our green space focus includes: Advanced fuels and chemicals using renewable feedstocks and pathways to manufacture products more sustainably; Plastics circular economy including novel chemistries and processes to convert waste materials and emissions into valuable products; Carbon capture, utilization and storage; ThruPlus® Delayed Coking Unit Technology; Hydrogen production, storage and delivery systems; and Novel water technologies that provide valuable resource conservation and reduce cost.

We use new process technologies, improvements in process and energy efficiencies, and advanced digital methods to improve carbon reduction, energy, and plant performance.

### **International oil and gas companies will have a rare chance to showcase their environmental initiatives and latest technologies during COP27. Why do you think it's important for companies to take part in the Decarbonization Day of COP27?**

As leaders in the industry, accounting for almost 30% of global operated oil and gas production, IOCs aim to leverage their collective strength and expand the pace and scope of transitions to a low-carbon future, helping to achieve net zero emissions as early as possible.

Major oil and gas companies have been barred from official involvement at the COP26 climate summit due to doubts over their claims

of going 'net zero'. This year at COP27, the Decarbonization Day will be the open window for industry leaders to showcase not only their commitment to the energy transition but also their ongoing efforts to meet their targets to provide more low-carbon energy.

Companies play a decisive role in accelerating climate action, both by decarbonizing their own operations and by developing and producing the next generation of technologies that can help prevent ongoing GHG emissions.

The oil and gas industry is not inherently sustainable, nor is it eco-friendly, but that doesn't mean companies are not innovating their way toward longer-term sustainability. With the use of modern technology and smart software, the forward-looking oil companies are working towards a cleaner, greener, safer future.

### **How do you think the outcomes of COP27 can affect the activities of the oil and gas industry?**

Egypt has already made an exceptional effort prior to COP27 to ensure that the oil and gas sector participates and has a significant role to play in the climate challenge. This has been achieved through the introduction of the Decarbonization Day at COP27 this year.

We anticipate the outcomes of COP27 to address the mobilization of finance, access to technology, and building the capacity to accelerate the energy transition, which are all key drivers for the role that oil and gas companies have to support the climate change challenge.

COP27 is seen by Egypt as an implementation COP, where we all come together to renew our determination and lay out a clear path toward turning pledges into tangible actions on the ground.



# REDEFINING ENERGY EFFICIENCY WITHIN CLIMATE COMPLEXITY

BY HESHAM TAWFIK ELSHAMY, COUNTRY MANAGER  
FOR EGYPT AT AGGREKO AFRICA

**aggreko**

Transformative energy usage has become critical, and it presents an opportunity for oil and gas companies to not only transition to cleaner energy but also to reduce wastage that results from flare gas. According to a recent analysis by the Organization for Economic Co-operation and Development (OECD), the world is struggling to progress when it comes to climate change outcomes and transformations. Companies and countries need to focus on initiatives and frameworks that allow them to achieve measurable decarbonization goals within realistic timeframes, and that ensure their decarbonization strategies are relevant to their unique situations. This perspective is reflected in Egypt's recent commitments around COP27 and the value it places on putting decarbonization at the forefront of strategy and decision-making.

Egypt has long had climate change at the heart of its considerations. The country is vulnerable to the threat that it presents with rising sea levels, heat waves, and water scarcity seriously impacting the economy and citizens' well-being. The situation is further complicated by the fact that the ecological footprint per capita is already higher than its biocapacity which puts it at risk of increased carbon dioxide waste. To address these challenges and threats to biodiversity and capacity, Egypt has put in place the Sustainable Development Strategy: Egypt Vision 2030 (Egypt Vision 2030) and the Integrated Sustainable Energy Strategy 2035 (ISES 2035).

Egypt Vision 2030 focuses on the reduction of greenhouse gases (GHGs) by 10% from the energy sector, including oil and gas, and introduces specific legislative steps and projects to help achieve this goal. ISES 2035 reinforces these strategies with a richer look at reform and updates across the energy and power sectors to invest in renewables, to improve investments and drive a 'vibrant domestic renewable energy industry.

Egypt has already shown itself as a leader and innovator across multiple areas of the climate change arena – the country created the first sovereign green bond worth \$750 million that has 46% of proceeds dedicated to clean transport and 54% towards sustainable water supplies and wastewater management. While the country has been making great strides in reducing flare gas, the country is still ranked among the top 30 flaring countries in the world according to the 2022 Global Gas Flaring Report. And with access to electricity being a challenge across the continent, there is a significant opportunity to utilize this flare gas to generate electricity for the continent.

Aggreko has collaborated closely with several organizations from around the world to help create flare-to-power solutions that align with their climate change and decarbonization goals, and that help resolve their APG gas challenges. In Egypt, Aggreko partnered with one of the biggest oil fields in the western desert. Their goal was to reduce flaring by 40%, which required an efficient and innovative solution in line with their long-term strategy. They used to have scattered diesel generators over every single well, resulting in significant costs to electrify the production field. Aggreko proposed a centralized power station utilizing flare gas instead of diesel, to eliminate the waste associated with flare gas, reduce their carbon footprint and ultimately drive down the cost of energy for the company. Using Aggreko's bespoke solution consisting of their gas generators, transformers, and switchgear, they were able to replace all their diesel generators, connect all the wells through overhead transmission and supply them with around 10 Megawatt of continuous electricity, while saving around 80 000 liters of diesel per day, resulting in a total saving of around \$25 million.

Similarly in Oman, Aggreko designed and engineered a flare gas to power initiative for critical oilfield areas that were situated in extreme conditions. The temperatures in the region rise to above 50 degrees Celsius and there are frequent sandstorms with fog moisture. In addition, the location was remote with only sand roads for access. The APG gas was also limited in availability and required both treatment and cooling with the biggest technical challenge coming in with the flare holding condensates too hot to be fed directly into a gas engine. The result was a bespoke engineered solution that could scrub, treat and cool the gas before going into the engine and a saving



of \$50,000 a month. The company could remove its reliance on diesel-fuelled power for critical loads in the oil field and achieve significant decarbonization of its operations through a reduction in gas flaring. The company has subsequently gained both recognition and credibility in the Oman oil industry for being the first to use flare to power.

According to a recent analysis by the International Association of Oil & Gas Producers (IOGP), the key elements of a solid action plan should involve a commitment to net zero, a willingness to share and adopt best practices, and standardization and knowledge-sharing. The IOGP also highlighted that flaring and venting should form one of the four disciplines that define energy transition in the country.

Generating power from associated petroleum gas (APG) can reduce the oil and gas sector's carbon footprint and can be used internally to reduce operating costs and potentially create new revenue streams. This is a radical shift from the perception that APG is a valueless waste product from the oil industry that's often classified as a problematic stranded gas reserve when in a remote oil field or when piped export isn't viable. The recent move toward wanting to monetize APG and find better ways of managing it is a move driven by the World Bank's Zero Routine Flaring by 2030 initiative. Launched in 2015, the initiative 'brought together governments, oil companies and development institutions to resolve flaring and APG challenges and to drive new environmental regulations that prevent gas flaring around the world. This has resulted in a significant rise in the flare to power projects that allow for organizations to not just align with climate change expectations, but to fully realize the potential locked within their APG reserves.

There are several considerations, however, that have to be assessed before moving into any flare-to-power project. Flexible power solutions that incorporate and accommodates potential fluctuation in APG volumes with the ability to measurably reduce the cost of energy using flared gas to power operations, or export to the grid are a key requirement. It's also essential to ensure that the quality of APG is always monitored to ensure that it is capable of direct use in generators. Issues such as high H<sub>2</sub>S, high water content, or low methane content can impact quality but are solvable with the right expertise and application knowledge. If



*Kalabsha Field Flare Gas to power plant*

an organization uses the right partner, then they are assured of sophisticated engineering capabilities and technologies that can effectively resolve H<sub>2</sub>S treatment and NGL stripping.

That said, overcoming these challenges has become far easier than in the past thanks to dedicated flare-to-power solutions developed by engineers and experts in the field. With the right partner, organizations can power their operations with a gas that was previously a liability – they can realign APG from being a wasted by-product, causing emissions to being an energy-generating asset, and they can minimize unnecessary costs while potentially creating a fresh revenue stream that adds value.

Aggreko supports the World Bank's Zero Routine Flaring by 2030 initiative using technologies that help reduce gas flaring globally and that have been featured in the World Bank's Global Gas Flaring Reduction Partnership's Technology Overview. With Aggreko as a trusted partner, companies become part of the climate change solution, measurably reducing their impact on the environment and their contribution to CO<sub>2</sub> emissions, black carbon and other pollutants. While associated gas cannot always be used to produce power, Aggreko can help make flare-to-power projects a reality wherever possible and to helping companies turn a liability into a sustainable power opportunity.



# DELIVERING LOW CARBON LEADERSHIP



At COP 27, the eyes of the world will turn to Egypt as His Excellency President El Sisi hosts global leaders and identifies the next steps in the fight against climate change. Egypt is already delivering actions to decarbonize and shape the energy systems of the future. Within this drive, Bapetco is rapidly establishing itself as a leader in the sector by identifying and implementing techniques to reduce emissions through optimization, application of proven technology, and commercial structures. Bapetco and its partners are supporting the Ministry of Petroleum's vision led by His Excellency Tarek El-Molla, with many actions already underway and exciting plans for the future.

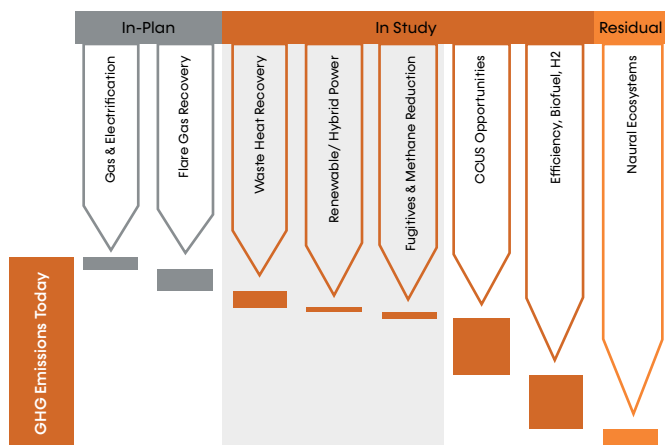
## Committed to Lower Carbon Energy & Shared Benefit

Bapetco and its partners Cheiron and Capricorn Energy are fully committed to delivering actions to support Egypt's implementation of the UN's Sustainable Development Goals as part of Egypt's 2030 Vision and national ambitions for access to affordable energy, providing decent work opportunities and economic growth and reducing inequalities. Our activities seek to support the transition to a lower carbon economy over the long term whilst meeting the necessities of today. We understand our role in supporting the sector's carbon mitigation plans under Egypt's recently updated Nationally Determined Contribution as well as its Long Term Low Emission Development and Climate Change Strategies.

## Establishing a Decarbonization Pathway

Bapetco and its partners have a clear decarbonization action pathway, setting out emission reduction activities over a short and longer-term time horizon. Guided by defined principles to avoid, reduce, substitute, sequester, and then offset, we are actively reducing greenhouse gas emissions (GHGs) across our operations, with a short-term target of a 23% reduction in GHG emissions by the end of 2024, against a monthly GHG emissions baseline in December 2019 of approximately 120 kilo tonnes of carbon dioxide equivalent (CO<sub>2</sub>e). A new baseline emissions study is underway.

The pathway we are following includes actions already underway (in plan) and actions under study to evaluate optimal implementation. The pathway also considers tackling residual emissions through natural ecosystem offsets through either our own schemes or those of others. We describe the exciting opportunities ahead next and the potential for international financing mechanisms to support them.



Bapetco's Greenhouse Gas Emission Reduction Pathway.  
Individual component contributions are estimated and subject to detailed design

## Actions Underway

We are improving our operations through diesel substitution, electrification, energy efficiency improvements, and our emissions reduction program and commitment to the World Bank's Zero Routine flaring by 2030 initiative. Flaring accounts for 15% of our emissions total with flare gas to power projects planned in a variety of locations; capturing a valuable resource that is otherwise lost, supporting cost savings whilst removing harmful emissions – a significant double benefit. They are part of a wider program to replace diesel with gas and electrify our operations through centralized power and distribution networks. Already, 35 generators were removed from the field between November 2021 and June 2022 alone, and a total reduction in emissions of 50 kilotonnes CO<sub>2</sub>e due to diesel substitution and fuel savings is anticipated in the 22/23 financial year. Such networks will also allow future renewable energy integration including solar power and potential tie-ins with sister companies for larger-scale investments.

## The Importance of Reducing Methane Emissions

Reducing methane emissions is a key objective globally in reducing GHG emissions in the near term, due to the highly potent warming impact of this greenhouse gas. A fugitive emission identification and control program to eliminate potential leaks of natural gas containing methane is being rolled out, along with the elimination of vented untreated natural gas. Various methodologies are to be deployed, including satellite mapping and cameras that identify otherwise invisible releases.

## Looking to the Future; our Medium to Long Term Plans

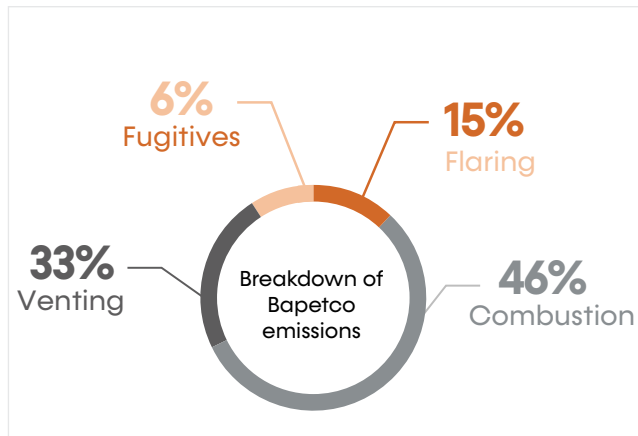
We have started a major study in our core production fields that will evaluate the feasibility of capturing CO<sub>2</sub> from high-content gas streams for reinjection into depleted reservoirs. We are also undertaking engineering design to recover waste heat from power turbines in our Obaiyed field in the Western Desert that can then be used to reduce fuel consumption in hot oil heaters. Further optimizations are planned across all fields to understand how we can use existing equipment more efficiently. Hydrogen is a future fuel the sector is evaluating and for any residual emissions that cannot be eliminated now, initial research is being undertaken to identify how we can use natural ecosystems to capture carbon or create biofuel.

Furthermore, Bapetco's partner Capricorn is exploring the potential for carbon credit schemes to provide funding to help unlock investment in additional low-carbon, and carbon-reducing technologies.

## Collaboration is Vital

Our workforce is our greatest asset and together, the Bapetco team will evaluate future opportunities to continue our reduction journey. More than 40 areas of opportunity have been mapped to date with more to come. They will secure our success in collaboration with EGPC, the Ministry, other JV partners, and third-party operators who may use our infrastructure, now or in the future, to process their oil and gas. Reaching alignment on the best GHG emission-reducing strategies with these various stakeholders will be key to reducing GHG emissions even further in the Bapetco facilities and infrastructure.

The role of decarbonized oil and gas in energy systems will continue and we have the ideas, commitment, and expertise to support Egypt's needs as the energy mix evolves and we contribute to helping Egypt meet its energy requirements in a responsible and sustainable way.



Breakdown of Bapetco emissions (venting includes stripped CO<sub>2</sub>)



Potential Heat recovery from turbines to replace fuel for heaters



“Bapetco is committed to working with all its shareholders and partners toward becoming a flagship company in Egypt for decarbonization, reducing energy intensity, and improving efficiency..”

**ENG. KHALID MANSOUR** Chairman and MD, Bapetco



“We have a duty to set an example and do what we can to build a better future for the coming generations. Bapetco has a clear road map with several identified projects to achieve lower emission, and higher efficiency operations in the foreseeable future; and we are already delivering with agility and efficiency.”

**ENG. SHAMRENDRA SINGH** General Manager and MD, Bapetco



“Cheiron has clear policies and targets in place aimed at reducing our Green House Gas emissions, and we are pleased to be able to support Bapetco's various decarbonization initiatives alongside those in our other Joint Operating Companies.”

**DAVID THOMAS** Cheiron Chief Executive Officer



“Our role in supporting Egypt's decarbonization journey is core to delivering Capricorn's commitment to be Net Zero in scope 1 & 2 emissions by 2040. Alongside our partners at Bapetco and Cheiron, we are already delivering results, with a clear pathway to significant longer-term reductions.”

**ELEANOR ROWLEY** Managing Director Egypt, Capricorn Energy PLC



# ENERGY CRISIS REINFORCING TWO-SPEED ENERGY TRANSITION IN THE SHORT TERM

The heightened focus on energy security and the rising cost of energy is reinforcing the difference in decarbonization speed between Europe and the rest of the world – according to the sixth edition of DNV's Energy Transition Outlook. Europe, which can be regarded as the leader of the energy transition, will double down on renewables and energy efficiency to increase its energy independence. European gas consumption will fall dramatically as a result of the war in Ukraine. Compared to last year's forecast, DNV sees the continent consuming almost half the amount of natural gas in 2050. Gas will meet just 10% of Europe's energy demand in 2050 compared to 25% today.

More broadly, inflationary pressures pose a short-term challenge to renewable growth. According to DNV's Outlook, the global electric vehicle (EV) 'milestone' – when the EV share of new vehicle sales surpasses 50% – has been delayed by one year to 2033.

However, the impact of the current crisis on the overall energy transition is outweighed by the plunging costs of renewables and increased carbon costs in the longer term.

For the first time, DNV's forecast sees non-fossil energy nudge slightly above 50% of the global energy mix by 2050. This is mainly because of the growing and greening of electricity production. Electricity production will more than double and electricity share will grow from 19% to 38% of the global energy mix over the next 30 years.

The short-term increase of coal consumption will not prevent it from rapidly exiting the energy mix with its peak back in 2014. Oil has been approaching a plateau for some years and it will start to decline sharply from 2030 onwards. As a consequence of the war in Ukraine, global gas consumption will be lower than previously forecast. Before the war, DNV forecast natural gas would be the single largest energy source by the end of this decade, but this has been delayed to 2048.

## Pathway to Net Zero

Alongside the 'best estimate' forecast for the energy transition the Outlook this year also includes the Pathway to Net Zero, which is DNV's most feasible route to achieving net zero emissions by 2050 and limiting global warming to 1.5°C. Despite UN Secretary General António Guterres warning at COP-26 that the situation is Code Red for humanity, DNV forecasts that the planet is on course to warm by 2.2°C by 2100.

Global CO<sub>2</sub> emissions reduction of 8% every year is needed for a net zero by 2050. In 2021, emissions were rising steeply, approaching pre-pandemic all-time highs, and 2022 may only show a 1% decline in global emissions. That makes for two 'lost' years in the battle against emissions.

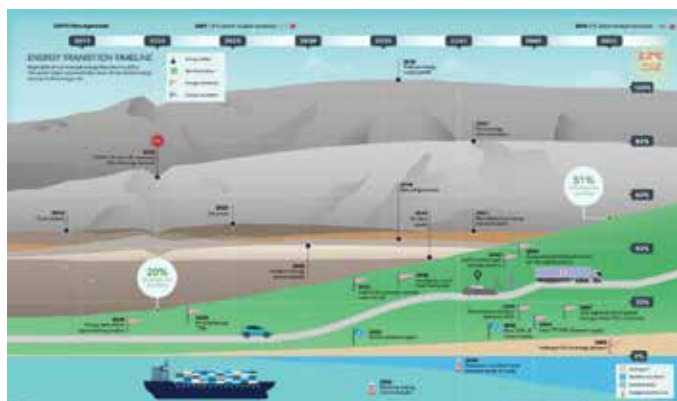
Reaching net zero globally in 2050 will require certain regions and sectors to go to net zero much faster. OECD regions must be net zero by 2043 and net negative thereafter; with carbon capture and removal enabling negative emissions. Some sectors like electricity production will need to reach net zero before

2050, while other sectors like cement and aviation will still have remaining emissions. In our net zero pathway the maritime sector needs to reduce emissions by 95% by 2050.

According to our Pathway to Net Zero, no new oil and gas will be needed after 2024 in high income countries and after 2028 in middle- and low-income countries. Investments in renewables and grid need to scale much faster; renewables investment needs to triple and grid investment must grow by more than 50% over the next 10 years.

DNV's Pathway to Net Zero requires much greater policy intervention than we see today. The full policy toolbox must be unpacked, including; higher carbon taxes and subsidies, stronger mandates, bans and financial incentives to encourage renewables to replace fossil fuels, and smarter regulation and standards.

"With COP-27 approaching, it is important that policymakers recognize the huge opportunities inherent in decarbonizing the energy mix in light of the mounting costs of climate change impact. The technology exists to achieve net zero emissions by 2050, but for this to happen, we must utilize the scope of the policy toolkit," said Remi Eriksen, Group President and CEO of DNV.



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# ENAP'S PLAN TO BE CARBON NEUTRAL BY 2050

- » Nearly 300 initiatives are being developed in Empresa Nacional del Petróleo (ENAP) in order to reach zero net GHG emissions by 2050 based on a new development model and a deep commitment to change the way of producing energy.
- » A sustainability plan is being projected based on five pillars: Decarbonization, Renewable Energies and Green Hydrogen, Water Management, Noise, Odors and Volatile Organic Compounds (VOCs)

To promote a sustainable energy future for the country and the territories where ENAP is present, together with the global challenge to face climate change and protect the environment, the Empresa Nacional del Petróleo (ENAP) is in a process of transition for the development of a sustainability plan to reach zero net GHG emissions in 2050, in parallel with the changes that the energy business in the world is experiencing.

Carbon neutrality is a goal that has been set by the Chilean Government, which must be embraced by companies based on a new development model. At ENAP, we are not far from this challenge. We have a deep commitment to changing how we produce energy. We want to achieve zero net emissions by 2050.

For this purpose, ENAP has defined five pillars which are: Decarbonization, Renewable Energies and Green Hydrogen, Water Management, Noise, Odors and VOCs.

## Decarbonization

ENAP is working on a substantial change to achieve zero net GHG emissions by 2050, in line with global challenges and the goal set by the Chilean Government.

In order to achieve this goal, a route to zero net emissions has been established, which includes the development of a CO2 Abatement Curve to determine the most effective and high-impact actions to reduce emissions and their associated cost.

ENAP also seeks to reduce emissions from its operations, incorporating new technologies, which involve technological upgrades to boilers and furnace burners and the implementation of a flare flow control system to reduce NOx emissions. In addition, we are evaluating opportunities for carbon capture, utilization, and storage in refineries.

It also involves generating energy through lower impact sources and optimizing consumption, as well as having suitable logistics

that can be used to transport the new fuels to the consumption centers.

At a general level, this plan involves accelerating investments to carry out a set of almost 300 initiatives that will enable the company to meet its goal of reaching zero net GHG emissions by 2050.

With the same alignment, ENAP Sipetrol Egypt has already completed the first phase of its gas power generation project in East Ras Qattara Concession, Western Desert, and succeeded to generate +/- 20% of the required power consumption for its fields by gas. ENAP Sipetrol Egypt aims to increase this to 90% by the middle of 2023 which will have a very good impact on the environment by reducing its emissions. Also, in its newly awarded block – West Amer in the Eastern Desert - ENAP Sipetrol Egypt is studying the feasibility to integrate renewable energy production from the surrounding wind farms to obtain part of its energy consumption for its future operations.

## Renewable Energies and Green Hydrogen

One of the pillars of this plan is to innovate and develop initiatives that allow ENAP to have new forms of energy in line with the objective of carbon neutrality. This is how Vientos Patagónicos, the southernmost wind farm in the world developed by ENAP and Pecket Energy in Cabo Negro, supplies clean energy to the city of Punta Arenas and started operations in 2020.

But, undoubtedly, the big challenge is green hydrogen, which will allow the development of different sources of carbon-neutral energy.

The Magallanes Basin has an important comparative advantage for the development of wind power generation which allows the region to become a strategic hub for green hydrogen. In that regard, ENAP will play a fundamental role in the development of green hydrogen in Magallanes due to the existence of its facilities, its strategic position in port services, and the availability of docks in the Strait of Magellan. These assets allow projects to be implemented in a shorter time and in a more cost-efficient manner.

The first steps have been already taken, with the signing of more than 10 collaboration agreements reaching more than 15 GW of projects.

With all these initiatives, ENAP seeks to reduce greenhouse gas emissions, contributing to the goals defined in the Paris agreement and the Climate Change Law.

# THE ROAD TO A MORE SUSTAINABLE ENERGY DYNAMIC



ESG in general, and decarbonisation specifically, are at the heart of Energean's operations. The majority of natural gas that we produce in the East Mediterranean can be seen to be the catalyst for and foundation of a more sustainable energy dynamic.

The molecules we produce can replace more pollutive fuels such as coal and fuel oil. Gas has a long-term transitional role as the complementary energy source to inherently intermittent renewable energy.

We have invested both time and capital in ensuring that we can be the best version of Energean that we can be. Energean was the first international exploration and production company to announce a NZ target. We are committed to this path and aim to hit NZ in 2050. Core examples of this investment are as follows:

- New Climate Change Policy
- Established an Environment, Safety, and Social Responsibility Committee, which focuses on climate change and ESG issues.
- Executive pay linked to ESG performance since 2020
- Incorporating carbon pricing into our investment decision-making process since 2020.
- Our zero routine-flaring policy remains effective across the entire portfolio.

This structural investment has resulted in significant success across a range of metrics:

- 22% decrease in Scope 1 emissions compared to 2020.
- 84% decrease in net Scope 2 emissions compared to 2020.
- 100% of Scope 2 emissions reduction at our operated sites due to the introduction of green electricity.
- 73% reduction in carbon intensity over the period 2019-2021; targeting >85% reduction over 2019-2025
- Improved our CDP Climate Change rating from B- in 2020 to B in 2021 and our Supplier Engagement rating from B to A-.

At COP, we will argue that prudently and efficiently produced hydrocarbons, particularly natural gas, are a vital component of a just transition. It is important to understand the broader socio-economic benefits of natural gas as well as its foundational role in creating a more sustainable energy dynamic.

The trilemma must not be forgotten. Energy must be secure, reliable, affordable, and sustainable. Natural gas is a mature and well-understood energy source that can meet the needs of

millions of people around the world, underwriting broader industrial employment as well as basic human needs such as heat and light. Natural gas remains far cleaner than coal or fuel oil and its inherent flexibility makes it the perfect partner for intermittent renewable energy – where the technology remains somewhat immature, not least in terms of energy storage.

Every molecule of gas that we produce in Egypt has multiple benefits.

- Domestically produced gas does not have to be transported from another market – thereby reducing emissions risk.
- Domestically produced gas reduces reliance on more pollutive fuels such as heavy oil or coal.
- Domestically produced gas enhanced energy security and underwrites investment in an industrial economy.
- Domestically produced gas can be exported, creating significant revenues for the Egyptian treasury.

A number of countries have recently found that an overreliance on energy imports can create catastrophic socio-economic and political consequences. We, therefore, congratulate Egyptian policymakers for encouraging upstream investment, ensuring that Egypt can crystalize value from its subsoil wealth.

All of the issues considered above are particularly relevant in the Eastern Mediterranean. Egyptian demand for natural gas is significant as it looks to create socio-economic value for its 100+ million population and to remove fuel oil from the energy mix. In a not dissimilar dynamic, Israel wants both enhanced competition and energy security, as well as moving to fully replace coal with gas and then gas and renewables.

Locally produced natural gas helps drive both of these positive decarbonisation dynamics. A developing interconnected energy market can bring countries and people closer together, in a region that has previously known significant volatility.

Finally, we have to understand that, particularly when considering the heavy industry, natural gas will always have a role in the energy dynamic – because of the inherent efficiency of molecular energy over electrons. This is where policymakers have to consider a broader balance of environmental and socio-economic value creation and the engineering limits of decarbonisation.

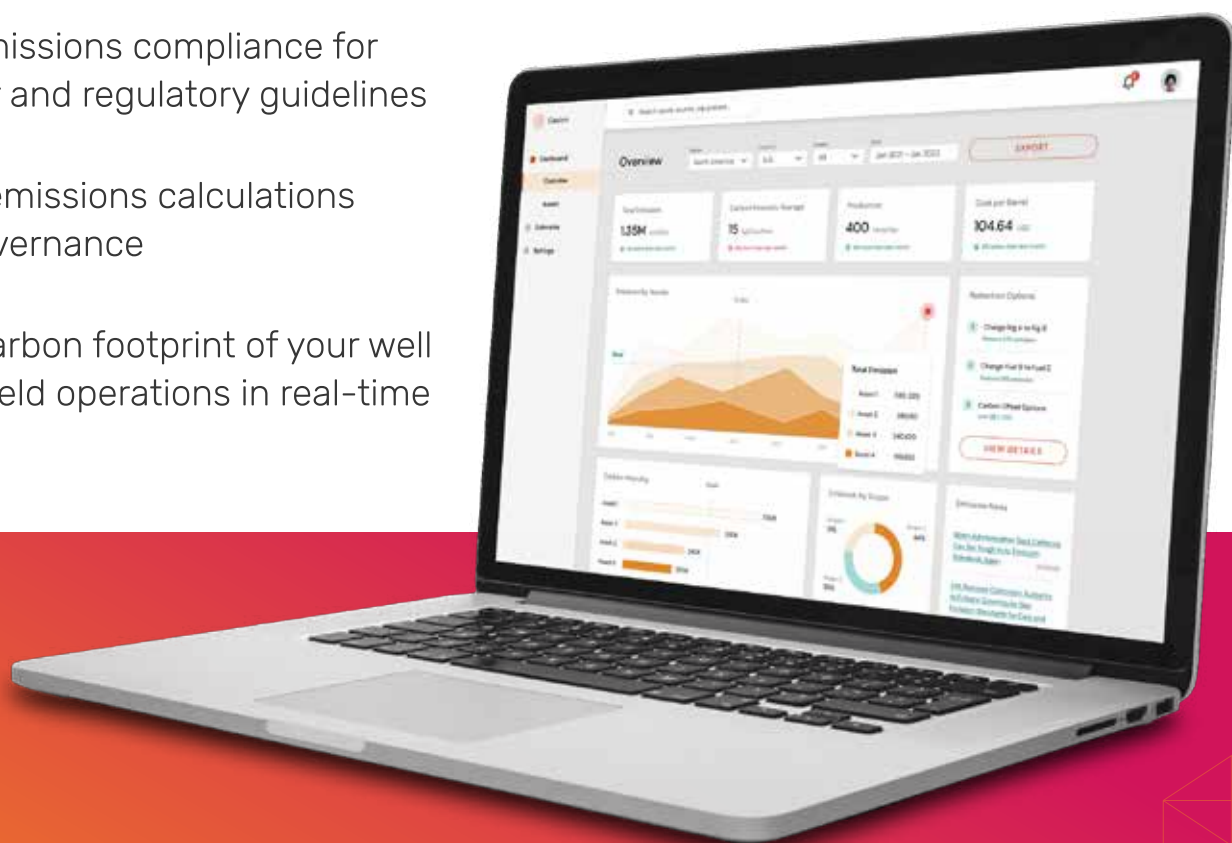
# what if you could...

Instantly visualize your carbon footprint with easy integration into existing workflows

Fastrack emissions compliance for stakeholder and regulatory guidelines

Centralize emissions calculations for easy governance

Track the carbon footprint of your well plans and field operations in real-time



Envana™

Helps achieve your E&P emissions reduction goals

HALLIBURTON | Landmark

# METHANOL: FUTURE-PROOF ENABLER FOR DECARBONIZATION



Methanex produces methanol that is essential to everyday life today and a pathway to a low-carbon future tomorrow. As a key chemical building block or as a fuel, when made from renewable sources, methanol can help society achieve its decarbonization goals.

## Methanol's Role in a Low-Carbon Economy

As society and industry commit to decarbonization, the world faces a dilemma: while demand for petrochemicals and global transportation of goods is growing, so are the pressures to reduce or eliminate the carbon footprint of these products and activities. Methanol, as both a chemical building block and a fuel, can help resolve this dilemma. Methanol can help meet the increased demand for petrochemicals-based products and reduce air pollution and GHG emissions from combustion-related applications. Methanol can also be made from renewable sources and support the long-term decarbonization of both the chemicals that make modern life possible and the transportation sector. Here are five key reasons why we believe methanol is "future-proof":

1. Methanol can support the decarbonization of the shipping industry – The shipping industry facilitates more than 75 percent of world trade. While shipping is the most energy-efficient<sup>1</sup> way to carry cargo (in terms of energy use per tonne-kilometre transported), it accounts for 3 percent of man-made CO<sub>2</sub> emissions. Transitioning maritime shipping to lower-carbon fuels could have tremendous economic and environmental benefits. Using conventional methanol as a fuel significantly reduces air emissions such as SO<sub>x</sub>, NO<sub>x</sub>, and PM during combustion on a tank-to-wake basis and reduces carbon emissions by 15 per cent<sup>2</sup> compared to other fossil fuels. The carbon reductions are greater moving from conventional to lower carbon forms of methanol. Investing in low- carbon and green methanol can support the decarbonization goals the shipping industry has set for itself.
2. Methanol can support decarbonization pathways in developing economies – Although electric vehicle adoption is rising quickly across advanced economies, developing economies will transition more slowly to lower-carbon fuels, not achieving net-zero goals until after 2050 even in the most aggressive International Energy Agency scenarios. These countries will require affordable energy options that still set them on a path to decarbonization. Methanol can be used as a vehicle fuel, heavy cargo fuel and even cooking fuel. While not all forms of energy can be moved or exported easily, methanol can be shipped across the world and has been safely transported for decades.
3. Methanol can leverage existing infrastructure – One of the greatest challenges in achieving the transition to a low-carbon economy is the massive investment required in energy infrastructure. Right now, one of the competing alternative fuels for transport is liquefied natural gas (LNG), which requires insulated tanks capable of maintaining an extremely cold temperature to preserve its liquefied state. Methanol is liquid at ambient temperature and pressure, allowing the continued use of the existing network of pipelines, storage tanks and ports that store methanol across the world. Engine designs require relatively minor modifications to use methanol for combustion in cars, trucks, and ships, making a transition to methanol relatively easy and more affordable.
4. Methanol plays an important role in society as an essential ingredient in everyday life – Methanol, like other petrochemicals, is part of the fabric of modern society as an ingredient in clothing, construction materials, packaging, pharmaceuticals, and other everyday items. It is a chemical building block for many products that will help make our lives more sustainable, including energy-efficient buildings, electric cars, solar panels, and wind turbines. According to the IEA<sup>3</sup>, petrochemicals are poised to consume an additional 56 billion m<sup>3</sup> of natural gas by 2030, equivalent to about half of Canada's total annual gas consumption today. If we can transform methanol production to reduce carbon emissions, we can continue to meet that demand in ways that support the transition.
5. Methanol can be produced in alternative ways – Depending on the feedstock used to produce methanol and associated carbon emissions, the resulting methanol can be categorized as high- or low-carbon intensity. However, the end result is the same essential building block chemical. Therefore, blue, or green (e-methanol, biomethanol) methanol when blended with conventional methanol or by itself can be used in the same applications, both chemical and fuel related, providing flexibility to meet society's product and emissions requirements.

For more information, please visit:  
[www.methanex.com](http://www.methanex.com)

We're using our scientific and engineering expertise and global collaborations to advance climate solutions. We're working to bring hydrogen and carbon capture and storage technologies to scale around the world.

# ExxonMobil

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# LEVERAGING TECHNOLOGY TO FUEL ENERGY TRANSITION

AN INTERVIEW WITH SHERIF FODA, NESR'S CHAIRMAN AND CHIEF EXECUTIVE OFFICER

## Why has decarbonization become important for the oil & gas industry?

The O&G industry is a primary contributor to greenhouse gas (GHG) emissions, with an estimated 75% of all GHG emissions coming from the production and consumption of energy. For upstream O&G, the bulk (~6%) of global GHG emissions come directly from fugitive emissions and flaring, of which methane (CH<sub>4</sub>) is the primary constituent. Since hydrocarbons will remain an important, low cost and dominant part of the global energy mix for years to come, it is incumbent on the industry to adopt new technologies & workflows to decarbonize and produce oil & gas more sustainably. 'Zero Flare' is just one key example of decarbonization, for which Egypt is a leader and visionary country.

## What services do you provide to support oil and gas decarbonization?

During FII 2021 in Riyadh, KSA, NESR announced its ESG Impact segment in which the company would leverage its existing 'open technology platform' to pursue game-changing decarbonization technology to import into the MENA region. The key areas of focus for ESG Impact are 1) Water Stewardship, 2) Flare Gas Elimination, 3) Heat Capture & New Energies, and 4) Emissions Detection. NESR's aim is to harness what the O&G has historically viewed as waste streams (produced water, associated gas, effluent heat) and turn them into value streams for internal use (circular economy) and/or community delivery (e.g. water for tree planting).

## How are you approaching the energy transition?

It is NESR's view that the energy transition will take time, hence the focus on "low hanging fruit" decarbonization of existing hydrocarbon production. However, NESR is also driving projects in carbon capture & storage (CCS) to aid in this decarbonization immediately. Additionally, the company is heavily involved in geothermal (e.g. Indonesia), and NESR teams are constantly evaluating new energies such as green, blue & turquoise hydrogen for future energy transition market opportunities.

## How can you support Egypt in reaching its decarbonization goals?

Through NESR's ESG Impact segment, the company has already engaged with multiple key operators in optimizing workflows around water (eliminating water dumping and treating this produced water to fresh water for the community), flare gas (capturing and processing gas for power, liquids, and other useful byproducts), and heat (to subsidize power consumption at the field level). Additionally, NESR is bringing emissions detection technology to Egypt, to aid operators in establishing a reliable GHG emissions baseline for reporting purposes and to measure the progress of decarbonization over time.

## What is the roadmap for NESR to decarbonize its business and assets?

NESR aims to grow its external (client facing) decarbonization business to become the largest reporting segment by 2030. Internally, the company is strategically deploying solar and water treatment technologies, and transforming its supply chain & procurement practices to decarbonize its overall asset base.

6-As the world needs to face climate change, and many are trying to take steps to decarbonize their businesses, do you see a major change in the mindset of your clients today compared to your early days when setting up the early days of NESR's operations?

The industry mindset is changing, but not nearly quickly enough to meet global decarbonization ambitions and also NESR's own internal goals. Additional stakeholders such as community representatives, governmental agencies & ministries, and even non-governmental organizations (NGOs) can contribute to the dialogue and help aid in the decarbonization of O&G through regulation, project financing, participation in carbon markets, and other drivers.

## What are the main challenges you would like to see resolved in the coming years to make decarbonization more feasible?

Global connectivity of the world economy will help stakeholders across the energy & industrial value chain better coordinate decarbonization efforts, but near-term pricing mechanisms are also needed to "jump-start" these trends. Voluntary Carbon Markets (VCMs) can play an important role by matching hungry 'ESG Capital' globally with decarbonization technology and projects in the MENA region. The challenges facing VCM proliferation are mainly around the standards and methodologies (or lack thereof) used in carbon accounting and project offset generation, so improvement and further standardization of these methodologies (e.g. standardization of emissions baseline & measurement practices) could provide better clarity for decarbonization project owners, and more certainty for project investment.

## What role do you think digitalization plays in decarbonization?

In addition to measuring and quantifying industry emissions more reliably (rather than relying on hypothetical emissions factors and self-reported figures), digitalization and AI can play a role in the optimization of industry operations & supply chains, to reduce waste and lower carbon emissions.

## What are your insights for the decarbonization day at COP27?

NESR would be honored to participate in the decarbonization day of COP27, and share learnings from key technologies and case studies that hold vast decarbonization implications for the energy industry (e.g.



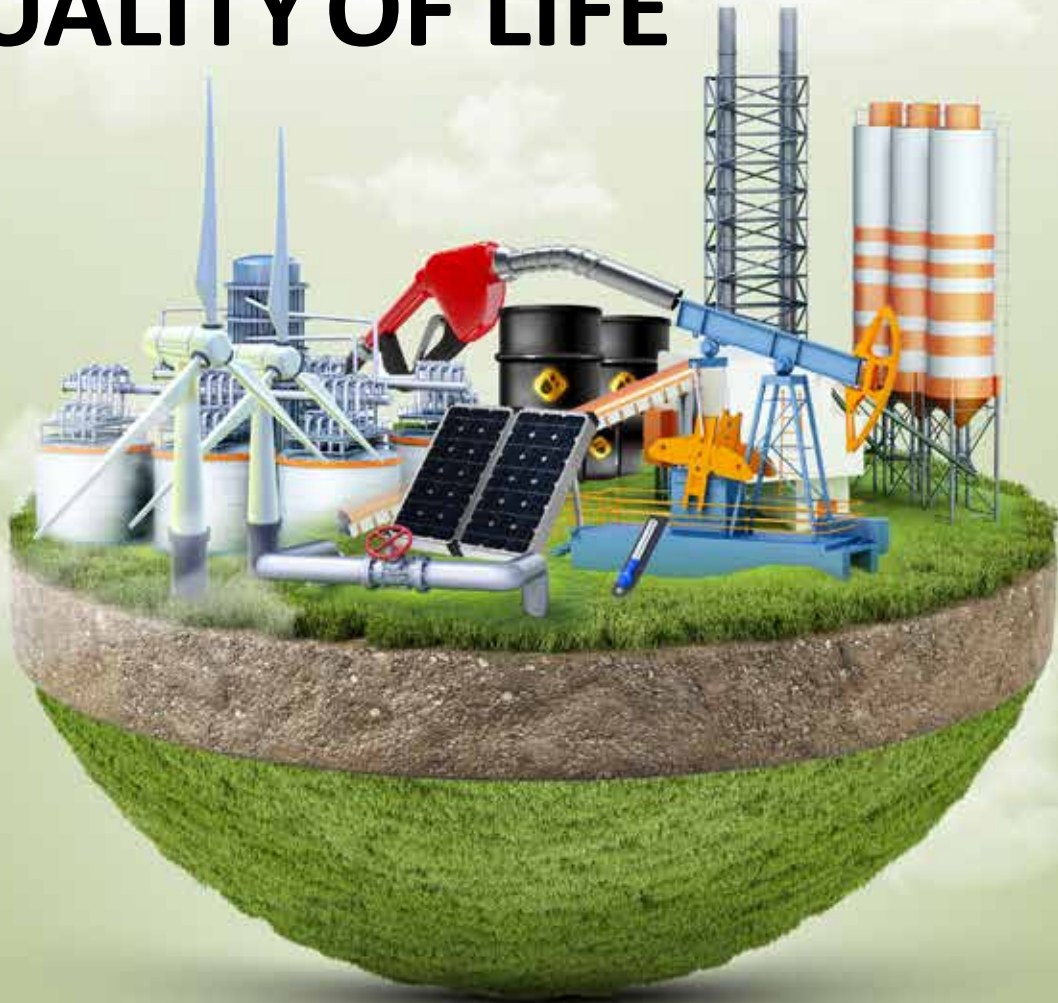
Flare-to-Forest project concept which aims to simultaneously eliminate flaring & produced water dumping, while generating much-needed freshwater and recovering valuable minerals for use in the community (e.g. tree planting) and other industries (e.g. salt industry)). Just as the Energy Services subsector is the driving force behind hydrocarbon production, so too can NESR be a driving force behind O&G decarbonization, and do so by empowering local engineers & manufacturers as the National Champion of MENA. We would be a productive contributor to the decarbonization day dialogue, because we are driving actual, complex decarbonization projects in the world's most carbon-intensive industry, an industry that has both the most to prove to the world (in terms of ESG commitment) and also the most potential to drive positive change.

## What do you look forward to gaining in COP27?

NESR looks forward to gaining insights and learnings from other industries and other stakeholders within the O&G industry. Too often is technological change stymied by lack of communication, information silos, or exclusion of stakeholders in the discussion. The energy services industry must contribute positively to the COP27 discourse because only the O&G industry can achieve such vast decarbonization progress while also providing reliable, affordable energy to the most vulnerable populations around the world. We look forward to learning and sharing our own learnings.



# IMPROVE QUALITY OF LIFE



“ We stand up to advancing a prosperous environment and **lower carbon emissions** to improve quality of life without compromising of future generations.

Kuwait Energy is committed to measure, report and **reduce** carbon footprint from our core operation. ”

# BUILT FOR THE ENERGY TRANSITION

## NEPTUNE ENERGY IS A BUSINESS BUILT FOR THE ENERGY TRANSITION.

Our global portfolio is gas-weighted and has a significantly lower carbon and methane intensity than the industry average. That is especially important, as geopolitical instability highlights the need for more domestic production to support energy security, while the drive to decarbonize energy production and consumption gathers pace.

Neptune Energy supports the goals of the Paris Agreement, and the net zero targets set by governments around the world. While these goals look to 2050, we are focusing on what we can do in the short to medium term, recognizing that actions in the next 10 years will be crucial in curbing global temperature rises.

Earlier this year, we announced our goal to store more carbon than is emitted from our operations, and from the use of our sold products by 2030. It is an ambitious strategy, and it is fully aligned with the ambitions of COP26. Importantly, it also acknowledges that gas will continue to play a major role for many years to come, underpinning energy security.

The strategy has two key pillars: producing lower carbon energy and developing integrated energy hubs.

First, we will produce lower carbon gas and oil by focusing on electrification of producing assets where it is efficient and economic to do so and by continuing to reduce emissions from our operated assets.

Producing gas and oil continues to be the mainstay of Neptune's business, and we will target production in our key producing regions - maintaining our gas-weighted portfolio - while lowering carbon intensity. And we will prioritize new gas and oil developments where they are consistent with our lower carbon strategy, along with those that provide opportunities to integrate multiple energy systems.

By the end of this year, more than 35 kboepd of Neptune's net annual production will be electrified and, with further projects planned in Norway, we aim to have around 50 kboepd electrified by 2027.

The second pillar of the strategy involves using our existing oil and gas infrastructure and capabilities to integrate energy systems. This integrated energy hub strategy provides an opportunity to drive offshore decarbonisation by extending the life of our producing assets, and repurposing them for CO<sub>2</sub> storage and hydrogen production, using domestic, lower carbon intensive gas or wind power.

Linking back to the first strategy pillar, we recognise that extending the life of our operating fields can also support the economics for electrification, helping decarbonise our existing production even further.

Naturally, Carbon Capture and Storage (CCS) will play a major role in our strategy, just as it does in supporting the global energy transition. And it is an area that Neptune knows well.

We are building on the significant experience gained with CCS in the Norwegian and Dutch North Sea. In Norway, we partner on the Snøhvit field which has been reinjecting CO<sub>2</sub> since 2008. And in the Dutch sector, we participated in a 14-year program to reinject CO<sub>2</sub> from a well into a producing gas field, saving more than 100,000 tonnes of CO<sub>2</sub> overall.

Today, we and our partners are developing the L10 CCS project in the Netherlands, which could store up to 5mt of carbon per year. We intend to have the project FEED-ready by the end of this year, followed by the submission of a storage licence application.



We have also begun developing the Errai CCS project in Norway with Horisont Energi. Errai could store 4-8 million tonnes of CO<sub>2</sub> annually, with the potential to store more in later phases. The project includes an onshore terminal for intermediate CO<sub>2</sub> storage, with the intention to permanently store the CO<sub>2</sub> in an offshore reservoir.

The onshore terminal would be capable of receiving CO<sub>2</sub> from European and domestic customers, including from the planned CO<sub>2</sub> terminal at the Port of Rotterdam. Several onshore locations in Southern Norway are being evaluated for the terminal.

Meeting the world's current and future energy needs - while also driving decarbonization of energy systems - will require significant investment in a diverse range of low-carbon projects as well as traditional oil and gas developments.

### Our sector is ideally placed to do so.

We can play a valuable, meaningful role as the world accelerates into the energy transition. We have a highly-skilled workforce with unrivaled project and engineering skills, robust global supply chains, and cutting-edge technology capabilities.





# REDUCING YOUR OPERATIONAL AND CARBON FOOTPRINT.

**We keep your operation turning while  
delivering on your climate commitments.**

Bring drilling waste processing to the  
wellsite to reduce carbon emissions and  
return real results for your operation.



**TWMA.**  
The world's drilling waste specialist.





# Hydrogen Consulting & Certification Services

## TÜV Rheinland Own Standard - H2.21: An Independent Verification for the Documentation of Carbon-Neutral Hydrogen.

TÜV Rheinland provides active support for the development of hydrogen as an energy carrier of the future. We are now offering to the industry, market players and relevant stakeholders a new practice-oriented specification for the certification of green hydrogen: the TÜV Rheinland Standard H2.21 Carbon-Neutral Hydrogen.

In the TÜV Rheinland Standard H2.21, our experts have specified requirements that allow a certification of the Product Carbon Footprint as less than or equal to zero. In addition, based on the "Carbon-Neutral Hydrogen" Certification, by fulfilling other specific criteria, the following optional criteria can be certified as well:

- Green Hydrogen
- Blue Hydrogen
- Turquoise Hydrogen
- RED II Compliant Hydrogen

### Our Services

- **Green Hydrogen Certification:** We assess and certify green and carbon-neutral hydrogen production within the hydrogen supply chain according to TÜV Rheinland Standard H2.21. In addition, we also assess and certify green and carbon-neutral ammonia production which is processed directly from the certified hydrogen.
- **Risk & Safety Management:** With our specialized risk management tools and methods (e.g. Bowtie, FMEA / HAZOP / HAZID / QRA, etc.), we provide customized solutions to manage the risk across the entire lifecycle of your hydrogen facilities and equipment.
- **Project management consultancy:** We provide project management consultancy services to help you minimize cost, maximize return on investment and achieve timely completion of your projects.

### Create Transparency with our Test Mark for Carbon-Neutral Hydrogen



Upon successful certification, we will present you with our Certificate and along with it, the right to use our Test Mark.

The "key words" in our Test Mark document the test contents of the certification and make them transparent to everyone.

### Bring Hydrogen to Life, Safely.

TÜV Rheinland's expert team bundle the needed know how of different technical areas to support plant operators, grid operators, manufacturers or hydrogen users with necessary structural changes. We provide you with a comprehensive package of integrated services that includes testing, inspection, training and consulting. Our expertise will help you manage the risks to people, plants, businesses and the environment and to create safe operating conditions.

As an experienced partner to the industry, we accompany you during the hydrogen revolution.



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**TransGlobe Energy**  
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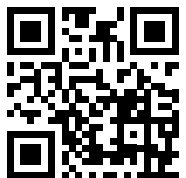


**ACCELERATING DECARBONIZATION  
TOWARDS A SUSTAINABLE GROWTH**

# Designing the Future of Digital Space

Contributing to a more decarbonized and sustainable world by reducing and offsetting our carbon emissions and promoting digital solutions that support our clients in their decarbonized journeys. Atos is helping to design the future of the information space.

A leader in cloud and digital workplace, we are ranked #1 in managed security services worldwide by revenue (2021). With these capabilities plus best-in-class computing power and the pioneering quantum learning machine, we provide tailored end-to-end solutions for all industries in 71 countries around digital consulting, customer experiences, cybersecurity, modern applications and platforms, infrastructure and foundation services along with private and hybrid cloud solutions.



The Atos logo, featuring the word "Atos" in a white, bold, sans-serif font. The letter 'o' is stylized with a circular cutout in the center. The logo is positioned in the bottom right corner, overlaid on a background of a dense forest of evergreen trees with golden-yellow foliage, suggesting an autumn setting. In the background, misty mountains are visible under a soft, hazy sky.