- Cleaning up Nigerian oil pollution could take 30 years, cost billions

  – UN

Why Emission Management

2015 Paris Agreement offers a blueprint for resolving one of the world's toughest issues.

Step - change approach is required to be aligned to the Paris Agreement

Warming up

1.2°C current increase in global average temp

2.7°C warming projected by 2100 with pre-COP 26 policies

Human exposure

800m people at risk from the rising sea levels on Pre-COP26 Trajectory

~1.7bn people experiencing severe heatwaves

Economic Impact

-25% loss in GDP by 2100 on current climate trajectory

~50% reduction in emissions required by 2030 to limit warming by 1.5°C by 2100

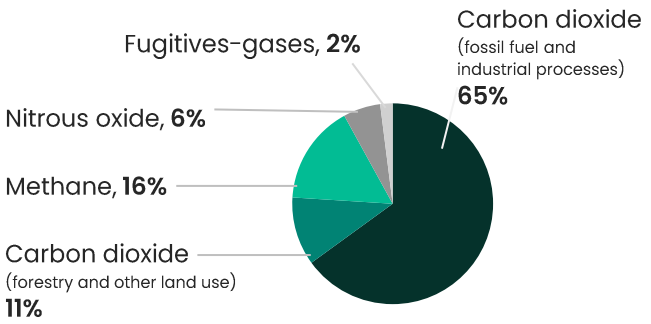
IPCC assessment report 2021

The global emissions challenge

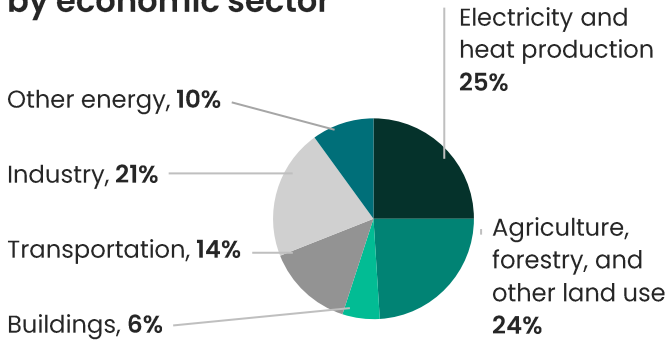
Reducing greenhouse gases (GHG) are critical to achieving net zero by 2050—and many are even more potent than CO_2:

- CH_4: 25x
- N_2O: 300x
- Fluorinated gases: 10,000x

Global GHG emissions by gas



Global GHG emissions by economic sector



Source: EPA epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

EU: Proposed regulation on methane emissions

SCOPE

- Upstream oil & gas + inactive wells
- Transmission & distribution
- Coal

MRV

Monitoring
Reporting
Verification

OGMP Oil And Gas Methane Partnership 2.0

LDAR

Leak Detection & Repair surveys to be carried out by operators

Flaring & venting

Ban on routine flaring & venting
Standard of combustion efficiency

Imported gas

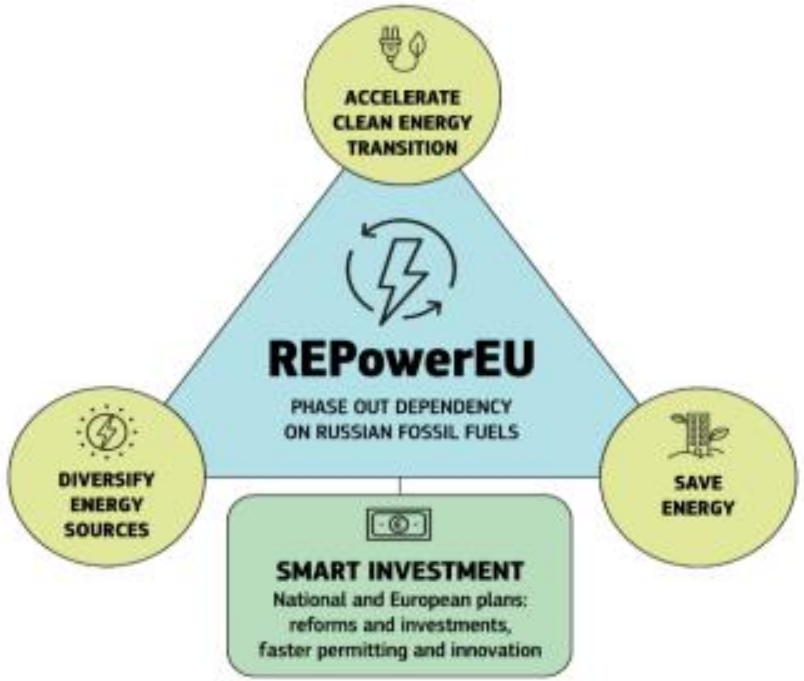
Info on the applicable regulations in the country of origin regarding venting and flaring, and whether the operator complies with OGMP 2.0.

Next steps

- **EU decision-making process**: Approx. 18 months of discussion within the European Parliament & in the Council (EU 27 Member States) before the proposal becomes a legally-binding instrument (in 2023)
- **Implementation**: Approx. 2025, 24 months from the effective date for certain requirements.
- Template to report on methane emissions will be developed by the European Commission (or a standard body).

REPowerEU Plan

The EU intends to reduce its dependency on Russian fossil fuels (e.g., around 150 bcm of natural gas) and accelerate the energy transition.



REPowerEU Plan is underpinned by a number of legislative proposals and a robust Strategy on external energy engagement.

What is relevant for Egypt

Memorandum of Understanding (EU, Egypt, Israel)

- Signed on 15 June 2022 during the East Mediterranean Gas Forum – will run for 3 years.
- Gas coming from Egypt, Israel or other EastMed countries if authorized by the parties and headed to the EU will be able to **transit through Egyptian LNG Infrastructure**.
- The parties will work on **reducing methane leakage**.
- Parties will explore possibility to apply **CCS**.
- All parties will incentivize **low-carbon and renewable hydrogen uptake** in the following areas: industrial processes, transportation, and energy storage.

EU-Egypt Joint Statement on Climate, Energy and Green Transition

- The EU will support Egypt in its work of **COP27.**
- Both parties commit to working together to ensure **stable delivery of gas to the EU**.
- A **Mediterranean Hydrogen Partnership** will be put in place: it will promote the investments needed to expand the production of renewable and low-carbon hydrogen and to develop storage, transport, and export infrastructure towards the EU.

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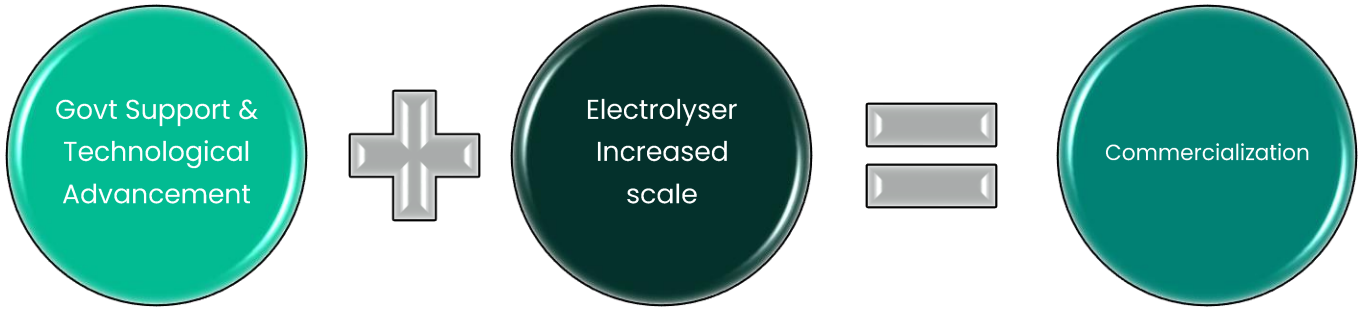
Green H2 Demand vs. Other Fuels

Currently ,
70 million tonnes of H2 produced for industrial use
~76% produced from Natural gas
~23% produced from Coal

Cost:
Grey H2: $1-1.8/kg
Blue H2: $1.4-2.4/kg
Green H2: $4.2-6.1 /kg

Demand by 2050:
- 158 million tonnes of Green H2
- 6,690Twh of electricity needed
  - 4,240GW Solar
  - 2,243 GW Wind (Onshore) + 1,775GW (Offshore)
  - (current capacity of 1,044GW of renewables is used for electricity and not green H2 production

Green H2 Production:
Largely produced at pilot projects
~Only 235MW of electrolyser installed worldwide



By 2030, cost of renewables drops to <$30/MWh
Green H2 will be cost –effective:
- Australia
- Germany
- Japan

Installed capacity of Electrolyser by 2050: *3000GW*
Green H2: ~$2.0/*kg* *in optimal location*
Needed investment : *~$20bn*

Source: Hydrogen Council

EU announces" Clean Hydrogen Alliance" as part of the new industrial strategy for Europe

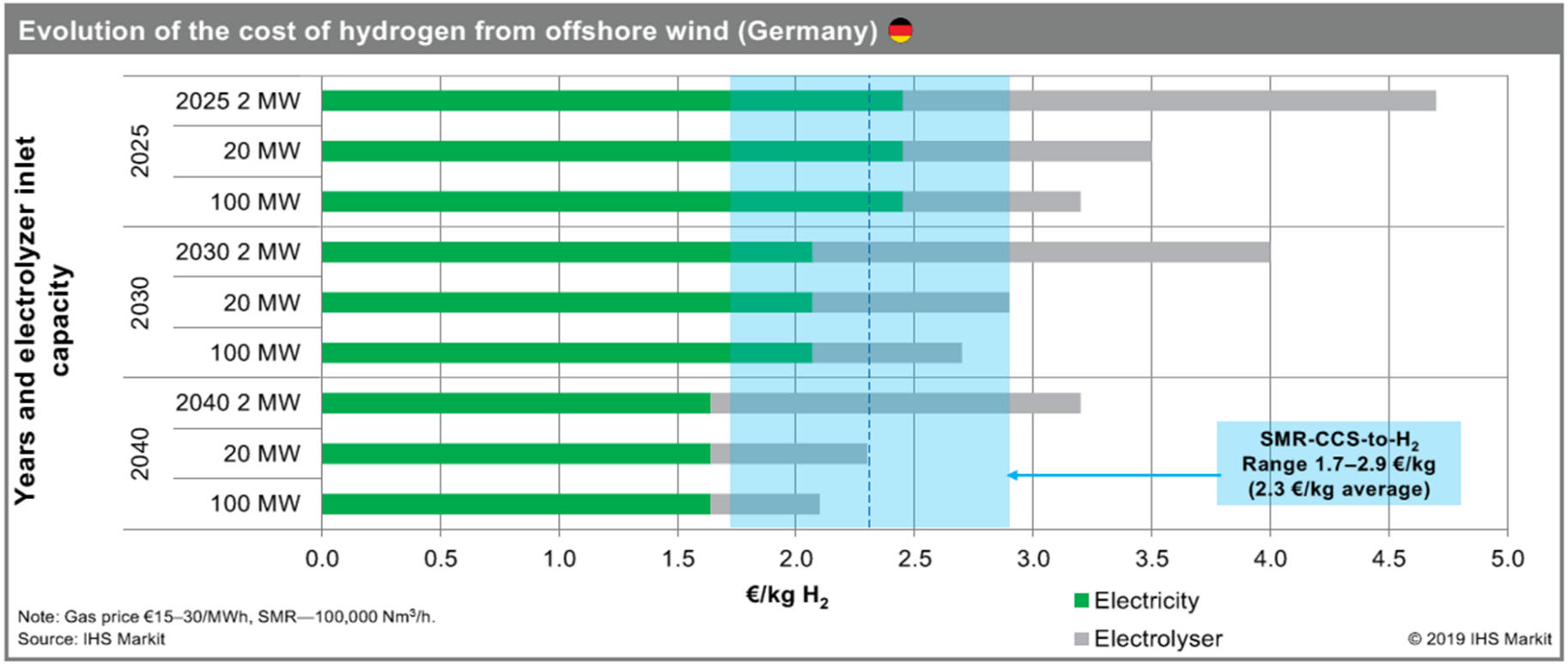
Europe

Focus:

- Electrification and renewables.
- Deployment of hydrogen across Economy (International aviation and shipping)

Increased scale and lower renewable cost offers a competitive H2 from electrolysis.

Increased size of electrolyzer from 2MW to 100MW reduces overall cost ~by 58%



By 2050;

The size of H2 role is dependent on Policy and Electrification.

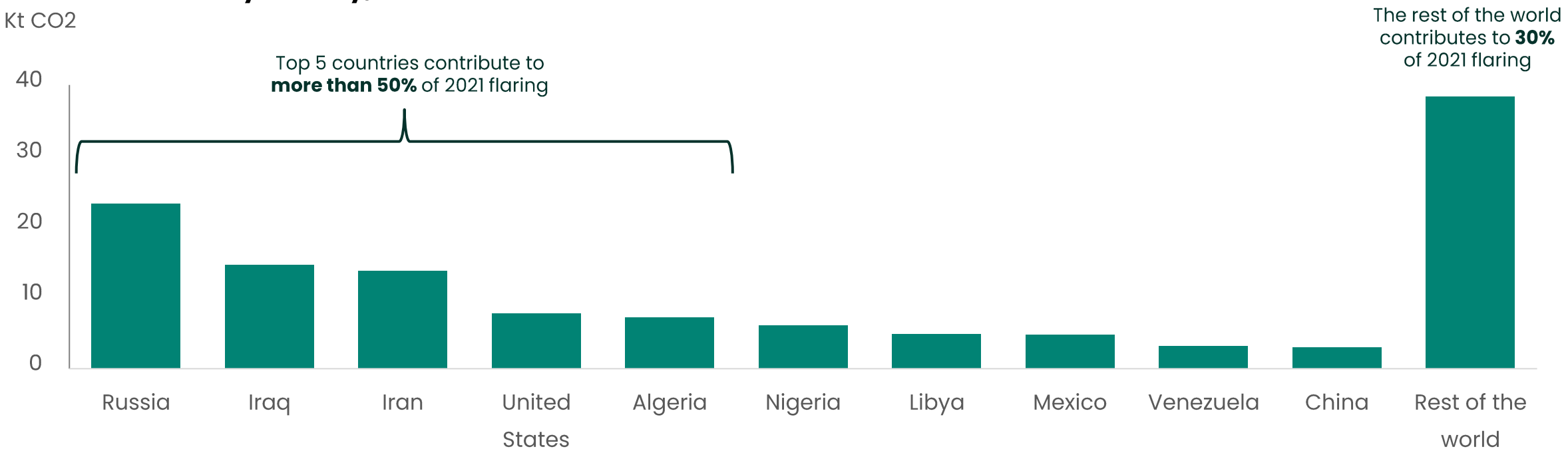
Transportation and heating will account for 10% of energy demand

- *For Shipping and aviation, observe a sharp rise in demand for H2 from 2035.*
- *With H2 supply at 6,000TWh by 2050, Green hydrogen is 28% .*
- *Natural gas usage with CCUS is expected till 2050, there is sufficient storage potential*
- *H2 production dominated from renewables, ~50% of power demand.*
- *H2 is used for balancing and storage.*

Top 5 countries represent more than 50% of flaring

Flaring emissions are heavily concentrated in a handful of countries

Flared emissions by country, 2021

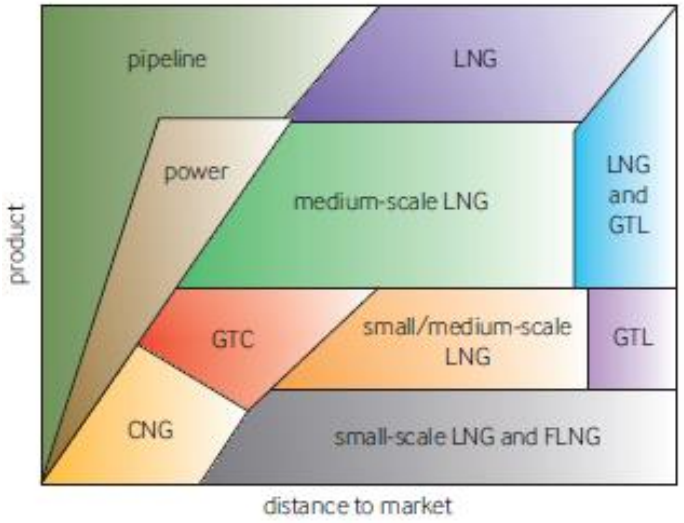


Flaring emissions are concentrated in a handful of high-emitting countries. More than half of global gas flaring occurs in Russia, Iraq, Iran, the United States and Algeria. These countries are also some of the world's largest oil producers.

Source: Rystad Energy research and analysis

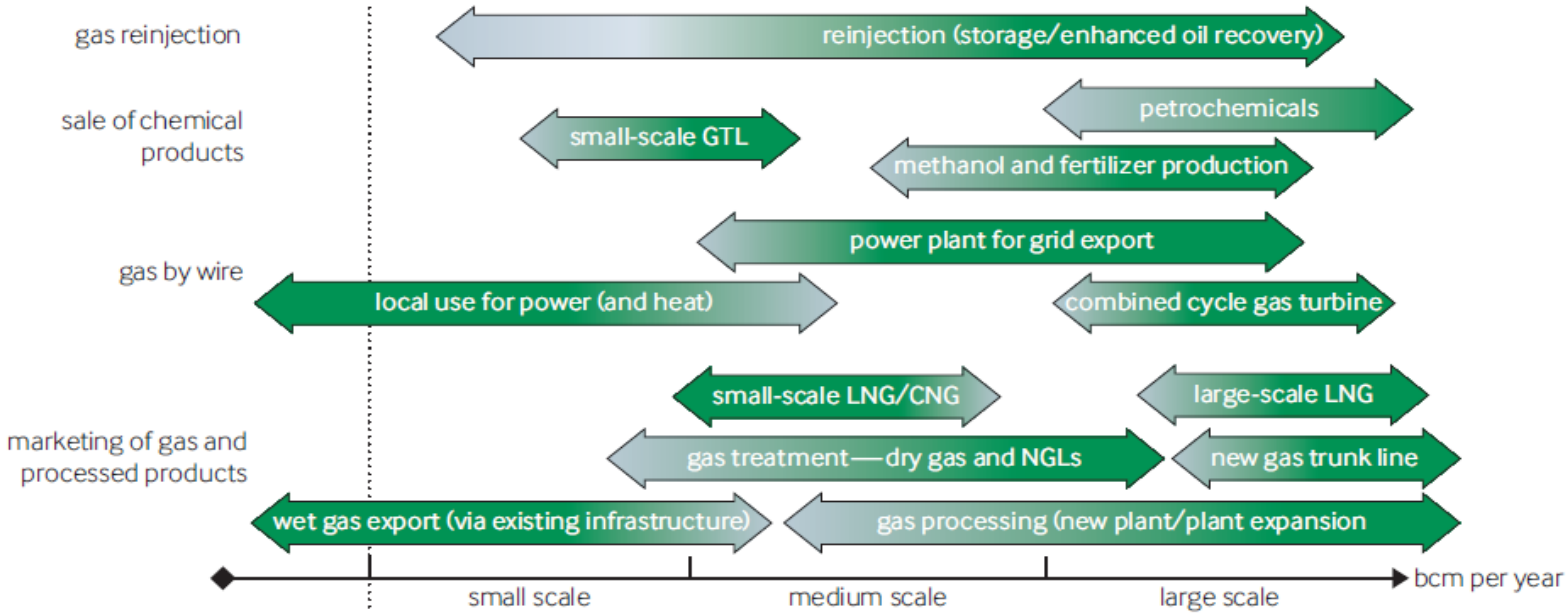
Eliminate Routine Flaring – no silver bullet

Solutions are highly dependent on eco/tech modeling



Aspect	Key Considerations
Technical	Gas Volume forecast
	Gas composition/treatment
	Gas pressure
Economic	Distance to market
	Infrastructure, take away
	Project economics, financing
	Market demand
	Takeaway commitments
	Netback price

Potential solutions across all operations; small-med-large assets



Source: IPIECA Flaring Management Guidance, BKR EM/Pana analysis

Methane policies in selected producing countries categorized by regulatory approach

	Prescriptive					Performance-based				Economic			Information-based		
	Permitting require-ments	Leak detection and repair	Restrict-ions on flaring or venting	Technol-ogy standards	Enforce-ment and related provisions	Strategic targets	Facility or company emissions standards	Process or equip-ment standards	Flaring or venting standards	Taxes, fees and charges	Emissions trading and credits	Other financial incentives	Emissions estimates	Measure-ment require-ments	Reporting require-ments
Brazil	●		●	●	●				●	●	●		●		●
Canada	○	●	○	●	○	●	○	●	○		○	●	●	●	●
China (People's Republic of)	●		●	●	●										
Iraq	●				●										
Iran	●														
Mexico	●		●	●	●	●	●	●	●		●		●	●	●
Nigeria	●		●	●	●	●			●	●		●	●	●	●
Norway	●		●		●					●			●	●	●
Russia	●								●	●					
Saudi Arabia	●			●	●										
United Arab Emirates	●				●										
United States	○	●	○	●	●	○	○	●	○	○		○	●		●

Source: Driving Down Methane Leaks from the Oil and Gas Industry A regulatory roadmap and toolkit, IEA, 2021.

Nigeria Climate Change Policy

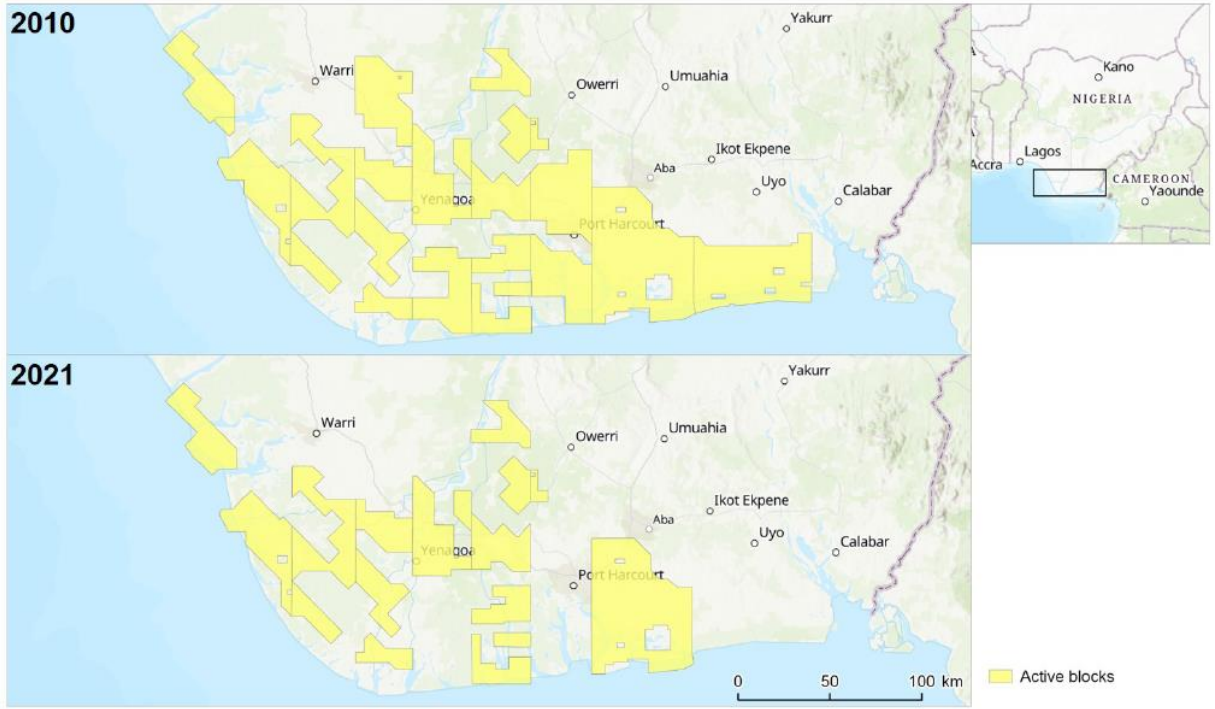
- Committed to a net zero target by 2060
- Zero gas flare by 2030. 60% reduction in Fugitive Emissions by 2031
- "Decade of Gas" – an FG initiative that declared Jan 2021 – December 2030 to take advantage of the gas reserves to power the economy
- By 2030, the Government estimates that 30% of Nigeria's electricity target of 30GW will be generated from renewables.13GW off-grid renewables. (mini-grid 5.3GW; 6.5GW Solar PV).
- 2.5% per year reduction in energy intensity across all sectors

Rest of the World

Country	Rules
NIGERIA 	• **Gas Flare Commercialization Programme:** an operator that produces more than 10,000 bopd must pay the government USD $2.00 for each 28.317 m3 of gas flared, irrespective of whether the flaring is routine or non-routine. Small facilities pay USD $0.50 per 28.317 m3 methane flared. • If flaring needs to occur, the operator needs a permit for each instance of flaring.
AUSTRALIA 	• **Federal Australian** methane-emission reporting methodologies rely to a significant extent on assumed emissions factors rather than direct measurement. • **Queensland** has a good code of practice for leak management, detection & reporting for petroleum operating plant. • **Northern Territory** has a code of practice on onshore petroleum activities: it covers e.g. venting & flaring.
CHINA 	• Peak emissions by 2030; 14th Five-Year Plan (2021-2025) refers to tightening control over methane. • PetroChina, Sinopec, China National Offshore Oil, PipeChina, Beijing Gas, China Resources Gas and ENN Energy set up an **alliance to reduce methane emissions**.
VIETNAM 	Vietnam has put in place a regulation with restrictions on flaring.
RUSSIA 	• **Methane is considered as a "toxic substance"** → methane emissions are reported and taxed. • Emitting more methane than permitted leads to a fine of $37 per 1,000 cubic metres. All methane emissions (including within permitted limits) are subject to a payment of $1.06/m3 .
MEXICO 	**Facilities must develop and implement a Program for Prevention and Integrated Control of Methane Emissions**. They must identify all sources of methane, calculate an emissions baseline, set an emissions reduction goal and establish an implementation schedule for mitigation measures, demonstrating annual progress towards their goal.
BRAZIL 	This regulation establishes **procedures for controlling and reducing flaring and losses from oil and gas developments**. It outlines annual and monthly limits for flaring and losses, linking these to royalty fees and non-compliance to sanctions.
ARGENTINA 	They established a set of good practices on addressing methane emissions. In July 2020, they presented a bill on LDAR programmes.

some majors are exiting shallow-waters and onshore assets in Nigeria

Reducing onshore holdings through divestment



- **High emissions**
- **Oil theft**
- **Regular disruption to operations**

An example of one major- emissions from its onshore and shallow-water assets in Niger Delta are among the highest in its global portfolio.

Source: Rystad Energy Ucube

We see three hard truths:

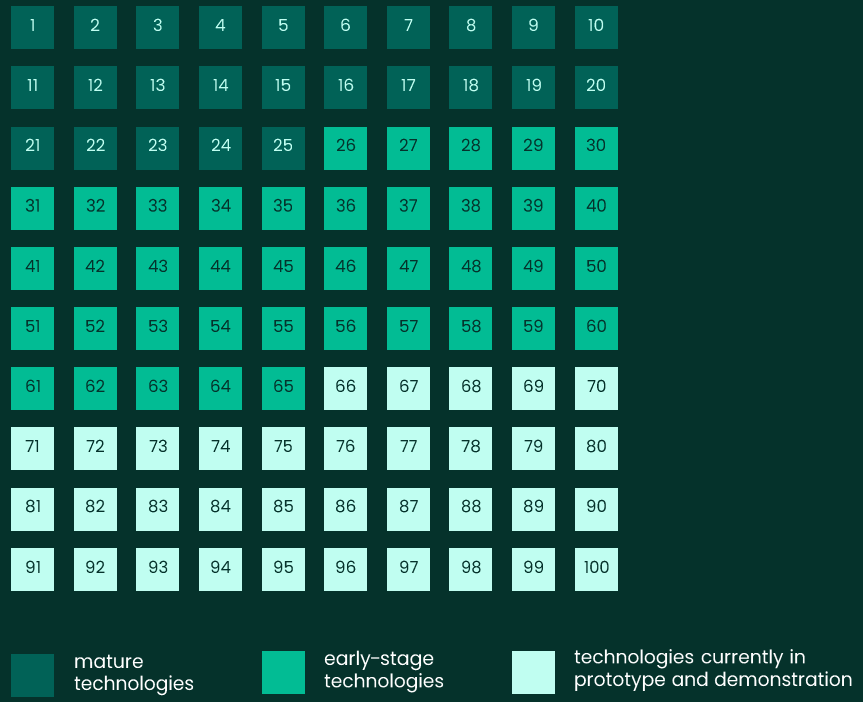
#1 **Without major acceleration, the industry will not meet net-zero targets**

#2 **Reliance on hydrocarbons will not disappear, so efficiency matters**

#3 **There's no path to net-zero without partnership and collaboration**

Why future technology is critical to meeting net-zero ambitions

% OF CUMULATIVE CO_2 REDUCTIONS BY TECHNOLOGY READINESS TO MEET NET-ZERO BY 2070



Source: IEA

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"2021 was a year of acceleration and action to advance our sustainability goals, while working with our partners, customers and suppliers to enable a low carbon future."

Lorenzo Simonelli, Chairman and CEO

Our values

Grow

Collaborate

Lead

Care

Energy Forward:
Rethink.
Redefine.
Renew.

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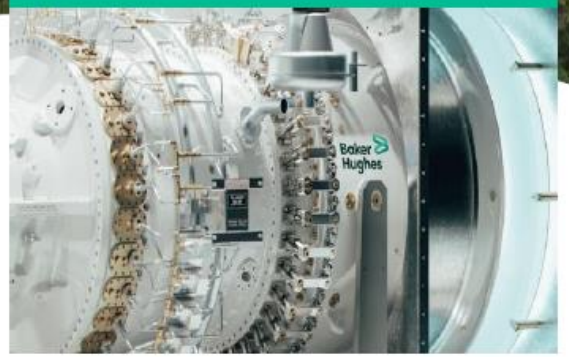
Climate technology solutions

Enabled by growth in digital technology offerings

Carbon Capture Utilization & Storage

- Consultation & feasibility
- CO_2 capture & liquefaction
- Compression & transportation
- Subsurface storage
- Integrity and monitoring

Hydrogen



- Turbomachinery provider across entire value chain
- Hydrogen-fueled gas turbines
- Wide range of hydrogen compression solutions
- Integration capabilities for optimized design and operations

Clean Integrated Power Solutions

- Clean power generation and energy efficient solutions for decentralized and industrial applications
- Digitally augmented low- to no carbon-only portfolio

Emissions Management

- Aerial and land-based emissions monitoring
- Real-time analytics
- Equipment upgrades and operational process efficiency

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End-to-end solutions for management of GHG emissions

Goals

- Comply with regulations
- Meet Net-zero commitments
- Near Zero methane emission intensity
- Eliminate routine flaring
- Zero carbon power
- OGMP 2.0 Gold standard
- Clean LNG & Certified Gas

Understand

Measurement

Venting & Fugitives
- LUMEN Terrain (Ground)
- LUMEN Sky (Drone)
- Other Tech

Flaring
- Flare IQ
- RS UV Flare

Combustion
- PEMS
- InsightPak

Abate

Abatement technology & services

Combustion
- Carbon Optimizer
- Boiler/Heat Ex efficiency
- Waste heat recovery

Flaring
- Flare IQ – Optimization
- Associated Gas Recovery
- Gas Liquid recovery

Venting & Fugitives
- Compressor, purge prevention
- Low emissions valves
- Pipeline workover venting prevention
- Leak repairs

Other Climate Technology Solutions

New technology integration, including:
- Clean Integrated Power
- Hydrogen
- CCUS
- Electrification

Carbon monetization

Control

EM Software – Measurement collection, estimation of the non-measured, consolidated trending of emissions, prioritization of abatement solutions, automated reporting Microsoft

Advisory – Customized roadmap for emissions reduction, planning & execution

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Backup

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Awards and recognition

Awarded a AA ESG rating by MSCI

Awarded a B rating by CDP

2020 Climate Leadership Award for Goal Setting

2021 3BL Media 100 Best Corporate Citizen

Bronze Sustainability Rating by Ecovadis

Eliminate routine flaring—associated gas recovery

Value proposition: eliminate emissions on site, recovery of product

Applications

- Large production plants, petrochemical

Key emission source

- Routine flaring

Key emission media

- CO_2, Methane slip, VOC

Problem

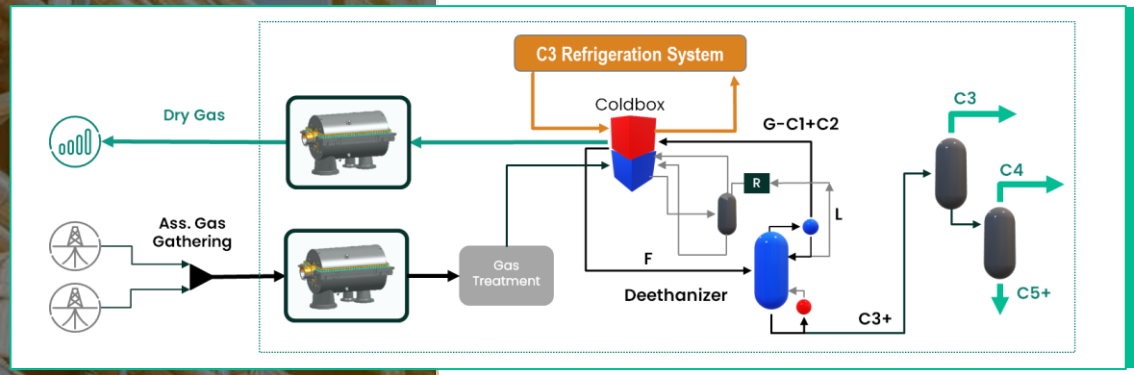
- Lack of take-away economics of associated gas in large production plants leads to routine flaring
- As some world regions have low regulatory pressure, economics need to be very strong to motivate investments in recovery technologies

Solution

- Modular gas recovery, treatment and compression system to eliminate the need of routine flaring
- Custom system design allows multiple product use from associated gas recovery

Value proposition

- Recovers 200 MMSCF/day, that would otherwise be flared. Turned into pipeline gas and liquids (butane, propane, GPL and C5+)
- Reduced carbon footprint
- Reduces reliance on gas imports



Installed base

2 major installations in Nassiriya, Al Gharraf

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