In 2022, PETRONAS completed 44 projects and initiatives mainly covering zero routine flaring and venting reductions, energy efficiency, and electrification categories as follows:

1 Zero Routine Flaring and Venting

PETRONAS had conducted three flare reduction and one vent reduction projects in Upstream Business in Malaysia where 0.18 Million tCO_2e was reduced in 2022. The projects were conducted using technologies that recover the hydrocarbon gas and monetise it.

- Three Flare Reduction: Kinabalu (0.003 Million tCO_2e), Bintulu Integrated Facilities (0.09 Million tCO_2e), Sabah Oil and Gas Terminal (0.05 Million tCO_2e); and
- One Vent Reduction: Dulang (0.04 Million tCO_2e)

2 Energy Efficiency

40 energy efficiency and optimisation efforts throughout PETRONAS have also reduced 0.44 Million tCO_2e in 2022.

- Upstream: Three projects and 0.09 Million tCO_2e
- Gas: 15 projects and 0.19 Million tCO_2e
- Downstream: 22 projects and 0.16 Million tCO_2e

3 Electrification

The intent of electrification is to either increase efficiency or to switch to an electric source with a lower GHG emission factor compared to the existing practice. In 2022, Malaysia LNG Sdn Bhd signed a Power Purchase Agreement with Syarikat SESCO Bhd, a subsidiary of Sarawak Energy, for 90MW of hydroelectric power import to PLC in Bintulu. This will result in about 40 per cent of PLC to be powered by renewable energy and reduce Scope 1 GHG emissions.

4 Carbon Capture and Storage (CCS)

CCS efforts in PETRONAS are driven by the need to develop high carbon dioxide (CO_2) gas fields. PETRONAS has been conducting research and development (R&D) on various capture technologies and patented a single and multi-stage membrane technology for onshore and offshore application in the past years. PETRONAS has also identified potential storage sites in offshore Malaysia. This has become an enabler to the development of CCS projects in PETRONAS.

Upstream business has embarked on a CCS project in the Kasawari gas field in offshore Sarawak to reinject the inherent CO_2 from the gas reservoir into a neighbouring depleted oil and gas field. The CCS facility is expected to be in operation in stages starting from 2024 (Phase 1), with first injection in 2026 (Phase 2).

When operations are in full swing, the Kasawari project can potentially store 3.3 Million tonnes of CO_2 per annum in a depleted reservoir making it the largest offshore CCS project in the world.

In 2022, PETRONAS signed several Memoranda of Understanding (MoUs) on CCS to partner and explore opportunities across the CCS value chain. Moving forward PETRONAS is also looking into building a CCS hub and becoming a leader in the CCS business within the region.

Methane Emissions Management

PETRONAS continues to explore the optimal top-down methane measurement via various MoUs to assess emerging technologies. Among the technologies tested in 2022 were satellite and drone to measure methane emissions from onshore and nearshore facilities. Based on the evaluations, suitable top-down measurement technology will be selected to enable reconciliation with bottom-up measurement and meet OGMP2.0 Gold Standard expectations.

We tested satellite technology to measure methane emissions where the results showed no emissions above the detection threshold of 100kg/hr at PETRONAS sites.

PETRONAS is pursuing another remote sensing technology through strategic collaborations with a local drone service provider to test methane sensors on drones (multi-rotor type) at selected sites i.e. gas transmission assets, refineries and regasification terminals.

PETRONAS also entered into a collaboration to test a technology that enables continuous monitoring of methane emissions from the assets through visualisation as well as measurement capabilities.

Striving Towards GHG Emissions Reduction Targets

As a result of our enhanced emissions accounting practices, which includes a change in organisational boundary, we have adjusted our 2019 baseline reference to 54.87 Million tCO_2e (previously calculated 57.73 Million tCO_2e) via equity share approach.

PETRONAS' short-term GHG emission target is to cap Scope 1 and Scope 2 operational emissions to 49.5 Million tCO_2e by 2024 for PETRONAS operated assets in Malaysia. In 2022, operational emissions in Malaysia amounted to 46.11 Million tCO_2e (2021: 44.12 Million tCO_2e).

In 2022, we achieved 0.6 Million tCO_2e GHG emissions reduction from projects and cumulatively since 2013, we have reduced 18.1 Million tCO_2e of GHG emissions from the implementation of decarbonisation activities for PETRONAS Groupwide assets under operational control.

Safeguard the Environment

The mid-term target for 2030 is to reduce 25 per cent of PETRONAS' Groupwide Scope 1 and Scope 2 GHG emissions under equity share approach, compared to the base year of 2019. To date, the reduction amounts to 8.49 per cent, delivered through projects addressing flaring and venting reduction and energy efficiency.

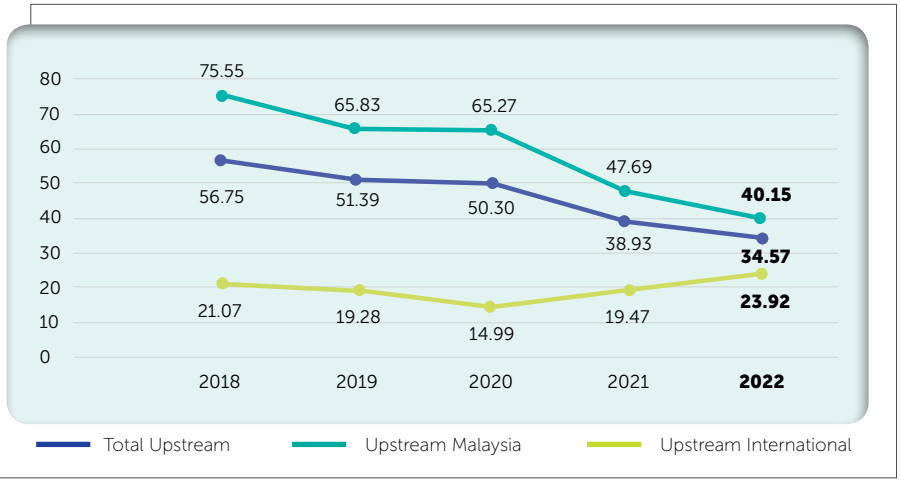
Our short-term methane target is to reduce 50 per cent of methane emissions from our natural gas value chain operations by 2025 compared to 2019. In 2022, we reduced absolute methane emissions by 49.88 per cent from 2019 levels, with Upstream flaring and venting reduction efforts playing a significant role. These efforts included setting flaring and venting targets, operational campaigns, and implementing capital expenditure projects. We plan to further reduce our methane footprint through continued reduction efforts and improved quantification accuracy.

Special Highlights

PETRONAS' commitment to the World Bank's Zero Routine Flaring by 2030 (ZRF) Initiative and UNEP's OGMP2.0 can be presented using the three key metrics below – Upstream GHG intensity, share of methane in total GHG emissions and reduction of hydrocarbon venting.

1 Upstream GHG Intensity Reduction

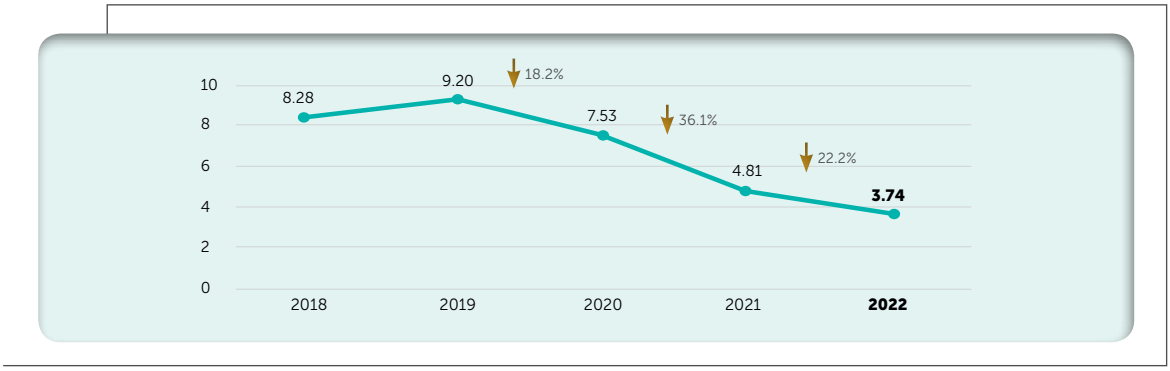
Upstream GHG Emissions Intensity under Operational Control Approach (tCO_2e/kboe)



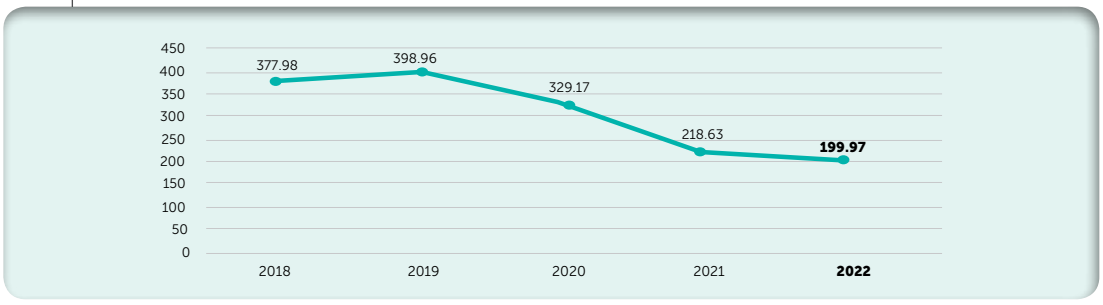
Upstream GHG intensity for total upstream operations has reduced by 32.73 per cent from 2019 driven by zero continuous flaring and venting requirement in PETRONAS Carbon Commitments.

2 Reduction of GHG Emissions Including Methane Through Venting Reduction Efforts

GHG Emissions Reduction from Venting under Operational Control Approach (Million tCO_2e)



Methane Emissions from Natural Gas Value Chain – Upstream and Gas only (thousand tonnes CH_4)



GHG Emissions Breakdown by Gases under Operational Control Approach (%)