

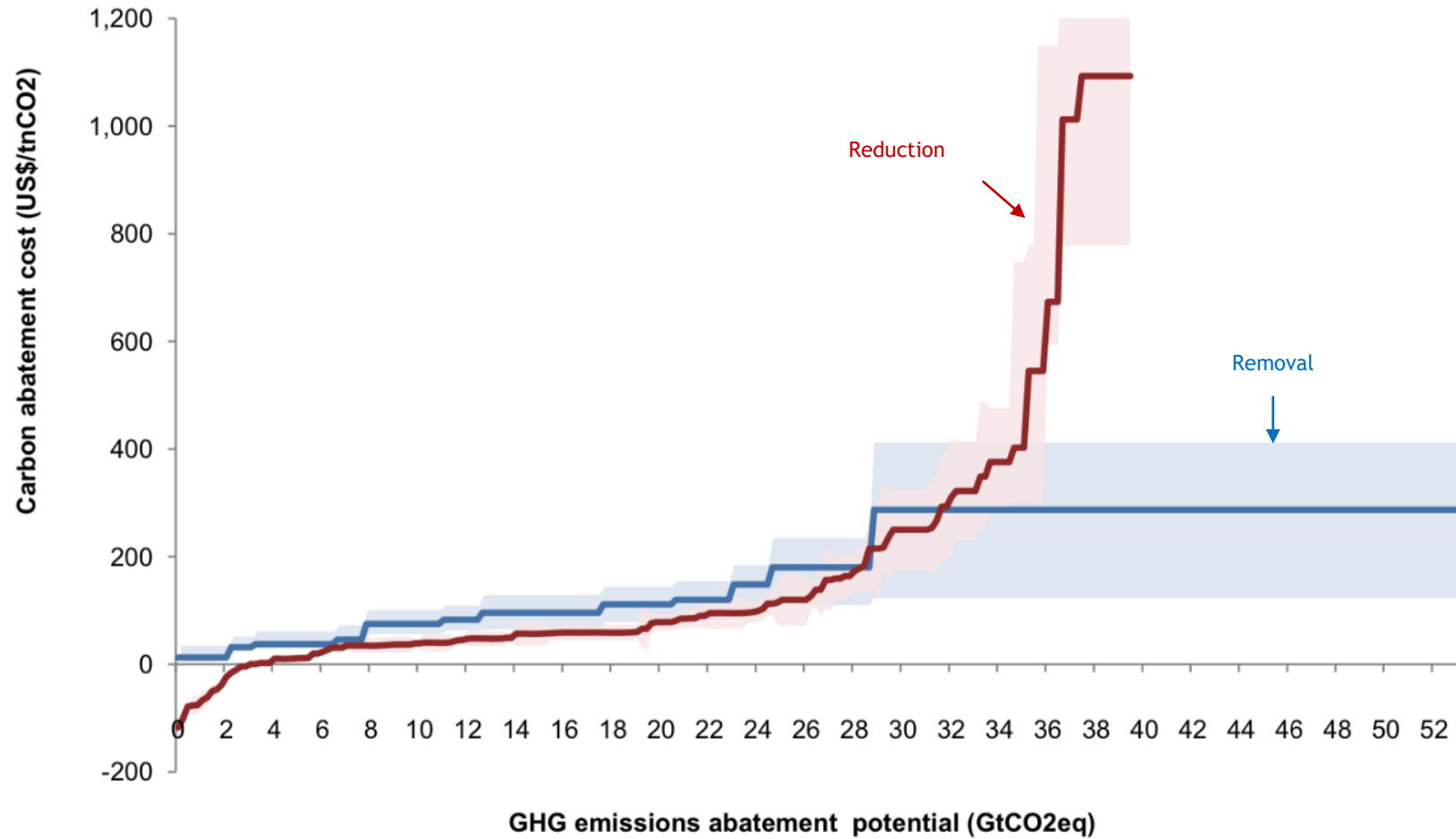
Impact of Global Energy Transition on Oil Producing Countries

Opportunities for Saudi Aramco

Ahmad O. Al Khowaiter
Chief Technology Officer
Saudi Aramco



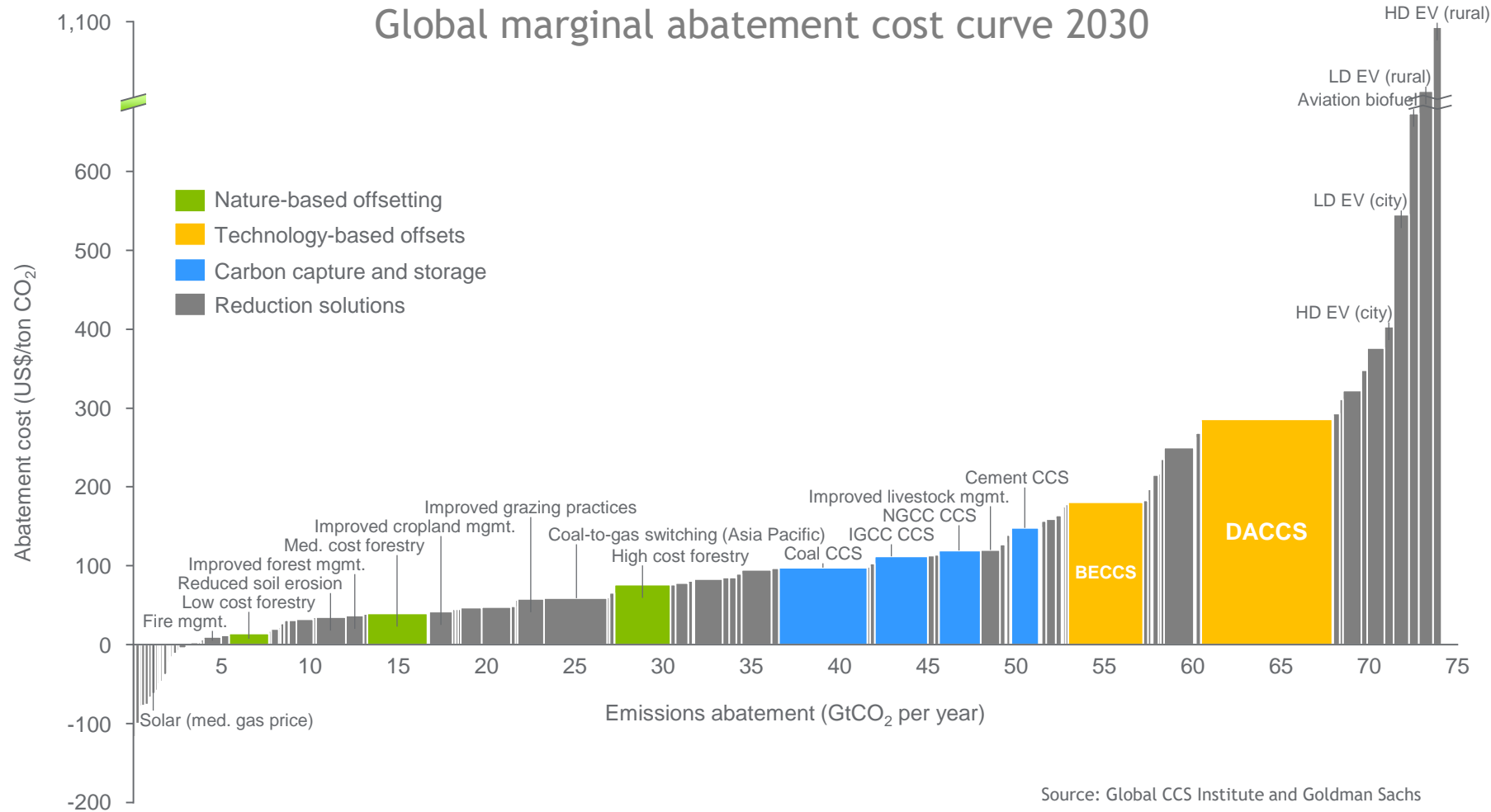
Reduction or removal, or both?



Source: Goldman Sachs



Reduction or removal, or both?

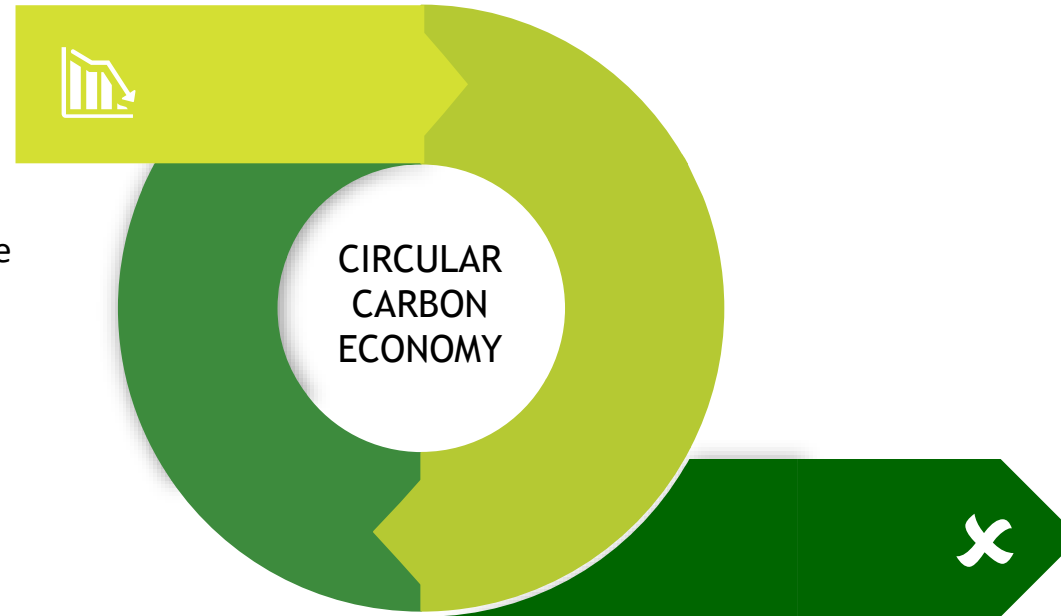


Circular carbon economy - O&G industry

Reduce

Reduce the amount of emissions

- Efficiency improvement
- Minimize flaring and methane emissions
- Renewable integration



Remove

Remove emissions permanently

- Reforestation
- Carbon Capture and Storage (CCS)
- Direct Air Capture (DAC)
- Bioenergy with CO2 storage

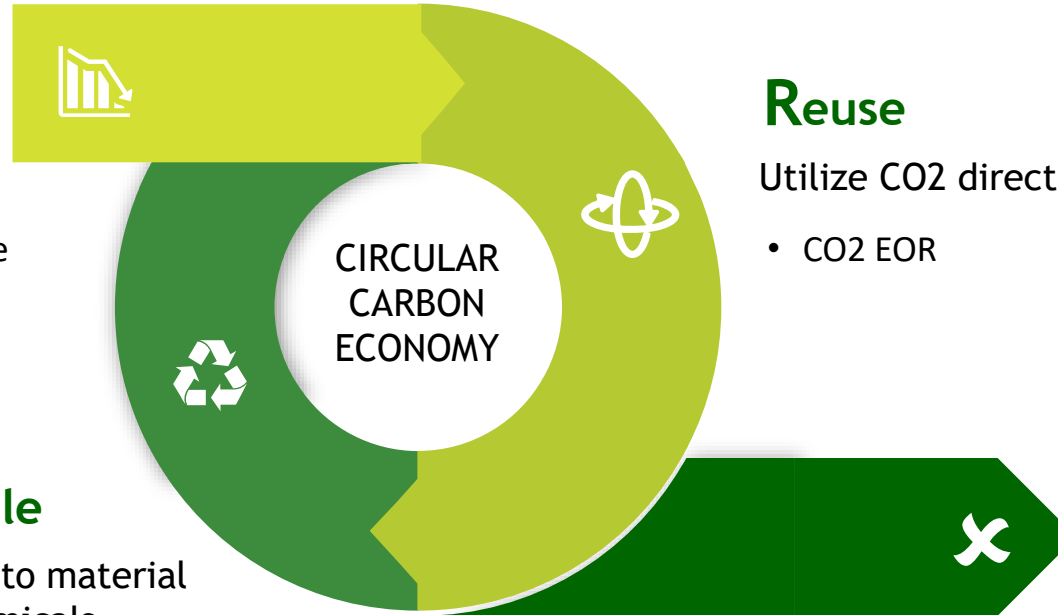


Circular carbon economy - O&G industry

Reduce

Reduce the amount of emissions

- Efficiency improvement
- Minimize flaring and methane emissions
- Renewable integration



Reuse

Utilize CO2 directly

- CO2 EOR

Recycle

Convert to material and chemicals

- CO₂ to chemicals
- e-fuel
- Concrete
- Fertilizers/urea

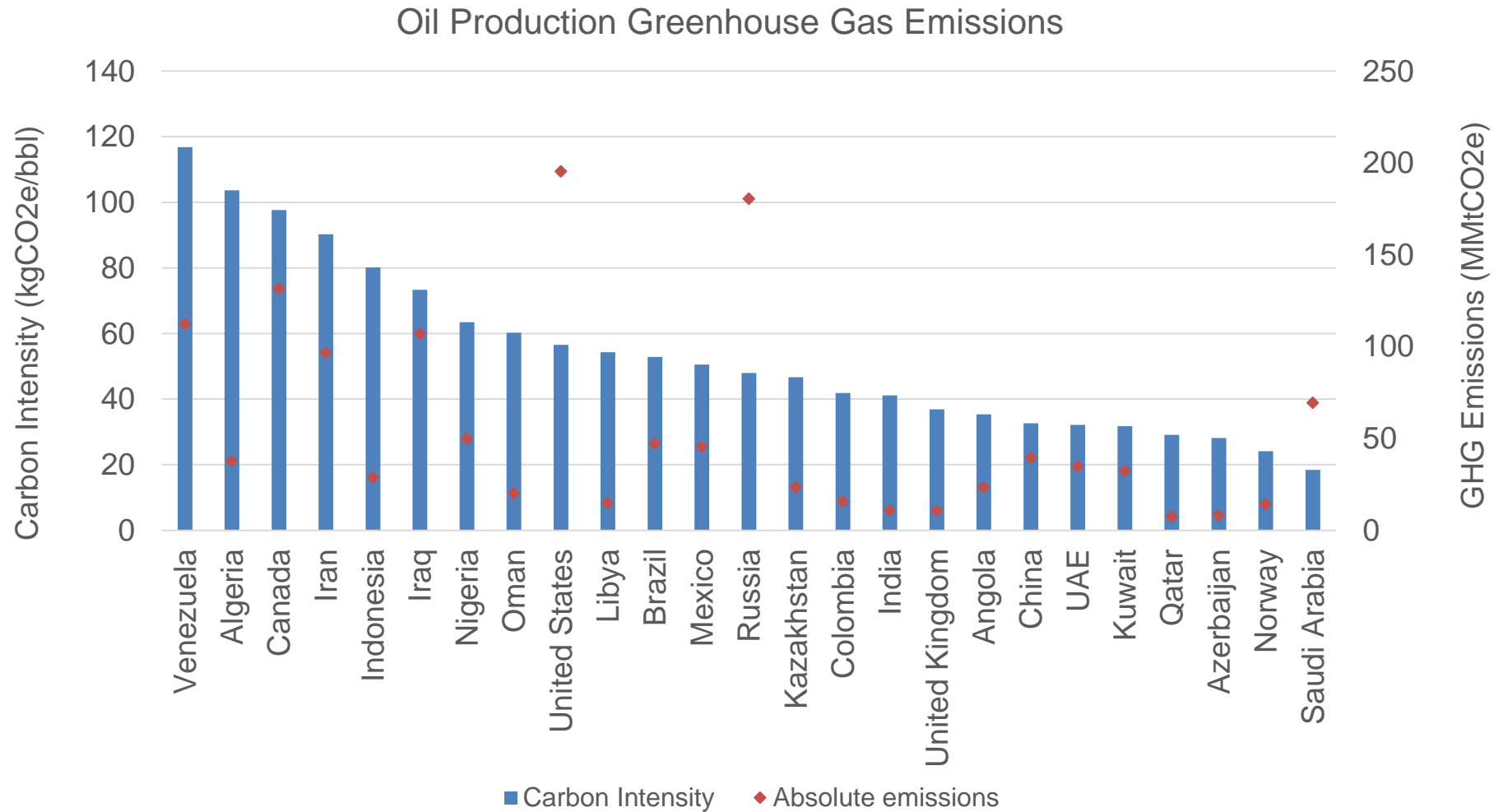
Remove

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Leading in carbon emissions performance

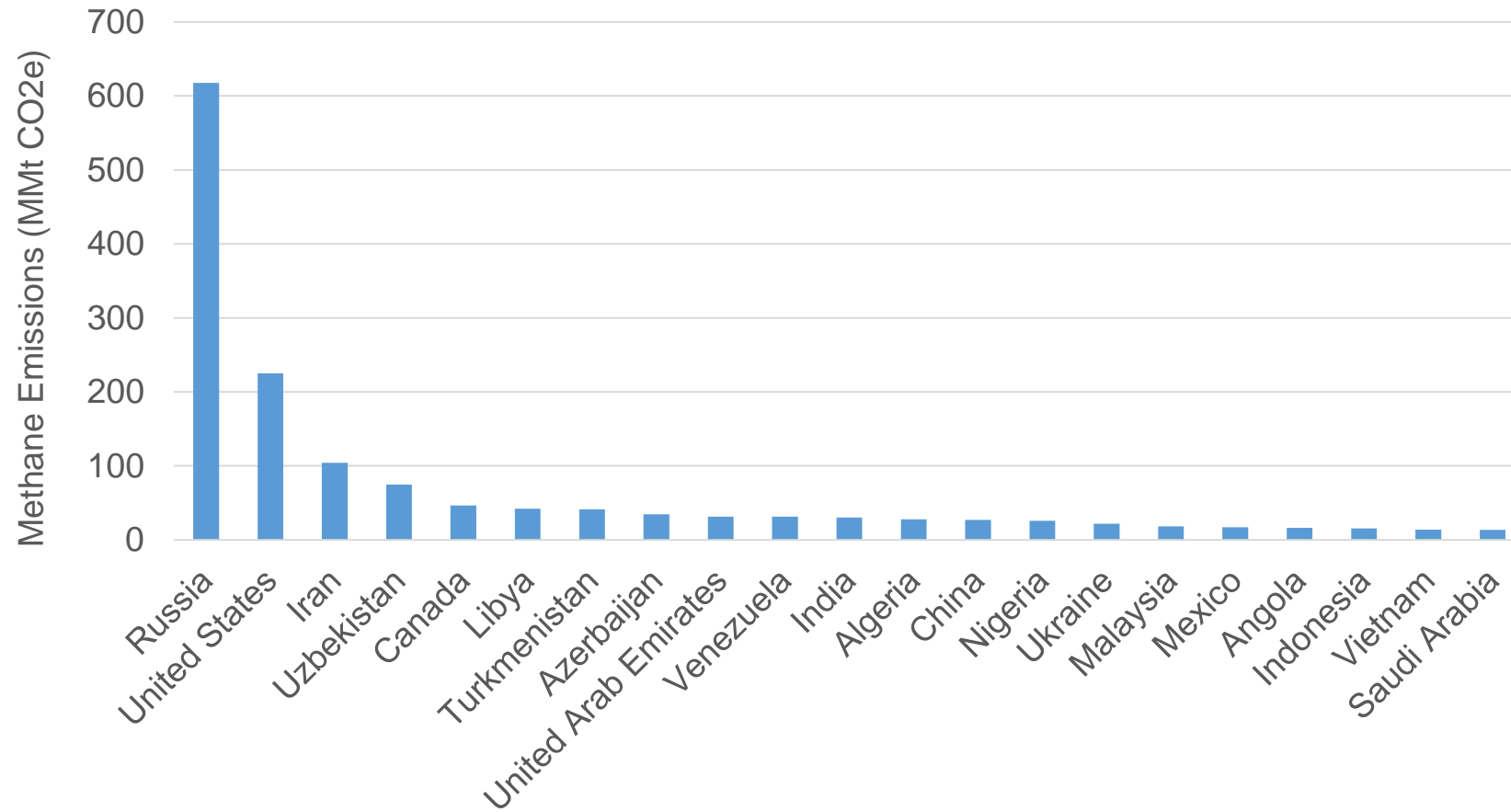


Source: Stanford University OPGEE model



Leading in carbon emissions performance

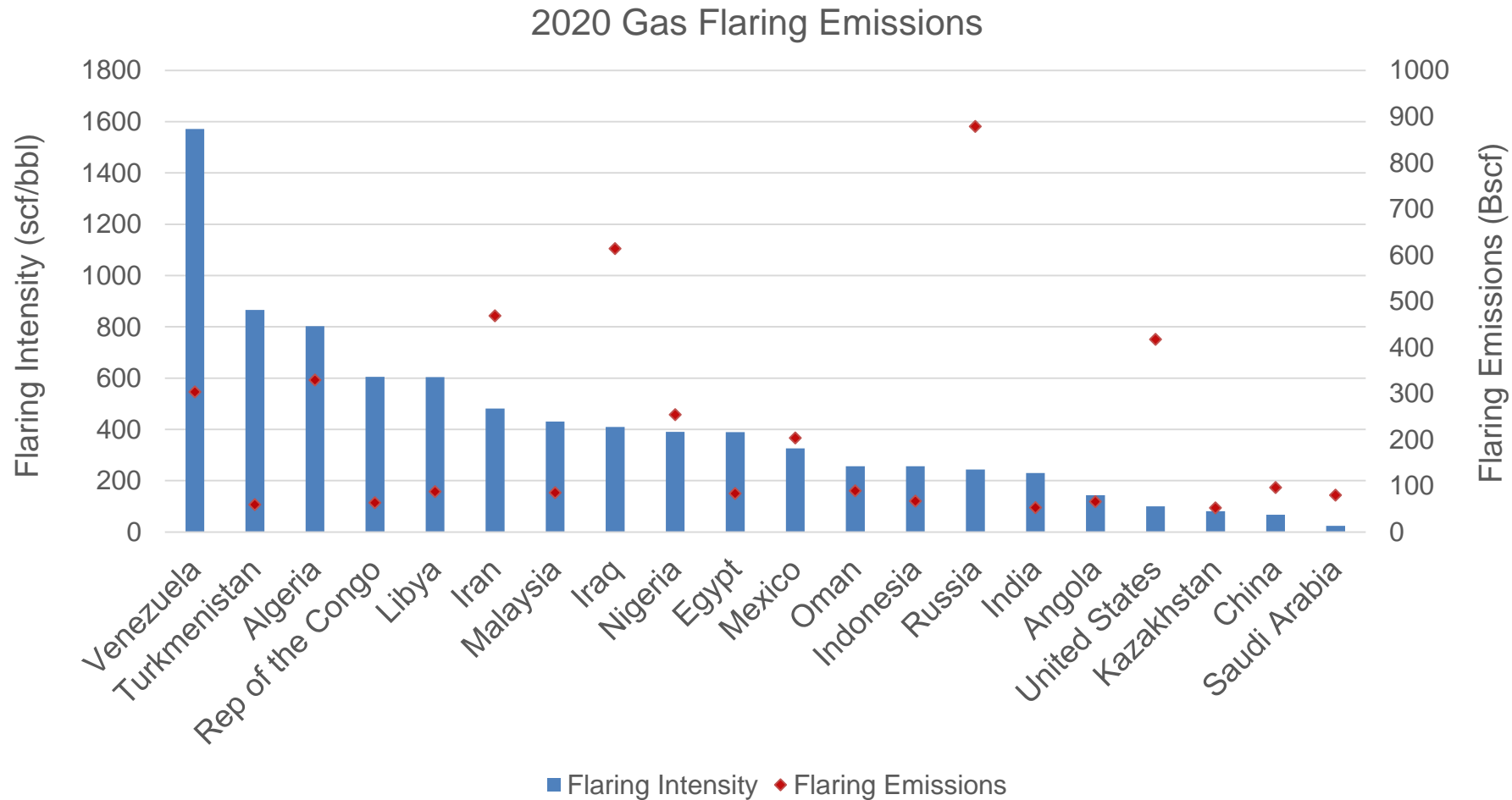
2020 Methane Emissions from Oil & Gas



Source: Global Methane Initiative, GMI



Leading in carbon emissions performance

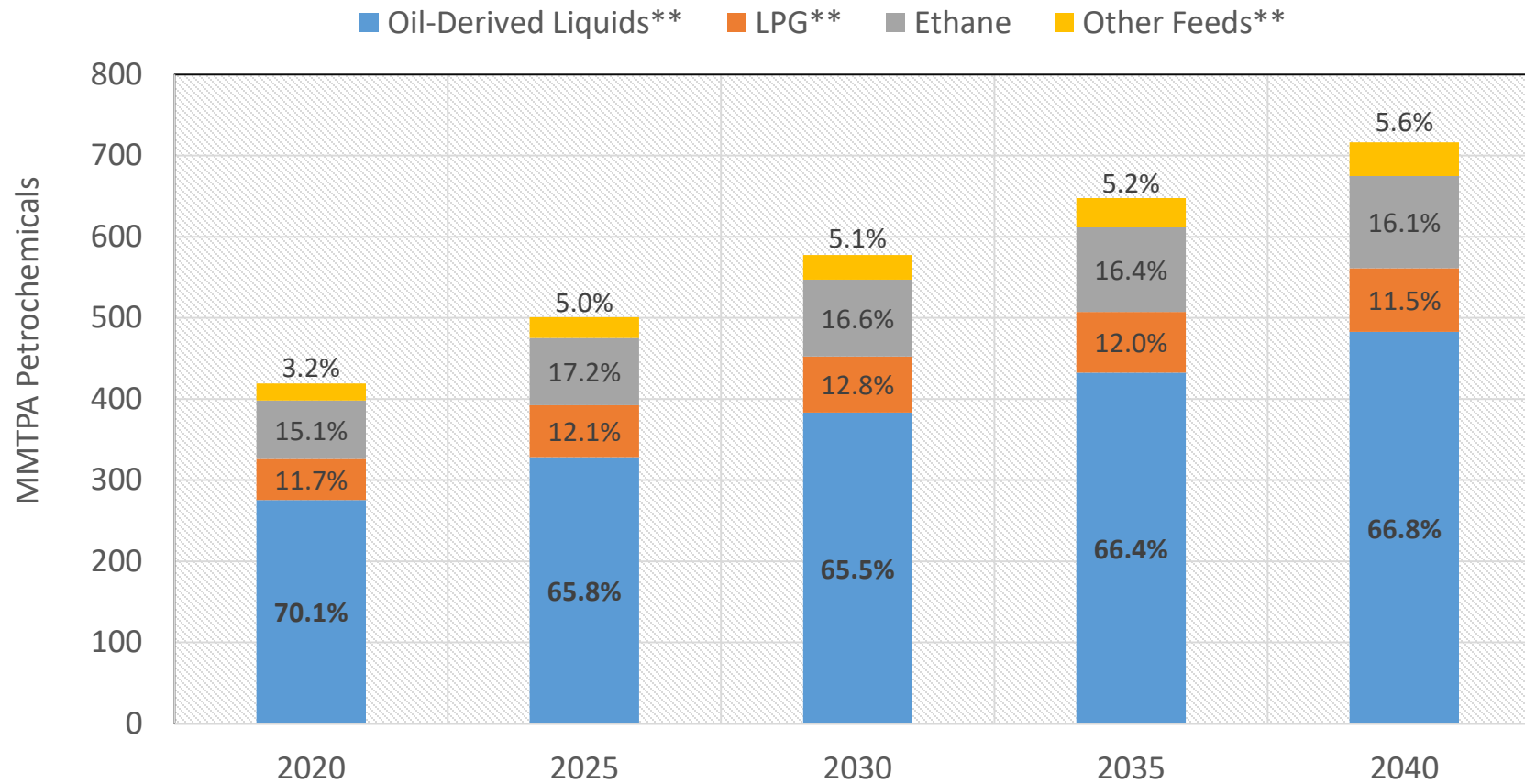


Source: GGFR



Growth in chemicals

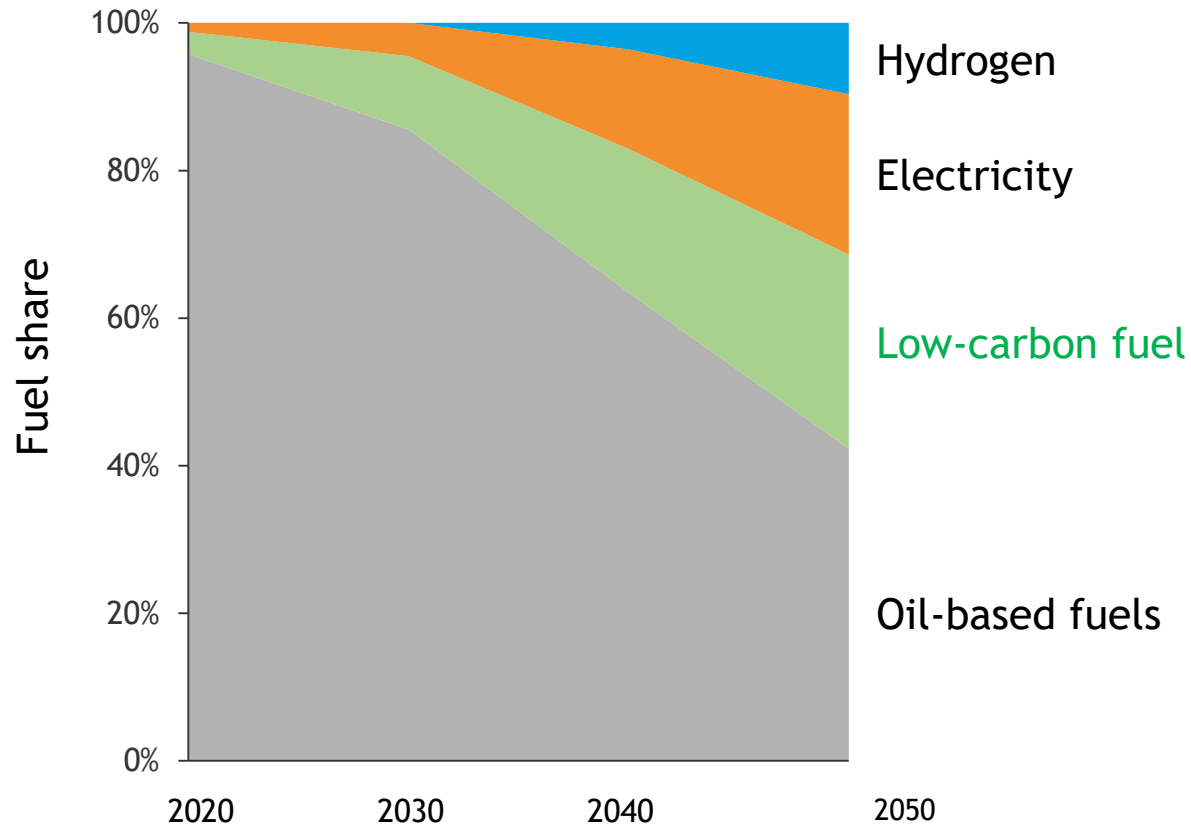
Petrochemical Demand



Source: Aramco Internal, Nexant and IHS Markit, 2020



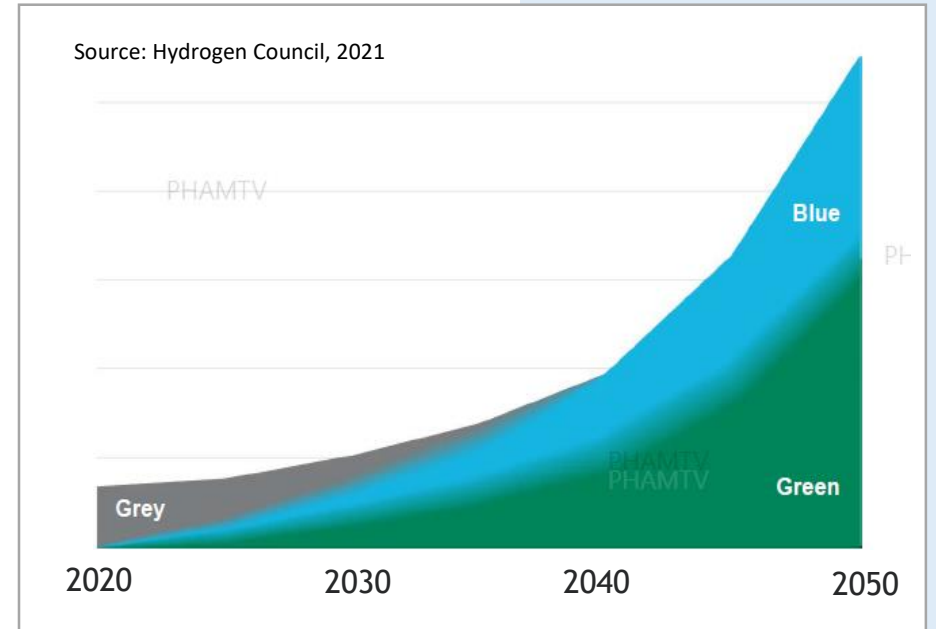
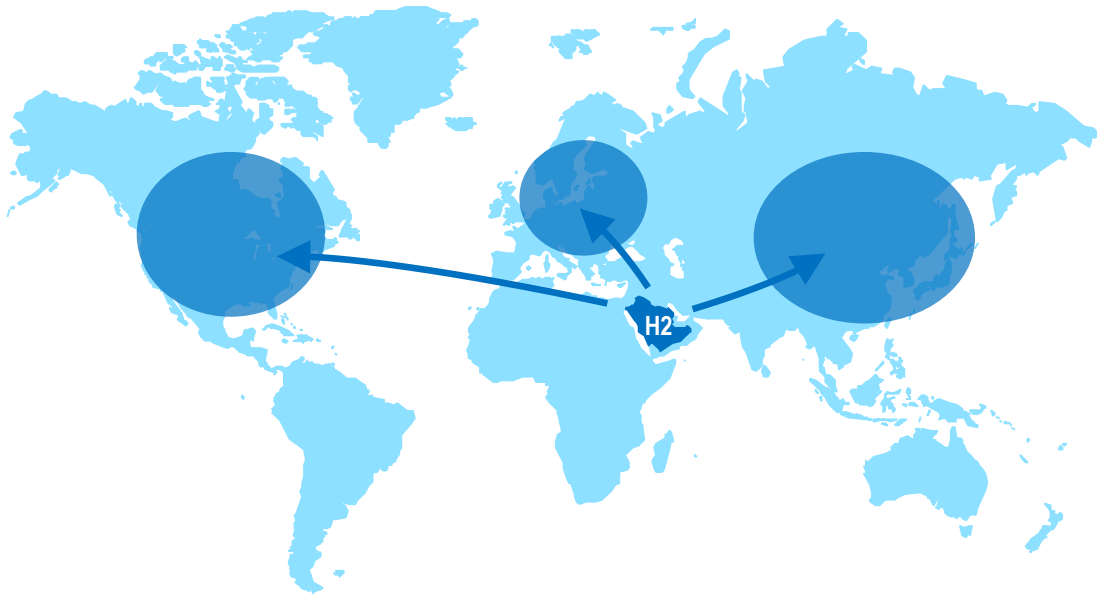
Opportunity in low-carbon fuels



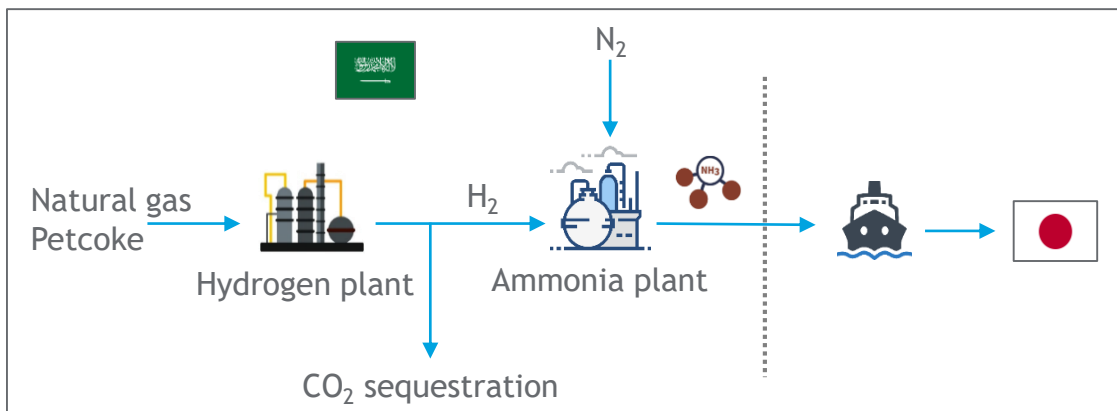
Source: IEA ETP 2020 - Sustainable Development Scenario



Opportunity in hydrogen



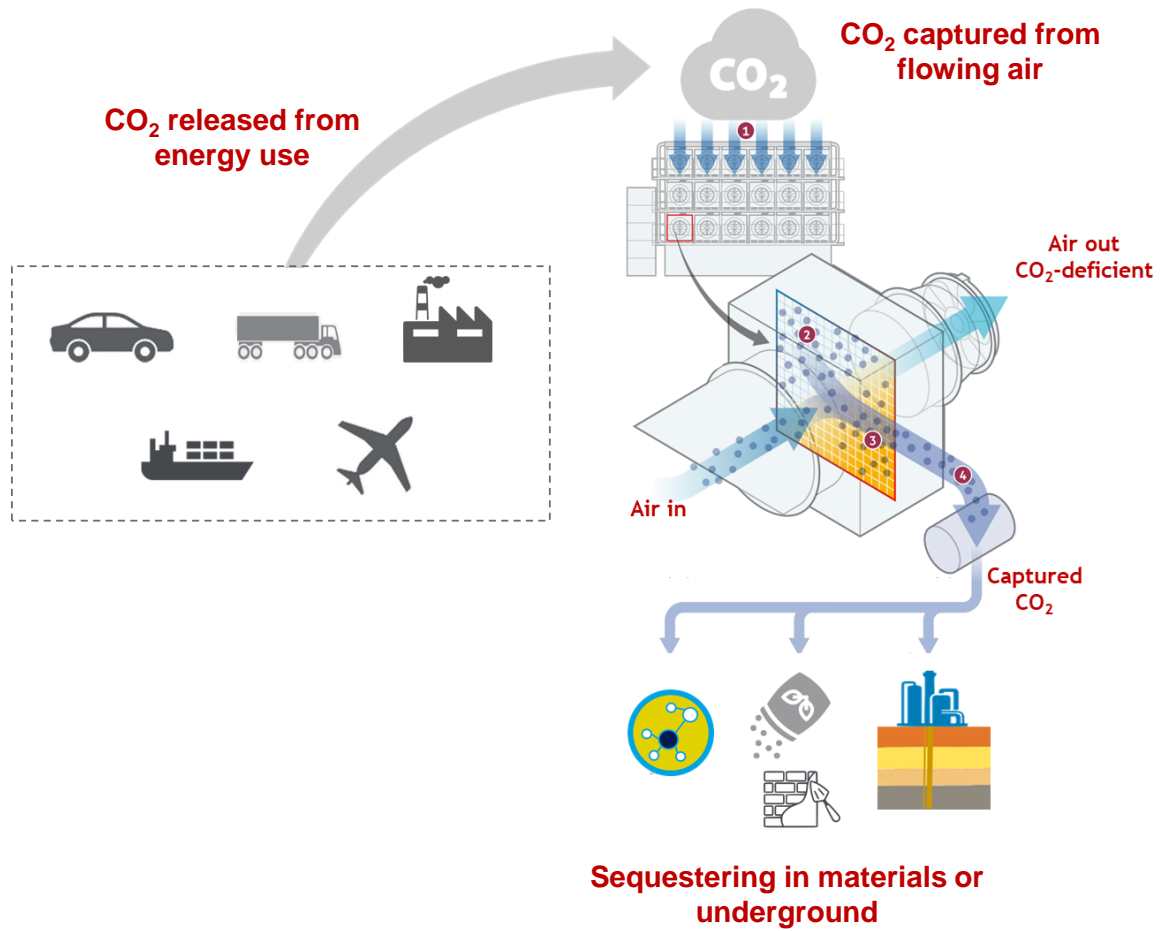
Blue Ammonia Supply Chain for Export



Blue Hydrogen Mobility



Direct air capture technology



Summary

- Circular carbon economy offers an effective framework for O&G industry to meet decarbonization targets.
- Saudi Aramco is leading the industry in carbon emissions performance.
- Many emerging opportunities available for O&G industry in line with the energy transition
- Opportunities for Saudi Aramco include expansion in low-carbon non-fuel applications (materials and chemicals), low-carbon fuels (synthetic fuels, biofuels, and hydrogen).
- Direct air capture is an important technology for net-zero future.

