

KSA's Progress Towards The Energy Transition and The Global Challenges Ahead

14th IEA-IEF-OPEC Symposium on Energy Outlooks
21 February 2024, Riyadh, Saudi Arabia

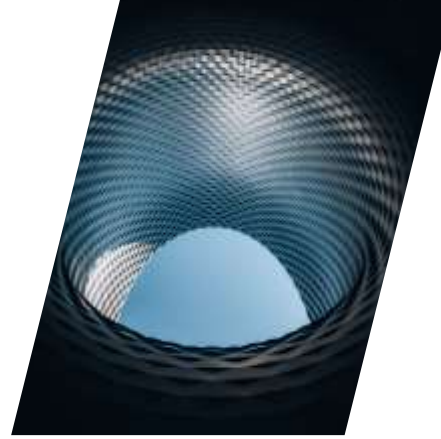
Saudi Arabia's energy transition has been proactive, holistic and inclusive since 2019



Saudi Arabia started its energy transition willingly and voluntarily many years ago



We are undertaking a holistic and inclusive energy transition, investing in all solutions



In 2019, we adopted the Circular Carbon Economy approach



Then, we launched the Saudi Green Initiative and the Middle East Green Initiative in 2021



**Energy in transition:
The journey of Saudi Arabia
World Energy Council 2019**

FUTURE INVESTMENT INITIATIVE

Powered by the Public Investment Fund

WHAT'S NEXT FOR THE ENERGY SECTOR?

A SPECIAL SUMMIT ON INNOVATION IN ENERGY

أهو مستقبل قطاع الطاقة؟

أهو مستقبل قطاع الطاقة؟ قمة
حول الابتكار في مجال الطاقة



FUTURE INVESTMENT INITIATIVE
Powered by the Public Investment Fund

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Future Investment Initiative 2019 Circular Carbon Economy Announcement



KSA Energy Transition

CIRCULAR
CARBON
ECONOMY

REMOVE

World Petroleum
Congress 2021

رحلة الانتقال الأخضر للمملكة العربية السعودية
KSA Green Transition Journey

2030

Powered by
Hydrogen

**Jeddah Security and
Development Summit 2022**

KSA Energy Transition

KINGDOM



COP27 2022



Energy Transition

وزارة الطاقة
MINISTRY OF ENERGY



Energy Transition

World Petroleum
Congress 2023

WE ARE COMMITTED

ROUGH 2030,

ABIA
TED
ING
GY
D
NMENTAL
LENGES

Energy Transition

WE ARE ACTING

2060
NET ZERO

2030

50% RENEW
ENERGY M

LEAD
CLEAN HI
PROD
AND EX

30%
OF THE KING

LAND AND
AS PROTEC
AREA

50%
of total energy
consumption

30%

2030

MENA Climate
Week 2023

Saudi's transition in Energy

تحويل الطاقة في السعودية

CIRCULAR CARBON ECONOMY

INITIATIVE

Energy Mix (Renewable Energy)

Flow Battery

COP28 2023

المملكة العربية السعودية
Kingdom of Saudi Arabia

Saudi Arabia's Energy in Transition Journey

Saudi Green Initiative

مبادرة السعودية الخضراء

Saudi Green
Initiative 2023

To lead the energy sector through the development of robust policies, efficient programs, and achievable plans in the pursuit of sustainable growth, energy endowment, value maximization and leadership in new energy vectors towards the preservation of wealth for future generations

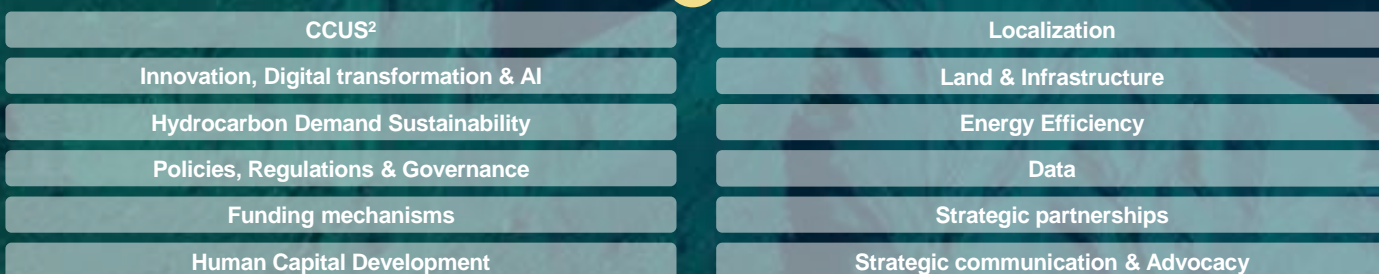
"Our Focus"

- Preeminence in energy markets
- Security & Reliability of Supply
- Emissions Management
- Local content
- Efficiency & economic development
- Fiscal optimization

"Claim and retain leadership"



"Build for the future"

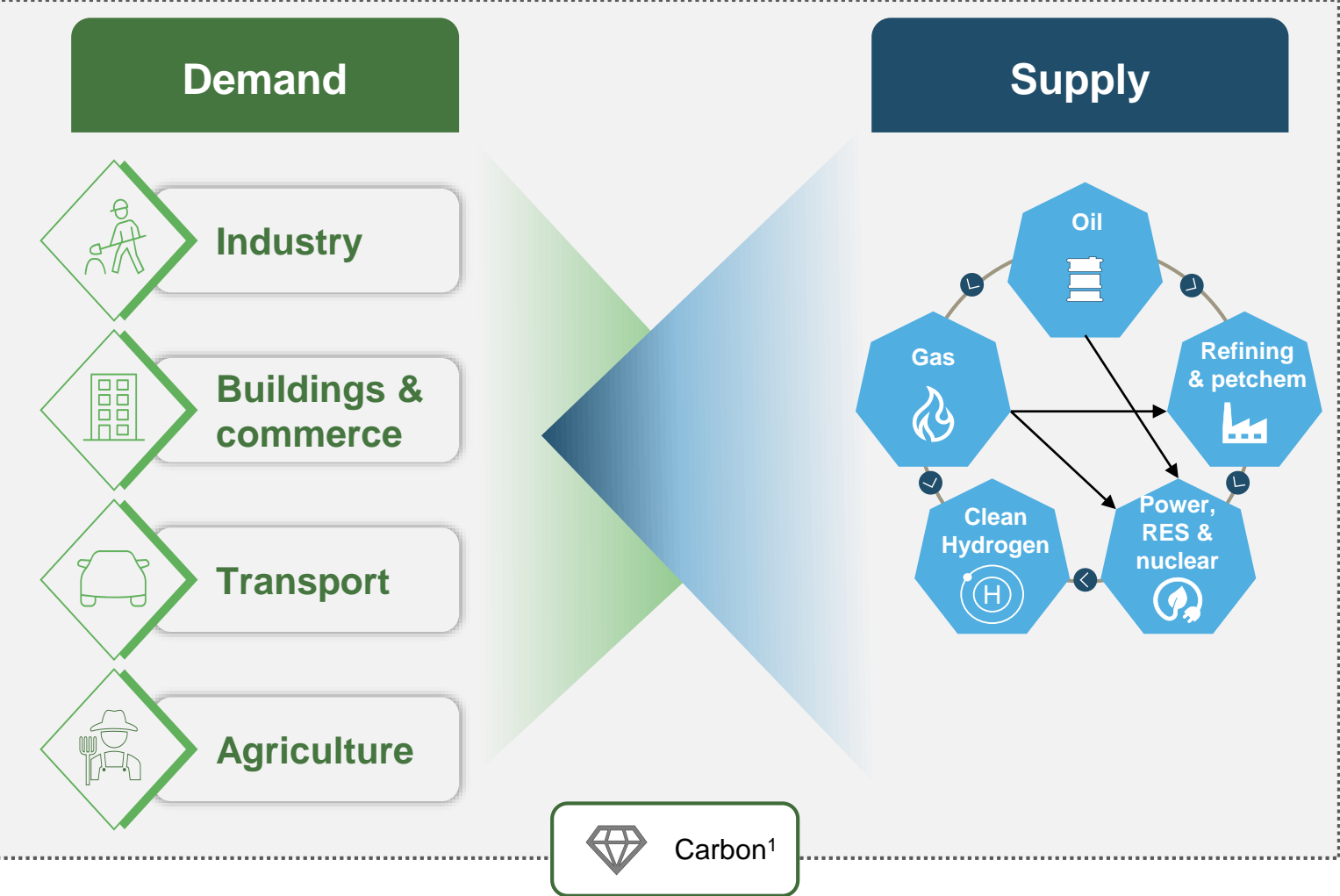


"The engine room"



1. Nuclear post-2030; 2. Carbon Capture Utilization and Storage; utilization includes reuse and recycle of carbon; 3. Small and Medium Enterprises

Saudi Arabia adopted an integrated approach to navigate the energy sector's complexities



Why integration?



Interconnectivity



Interchangeability



Interdependency



Integration will enable the Kingdom to ensure energy security, maintain energy affordability, and target energy sustainability

Notes: [1] Covering carbon management and scale-up of the 4Rs of the CCE framework application across both demand and supply sources to enable transition to net-zero

KSA adopted the Circular Carbon Economy as a wholistic and pragmatic pathway to net zero

1

Reduce

Liquid Displacement

Renewable Energy production & export

Combined-cycle gas plant with carbon capture readiness

Energy Efficiency Program

Clean and green hydrogen production & export

2

Reuse

Enhanced Oil Recovery (EOR)

CO2 for food and beverages

3

Recycle

Carbon Capture & Utilization

- Glycol and Urea
- Synthetic Aviation Fuel
- Green methanol

Carbon cured concrete

4

Remove

Carbon Capture & Storage (CCS) Hub in Jubail

Nature-Based Solutions

Saudi Arabia is making tangible progress in the energy transition

Energy Efficiency

SEEP program started in 2012, resulted in savings **492,000 BOE/Day**

Liquid displacement

~1 million barrels of oil equivalent of liquid displacement by 2030

CCS

Capture and store **44 million tons of CO₂** Annually by 2035

CCU

Capture and utilize **2 million tons per year of CO₂** to produce glycol, urea, green methanol and clean fuels

Renewable energy

50% of electricity generation capacity to be from renewable energy by 2030

Clean Hydrogen and low-emissions fuels

150,000 tons of clean ammonia shipped globally

Largest **Green H₂** project in NEOM

1.5 mtpa CO₂ utilized to produce clean fuels

Nature-Based Solutions

600 million trees to be planted by 2030 and a goal of planting **10 billion trees**

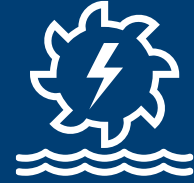
We remain a responsible hydrocarbon producer, and we are growing our renewable energy capacity



Second-lowest methane intensity among major oil and gas producers



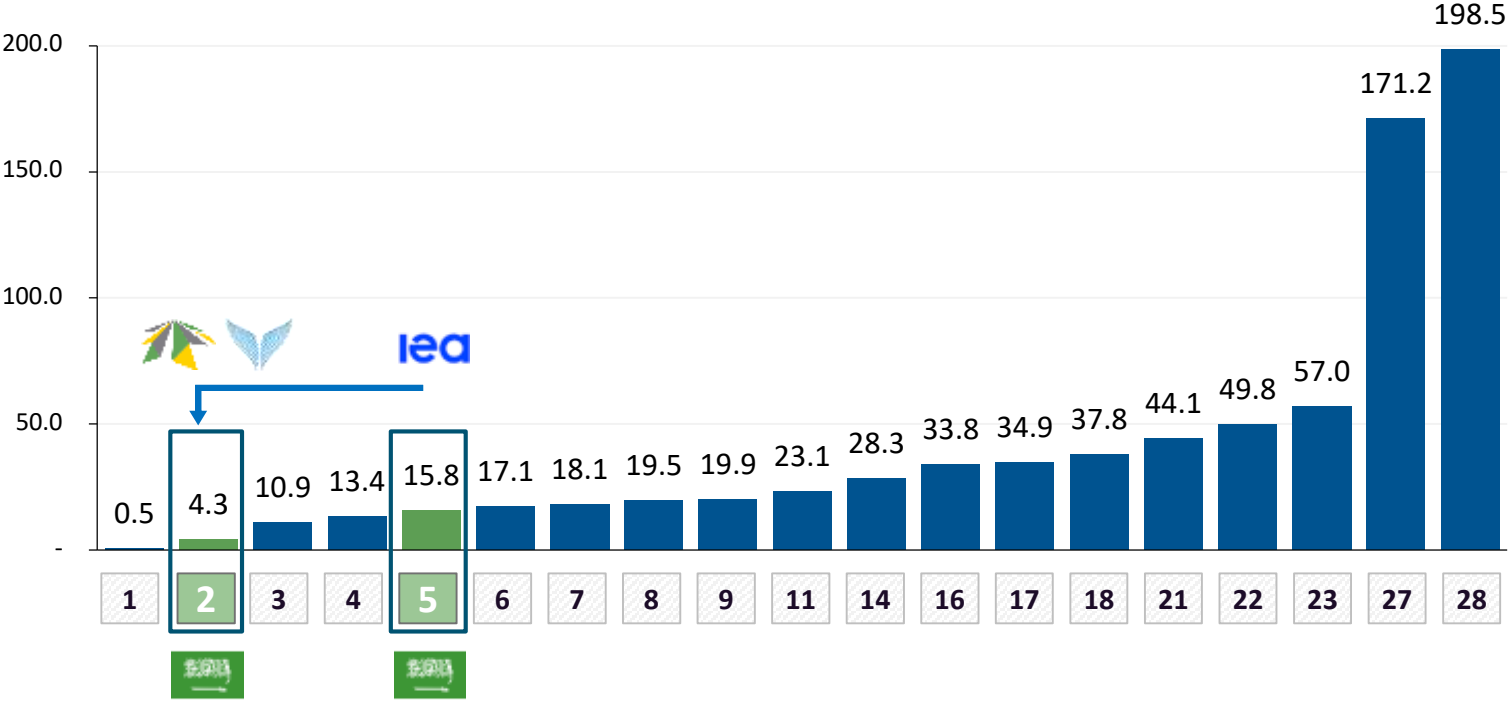
Second-lowest in the world in terms of crude oil carbon intensity



Tendering 20 GW of renewable capacity annually from 2024

Saudi Arabia has the 2nd lowest methane intensity, and is committed to further reducing methane emissions from oil and gas

Saudi Arabia methane intensity ranking improvement by using satellite measurements ^[1] (kgCO₂ eq/ boe)



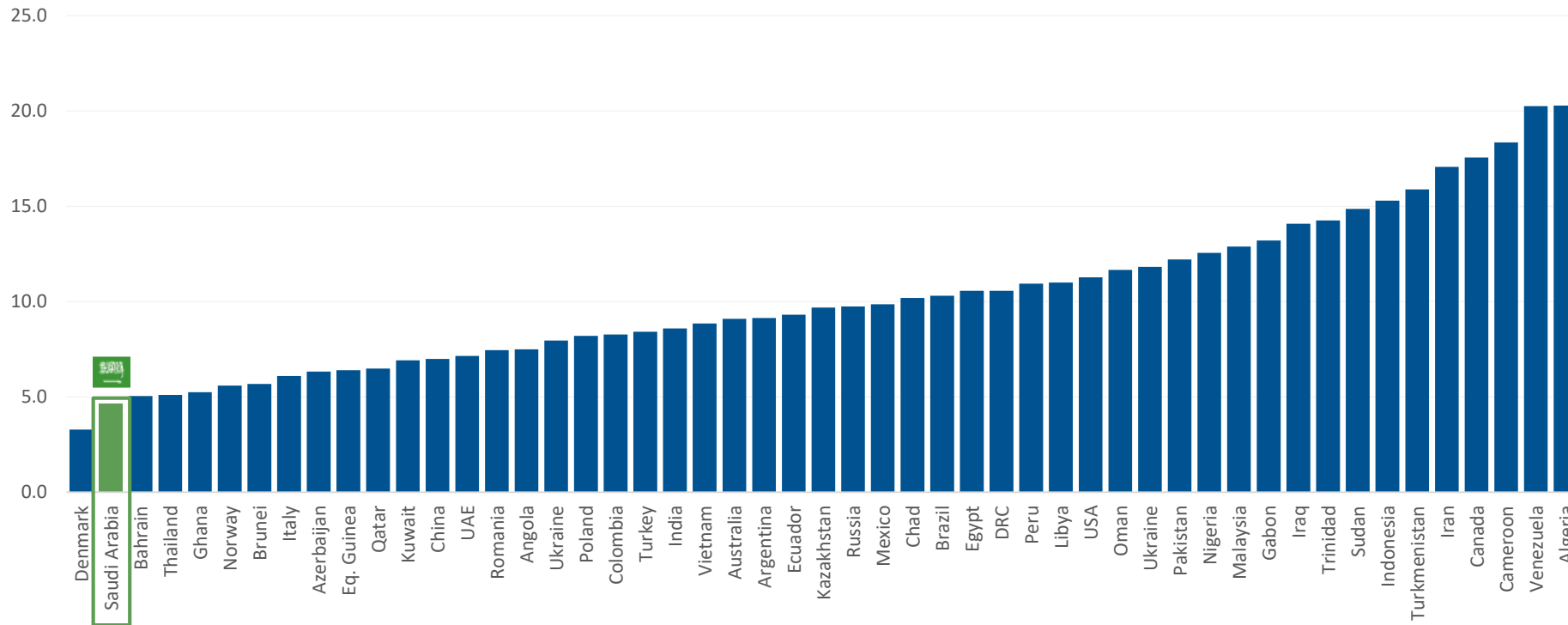
Based on a **KAPSARC study using Kayrros** satellite emission measurement, **KSA methane intensity is 73% lower than the value reported by the IEA**

As a result, **Saudi Arabia has the 2nd lowest methane intensity** among the major oil and gas producing countries ^[2]

[1] Nations with >1M boepd production; [2] KAPSARC study based on Kayrros data on satellite emissions. Sources: Intensities from IEA's 2022 methane emissions & Rystad's 2022 data 17

Additionally, the carbon intensity of a barrel produced from KSA is among the lowest in the world

Selection of Average Crude Upstream Carbon Intensities
(g CO₂eq/MJ) ^[1]

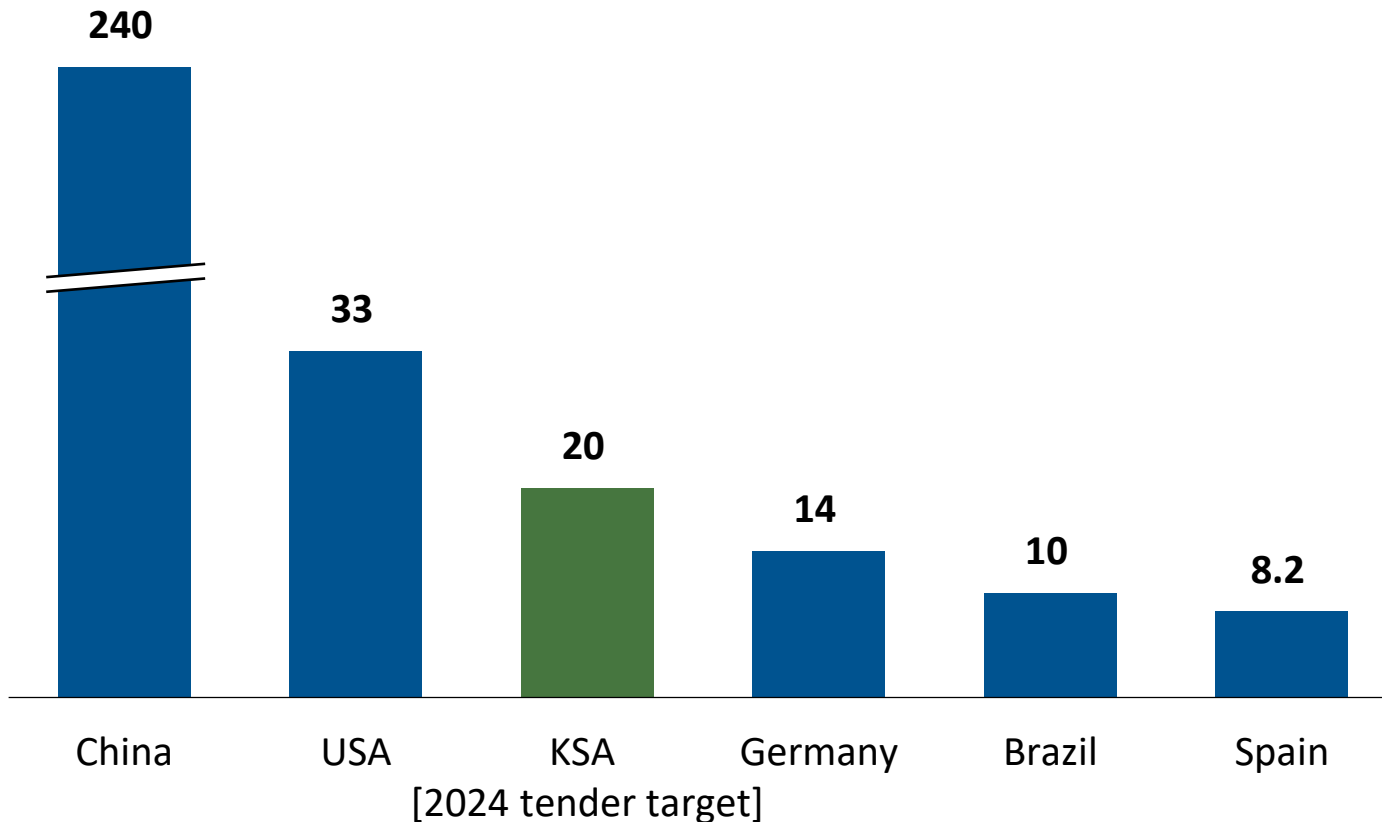


Saudi Arabia has the **second-lowest carbon intensity** among major crude oil producers

KSA joined the **Net Zero Producers Forum** together with **Canada, Norway, Qatar, UAE, and USA**

The Kingdom aims to tender 20 GW of renewable capacity in 2024, a target that has only been surpassed by China and the USA

Ranking of leading countries' annual renewable capacity additions in 2023 ^[1] compared with the Kingdom's tendering target for 2024 [GW]



Over **23.7 GW** of renewable capacity are at different stages of development, of which **2.8 GW are already operational**

Starting in 2024, the Kingdom plans to **tender 20 GW of renewable capacity annually**

Saudi Arabia's implementation of a domestic market mechanism The GHG Crediting & Offsetting Mechanism (GCOM)



Robust



Holistic



Transparent



Inclusive



Project-level
accounting



Achieve our
NDCs



Pave the way to
net-zero by 2060

Paragraph 28 = A La Carte Menu

28. Further recognizes the need for deep, rapid and sustained **reductions in greenhouse gas emissions** in line with 1.5 °C pathways and **calls on Parties to contribute** to the following global efforts, **in a nationally determined manner**, taking into account the **Paris Agreement** and their **different national circumstances, pathways and approaches**:

- ✓ (a) **Tripling renewable energy** capacity globally and **doubling** the global average annual rate of **energy efficiency** improvements by 2030
- ✓ (b) Accelerating efforts towards the **phase-down of unabated coal power**
- ✓ (c) Accelerating efforts globally towards **net zero emission energy systems**, utilizing **zero- and low-carbon fuels** well before or **by around mid-century**
- ✓ (d) **Transitioning away from fossil fuels in energy systems**, in a **just, orderly and equitable** manner, accelerating action in this critical decade, **so as to achieve net zero** by 2050 in keeping with the science
- ✓ (e) Accelerating **zero- and low-emission technologies**, including, inter alia, **renewables, nuclear, abatement and removal technologies** such as **carbon capture and utilization and storage**, particularly in hard-to-abate sectors, and **low-carbon hydrogen production**
- ✓ (f) Accelerating and substantially reducing non-carbon-dioxide emissions globally, including in particular **methane emissions** by 2030
- ✓ (g) Accelerating the reduction of emissions from **road transport on a range of pathways**, including through development of infrastructure and rapid deployment of **zero-and low-emission vehicles**
- ✓ (h) **Phasing out inefficient fossil fuel subsidies** that do not address **energy poverty or just transitions**, as soon as possible

The world has made progress towards climate change mitigation and adaptation since the Paris agreement in 2015...



In 2023, clean energy investments surpassed **\$1.8 trillion**^[1] and the **Loss and Damage fund** was established^[2]



Global renewable capacity additions increased from approximately 150 GW in 2015 to nearly **510 GW** in 2023, the **fastest growth rate** in the past two decades^[3]



Since 2015, more than **300 million people** have gained access to **electricity** and over **700 million to clean cooking** fuels^[4]

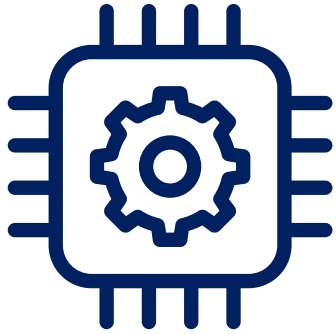


COP28 came to a historic agreement for deep, rapid and sustained reduction in GHG emissions in a nationally determined manner **through 8 global efforts**

Thanks to the collective progress on climate action, the worst-case scenario for temperature rise (4°C) has been avoided
...however, there is still work ahead of us

Achieving the global energy transition requires overcoming major challenges

Upscaling Deployment



Mobilizing Investments and Financing

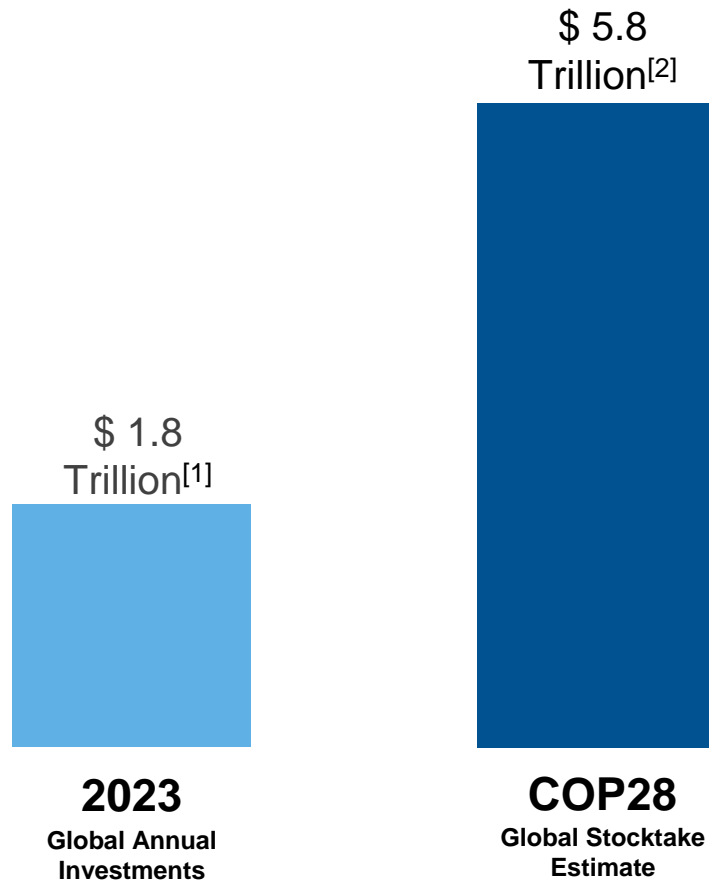


Addressing Equity and Justice

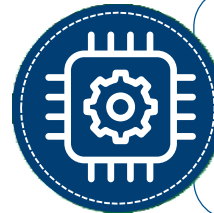


The energy transition will require annual investments of nearly \$6 Trillion

Latest global investment levels vs. estimates of required annualized energy investments



The required annual investments amount to **7.5% of the world's entire GDP**



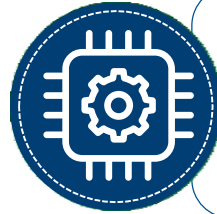
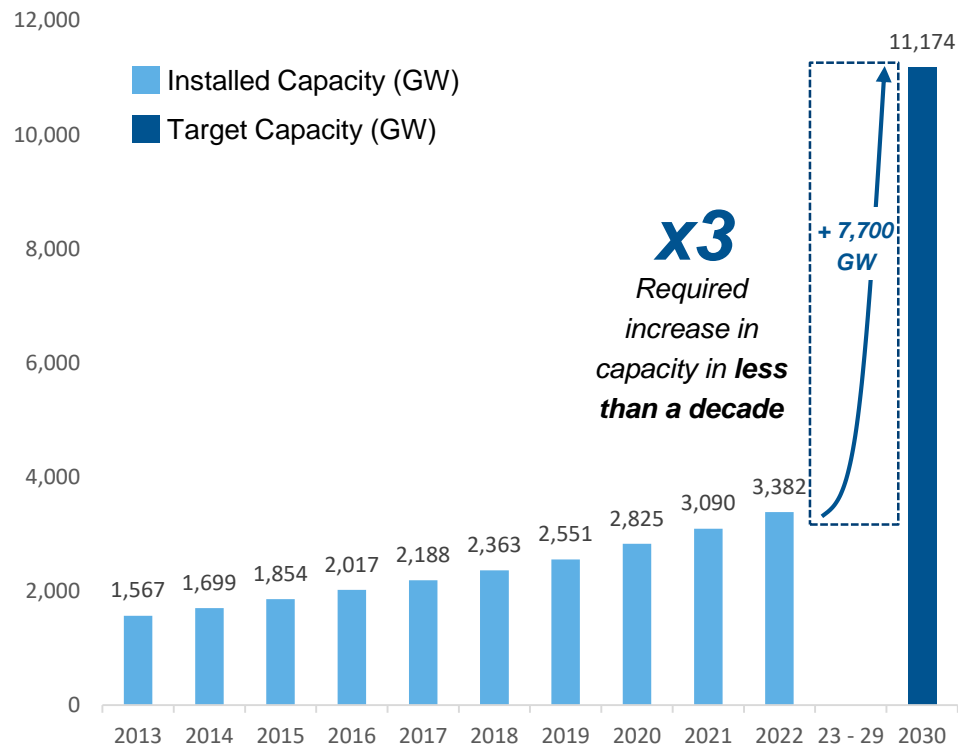
International **financial systems** must evolve to facilitate the growth needed from public & private funding



The **gaps in transition financing** represent a major barrier to **developing nations** in pursuing their net-zero ambitions

Although renewables grew at a record rate, more effort is required to triple renewable capacity in less than a decade

Installed renewable capacity and 2030 target^[1]



Permitting constraints are anticipated to delay annual global **offshore wind** construction by roughly **30%** this decade^[2]



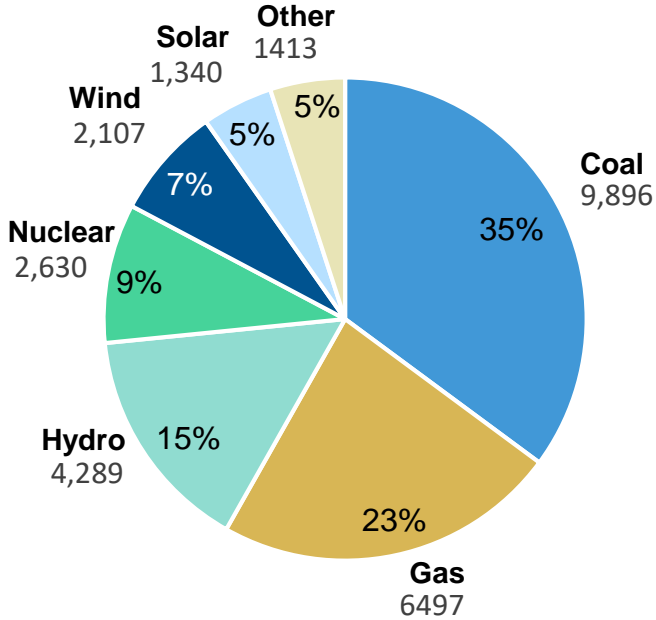
To **triple** by 2030, **\$8 Trillion**^[3] is required for the new installed capacity and **\$3.6 Trillion**^[4] for grid expansion



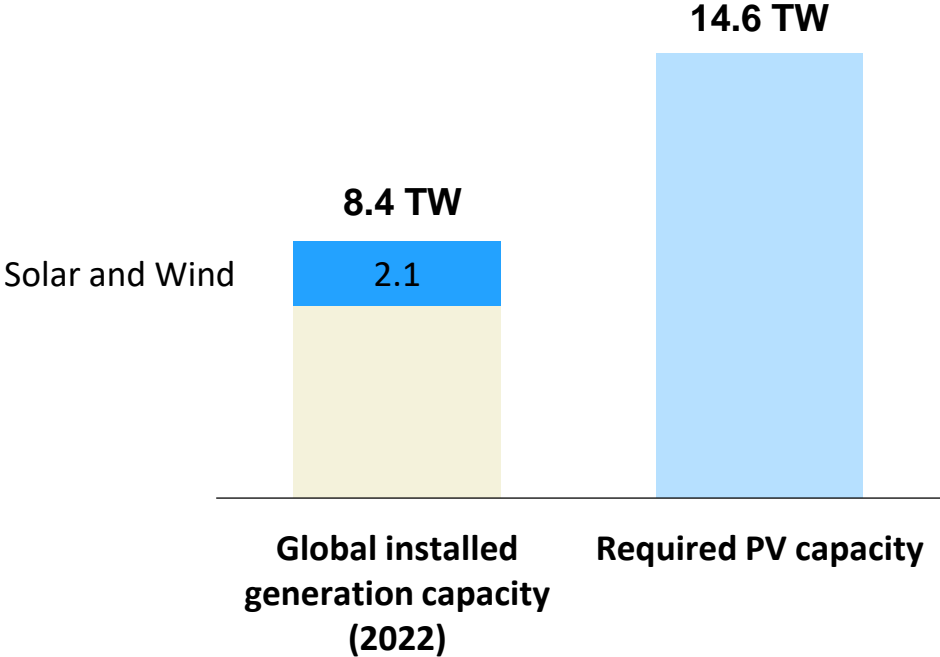
Most capacity additions will be in **developing nations** which lack **infrastructure** and **grid capacity** to integrate renewables

Replacing fossil fuels in the global electricity mix requires more solar PV than all the existing generation capacity

Global electricity mix in 2022 [TWh]^[1]



Generation capacity required from a single source to replace 17,060 TWh of fossil fuel demand [TW]^[2]
 Not considering storage, economical, and geopolitical challenges



~ \$4 Trillion for storage

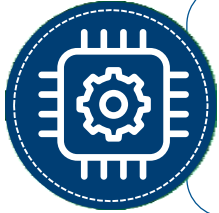
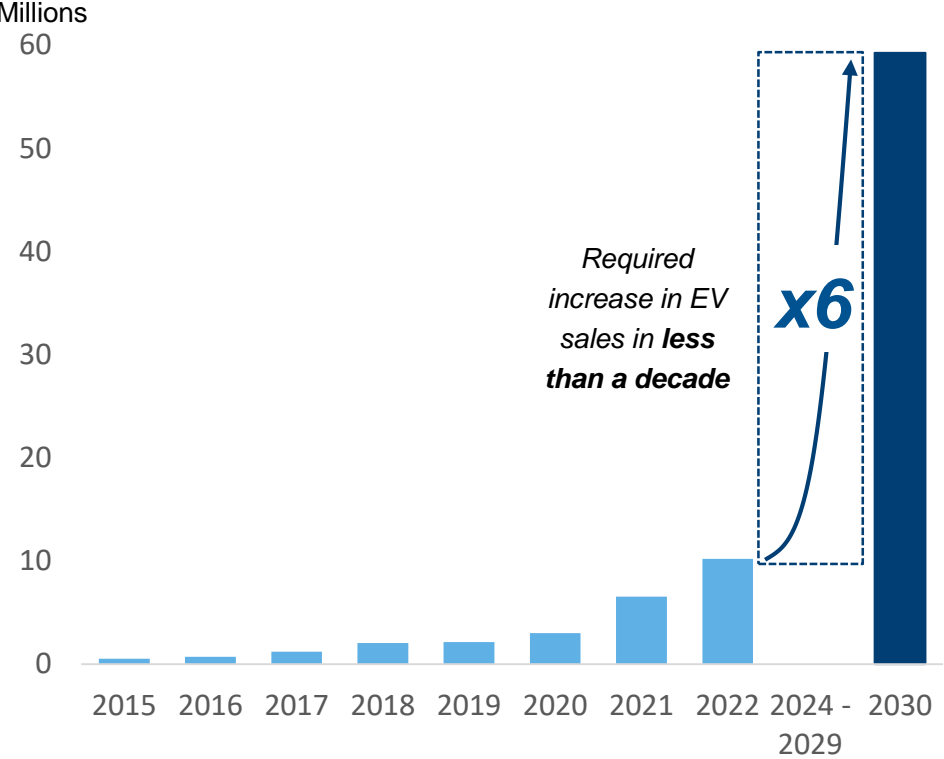


Land area larger than 100,000 km²

Sources: [1] Electricity mix: BNEF, [2] Calculation based on average Solar PV capacity not considering storage, technical, economical and geopolitical challenges

Reaching the EV penetration target by 2030 requires addressing unprecedented industrial and infrastructure development challenges

Electric car sales in the IEA Net Zero Scenario, 2015 – 2030 [1]



In 5 years, EV global annual manufacturing capacity must grow by **500%** to reach 60 million - comparable to current motor vehicle capacity of ~80 million



While \$100bn has been invested in charging infrastructure thus far, we still require almost **\$400bn globally by 2030** [2]

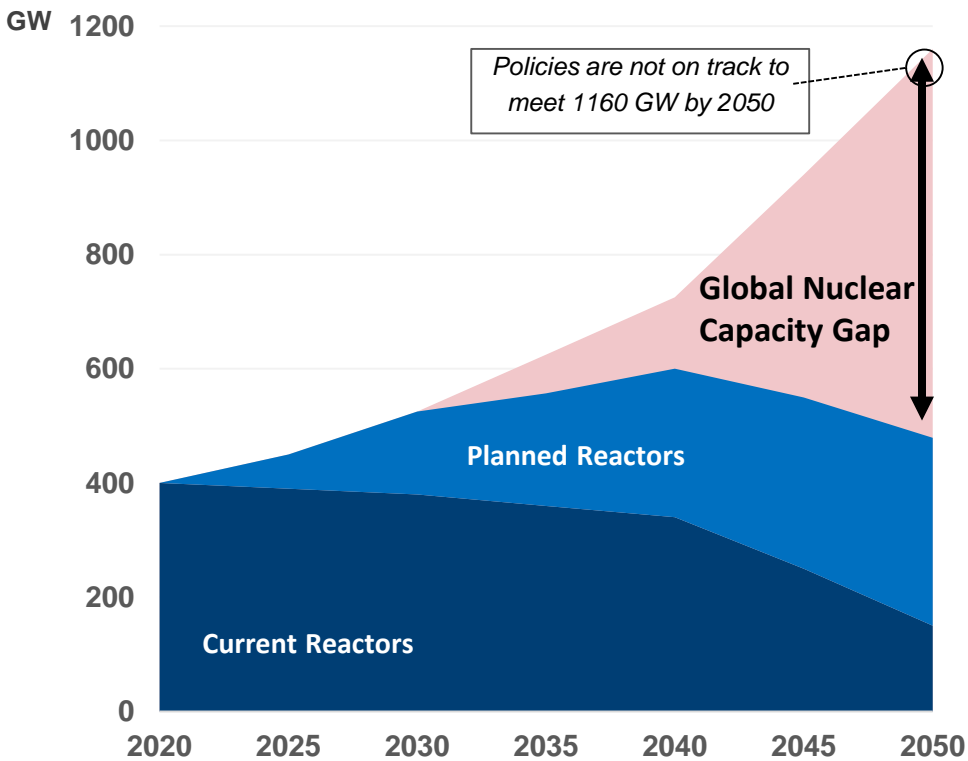


Over 90% of global sales in 2022 were incentivized by **subsidies** which **developing nations lack the capacity to match** [3]

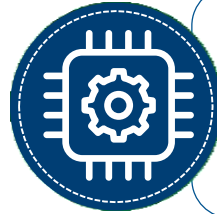
Source: [1] IEA Electric car sales and sales share in the Net Zero Scenario, 2015-2030, [2] BNEF [3] IEA Global EV Outlook 2023

It took 70 years to build 370 GW of global nuclear generation capacity, the world must now build double that in half the time

Planned global nuclear installations and the capacity gap to achieve 2050 targets (GW)^[1]



\$1.5 trillion in investments to close the gap^[2]



Regulatory frameworks designed for 20th-century reactors hinder innovation



Nuclear projects are **capital intensive**, more at risk of **inflation** and high **financing cost**

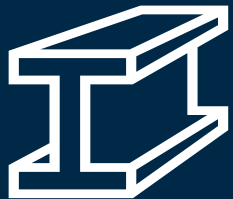


Low social acceptance needs to be addressed

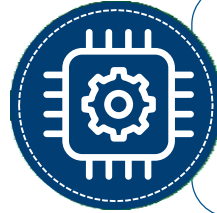
Decarbonizing hard-to-abate industries may lead to a substantial increase in the cost of basic commodities



Up to
115% Increase in
cost by using
**Green
Cement**^[1]



Up to
40% Increase in
cost by using
**Green
Steel**^[1]



Significant emissions are **process** related which are **unavoidable**



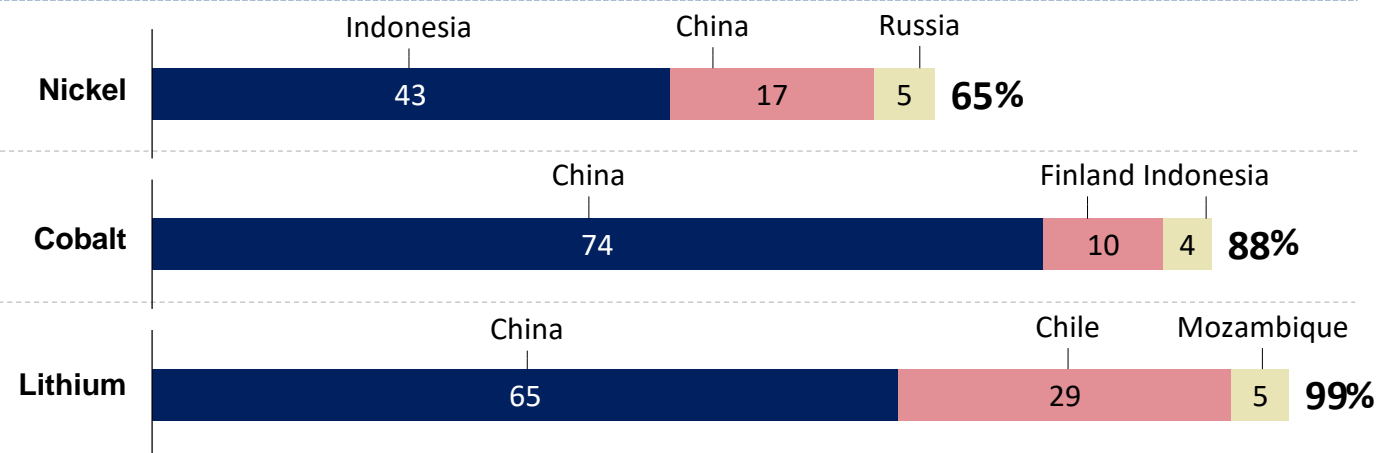
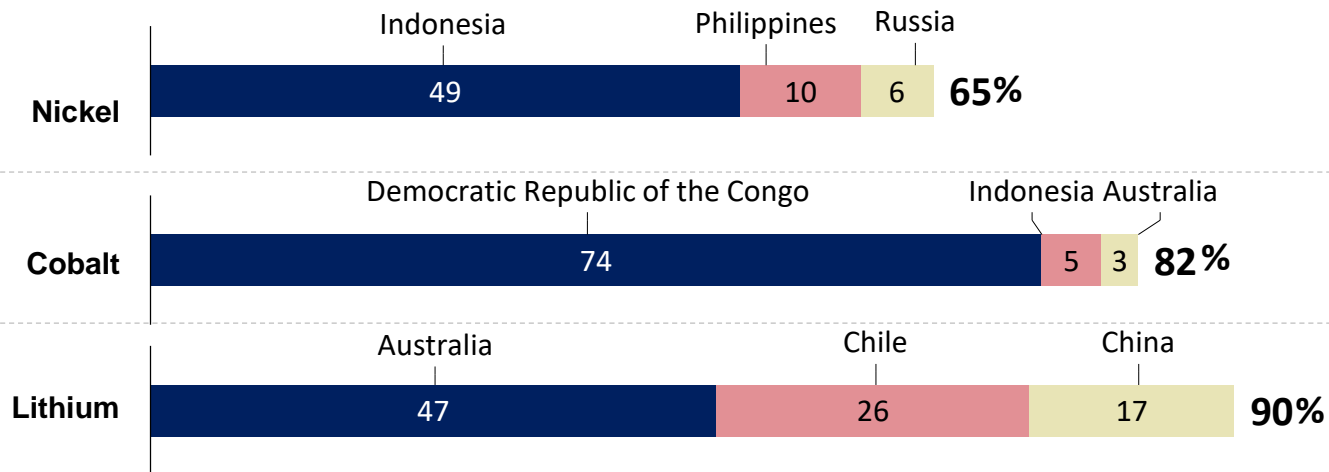
Adopting **CCUS** and **H2** systems will **increase** the **cost of production**



Higher cost of construction materials will disproportionately impact **developing nations**

Securing access to the critical minerals needed for the energy transition requires addressing significant dependency risks


Share of top 3 producing countries in total production for selected resources and minerals in 2022 [%]^[1]




Critical minerals supply chains (extraction and processing) **have a high level of market concentration**

Dependency risks could pose major challenges to the energy transition


Eliminating energy poverty is pivotal for a just and equitable transition



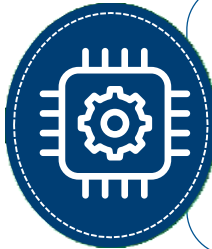
~ 675 Million People Without access to electricity ^[1]



~ 2.3 Billion People Without access to clean cooking^[1]



~ 8.3 Billion People Will be in developing nations by 2050^[2]



Limited access to **advanced decarbonization technologies**



Energy costs in developing nations often represents a **significant portion** of household expenses



Developing nations are most exposed to the risks in failing to achieve the transition

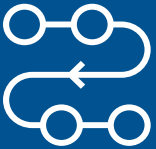
Building a new energy system requires collective and equitable efforts



Strategically utilize the **full spectrum of options** in the energy toolkit for a sustainable and impactful transition



Effective **capital allocation** and **financing** to address socioeconomic impacts are imperative for a **just and equitable** transition



Tailoring the approaches to fit every **nation's circumstances and timeframe** is essential for the **success of global energy transformation**



Addressing the **vulnerable and most exposed nations** is crucial to ensure that no one is **left behind** in the energy transition

Thank you

