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Commodity Insights

CO_2 Reductions in North America versus Abroad

The Energy Council

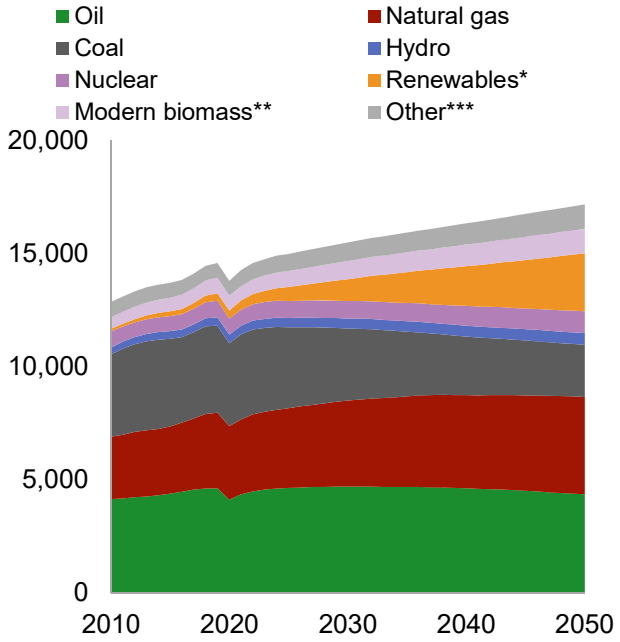
2023 Global Energy and Environmental Issues Conference

Deb Ryan, Head of Strategic Commodities, Centre of Emissions Excellence

December 2023

The view from 2021: Fossil fuel demand set for slow decline as renewables grow, but Paris Agreement targets appear out of reach

Global TPED by fuel, Inflections base case outlook 2021 (MMtoe)

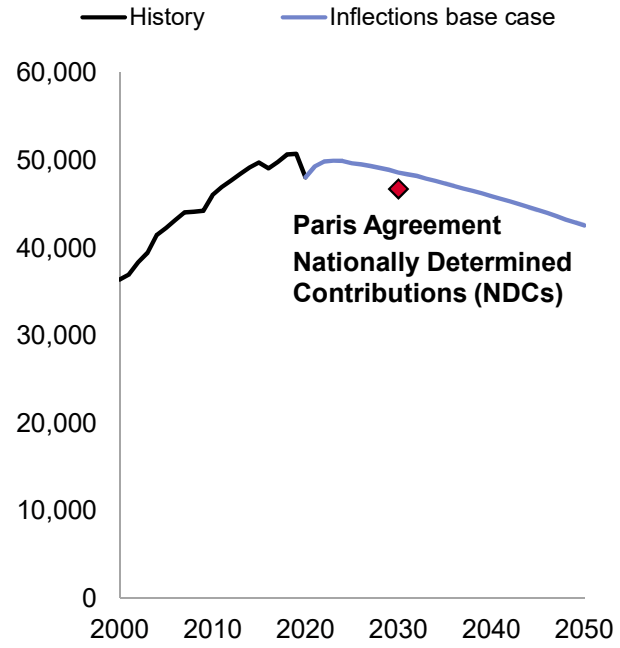


Data compiled September 2023
* Includes solar, wind, geothermal, and ocean energy.
** Includes biofuels and biomass (industry, electricity, district heat, and refining).
*** Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat
Source: S&P Global Commodity Insights

Global key energy metrics % change 2050 vs. 2021

Total primary energy demand	
Oil	+0%
Gas	+30%
Coal	-39%
Power generation	
Total	+88%
Wind	+558%
Solar	+929%
Nuclear	+35%
Fossil fuels	-4%

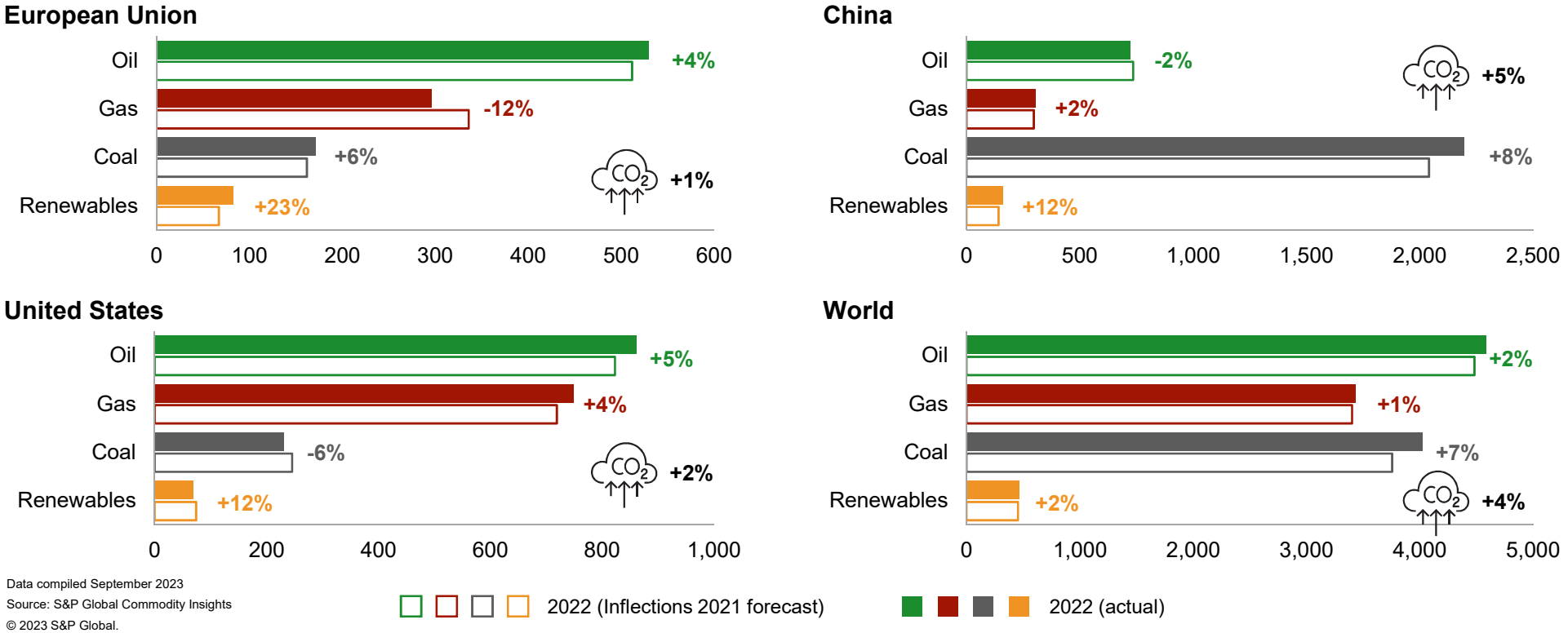
Global GHG emissions 2000 - 2050, Inflections base case outlook 2021 ($MtCO_2e$)



Source: S&P Global Commodity Insights

2022 confounded expectations: fossil fuel consumption and emissions were higher than expected, but so too was demand for renewables

Global & regional Oil, Gas, Coal & Renewables demand 2022, Inflections 2021 forecast vs. actual (MMtoe)



Data compiled September 2023
Source: S&P Global Commodity Insights

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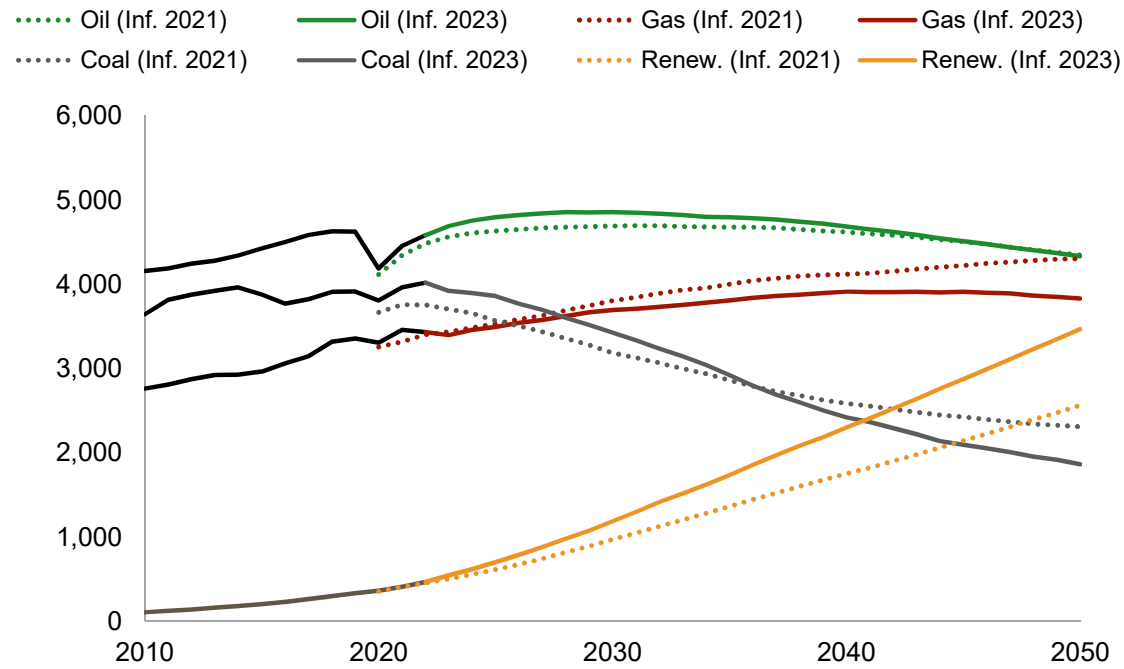
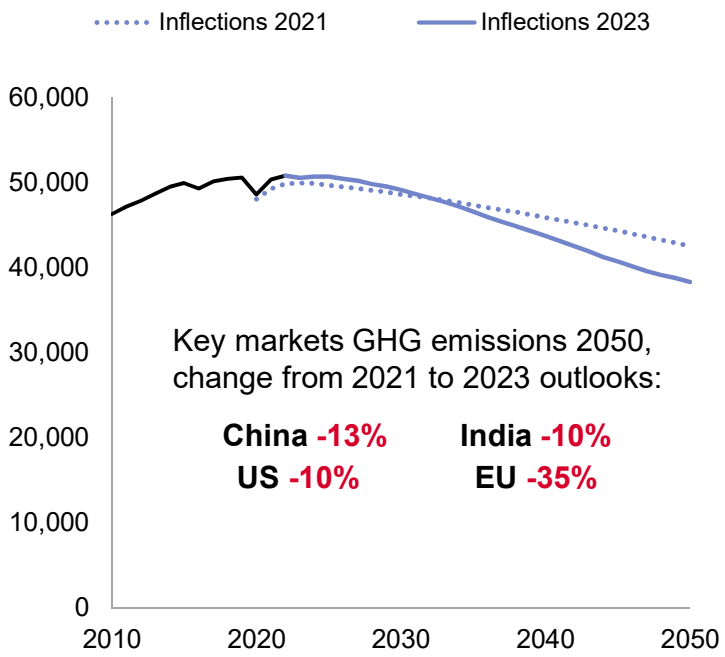
The events of 2022 will have long-term impacts: faster declines in demand for fossil fuels and emissions of GHGs, and accelerated growth for renewables

Global Oil, Coal, Gas & Renewables demand 2010 - 2050, Inflections 2021 vs. Inflections 2023 (MMtoe)



Global GHG emissions 2010 - 2050, Inflections 2021 vs. Inflections 2023



Data compiled: September 2023
Source: S&P Global Commodity Insights, Energy and Climate Scenarios

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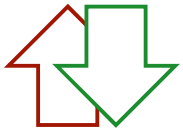
Diverse futures, but common themes across the five outlooks

- **Industrial policy is turbocharging cleantech investment**

- **The Ukraine conflict will permanently reduce European demand for fossil fuels**



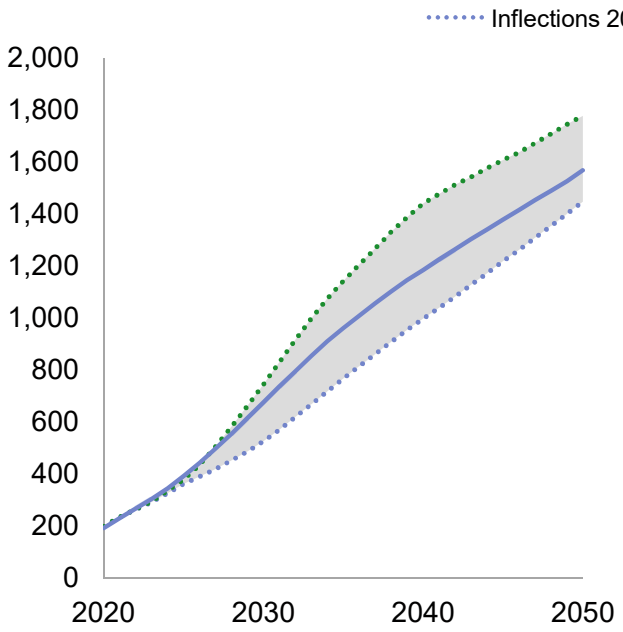
- **A two-trajectory Asia Pacific is emerging**

- **Renewables will represent more than half of total global power generation by 2050 under the Inflections base case**

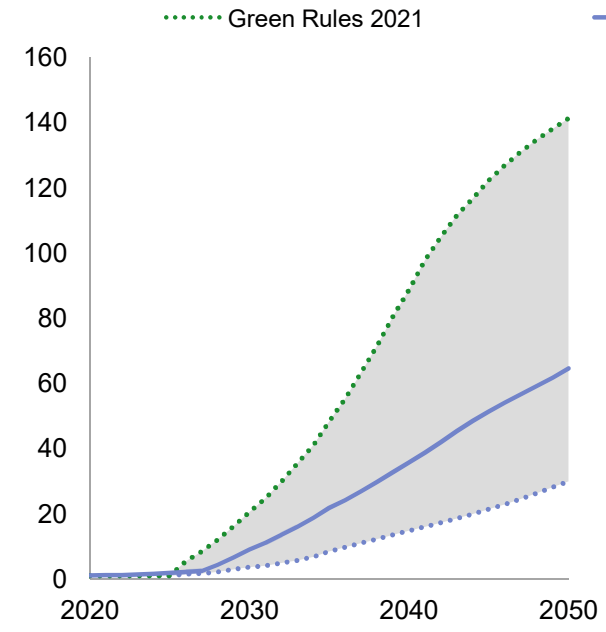
Source: S&P Global Commodity Insights

In the United States, the Inflation Reduction Act has driven a material uplift in expectations for renewable and battery storage capacity growth

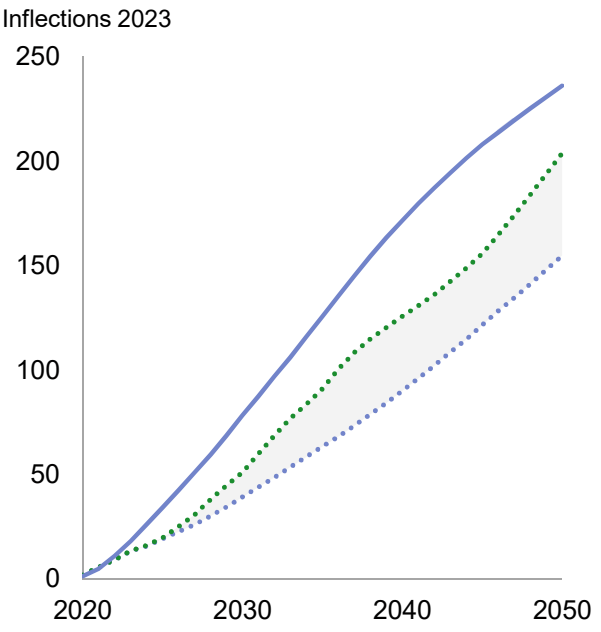
US renewable power* capacity, 2020 - 2050 (GW)



US low-carbon hydrogen production, 2020 - 2050 (MMtoe)**



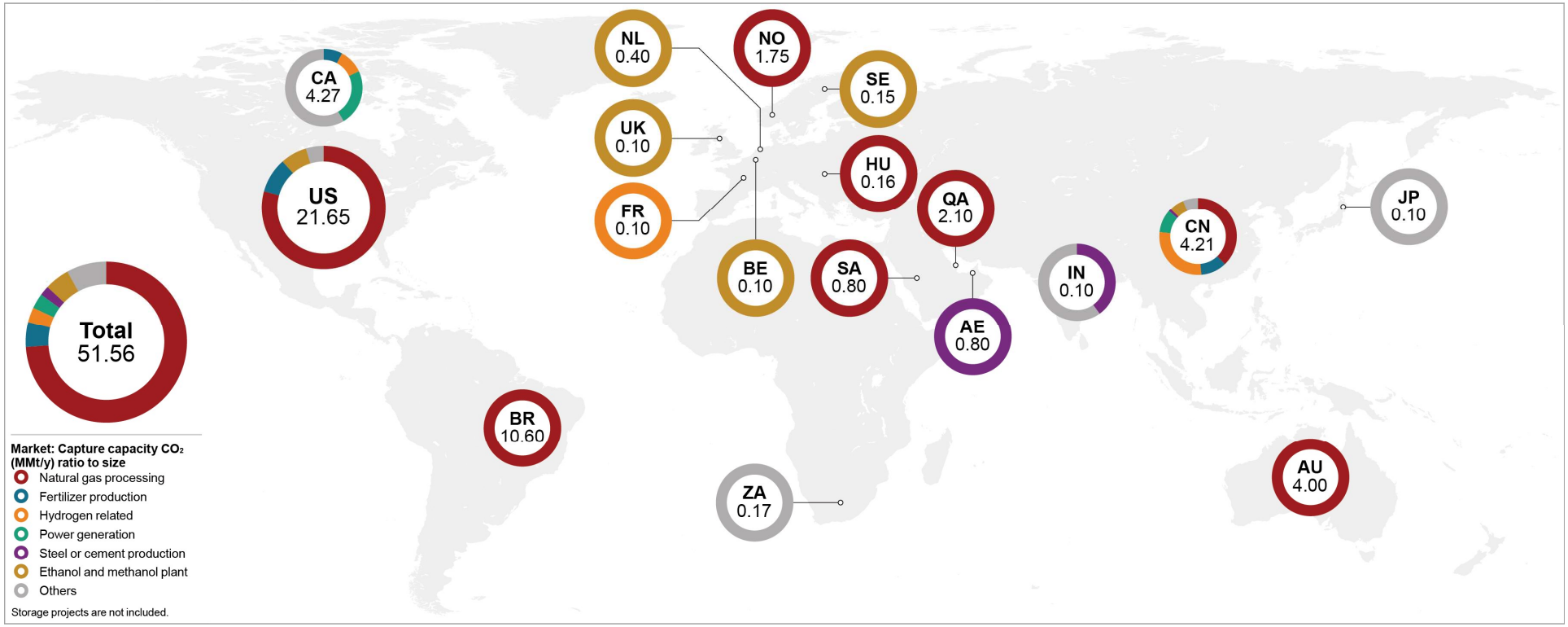
US battery storage capacity, 2020 - 2050 (GW)



Note: *Renewable power = Wind + Solar; **low-carbon hydrogen production = blue + green hydrogen
Data compiled September 2023
Source: S&P Global Commodity Insights

Most of the current CO2 capture capacity is in the Americas, with the US accounting for 42% of the capacity, mainly from natural gas processing

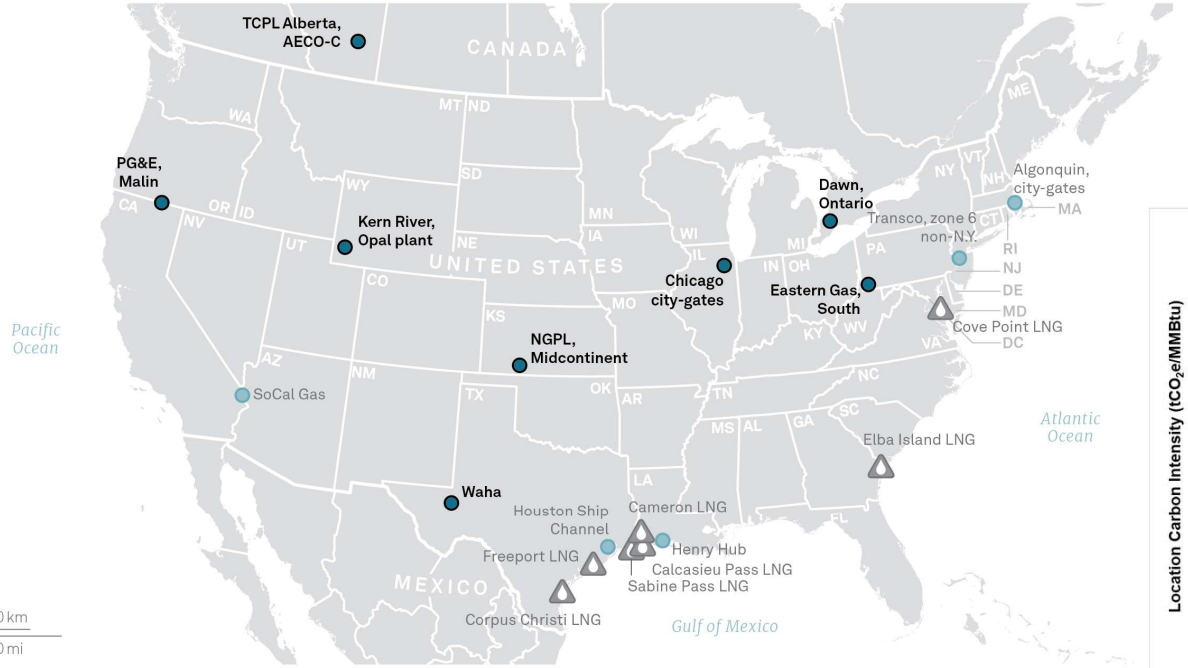
Current CO_2 capture capacity by emission source



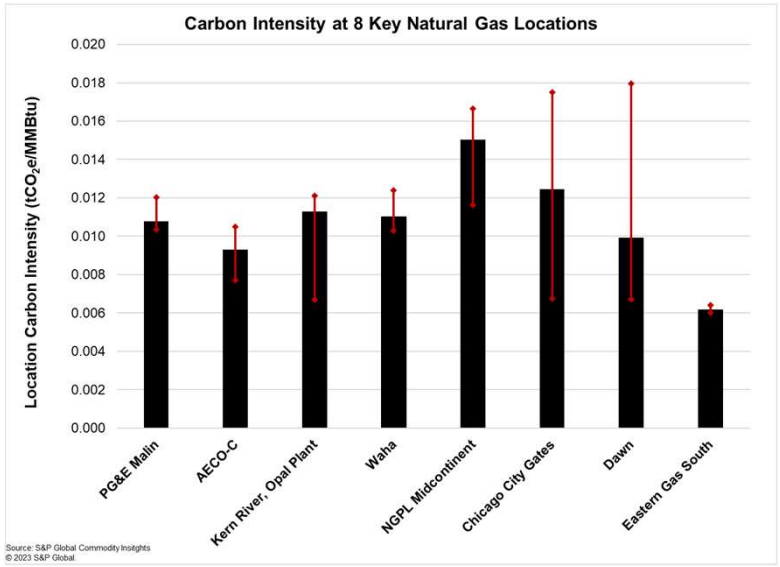
Data compiled Aug. 10, 2023.
Source: S&P Global Commodity Insights: 2010509.

Understanding how carbon intensity varies across production areas and how decarbonization methods with vary based on operations

Natural gas carbon intensity assessment locations

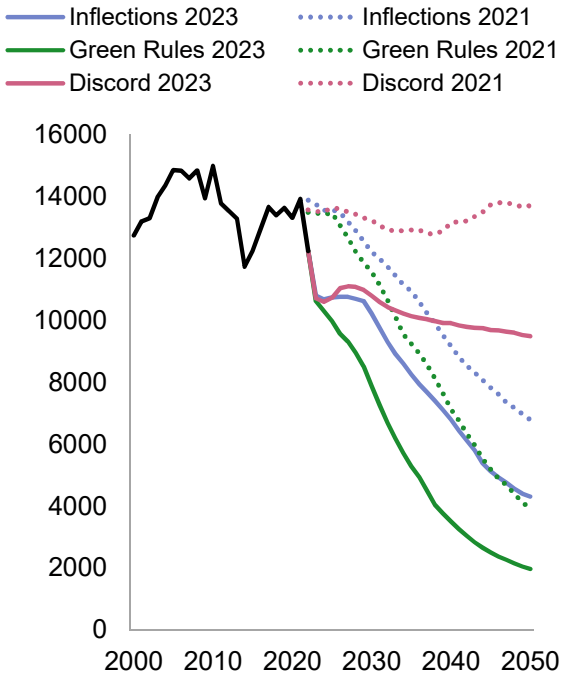


Source: S&P Global Commodity Insights



The European Union's response to the Ukraine war will drive down gas demand and accelerate renewables growth

EU natural gas demand, 2000 – 2050 (Bcf)



Data compiled July 2023
Source: S&P Global Commodity Insights
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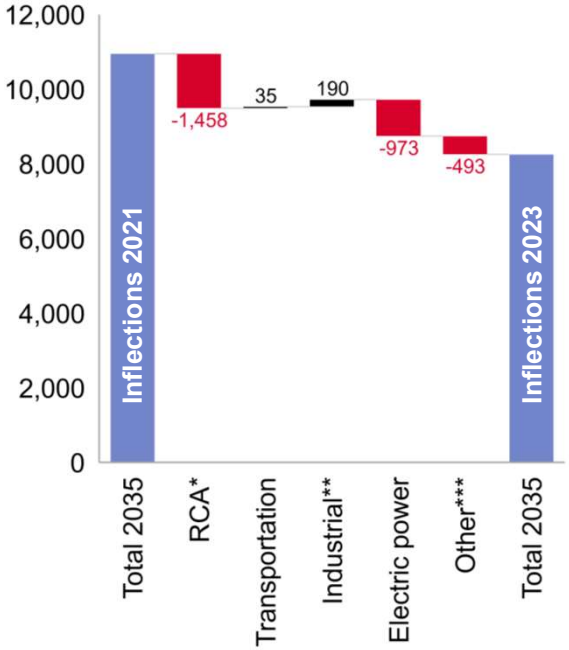
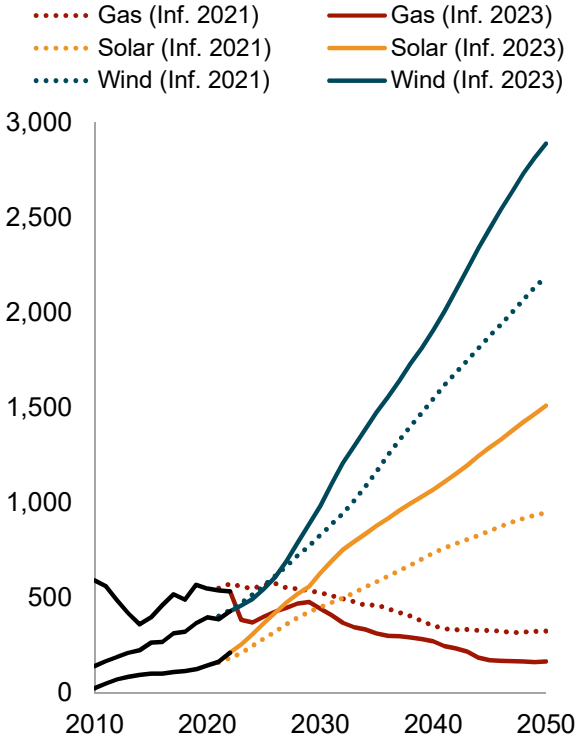
EU natural gas demand 2035, change between forecasts (Bcf)



* RCA = Residential / Commercial / Agricultural
** Includes feedstocks
*** Includes hydrogen production, energy sector uses, distribution losses and statistical differences

EU power generation select fuels, Inf. 2021 vs Inf. 2023 (TWh)



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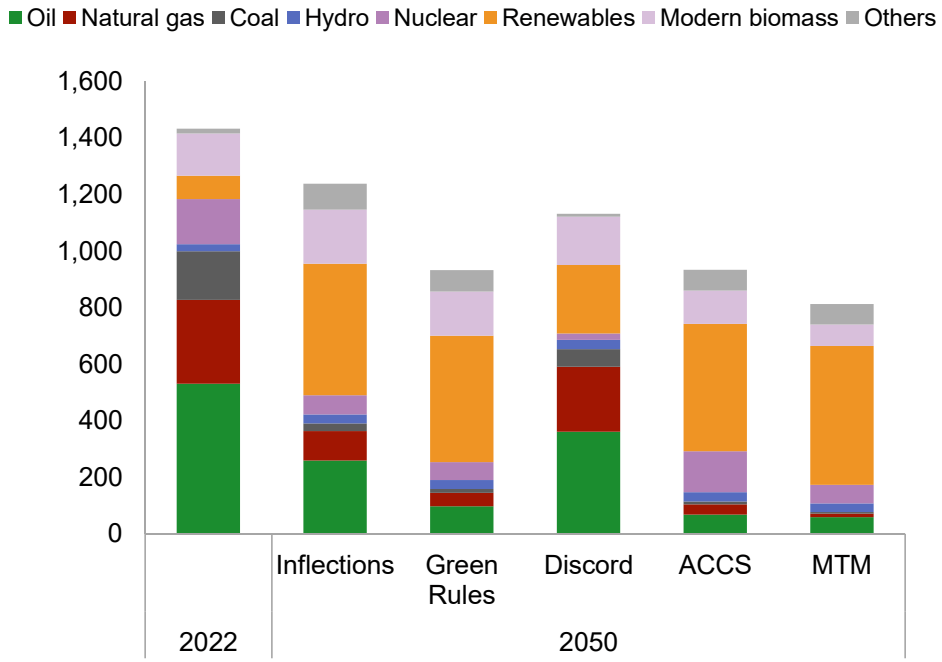
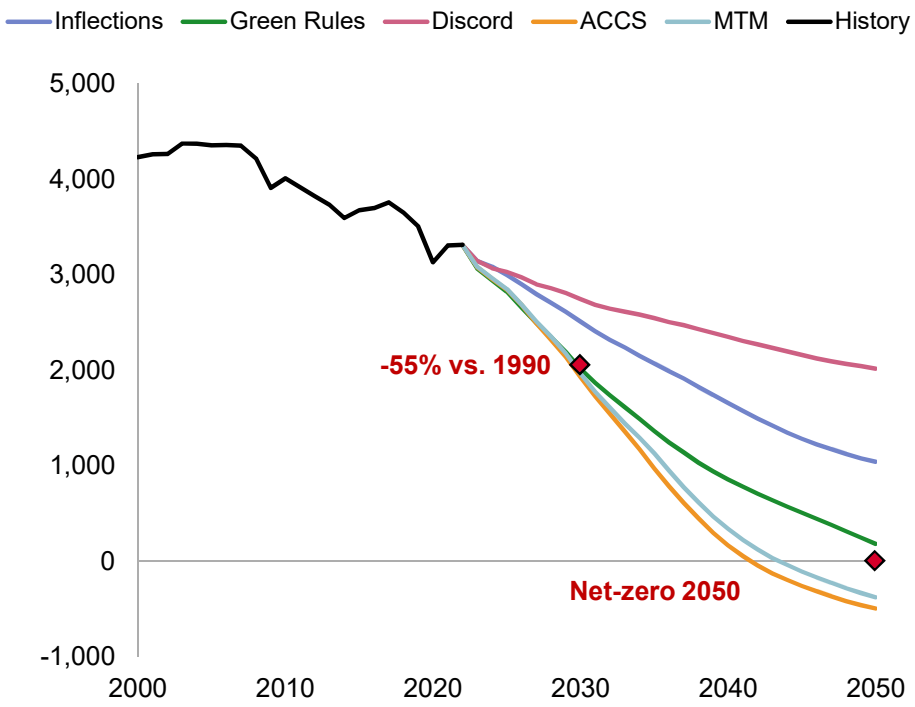
The EU will decarbonise faster and to a greater degree than any other region. But long-term climate targets remain highly ambitious

EU total primary energy demand by fuel, 2022 & 2050 (MMtoe)



EU GHG emissions, 2000 - 2050 ($MtCO_2e$)



Data compiled July 2023

Source: S&P Global Commodity Insights

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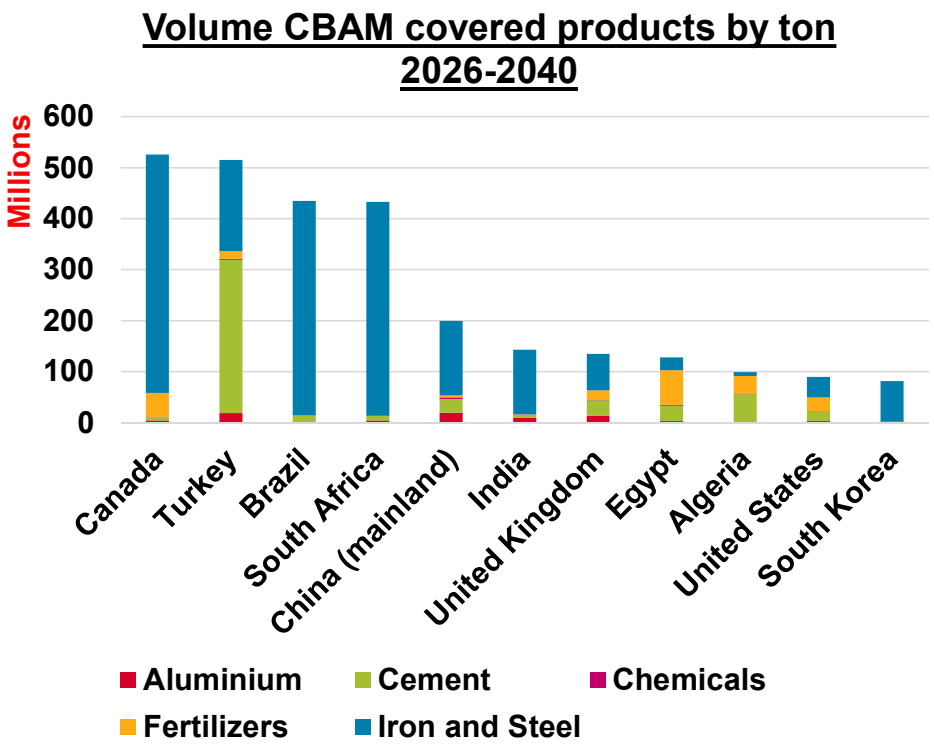
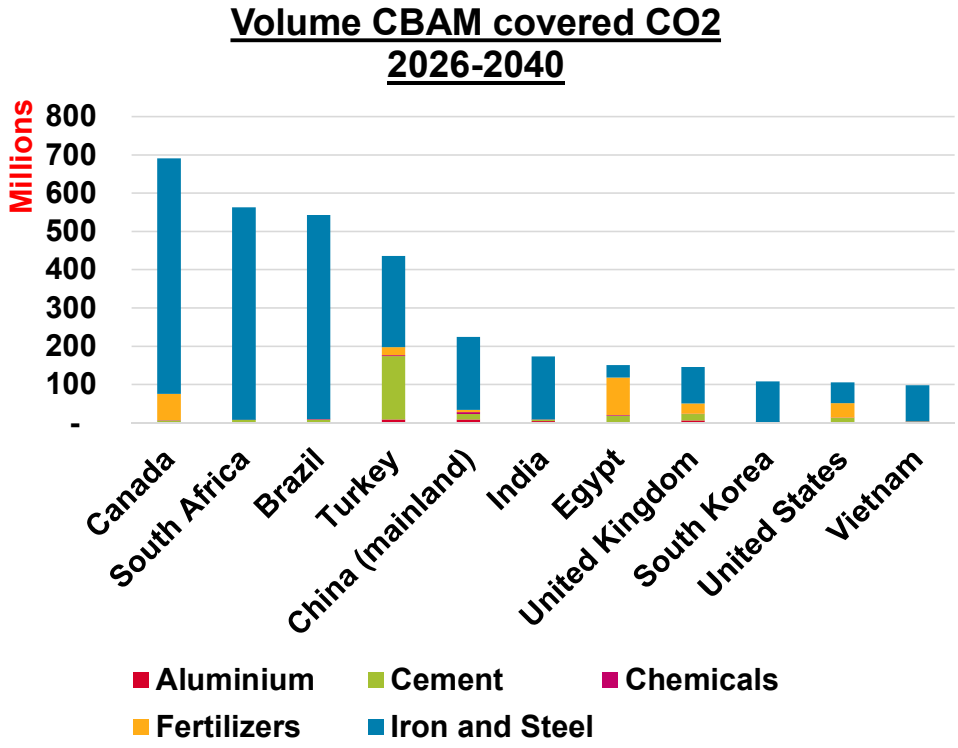
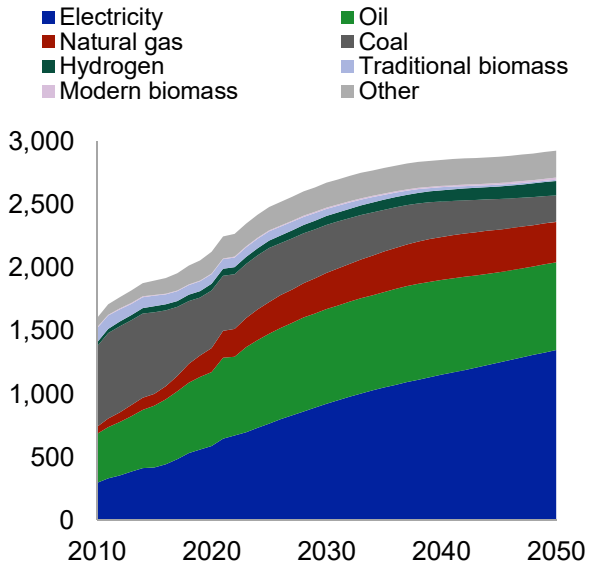
Canada, South Africa and Brazil to produce most CBAM emissions. Turkey's CO2 exposure reduced by export of lower carbon intensity goods to EU market



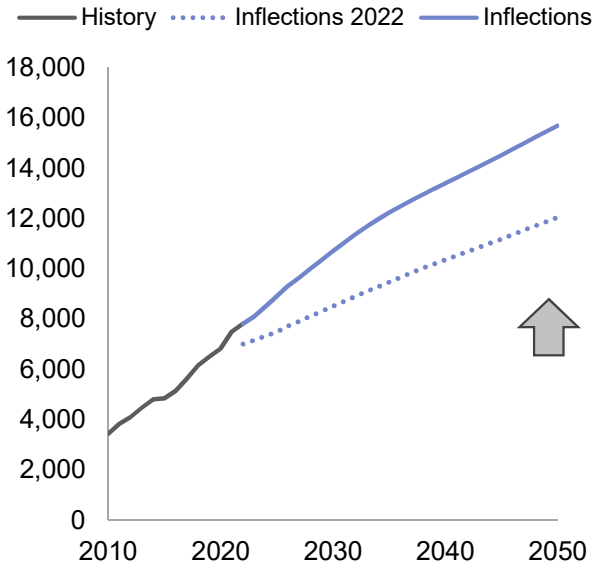


China is increasingly resembling a mature market, with slowing demand growth, accelerated electrification and rapid buildout of renewable power capacity

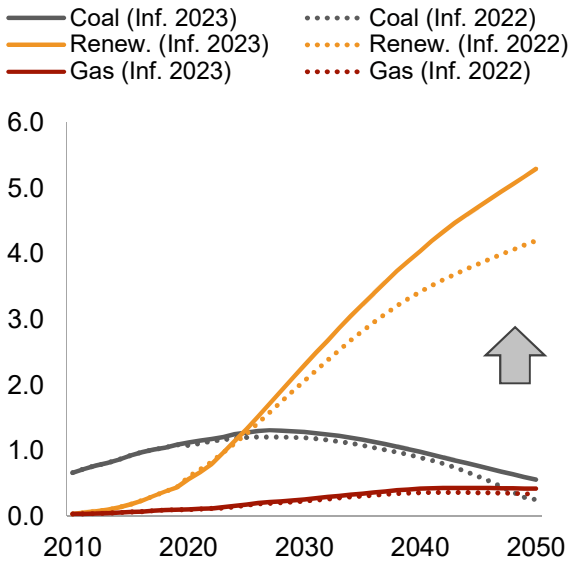
China final energy demand by fuel, Inflections scenario, (MMtoe)



China final electricity demand, (TWh)



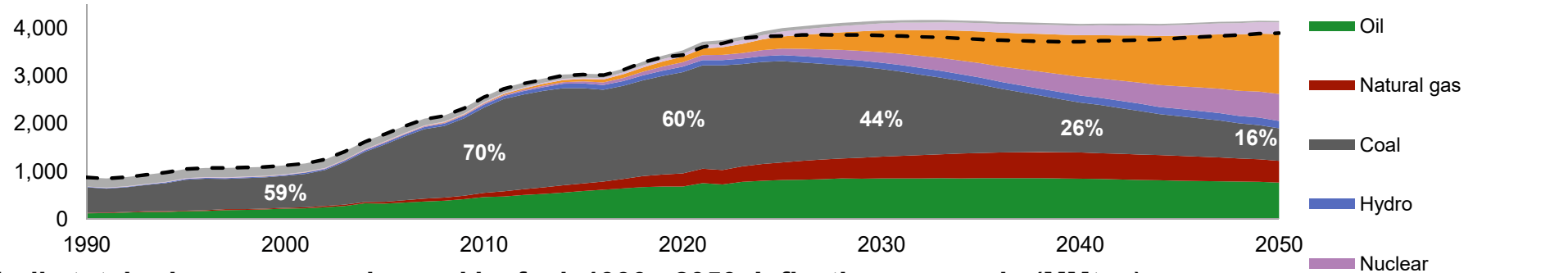
China power capacity by key generating type, Inflections scenario, (TW)



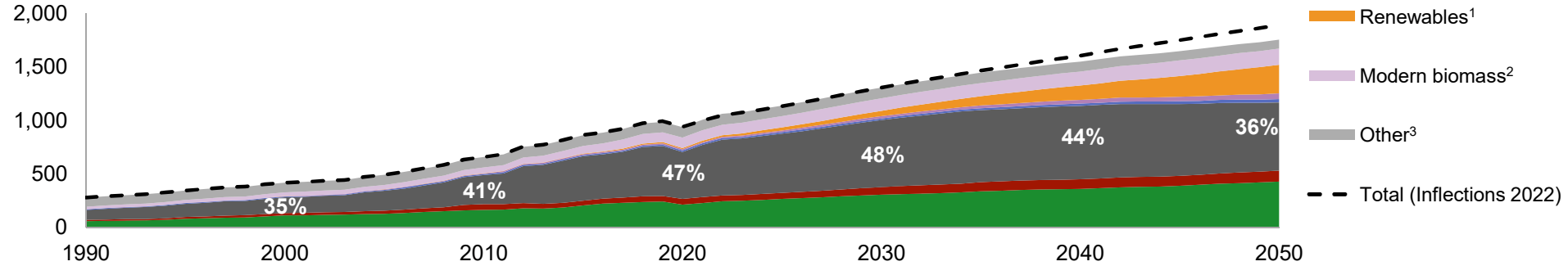
Data compiled July 2023
1 Final energy consumption is energy supplied to final consumers for all energy uses. It is calculated by end-use sector and does not include energy losses from conversion or distribution.
2 Coal includes steam and coking coal.
3 Traditional biomass is used in the domestic sectors and includes charcoal, wood, and bagasse.
4 Modern biomass includes biofuels, biogas, biowaste, wood chips, and wood pellets.
5 Other includes district heat, small-scale nonelectric renewables (e.g., solar thermal water heating, heat pumps
Source: S&P Global Commodity Insights

Diverging trends mean China will hit ‘peak fossil’ demand by 2025 in the Inflections scenario, but India grows its use of coal, gas and oil through 2050

China total primary energy demand by fuel, 1990 - 2050, Inflections scenario (MMtoe)



India total primary energy demand by fuel, 1990 - 2050, Inflections scenario (MMtoe)



Data compiled July 2023

1 Includes solar, wind, geothermal, and ocean energy.
2 Includes biofuels and biomass (industry, electricity, district heat, and refining).
3 Includes solid waste, traditional biomass, ambient heat, net trade of electricity, or heat
Source: S&P Global Commodity Insights

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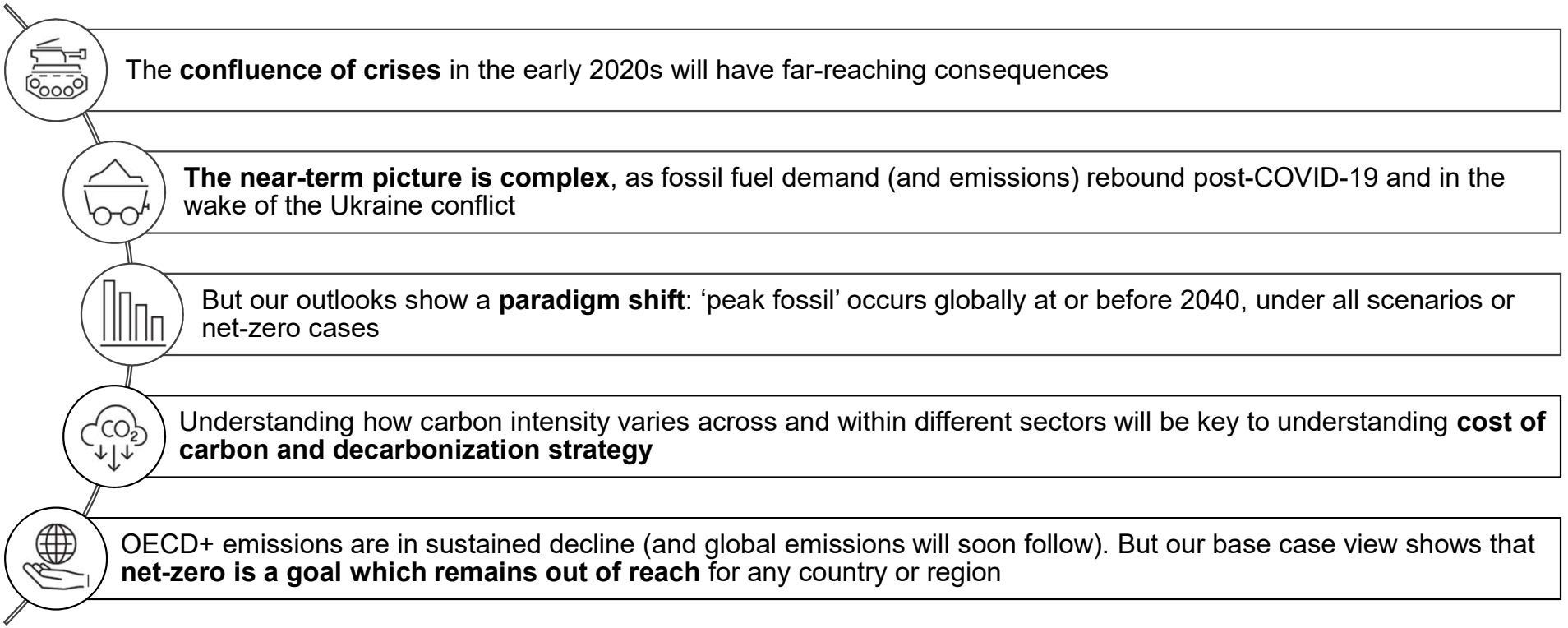
Conclusion



Source: S&P Global Commodity Insights

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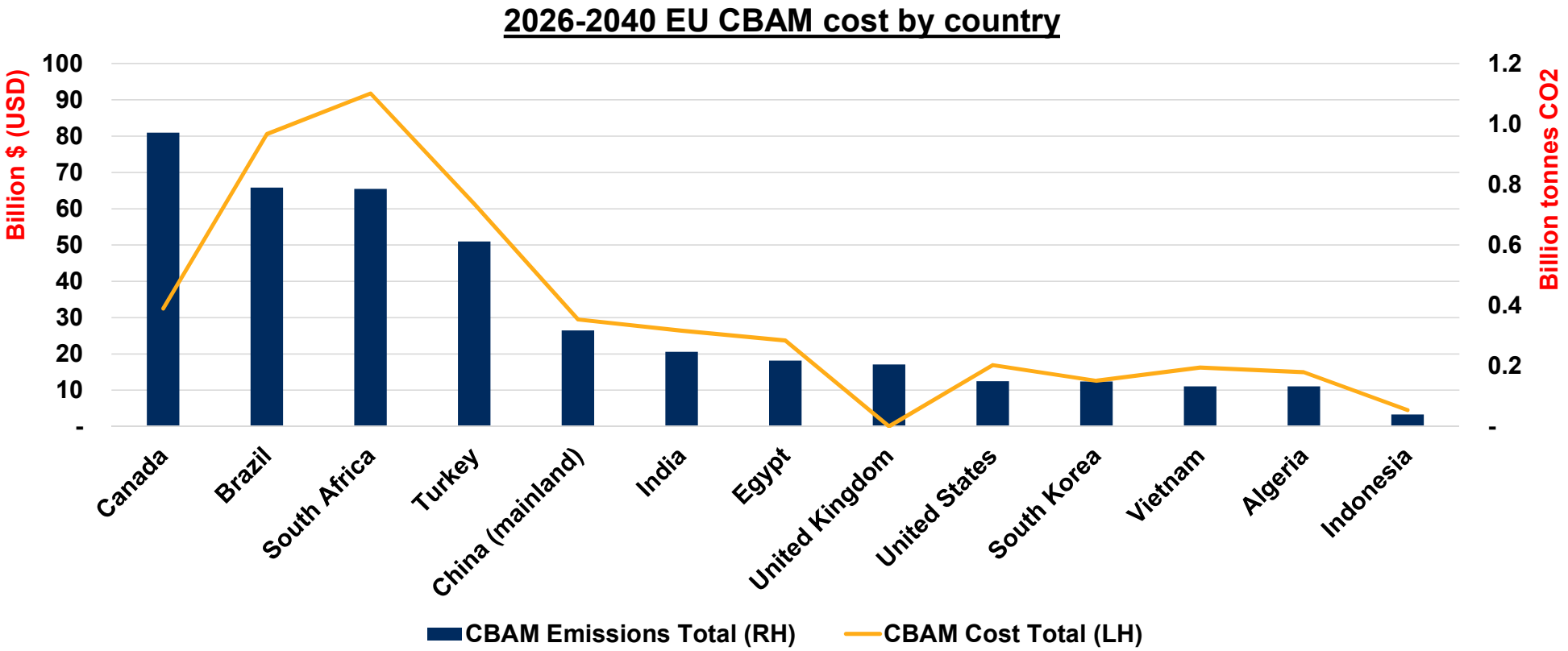
Carbon pricing key towards reducing total EU CBAM liability; UK and Canada significantly reduce exposure owing to strong carbon prices



Note: Carbon price forecasts converted into USD. Draft forecast valid December 2022, based on Inflections scenario of Energy and Climate Scenario modelling South Africa carbon price derived from forecast carbon tax level. India carbon price derived from assumptions over future cap and trade system. China ETS represents national ETS.

Agenda

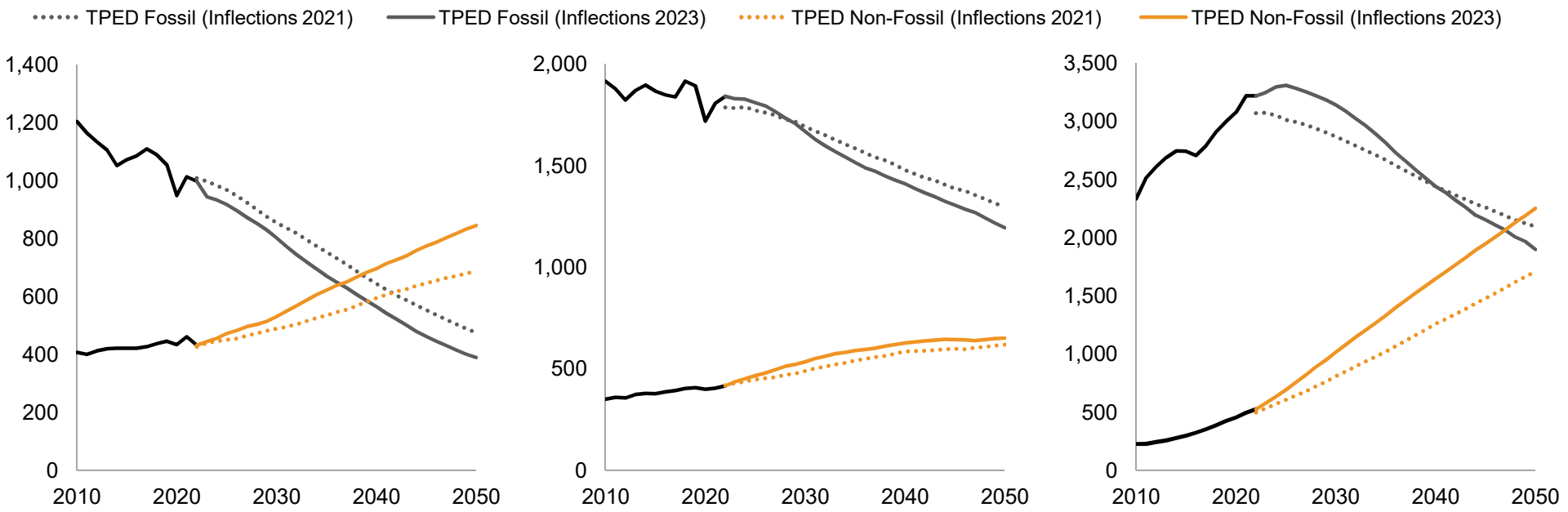
- **How has our view of the world changed since 2021?**
- **Is this a temporary blip, or a new era?**
- **What emerging trends will define the energy transition?**
- **What are the prospects for global decarbonization and the race to net-zero?**

The events of 2022 will have long-term impacts. Industrialised economies will see faster declines in demand for fossil fuels, and accelerated growth for renewables

EU Fossil & Non-Fossil demand 2010 - 2050, Inflections 2021 vs. Inflections 2023 (MMtoe)

US Fossil & Non-Fossil demand 2010 - 2050, Inflections 2021 vs. Inflections 2023 (MMtoe)

China Fossil & Non-Fossil demand 2010 - 2050, Inflections 2021 vs. Inflections 2023 (MMtoe)



As of September 2023

Source: S&P Global Commodity Insights

All outlooks illustrate some degree of energy transition. Compared to today's levels, fossil fuel demand and GHG emissions are lower in 2050 across the board

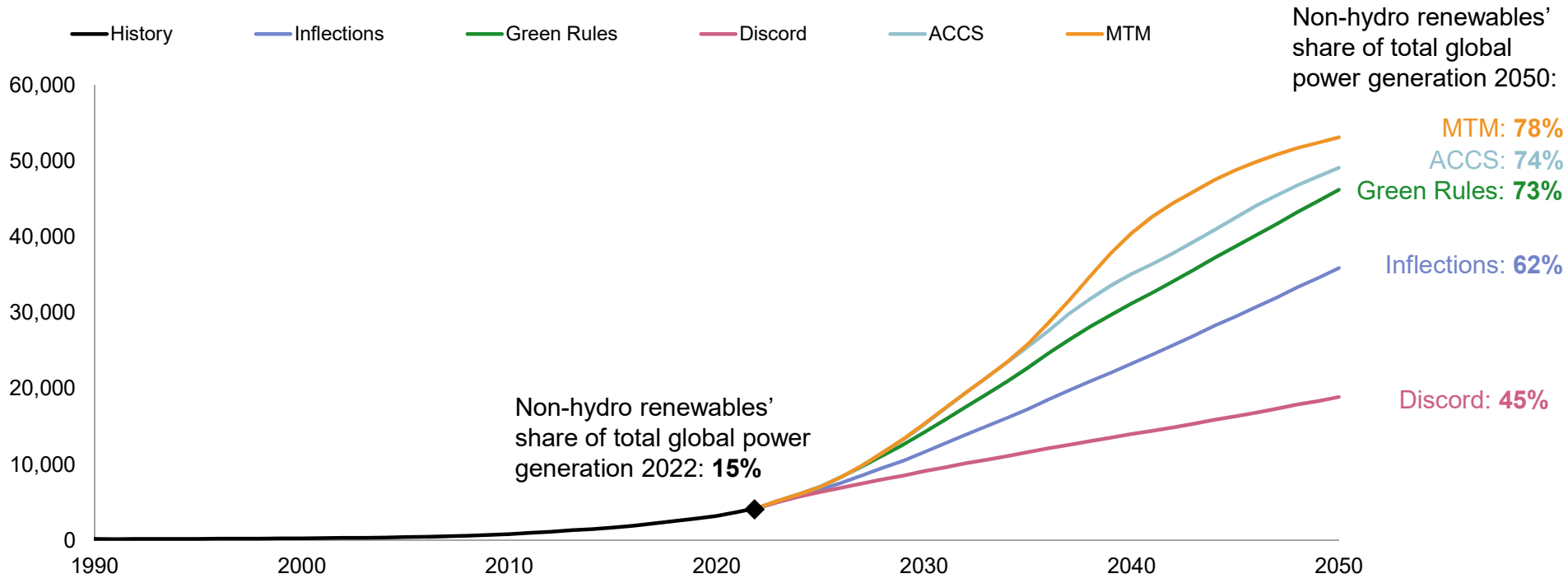
S&P Global Commodity Insights Energy and Climate Scenarios and Net-Zero cases: key metrics

	Global GDP (CAGR 2022–50)	2050 TPED (change vs 2022)	2050 Fossil fuel % of TPED	GHG emissions (change vs. 2022)	Global temperature (change by 2100)
Inflections (base case)	2.6%	+15%	58%	-25%	2.4°C
Green Rules	2.4%	-6%	39%	-59%	1.7°C
Discord	2.1%	+8%	68%	-11%	3.0°C
Net-Zero cases					
Accelerated CCS (ACCS)	2.3%	-13%	30%	-103%	1.5°C
Multitech Mitigation (MTM)	2.3%	-20%	20%	-101%	1.5°C

Data compiled July 2023
Note:Commodity Insights considers a country or region to have effectively reached "net-zero" emissions once GHG emissions have fallen to less than 1% of their 2022 level and remain at that level over the course of a year.
GHG = greenhouse gas; TPED = Total Primary Energy Demand
Source: S&P Global Commodity Insights

Renewable power output grows multi-fold under all outlooks & represents more than half of total global power generation by 2050 under the Inflections base case

Global power generation by non-hydro renewable sources, 1990 - 2050 (TWh)



Data compiled July 2023
Source: S&P Global Commodity Insights

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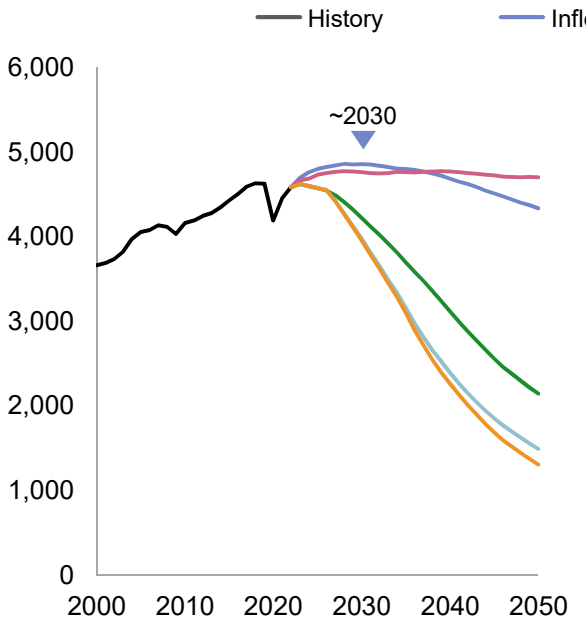
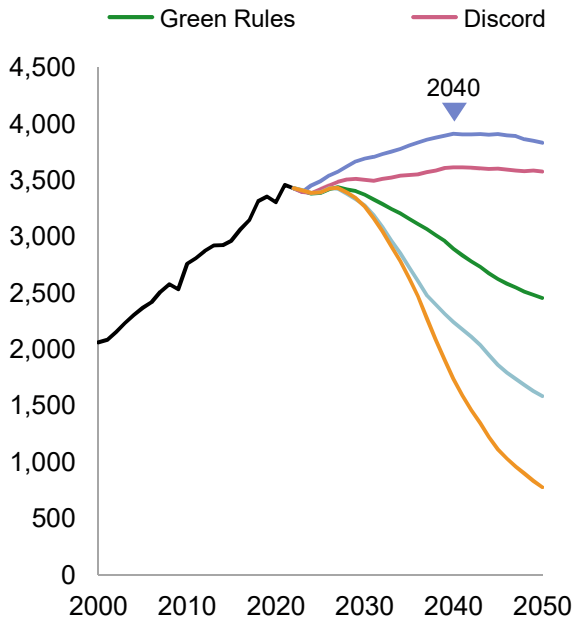
Our alternative scenarios reinforce this major paradigm shift: we no longer have a ‘Business as Usual’ view for long-term oil, gas and coal demand growth

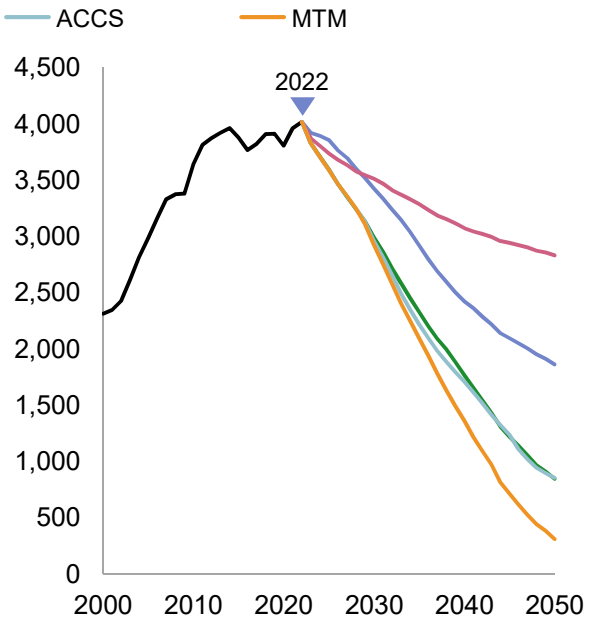
Global primary oil demand, 2000 - 2050 (MMtoe)



Global primary gas demand, 2000 - 2050 (MMtoe)



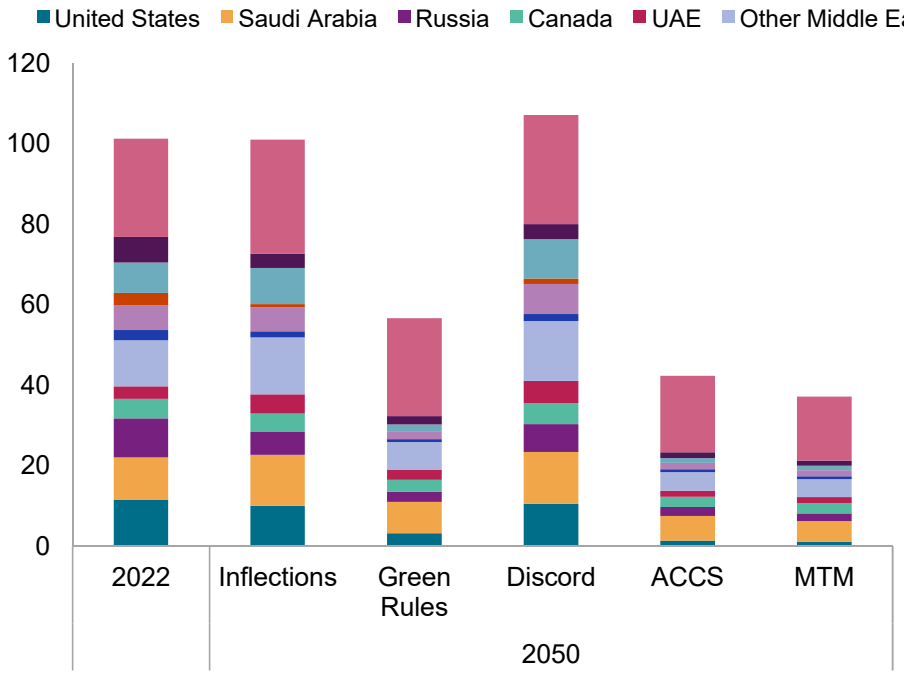
Global primary coal demand, 2000 - 2050 (MMtoe)



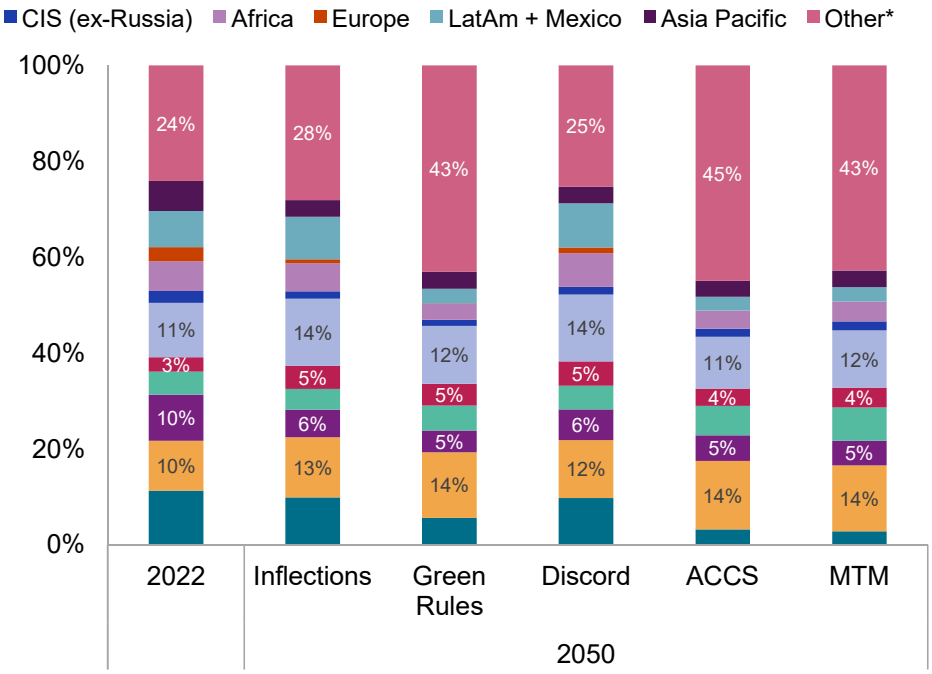
Data compiled September 2023
ACCS = Accelerated CCS net-zero case
MTM = Multitech Mitigation net-zero case
Source: S&P Global Commodity Insights, Energy and Climate Scenarios

Under the lower-demand scenarios key oil suppliers retain market share, but the growing role of biofuels is notable

Global oil (liquids) production 2022 & 2050 (million b/d)



Global oil (liquids) production 2022 & 2050 (% of total)



* Includes condensate, NGLs, processing gains **& biofuels**
Data complied October 2023
Source: S&P Global Commodity Insights

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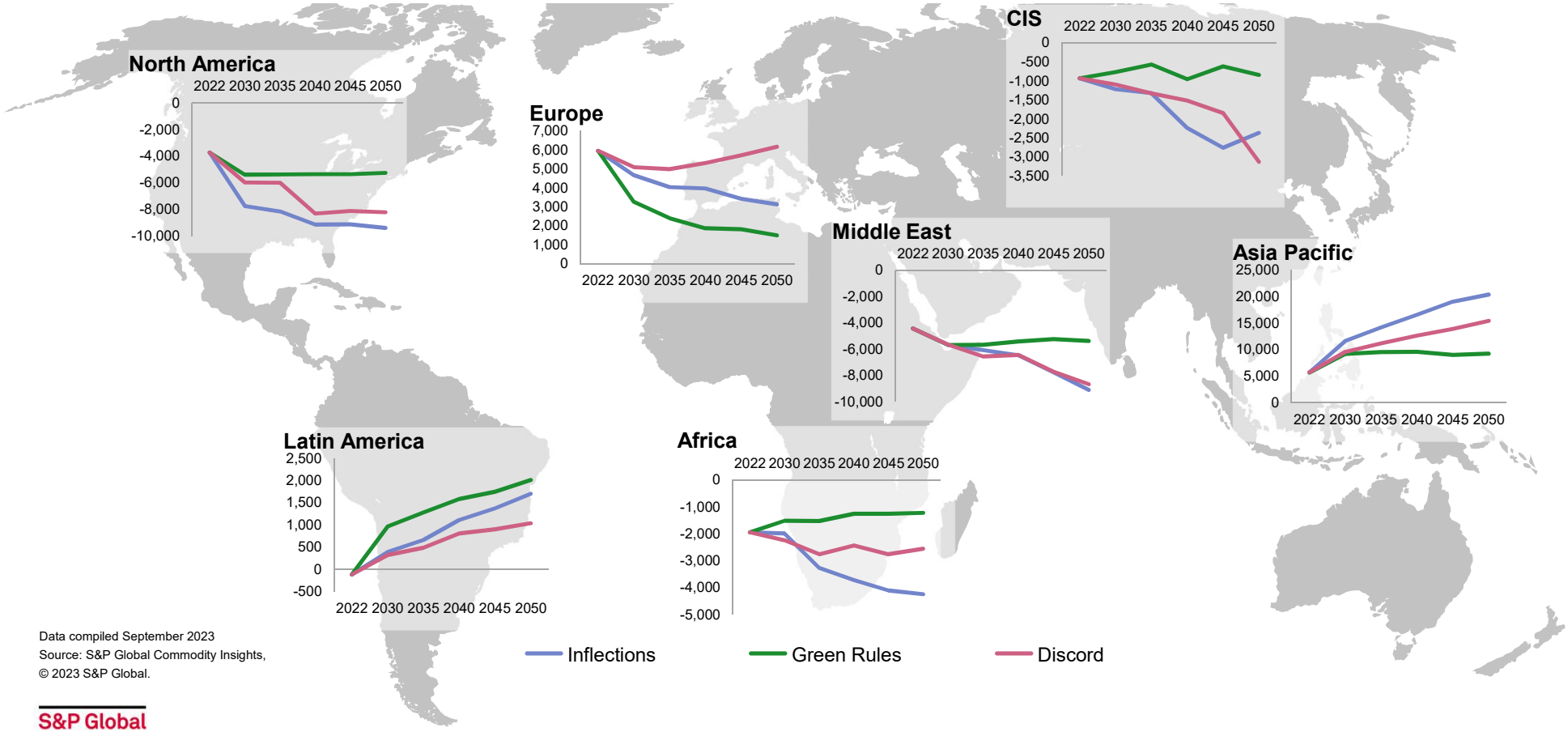
Long-term LNG trends are nuanced, but import demand shifts increasingly to Asia Pacific regardless of outlook

LNG regional net imports / exports, 2022 – 2050 (bcf)



Data compiled September 2023
Source: S&P Global Commodity Insights,
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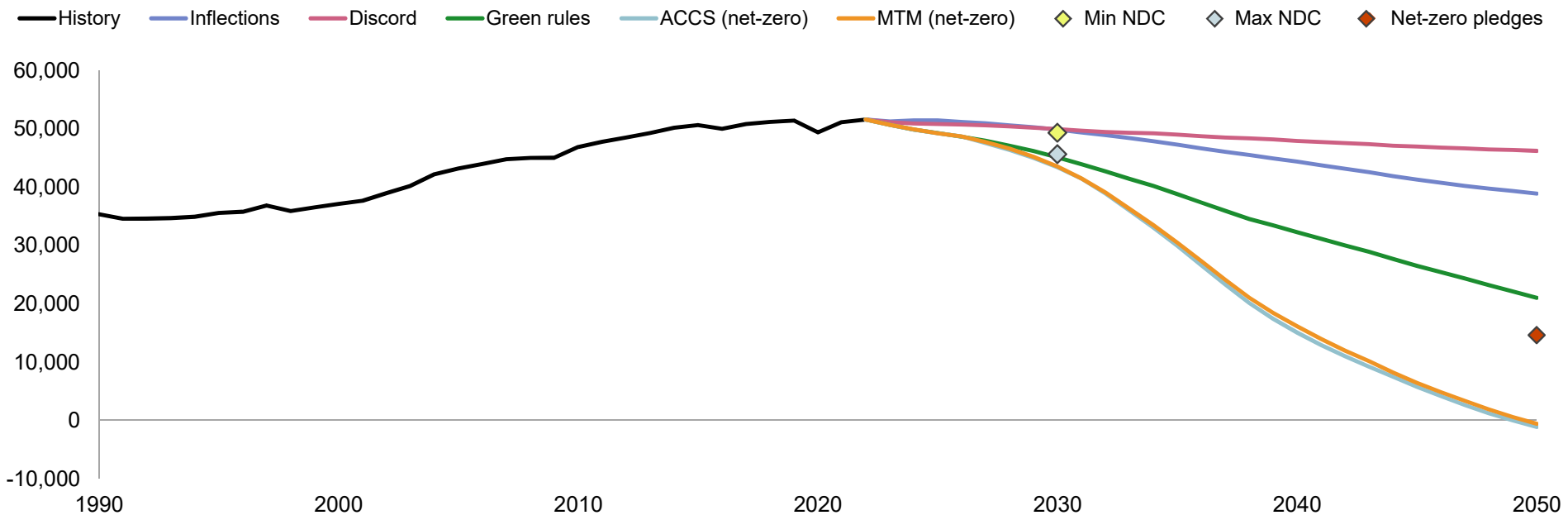
Heading into COP28, emission pledges made so far may or may not be adequate to meet the goals of the Paris Agreement

Total GHG emissions in S&P Global Commodity Insights global scenarios, parties' NDC targets, and net-zero pledges ($MMtCO_2e$)



Data compiled October 2, 2023.
Note: Assuming straight-line emissions reduction from 2030 NDC target to net-zero emissions in time frame targeted in pledge.
Source: S&P Global Commodity Insights

COP28: Parties called on to go ‘after gigatons’ and ‘activate a truly global response to the Global Stocktake (GST)’

- **COP28 has been presented as an inclusive and solution-driven summit.** Statements from the COP28 presidency highlight “keeping the 1.5 degree C goal alive” as the COP28 key priority, while maintaining an action-oriented vision.

- **At COP28, for the first time, Parties will be called on to assess progress on climate ambition action under the 1st Global Stocktake (GST).** The GST is a “moment of truth,” designed to catalyse further political commitment to fill current gaps and accelerate efforts in global climate ambition and action.

- **Cutting global GHG emissions over the next 7 years by about 43% (22 Gt) relative to present levels, as COP28 president-designate called for, is an incredibly ambitious and challenging goal.** At COP28, Parties will be inevitably called on addressing the sticking point of the phase out of fossil fuels along with the deployment of zero-carbon alternatives and the expansion of renewable energy.

What to expect: COP28 agenda items and high-stake negotiating topics

DECARBONIZATION

Fossil fuel phase out

End of fossil fuel subsidies

Triple global renewable capacity by 2030 and support deployment of other zero –carbon alternatives and solutions

CLIMATE FINANCE

Meet $100 billion pledge

Unlock trillions and private sector potential international financial institutions reform

Double financing to adaptation

LOSS AND DAMAGE

Decisions on the operationalization new funding arrangements and associated fund

ADAPTATION

Comprehensive framework for a structured approach to the global goal of adaptation

PEOPLE, LIVES AND LIVELIHOODS

Address climate vs food system challenges

Embed nature-positive investments in national strategies

ARTICLE 6

Decision on the operationalization of Art.6.4 for the creation of an integrated global carbon market

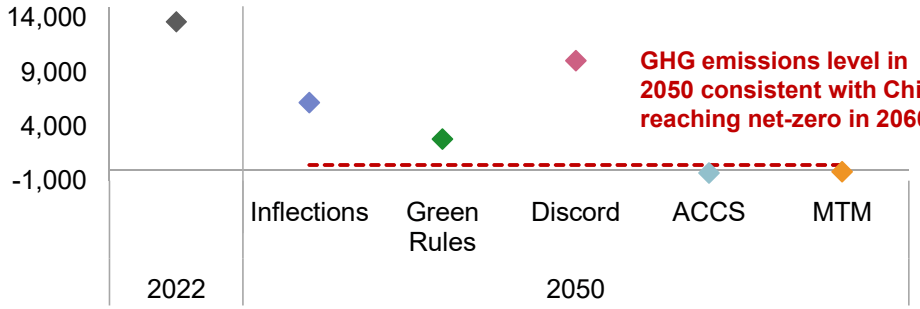
More contentious

Less contentious

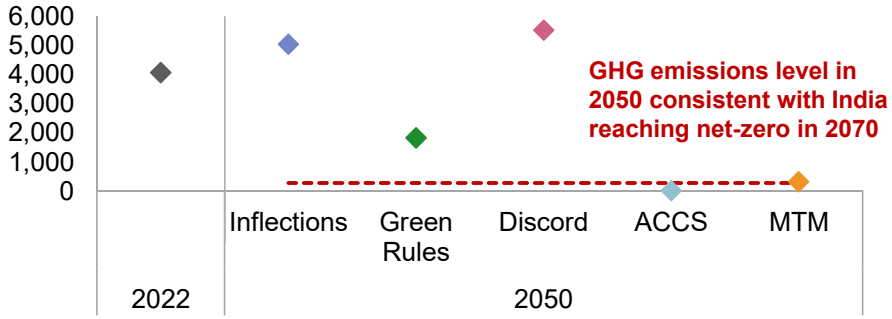
Source: S&P Global Commodity Insights

But pledges may not be enough. Under the three core scenarios of Inflections, Green Rules and Discord, no market reaches or is on target for net-zero by 2050

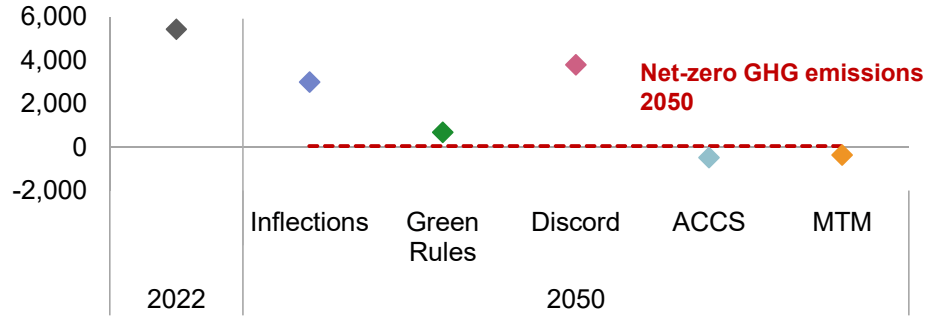
China GHG emissions, 2022 and 2050 ($MtCO_2e$)



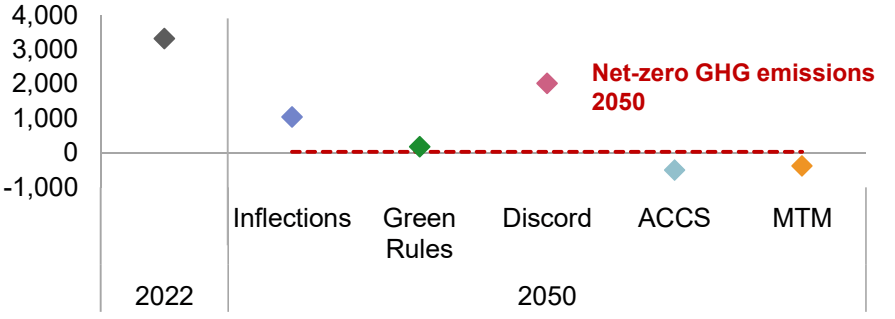
India GHG emissions, 2022 and 2050 ($MtCO_2e$)



US GHG emissions, 2022 and 2050 ($MtCO_2e$)



EU total GHG emissions, 2022 and 2050 ($MtCO_2e$)



Data compiled July 2023

Note:Commodity Insights considers a country or region to have effectively reached "net-zero" emissions once GHG emissions have fallen to less than 1% of their 2022 level and remain at that level over the course of a year.

Source: S&P Global Commodity Insights