Latin America Energy Outlook

Overview: Brazil

International Energy Agency

World Energy Outlook Special Report

INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 31 member countries, 13 association countries and beyond.

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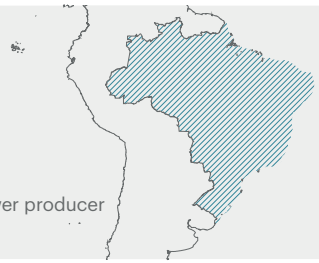
Brazil

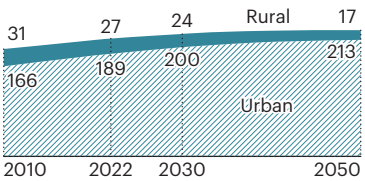


LARGEST
economy in Latin America and the Caribbean

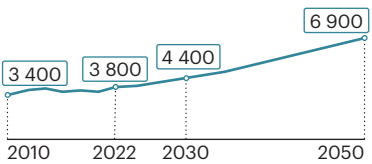
2ND
largest biofuels producer in the world

2ND
largest hydropower producer in the world

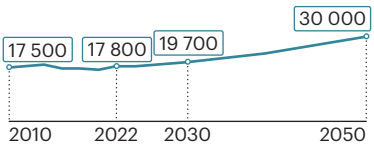
Population
Million people



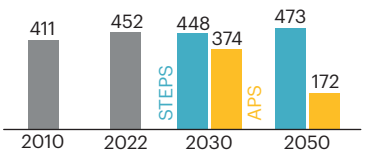
GDP
Billion USD (2022, PPP)



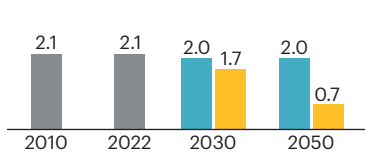
GDP per capita
USD per capita (2022, PPP)



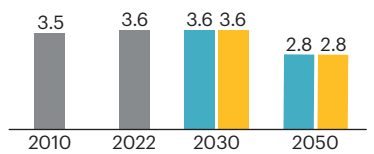
CO_2 emissions
Mt CO_2



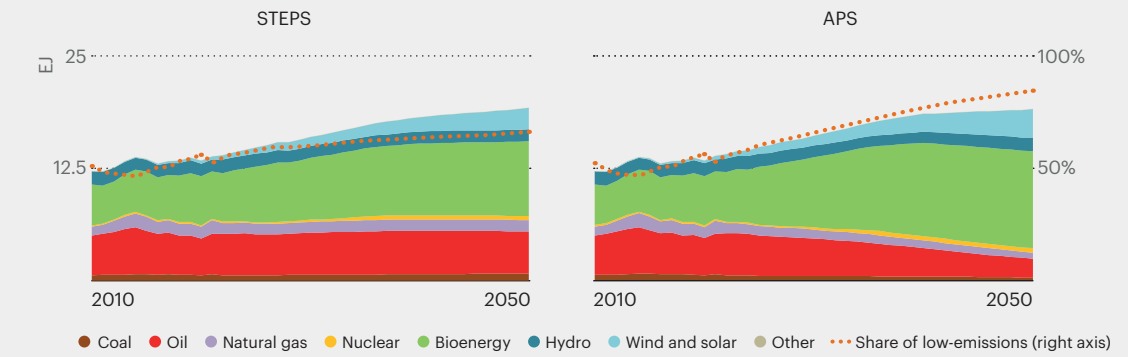
CO_2 emissions per capita
t CO_2/capita



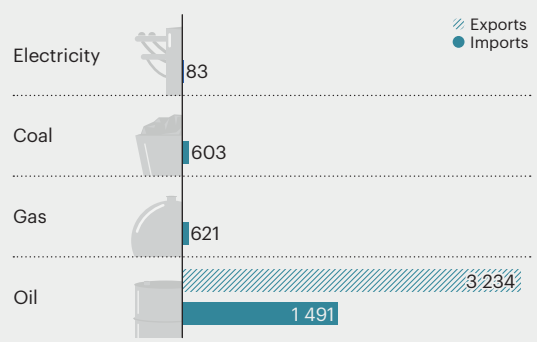
Energy intensity
GJ per thousand USD (2022, PPP)



Primary energy supply and share of low-emissions sources



Trade of main energy products (2021)
PJ



Trade of non-energy products (2021)
Billion USD

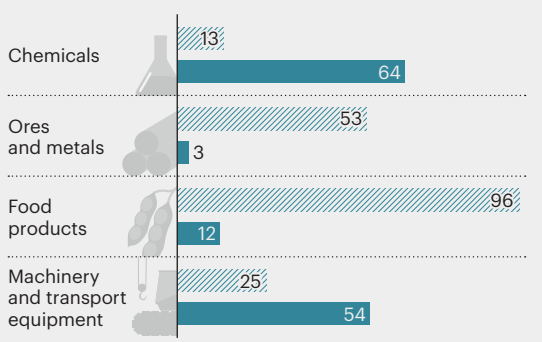


Table 1 ▷ **Recent policy developments in Brazil**

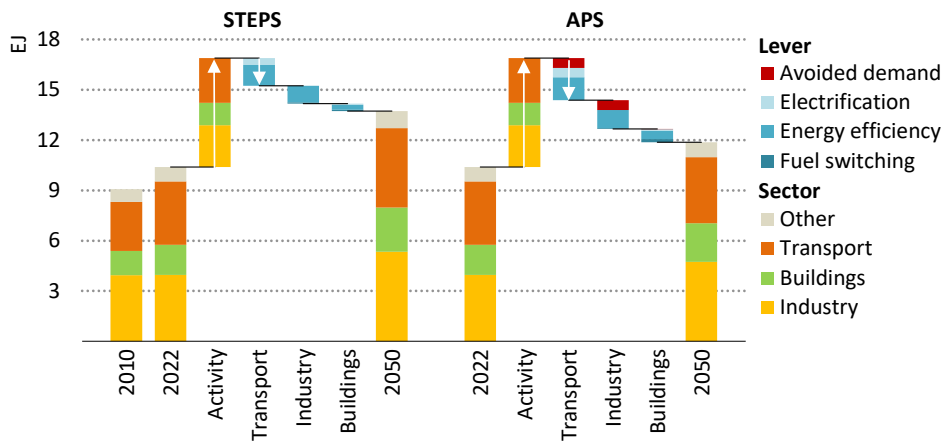
	Policy	Publication year
Economy-wide measures	• NDC: 50% reduction of GHG emissions by 2030 from 2005 levels.	2022
	• Net zero emissions by 2050 target.	2022
	• Guidelines for a National Strategy for Climate Neutrality: between 45% and 50% of renewable energy in the national energy mix by 2030.	2022
	• Decennial Energy Expansion Plan 2032 (PDEE 2032) (indicative).	2023
Just transition policies	• Amazon Decarbonisation Programme: Reduce diesel power plant generation in the Amazon region by 40% by 2026, USD 1 billion.	2023
	• *Luz para todos* programme (initially launched in 2003): To bring electricity to 500 000 families that lack access by 2026.	2023
	• *Novo PAC*: USD 105 billion for the energy transition and energy security.	2023
AFOLU	• Action Plan: Zero deforestation by 2030 (5th phase).	2023
Environment and water resources	• *Metano Zero* programme: 25 new biomethane plants (2.3 mcm/d in 2027).	2022
	• Hydropower Reservoir Recovery Plan: Improve water management.	2022
Hydrogen	• 2023-2025 Working Plan of the National Hydrogen Programme.	2023
Power	• Revised subsidies for distributed generation (net billing scheme).	2022
Industry	• Energy Efficiency Programme: Public funds (about USD 117 million in 2020).	2020
Transport	• RenovaBio Programme - National Biofuel Policy.	2017
	• National Bio Kerosene Programme: Promotes R&D for biofuel for aviation.	2021
	• *Combustível do Futuro* programme: Targets 30% bioethanol and 15% biodiesel blending rate.	2021

Table 2 ▷ **Major infrastructure projects in Brazil**

	Project	Size	Date online	Status	Description
Oil and gas	Pre-salt (Etapa 3 & 4)	+0.5 mb/d (target 2.2 mb/d)	2027	🟢	Oil and gas
Hydrogen/ ammonia	Port of Pecem - Base One	600 kt H_2/year (production)	2025	🟡	Dedicated hydro
	Unigel, phase I	10 kt H_2/year (capacity)	2023	🟢	Dedicated wind
Nuclear	Angra 3	1 405 MWe	2028	🟢	Nuclear reactor
CCUS	Lucas do Rio Verde, FS Bioenergia	0.4 Mt CO_2/year	2030	🟡	BECCS
Transmission, interconnections	Graça Aranha–Silvânia (HVDC)	800 kV	2028	🟡	1 440 km

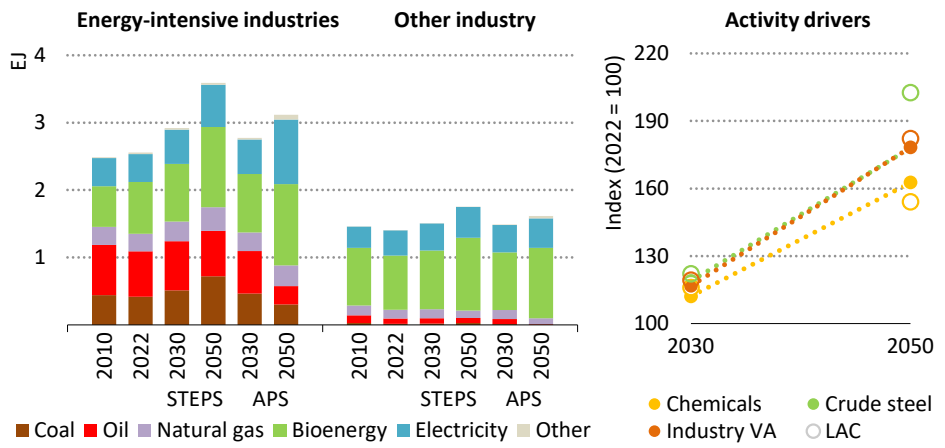
Status 🟡 Feasibility study 🟢 Under construction

Figure 1 ▷ **Final energy consumption by scenario in Brazil**



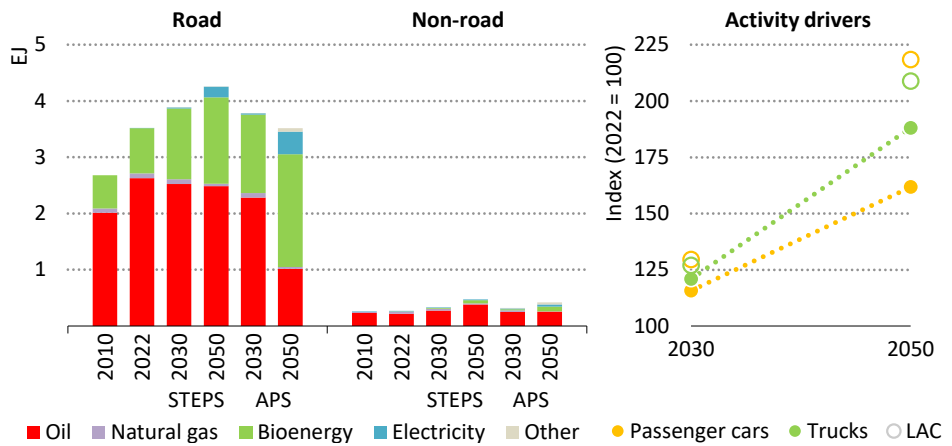
- Today, transport and industry account for 75% of final energy consumption in Brazil.
- In the STEPS, total final consumption increases over 30% by 2050, with the most growth coming from industry. In the APS, energy efficiency gains and avoided demand mean that final consumption grows nearly 15% less than in the STEPS.

Figure 2 ▷ **Fuel consumption in industry by type and scenario in Brazil**



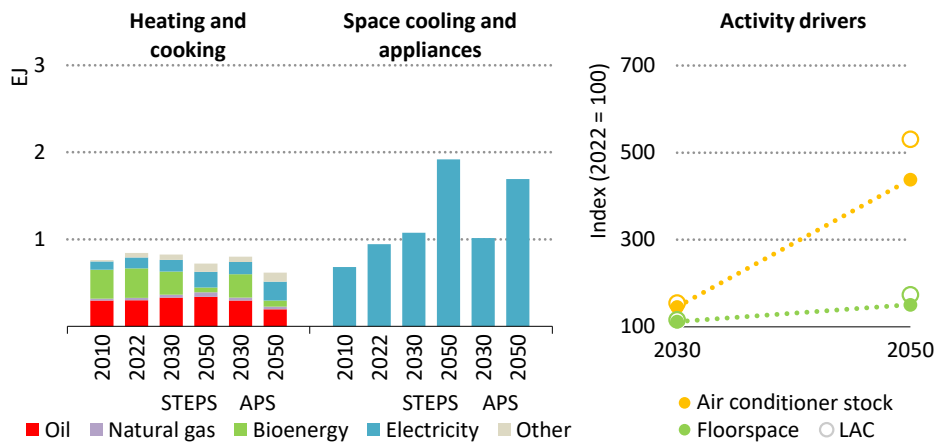
- Brazil is the region's industry heavyweight, especially for ethylene, steel and aluminium production. Energy-intensive industries make up 65% of total industry energy demand.
- Bioenergy meets 40% of industrial energy consumption today: by 2050, its share expands to 42% in the STEPS and nearly 50% in the APS.

Figure 3 ▷ **Fuel consumption in transport by type and scenario in Brazil**



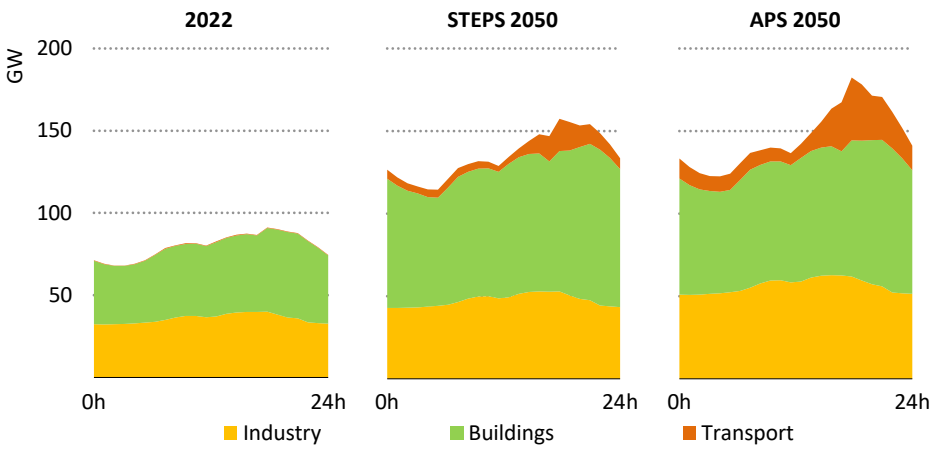
- Today, oil accounts for 75% of energy consumption in transport. The share of oil declines in both scenarios, with bioenergy being the dominant fuel in the APS by the early 2040s.
- By 2050, road freight activity increases by around 90% from today's level; passenger cars activity increases by over 60%.

Figure 4 ▷ **Fuel consumption in buildings by type and scenario in Brazil**



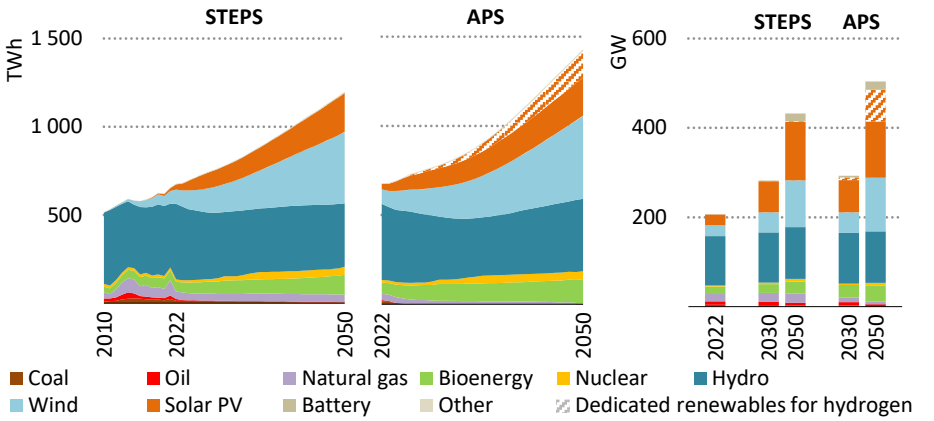
- Heating and cooking needs currently are met by bioenergy (40%) and oil (36%). Higher access to clean cooking and electrification reduces the traditional use of biomass.
- Electricity demand for cooling almost triples by 2050 in the STEPS. In the APS, minimum energy performance standards and more efficient buildings cut this growth by 35%.

Figure 5 ▷ **Average electricity daily load profile by scenario in Brazil**



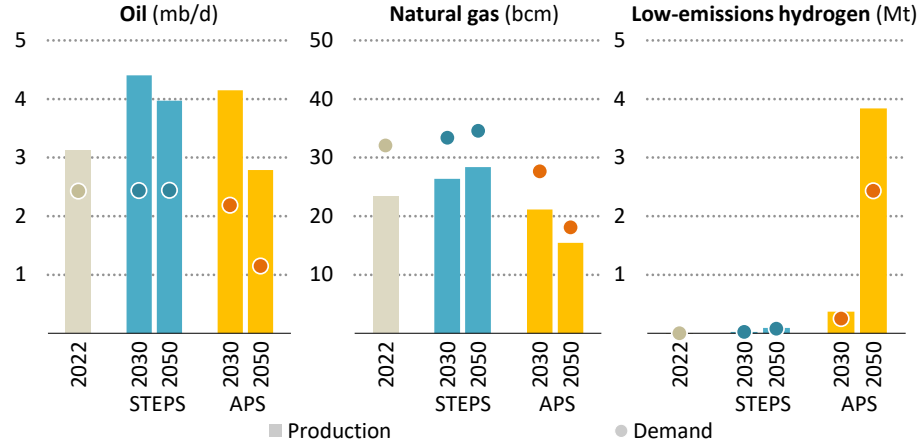
- Peak electricity demand rises by more than 75% in the STEPS by 2050 and more than doubles in the APS, where peak increases much faster than average electricity demand.
- The increase in daily peak demand is mainly driven by higher use of electricity in buildings. Demand-response and load shifting measures could flatten the load curve.

Figure 6 ▷ **Electricity generation and capacity by fuel and scenario in Brazil**



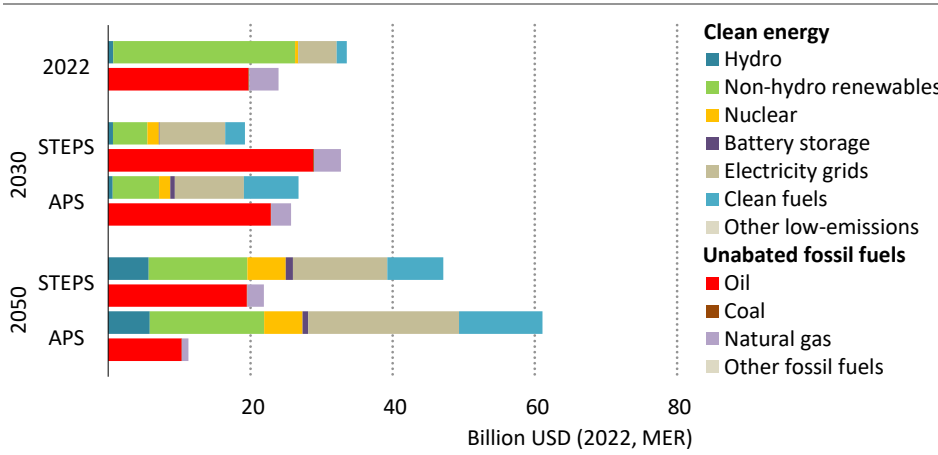
- Hydropower dominates the current power mix, but its expansion in both scenarios is constrained by inherent resource limits and social acceptance concerns.
- Wind and solar PV meet nearly all electricity demand growth. In the APS, they account for nearly 60% of electricity generation in 2050 compared with 17% today.

Figure 7 ▷ **Fuel demand and production by scenario in Brazil**



- Oil production in the STEPS increases from 3 mb/d to just over 4 mb/d by 2030; natural gas production grows in response to rising demand in the STEPS but declines in the APS.
- In the APS, hydrogen production reaches 4 Mt in 2050 boosted by the national strategy.

Figure 8 ▷ **Annual investment in energy supply by type and scenario in Brazil**



- Investment in clean energy supply accounts for 1.4% of Brazil's GDP in the STEPS in 2050 and 1.8% in the APS.
- By 2050, investment in clean energy supply is more than double the level of investment for fossil fuels in the STEPS and more than five-times their level in the APS.

Notes

Units

Area	ha	hectares
Distance	km	kilometre
Emissions	Gt CO_2	gigatonnes of carbon dioxide
	Mt CO_2	million tonnes of carbon dioxide
	Mt CO_2-eq	million tonnes of carbon-dioxide equivalent (using 100-year global warming potentials for different greenhouse gases)
	t CO_2-eq	tonnes of carbon-dioxide equivalent
Energy	EJ	exajoule (1 joule x 10^{18})
	PJ	petajoule (1 joule x 10^{15})
	TWh	terawatt-hour
	Tcal	teracalorie (1 calorie x 10^{12})
Gas	bcm	billion cubic metres
	bcm/d	billion cubic metres per day
	mcm/d	million cubic metres per day
Mass	kg	kilogramme
	kt	kilotonnes (1 tonne = 1 000 kg)
Monetary	USD million	1 US dollar x 10^6
	USD billion	1 US dollar x 10^9
Oil	mb/d	million barrels per day
	b/d	barrels per day
Power	GW	gigawatt
	MW	megawatt
	kV	kilovolt

Terms

Activity drivers for industry include production levels (Mt) and value added (USD 2022, PPP); for transport, vehicle-kilometres (km) for passenger cars and tonne-km for trucks; for buildings, air conditioning (million units) and floorspace (million square metres). The activity numbers presented correspond to the Stated Policies Scenario (STEPS) indexed on the 2022 value.

Bioenergy refers to bioenergy and waste.

Clean fuels refers to biofuels, hydrogen and hydrogen-related fuels.

Daily average electricity load profiles do not factor in electricity demand generated by dedicated renewable sources connected to electrolysers, and they also do not consider the influence of demand-response mechanisms.

Energy-intensive industries include chemicals, iron and steel, non-metallic minerals (cement and other), non-ferrous metals (aluminium and other) and pulp, paper and printing.

Heating and cooking in buildings refers to energy demand for space and water heating, and cooking.

Hydrogen demand excludes both hydrogen exports and the hydrogen used for producing hydrogen-based fuels which are exported.

Investment data are presented in real terms in year-2022 US dollars.

Large-scale CCUS projects refer only to facilities with a planned capture capacity higher than 100 000 tonnes of CO_2 per year.

Low-emissions hydrogen projects considered are those with an announced capacity for 2030.

Non-road transport includes rail, domestic navigation, domestic aviation, pipeline and other non-specified transport.

Other for power generation and capacity refers to geothermal, concentrated solar power, marine, non-renewable waste and other non-specified sources.

Other for final consumption in sectors refers to non-renewable waste, hydrogen, solar thermal and geothermal.

Other in a sector category refers to agriculture and other non-energy uses.

Other fossil fuels in energy supply investment refer to non-renewable waste and other supply sources.

Other fuel shifts include bioenergy, nuclear, solar thermal, geothermal and natural gas.

Other industry refers to the construction, food and tobacco, machinery, mining and quarrying, textile and leather, transport equipment, wood industry branches and remaining industry.

Other low-emissions in energy supply investment include heat pumps, CCUS, electricity generation from hydrogen, electricity generation from ammonia and direct air capture.

Road transport includes six vehicle categories (passenger cars, buses, two/three-wheelers, light-duty vans and trucks, and medium and heavy trucks).

SDG 7 refers to Sustainable Development Goal (SDG) 7: "ensure access to affordable, reliable, sustainable and modern energy for all", adopted by the United Nations in 2015.

Solar potential data is calculated based on the average potential at national level assessed in kilowatt-hour per kilowatt peak per day (2020).

Total final consumption includes consumption by the various end-use sectors (industry, transport, buildings, agriculture, and other non- energy use). It excludes international marine and aviation bunkers, except at world level where it is included in the transport sector.

Acronyms

Scenarios: **STEPS** = Stated Policies Scenario; **APS** = Announced Pledges Scenario.

AFOLU	agriculture, forestry and other land use
BECCS	bioenergy with carbon capture and storage
CCUS	carbon capture, utilisation and storage
CNG	compressed natural gas
EV	electric vehicle
GDP	gross domestic product
GHG	greenhouse gases
H_2	hydrogen
HVDC	high voltage direct current
ICE	internal combustion engine
MEPS	minimum energy performance standards
MER	market exchange rate
NDC	Nationally Determined Contribution
PPP	purchasing power parity
PV	photovoltaics
SDG	Sustainable Development Goals
VA	value added
ZEV	zero emissions vehicle

The policy tables include existing policies and announcements as of the end of September 2023. The same applies to the tables of existing and announced projects.

The IEA does not use colours to refer to the various hydrogen production routes. However, when referring to specific policy announcements, programmes, regulations and projects where an authority uses colour to define a hydrogen production route, e.g. green hydrogen, we use that terminology to report developments in this review.

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