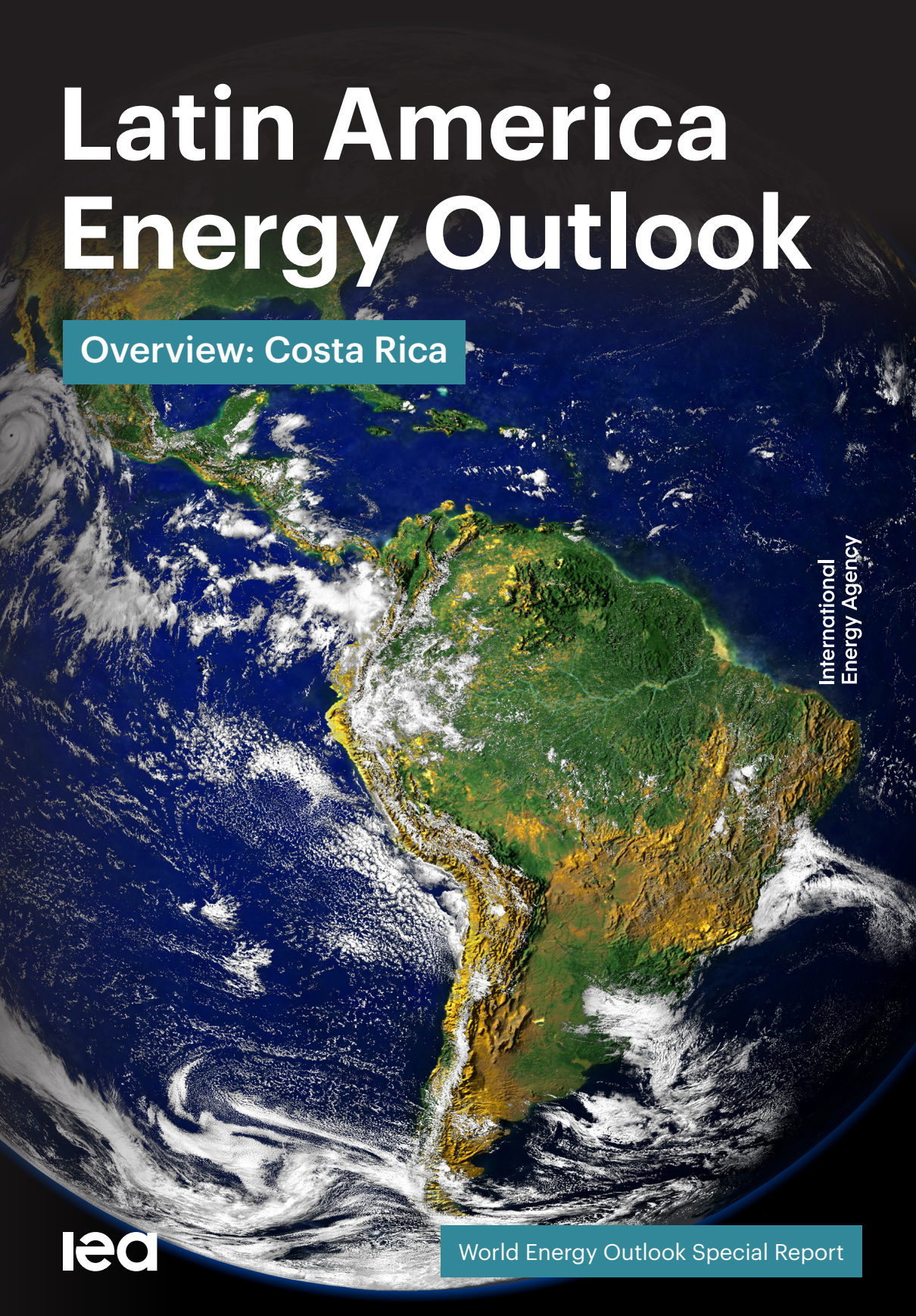
Latin America Energy Outlook

Overview: Costa Rica



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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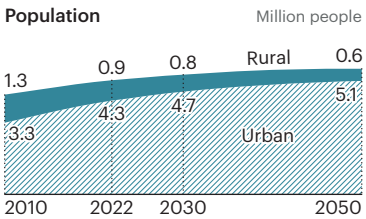
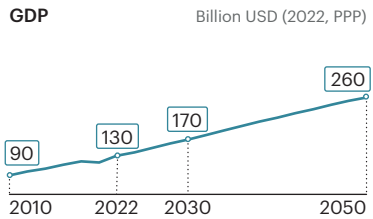
Costa Rica

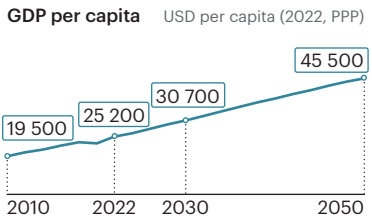
3RD
largest producer of geothermal energy in Latin America and the Caribbean

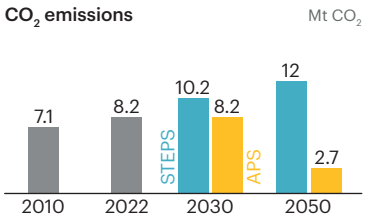
100%
share of renewables in electricity generation

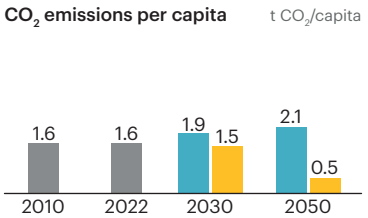
HIGHEST
electrification in buildings in Latin America and the Caribbean

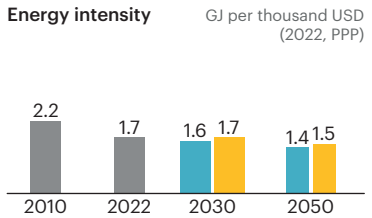




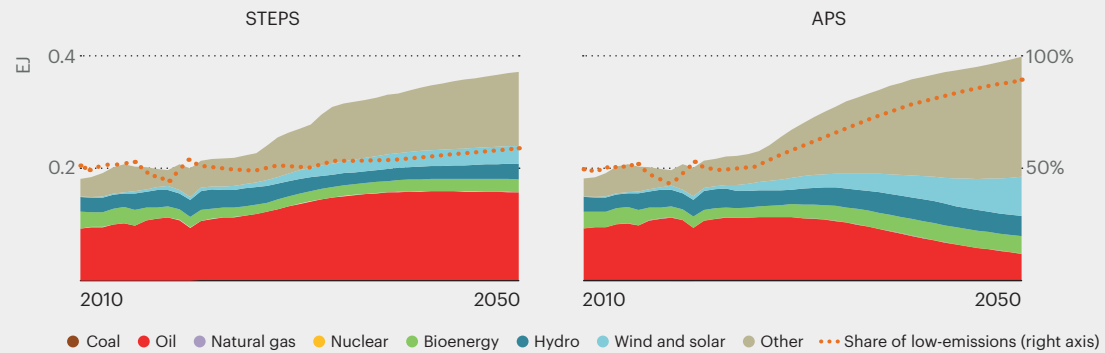




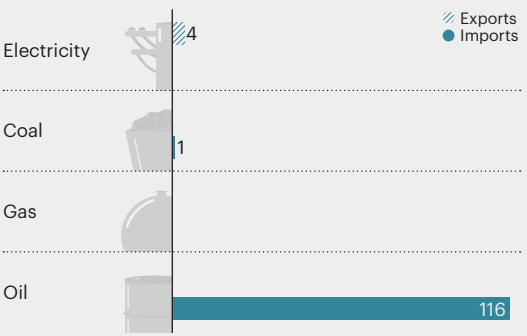




Primary energy supply and share of low-emissions sources



Trade of main energy products (2021)



Trade of non-energy products (2021)

Table 1 ▷ Recent policy developments in Costa Rica

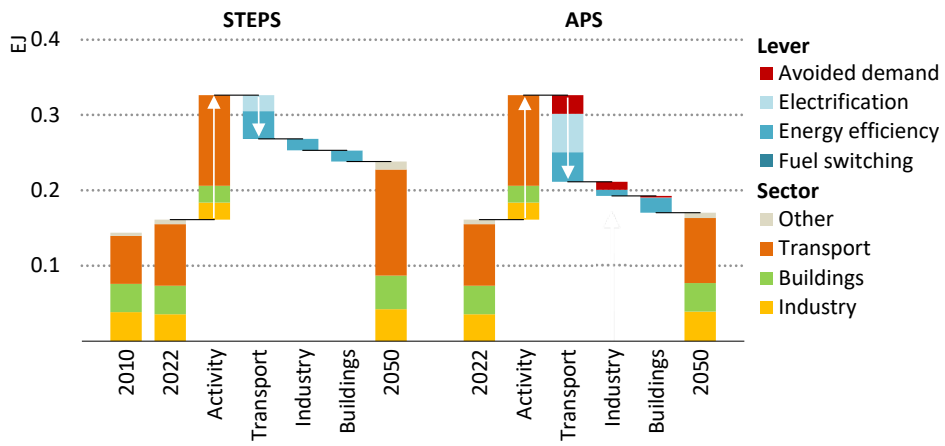
	Policy	Publication year
Economy-wide measures	• NDC (revised in 2020): Commitment to a maximum of 9.11 Mt CO_2-eq of net emissions by 2030 and to reach net zero emissions by 2050.	2020
	• Net zero emissions target (target reiterated in NDC in 2020): General commitment to net zero emissions goal by 2050 in its National Decarbonisation Plan 2018-2050.	2019
	• National Adaptation Plan (2022-2026): Roadmap to strengthen resilience to the impacts of climate change.	2022
AFOLU	• Implementation Plan for the National REDD+ Strategy: Increase forest cover by recovering 254 923 hectares of agricultural land by 2025.	2017
Oil and gas production	• Decree No. 41578: extends the national moratorium on activities related to oil exploration and exploitation from 2021 to 2050.	2019
Hydrogen	• National Hydrogen Strategy 2022-2050. Three key strategies: use green hydrogen to decarbonise the transport and industry sectors; develop a technology hub; and foster the conditions to facilitate hydrogen exports.	2022
Power	• Generation Expansion Plan 2022-2040: Install 1 775 MW of solar PV and wind capacity.	2023
Industry	• Decarbonisation National Plan 2018-2050: Industry to shift energy sources to reduce emissions while increasing activity.	2019
Transport	• Decarbonisation National Plan 2018-2050: 60% of the light-duty vehicle fleet and 100% of the public transport fleet will be zero emissions, with electricity as the main power source.	2019
	• *Plan Nacional de Desarrollo en Inversión Pública 2023-2026*: *Rogelio Fernández Güell*: Implements a blending target of 8% of renewable components in fossil fuels sold in the domestic market.	2022
Buildings	• Agreement 09- MINAE. Creates the National Environmental and Energy Efficiency Labelling Programme of Costa Rica and the Technical Committee for Environmental and Energy Labelling.	2023

Table 2 ▷ Major infrastructure projects in Costa Rica

	Project	Size	Date online	Status	Description
Hydrogen/ammonia	Costa Rica Transportation Ecosystem Project	0.2 kt H_2/year (capacity)	2025	●	Dedicated renewables
Hydropower	Fourth Cliff	61 MW	2029	●	Hydropower
Geothermal	Borinquen I	55 MW	2027	●	Geothermal
	Borinquen II	55 MW	2031	●	Geothermal

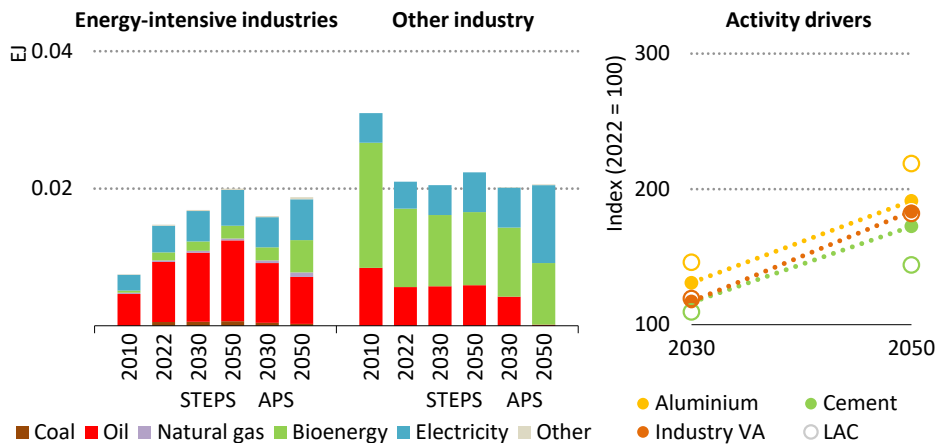
Status ● Feasibility study ● Under construction

Figure 1 ▷ **Final energy consumption by scenario in Costa Rica**



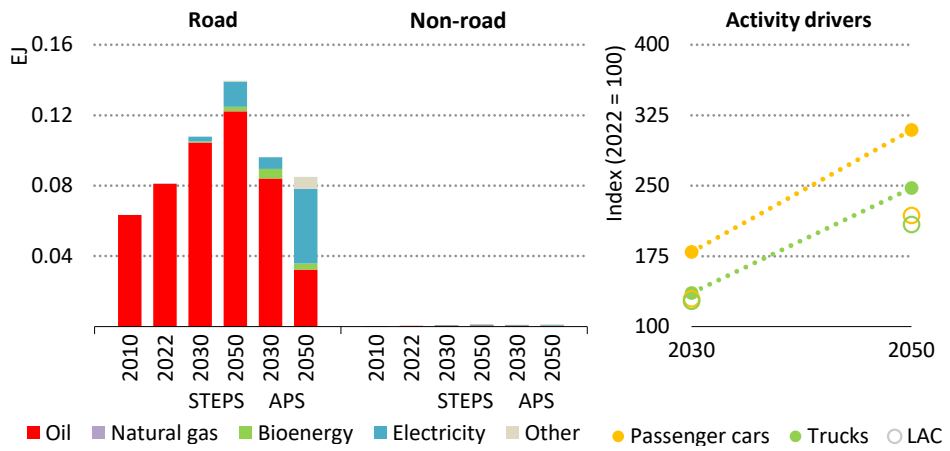
- Today, transport alone accounts for more than half of final energy consumption.
- In the STEPS, total final energy consumption increases by 50% by 2050, mainly driven by increased transport demand. In the APS, final energy consumption increases by only 6% thanks in part to accelerated electrification that tempers 33% of the increase in activity.

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



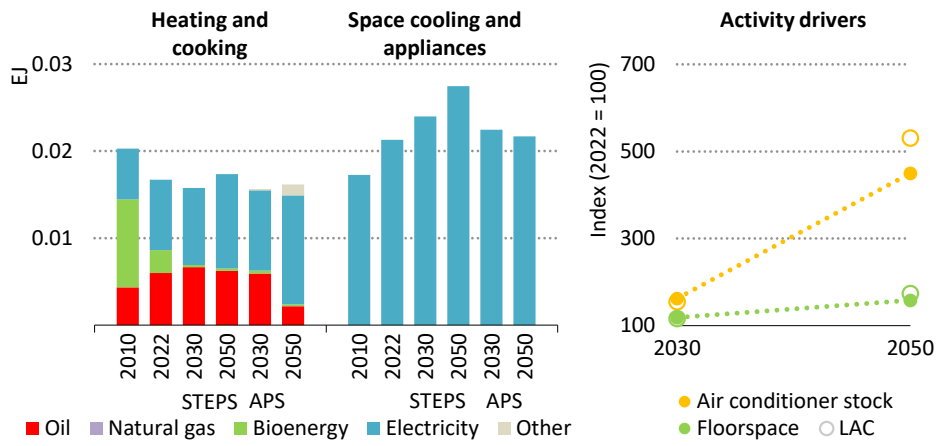
- Energy-intensive industries account for over 40% of energy demand in industry today.
- In the APS, bioenergy continues to play a key role, and electricity use rises as industrial heat pumps supply low-temperature heat. Oil use in industry is halved by 2050 compared to today.

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



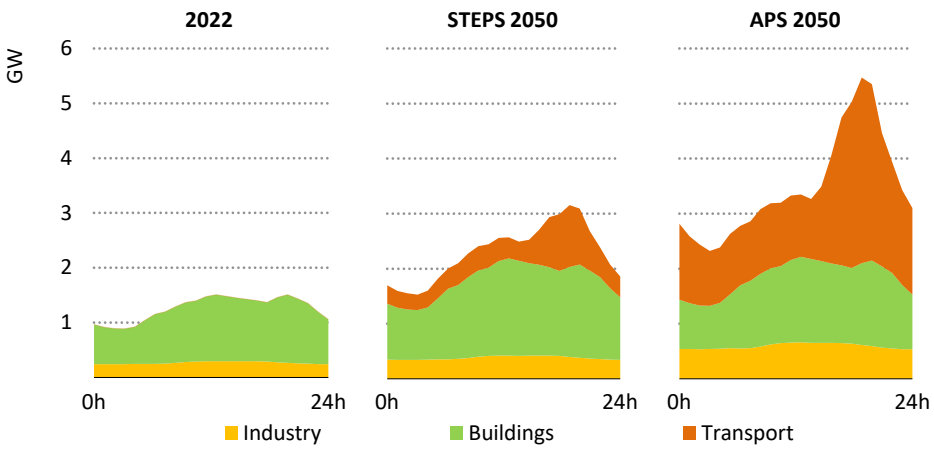
- The transport sector is the largest source of energy-related CO_2 emissions in Costa Rica. Electrification plays a key role to decarbonise transport in future years.
- In the APS, electricity is 50% of consumption in 2050, curbing energy demand growth.

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



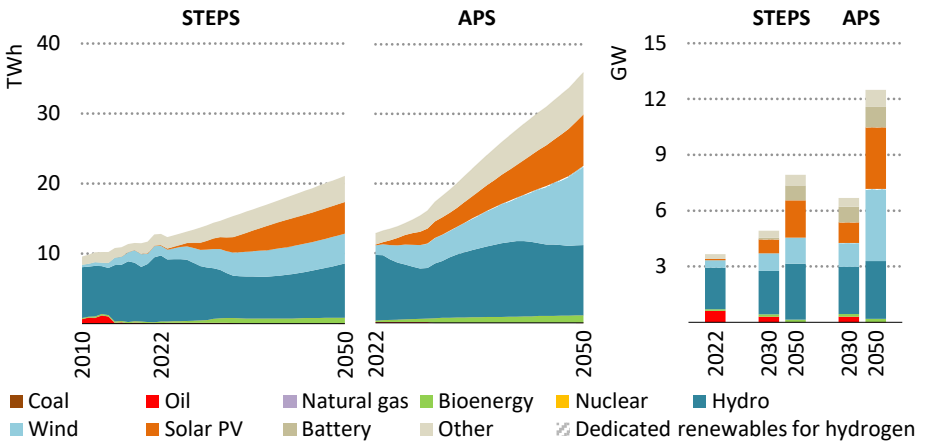
- Most cooking needs today are met by electricity. In the APS, the share of oil in heating and cooking declines as the share of electricity rises 1.4-times from its 2022 level.
- In the STEPS, the increase in demand for appliances and space cooling is responsible for 60% of the increase in electricity consumption in the buildings sector.

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



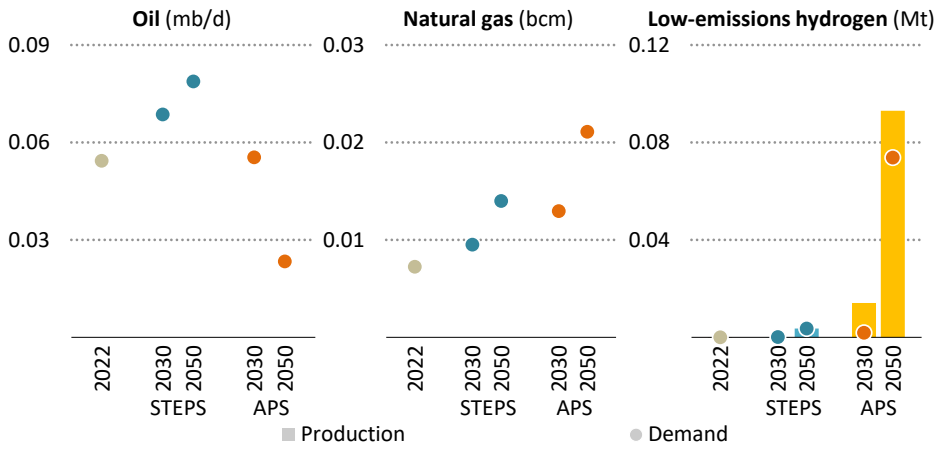
- Peak electricity demand doubles by 2050 from current levels in the STEPS and increases more than 3.5-times in the APS. It rises over 80% more than average electricity demand.
- Electricity for transport is the main driver of the increase in electricity peak demand.

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



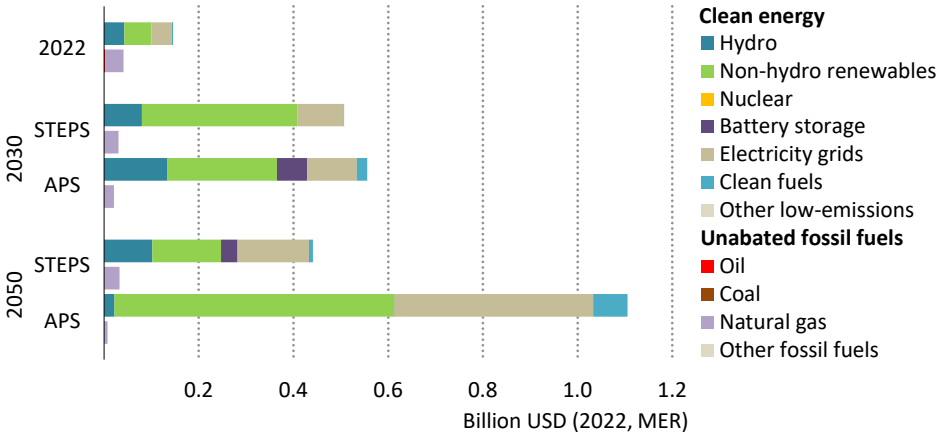
- Hydropower dominates the current power mix. It continues to play a key role to 2050 in both scenarios. Geothermal plays an important role both today and in the future.
- Wind and solar PV meet most of the electricity demand increase in both scenarios. In the APS, their share of total generation rises from 10% today to more than 50% in 2050.

Figure 7 ▷ **Fuel demand and production by scenario in Costa Rica**



- After 2030, demand for oil plateaus in the STEPS and decreases significantly in the APS.
- Low-emissions hydrogen production and demand is around 0.1 Mt by 2050 in the APS.

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



- Investment in clean energy supply accounts for 0.3% of GDP in Costa Rica in the STEPS in 2050 and 0.8% in the APS.
- In the APS, investment in clean energy supply increases fourfold by 2030 from current levels, and over USD 0.6 billion is invested in renewables in 2050.

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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