

Overview

Peru's Sistema Eléctrico Interconectado Nacional ([SEIN](#)) integrates 97% of total electricity generated in the country with the balance attributed to isolated systems¹. [OSINERGMIN](#) (Organismo Supervisor de la Inversión en Energía y Minería) is responsible for regulating tariffs and supervision of utility providers.

Peru's annual grid emission factor has consistently averaged between 0.2 and 0.3 in the past decade, with hydro contributing 48-60% of the country's total electricity generation. The balance is mostly from natural gas, notably from Camisea which began production in 2004 and accounted for 33-45% of the country's total.

National targets for electricity emissions

Non-conventional renewable power (NCR - solar, wind and biomass) has increased from 1.5% of country's total in 2014 to 9.2% in 2024. The Supreme Decree No 003-2022-MINAM (2022) sets a target for this number to rise to 20% by 2030. The latest COES Transmission plan (2025-2034) only projects an increase to 11% in 2026-28 with no specified numbers beyond this, including incremental electricity generation of 0.8TWh from solar projects and 1.6TWh from wind projects.

A recent study by [IFC](#) in collaboration with third party consulting firms projects non-conventional renewables will represent 45% of the installed capacity by 2050, with one of the key priorities for the country being "inclusive electrification" as 30% of the rural populations in the Amazon lacks access to electricity.

Hydropower is present in most regions; wind and solar focused in Ica and Moquegua

In 2024, all 25 regions in Peru generated electricity from fossil fuels (predominantly natural gas) with Lima being the most reliant (20TWh).

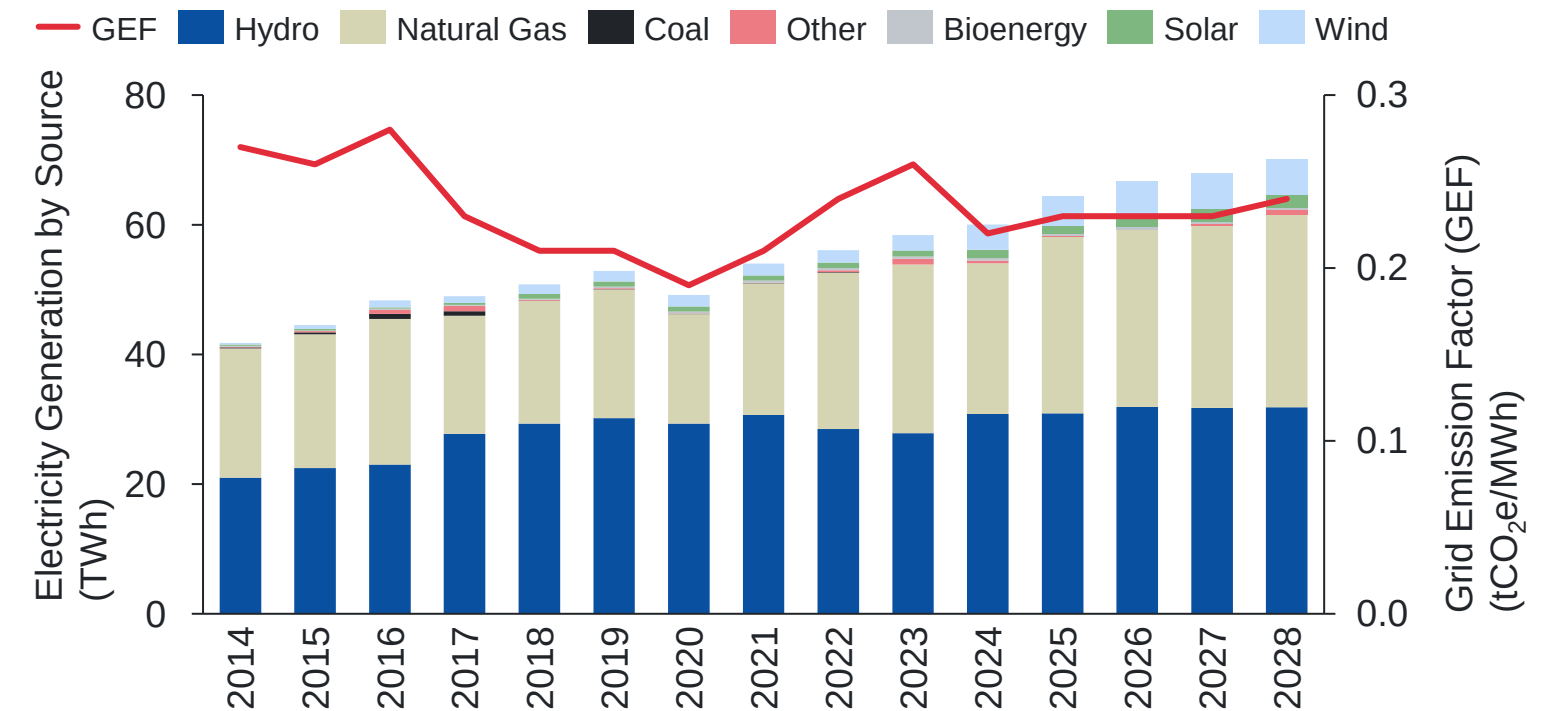
Hydro electricity was produced by 19 regions with Huancavelica (9TWh) and Lima (7TWh) being most prominent. Solar and wind power was generated 10 regions although only two regions produced more than 1TWh; Ica supplied 3TWh of wind, Moquegua 1TWh of solar.

Pipeline of renewable power projects extensive, but what is a realistic development timeframe?

According to OSINERGMIN, as of November 2024, the power plant project portfolio was made up of 61 initiatives in various stages of development and 10 under construction. The last group collectively represent 1,200 MW of capacity, consisting of 6 hydropower projects (290MW), 3 solar (841MW) and 1 biogas (69MW). It should be noted that of the 10 under construction, 5 were in progress (including all 3 solar projects) while 4 were delayed and 1 suspended. The 3 solar projects in construction could generate 1.4TWh of incremental electricity, which is almost double the projected 0.8TWh in the latest transmission plan. Wind power is projected to be 5.5TWh by 2027 (3.9TWh in 2024).

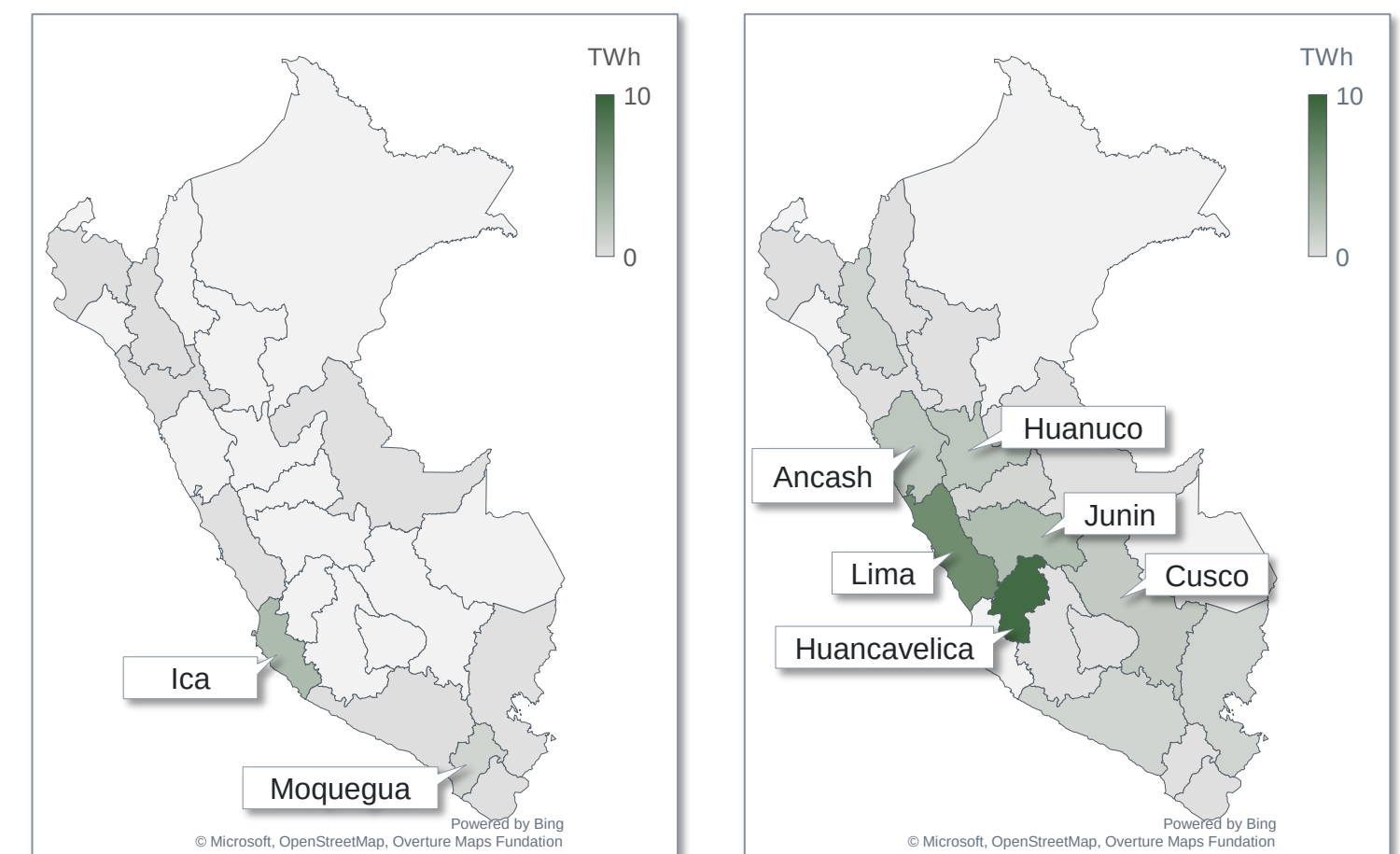
The Minister of Energy and Mines, Rómulo Mucho, stated recently that there is a much larger [potential](#) for the country with up to 70GW of hydropower, 937GW solar, 20GW wind and 3GW geothermal as indicated by technical studies.

Electricity Generation by Source in the baseline scenario, 2014 to 2030



Source: COES – Informe de la Operación Anual Del SEIN (2024), Skarn Associates

Electricity generation in 2024 from solar and wind (left) and hydropower (right)



Source: COES – Informe de la Operación Anual Del SEIN (2024), Skarn Associates

Marginal costs determined by availability of hydro reserves and subsidised natural gas

As is typical for power generation from hydro, there is monthly variation in electricity generated determined by the availability of reserves in the respective basins. Depending on the supply of main generational sources (i.e. hydro and natural gas), it may be necessary to force additional generation from diesel which is a more expensive energy source in Peru.

In 2024, variation of marginal cost by month was not significant, with the highest recorded in June at \$41/MWh and lowest in December at \$23/MWh. This was more notable in 2023 with costs peaking at \$180/MW in September due to scheduled maintenance of Mantaro and Chaglla hydro plants compared with an annual low of \$27/MWh in December.

Reliance on hydro is a concern as water levels have been at risk with [WRI Aqueduct](#) projecting water stress levels to remain extremely high in the coming decades. Aside from power generation risks, water management in general is a challenge in Peru with climate varying from tropical in the north to desert in the south. Mine operations vary in size but often work in the same water catchment areas with other activities resulting in water-related permitting challenges for projects such as Tia Maria and Conga. [Skarn Water](#) notes Peru is one of the countries with the highest copper production risk (8% of country total in 2018, 14% in 2025 and rising to 19% in 2029).

Natural gas produced from Camisea Lot 88 accounts for c. 40% of the country's total electricity generation, for which two price caps are in place – a lower one for power generation and a higher one for other uses. Consequently, the cost of natural gas from Camisea is artificially lower as is the cost of power generation from this source. While this enables a lower electricity price for the country, it also means the cost structure is subject to change if the subsidy is removed; furthermore, it can disadvantage other electricity projects (hydro, renewables) if their LCOE is significantly higher ([World Bank](#), 2022).

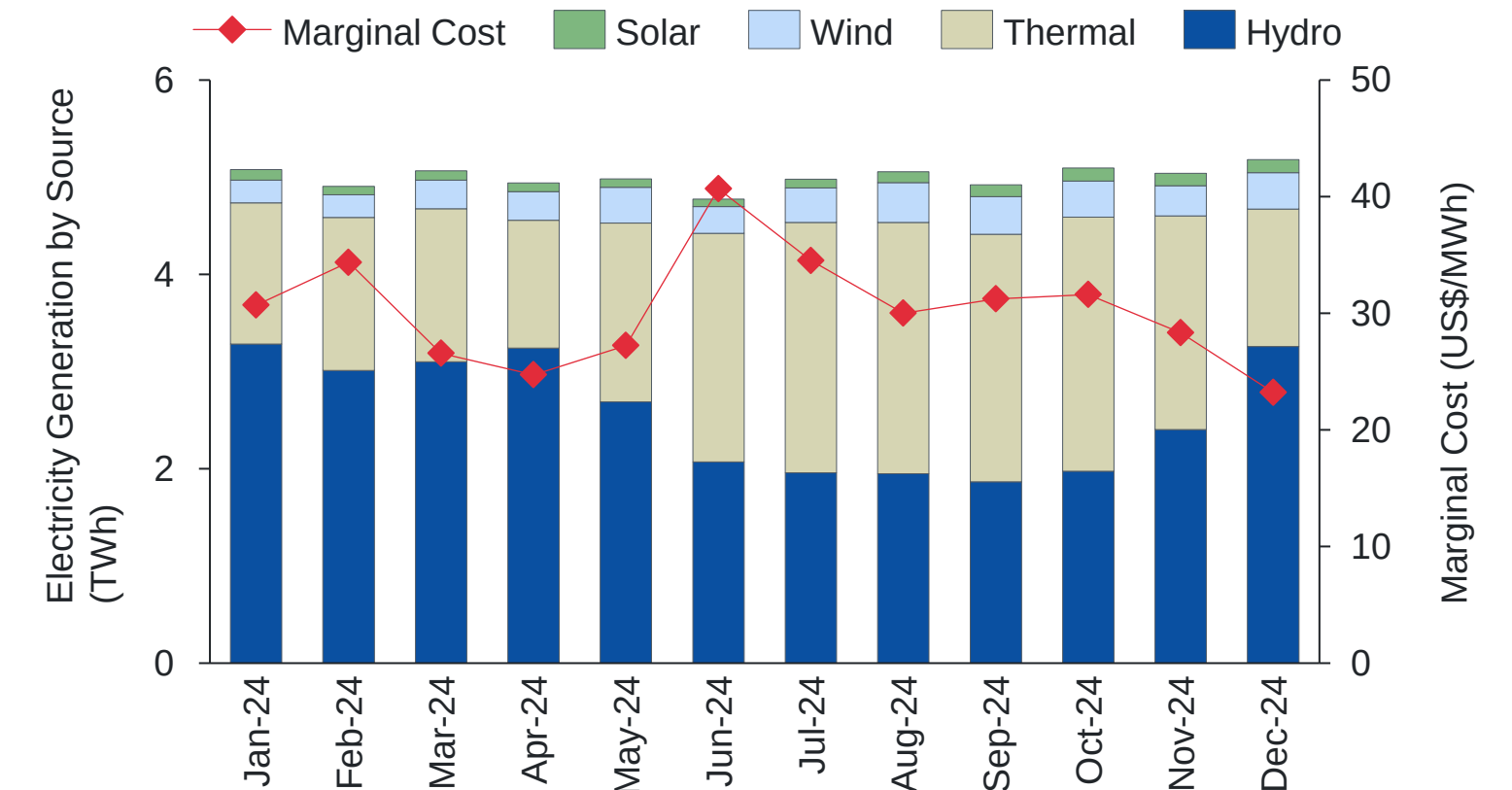
Leading utility providers

In 2024, the top 15 producers of electricity accounted for 79% of the country's total power generation. As illustrated above, the top five have mixed portfolios except for Electroperu whose asset basis is entirely hydro.

The top 3 producers of NCR energy (including biomass) are Engie, Enel and Orygen, followed by smaller producers such as Energia Renovable Del Sur and P.E. Hermanas which typically operate a portfolio entirely of renewable power generation. The next five producers of renewable power not shown in the chart include Energia Eolica, EMGE Junin, GEPSA, SINERSA and Santa Ana. Kallpa, the largest provider, also has a portfolio of NCR power projects which are expected to be commissioned in the next few years including three solar plants (Pampa Salinas I and II, 234 MW each, and Sunny III, 356.4 MW).

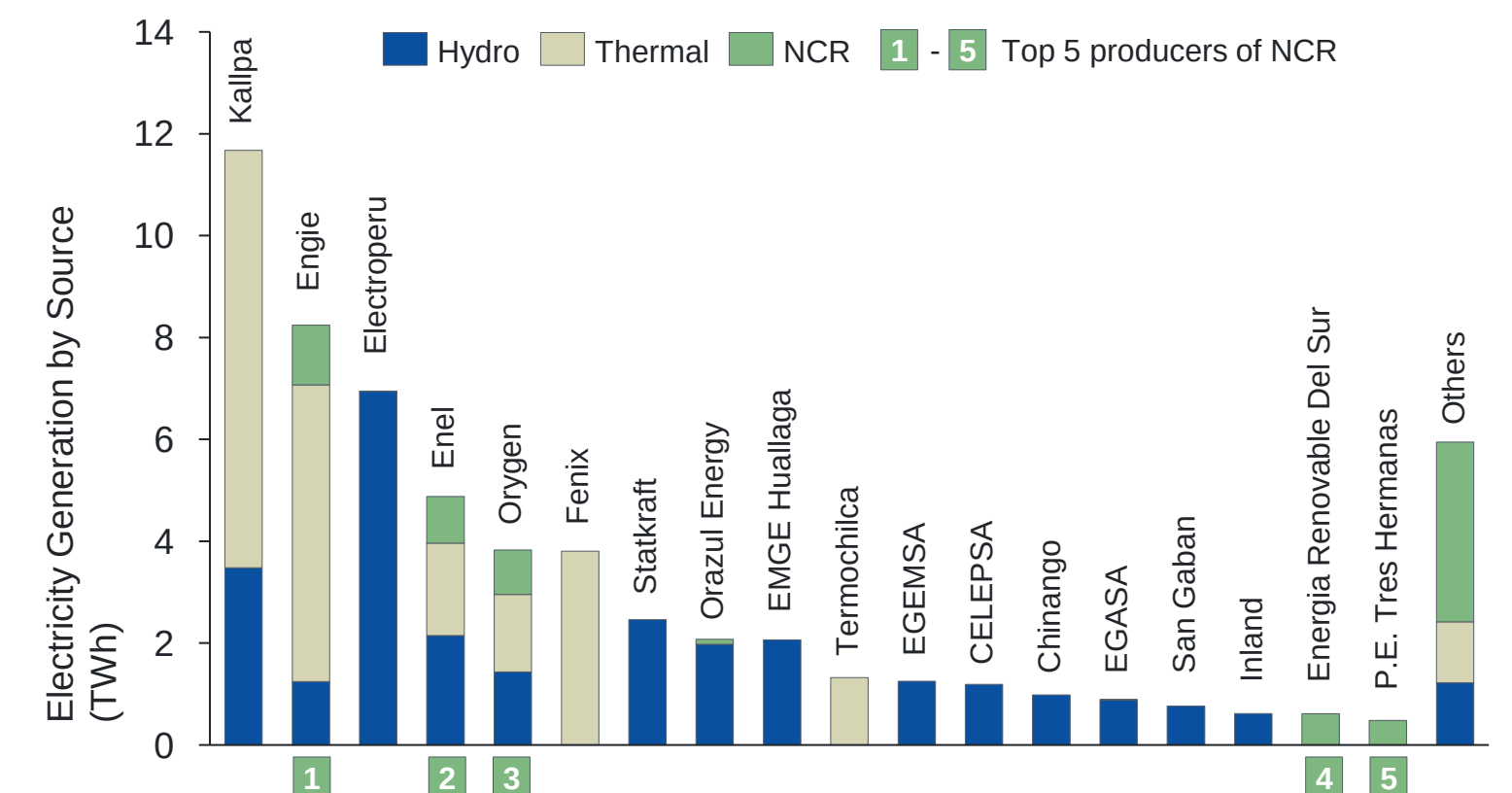
Two companies provide i-REC certification for power producers in Peru - the [Green Certificate Company](#) (GCC) and [AENOR Peru SAC](#).

Electricity Generation by Source by Month (2024)



Source: COES – Informe de la Operación Anual Del SEIN (2024)

Electricity Generation by Source by Company (2024)



Source: COES – Informe de la Operación Anual Del SEIN (2024)

Scope 2 emissions are low relative to Scope 1 emissions

Operations in Peru have benefited from a relatively low grid emission factor and Scope 2 emissions are relatively lower for mine sites in comparison to Scope 1 for open pit operations where diesel consumption by mine fleet remains the primary contributor of GHG emissions. This is particularly the case for copper, and gold to an extent as by-product of primary copper mines. Zinc operations on the other hand are typically smaller underground mines with much lower Scope 1 emissions, which in turn make Scope 2 emissions more relevant.

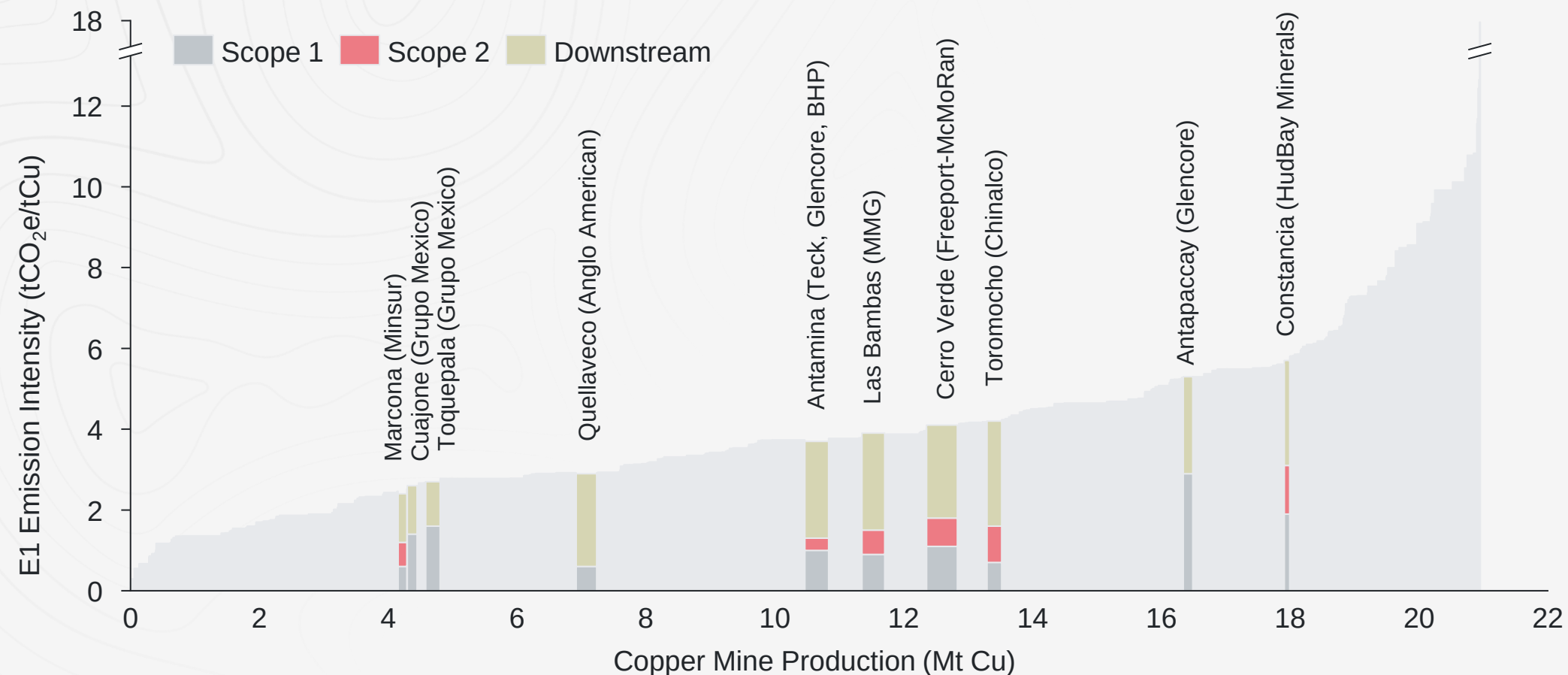
Recent renewable PPAs in the metals and mining sector

We have observed that for leading producers, every lever counts and notable assets in the country have secured renewable PPAs or i-RECs. Examples include Quellaveco (Anglo American / Engie Energy), Yanacocha (Newmont / Kallpa), Cerro Corona (Goldfields / Kallpa), Toquepala and Cuajone (Grupo Mexico / Kallpa) and Antapaccay (Glencore / Kallpa). Cerro Verde's renewable PPA comes into effect in 2026.

Currently, PPAs can have terms up to 15 years and firm prices, which cannot be modified without prior authorisation from OSINERGMIN.

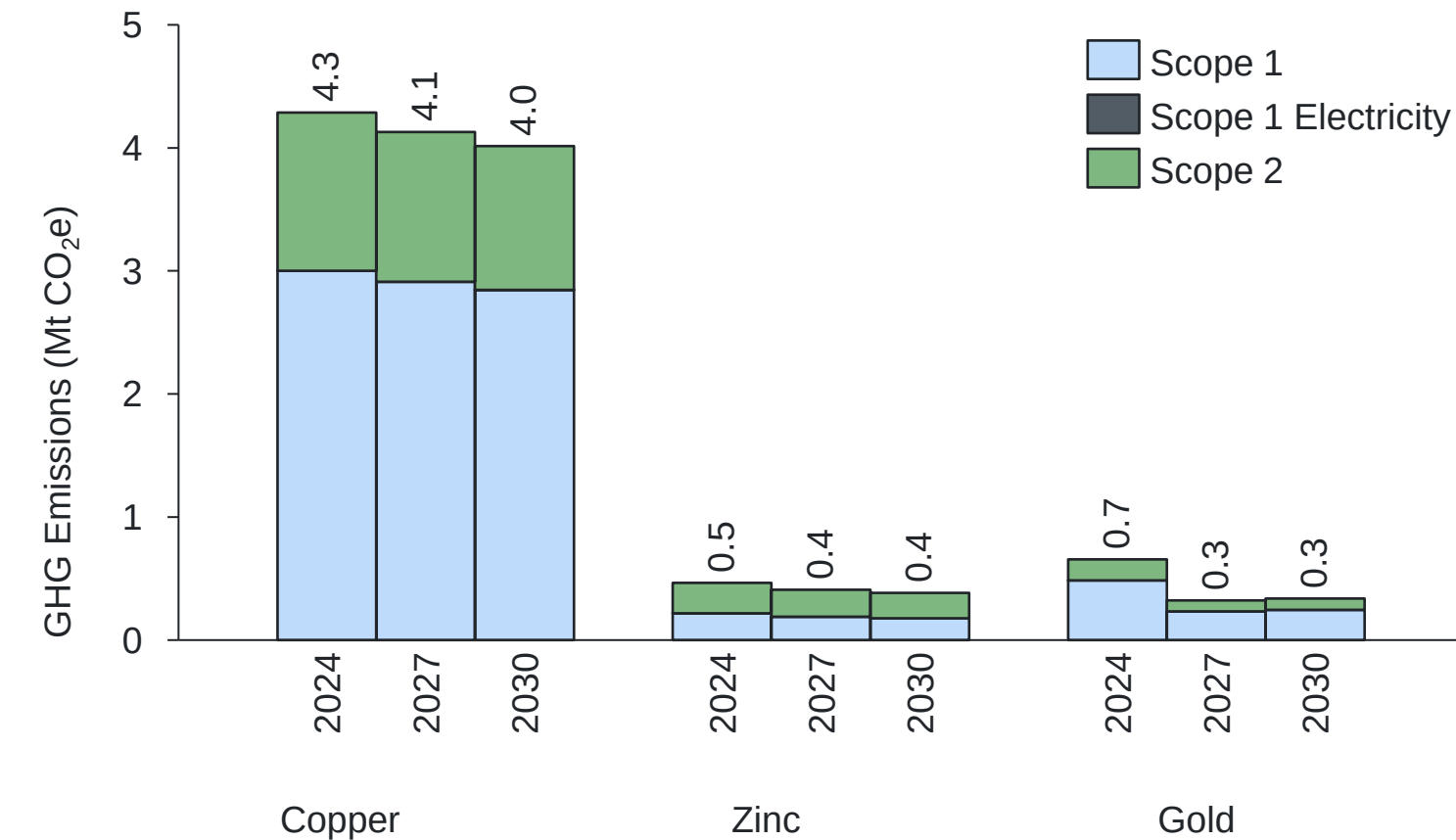
2025 E1 position of key copper mines in Peru

Production and emissions presented on a 100% basis for each asset, operators in brackets

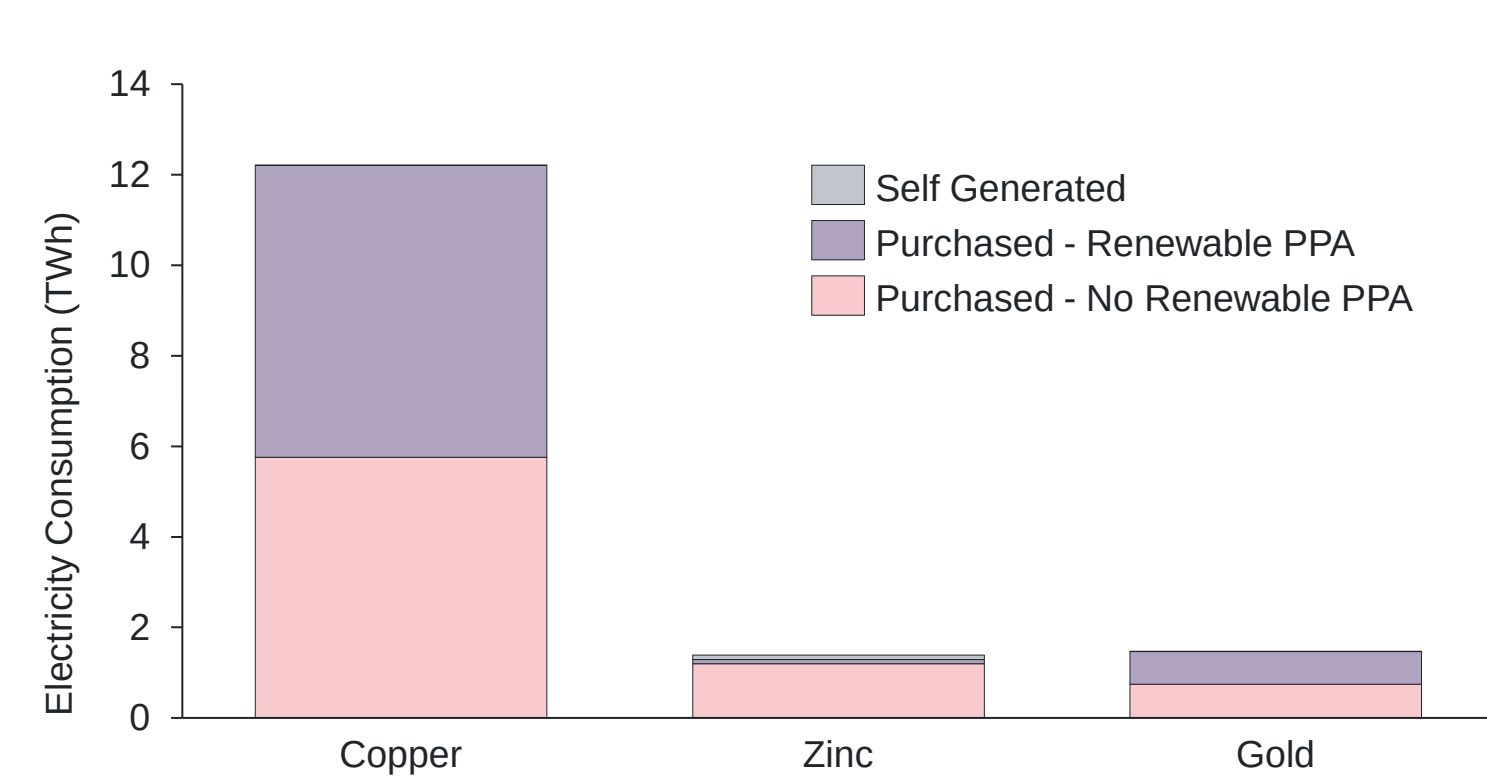


Source: Skarn Associates

Scope 1 and Scope 2 Emissions by Commodity (Mt CO₂e)



2024 Electricity Consumption by Commodity – Peru (TWh)



Source: Skarn Associates