

The BHP logo is displayed in a bold, orange, sans-serif font in the top right corner of the page. The background of the entire page is a photograph of solar panels at sunset, with the sun low on the horizon, creating a warm, orange glow and long shadows across the panels.

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# **BHP Energy Transition Trends**

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**This chapter is the part of BHP's economic and commodity outlook for the first half of the 2024 Financial Year. To read the full report click [here](#).**

We have touched on elements of the energy transition in the commodity chapters, but it is worth also reflecting on how the low GHG emissions technology transition is progressing in aggregate. Many of the commodities in our portfolio are positively leveraged to the energy transition mega-trend, with copper, nickel, steel and potash all beneficiaries of elements of the decarbonisation of power, electrification of transport and growing land intensification associated with most of the Paris-aligned scenarios we have reviewed.

So how is the transition progressing? Bloomberg NEF (BNEF), an energy think tank, reports that global energy transition investment reached \$1.77 trillion in calendar 2023, a +17% increase over calendar 2022 in nominal terms. That compares to an average +24% CAGR from 2020–23.<sup>1</sup> While China dominated last year's figures, growth in calendar 2023 was broader-based. The EU-27 and the UK collectively contributed to one-third of the annual increase, the US to over one-fifth, with China around two-fifths, down from 90% in calendar 2022.

Solar continues to lead energy transition spending in the power sector globally, at \$393 billion, with China accounting for roughly half of that. The renewables installations in China in calendar 2023 were truly monumental: the country installed 293 GW of wind and solar in calendar 2023, with solar now the second largest power source by capacity. In just 12 months, China installed the equivalent amount of wind and solar that the United States had installed in its entire history until the beginning of last year.

Despite the large growth in physical wind and solar capacity on the ground, BNEF reported that renewables investment (measured at the global level) was weighed down by wind, and particularly wind investment in China, which declined –35% year-on-year. Capacity additions typically lag investment, so while China's National Energy Administration and the International Energy Agency both reported a large uptick in new wind projects installed in calendar 2023, we could potentially see a slowdown in wind turbines coming online at a global level this year. Ex-China, the wind value-chain has been struggling for a little while now, with weak offshore auctions results, sharply rising manufacturing costs, project over-runs, asset write-downs and job losses at bellwether companies.<sup>2</sup>

A notable exception to the OECD growth story mentioned above was Australia, which saw tepid growth of +2%, versus the OECD average of +28%. Despite having a target of 82% renewables by 2030, only six utility-scale wind and solar projects reached FID in the first three quarters of calendar 2023—the lowest since 2015. “Clean” power investments (according to the BNEF definition) for the full year were down –35%. In speaking with our renewables suppliers (BHP sources renewable power for a proportion of our power needs at almost all of our operated assets [globally](#)), they cite numerous reasons for the slowdown, including higher financing and supply chain costs, as well as grid constraints—not dissimilar to the headwinds that would be facing the rest of the OECD. Policy uncertainty and approval delays add to the list. Another major challenge has been integration of the growing number of households with rooftop solar. Distributed solar in the National Electricity Market (or NEM, which serves the states of Queensland, New South Wales, Victoria, South Australia and Tasmania) accounted for 11% of power generation in calendar 2023 (+2 percentage points from calendar 2022); in South Australia, it reached as high as 22%.<sup>3</sup> Meanwhile, investment in energy storage and grid interconnections in Australia, while growing, has been inadequate to temper the wide swings in day and night-time grid demand and supply caused by rooftop solar.<sup>4</sup>

<sup>1</sup> Bloomberg NEF changed its methodology in this year's update to include a wider range of technologies (grids, “clean” shipping, “clean” industry), but using last year's methodology, growth was even higher at +20% YoY. The expanded coverage to grids now brings the Bloomberg numbers closer to the IEA's methodology, which estimated “clean” energy investment would reach US\$1.74 trillion in CY23.

<sup>2</sup> Siemens (the leading offshore turbine manufacturer), Vestas (the leading turbine maker on a combined basis) and Orsted (global project developer and generator), three European giants operating in various segments of the wind industry, all reported financial results in February 2024. The general theme was that the sector's profitability is being challenged on many fronts.

<sup>3</sup> In contrast, distributed solar generation accounts for around 3% of the EU-27's power generation mix.

<sup>4</sup> For example, in Queensland the phenomenon known as the “Russ Christ Effect” is often at play in the summer months. During daylight hours strong rooftop solar offsets higher demand during hot and humid days, but by late afternoon, storm clouds from the rising humidity can dim solar penetration, while household air conditioning demand remains at relatively high levels. This leads to a sharp increase in operational grid demand, requiring expensive gas generators (or even diesel) to rapidly be brought into the system.





These dynamics have contributed to extreme volatility in wholesale power prices over 24-hour periods, with daytime prices often negative, but shooting into the triple digits per megawatt-hour in the evening hours. Enhancing energy storage and grid interconnectors could help smooth the peaks and troughs, but progress has been patchy to date (see: the multiple year delay to the South Australia-New South Wales interconnector since the project was announced).

We are hopeful that the expansion of the Government's Capacity Investment Scheme, which aims to bring an additional 23 GW of renewables and 9 GW of low GHG emissions dispatchable capacity in Australia, will bolster investor confidence in this space.

Access to low GHG emissions firm power supply and grid infrastructure are an essential enabler for the mining sector to meet its decarbonisation targets in Australia, as well as to ensure the competitiveness of Australia's mining sector writ large. Further policy support to ensure zero emission power supply is ready to replace retiring thermal capacity, such as providing clarity around the Renewable Guarantee of Origin scheme, reforming permitting (with the goal of reducing approval timelines without lowering standards) and enhancing coordination and consistency between federal and state governments, will be essential.

Moving back to the global story, electric vehicle penetration continued to climb, reaching 16% of worldwide auto sales and growing around 40% year-on-year in calendar 2023. For the first time, electrified transport also grew to be the largest segment of "clean" energy investment in BNEF's methodology, overtaking all forms of renewable energy. China was the overwhelming stand-out in terms of vehicle output: nearly 1 in 3 light duty vehicles sold in China in calendar 2023 were non-internal combustion engine (ICE) vehicles—more than double the amount of EVs sold in all of Europe, and more than all the vehicles (ICE and non-ICE) sold in developed Asia. Increasingly affordable Chinese EVs, and a proliferation of new models and features to lure consumers, not only underpinned a rise in domestic demand but have also enabled a surge in exports. This has accelerated growth in markets that allow unfettered access

to Chinese EVs. For instance, Israel and Thailand both recently passed the 10% penetration mark, a critical first infection point for S-curve take-off.

In the US and Europe, EV sales penetration continued to rise, but at a slower rate. Both saw penetration lift around 3 percentage points in calendar 2023, to around 9% and 23% respectively. A number of factors are turning retail buyers more cautious, from higher interest rates (coupled with higher EV financing rates) to OEMs announcing a roll-back in some model releases—particularly in the affordable segments. In the US, hybrids have gained market share after some battery electric models lost access to tax credits amid stricter eligibility criteria. This trend could deepen in the coming months following stricter 'foreign entity of concern' guidelines, which may render some more EV models ineligible for federal credits. Fleet operators such as hire car companies have also become somewhat wary of EVs due to less-than-expected residual values on the second-hand market.



**We view the recent EV slowdown in the US and EU as a “bump in the road.” In time, improved cost economics coming out of China should translate to learning and improvements in all markets—as has been the case in a variety of energy transition technologies over the last decade. We still expect a sticker price cross-over point in most major markets between ICE and EVs in the second half of the 2020s, particularly as manufacturing scales and new technologies, such as solid-state batteries, permeate the mass market. Nevertheless, protectionist policies in the politically sensitive auto sector remain a key risk to the outlook in the near term.**

Investment in harder-to-abate decarbonisation technologies is accelerating but is still only ~4% of the investment flowing into the power and transport sectors. According to BNEF, hydrogen and CCUS investments have each grown to above \$10 billion for the first time, while investments in the “clean industry” category, which includes low-GHG emissions steelmaking and ammonia, as well as recycling facilities and bioplastics, grew to \$49 billion. We have yet to see the true impact of the US IRA come through in the data for the hard-to-abate sectors, but an increase can be expected in the coming years as businesses wrap their heads around the complex legislation—noting of course the clear policy risk at play as we head into a US Presidential election year.

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On the international policy front, two major pledges were signed at COP28 in Dubai: one to triple global renewables capacity by 2030 (signed by 129 countries, representing roughly half of global power demand) and one to triple global nuclear capacity by 2050 (22 signatories, ~30% of global power demand, but 70% of nuclear capacity).

For the first time ever in a COP agreement, nuclear was also called out as a solution to combat climate change. If achieved, the pledges would drive renewables capacity to 11 terawatts by 2030 and nuclear to 1100 gigawatts by 2050—both above the plausible upside case in our planning range. An important nuance to the pledges is that they do not require each individual signatory to triple capacity domestically, but rather to support a global goal. Notably absent from the list of signatories were China and India, which we expect will be responsible for 40–60% of capacity growth in renewables and nuclear over the coming decades. Without their contribution, the ‘global’ targets may be difficult to meet.

Meeting the two targets or even getting close to them (noting that on average, the external 1.5-degree scenarios we have studied only get to 6.2 terawatts of wind and solar by 2030, and 939 gigawatts of nuclear by 2050) will require an even steeper uplift in primary mineral and metal supply than currently expected. A typical onshore wind turbine is 3 ½ times more steel-intensive and 1½ to 2 times more copper-intensive than a gas-fired power plant; moving that turbine offshore requires 5.3 times more steel than the gas plant, and over 5 times as much copper.

These multiples quickly add up, and demand from “energy transition” sectors (i.e. renewables, EVs) represent a growing share of metals and minerals demand over time. BHP’s 1.5-degree scenario<sup>5</sup> envisages cumulative primary copper demand over the next 30 years to be around double the amount consumed in the previous 30. Whereas today, the ratio of traditional sources of copper demand (construction, consumer durables, capital goods, etc) to energy transition end-use demand is roughly 93:7, by 2035, that ratio shifts to 80:20. Steel demand, too, sees upside growth from the power sector that more than offsets declines driven by the phase down in fossil fuels.

On the nuclear pledge, the uranium spot market certainly took notice. Nuclear’s standing in the COP process, coupled with a series of supply announcements—with the latest being Kazatomprom’s downgrade of its calendar 2024 production outlook—sent the uranium price above \$100/lb for the first time since 2007. These latest developments have augmented the upside coming from the geostrategic risks that have engulfed nuclear fuel supply chain since Russia’s invasion of Ukraine: Russia accounts for half of global enrichment capacity, and one-quarter of Kazakh mined supply is Russian-owned (Kazakh supply represents around 40% of the global total). If the US Senate joins the House in banning the imports of enriched Russian uranium later this year, it could send the spot price even higher.

Progress across all aspects of the energy transition is accumulating, but the world is still not on track to keep global average temperatures from increasing by more than 1.5-degrees above pre-industrial levels at the end of the century. Current pledges, in our view, fall short of this objective whilst the populous emerging markets target carbon neutrality at a point beyond 2050. Both Bloomberg and the International Energy Agency (IEA) agree that current investment in the energy transition is only slightly above one-third of where it needs to be this decade in their respective Paris-aligned scenarios. The story is nuanced, of course, with some categories roughly tracking to where they’d need to be in a 1.5-degree scenario—this is particularly true for technologies that have reached the point of being commercially competitive (e.g. new solar, Chinese EVs). However, major changes in behaviour and policy are clearly still required for the rest of the energy system. For our part, BHP will continue to focus on the more sustainable production of resources that are essential to meet the world’s climate ambitions.



**Back in 2021, we celebrated the crossing of the \$500 billion mark for annual investment focused on the energy transition, but we noted that there was still much more to do. We’re now well past \$1 trillion, and yet the message remains the same.**

<sup>5</sup> This scenario requires steep global annual GHG emission reduction, sustained for decades, to stay within a 1.5°C carbon budget. 1.5°C is above pre-industrial levels. For more information about the assumptions, outputs, and limitations of our 1.5°C scenario refer to the BHP Climate Change Report 2020, available at [bhp.com/climate](https://bhp.com/climate).





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