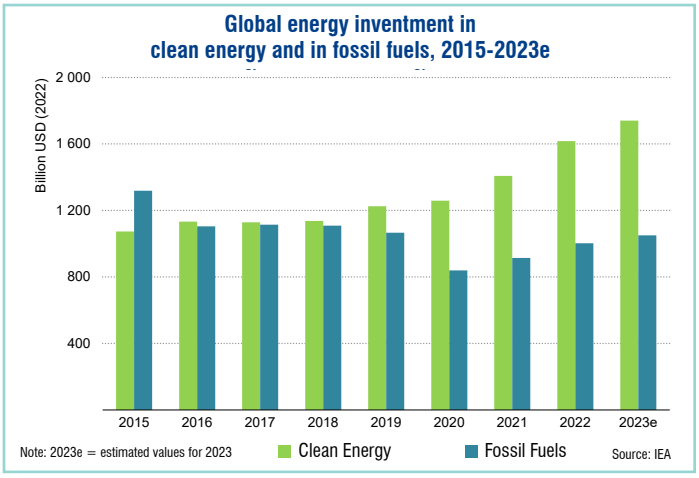
The New Clean Energy Economy

By Deepika Lal

Renewables and electric shine in the emerging low carbon pathway

The Russia-Ukraine conflict that started in 2022 not only got countries across the world worried about their short term energy security but also question the existing energy system and its fragility. Some of the tensions in energy markets receded in 2023 since the extreme volatility of the global energy crisis in 2022, but the situation remains fragile. Fossil fuel prices are down from their 2022 peaks, but markets continue to be tense. Continued fighting in Ukraine for more than two years is now accompanied by the risk of protracted conflict in the Middle East. The global macro- economic mood is downbeat, with stubborn inflation, higher borrowing costs and elevated debt levels.



Today, the global average surface temperature is already around 1.2 °C above pre-industrial levels, prompting heatwaves and other extreme weather events, and greenhouse gas emissions have not yet peaked. The energy sector is also the primary cause of the polluted air that more than 90% of the world's population is forced to breathe, linked to more than 6 million premature deaths a year. Positive trends on improving access to electricity and clean cooking have slowed or even reversed in some countries.

So overall, the urgent task of transforming the energy system, after seeing the frailties of fossil fuel age and its hazards, now takes place in a more challenging macroeconomic and geopolitical context. Against this complex backdrop, the momentum behind the deployment of a range of clean energy technologies has accelerated. This momentum is particularly strong in renewable power and EVs, with important contributions also from other areas such as batteries, heat pumps and nuclear power.

The amount of investment in clean energy per year now stands at USD $1.7 trillion (2022), compared to USD $1 trillion in fossil fuels. Five years ago, that ratio was 1:1. More than USD

$1 billion per day is now spent on solar power, "the shining star of the global energy investment landscape", according to the IEA, edging this spending above that in upstream oil for the first time.

This growing presence of clean energy technologies has been due to a variety of factors - improved economics at a time of high and volatile fossil fuel prices; enhanced policy support through instruments like the US Inflation Reduction Act and new initiatives in Europe, Japan, China and elsewhere; a strong alignment of climate and energy security goals, especially in import-dependent economies; and a focus on industrial strategy as countries seek to strengthen their footholds in the emerging clean energy economy. With this, we also face many uncertainties about the resilience of energy supply chains old and new, about risks to the security and affordability of this transition, and about whether the process of change will be sufficiently rapid to avoid very severe impacts from a changing climate.

In this issue of *Gas Statistical Review*, we have tried to put together for you some recent trends and statistics suggesting comparatively lesser role of the fossil fuels (coal, oil and natural gas) in generating energy going forward and the ongoing transition towards a cleaner economy primarily led by renewables and electric. We believe that as this energy transition takes place and increased capacities of wind and solar power are added to the electric grid, diverse sources of backup capacity, mostly natural gas, will be needed to operate the grid reliably.

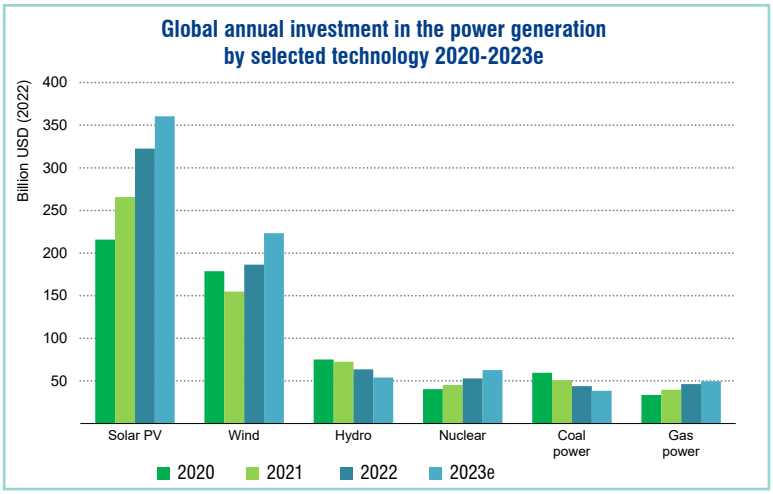
Demand for fossil fuels likely to slow down

The demand for fossil fuels i.e coal, oil and gas is expected to slow down going forward given the current policy settings by governments worldwide, a slight downward revision in the economic outlook, and the continued ramifications of the 2022 global energy crisis. That said, the demand trends for the three fuels vary considerably among regions, with reduced demand in advanced economies partially offset by continued growth in many emerging markets and developing economies, particularly for natural gas.

COAL According to IEA, global coal demand is likely to fall within the next few years reflecting declines in recent years of capacity additions of both coal-fired power and coal-fired iron and steel production – the two largest consumers of coal today – which account for 65% and 16% respectively of overall coal consumption. The share of coal-fired power in new worldwide capacity additions hit a high point in 2006 at 45% and has since fallen steadily to 11% in 2022. The size of annual coal capacity additions peaked in 2012 at over 100 GW before dropping to 50 GW in 2022, with big investments in coal falling away rapidly, and solarPV and wind power increasingly dominating the expansion of electricity systems. Also, the role of coal-fired power plants has started to shift towards providing flexibility and system services rather than bulk power.

Similarly, capacity additions of coal-based steel production plants peaked in 2003 at over 130 million tonnes, driven in large part by China's rapid industrialisation. In 2014, global coal demand for iron and steel production peaked at over 950 million tonnes of coal equivalent before starting to fall since 2015 – a result of growth in the share of scrap-based production in electric arc furnaces, as well as alternatives to blast furnaces for iron production such as natural gas-based direct reduced iron.

In terms of demand, coal demand peaked in 2007 in advanced economies. In China – the world's largest coal consumer – the impressive growth of renewables and nuclear alongside macroeconomic shifts are likely to induce a decrease in coal use in coming years. That said, coal use continues to increase in other emerging market and developing economies as new power plants and industry capacity come online.



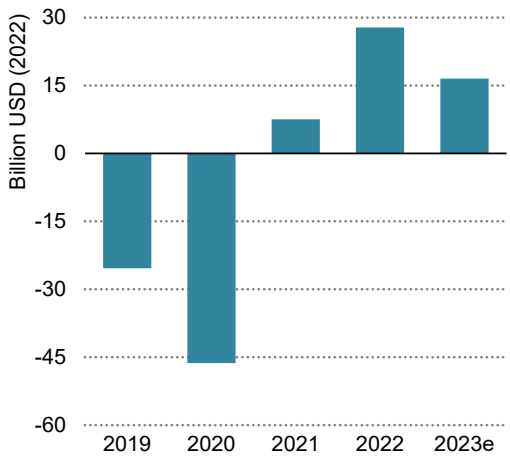
OIL In the past two decades, oil demand has surged by 18 million barrels per day (mb/d) mostly driven by rising demand in road transport, which now accounts for around 45% of global oil demand (the petrochemicals sector, second-largest in oil consumption, accounts for 15% of oil demand). During the same period, the global car fleet expanded by more than 600 million cars and road freight activity has increased by almost 65%. However, the astounding rise in EV sales is now having an impact on demand for oil in road transport. That can be seen in the statistical data. Sales of gasoline and diesel cars, two/three-wheelers and trucks peaked in 2017, 2018 and 2019 respectively and since then has been coming down. On the contrary, in 2020, EVs accounted for 4% of global car sales and reached 16% in 2023 with almost 14 million EV sales, mostly in China and the advanced economies. Even going forward, the growth in oil demand is likely to vary across regions; the decline will be more pronounced in the advanced economies and China's robust oil demand growth will likely weaken in the coming years. In emerging market and developing economies (other than China), which see growing populations and car ownership, oil demand is likely to grow continuously.

Although oil demand for petrochemicals, aviation and shipping continues to increase this is not enough to offset reductions in demand from road transport, as well as in the power and buildings sectors.

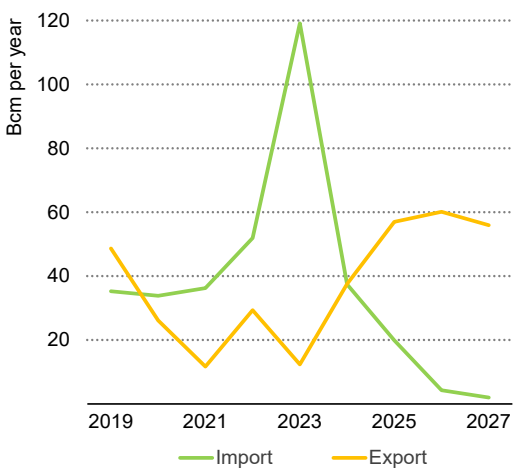
NATURAL GAS Global natural gas use has increased by an annual average of almost 2% since 2011. The power and buildings sectors – today's biggest consumers of natural gas accounting for 39% and 21% respectively of total global demand – have already seen peaks in natural gas capacity additions for power plants and space heating boilers, and muted demand in these two sectors reduces natural gas use enough to likely cause it to peak in coming years. The high point for natural gas power capacity additions was in 2002, when they exceeded 100 GW and made up around 65% of total annual capacity additions. Capacity additions fell to less than 30 GW in 2022. Despite this slowing in annual additions, the global installed capacity of natural gas power continues to expand over time. Sales of gas-fired boilers for space heating in buildings have also peaked. At their height, gas boilers accounted for around 40% of total sales of space heating equipment. The subsequent decline in sales over the last few years reflects the rapid rise of heat pumps, especially in advanced economies. Heat pump sales have a strong impact on gas demand in the buildings sector because space heating is by far the leading end-use in terms of natural gas demand today. In advanced economies, the rebound in natural gas demand seen in 2021 did not last long, and demand in 2022 was below pre-pandemic levels. This faltering in demand reflects a shift to renewables in electricity generation, the rise of heat pumps, and Europe's accelerated move away from gas following Russia - Ukraine conflict. This trend is likely to continue despite continued demand growth in emerging market and developing economies.

On supply side, cuts in Russian gas deliveries to Europe have prompted higher investment in alternative sources of supply and in LNG infrastructure. Projects that have started construction or taken final investment decision are set to add 250 billion cubic metres per year of

Change in global investment in natural gas supply



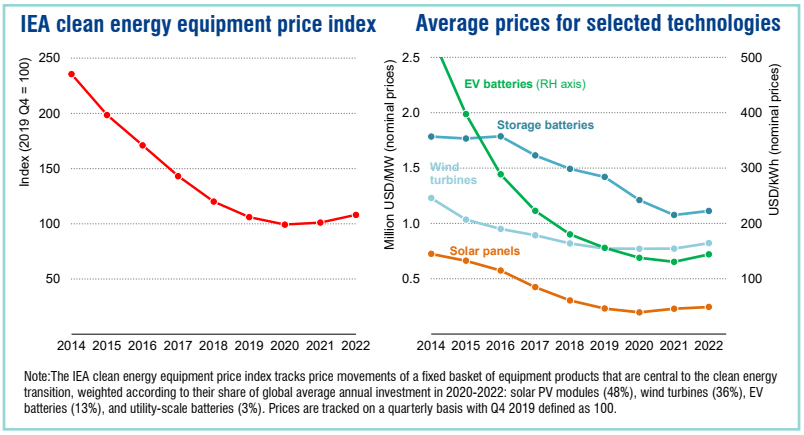
Annual LNG import and export capacity additions



liquefaction capacity by 2030, equal to almost half of today's global LNG supply. Announced timelines suggest a particularly large increase between 2025 and 2027. More than half of the new projects are in the United States and Qatar. **This additional LNG arrives at an uncertain moment for natural gas demand and creates major difficulties for Russia's diversification strategy towards Asia.** The strong increase in LNG production capacity eases prices and gas supply concerns, but comes to market at a time when global gas demand growth has slowed considerably since its "golden age" of the 2010s. Alongside gas contracted on a longer-term basis to end-users, more than one-third of the new gas will be looking to find buyers on the short-term market. However, mature markets – notably in Europe – are moving into stronger structural decline and emerging markets may lack the infrastructure to absorb much larger volumes if gas demand in China slows. Besides, a wave of new regasification capacity is also underway as countries look to secure LNG imports. Europe's annual regasification capacity is set to increase by 50 bcm from 2022-2025, expanding the continent's overall LNG import capacity by one-fifth. Import projects are growing even more quickly in Asia, which is set to add over 100 bcm of LNG import capacity by 2025 (more than half in China). A key dilemma for investors undertaking large, capital-intensive gas supply projects is how to reconcile strong near-term demand growth with uncertain and possibly declining longer-term demand. This is a particular issue for Europe, given the continent's strong climate goals. Many importers have been reluctant to commit to long-term contracts for gas supply. A preference for floating regasification terminals has been a way to avoid locking in future emissions.

Global economy slowly moving towards clean energy; clean energy deployment is accelerating fast

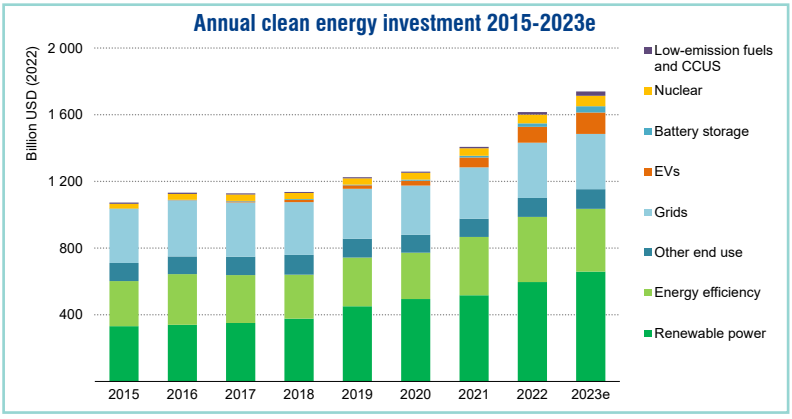
Fossil fuel technologies have been losing market share to clean energy technologies across various sectors in recent years. The push to bring down emissions is a key reason, but not the only one. The economic case for mature clean energy technologies is strong. Mature clean technologies remain very cost-competitive in today's fuel-price environment; the pressures of 2022 eased in 2023. Energy security is also an important factor, particularly in fuel-importing countries, as are industrial strategies and the desire to create clean energy jobs.

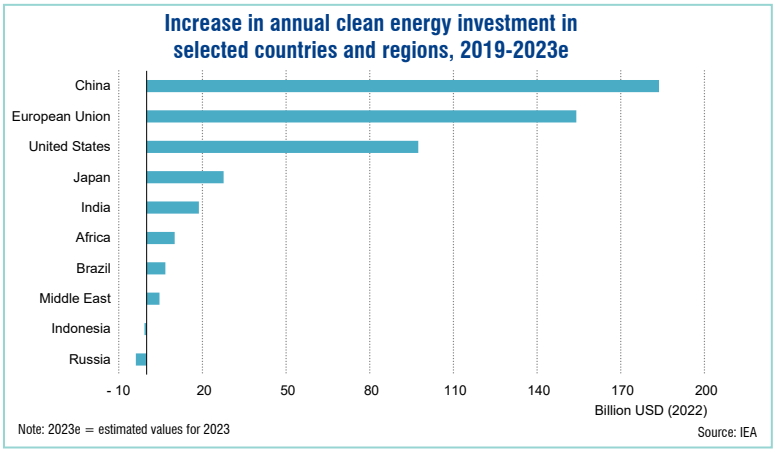


Note:The IEA clean energy equipment price index tracks price movements of a fixed basket of equipment products that are central to the clean energy transition, weighted according to their share of global average annual investment in 2020-2022: solar PV modules (48%), wind turbines (36%), EV batteries (13%), and utility-scale batteries (3%). Prices are tracked on a quarterly basis with Q4 2019 defined as 100.

Clean energy investment and deployment have increased rapidly in response to the market signals and financial incentives provided by governments, with mass-manufactured technologies such as solar PV, wind turbines and EVs leading the way. Investment in clean energy has risen by 40% since 2020. Sales of residential heat pumps and stationary battery storage are also rising fast. Since the Paris Agreement was signed in 2015, almost 1 terawatt (TW) of solar PV capacity has been added to the global system – nearly equivalent to the total installed electricity capacity in the European Union. Around 40% of this deployment was in 2021 and 2022. Well over half of the electric cars on the road worldwide have been sold since 2021. This progress reflects major cost reductions in recent years: the costs of key clean energy technologies – solar PV, wind, heat pumps and batteries – fell by close to 80% on a deployment weighted average basis between 2010 and 2022.

That said, not all clean technologies are thriving and some supply chains, notably for wind, are under pressure, but there are striking examples of





China's growth shapes energy markets

In the last decade, China accounted for more than 50% of global energy demand growth and 85% of the rise in energy sector CO2 emissions. It accounted for almost two-thirds of the rise in global oil use, nearly one-third of the increase in natural gas, and has been the dominant player in coal markets. After a very rapid building out of the country's physical infrastructure, the scope for further additions is narrowing. The country already has a world-class high-speed rail network; and residential floorspace per capita is now equal to that of Japan, even though GDP per capita is much lower. This saturation points to lower future demand in many energy- intensive sectors like cement and steel. But its economy is changing. China's leaders have long acknowledged that its current phase of massive and resource-intensive investment in urbanisation, infrastructure and factories must end. As clean energy use grows, China is also the dominant player accounting for around half of wind and solar additions and well over half of global EV sales in 2022.

an accelerating pace of change. In 2020, one in 25 cars sold was electric; in 2023, this is now one in 5. More than 500 GW of renewables generation capacity are set to be added in 2023 – a new record. More than USD 1 billion a day is being spent on solar deployment. Manufacturing capacity for key components of a clean energy system, including solar PV modules and EV batteries, is expanding fast. This increase in clean energy investment is certainly impressive but also heavily concentrated in a handful of countries with China, European Union and US much ahead of others.

Clean energy policies support the transition

Policies supporting clean energy are delivering as the projected pace of change picks up in key markets around the world. As of September 2023, ninety-three countries and the European Union have pledged to meet a net zero emissions target. Governments around the world, especially in advanced economies, have responded to the pandemic and the global energy crisis by putting forward new measures designed to promote the uptake of renewables, electric cars, heat pumps, energy efficiency and other clean energy technologies. and Fit-for-55 package, and India's renewables targets.

The United States, through the Inflation Reduction Act adopted in 2022, has provided unprecedented funding to support deployment and reduce costs for a range of low-emissions technologies. It includes new or extensions to tax credits for wind, solar PV and storage based on project investment costs (USD) and generation (USD/MWh), tax credits for local manufacturing and grid upgrades, and various other forms of assistance. Thanks to this, 50% of new US car registrations are likely to be electric by 2030. Two years ago, the corresponding figure in the World Energy Outlook-2021 was 12%. EV targets have driven a major transformation in the industrial strategies of car and truck manufacturers in recent years, together with fuel economy and CO2 emissions standards in the European Union and China. Electric two/three-wheelers and buses have seen significant uptake in India and other emerging market and developing economies thanks to policy support, increasing economic competitiveness and limited infrastructure needs.

The strong underlying economics of renewables have been reinforced by policy packages such as REPowerEU plan and Fit-for-55 (EU's commitment to reduce its net greenhouse gas emissions by at least 55% by 2030) in the European Union. A provisional agreement was reached in March 2023 to raise the EU's renewable target for 2030 to a minimum of 42.5% of final energy consumption, up from the current 32% target. The European Commission also proposed a Net Zero Industry Act, which targets domestic manufacture of up to 40% of Europe's clean energy technology deployment needs by 2030. The act would cover eight technologies and simplify regulation, supported by existing funding channels. Successive five-year plans in China have progressively raised ambitions for solar PV taking projected additions of solar PV and offshore much higher than they were in the WEO-2021 and driving

Key low-emission power policies introduced and proposals announced in 2022-2023 in selected countries and regions

Region	Policies
United States	• Approval of the Inflation Reduction Act ○ Tax credit extensions for solar PV and wind: production credit (per unit of energy) and investment credit (capital costs) ○ Investment tax credit also available for battery storage and zero-emission nuclear ○ Financial support for grids and manufacturing clean power equipment
China	• 14th Five-Year Plan raises renewable target to 33% of power consumption by 2025 (and 18% for non-hydro renewables)
Europe	• Announcements by the European Commission: REPowerEU Plan, Net-Zero Industry Act proposal and other potential reforms ○ Increase EU 2030 renewables target to 45% by 2030 (whole energy matrix not just power) ○ Fast-tracking permitting process plus ~EUR 225 billion in loans for grids ○ Proposed reform of market design and technology-specific targets for EU manufacturing capacity • Nine European countries committed to boost offshore wind capacity to over 120 GW by 2030 and over 300 GW by 2050
Indonesia and Southeast Asia	• Indonesia introduced its JETP ○ Renewable energy target up to at least 34% of power generation by 2030, accelerate coal power plant retirement and achieve net zero emissions in the power sector by 2050 ○ USD 20 billion of initial funding • Thailand introduced new regulation for renewable power procurement, establishing the feed-in tariffs payable by distribution companies and capacity targets (additional 5 GW of biogas, solar, solar with storage, and wind) • Philippines set out a 35% renewable electricity generation target by 2030 (from about 20% in 2021) and 50% by 2040
India	• Continues to expand the Production-Linked Incentive (PLI) scheme ○ 50 GWh of battery manufacturing capacity ○ 40 GW of solar PV manufacturing capacity to be added in next three years
Japan	• Government is studying extension to lifetime of nuclear power plants (beyond 60 years)
Korea	• Plan to increase nuclear power to 35% of total generation and renewables to 31% from 10% in 2021 by 2036 • Coal-fired power to reduce to 15%
South Africa	• Government concluded sixth renewable auction
Brazil	• Planning two major transmission auctions in 2023, including the largest ever held in Brazil (in investment terms)

down global costs. India's Production-Linked Incentive (PLI) scheme is providing incentives for domestic manufacturing of high- efficiency solar PV modules as well as for batteries. Investments in renewables should also benefit from the Just Energy Transition Partnerships (JETPs) that South Africa, Indonesia and Viet Nam have signed with international partners and financial institutions. JETPs aim to boost clean power and reduce reliance on coal assets, while addressing the social implications of change. Kenya also lifted a ban on new power purchase agreements (mainly affecting renewable projects).

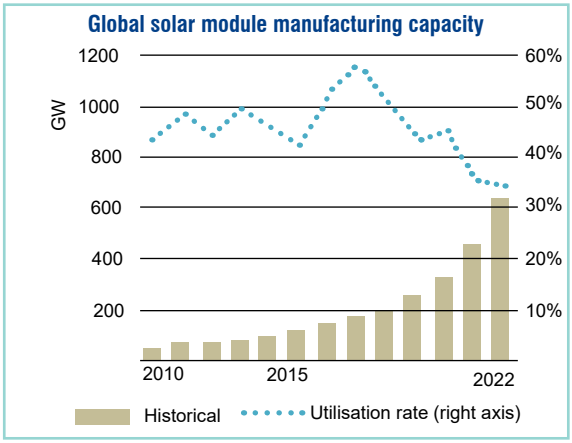
Prospects for nuclear power have also improved in leading markets, with support for lifetime extensions of existing nuclear reactors in countries including Japan, Korea and the United States, as well as for new builds in several more. Japan is discussing legislation to extend nuclear power plant lifetimes beyond 60 years and South Korea's 10th Electricity Plan incorporates a slightly higher share of nuclear power in the generation mix (35% by 2036).

Let's take a look at the two most promising and progressing clean energy pathways – renewables (primarily solar and wind) and electric.

Solar & Wind

Renewables are set to contribute majority of the new power capacity in coming years, with solar PV alone accounting for a big chunk. Solar manufacturing has experienced a remarkable expansion over the last decade, increasing ten-fold globally to meet increasing demand for clean energy. This trend is set to continue at an elevated pace, with investments in the pipeline set to raise global solar module manufacturing capacity from about 640 GW in 2022 (only a fraction of world's potential) to over 1200 GW in the medium term. Global solar PV capacity additions, including both rooftop solar and utility-scale projects, reached a record high of 220 GW in 2022, twice the level in 2019 and more than seven-times the level ten years earlier. China alone added over 100 GW of this solar PV capacity, almost 70% higher than in 2021, and annual installations increased by 40% or more in Europe, India and Brazil, despite inflation and supply chain issues. Global solar PV deployment is currently around 40%, 220 GW in 2022 but is likely to expand to about 500 GW in 2030.

However, solar manufacturing capacity today is highly concentrated - just five countries account

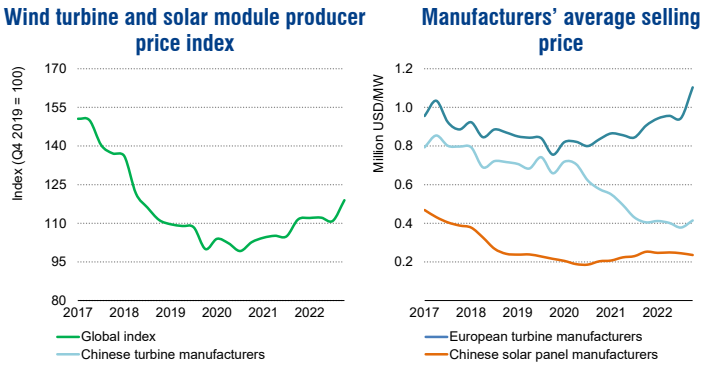


for over 90% of global capacity. China is the largest producer with the capacity to produce solar modules with an output of over 500GW every year, equivalent to 80% of world manufacturing capacity. The other four are Viet Nam (5% of the global market), India (3%), Malaysia (3%) and Thailand (2%). The next five leading solar manufacturers – the United States, Korea, Cambodia, Türkiye and Chinese Taipei – each account for around 1% of the global total, as does the European Union.

While fewer than 40 countries have capacity to produce solar modules, over 100 countries completed solar PV projects in 2022, which mostly relied on imported solar panels. China is the primary exporter of solar panels and its exports, and those of other exporters, facilitate the expansion of renewable energy in markets around the world. Southeast Asia is the second-largest exporter, with many of the panels it exports going to the United States and the European Union. As domestic manufacturing capacity in India has increased in recent years, there is potential to reduce import dependence over the coming years. Today, the European Union and the United States are the largest importers of solar panels. New import tariffs have recently been put in place in the United States on solar modules that originate in China: these are set to change the pattern of imports to the United States, and may have knock-on effects in other markets.

Plans for additional capacity suggest that solar manufacturing will remain highly concentrated, and that trade will continue to be important for many markets to support worldwide deployment of solar. China plans to add another 500 GW of solar module manufacturing capacity in the coming years, far outstripping plans for new capacity in other countries. Expansion on this scale means that it is likely to maintain its 80% share of the global total and to remain the primary exporter of solar modules by some distance. India aims to continue expanding its production capacity to meet domestic needs and to export solar modules: projects in the pipeline under the Production Linked Incentives scheme suggest that its manufacturing capacity could exceed 70 GW per year by 2027. Production capacity in Southeast Asia is set to outpace regional needs, allowing it to remain an important exporter. In the United States, planned solar module production capacity investments have been boosted by the Inflation Reduction Act, and are on course to increase sixfold in the medium term. Solar manufacturing in the European Union is set to double in the medium term, but here too deployment is increasing rapidly, and so it would depend on imported solar modules in near term unless further investments are made in manufacturing in the European Union. Solar PV on buildings, including rooftops, represents about half of total solar PV capacity additions today.

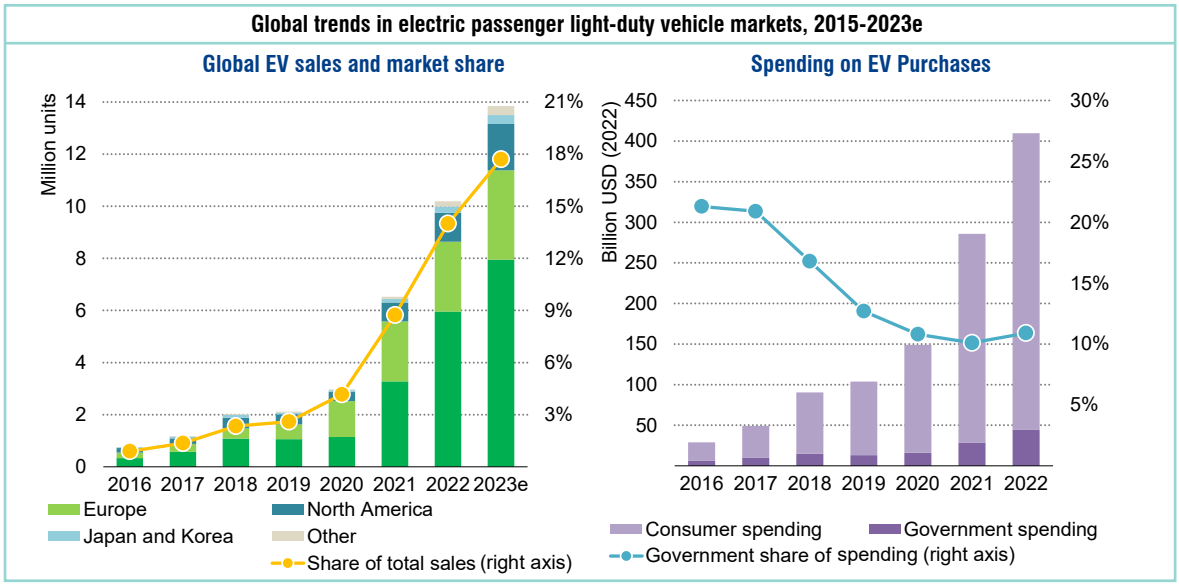
IEA global wind turbine and solar PV module producer price index and average manufacturing prices among key regions



A global producer price index of solar PV modules and wind turbines developed by the International Energy Agency shows that prices kept falling till 2020 but were then pushed up by tight markets for materials and labour in the following years. China has followed a different path. Debt financing remained favourable as the People's Bank of China has kept reference lending rates low to boost the economy and renewable projects can access preferential rates. The price of local wind turbines continued to decrease given Chinese manufacturers' ability to manage supply chain pressures and a growing number of orders. LCOEs for solar PV and wind, having fallen for years, increased in 2022, but remained a more attractive proposition than fossil fuel power for new generation in most markets around the world.

Off-grid solar home systems play a vital role in closing electricity access gaps in sub-Saharan Africa. However, utility-scale projects make up the majority of new solar capacity in future, in large part because of their significantly lower levelised costs of electricity.

Global wind capacity additions dropped to 75 GW in 2022. Wind turbine costs, especially for European manufacturers, remained high in early 2023, at 35% above the low levels of early 2020. Permitting has been a key concern for investors and financiers, especially for wind and grid infrastructure. As technology continues to improve and costs to fall, these are the investments are expected to rise. China is the largest market for wind power, as it is for solar PV. It accounted for half of global capacity additions in 2022 and is likely to be a big contributer to the future



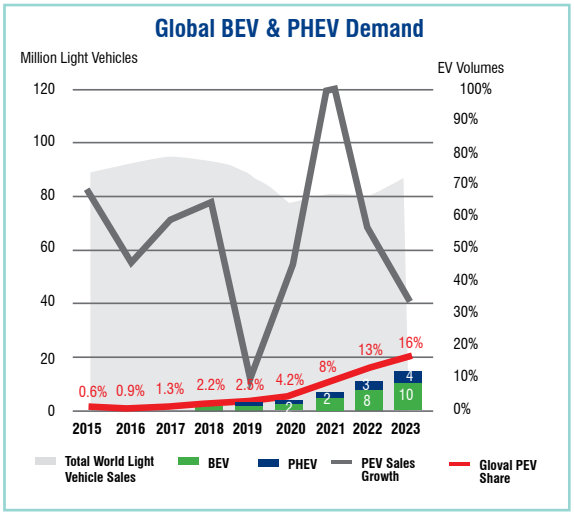
additional capacity. The European Union (18% of global additions), United States (11%) and Brazil (4%) were other leading markets in 2022.

Electric vehicles

Consumers are increasingly investing in more electrified end uses. The primary growth segment for electric is road transport. Investment in EVs (defined as the incremental spending on EVs vs the average price of vehicles sold in a given country) has more than doubled since 2021, reaching USD 130 billion in 2023.

Global sales of fully electric and plug-in hybrid vehicles (PHEVs) rose 31% in 2023 to 13.7 million, which is 16% of the worldwide vehicle volumes sold compared to 13% in 2022, 8% in 2021 and 4% in 2020. Of this, fully electric or battery electric vehicles (BEVs) accounted for 9.5 million, up 30% year-over-year with 11% market share (compared to 10% in 2022 and 6.1% in 2021). PHEVs accounted for the balance at 4.2 million, up 47% with 5% market share.

Segment-wise, two/three-wheelers already have the highest electrification shares today of any road transport mode, in particular in emerging market and developing economies, and that looks set to continue as infrastructure requirements and cost premiums are limited. However, less than 1% of heavy trucks sold today are electric. More widespread deployment of charging infrastructure is needed to increase the rate of heavy trucks electrification, especially in emerging market and developing economies. Deployment levels are higher for electric buses, which are already cost competitive on a lifetime basis and are often



subsidised by local municipalities.

Region-wise in 2023, BEV sales jumped 50% in the US and Canada, and grew 27% and 15% in Europe and China respectively. Given China's size as the world's largest car market, it leads by far in outright sales becoming the largest EV market, shipping 7.6 million units with 55.5% market share. The country saw the opportunity to make strategic investments in EVs at an early stage to export batteries and vehicles to international markets and its government has also supported EV adoption as a way to reduce air pollution and dependence on oil imports. However, being the main driver for global volume and growth, the country is also the main source of forecast uncertainties, with economic headwinds hanging over the automotive sector alongside potential policy changes that could disrupt EV uptake.

Europe, with a shipment of 3.2 million units and North America with a shipment of 1.8 million units rounded up as the next two big EV markets

in 2023. In Europe, better products, higher EV incentives and the 95g/km CO2 mandate for average fleet emissions stimulated demand and supply beyond expectations in the second half of 2020 and 2021. BEVs and PHEVs accounted for 16.9% of Europe's new light-vehicle market in 2021, before reaching 20.7% in 2022. EV-volumes has improved its outlook for total European light-vehicle sales but lowered its EV share and volume expectations. This is because of the lacklustre performance of PHEVs, the end of incentives for non-private buyers in Germany, as well as the UK extension of the new-car internal-combustion engine (ICE) ban from 2030 to 2035. New tax rebates in Spain may support higher EV uptake. The EU zero-emission mandate for 2035 still leaves room for e-fuels, with support mounting in Austria and Germany for example.

North America including US and Canada is also seeing electric boom. Inflation Reduction Act (IRA) supports further EV growth in the US, even if compliance with upcoming battery and material-sourcing requirements remains unclear for many EV entries. The incentives for producing vehicles and batteries in the region remain strong but also imply handicaps for imported brands and models. However, there is a loophole whereby imported EVs can qualify if they are leased instead of purchased.

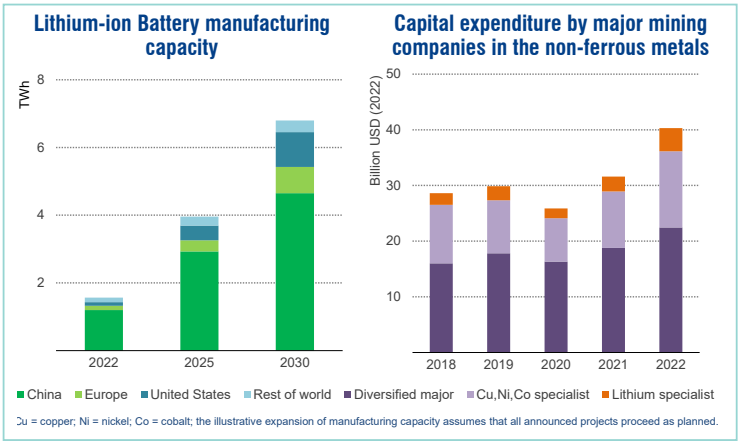
Due to better availability of products, higher EV incentives, and lowered import tariffs in some countries, EV volumes are rising sharply in also other regions such as Asia (excluding China), Eastern Europe, Middle East and Africa, Central and South America.

Company-wise, BYD and Tesla are world's leading EV players others being Volkswagen (VW) Group, Hyundai Motor, General Motors (GM) and Stellantis.

EV markets are experiencing slower year-on-year growth compared with that seen in previous years. Carmakers are accelerating localisation efforts to drive consumer demand by launching region- and market-fit EV models and enhancing the overall EV user experience by developing charging infrastructure and intelligent services ecosystem to support smarter mobility. The general weak cost-effectiveness and subsidy reductions are two significant challenges that carmakers must address to gain stronger growth momentum. The tail end of supply chain disruptions caused by the pandemic, high inflation and weakening consumer confidence, and the instability caused by the war in Ukraine compounded the challenge of maintaining high growth rates as the European market matures. Fossil fuel subsidies aimed at shielding consumers from peak oil prices, delays in implementing low-emission zones and uncertainty over the European 2035 ICE ban may also have played a role.

Current EV battery designs use significant quantities of so-called critical minerals, specifically lithium, cobalt, manganese, nickel, and graphite. Radically increasing global production and purchases of EVs with these battery designs will lead to order-of-magnitude increases in demand for these minerals. Record sales of EVs, strong investment in battery storage for power (which are expected to approach USD 40 billion in 2023, almost double the 2022 level) and a push from policy makers to scale up domestic supply chains have sparked a wave of new lithium-ion battery manufacturing projects around the world. If all capacity announcements were to materialise, then 5.2 TWh of new capacity could be available by 2030.

China is again the main player at every stage of global battery manufacturing, with the exception of the mining of critical minerals. In 2022, over 75% of existing battery manufacturing capacity was located in China. A key question for battery manufacturers, however, is whether supplies of critical minerals will keep up with demand. Thanks to high prices and growing policy support, investment in critical mineral mining rose by 30% in 2022. Exploration spending also grew, notably for lithium, copper and nickel, led by Canada and Australia and with activities growing in Brazil and resource-rich countries in Africa. But moving



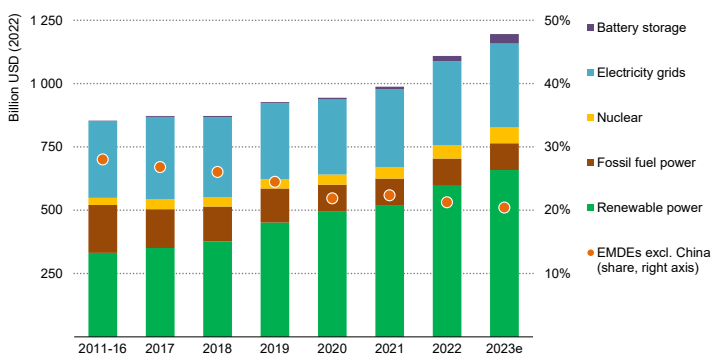
from exploration to new production can take more than 10 years, and there remain widespread concerns that critical mineral investment will become a constraining factor for clean technology manufacturing and deployment. Clean technology innovation remains essential if the potential in critical minerals and batteries has to be realised.

There is a very optimistic outlook on EVs due to new voluntary EV targets by major automakers as well as new vehicle standards, mandates and subsidies in China, European Union and United States. AS EV sales have increased rapidly over the past few years, some governments are adjusting the focus of their incentives. The US government is notably directing automotive manufacturers to build out a domestic EV supply chain through the Inflation Reduction Act, which stipulates that vehicles containing battery components from a "foreign entity of concern", such as China, will no longer be eligible for its $7,500 federal tax credit from January 1, 2024. In Australia, the states of Victoria and New South Wales government are removing purchase incentives for new EV from January as suppliers have cut prices. Still, they will reallocate some of the funding to install more charging stations to continue encouraging uptake. The Thai government has extended its EV subsidies for consumers — which were set to expire at the end of this year — to 2027, although it has cut their value as EV uptake in the country has increased rapidly. The strong growth of the domestic EV market and subsidies for manufacturers have encouraged foreign investment in Thailand, which is southeast Asia's automotive hub, as it aims to position itself as the region's EV production base. A growing number of Japanese and Chinese vehicle manufacturers have announced plans to expand their presence in the country.

While EVs produce fewer carbon emissions than ICE vehicles over their lifespan, there are concerns about the environmental impact of the manufacturing process, as well as shipping finished vehicles over long distances. The French government aims to address this by introducing new cash incentives for EV buyers starting January 2024, which will consider the vehicle's raw materials, production and components. This means a vehicle manufactured in China in a facility powered by coal-fired electricity would not be eligible, while vehicles produced using renewable energy in France and the EU would.

The sector is still nascent and there are many challenges

Global average annual investment in the power sector by category, 2011-2023e



Notes: Investment is measured as ongoing capital spending on new power capacity; all numbers throughout are in 2022 USD; Fossil fuel power includes unabated and abated power; EMDEs = emerging market and developing economies; 2023e = estimated values for 2023.

The positive momentum behind clean energy investment is not distributed evenly across countries or sectors, highlighting issues that policy makers will need to address to ensure a broad-based and secure transition. The macroeconomic environment presents additional obstacles, with higher short-term returns for fossil fuel assets and rising borrowing costs and debt burdens. Clean energy investments often require high upfront spending, making the cost of financing a crucial variable for investors, even if this is offset over time by lower operating costs.

Scale up clean energy investment in emerging market and developing economies

Clean energy investment needs to rise everywhere, but the steepest increases are needed in emerging market and developing economies other than China. More than 90% of the increase in clean energy investment since 2021 has taken place in advanced economies and China. From 2015 to 2022, advanced economies and China together accounted for over 95% of global electric car and heat pump sales and nearly 85% of combined wind and solar capacity additions. There are some bright spots elsewhere, notably solar investment remains dynamic in India; deployment in Brazil is on a steady upward curve; and investor activity is picking up in parts of the Middle East, notably in Saudi Arabia, the United Arab Emirates and Oman. However, higher interest rates, unclear policy frameworks and market designs, financially-strained utilities, a high cost of capital for clean energy projects as well as challenges

related to land acquisition, enabling infrastructure and skilled labour are holding back investment in many other countries. Overcoming these will require stronger domestic policies together with enhanced international support, including much more concessional funding to improve risk adjusted returns and mobilise private capital at scale. Sustainable finance instruments remain concentrated in advanced economies and China, accounting for nearly 80% of sustainable debt issuance in 2022. Issuances elsewhere (outside China) are growing from a low base, with India's successful first green bond a landmark in this sector. Scaling up these instruments and mobilising much greater support from development finance institutions will be critical to the continued broadening and acceleration of clean energy transitions.

Ensure a balanced mix of investment, especially in infrastructure

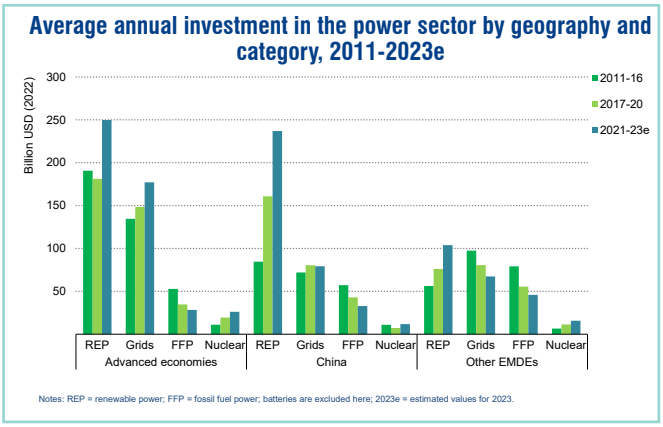
A net zero or clean energy system cannot rely only on solar, wind power and EVs. **Rapid growth in the use of these technologies needs to be complemented by larger, smarter and repurposed infrastructure networks, large quantities of low-emissions fuels, and technologies to capture CO2 and store it permanently or transform it into climate neutral fuels.** Investments in many of these

Role of natural gas is critical for achieving an integrated low-carbon economy

The current global energy crisis has placed electricity security and affordability high on the political agenda, favouring renewable solutions. But sunshine and wind are not always available, requiring a range of backup generation options as well as smarter and better-connected grids to manage this variability. And here, natural gas can come to use. As increased capacities of wind and solar power are added to the electric grid, diverse sources of backup capacity, mostly natural gas, will be needed to operate the grid reliably.

Natural gas and renewable energy have a synergetic relationship; each facilitates the other. World over energy leaders have expressed support for new natural gas capacity to facilitate the development of wind and solar power. The two forms of energy appear complementary in many respects: natural gas electricity generation enjoys lower capital costs and variable fuel costs, while renewable energy generators have higher capital costs but generally zero fuel costs, excluding bioenergy. Both forms of energy support a future orientation towards an environment that utilises clean energy supply and use, including distributed generation and home vehicle fuelling. NGS therefore, suggests in India we must attempt to make serious efforts to identify how natural gas and renewable energy could work together in order to complement each other. Renewable in conjunction with natural gas should be encouraged as a reliable and sustainable source of electricity.

- Natural gas is the leading choice for on-site power generation because of its environmental benefits and the existing natural gas supply infrastructure. There are a number of ways in which natural gas may be used on-site to generate electricity and as back-up support to renewable. Fuel cells, gas-fired reciprocating engines, industrial natural gas-fired turbines, and micro-turbines are all popular forms of using natural gas for back-up support to renewable as well as on-site electricity needs. Natural gas is also one of the leading energy sources for distributed generation which would require separate research.
- The renewable resources' abilities to generate power vary by season, day, and even by hour. Solar and wind are "intermittent" resources – they are only available when the sun is shining or the wind is blowing. Sustained reliability is in question. Forecasts often differ from the weather actually experienced and therefore, it is uncertain how much power renewables will be able to provide to the electric grid on any given day.
- To ensure that electricity is available on a reliable basis, operators of the electric grid need backup sources of power to account for the variability and uncertainty associated with renewable energy. This is particularly critical during periods when electricity is in peak demand during excessive heat or cold.
- Natural gas serves as the ideal backup source of electricity to support renewable energy because of its flexibility, reliability and clean energy. Gas-fired generators/engines can turn on and off very quickly – typically in as little as 10 minutes – and thus provide a flexible and reliable power source to accommodate fluctuating weather patterns.
- Operators of the electric grid will need to rely most heavily on gas generators to compensate for the variability of renewables in the future.



areas are lagging. Grid infrastructure is a case in point: weak grid infrastructure is a limiting factor for renewable investment in many developing economies, and here too current investment flows are highly concentrated. Advanced economies and China account for 80% of global spending and for almost all of the growth in recent years. The time required to obtain grid connections can take several years and appears to be increasing rather than shrinking. This is hindering current projects and risks choking off new ones.

Expanded, modernised and cybersecure transmission and distribution grids are critical to electricity security in a world where the share of solar PV and wind in electricity generation is rising rapidly. Investment is needed to provide adequate system flexibility, without which there is a risk of rising amounts of surplus solar PV and wind power at times when output exceeds demand.

Find ways for governments to work together

Above all, countries need to find ways to make this a common, unified effort. This is vital to expand financial flows to developing economies, to accelerate clean energy technology development, to ensure equitable and cost-effective clean energy supply, and to ensure that effective safety nets are in place in case of disruptions. The pathway to net zero emissions is much more complex and costly in a low-trust, low-collaboration world.

Scaling up and maintaining much higher levels of solar PV and wind power generation requires action to address a number of barriers

Permitting and licensing of new projects. Work to complete the necessary regulatory steps for new projects, including environmental assessments where applicable, can delay individual projects by years and slow market growth. Standardising and streamlining these processes, while ensuring that they involve local communities, will be critical to clean energy transitions.

Smart Grid development and connections. Modernising, digitalising and reinforcing existing electricity networks can take years, and the same is true for the addition of new grid connections. Streamlining permitting and licensing processes would help with this, but timely grid development also calls for improved long-term planning and the scaling up of investment to support the rapid deployment of wind and solar PV.

Expanding wind manufacturing capacity and improving the financial health of wind supply chains. Despite low levelised costs of electricity and recent market growth, the manufacture of turbines and other equipment needed for wind power involves thin profit margins as a result of uncertainty about commodity prices and the way that auction schemes are operated. Measures to mitigate these risks, including through contract terms, are needed to ensure that they do not endanger the wind industry and impede clean energy transitions.

Enhancing power system flexibility to integrate rising shares of solar PV and wind. Action to enhance power system flexibility is essential to make the best use of solar PV and wind. Battery storage and demand response have a major part to play in meeting short-term flexibility needs, while hydropower and thermal sources will play a central part in the provision of seasonal flexibility. Reliable supplies of critical minerals will also be essential.

Investment in other technologies

While spending on hydropower continued to fall, nuclear power investment also rose, mainly in advanced economies and China. More than a decade after the accident at Fukushima Daiichi, an increasing number of countries are taking a fresh look at how nuclear technologies might provide low-emissions and dispatchable power. Other pillars of clean energy transitions do not yet show the same positive dynamics as clean electrification. Investment in energy efficiency has been increasing, but is well off track to meet more ambitious climate scenarios. Investment in low-emission fuels is being spurred by new policy measures, but from a very low base.

India's Story

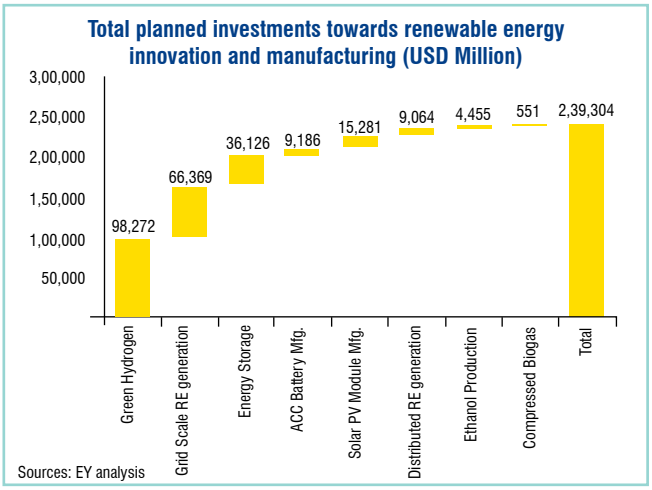
Solar & Wind

Thermal is a major source of electricity generation in India, contributing 57% of the total capacity of generation in 2022-23, followed by renewable energy sources (RES) (30.1%), hydro (11.3%) and nuclear (1.6%). However, the share of thermal-based generation capacity in the total installed capacity has gradually come down from 63.3% in 2008-09 to 57% in 2022-23. During this period, the share of hydro-based generation capacity also decreased from 24.9% to 11.3%, whereas renewables-based generation capacity witnessed an increase from 8.9% to 30.1%. The CAGR of total installed electricity generation capacity was about 7.7% during the period as compared to 17.4% in RES and 5.7% in all other sources.

India has laid down ***five Panchamrit goals*** to reduce its carbon emissions. The total planned domestic energy transition investments including supply chain innovation and manufacturing, is about US$240 billion in the present scenario.

Panchamrit of India's climate action

- 500 GW of non-fossil energy capacity by 2030.
- 50% of energy requirement from renewable sources by 2030.
- One billion tons of projected carbon emissions reduction by 2030.
- 45% reducation in carbon intensity of the economy by 2030.
- Net zero emissions by 2070.



Solar constituted around 53.4% of total RES capacity in India, followed by wind (34.1%), bio-power (8.6%) and small hydropower (4%) in 2022-23. Though the capacity from all the sources increased over the years, the relative share of solar increased considerably from less than 1% in 2008-09 to about 53% in 2022-23.

However, in terms of generation, of all the sources, electricity generation from thermal (mainly coal) continues to play a dominant role in the energy mix of the country, with a share of about 74% in 2022-23. Though its relative share continues to be the highest, it has shown a declining trend over the last few years, mainly because of increasing emphasis on renewable energy sources. The amount of electricity generated from RES increased from 3.7% in 2008-09 to 12.5% in 2022-23. Total renewable electricity generation increased from 65.78 BU in 2015-16 to 203.55 BU in 2022-23 at a CAGR of 17.5%. Solar generation increased significantly from 7.45 BU in 2015-16 to about 102 BU in 2022-23 at a CAGR of 45.3%.

However, despite achieving substantial progress in installing renewable energy capacity, securing the fourth position globally in 2022 (after China, the US and Germany), India's dependence on fossil fuels is still on the rise as it directs coal and gas-fired power plants to operate at peak capacity to meet the rise in seasonal electricity demand brought on by record-hot summers. Reliance on coal power continues to be a drag on ambition. While there

Installed Electricity Generation Capacity in India (GW), 2008-09 to 2022-23

Year	Thermal	Hydro	Nuclear	RES**	Total
2008-09	93.73	36.88	4.12	13.24	147.97
2009-10	102.45	36.86	4.56	15.52	159.40
2010-11	112.82	37.57	4.78	18.45	173.63
2011-12	131.60	38.99	4.78	24.50	199.88
2012-13	151.53	39.49	4.78	27.54	223.34
2013-14	168.26	40.53	4.78	34.99	248.55
2014-15	188.90	41.27	5.78	38.96	274.90
2015-16	210.68	42.78	5.78	45.92	305.16
2016-17	218.33	44.48	6.78	57.24	326.83
2017-18	222.91	45.29	6.78	69.02	344.00
2018-19	226.28	45.40	6.78	77.64	356.10
2019-20	230.60	45.70	6.78	87.03	370.11
2020-21	234.73	46.21	6.78	94.43	382.15
2021-22	236.11	46.72	6.78	109.89	399.50
2022-23*	237.27	46.85	6.78	125.16	416.06

Source: CEA, Growth of Electricity Sector in India, various issues.
*** RES includes Small Hydro Project (≤ 25 MW)*

Installed RES Capacity in India (GW), 2008-09 to 2022-23

Year	SHP	Wind	Bio-Power	Solar	Total RES
2008-09	2.16	9.34	1.74	0.00	13.24
2009-10	2.60	10.65	2.26	0.01	15.52
2010-11	2.91	12.81	2.70	0.03	18.45
2011-12	3.41	16.90	3.26	0.94	24.50
2012-13	3.64	18.49	3.73	1.69	27.54
2013-14	3.80	21.04	7.51	2.63	34.99
2014-15	4.06	23.35	7.81	3.74	38.96
2015-16	4.27	26.78	8.11	6.76	45.92
2016-17	4.38	32.28	8.30	12.29	57.24
2017-18	4.49	34.05	8.84	21.65	69.02
2018-19	4.59	35.63	9.24	28.18	77.64
2019-20	4.68	37.69	10.02	34.63	87.03
2020-21	4.79	39.25	10.31	40.09	94.43
2021-22	4.85	40.36	10.68	54.00	109.89
2022-23	4.94	42.63	10.80	66.78	125.16

Source: CEA, Growth of Electricity Sector in India, various issues.

is no plan for building additional coal capacity beyond what is under development until 2026-27, the latest electricity plan includes adding substantial new coal power capacity in the following five years, and the government is pushing for increased domestic coal production. With the falling cost of renewables and the shelving of several coal projects in recent years, it is questionable whether this capacity will actually be built. India is also increasing its LNG imports, given its increasing utilisation of gas power plants. The National Electricity Plan (NEP2023), adopted in May 2023 sees renewable share within total capacity of 57% and 66% in 2026-27 and 2031-32, respectively. It does eliminate the small amount of new gas power that had been planned for 2022-2027, as well as reducing the overall reliance on nuclear power throughout the decade. The total added solar capacity has been raised by 31 GW compared to the draft version, but the plan foresees slightly less wind power (12 GW less), for an overall increase of 21 GW in non-hydro renewable energy capacity. Some of the policy actions that have facilitated the growth of grid-connected renewables in the past few years include reverse auctions resulting in progressively falling prices, lower corporate tax rates for developers, renewable purchase obligations mandating utilities to procure a certain minimum purchase of renewable power, investment in transmission infrastructure, and support for solar parks that help reduce project development and land acquisition risks. Some of the recent positive developments in terms of climate change mitigation policies include:

- Minimum renewable purchase obligation for the power distribution companies to be gradually increased from 24.6% in 2023 to 43.33% in 2030.
- Policy support enhanced to expand storage capacity. The newly-adopted NEP2023 provides guidance to facilitate the procurement and utilisation of Battery Energy Storage Systems (BESS). The Ministry of Power has also adopted guidelines for pumped storage projects. However, concern has been expressed over the environmental clearance process stated in the guidelines.
- The Indian government is providing financial incentives to promote renewable energy. Measures have been taken to boost domestic solar module manufacturing and attract private investment, including import duties to protect local producers.

Renewable Electricity Generation* in India (BU), 2015-16 to 2022-23

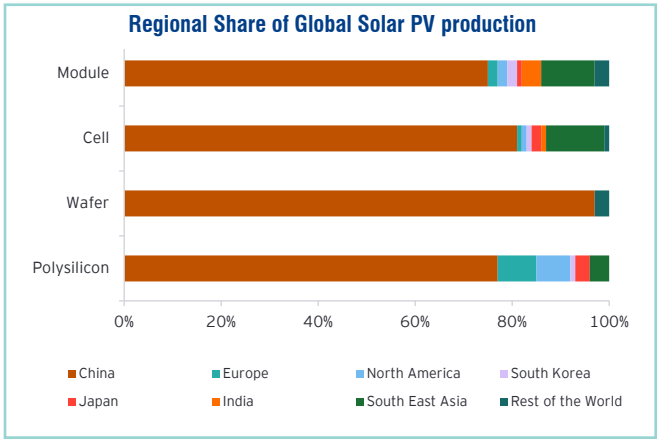
Year	SHP	Wind	Bio-Power	Solar	Others	Total RES
2015-16	8.36	33.03	16.68	7.45	0.27	65.78
2016-17	7.67	46.00	14.16	13.50	0.21	81.55
2017-18	7.69	52.67	15.25	25.87	0.36	101.84
2018-19	8.70	62.04	16.33	39.27	0.43	126.76
2019-20	9.45	64.65	13.74	50.13	0.37	138.34
2020-21	10.26	60.15	14.82	60.40	1.62	147.25
2021-22	10.46	68.64	16.06	73.48	2.27	170.91
2022-23	11.17	71.81	16.02	102.01	2.53	203.55

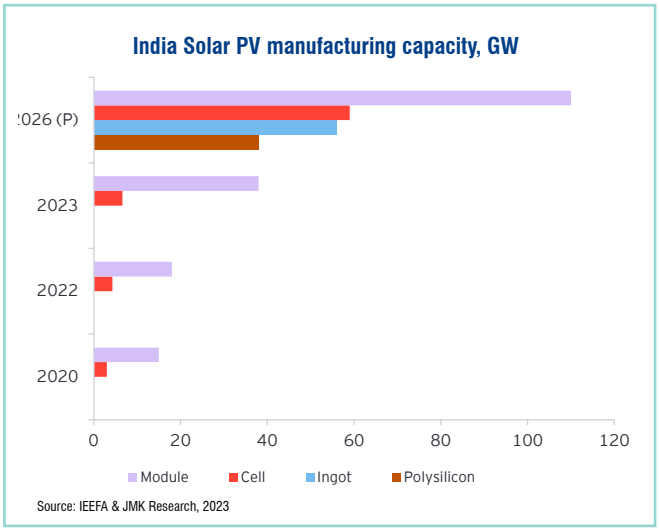
Source: CEA, Report of Renewable Generation
** Excluding Large Hydro*

The global manufacturing capacity of solar PV modules and other raw materials has significantly increased over the last decade. Global polysilicon, wafer, cell, and module manufacturing capacities were 294 GW, 414 GW, 441 GW and 482 GW, respectively.

As of March 2022, India's cumulative PV module manufacturing (nameplate) capacity was approximately 18 GW. However, by March 2023, this capacity had surged to around 38 GW, representing a remarkable addition of over 100%. Furthermore, there is a pipeline of approximately 90 GW of PV cell and module capacity announced, in permitting and construction stages. In terms of PV cell manufacturing, the cumulative capacity increased from about 4.3 GW in March 2022 to around 6.6 GW by March 2023. Additionally, there is a pipeline of approximately 68 GW of cell capacity under various stages of implementation.

There are currently few players in ingot-wafer manufacturing, and no presence of polysilicon manufacturing in India, due to its complexity, lack of technology / IPR, raw materials, and high capital expenditure. Over the past decade, India has heavily relied on China for its solar PV modules, leading to an increased risk in the supply chain. In FY-22 alone, India imported solar modules valued at INR 22,931 crores, along with





solar cells worth INR 8,013 crore, primarily from China. To address this dependency, the Indian government took significant measures. A Basic Custom Duty (BCD) was introduced to make domestically manufactured products more competitive. Additionally, the Ministry of New and Renewable Energy mandated manufacturers to empanel their models and manufacturing units under the Approved List of Models and Manufacturers (ALMM) for availing policy incentives. This initiative aimed to streamline and regulate the quality and performance standards of solar modules in the market, further encouraging domestic production. These initiatives helped boost domestic production of solar PV cells and modules and reduce dependency on imports.

By 2026, India's capacity for critical upstream components in the solar PV value chain, such as polysilicon and ingot/wafer, is expected to reach 38 GW and 56 GW, respectively. PV cell and module capacity is likely to exceed 59 GW and 110 GW, respectively. This expansion is driven by factors such as the Production Linked Incentive (PLI) scheme for integrated solar PV module manufacturing and the significant market potential both within India and globally.

However, the availability of critical raw materials, technology development/acquisition, infrastructure and skilling for complex production processes plays a crucial role in this expansion. For instance, in the manufacturing of metallurgical silica, which is an essential component in the production of solar modules, India relies on the import of raw materials such as low ash coal and charcoal. By strengthening the upstream supply chain, India seeks to build a robust and integrated solar PV manufacturing ecosystem sector to meet both the growing domestic and international demand.

Electric

India now has over 3.45 million registered EVs. As against 16% EV global market share, the overall share of EVs in India's auto sales stood at 6.38% in 2023. However, it was a steep growth from 1.75% in 2021, reflecting a growing consumer preference for electric vehicles. The total electric vehicle sales in 2023 were 1.53 million, a 50% increase from 1.02 million in 2022.

Two wheeler and three wheeler vehicles have been the primary drivers of EV sales in India, accounting for over 94% of total sales in 2023.

Share of EVs across different segments in India

	Total sales in 2023	% of total EVs sold in 2023	% share of total vehicle segment
Electric two wheelers	859376	56.17%	5%
Electric three wheelers	582793	38.09%	54.8%
Electric passenger vehicles	82105	5.36%	2.1%
Electric commercial vehicles	5673	0.37%	0.53%
Total EV sales	**1529947**	**100%**	**6.4%**

Two wheelers account for as much as 56% of the total EV sales in India but just 5% of the overall two wheeler market. In two wheelers, the market is consolidating towards four major players from 5–10 players with small market shares. The top 4 brands now account for 71% of the total sales, up from 62% in 2022. Ola Electric remains the market leader with 31% market share, followed by TVS at 19%, Ather Energy at 12%, and Bajaj at 9%.

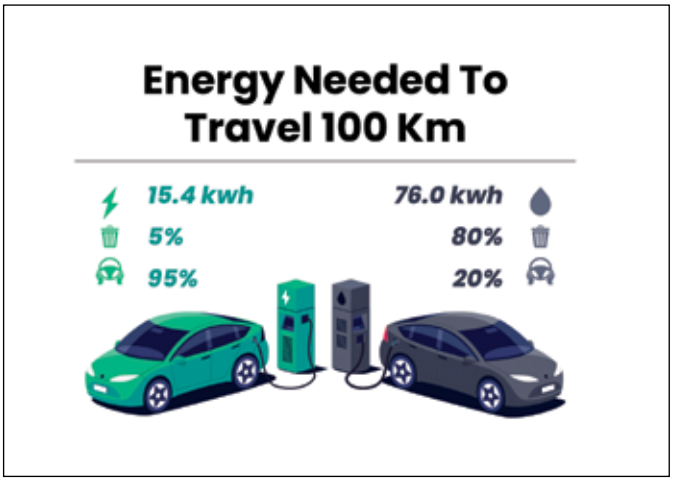
Electric three wheelers have the highest market penetration with close to 55% of total three wheeler market being served by electric three wheelers. The electric variant competes with diesel and CNG variants. However, other than Mahindra & Mahindra, the electric three wheeler segment lacks innovative startups or established OEM brands. Most of the brands and models are low-speed rickshaws imported and assembled here. Hence, the adoption rate has

plateaued. The ICE market leader in this segment is Bajaj Auto, which has nearly 60% share in the ICE segment and has also expanded in electric variants with a small market share.

Electric passenger vehicles (cars), however, has just about 2% market penetration with about 5% of the total EV sales. Company-wise, Tata Motors is the dominant player in electric passenger vehicles segment, accounting for 75% of all BEVs sold in 2023 while other brands such as Chinese–UK brand MG and Mahindra & Mahindra are also building their portfolios.

Commercial vehicles in India span a wide range of vehicular segments and include buses, heavy-duty trucks, light passenger and cargo vans, among others. Similar to global trends, the electrification of this segment is still in its infancy. However, it is expected that going forward, electrification will be relatively faster in buses and vans. There are several government initiatives to phase out diesel buses from inter-city and intra-city transportation (including a joint US–India initiative to replace 10,000 buses). As far as the van segment, a lot of vehicles are primarily used for last-mile supply chain transport. Given the aggressive net zero targets of large retailers and with the planned launches of new models across brands, this segment will continue to be electrified.

What makes electric vehicles better than Internal Combustion Engine (ICE) vehicles is their higher power efficiency compared to ICE vehicles. While ICE vehicles' energy usage is around 20% and the rest is wasted as heat, EVs have high energy efficiency levels, ranging from 87% to 95%, meaning they convert a high percentage of the energy into useful propulsion. EVs also have a lower cost of running. One will spend somewhere between Rs 7-8 Rs per kilometre as the running cost in a small petrol car but in an EV, he will only spend Rs 1 to 1.5 per km. The cost of maintenance of electric cars is also lower - yearly maintenance of an electric car can be as low as 1/4th of cost of petrol car given fewer parts to service as compared to those in ICE vehicles. This explains why EVs are the ubiquitous choice as a green and affordable mobility option.



However, inadequate charging infrastructure, concerns about battery capacity, and higher upfront purchase prices compared to ICE vehicles are slowing down the EV market in India. The cost of buying an electric car is definitely higher than a petrol car and one of the major reasons for this price difference is the battery pack. Nonetheless, Indian automakers have started offering huge discounts on their electric cars as battery costs seem to be heading South. For example, Tata Motors recently cut down the prices of the Nexon EV by up to Rs 1.2 lakh while the Tiago EV got a reduction of up to Rs 70,000. Similarly, MG Motor India too offered discounts of up to 1 lakh on the ZS EV and Comet EV. Presently, one has to pay a premium of 20-30 percent over a similar petrol vehicle while buying an electric car. Comparing the cost of a petrol and electric car, the price for the top-of-the-line Tata Nexon petrol costs Rs 15.6 lakh and the price for the top-of-the-line Nexon EV is Rs 19.2 lakh (both prices ex-showroom). Talking about the Mahindra XUV, the price for the top-of-the-line petrol XUV 300 is Rs 13.5 lakh and the price for the top-of-the-line all-electric XUV 400 is Rs 17.7 lakh (both prices Ex-showroom). Similarly, the top-of-the-line MG ZS EV costs Rs 25 lakh and the price for the top-of-the-line MG Astor costs Rs 18 lakh (both prices Ex-showroom).

Recently, the revision of the FAME II policy in mid 2023 has also impacted the growth of 2W and 3W segments. A sudden withdrawal of FAME II or other incentives could lead to a 25-30% increase in EV prices, which would severely impact the adoption rate. The government revised the FAME-II subsidy amount to ₹10,000 ($121) per kWh as against the earlier amount of ₹15,000 ($182) per kWh. It also capped incentives on e-2Ws at 15% of the ex-factory price of vehicles from 40% earlier. Most electric scooters currently selling have a battery capacity of around 2.5 to 3.5 kWh, retailing between ₹120,000 to ₹150,000 ($1,450 to $,1800). This resulted in reduction in subsidy of ₹20,000 to ₹25000 ($250–$300). The change in subsidy has driven the prices up for the launch plans of major players such as Ola Electric.

Sources: International Energy Agency Outlook Reports, Central Electricity Authority Data, MOSPI, Govt. of India Reports, Economist Intelligence Unit, EIU Outlook Reports, Ernst & Young Reports

The author of this article is Deepika Lal. She has been the lead content writer for GSR since 2015. An economics graduate and an MBA (Finance), she has over 22 years of experience in research and analysis and content writing in the energy sector. She has produced several industry reports and research papers and has profiled many leading names in the oil and gas domain in her professional career.