CHAPTER 6

THE OUTLOOK FOR SDG 7

Photo: © Kola Sulaimon/AFP via Getty Images

Main messages

- **Outlook for progress toward 2030 goals.** Policy and technological innovations have yielded meaningful results in recent years, particularly in expanding renewable energy deployment and improving energy efficiency. Yet the global energy transition is unfolding against a backdrop of compounding crises that have repeatedly disrupted progress and whose full implications remain uncertain. The war in Ukraine triggered a global energy crisis in 2022, driving up prices, straining public finances in developing economies, and redirecting investment flows. The recent conflicts in the Middle East and other parts of the world are further intensifying risks to energy markets, supply chains, and the fiscal space for interventions designed to promote the energy transition, with the ultimate scale of their impact on the outlook for achievement of Sustainable Development Goal (SDG) 7 by 2030 uncertain. These successive shocks underscore that progress toward SDG 7—achieving universal access to affordable, reliable, sustainable, and modern energy by 2030—is not only a function of policy ambition, but also of geopolitical stability and the resilience of international cooperation.
- **Energy security considerations at the national level have come increasingly to the fore,** with governments prioritizing diversification of energy supply, expanded deployment of domestic renewable energy, and reduced dependence on fossil fuel imports in response to price volatility and geopolitical disruptions. Sustained and scaled-up investment and policy support for renewables, energy efficiency, and energy access remain essential. Yet, crises constrain the fiscal space needed for energy access in many countries—a tension felt acutely in clean cooking, where sudden increases in the price of liquefied petroleum gas have rocked household budgets and subsidy programs across low and middle-income countries.
- **Outlook for access to electricity.** The global deficit in access to electricity is narrowing slowly. The number of people without access declined by 11 million between 2023 and 2024, a pace well below pre-pandemic trends. Under the Stated Policies Scenario of the International Energy Agency (IEA), around 640 million people—85 percent of them in Sub-Saharan Africa—will still lack access by 2030. Achieving universal access would require connecting an average of 110 million people per year through 2030, four out of five of them in Sub-Saharan Africa, at an annual investment cost of USD 45 billion. The main headwinds are debt burdens, cuts in international aid, and rapid population growth. To beat those headwinds, concessional finance and robust national electrification plans will be indispensable.
- **Outlook for access to clean cooking.** Universal access to clean cooking fuels and technologies by 2030 remains out of reach under current policies. IEA and the World Health Organization (WHO) project that between 1.6 and 1.8 billion people—over one-fifth of the world's population—will still lack access by the end of the decade, with Africa accounting for more than half of that deficit. Reaching the universal target will depend on providing access to more than 300 million people each year and, at minimum, an investment of USD 8 billion annually through 2030, half of it for Sub-Saharan Africa. Universal access would deliver a net reduction of 1.5 gigatonnes of CO_2 equivalent per year by 2030—comparable to the annual emissions from all planes and ships combined—alongside significant health and social co-benefits, including the prevention of many deaths from poor indoor air quality and time savings of at least 1.5 hours per day for households, with particular benefits for women. Yet today, less than 20 percent of clean cooking plans are backed by clear financing schemes, underscoring that the gap is not only one of ambition but of resources and implementation.

- **Outlook for renewable energy.** Renewable energy continues to lead global electricity growth. In 2025, renewables surpassed coal as the predominant source of generation, with solar photovoltaic (PV) and wind driving the expansion. Under IEA's Stated Policies Scenario, the share of modern renewables in total final energy consumption (TFEC) is projected to reach 18 percent by 2030. However, meeting the pledge made at COP28 (the 2023 United Nations Climate Change Conference) to triple global renewable power capacity by 2030 requires a more ambitious trajectory. The International Renewable Energy Agency's (IRENA's) 1.5°C Scenario calls for renewables to reach approximately 35 percent of TFEC and 68 percent of electricity generation by 2030. Current targets specified in Nationally Determined Contributions (NDCs) made under the United Nations Framework Convention on Climate Change amount to just 5.8 TW—roughly half the tripling goal—which means that ambition must double in less than five years.
- **Outlook for energy efficiency.** Some 250 new or updated efficiency measures were adopted in 2025 in countries representing more than 85 percent of global energy demand, and more than 50 countries incorporated updated efficiency targets into their NDCs ahead of COP30 (the 2025 United Nations Climate Change Conference). Global energy intensity is estimated to have improved by 1.8 percent in 2025, up from 1 percent in 2024—which remains well short of the 4 percent annual improvement needed under the IEA's Net Zero Emissions by 2050 Scenario and the 5 percent per year required under IRENA's 1.5°C Scenario from 2025 to 2030. Regional progress is uneven, with China and India showing stronger gains, while the United States and European Union are set to fall below 1 percent. Four structural barriers continue to hold back progress. Gains in industrial energy intensity have slowed. Standards have failed to keep pace with best-available technology. Demand for insufficiently efficient cooling equipment has surged. And demand for electricity has outpaced supply generated from renewable sources.
- **Investment needs.** Capital flows to the energy sector are set to rise to USD 3.3 trillion in 2025, with USD 2.2 trillion directed toward clean energy—twice the amount flowing to fossil fuels. Yet this remains insufficient. IEA's Net Zero Emissions by 2050 Scenario calls for average annual energy investments of USD 3 trillion through 2030. IRENA, meanwhile, estimates that the targets of the UAE Consensus on renewables and efficiency will require around USD 5 trillion per year (IRENA, COP30 Presidency, and Global Renewables Alliance 2025). Investment in renewable power capacity reached USD 624 billion in 2024 but must rise to USD 1.5 trillion annually. IEA data shows energy efficiency investment of USD 350 billion in 2024, which must rise sevenfold to approximately USD 2.6 trillion per year. Investment flows remain heavily concentrated in China, the European Union, and the United States, leaving emerging markets and developing economies critically underfunded.

Presentation of scenarios

This chapter describes the results of global modeling exercises undertaken to determine whether current policies are sufficient to meet the SDG 7 targets and to identify what additional actions might be needed. It also examines the investments that would be required. Scenarios for the targets are taken from IEA's *World Energy Outlook* (IEA 2025a), *IRENA's World Energy Transitions Outlook: 1.5°C Pathway* (IRENA 2024), and WHO's Business-as-Usual Scenario (see annex 1). The chapter also draws on insights from two major reports: *COP28 Tripling Renewable Capacity Pledge* (IEA 2024) and *Delivering on the UAE Consensus* (IRENA, COP30 Presidency, and Global Renewables Alliance 2025). It explores scenarios in which energy trends evolve under today's policies, as well as pathways that deliver on all energy-related SDGs, including substantial reduction of air pollution, which causes death and illness (SDG target 3.9), and initiation of effective action to combat climate change (SDG 13). Finally, the chapter considers key investment needs to achieve these goals.

IEA's Stated Policies Scenario (IEA 2025a) explores how energy trends evolve under today's policies, assuming no additional policies are put in place. Under this scenario, bottom-up modeling is conducted that considers how policies, pricing, efficiency standards, electrification programs, and specific infrastructure projects would influence energy trends. The Net Zero Emissions by 2050 Scenario considers the SDG 7 goals of 2030 and net-zero energy sector emissions by 2050 as targets to determine what would be needed to achieve these outcomes. Under the Net Zero Emissions by 2050 Scenario, by 2030, modern renewables reach or exceed a 30 percent share of TFEC, and average annual energy efficiency improvements in global energy intensity reach 4.1 percent over 2025–30. After this critical near-term period, the scenario emphasizes efficiency, renewables, and clean fuels, bringing energy sector emissions to net zero by 2050 and limiting the end-of-century global temperature increase to 1.5°C over preindustrial levels.

IRENA's Planned Energy Scenario (IRENA 2024) presents an outlook for future energy system developments based on current government plans, targets, and policies. In contrast, the agency's 1.5°C Scenario sets out a transformative pathway to align the global energy system with the objective of limiting the earth's temperature rise to 1.5°C above pre-industrial levels by the end of the century. This pathway is underpinned by a set of urgent technological and policy actions, including the rapid scale-up of renewable power generation, increased direct use of renewables, significant improvements in energy efficiency, and the electrification of end-use sectors. It also entails the deployment of clean hydrogen and its derivatives, alongside carbon management solutions such as carbon capture and storage and bioenergy coupled with the latter. Together, these measures would enable deep emissions reductions by 2050, laying the groundwork for a net-zero energy system by mid-century. The scenario also further highlights the broader socioeconomic impacts of the transition, including opportunities for economic growth, job creation, and enhanced social equity (IRENA 2024).

Projected clean cooking access rates, access deficits, and fuel use are estimated using the WHO Global Household Energy Model (see annex 1 for further details). In that model, uncertainty grows the further into the future that estimates are calculated, reflecting how country trends may shift based on how unsettled they were during the data period.

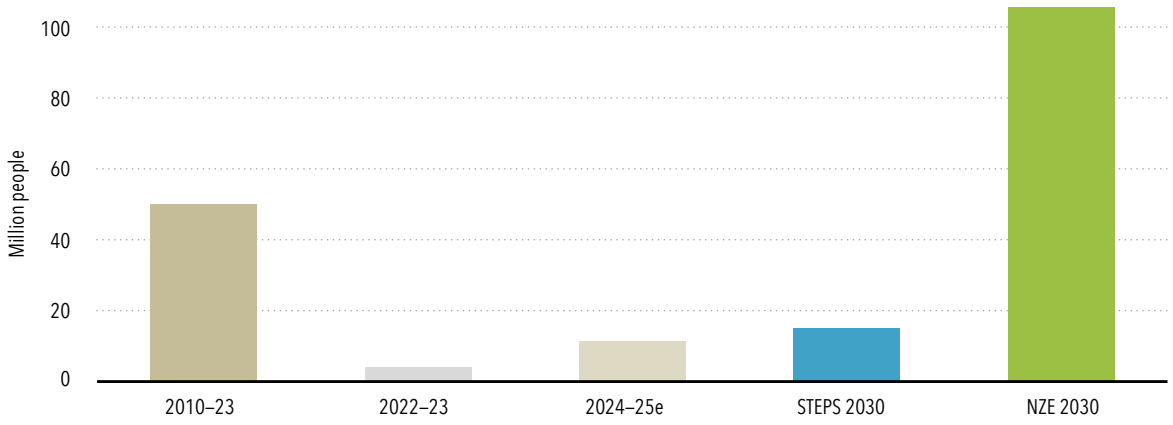
WHO's Business-as-Usual Scenario, used for deriving the clean cooking–related projections, is a hypothetical scenario under which no new policies or interventions (positive or otherwise) are implemented or take place. As such, it is useful as a baseline scenario for comparing the effects of interventions. The Business-as-Usual Scenario is calculated by extrapolating current trends into the future. The year that each country will achieve 100 percent access to clean fuels and technologies is estimated from these projections.

The outlook for access to electricity

The IEA's latest data reveal that the number of the world's people lacking access to electricity declined by just 11 million from 2023 to 2024. That pace is slower than the annual progress achieved before the pandemic and confirms the IEA's earlier estimates. Preliminary 2025 data suggest that the trend will continue, with progress remaining fragile. In many Sub-Saharan African countries, population growth continues to outpace electrification. Debt burdens, which were still elevated after the COVID-19 pandemic and the global energy crisis, along with cuts in international aid, are impeding progress. The end result is that the number of people without access to electricity has remained largely unchanged since 2020.

Electricity access is expected to keep improving through 2030. Trends vary significantly across countries; many will not achieve universal access by 2030 under current policies. In fact, only nine Sub-Saharan African countries achieve universality. Under IEA's Stated Policies Scenario, around 640 million people—roughly 8 percent of the global population—will remain without electricity access by 2030, 85 percent of them in Sub-Saharan Africa. In that region, 40 countries without universal access to electricity have official targets today, yet only about half of them have targets at least as ambitious as SDG target 7.1. This target remains within reach for countries with adequate policies, holistic electrification plans, and well-resourced implementing institutions. Countries without electrification plans and enabling frameworks are not on track to meet the target (figure 6.1).

Figure 6.1 • Population gaining access to electricity annually, historically, and in 2030 under IEA's scenarios



Source: IEA 2025a.

e = estimate; STEPS = IEA Stated Policies Scenario; NZE = IEA Net Zero Emissions by 2050 Scenario.

Most developing nations in Asia are still on course to achieve near-universal electricity access, with fewer than 2 percent of the region's population projected to lack electricity by 2030. According to the Stated Policies Scenario, reaching full universal access by 2030 will require stronger efforts from countries including Afghanistan, Mongolia, and Pakistan. In Central and South America, electricity access is expected to be nearly universal by 2030, with only the most isolated communities remaining without power. Haiti stands as the main exception: despite regional progress, a significant portion of its population is still projected to lack electricity by 2030.

Obtaining financing is often more challenging for countries that have the greatest need to improve access. International support in the form of concessional finance is essential, especially under current economic conditions. More importantly, public finance remains vital for building energy infrastructure, investing in the socioeconomic ecosystem that relies on energy as an input, bridging affordability gaps for consumers, expanding access to last-mile communities, and

derisking private investments, including rural economies and food systems that depend on energy for production, processing, and service delivery. Governments must facilitate better access to international finance so that robust electrification plans can be implemented and capital can be allocated to access projects accordingly (IEA 2025a).

Some 110 million people would have to gain access annually to achieve the target of universal access to by 2030. Four out of five of those people live in Sub-Saharan Africa. Efforts must be stepped up there, especially in Nigeria and the least-developed, fragile, and conflict-affected countries of the region, which might benefit from special support measures. The Democratic Republic of Congo, Niger, Sudan, the United Republic of Tanzania, Uganda, and Ethiopia fall into that category; together they are home to half of the region's population projected to be without electricity in 2030. These countries also host tens of millions of forcibly displaced people, who typically have lower levels of access and will require greater inclusion into national policies and plans if universal electrification is to be achieved.

Affordability remains the primary impediment to gaining access and benefiting from it. Central to sustainable improvements will be support for decentralized solutions, tracking and monitoring, the use of geospatial data in electrification planning, and the establishment of capable entities to implement the plans. Low-capacity off-grid energy solutions—for example, small solar systems—will continue to play an important role, especially in remote and hard-to-reach areas. Nevertheless, decentralized solutions must be aligned to support the gradual expansion of energy services via larger systems or grid connections. These alignments will require robust national planning capacity. IRENA supports its member countries in this regard through the Strategic Energy Access Planning Support (SEAPS) program, which provides tools and skills for data-driven, least-cost integrated electrification planning. Good planning, in turn, helps unlock investments to provide underserved communities with the cost-effective solutions. SEAPS has four interconnected pillars: data collection, planning tool development, scenario development, and stakeholder engagement. The four pillars combine to form a participatory, data-driven approach to energy access planning.

In IEA's Net Zero Emissions by 2050 Scenario, nearly 90 percent of new electricity connections will be based on renewables, supported by a decline in the cost of solar PV panels and batteries. The delivery technology is unique to each location. In Sub-Saharan Africa, 43 percent of new connections by 2030 would be directly to the grid, 30 percent through mini-grids, and the remainder through stand-alone systems (mostly solar home systems). In developing countries in Asia, just over half of the new connections would be directly to the grid; almost a third would be through mini-grids.

Many successful electrification plans—such as those in Côte d'Ivoire, the Gambia, Kenya, and Rwanda—take into account the needs of health facilities, schools, agricultural enterprises, and other productive uses, alongside households' needs.

Achieving universal electricity access will require investment amounting to USD 45 billion annually through 2030. These investments include electricity generation, electricity networks, and decentralized solutions. Electricity access must extend beyond a simple connection powering a few household devices; it must support the growing use of energy services that can contribute to socioeconomic prosperity.

The outlook for access to clean cooking fuels and technologies

Current policies are insufficient to achieve universal access to clean cooking by the 2030 target. If current trends continue, IEA and WHO estimate that between 1.6 and 1.8 billion people—over one-fifth of the world's population—will still lack access to clean cooking by 2030 (figure 6.2). Both IEA and WHO have reported significant progress in Asia. In Africa, by contrast, almost the same number of people as today are expected to remain without access at the end of the decade (IEA 2025a; WHO 2026). Many African countries are not expected to achieve universal access even in the 2050s.

IEA estimates that achieving universal access would require adding more than 300 million people each year—about half of them in Sub-Saharan Africa—through 2030. The effort required in Sub-Saharan Africa is equivalent to repeating the best single-year advances in the rest of the world every year from now till 2030. While African countries are implementing clean cooking plans, they lack the resources to support them. Today, less than 20 percent of clean cooking plans are backed by clear financing schemes.

In terms of changes in the fuel mix, if current trends remain unchanged, WHO projects that 70 (64–74) percent of the population of the low- and middle-income countries will rely primarily on gas for cooking if current trends continue through 2030; 6 (3–9) percent will rely primarily on electricity.[39] However, by 2030, 19 (16–24) and 4 (3–5) percent, respectively, will still rely on unprocessed biomass and charcoal, whereas around 1 percent will use kerosene and coal (WHO 2026). The use of gaseous fuels is expected to drive most of the increase in the percentage of the low- and middle-income country population using clean fuels and technologies for cooking.

Under IEA's Net Zero Emissions by 2050 Scenario, the demand for modern uses of energy grows until 2030, while the consumption of charcoal and firewood for cooking is phased out. In some regions, new infrastructure would be needed. For instance, on this pathway in Sub-Saharan Africa, the demand for liquefied petroleum gases grows threefold by 2030, requiring an expansion of distribution services and an increase in cylinders and refilling stations. By 2030, electric cooking alone in Sub-Saharan Africa drives up electricity demand 16 percent from today; that growth could potentially strain distribution systems if not managed well (IEA 2025b). Diversifying clean cooking pathways, including through sustainable options like biogas, can help reduce pressure on electricity systems while expanding access in constrained settings.

Achieving universal access would deliver a net reduction of 1.5 gigatonnes of CO_2 equivalent per year by 2030—a figure comparable to the annual emissions from all planes and ships combined. While transitioning households to electricity and cleaner fuels such as liquefied petroleum gas adds emissions, these are more than offset by reductions in methane and other greenhouse gases from incomplete combustion in traditional stoves (0.9 Gt CO_2-eq), as well as lower deforestation rates (0.7 Gt CO_2-eq). These climate gains come alongside significant health and social co-benefits: many premature deaths from poor indoor air quality could be prevented, and the average household would save at least 1.5 hours a day—time that could be redirected toward education or income-generating work, particularly among women.

Total capital investments in clean cooking technologies and infrastructure through 2030 amount to USD 8 billion annually-half in Sub-Saharan Africa alone (IEA 2023). That amount of investment would require a substantial increase from the current level, which approximates USD 2.5 billion. For these larger investments to materialize, policy guidelines and institutional frameworks must be put in place to incorporate clean cooking into energy planning strategies and attract private funding.

---

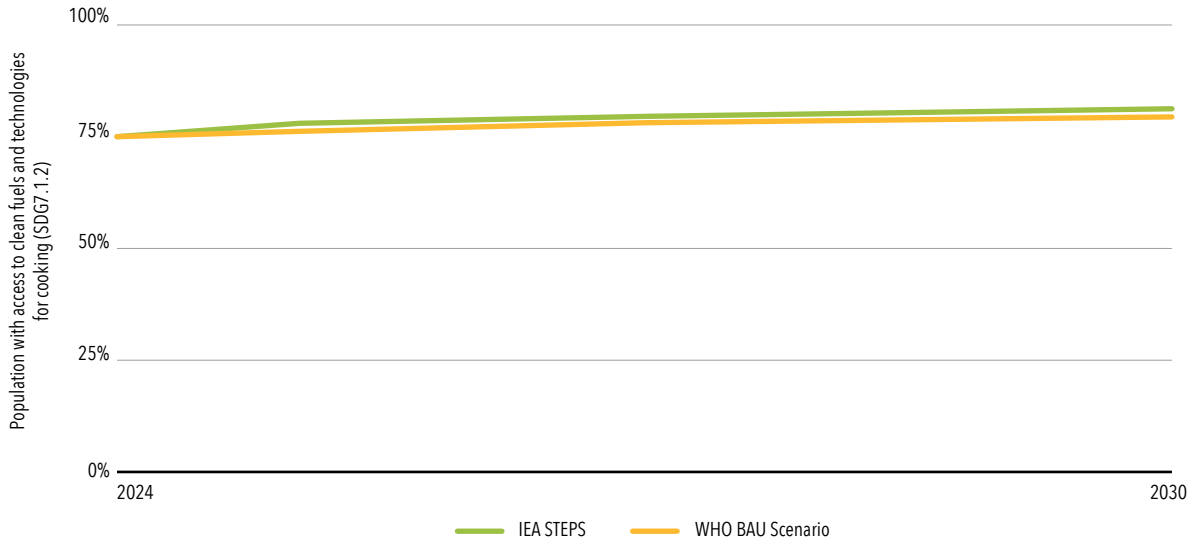
39 Figures appearing after estimates inside brackets/parentheses are 95 percent uncertainty intervals.

Building high-level political support for this often-overlooked part of the energy access agenda is critical to achieving the universal clean cooking target. In 2024, the IEA, in partnership with Tanzania, Norway, and the African Development Bank, co-chaired a Summit on Clean Cooking in Africa. The summit resulted in the adoption of the Clean Cooking Declaration by more than 130 governments and organizations. Around USD 470 million of the USD 2.2 billion committed has already been disbursed, exceeding the annualized commitment needed to meet the 2030 pledges. Investments have reached 22 African countries, with the IEA tracking direct public investments in six countries and private sector disbursements across all 22. This year, the 2026 Summit on Clean Cooking in Africa—co-chaired by Kenya, Norway, the United States, and the IEA, and co-organized with the African Union and the African Development Bank—comes as a response to current pressures on households and governments, with rising costs, supply constraints, and inflation raising the risk of fuel shortages and deepening energy poverty, particularly for the most vulnerable.

To bridge the gap in access to clean cooking, each country must develop its own roadmap, based on its specific circumstances and stage of development. Doing so requires a systematic approach supported by national action as well as international collaboration, with specific attention to the promotion of clean cooking among the most vulnerable and hard-to-reach groups, such as people living in countries and contexts affected by fragility, conflict, and displacement.

A significant increase in public funding will be crucial to attract private investment, make clean cooking more affordable, and foster innovation in clean fuels and technologies. Climate finance, particularly carbon finance, if properly managed, can be pivotal in making clean cooking more accessible, especially for the most underserved communities. Where bioenergy solutions are scaled up for clean cooking, the application of robust assessment frameworks, such as the Global Bioenergy Partnership indicators, will be essential to ensure environmental protection, social inclusion, and economic viability across value chains.

Figure 6.2 • Clean cooking access rate by 2030 in IEA's Stated Policies Scenario and WHO's Business as Usual scenario



Source: IEA 2025a and WHO 2026.

The outlook for renewable energy

SDG target 7.2 calls for a substantial increase in the share of renewable energy in the energy mix. Although it does not specify a quantitative objective, various long-term scenarios for a net-zero energy sector by 2050 require a tripling of installed capacity of renewables-based power by 2030. This is reflected in the COP28 agreement for tripling renewables-based power, which calls for at least 11,000 GW by 2030 (UNFCCC 2023), in line with IEA's Net Zero Emissions by 2050 Scenario and IRENA's 1.5°C Scenario.

The outlook for renewables under the two scenarios remains positive in all regions despite the impact of recent crises on supply chains and prices. The positive outlook is underpinned by targeted policies and falling technology costs. Under IEA's Stated Policies Scenario, the share of all renewables (including traditional uses of biomass) in TFEC is projected to rise from 17 percent in 2024 to 22 percent in 2030, while the share of modern direct uses of renewables, which excludes traditional use of biomass, is projected to increase from 12 percent in 2024 to 18 percent in 2030. In contrast, under IRENA's Planned Energy Scenario, the share of modern use of renewables in TFEC would increase to 18 percent by 2030, driven by the expansion of renewables, particularly in the power and transport sectors. Expanding the use of renewables in productive sectors, such as agriculture, can further support increases in renewable shares in TFEC while delivering development and resilience co-benefits.

Renewables used in the power sector continue to be the fastest-growing energy source worldwide. With governments increasingly prioritizing renewable projects and addressing short-term supply chain concerns, annual capacity additions for renewables in 2025–30 are projected to increase two-and-a-half-fold over 2015–24; solar PV and wind are projected to spearhead the expansion. By 2025, renewables are expected to surpass coal as the predominant source of electricity generation. Solar PV leads as the renewable electricity source, meeting nearly half of the growth in electricity demand over the period, followed by wind, accounting for around 35 percent. Hydropower will continue to be the key low-emission electricity source globally through 2030, providing flexibility through pumped hydro and supporting other essential power system services. Combined with end-use electrification, pumped hydro's flexibility, other forms of storage, and grid expansion will enable the share of renewables-based electricity in TFEC to approach percent by 2030, up from 6 percent in 2024. This trend includes a larger role for transport sector electrification owing to the rapidly growing use of electric vehicles. At the same time, it will add to grid flexibility to the extent that controlled charging is feasible.

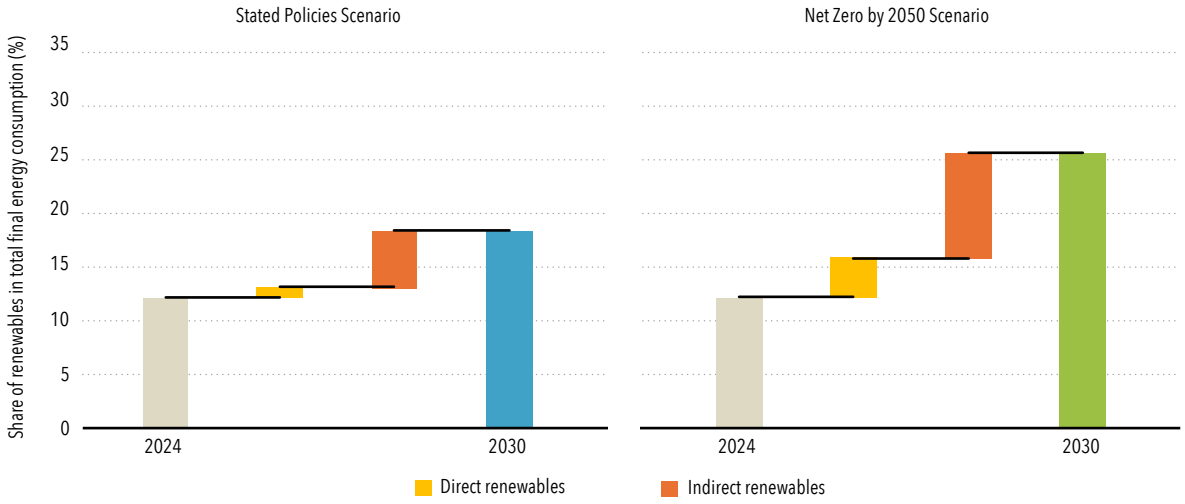
To meet the 2030 target, renewable energy deployment across transport, industry, and buildings would need to accelerate markedly toward 2030 in both scenarios, with the growth rate doubling between 2025 and 2030 compared with the rate from the previous seven-year period. The acceleration would be driven largely by rapid expansion of renewable electricity, which increasingly drives electrification across all end-use sectors. For transport, electric mobility accounts for a major share of the growth, complemented by modern use of sustainable biofuels, with smaller contributions from biogases, clean hydrogen, and e-fuels by 2030. For heating, renewables consumption would need to expand by more than 50 percent, driven by sustainable renewable electricity use in buildings and low-to-medium temperature industrial processes where feasible, alongside continued growth in sustainable bioenergy and pilot applications of green hydrogen (IEA 2025c and IRENA 2024).

Policy action remains key, especially if end-use renewables are to grow at the pace needed to meet climate ambitions. Although cost increases and competing budgetary pressures pose a risk of probable delay in reaching some targets, locally sourced end-use renewables can be part of the toolkit for boosting energy security, reducing risks, and, in turn, cutting costs.

Bridging the gap: Insights from IEA's Net Zero Emissions by 2050 Scenario

The use of renewables increases twice as rapidly under the Net Zero Emissions by 2050 Scenario as under the Stated Policies Scenario (IEA 2025a). Under the more ambitious Net Zero Emissions by 2050 Scenario, modern uses of renewables would represent around a third of TFEC in 2030 (figure 6.3).

Figure 6.3 • Renewables' share in total final energy consumption in 2024 and under IEA scenarios by 2030



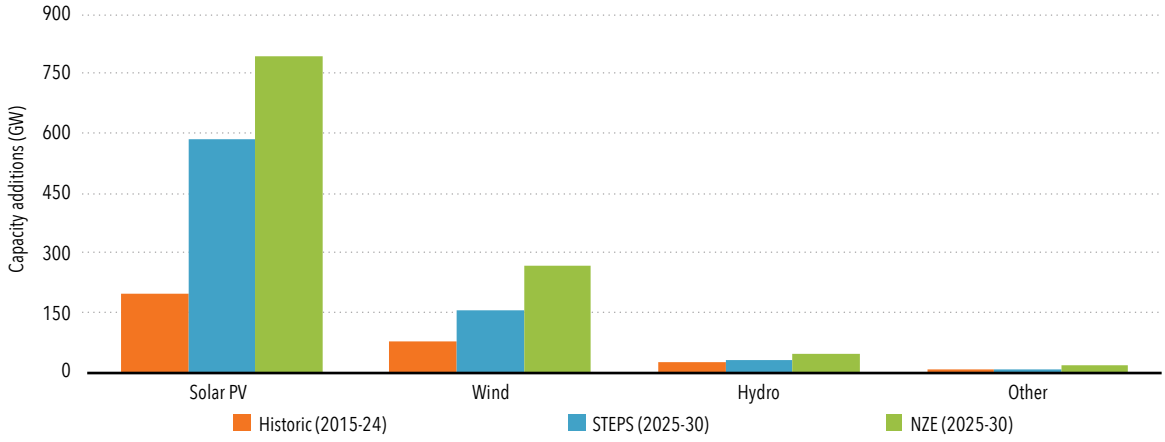
Source: IEA 2025a.

Under the Net Zero Emissions by 2050 Scenario, increased electrification of energy end uses is a primary means to boost renewables' share in TFEC. Under the scenario, electricity's share in final energy demand rises to exceed 30 percent by 2030, compared with about 20 percent under the Stated Policies Scenario. This growth is driven primarily by the electrification of transport and heat. Direct use of renewables, principally biofuels, constitutes 11 percent of fuel for road transport, on average. Combined with growing electrification, renewables' share in transport rises to nearly 17 percent (IEA 2025a).

Renewable energy is used for heating in various applications, including space and water heating, cooking, and industrial processes. The heat can come directly from sources like bioenergy, solar thermal, or geothermal energy, or indirectly through electricity and district heating generated from renewables. Transitioning to direct renewable heat—such as solar thermal water heating, biomass, and low-carbon gases—can help decrease reliance on fossil fuels. In 2024, renewables represented 12 percent of the total energy consumed for heating worldwide. By 2030, that share grows to around 30 percent under the Net Zero Emissions by 2050 Scenario. Under the same scenario, traditional uses of biomass are phased out completely by 2030, being replaced with more modern and efficient fuels and technologies. (Under the Stated Policies Scenario they fall to 3 percent of TFEC by the target year.)

As a share of TFEC in 2030, renewables-based electricity generation increases the most rapidly—to about 60 percent from the current level, a 16 percentage point increase over the level projected in the Stated Policies Scenario. Globally, renewables-based electricity generation grows by 12 percent annually, to approximately 22,520 terawatt-hours by 2030. This is supported by unprecedented solar PV and wind capacity additions, reaching, respectively, 585 GW and 157 GW a year on average over 2025–30 (figure 6.4). Annual investment in renewables-based power triples over the decade, to more than USD 1.2 trillion a year by 2030. That growth is supported by additional spending on expanding and modernizing electricity networks and battery storage and by improving the operational flexibility of existing assets to better integrate renewables.

Figure 6.4 • Average annual capacity additions of renewable power generation, by technology, under IEA scenarios



Source: IEA 2025a.

GW = gigawatt; NZE = Net Zero Emissions by 2050 Scenario; PV = photovoltaics; STEPS = Stated Policies Scenario.

Energy policy, socioeconomic factors, and natural resource availability influence the growth of renewables differently across regions. In developing economies, renewable electricity generation is projected to account for more than 80 percent of growth by 2030 under the Stated Policies Scenario. Under the same scenario, the share of renewables in electricity generation by 2030 varies widely, from 15 percent in the Middle East and 17 percent in Northern Africa to around 80 percent in Central and South America, where hydropower dominates. In the Net Zero Emissions by 2050 Scenario, renewables play an expanding role in all regions, reaching or surpassing 50 percent of total electricity generation in many areas by 2030.

Under the Net Zero Emissions by 2050 Scenario, the supply of low-emission hydrogen increases from 0.3 million metric tons (Mt) today to 90 Mt in 2030. The share of low-emission hydrogen in TFEC reaches 10 percent. Achieving net-zero emissions by 2050 also requires carbon capture technologies. Under the Net Zero Emissions by 2050 Scenario, in 2030, just above 1.2 $GtCO_2$ is absorbed via carbon capture, use, and storage, and by CO_2 removal technologies that do not include nature-based measures.

Accelerating the Energy Transition: Insights from IRENA'S 1.5°C Scenario and from Delivering on the UAE Consensus

Tripling global renewable power capacity by 2030 is a cornerstone of progress toward SDG 7 and of advancing climate action under SDG 13. The period to 2030 represents a critical window for raising ambition and accelerating implementation. While a broad portfolio of technologies will be required to fully decarbonize the energy system by 2050, the limited timeframe to 2030 narrows the range of solutions that can be deployed at scale. In this context, renewable power and energy efficiency stand out as the most readily scalable options to deliver near-term progress. At the same time, sustained innovation and development across a wider set of low-carbon technologies remain essential to ensure long-term transformation for decarbonization and economic growth.

IRENA's 1.5°C Scenario outlines key performance indicators to guide this transition (IRENA 2024). By 2030, renewable energy's share in TFEC would need to rise to around 35 percent to make the pathway a reality, while renewables would account for approximately 68 percent of electricity generation. The share of electricity in TFEC would need to surpass 30 percent, reflecting accelerated electrification across all end-use sectors. Energy intensity improvements would need to average at least 4 percent per year from 2023 until 2030—more than double the rate achieved in the previous decade. In parallel, clean hydrogen production would need to scale up to around 125 million tonnes by 2030. Targeted deployment of carbon removal solutions, particularly in hard-to-abate sectors such as heavy industry, would also be required to complement these efforts.

Figure 6.5 • Key performance indicators for IRENA's 1.5°C Scenario in 2030 compared with the Planned Energy Scenario in 2030 and 2050: Global perspective

GLOBAL PERSPECTIVE	Historical			Planned Energy Scenario (PES)[1]		1.5°C Scenario[1]		Essential milestones
	2021	2022	2023	2030	2050	2030	2050	
KPI.01 RENEWABLES (POWER)[2]								
Renewable energy electricity generation (TWh/yr)	7 873	8 440	N/A	16 504	38 118	27 358	82 148	• Tripling renewable capacity by 2030. • Nine-fold increase in renewables by 2050. • Renewable electricity share in electricity generation to reach c. 70% by 2030 and 90% by 2050.
Renewable energy share in electricity generation (%)	28	29	N/A	46	73	68	91	
Renewable energy installed capacity (GW)	3 083	3 391	3 865	6 773	15 835	11 174	33 216	
Renewable energy share in installed capacity (%)	38	40	43	58	80	77	94	
KPI.02 RENEWABLES (DIRECT USES)								
Renewable energy share in TFEC (%)	17[3]	17[3]	N/A	23	33	35	78	• Doubling the direct use of renewable energy by 2030 and quadrupling it by 2050. • Tripling modern use of bioenergy by 2050.
Modern use of bioenergy (EJ)[4]	23[3]	24[3]	N/A	30	41	46	53	
KPI.03 ENERGY INTENSITY								
Energy intensity improvement rate (%)	0.7[5]	2[5]	N/A	2[6]	2[7]	4[6]	3[7]	• Urgent doubling energy efficiency improvements by 2030.

Figure 6.5 • Key performance indicators for IRENA's 1.5°C Scenario in 2030 compared with the Planned Energy Scenario in 2030 and 2050: Global perspective *(continued)*

GLOBAL PERSPECTIVE	Historical			Planned Energy Scenario (PES)[1]		1.5°C Scenario[1]		Essential milestones
	2021	2022	2023	2030	2050	2030	2050	
KPI.04 ELECTRIFICATION IN END-USE SECTORS (DIRECT)								
Electrification rate in TFEC (%)	22[3]	23[3]	N/A	23	28	30	52	• Direct electrification of end-use sectors would need to increase by 50% by 2030 and more than double by 2050.
KPI.05 CLEAN HYDROGEN AND DERIVATIVES								
Production of clean hydrogen (Mt)	0.6[8]	0.7[8]	0.7[8]	2	21	125	523	• A new set of hydrogen facilities to be scaled up by 2030 and beyond.
KPI.06 CCS, BECCS AND OTHERS								
CO_2 captured from CCS, BECCS and other removal measures (Gt)	0.05[9]	0.05[9]	0.05[9]	0.1	0.5	2.2	7.0	• CO_2 removal, capture and storage measures also needed – to 2.2 Gt and 7 Gt by 2030 and 2050.

Notes: The scenario results presented herein are subject to upward revision in the 2025 edition of the *World Energy Transitions Outlook*, given the current pace of solar and storage growth in certain countries.
BECCS = bioenergy with carbon capture and storage; CCS = carbon capture and storage; CO_2 = carbon dioxide; EJ = exajoule; GW = gigawatt; Gt= gigatonne; KPI = key performance indicator; Mt = megatonne; PES = Planned Energy Scenario; TFEC = total final energy consumption; TWh/yr = terawatt hour per year.

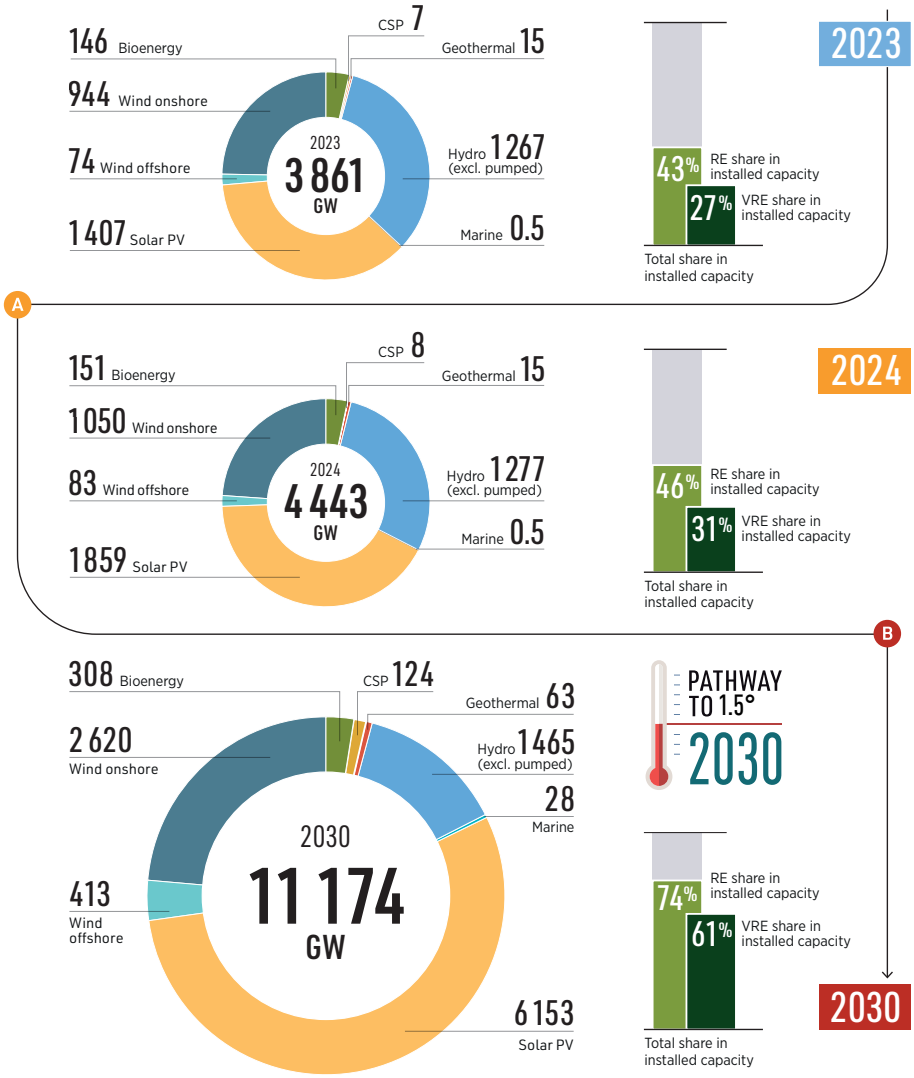
[1] PES and 1.5°C Scenario analyses as of March 2023.
[2] (IRENA, 2024a).
[3] Based on (IEA, 2024b).
[4] Excludes non-energy uses.
[5] Energy intensity improvement achieved estimated using (IEA, 2024b) for primary energy supply and (CE, *n.d.*) for GDP statistics.
[6] Average annual improvement rate from 2023 to 2030 uses (IEA, 2024b) for primary energy supply (historical data), and (CE, *n.d.*) for GDP historical statistics.
[7] Average annual improvement rate from 2023 to 2050 uses (IEA, 2024b) for primary energy supply (historical data), and (CE, *n.d.*) for GDP historical statistics.
[8] (IEA, 2023a).
[9] (IEA, 2024c).

Accelerating the energy transition at the pace and scale required calls for the near-complete decarbonization of the electricity sector by mid-century. In this context, tripling global renewable power capacity by 2030 is both technically feasible and economically viable, but it will depend on strong policy commitments, enabling frameworks, and scaled-up investment across capacity and infrastructure.

Since the adoption of SDG 7 in 2015, annual additions of renewable power capacity have consistently surpassed those of fossil fuel and nuclear generation combined, reaching 692 GW in 2025 (IRENA 2026). However, the expansion of most renewable technologies—including wind, hydropower, geothermal, bioenergy, concentrated solar power, and marine energy—remains below the levels required to align with a 1.5°C pathway and meet the tripling pledge (figure 6.6). Solar PV is a notable exception, with additions of 511 GW in 2025 (IRENA 2026).

Under IRENA's 1.5°C Scenario, accelerating electrification across end-use sectors—particularly heating and transport—together with the expansion of green hydrogen production and new consumption from expanding data centers, is expected to drive a substantial further increase in electricity demand.

Figure 6.6 • Global installed renewables-based power capacity in 2023, 2024, and 2030 under IRENA's 1.5°C Scenario

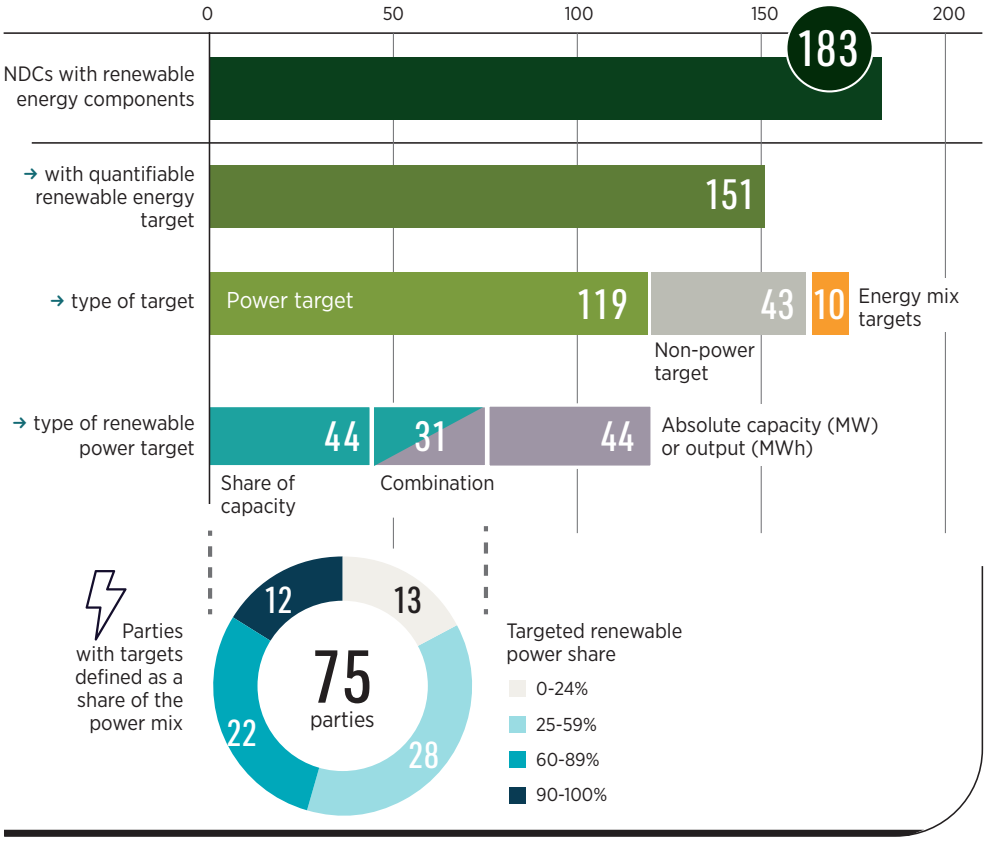


Source: IRENA, COP30 Presidency, and Global Renewables Alliance 2025.

CSP = concentrated solar power; GW = gigawatt; PV = photovoltaic; VRE = variable renewable energy; bioenergy includes biogas, biomass waste and biomass solid; hydropower data excludes pumped hydro; tripling target for the global installed capacity by 2030 is compared to 2022 status.

To achieve the global goal of tripling renewable power capacity by 2030, installed capacity would need to reach around 11.2 TW—highlighting a wide gap relative to current national commitments. IRENA's latest assessment shows that renewable power targets in NDCs submitted as of October 2025 amount to only about 5.8 TW by 2030, or roughly half of what is required. Even when considering broader national plans and targets, projected capacity reaches only around 7.4 TW, still well below the tripling goal (figure 6.7).[40]

Figure 6.7 • Global renewable energy targets in NDCs (as of October 2025) and the gap to the 2030 tripling goal



Source: IRENA, COP30 Presidency, and Global Renewables Alliance 2025.

This shortfall indicates that current ambitions must nearly double within less than five years to remain on track. Although some progress has been made, including updates to NDCs, the overall increase in national targets has been limited. Closing this gap will require significantly stronger policy action, faster implementation, and a major scale-up in investment to accelerate renewable energy deployment.

At the same time, progress across the energy sector remains insufficient to keep the 1.5°C goal within reach. The pace of renewable deployment, energy efficiency improvements, and electrification continues to lag behind what is required, highlighting the need for rapid acceleration before 2030 to scale up renewables, reduce dependence on fossil fuels, and enhance the resilience of the energy system in the face of growing geopolitical uncertainties while avoiding further "lock-in" effects.

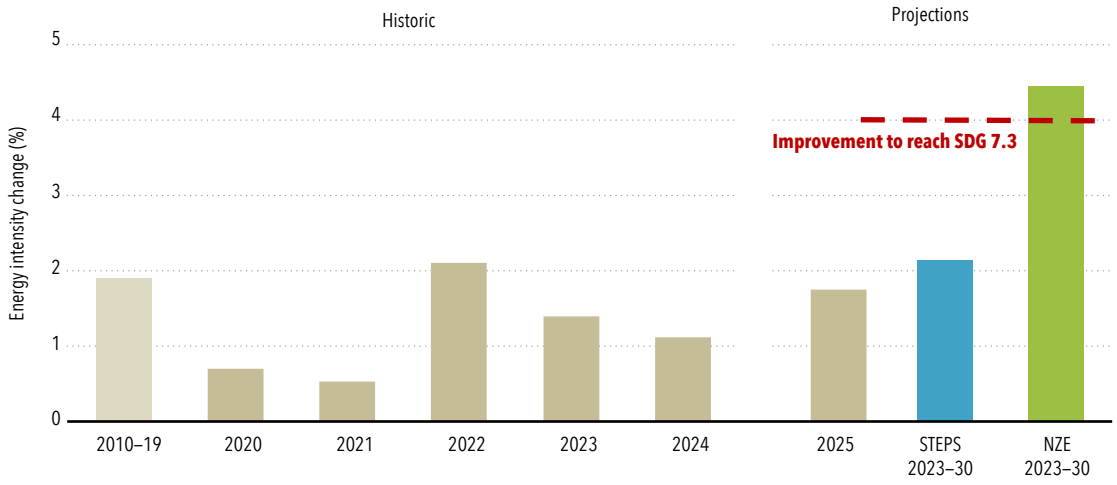
40 The Planned Energy Scenario reflects both explicit and implicit national targets, energy plans, and policies in place. It will be updated in IRENA's forthcoming World Energy Transitions Outlook.

The outlook for energy efficiency

In 2025, governments implemented more than 250 new or updated efficiency-related policies in countries representing 85 percent of global energy demand—an expansion from 2024, when countries accounting for only 70 percent of global energy demand took action. More than 50 countries have also incorporated updated energy efficiency targets into their NDCs ahead of COP30. While this broadening of the policy landscape provides a basis for faster progress, the central challenge remains translating policy coverage into implementation at the pace and stringency required to close the gap between projections and targets.

Global energy intensity is estimated to improve by 1.8 percent in 2025, up from around 1 percent in 2024. While this represents a partial recovery from a particularly weak year, it remains well below the pace required to meet global efficiency targets. Preliminary estimates indicate that several key regions are showing some signs of stronger progress on energy intensity relative to their post-2019 averages. Progress in 2025 is estimated to have been in excess of 3 percent in the People's Republic of China (hereafter "China") and 4 percent in India—both above their averages since 2019. In the United States and the European Union (EU), however, progress in 2025 is set to fall below 1 percent, a marked deceleration following several years of stronger performance in the wake of the energy crisis (figure 6.7). These divergences reflect the extent to which efficiency gains in some advanced economies were partly crisis-driven rather than structurally embedded in policy frameworks.

Figure 6.7 • Historical and projected improvement in global energy intensity by scenario, 2010–30



Source: IEA 2025d.

NZE = Net Zero Emissions by 2050 Scenario; SDG = Sustainable Development Goal; STEPS = Stated Policies Scenario.

Several of the countries that introduced new or updated efficiency policies in 2024 are noted below. Kenya revised its building code to mandate efficiency requirements for new construction. The European Union strengthened regulations to achieve a zero-emission building stock by 2050, including measures to encourage retrofitting. China enhanced appliance standards and set more ambitious national efficiency targets, while the United States tightened fuel economy standards for heavy-duty vehicles.

Over the past year, governments allocated approximately USD 60 billion for building efficiency measures and USD 45 billion for low-emission vehicles, bringing total efficiency-related funding over the last five years to more than USD 1 trillion.

However, policy implementation must accelerate considerably to improve progress on energy efficiency and enter into alignment with global climate ambitions. Around the world, almost half of newly built floor area is not yet covered by efficiency requirements, and the regulations in place vary significantly among countries in their scope and stringency. Similarly, just three out of five industrial electric motors in use globally are covered by minimum energy performance standards—gaps that represent substantial unrealized savings.

Energy efficiency is essential for reducing reliance on fossil fuels. In a highly ambitious scenario aligned with the IEA's pathway to net zero energy sector emissions by 2050, faster efficiency improvements could account for over 70 percent of the projected decline in oil demand and 50 percent of the reduction in gas demand by 2030. The drop in oil demand—comparable to China's total oil consumption in 2025—would largely result from technical efficiency gains (such as more fuel-efficient vehicles) and electrification, including the adoption of EVs. Meanwhile, the reduction in natural gas demand—exceeding Europe's total gas use in 2024—would be driven by measures such as better building insulation and the electrification of heating. Realizing these reductions would require a pace of efficiency improvement far beyond current trends.

Four structural trends continue to hold back faster progress. First, two-thirds of global growth in final energy demand since 2019 has been concentrated in industry, a sector where progress on energy intensity has slowed sharply. Industrial energy demand growth has accelerated since 2019, while the average annual rate of improvement in industrial energy intensity fell below 0.5 percent over that same period, tumbling from almost 2 percent the previous decade. The shift toward more intensive energy use in industry is offsetting gains made in other sectors and weighing down overall progress on energy efficiency.

Second, policies have lagged behind technological advances, leaving significant savings on the table. Many appliances being sold today are only half as efficient as the best available models. As technologies have become more efficient in recent years, efficiency standards have not progressed at the same pace. For example, the efficiency of best-in-class lightbulbs doubled over the past 15 years, while minimum performance standards increased by only 30 percent.

Third, increased access to air conditioners has pushed up electricity demand. Higher living standards have allowed more people to afford much-needed cooling, especially in emerging economies. Energy for space cooling has seen the fastest growth of any end-use in buildings since 2000, rising by more than 4 percent per year. However, the increased demand has largely been met with equipment that falls well short of the most efficient available. If every air conditioner bought since 2019 had been the most efficient available, the world could have avoided demand for electricity equivalent to demand from data centers over the same period.

Fourth, electricity demand growth has outpaced renewable supply, leading to an overall increase in less-efficient fossil fuel generation.

Under IRENA's 1.5°C Scenario, the average annual rate of energy intensity improvement must exceed 3.3 percent over 2020–30. As noted, however, recent progress has fallen short: Energy intensity improved by just 1 percent between 2023 and 2024, well below the level required to meet global targets. As a result, the pace must now accelerate to at least 5 percent annually from 2025 to 2030 given the limited progress made in the past years.

Achieving this scale-up will require the rapid deployment of measures that enhance technical performance—such as high-efficiency boilers, air conditioners, motors, heat pumps, and appliances—alongside greater uptake of technologies enabling the direct use of renewable energy, including solar thermal systems. Delivering these improvements also depends on strong cross-sectoral policies and coordinated action among governments, industry, financial institutions, and other stakeholders, supported by measures such as standards, labeling, and targeted financing. Initiatives such as the Global Energy Efficiency Alliance, launched at COP29 in 2024, play a role in advancing international cooperation, mobilizing finance, and accelerating deployment of technology toward the goal of doubling global improvements in energy efficiency by 2030—a goal that current trajectories have yet to put within reach.

Investments needed to achieve SDG 7

Despite elevated geopolitical tensions and economic uncertainty, capital flows to the energy sector are expected to have risen in 2025 to USD 3.3 trillion, a 2 percent rise in real terms from 2024. Around USD 2.2 trillion is going collectively to renewables, nuclear, grids, storage, low-emissions fuels, efficiency, and electrification, twice as much as the USD 1.1 trillion going to oil, natural gas, and coal. Open questions about the economic and trade outlook means that some investors are adopting a wait-and-see approach to new project approvals, but spending on existing projects has not yet changed significantly. As the 2030 deadline approaches, the central challenge is ensuring that rising investment levels translate into effective delivery of energy access, clean cooking, and reliable services in underserved and rural contexts.

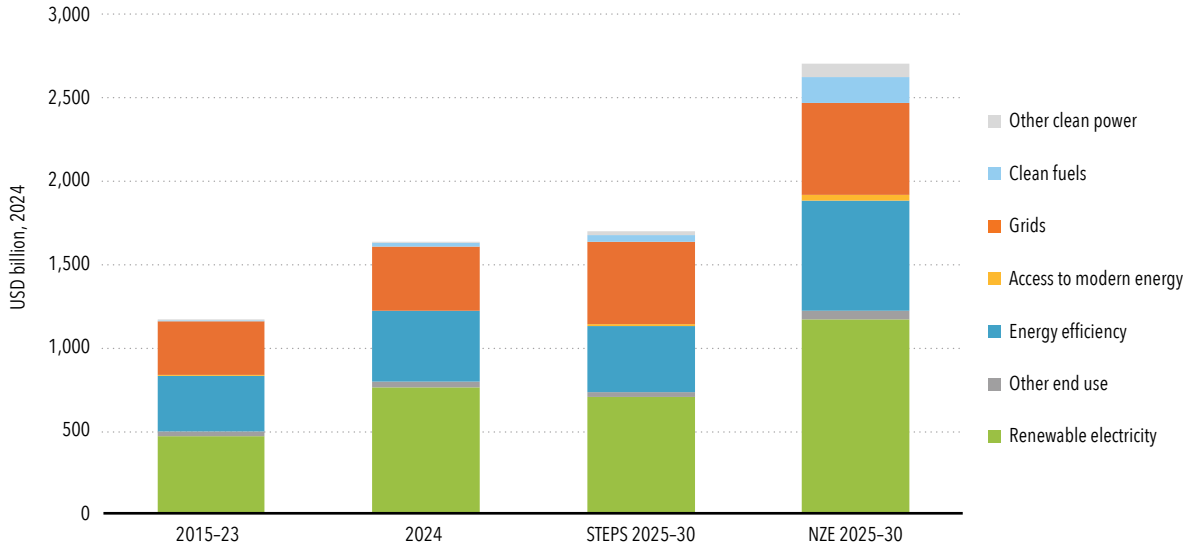
Between 2015 and 2021, annual clean energy investments averaged more than USD 1 trillion (in 2022 dollars). Both IEA and IRENA emphasize the pressing need to escalate investments in the energy transition. According to IEA's Net Zero Emissions by 2050 Scenario, meeting the SDG 7 targets requires an average annual investment of USD 3 trillion in the energy sector over 2022–30, whereas clean energy investments under the Stated Policies Scenario average close to USD 2 trillion in the same period.

The bulk of the investment required to meet the SDG 7 targets under IEA's Net Zero Emissions by 2050 Scenario is allocated to renewables-based electricity generation (including batteries) and end-use efficiency. The investment amounts to USD 1,016 billion and USD 566 billion per year, respectively (again, in 2022 dollars). However, additional average annual spending of USD 2024 496 billion on expanding and modernizing electricity networks is essential to support investments in renewables-based power. Grid investments have not kept pace with generation, especially in emerging markets and developing economies, posing a potential barrier to clean energy transitions without appropriate incentives.

Under the same scenario, achieving universal energy access in developing economies necessitates average annual investments of USD 33 billion by 2030 (figure 6.8). Two-thirds of the investment is required in Sub-Saharan Africa.

Even though these investments represent only 10 percent of annual spending in the upstream oil and gas sector, reaching these levels for access remains challenging owing to the small scale of projects, the affordability challenges faced by end users, and the fragility of many countries with large energy access deficits. International support in the form of aid and from multilateral development banks will be crucial in mobilizing investment levels and mitigating the risks associated with access and other energy investments in emerging markets and developing economies. Aligning access investments with broader sectoral investments in production, transport, processing, storage, and retailing can amplify their effect, helping ensure that they deliver durable socioeconomic benefits and contribute directly to the achievement of SDG 7.

Figure 6.8 • Average annual investment in selected technologies, historically and under IEA scenarios, 2015–30



Source: IEA 2025a.

NZE = Net Zero Emissions by 2050 Scenario; PV = photovoltaic; STEPS = Stated Policies Scenario.

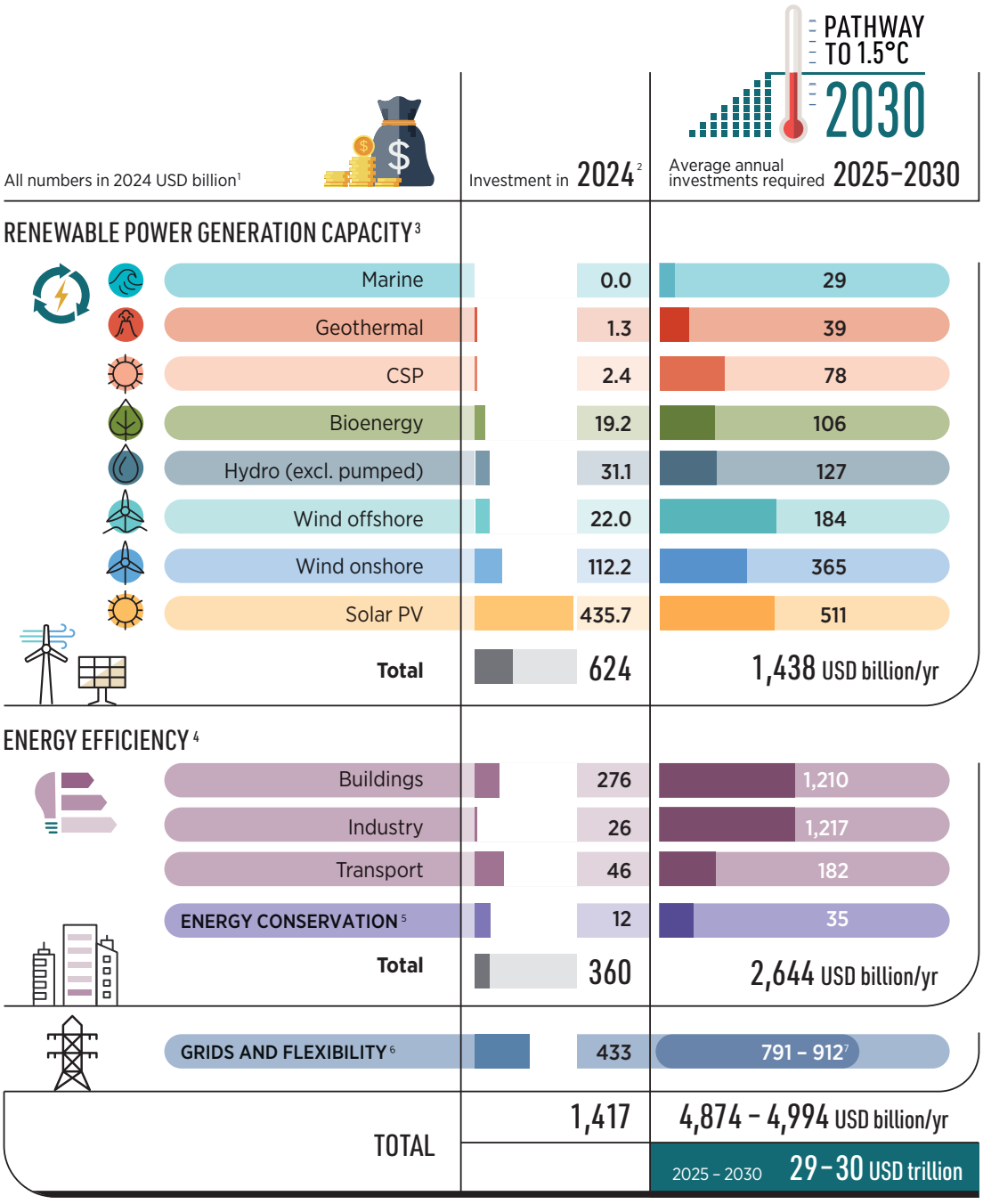
IRENA estimates that achieving the UAE Consensus targets for renewable energy and energy efficiency will require USD 30 trillion in cumulative investment between 2025 and 2030 across renewables, grids, flexibility measures, energy efficiency and conservation measures (figure 6.9).

Closing the investment gap remains a critical challenge, as current capital flows are insufficient to support the scale of transformation envisioned in IRENA's energy transition pathway. Annual investment in renewable power capacity reached about USD 624 billion in 2024, but needs to rise to USD 1.5 trillion per year over 2025 to 2030—more than double current levels. Moreover, investment flows remain highly concentrated, with more than three-quarters directed to China, the European Union, and the United States, leaving emerging markets and developing economies significantly underfunded.

From a technology perspective, solar PV investment is broadly on track to meet the tripling target. However, other technologies—including wind, hydropower, bioenergy, concentrated solar power, geothermal, and ocean energy—remain underfunded and require substantial scaling up. At the same time, investment in enabling infrastructure is lagging: Grids supporting infrastructure and flexibility measures will require approximately USD 790–910 billion annually between 2025 and 2030, nearly double current spending levels, to support renewables integration and system reliability.

On the efficiency side, investment needs are even more pronounced. Current spending—USD 350 billion in 2024—will need to increase more than sevenfold to reach an average of USD 2.6 trillion per year across buildings, transport, and industry over 2025–30. Accelerating both the scale and geographic distribution of investments will be critical to meeting global climate and energy efficiency goals.

Figure 6.9 • Investments required to triple renewable power capacity and double energy efficiency by 2030 compared with 2024 progress



Source: IRENA, COP30 Presidency, and Global Renewables Alliance 2025.

Conclusion

This chapter paints a sobering picture of where the world stands in its pursuit of SDG 7. Progress has been real: since 2000, nearly one billion people have gained access to electricity; renewables now surpass coal as the leading source of global electricity generation; and energy efficiency policies are expanding in scope and stringency. Yet on every dimension of SDG 7—electricity access, clean cooking, renewable energy share, and energy efficiency—the pace of change falls short of what is required to meet the 2030 targets or to keep a 1.5°C pathway within reach.

The access deficit remains concentrated and stubborn. Under current policies, around 640 million people will still lack electricity by 2030 and between 1.6 (IEA 2025a) and 1.8 (WHO 2026) billion will lack clean cooking—with Sub-Saharan Africa accounting for most of both shortfalls. In many countries in the region, population growth is outrunning electrification, and debt burdens compounded by cuts in international aid are undermining the institutional and financial foundations needed to scale up. Addressing these gaps requires not only a major increase in investment—USD 45 billion per year for electricity access and USD 8 billion per year for clean cooking—but also holistic national electrification and clean cooking plans backed by clear financing schemes and empowered implementing institutions.

With respect to renewables' share in TFEC, the trajectory is broadly positive but insufficient. Annual capacity additions are accelerating, and solar PV deployment is outpacing all expectations, yet the portfolio of technologies needed—wind, hydropower, geothermal, bioenergy, and concentrated solar power—is not expanding at the pace required to stay on the 1.5°C pathway. Progress in end-use sectors, especially transport, buildings, and industry has been particularly lagging (see chapter 3). NDC targets submitted by late 2025 make up only half the goal of 11,000 GW by 2030. Closing that gap will demand much stronger policy commitments, faster implementation, and a sustained scale-up in investment, particularly in emerging markets and developing economies, where more than three-quarters of investment currently flows to just three geographic markets. Significant increases in direct uses of renewables as well as electrification across all end uses will be vital, together with economic and technical measures to integrate increasingly high shares of variable renewable energy into the energy system, including grid expansion, flexibility measures, charging refueling infrastructure, energy storage, and market design.

Energy efficiency improvements are picking up but not fast enough. Global energy intensity improved by only around 1 percent in 2024 against a required rate of more than 4 percent annually. Reaching the 2030 efficiency target will now require accelerating to at least 5 percent per year from 2025 onward. Slowing gains in industrial energy intensity, fast growth in demand for air-conditioning, and the spreading gap between technology performance and regulatory standards are the key drags. Initiatives such as the Global Energy Efficiency Alliance, launched at COP29 in 2024, signal growing political will, but they must be translated urgently into binding standards, scaled financing, and cross-sectoral coordination.

Underpinning all is the investment imperative. Current clean energy investment levels—though growing—are roughly half of what IEA's net-zero pathway requires and less than a fifth of the approximately USD 5 trillion annually that IRENA estimates is needed to meet the UAE Consensus targets on renewables and efficiency. Bridging the gap demands both a significant increase in public finance and stronger mechanisms to attract private capital, but also broader improvements in the economic fundamentals that make investments viable in the first place. These include robust project development pipelines, enabling infrastructure, skilled workforces, credible policy incentives, and dynamic market design. Depending on the country context, concessional finance, blended finance mechanisms, de-risking instruments, and multilateral development bank engagement can help mobilize the investment flows the energy transition requires.

The road to SDG 7 is challenging, but much headway can be made in the years to 2030. The technologies are available, the costs of renewables and batteries have fallen dramatically, and the policy architecture is expanding. Ensuring widespread accessibility, affordability, and sustainability requires coordination, a sense of urgency, and the political will to translate commitments into tailored policies and sufficient resources so that the benefits of the energy transition reach every person in every region, including the most vulnerable communities currently at risk of being left behind.