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CHAPTER 6
THE OUTLOOK FOR SDG 7

Main messages

- **Outlook for progress toward 2030 goals.** Policy and technological innovations have shown promising results, especially in boosting access to renewable energy and improving energy efficiency. The COVID-19 pandemic and the 2022 energy crisis slowed progress, notably in Africa, where advances in energy access have been reversed, even though preliminary analysis of 2023 trends is optimistic. Sustainable Development Goal (SDG) 7—that is, achieving universal energy access by 2030—and putting the world on a 1.5°C pathway require investment and policy to support renewables, energy efficiency, and energy access.
- **Outlook for access to electricity.** Despite setbacks due to recent global crises, the number of people without electricity access globally is decreasing again, supported by significant adoption of solar home systems (SHSs) in Sub-Saharan Africa. However, the International Energy Agency (IEA) projects that 660 million people will remain without electricity access in 2030—85 percent of them in Sub-Saharan Africa—underscoring the need to step up efforts. Achieving universal electricity access by 2030 requires significant investment and policy support, as well as accelerated deployment of renewable energy.
- **Outlook for access to clean cooking.** Current policies and investments are not sufficient to ensure universal access to clean cooking by 2030. Estimates of the IEA and the World Health Organization (WHO) indicate 1.8 billion people will still lack access to clean cooking by the end of the decade. While significant progress has been made in Asia, the number of people without access to clean cooking in Sub-Saharan Africa is increasing, largely due to the rate of population growth outpacing access to clean cooking. Such estimates project a continued decline in the use of polluting fuels and an increase in the use of gaseous fuels and electricity for cooking by 2030. According to IEA's estimates, reaching full clean cooking access would require USD 8 billion annually through 2030, half of it for Sub-Saharan Africa alone.
- **Outlook for renewable energy.** Renewable energy continues to be the fastest-growing energy source; projections indicate that renewables will surpass coal as the predominant electricity source globally by 2025. IEA's Net Zero Emissions by 2050 Scenario and the International Renewable Energy Agency's (IRENA's) 1.5°C Scenario outline ambitious energy pathways for achieving SDG 7 and SDG 13 on climate action. Aligning with these scenarios, however, requires unprecedented capacity additions, and investment and policy support to help modern renewables reach an expected 32–35 percent share in total final energy consumption (TFEC) by 2030 -up from 18 percent today. The pledge made by more than 130 countries at the 2023 United Nations Climate Change Conference (COP28) in Dubai to triple global renewable power capacity to more than 11,000 gigawatts (GW) by 2030 is consistent with these scenarios.
- **Outlook for energy efficiency.** The global push for energy efficiency has gained momentum, driven by increasing energy costs and security concerns, even though early estimates for 2023 show a modest annual energy intensity improvement rate of 1.3 percent. Doubling the average annual energy efficiency improvement rate in global energy intensity by 2030, as agreed to at the COP28, requires robust policy action and a significant increase in investment. IEA's NZE scenario estimates the rate of improvement needed to be just over 4 percent – slightly higher than the SDG 7 target of 3.8 percent. This highlights the crucial role of energy efficiency in meeting sustainability and climate goals.

- **Investment needs.** Achieving the SDG 7 targets demands a substantial increase in clean energy investments. IEA and IRENA estimate average annual energy-focused investments in the range of USD 3–4.5 trillion by 2030,[43] significant portions of which are to be committed to investments related to the energy transition. These investments would focus on renewables, efficiency, and low-carbon technologies, and include enabling infrastructure like power grids and storage. Addressing the investment gap, particularly in developing economies, is crucial for advancing the energy transition and ensuring universal access to clean energy and technologies.

Presentation of scenarios

This chapter describes the results of global scenario analysis undertaken to determine whether current policy ambitions are sufficient to meet the SDG 7 targets and to identify what additional actions might be needed. It also seeks to determine what investments are required. Scenarios for the targets are taken from IEA's World Energy Outlook (IEA 2023a), IRENA's World Energy Transitions Outlook: 1.5°C Pathway (IRENA 2023), and WHO's Business-as-Usual Scenario (see annex 1). The chapter explores scenarios in which energy trends evolve under today's policies, and pathways that deliver on all energy-related SDGs, including substantial reduction of air pollution, which causes deaths and illness (SDG target 3.9), and initiation of effective action to combat climate change (SDG 13).

IEA's Stated Policies Scenario explores how energy trends evolve under today's policies, assuming no additional policies are put in place. Under this scenario, bottom-up modelling is conducted that considers how policies, pricing policies, efficiency standards, electrification programs, and specific infrastructure projects would influence energy trends. The Net Zero Emissions by 2050 Scenario considers the SDG goals of 2030 and net-zero energy sector emissions by 2050 as targets to determine what would be needed to achieve these outcomes in a cost-effective, plausible way. Under the Net Zero Emissions by 2050 Scenario, by 2030, universal access to electricity and clean cooking is achieved, modern renewables reach a 32 percent share of TFEC, and average annual energy efficiency improvements in global energy intensity reach 4.1 percent over 2022–30. 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 provides a perspective on energy system developments based on governments' energy plans and other planned targets and policies. Its 1.5°C Scenario describes an energy transition pathway that enables limiting global average temperature increase to 1.5°C by the end of the 21st century relative to preindustrial levels. The 1.5°C Scenario is underpinned by several key technological avenues and measures in terms of renewable-based power; direct use of renewables; energy intensity improvements; electrification in end-use sectors; clean hydrogen and its derivatives; and carbon capture and storage (CCS), bioenergy with CCS, and other carbon removal technologies. These avenues and measures would lead to major emission reductions between today and 2050, paving the way toward a net-zero carbon world by midcentury. The scenario also provides insights into the socioeconomic footprint of the global energy transition.

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.

43 In 2022 and 2021 U.S. dollars, respectively.

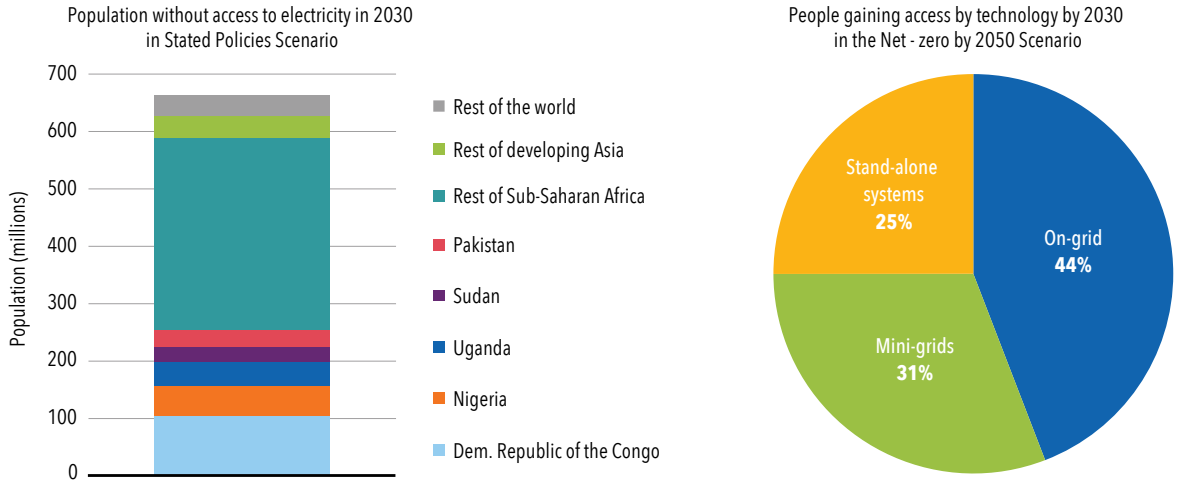
WHO's Business-as-Usual Scenario, used for deriving the clean cooking–related projections, is a hypothetical scenario under which no new policies or interventions (positive or otherwise) are implemented or take place. As such, it is useful as a baseline scenario for comparing the effects of interventions. 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.[44]

The outlook for access to electricity

According to IEA's latest estimates, the number of people worldwide without access to electricity declined in 2023 following a three-year period of multiple crises, when the number had increased (IEA 2023a). This decline has largely been driven by SHSs, whose viability as a reliable electricity source for households was clearly demonstrated, especially in Sub-Saharan Africa.

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—only nine Sub-Saharan African countries have achieved universal electricity access. Under IEA's Stated Policies Scenario, 660 million people—roughly 8 percent of the global population—will remain without electricity access by 2030, 85 percent of them in Sub-Saharan Africa, where less than half of the countries without universal access to electricity have official targets, and only about 22 percent have targets at least as ambitious as SDG target 7.1. This target remains within reach for countries with adequate policies, holistic electrification plans, including centralized and decentralized solutions, and 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 WITHOUT ACCESS TO ELECTRICITY IN 2030 UNDER IEA'S STATED POLICIES SCENARIO AND DELIVERY OF ELECTRICITY CONNECTIONS UNDER IEA'S NET ZERO EMISSIONS BY 2050 SCENARIO, BY TECHNOLOGY REQUIRED.



Source: IEA 2023a.

Most developing countries in Asia remain on track to reach near-universal access; only 2 percent of the region's population is without electricity access in 2030. The Stated Policies Scenario shows that for the region to achieve universal access in 2030, countries such as Afghanistan, Mongolia, and Pakistan need to step up efforts. In Central

44 Detailed datasets with country data for all SDG 7 indicators can be accessed at no charge at https://trackingsdg7.esmap.org/downloads.

and South America, only the most remote populations remain without electricity access by 2030; the region achieves a 98 percent access rate. Haiti, one of the poorest countries in the world, is the sole exception, with a large share of its population expected to remain without access in 2030.

Without improvements in Sub-Saharan African countries, achieving SDG target 7.1 remains improbable. More than half of those without electricity access live in countries that do not have official electrification plans or regularly track progress.

Accessing finance is often more challenging for countries that have the greatest need to urgently improve energy access. International support in the form of concessional finance is essential, especially under current economic conditions. More importantly, public finance remains vital in deploying 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 (IRENA 2024). Governments must facilitate better access to international finance so that robust electrification plans can be implemented, and capital can accordingly be allocated to access projects (IEA 2023a).

Achieving universal electricity access by 2030 requires that, every year, 110 million people on average gain access. Four out of five such people would be in Sub-Saharan Africa. Efforts must be stepped up, especially in least-developed countries, which might benefit from special support measures, including the Democratic Republic of Congo, Niger, Sudan, the United Republic of Tanzania Uganda, and Ethiopia, which together are home to half of the region's population projected to be without electricity access in 2030.

IEA's Net Zero Emissions by 2050 Scenario proposes a sustainable pathway to achieve universal access to electricity by 2030. This implies addressing affordability issues, which remain the primary hindrance to people gaining electricity access or benefiting from it. About a third of the Sub-Saharan African population without electricity access cannot afford basic energy services without additional financial incentives (IEA 2023b). Central to sustainable improvements will be support for decentralized solutions, tracking and monitoring, and the use of geospatial data as the basis for electrification planning and the creation and empowerment of entities responsible for implementing the plans. Low-capacity off-grid energy solutions—for example, small off-grid solar systems—will continue to play an important role, especially in remote areas. Nevertheless, strategies must align to support households through the gradual extension of energy services via bigger systems or grid connections.

IEA's Net Zero Emissions by 2050 Scenario indicates that almost 90 percent of new electricity connections will be based on renewables, supported by a resumed decline in the cost of solar photovoltaic (PV) and batteries.

The delivery technology is unique to each location under IEA's Net Zero Emissions by 2050 Scenario. 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 would be stand-alone systems (mostly SHSs). In developing countries in Asia, just over half of the new connections would be directly to the grid, and almost a third would be through mini-grids.

Robust electrification plans can help achieve universal electricity access by 2030. Sub-Saharan African countries (including Côte d'Ivoire, the Gambia, Kenya, and Rwanda) have achieved or surpassed target levels in the past. But 22 other Sub-Saharan African countries representing more than half of the region's unelectrified population (including Chad, the Democratic Republic of Congo, Madagascar, Malawi, Mozambique, and the Niger) have been witnessing a rise in the number of people without access (IEA 2022a). Many of the successful electrification plans consider the needs of health facilities, schools, productive use and agricultural enterprises, and similar organizations, alongside households' needs. Achieving universal electricity access requires investment amounting to USD 30 billion annually through 2030. These investments include electricity generation, electricity networks, and decentralized solutions. Achieving universal electricity access as outlined under IEA's Net Zero Emissions by 2050 Scenario requires a threefold growth of investments over pre-COVID levels. Electricity access must go beyond a simple connection able to power a few household items, to support the growing use of energy services that can contribute to socioeconomic prosperity as also illustrated by the World Bank's Multi-Tier Framework.

The outlook for access to clean cooking fuels and technologies

Current policies are insufficient to achieve universal access to clean cooking. If the current trends continue, IEA and WHO estimate that 21 percent of the world's population—or around 1.8 billion people—will still lack access to clean cooking by 2030 (figure 6.2). Both IEA and WHO have reported significant progress in Asia, whereas for Africa, almost the same number of people as today are expected to remain without access to clean cooking fuels and technologies at the end of the decade (IEA 2023c). Under the current policy and investment environments, the access deficit in Sub-Saharan Africa alone could exceed 1 billion by 2030. Many African countries are not expected to achieve universal clean cooking access even into the 2050s (IEA 2023c).

Achieving universal access to clean cooking is an essential part of a just energy transition and essential for protecting our climate. A successful transition to net-zero emissions by 2050 requires significant improvements in decarbonizing cooking fuels, electricity, the power grid, and other infrastructure. In this context, a global roadmap has been proposed (United Nations 2023) outlining key milestones toward this global goal including: (1) eliminate cooking poverty and achieve cleaner cooking for all by 2030, (2) achieve universal cooking with modern cooking services and accelerate the decarbonization of cooking fuels by 2040, and (3) achieve net-zero clean cooking by 2050.[45]

IEA estimates that achieving universal access to clean cooking requires providing access to over 300 million people each year—about half of them in Sub-Saharan Africa—through the decade's end. 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, WHO projected 67 and 8 percent, respectively, of the LMIC population to primarily use gas and electricity for cooking if current trends continue through 2030. However, by 2030, 18 and 5 percent, respectively, will still rely on unprocessed biomass and charcoal, whereas 2 percent will use kerosene and coal. The use of gaseous fuels is expected to drive the majority of the increase in the percentage of the LMIC population using clean fuels and technologies for cooking.

Under IEA's Net Zero Emissions by 2050 Scenario, liquefied petroleum gas continues to lead as the fuel for clean cooking. It represents a 45 percent share of fuels among people gaining access to clean cooking by 2030; electricity represents a 12 percent share; and other sources, such as bioethanol and biogas, represent an approximately 10 percent share (figure 6.2). Until 2030, high-quality improved cookstoves provide a first transitional step to cleaner cooking for one-third of households globally, providing meaningful benefits as a fast and feasible solution for rural households that infrastructure will be slow to reach.

Under IEA's Net Zero Emissions by 2050 Scenario, the demand for modern uses of energy grows minimally till 2030, whereas the use of firewood and charcoal falls 50 percent. In some regions, new infrastructure would be needed. For

45 The roadmap estimates that the annual public investments required to achieve universal access to cleaner cooking and to eliminate cooking poverty from 2020 to 2030 amount to USD 7.4 billion. Additionally, the investments needed for universal access to modern energy cooking services from 2030 to 2040 are estimated at USD 13 billion. The roadmap also highlights that the annual health, gender, and climate co-benefits from achieving universal access to cleaner cooking and eliminating cooking poverty by 2030 total USD 192.3 billion, which is more than 25 times the estimated public-sector investment. Furthermore, the annual benefits of transitioning to exclusive use of modern energy for cooking by 2040 amount to USD 232.3 billion, about 17 times the estimated public financing.

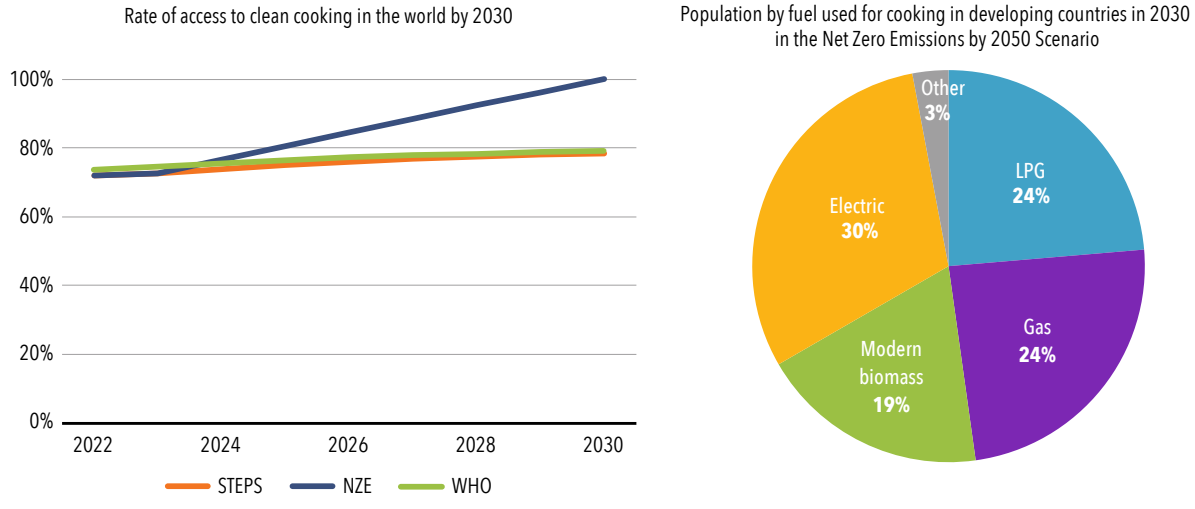
instance, in Sub-Saharan Africa, the demand for liquefied petroleum gases grows threefold by 2030, requiring an expansion of distribution services, and an increase in cylinders and refilling stations. By 2030, electric cooking alone in Sub-Saharan Africa drives up the electricity demand 16 percent from today; this growth could potentially strain distribution systems if not managed well (IEA 2023c).

Achieving universal access to clean cooking brings immense health, social, and climate co-benefits. Improved health outcomes will result from reduced exposure to household air pollution. The resulting time savings from less fuelwood collection, often several hours a day, would offer households members, particularly women and children with more time for activities like schooling, income generation or leisure. Such a transition could also lead to a net reduction of 1.5 gigatonnes of carbon dioxide equivalent ($GtCO_2eq$) in greenhouse gas emissions resulting from the incomplete biomass combustion and deforestation—equal to the emissions from aviation and shipping today.

Investments in clean cooking stoves, technologies, and infrastructure by 2030 would need to reach USD 8 billion annually, half of it aimed at Sub-Saharan Africa (IEA 2023c). This represents a substantial increase from the current annual investment of USD 2.5 billion. Accelerating the global transition to clean cooking and reaching the 2030 and 2050 targets also require substantial political engagement. While some progress has been made in this regard, with 98 LMICs having included household energy or clean cooking–related goals in their Nationally Determined Contributions as of March 2023, current commitments are insufficient to reach the 2050 net-zero emissions target. Governments need to incorporate clean cooking demand into their energy planning strategies and ensure appropriate institutional frameworks, enable public investment, and facilitate private sector engagement.

Each country should develop its own unique roadmap for the clean cooking transition, based on its specific circumstances and stage of development. This requires a systemic approach supported by national action as well as international collaboration. A significant increase in public funding is 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.

FIGURE 6.2 • CLEAN COOKING ACCESS RATE BY 2030 IN IEA'S STEPS AND NZE SCENARIOS, AND IN WHO'S BUSINESS AS USUAL SCENARIO; AND COOKING FUELS MIX IN 2030 UNDER IEA'S NZE SCENARIO



Source: IEA 2023a and WHO.
LPG = liquefied petroleum gas; NZE = Net Zero Emissions by 2050 Scenario; STEPS = Stated Policies Scenario; WHO = World Health Organization.

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 IEA's Stated Policies Scenario and IRENA's Planned Energy Scenario remains positive in all regions despite the impact of recent crises on supply chains and prices. This positive outlook is supported 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 18 percent in 2022 to 23 percent in 2030, and the share of modern uses of renewables, which excludes traditional use of biomass, is projected to increase from 12 percent in 2022 to 19 percent in 2030. By contrast, under IRENA's Planned Energy Scenario, the overall share of modern uses of renewables in TFEC grows to 18 percent in 2030, due to an expansion of renewables, namely, in electricity and transport.

Renewables in the electricity 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 2022–30 are projected to triple over the trends seen in 2015–21; solar PV and wind are projected to spearhead this 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 (49 percent) of the growth in electricity demand from 2022 over the period, followed by wind (37 percent). Hydropower continues to be the largest low-emission electricity source globally through 2030, providing flexibility and supporting other essential power system services. This combined with end-use electrification enables the share of renewables-based electricity in TFEC to rise above 10 percent by 2030, up from 6 percent in 2022. This includes increased use of electricity in transport due to higher electric vehicle (EV) penetration.

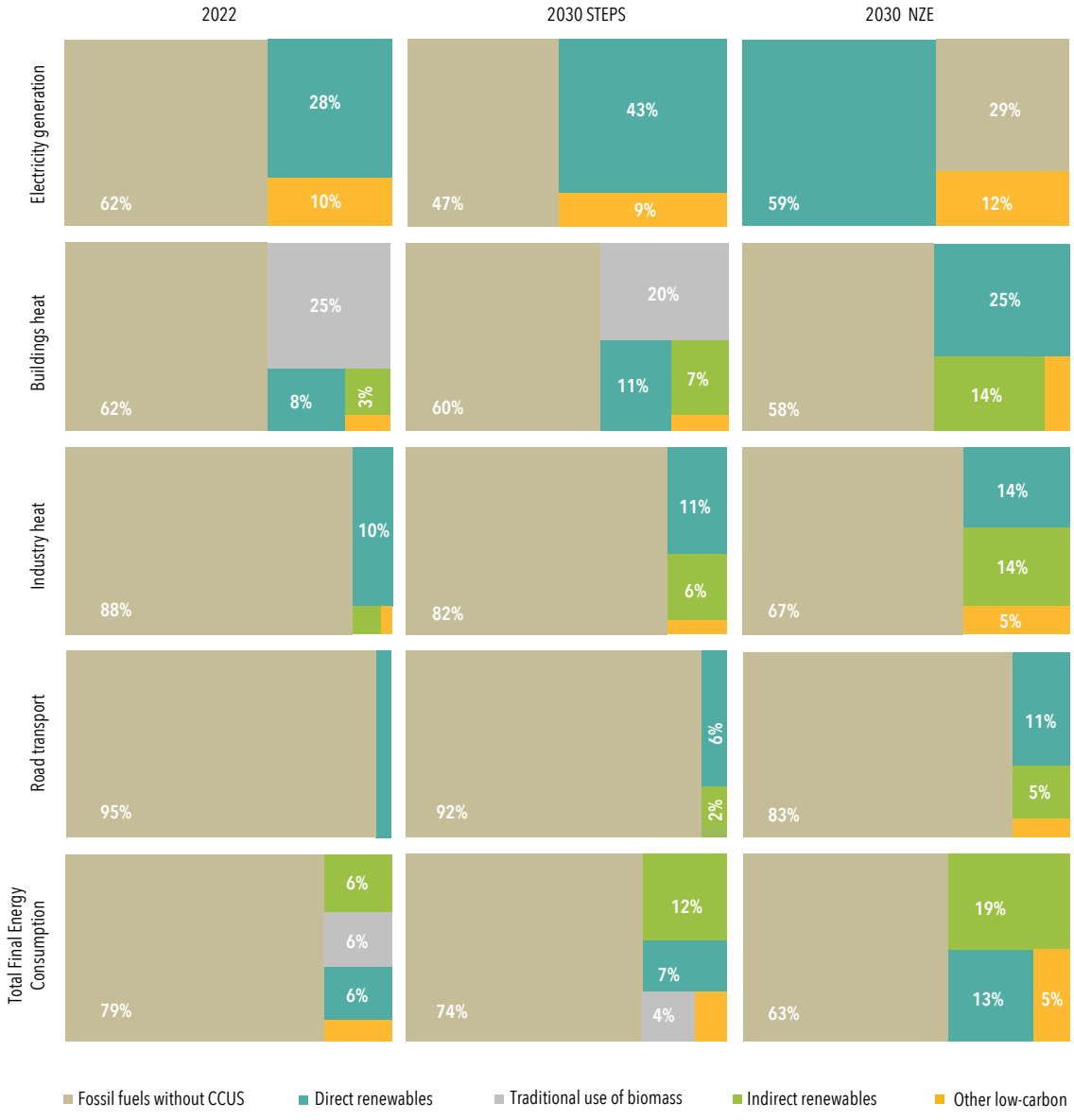
Renewables-based heat has had a steadily progressing share in end use, although the pace of progress is slow. Modern uses of bioenergy constitute the major driver of growth for renewables-based heat through 2030. In transport, liquid biofuels experience robust expansion—albeit limited without the adoption of new blending requirements or the reinforcement of implementation in regions where they are currently lacking. Renewable heat experiences growth in the industrial and residential sectors; modern bioenergy leads in this regard, driven by renewable mandates in Europe and experimental initiatives in China. The demand for biogas and modern uses of biomass for heating also rises, fueled by industrial expansion (IEA 2022b).

Policy action remains key, especially for end-use renewables 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—and reducing risks, and in turn costs.

BRIDGING THE GAP: INSIGHTS FROM IEA'S NET ZERO EMISSIONS BY 2050 SCENARIO

The projected increases in the use of renewable energy that are likely to occur under the Stated Policies Scenario are insufficient for reaching global climate targets or the SDGs. The use of renewables increases twice as rapidly under the Net Zero Emissions by 2050 Scenario as under the Stated Policies Scenario (IEA 2023d). Under the more ambitious Net Zero Emissions by 2050 Scenario, modern uses of renewables would represent just over a third of TFEC in 2030 (figure 6.3).

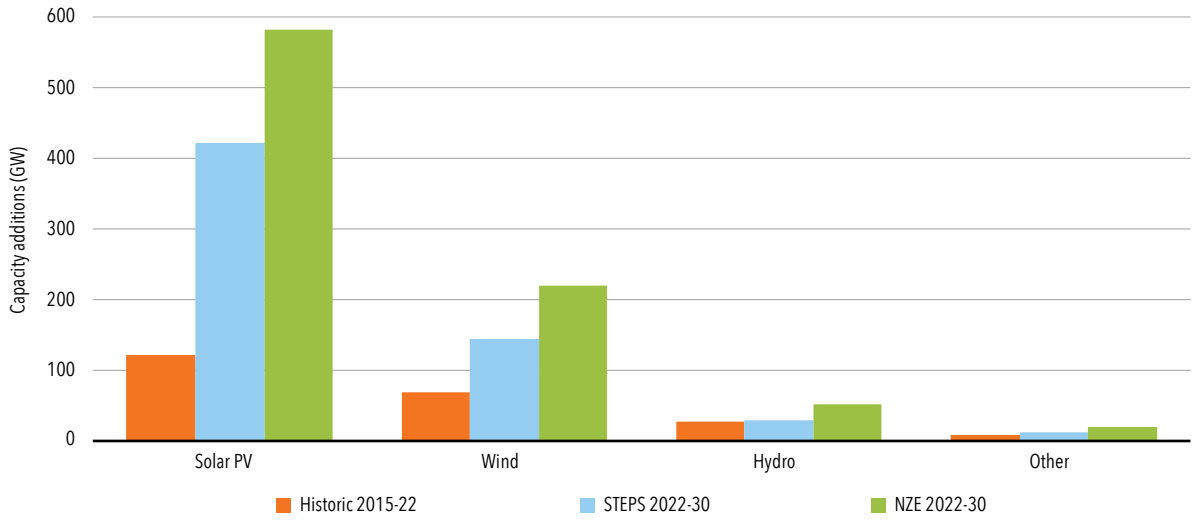
FIGURE 6.3 • RENEWABLES' SHARE IN TOTAL FINAL ENERGY CONSUMPTION IN 2022 AND UNDER IEA SCENARIOS BY 2030



Source: IEA 2023a.
CCUS = carbon capture, utilization, and storage; NZE = Net Zero Emissions by 2050 Scenario; STEPS = Stated Policies Scenario.

The share of renewables-based electricity generation increases the most rapidly—to just about 60 percent from the current level by 2030, or a 16 percentage point increase over that in the Stated Policies Scenario. Globally, renewables-based electricity generation increases 12 percent annually, to approximately 22,520 terawatt-hours by 2030. This is supported by unprecedented solar PV and wind capacity additions, reaching, respectively, 580 GW and 230 GW a year on average over 2022–30 (figure 6.4). Annual investment in renewables-based power triples over the decade, to over USD 1.2 trillion a year by 2030. This is supported by additional spending on expanding and modernizing electricity networks and battery storage and 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 2023a.
GW = gigawatt; NZE = Net Zero Emissions by 2050 Scenario; PV = photovoltaics; STEPS = Stated Policies Scenario.

Under IEA's Net Zero Emissions by 2050 Scenario, increased electrification of energy end uses is a primary means to boost renewables' share in TFEC. Under this scenario, electricity's share in the final energy demand rises to 28 percent by 2030, compared with about 22 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 2023a).

The use of renewables for heat encompasses space and water heating, cooking, industrial processes, and other uses. This heat can be provided directly by bioenergy, solar thermal, or geothermal, or indirectly through electricity and district heat produced from renewable sources. Switching to the direct use of renewables—using solar thermal–based water heating, biomass, and low-carbon gases, for example—can also reduce the use of fossil fuels. In 2022, renewables represented 12 percent of the total energy consumed for heating worldwide. By 2030, this share increases to 31 percent under the Net Zero Emissions by 2050 Scenario.

The share of traditional uses of biomass falls to 4 percent of TFEC by 2030 under the Stated Policies Scenario. Under the Net Zero Emissions by 2050 Scenario, traditional uses of biomass are phased out completely by 2030, since developing countries replace it with more modern and efficient fuels and technologies.

Across regions, variations in energy policy, socioeconomic trends, and natural resource endowments result in varying growth trajectories for renewables. Developing economies represent over 80 percent of the growth in electricity generation through 2030 under the Stated Policies Scenario and almost 90 percent under the Net Zero Emissions by 2050 Scenario. Under the Stated Policies Scenario, the outlook to 2030 for renewables-based electricity generation ranges from 10 percent in the Middle East and 16 percent in Northern Africa, at the low end, to over 80 percent in Central and South America, where hydropower is the backbone of the power mix. Under the Net Zero Emissions by 2050 Scenario, renewables-based electricity generation has a growing share in all regions, approaching or exceeding half of all electricity generation by 2030 in many.

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 and 450 Mt in 2050. 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 captured via carbon capture, utilization, and storage and CO_2 removal technologies that do not include nature-based measures.

BRIDGING THE GAP: INSIGHTS FROM IRENA'S 1.5°C SCENARIO

IRENA's 1.5°C Scenario requires a significant scale-up of renewable energy and energy-efficient solutions but also other energy transition technologies and related infrastructure. It entails a transformation of how societies consume and produce energy. The decade to 2030 will be crucial for raising the level of ambition. While a diverse selection of technologies is essential to fully decarbonize the energy system by 2050, the urgency of the 2030 deadline reduces the options available. Only renewable power and energy efficiency measures can be scaled up quickly enough to meet this approaching milestone. To ensure long-term success, however, this accelerated deployment must be complemented by continuous innovation and development across a much broader suite of technologies.

IRENA's 1.5°C Scenario details six key categories of performance indicators. These indicators help provide a broad overview of the required level of transition (figure 6.5), which includes scaling up renewable energy's share in TFEC and electricity generation to, respectively, 35 and 68 percent by 2030, with a corresponding increase in the share of energy supplied from electricity to 29 percent. The average annual primary energy intensity improvement rate would need to increase to 3.3 percent between 2020 and 2030, more than double the rate observed in the previous decade. The production of clean hydrogen would need to increase to 125 Mt by 2030. Finally, some investment in CO_2 removal technologies will also be required, namely, in the hard-to-abate sectors, such as industry and some transport sectors.

FIGURE 6.5 • KEY PERFORMANCE INDICATORS FOR IRENA'S 1.5°C SCENARIO IN 2030

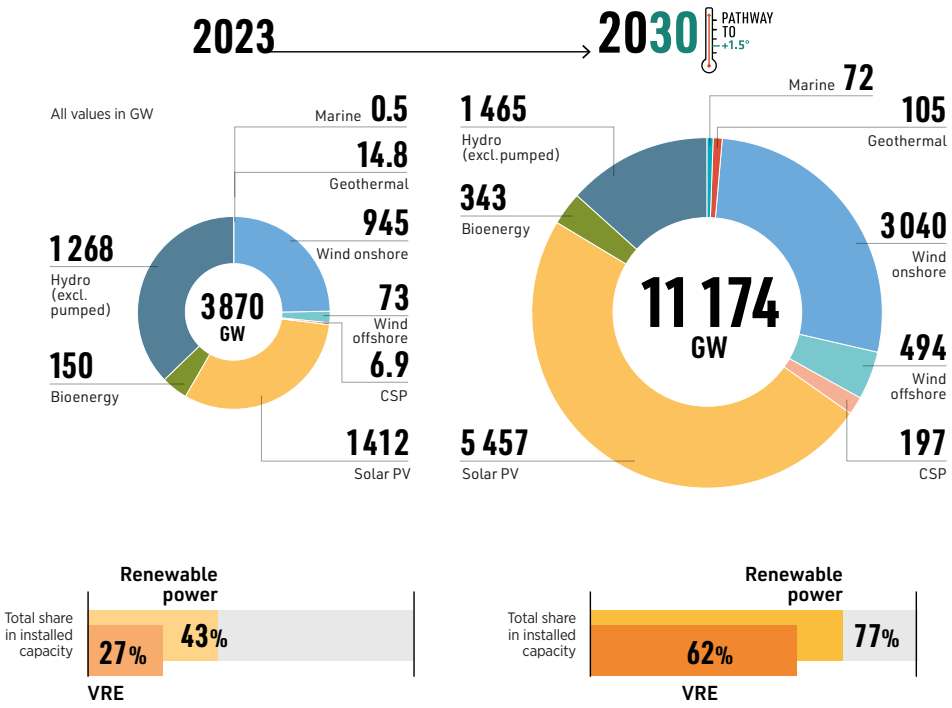
			Recent years	2030	
			2020	PES	1.5°C Scenario
KPI.01 RENEWABLES (POWER)	Electricity generation (TWh/yr)	Global	7 468	16 504	27 358
		G20	6 237	14 269	22 397
	Renewable energy share in electricity generation (%)	Global	28%	46%	68%
		G20	28%	48%	69%
KPI.02 RENEWABLES (DIRECT USES)	Renewable energy share in TFEC (%)	Global	18%	23%	35%
		G20	16%	22%	36%
	Modern use of bioenergy (EJ)[1]	Global	21	30	50
		G20	19	26	36
KPI.03 ENERGY INTENSITY	Energy intensity improvement rate (%)	Global	1.7%	1.8%	3.3%
		G20	2.1%	2.1%	3.6%
KPI.04 ELECTRIFICATION IN END-USE SECTORS (DIRECT)	Electrification rate in TFEC (%)	Global	22%	23%	29%
		G20	24%	26%	31%
KPI.05 CLEAN HYDROGEN AND DERIVATIVES	Production of clean hydrogen (Mt)	Global	0.7 Mt/yr[2]	2	125
		G20	0.5 Mt/yr[2]	2	94
KPI.06 CCS, BECCS AND OTHERS	CO_2 captured from CCS, BECCS and other removal measures (Gt)	Global	0.04 $GtCO_2$/yr[3]	0.1	2.2
		G20	0.03 $GtCO_2$/yr[3]	0.1	2.1

Source: IRENA 2023.
Notes: The Planned Energy Scenario, the reference case for WETO 2023, is based on countries' current plans.
1. Includes non-energy uses.
2. Operational project capacity through October 2022 (IEA Hydrogen Project Database).
3. Operational project capacity through March 2023 (IEA CCUS Database).
BECCS = bioenergy with carbon capture and storage; CCS = carbon capture and storage; CO_2 = carbon dioxide; EJ = exajoule; G20 = Group of Twenty; Gt = gigatonne; KPI = key performance indicator; Mt = megatonne; PES = Planned Energy Scenario; TFEC = total final energy consumption; TWh/yr = terawatt hours per year.

Advancing the energy transition at the required pace and scale would need the electricity sector to be decarbonized completely by midcentury. Tripling renewables-based power capacity by 2030 is technically feasible and economically viable but requires commitment, policy support, and investment at scale. IRENA's monitoring and analysis of renewable energy development and deployment reveals that the technological maturity achieved for renewables–with policy support, greater competitiveness, and abundant resources–has positioned the industry at the very heart of climate, development, and energy security strategies. Since 2015, new installed renewables-based power capacity additions

have consistently outpaced new fossil fuel and nuclear power installations combined, reaching an estimated 473 GW in 2023 alone. However, tripling renewable power capacity globally will also require considerable progress elsewhere, including accelerated investments in infrastructure and system operation (e.g., power grids, storage), updated policies and regulations (e.g., power market design and regulation, streamlining permitting), measures to strengthen supply chains and develop transition-related skills, and a major scale-up of investment, including public funds, supported by international collaboration. Also, under IRENA's 1.5°C Scenario, rapid electrification of heating and transport applications, alongside increased green hydrogen production, would significantly boost the demand for electricity. According to IRENA's 1.5°C Scenario, by 2030, the global total installed renewables-based power generation capacity would need to grow from 3,870 GW in 2023 to 11,174 GW, through exploration of diverse renewable sources (figure 6.6). Renewable energy would meet 68 percent of the total electricity need by then.

FIGURE 6.6 • GLOBAL INSTALLED RENEWABLES-BASED POWER CAPACITY IN 2023 AND 2030 UNDER IRENA'S PLANNED ENERGY SCENARIO AND 1.5°C SCENARIO



Source: IRENA 2023.
Note: Bioenergy includes biogas, biomass waste, and solid biomass.
CSP = concentrated solar power; GW = gigawatt; PV = photovoltaic; VRE = variable renewable energy.

Outside the power sector, progress is more mixed. Under IRENA's 1.5°C Scenario, transport, in particular, road vehicles, would see rapid transition in the decade. Progress in transport electrification in 2023 fell short of the required pace. Road transport is the subsector with the highest potential for electrification. Under IRENA's 1.5°C Scenario, the electrification rate in the global transport sector would rise to almost 7 percent by 2030. Successful launch of new EV models, financial incentives, and improvement of charging infrastructure have been strong drivers, yet the current stock of battery EVs and plug-in hybrid electric vehicles would need to grow from 40 million today to 360 million by 2030—a target that cannot be achieved at current growth rates.

Direct uses of renewables (e.g., bioenergy, solar thermal, and geothermal) are needed to bring much-needed solutions in transport, buildings, and industry for energy services that are hard to electrify. Under IRENA's 1.5°C Scenario, the

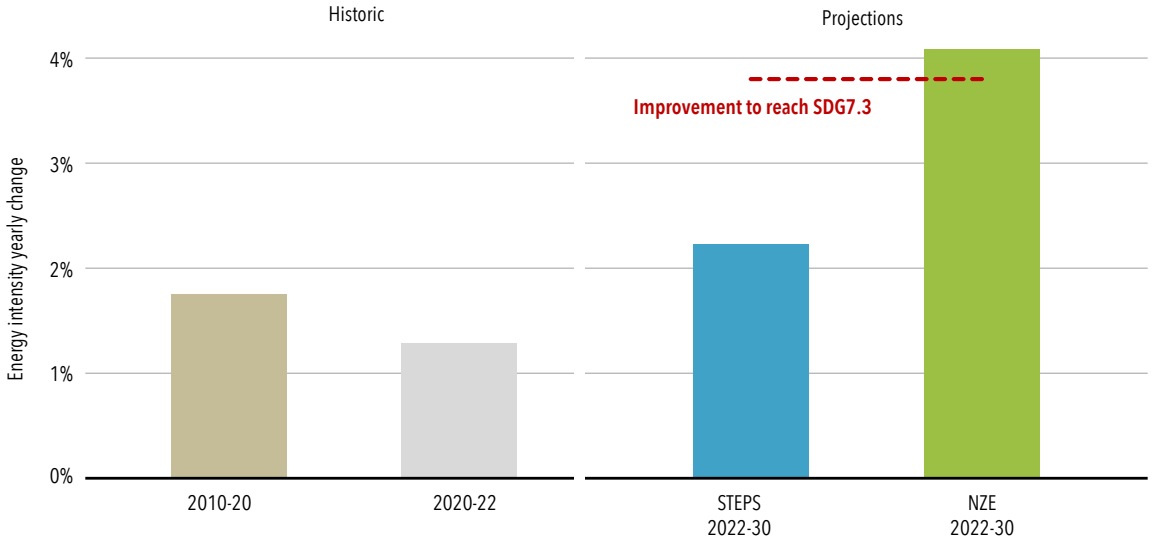
direct use of modern bioenergy would rise from 21 exajoules (EJ) to 46 EJ by 2030; the area of solar thermal collectors would increase threefold to 1,553 million square meters; and the consumption of geothermal-based heat would increase 60 percent. Under IRENA's 1.5°C Scenario, clean hydrogen production would grow from 2 Mt today to 125 Mt by 2030 (IRENA 2023). Hydrogen has been largely consumed for industrial applications in this decade, although a small quantity is used in the transport sector.

Sales of heat pumps, essential for the decarbonization of the heating sector, are showing signs of a slowdown. Heat pump sales grew 11 percent globally in 2022—notably, in Europe, where they increased 38 percent, partly due to energy security concerns. However, preliminary data show that heat pump sales decreased in most European markets in 2023, falling about 5 percent relative to 2022 (Azau 2024).

The outlook for energy efficiency

The key indicator used to track global progress on energy efficiency is energy intensity, measured as the ratio of primary energy supply to an economy's gross domestic product. The Russian invasion of Ukraine and the ensuing energy crisis resulted in a renaissance of energy efficiency, after two years of stalled progress during the COVID-19 pandemic. Increases in energy costs, energy security concerns, and supply disruptions have prompted policy makers to recognize the important role of energy efficiency in making energy more affordable and secure. This recognition culminated with the consensus reached at COP28 to target a doubling of the energy efficiency improvement rate by 2030. Despite this policy momentum, early estimates for 2023 indicate an annual energy intensity improvement rate of 1.3 percent, largely reflecting an increase in energy demand of 1.7 percent in 2023 and a slowdown of efficiency improvements in China (IEA 2023e). Under IEA's Stated Policies Scenario, the outlook for annual energy intensity improves to 2.3 percent by 2030, slightly stronger than progress on energy intensity over the decade ending in 2020 (figure 6.7).

FIGURE 6.7 • HISTORICAL AND PROJECTED IMPROVEMENT IN GLOBAL ENERGY INTENSITY BY SCENARIO, 2010–30



Source: IEA 2023a.
NZE = Net Zero Emissions by 2050 Scenario; SDG = Sustainable Development Goal; STEPS = Stated Policies Scenario.

Policy action has scaled up significantly since early 2022. Countries representing 70 percent of the global energy demand introduced or significantly strengthened efficiency policy packages. Annual energy efficiency investments rose 45 percent since 2020, with particularly strong growth for EVs and heat pumps. Because the impacts of new government policies and investment growth are not always immediate, these efficiency gains may be realized only over a period of years.

Moreover, this year's slower progress in global energy intensity obscures exceptional gains in some countries and regions, where strong policy action, increased investments, and changes in consumer behavior led to improvements well above the average global rate. Robust improvements, from 4 percent to 14 percent, have been recorded by the European Union and the United States, as well as by many other countries since the beginning of the energy crisis, including the Republic of Korea, Türkiye, and the United Kingdom of Great Britain and Northern Ireland (IEA 2023e).

Energy efficiency is one of the building blocks of IEA's Net Zero Emissions by 2050 Scenario. To achieve net zero emissions by mid-century, the rate of global primary energy intensity improvement doubles to 4.1 percent by 2030 from just over 2 percent in 2022. While this doubled rate exceeds the SDG 7 target of 3.8 percent, it is necessary given the lack of sufficient progress in recent years. Doubling the annual rate of energy intensity improvement by 2030 not only reduces emissions, but also boosts energy security and affordability, saving the energy equivalent of all worldwide oil use in road transport today. While priorities vary by country, the key improvements at the global level come from upgrading the technical efficiency of equipment such as electric motors and air conditioners, from efficiency gains due to electrification, a shift away from solid biomass use in low-income countries, and the more efficient use of energy and materials (IEA 2023d).

For energy efficiency improvements to double, there is a need for robust government policy packages incorporating information, regulations, and incentives, and a tripling of global investments. These will generate efficiency gains in every sector. Between now and 2030, cars become 5 percent more efficient each year, largely through electrification and a switch to smaller vehicles. In industry, annual energy productivity increases 2.3 percent per year, and electricity accounts for 30 percent of energy use by 2030. The retrofit rates for buildings more than double to 2.5 percent per year, generating sufficient energy savings to power all buildings in China and India today. Appliances including air conditioners and refrigerators require 30–40 percent less energy, and consumers make active behavioral changes, for example, limiting heating to 19–20°C.

While achieving this rate of improvement will be challenging, it is not unprecedented. Of the 150 countries for which data exist since 2012, in almost all (91 percent), energy intensity improved by 4 percent or more at least once and by more than half (53 percent) at least three times. The challenge for governments will be to sustain this level of improvement for the rest of the decade. Fortunately, many of the necessary policies and technologies are already in place. In most sectors, governments can make rapid progress toward doubling by building upon existing policies and accelerating the deployment of already-available technologies. Many existing minimum energy performance standards of governments are already at or very close to the levels set forth under the Net Zero Emissions by 2050 Scenario. Implementation and enforcement of these standards across all key sectors by all governments would aid in the collective achievement of a doubling of energy efficiency progress.

Under IRENA's 1.5°C Scenario, the average annual energy intensity improvement rate would need to increase to over 3.3 percent per year over 2020–30. A key step in this regard is the deployment of energy efficiency measures that improve technical efficiency, for example, more efficient boilers, air conditioners, motors, heat pump systems, and appliances, as well as the deployment of technologies that support the direct end use of renewables, for example, solar thermal.

Investments needed to achieve SDG 7

Global clean energy investments, encompassing renewables-based power, renewables-based fuel, efficiency, end-use electrification, and grids, rose by over 5 percent in 2023. These investments were crucial in advancing renewables and boosting energy efficiency and helped to counterbalance the increased reliance on coal and oil. Without this surge in clean energy investments, emissions could have spiked threefold.

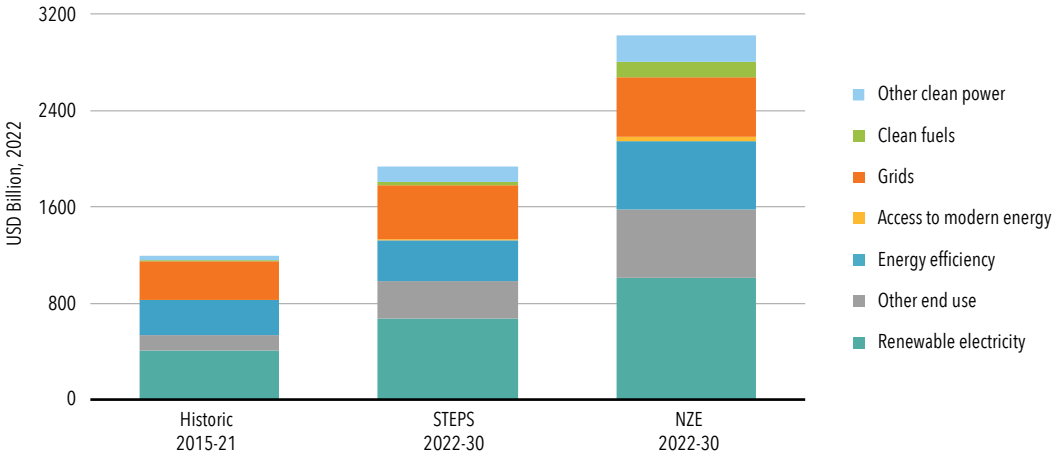
Between 2015 and 2021, annual clean energy investments averaged over USD 1 trillion (in 2022 dollars). Both IEA and IRENA emphasize the pressing need to escalate investments in the energy transition. According to IEA's Net Zero Emissions by 2050 Scenario, meeting the SDG 7 targets requires an average 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 the 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 2022 494 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 IEA's Net Zero Emissions by 2050 Scenario, achieving universal energy access in developing economies necessitates average annual investments of USD 30 billion for electricity access and USD 8 billion for access to clean cooking over 2022–30 (figure 6.8). Half of this 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 due to the small-scale nature of projects and the affordability challenges faced by end users. Before COVID-19, investments in electricity access fell significantly short of the required levels and were concentrated in a few countries. The status of access to clean cooking is even more alarming; investments in 2019 fell far below the required levels, especially in Africa, where they would need to grow 15 times over current levels. International support through development 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.

FIGURE 6.8 • HISTORICAL AVERAGE ANNUAL INVESTMENT IN SELECTED TECHNOLOGIES AND UNDER IEA SCENARIOS, 2022–30

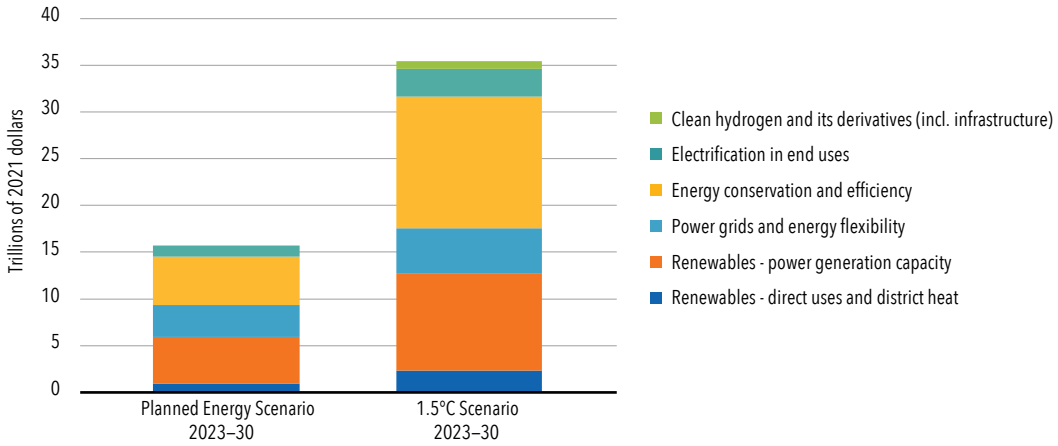


Source: IEA 2023a.
NZE = Net Zero Emissions by 2050 Scenario; PV = photovoltaic; STEPS = Stated Policies Scenario.

Under IRENA's 1.5°C Scenario, cumulative investments between now and 2030 total USD 45 trillion (in 2021 dollars), and the technologies for the transition represent 81 percent of these investments, or USD 36 trillion (figure 6.9). Total cumulative energy sector investments under the Planned Energy Scenario until 2030 are USD 29 trillion. Therefore, an additional cumulative investment of USD 16 trillion would be needed under IRENA's 1.5°C Scenario through 2030.

Investments in efficiency, grid expansion, and flexibility are essential, while any financing for fossil fuels and related infrastructure should align with the transition goals if only to avoid stranding assets. Therefore, IRENA's 1.5°C Scenario requires an average annual outlay of USD 4.5 trillion (2021 dollars) in clean energy transition investments through 2030. These outlays would focus on renewables, efficiency, and low-carbon technologies and include enabling infrastructure, such as power grids and energy storage.

FIGURE 6.9 • GLOBAL CUMULATIVE CLEAN ENERGY TRANSITION INVESTMENTS: PLANNED ENERGY SCENARIO AND 1.5°C SCENARIO, 2023–30



Source: IRENA 2023.

Conclusion

Across this comprehensive analysis of the progress and challenges associated with SDG 7, which aspires for universal access to affordable, reliable, sustainable, and modern energy by 2030, a nuanced picture emerges. Despite notable advances in some areas, significant hurdles remain, underscoring the imperative need for a more concerted and multifaceted approach to align current trajectories with the SDG targets. While innovative technologies and policy interventions have helped expand access to electricity and clean cooking facilities, particularly in Asia, regional disparities persist. These disparities highlight the critical need for enhanced international cooperation, innovative financing mechanisms, and robust, forward-looking policy frameworks capable of adapting to the evolving energy landscape.

The urgency of scaling up renewable energy sources and enhancing energy efficiency is clear, not only to meet SDG 7 but also to address broader environmental challenges and socioeconomic objectives. Reaching the ambitious targets of SDG 7 requires a paradigm shift in how energy is produced, distributed, and consumed. This entails a significant increase in investments and necessitates an enabling policy environment that fosters clean energy transitions across the globe. Policy makers thus have a pivotal role to play in creating conducive environments for the adoption of renewable energy and energy efficiency technologies, facilitating the mobilization of necessary investments, and implementing measures that ensure energy access for all.

Besides the need for direct investments in renewable energy and energy efficiency measures, there is a need for comprehensive strategies that address the full spectrum of challenges associated with achieving SDG 7. This includes developing sustainable clean cooking solutions, which remains a significant issue in many parts of the world, especially Sub-Saharan Africa. Also important is to expand electricity access through proven solutions like SHSs and mini-grids, which have shown promise in reaching remote populations.

The transition toward a sustainable energy future requires not only technological innovation but also significant improvements in infrastructure, regulatory frameworks, and human capital. It requires governments, the private sector, international organizations, and civil society to work collaboratively to create the conditions for the large-scale adoption of clean energy solutions. This collaborative effort should aim to mitigate the financial risks associated with clean energy projects, make clean energy technologies more affordable for end users, and ensure that the benefits of the energy transition are equitably distributed.

The journey toward reaching SDG 7 and ensuring a sustainable energy future for all has many challenges but also brings many opportunities. The path forward requires not only a significant scale-up of current efforts, but also a holistic approach that addresses the interconnectedness of energy access, renewable energy adoption, energy efficiency, and socioeconomic development, ensuring no one is left behind in the global transition to a sustainable energy future.

ANNEX 1.
METHODOLOGICAL NOTES

Chapter 6. Outlook for SDG 7

All investment figures from IEA scenarios are in constant 2021 USD at market exchange rate while from IRENA scenarios in constant 2015 USD at market exchange rate.

IEA METHODOLOGY

The analysis presented in this chapter is based on results from the World Energy Model (WEM) and IEA analysis in the *World Energy Outlook* (WEO). Detailed documentation of the WEM methodology can be found at https://www.iea.org/reports/world-energy-model/documentation#abstract.

IEA models two scenarios. The Stated Policies Scenario is designed to give feedback to decision makers about the course they are on today, based on stated policy ambitions. This scenario assumes that the COVID-19 pandemic is brought under control in 2021. It incorporates IEA's assessment of stated policy ambitions, including the energy components of announced stimulus or recovery packages (as of mid-2020) and the NDCs under the Paris Agreement. Broad energy and environmental objectives (including country net-zero targets) are not automatically assumed to be met. They are implemented in this scenario to the extent that they are backed up by specific policies, funding, and measures. The Stated Policies Scenario also reflects progress with the implementation of corporate sustainability commitments.

The Net Zero Emissions by 2050 Scenario is a normative IEA scenario that shows a narrow but achievable pathway for the global energy sector to achieve net-zero CO2 emissions by 2050, with advanced economies reaching net-zero emissions in advance of others. This scenario also meets the key energy-related SDGs, achieving universal energy access by 2030 and major improvements in air quality. This scenario is consistent with limiting the global temperature rise to 1.5°C without a temperature overshoot (with a 50 percent probability), in line with reductions assessed by the IPCC in its *Special Report on Global Warming of 1.5°C*. This scenario is based on the following assumptions:

- Uptake of all available technologies and emission reduction options is dictated by costs, technology maturity, policy preferences, and market and country conditions.
- All countries cooperate toward achieving net-zero emissions worldwide.
- An orderly transition occurs across the energy sector that always ensures the security of fuel and electricity supplies, minimizes stranded assets where possible, and avoids volatility in energy markets.

METHODOLOGY FOR ACCESS TO ELECTRICITY AND ACCESS TO CLEAN COOKING

The projections presented in the WEO and in this chapter focus on two elements of energy access– household access to electricity and clean cooking facilities–which are measured separately. IEA maintains databases on the levels of national, urban, and rural electrification rates. For the proportion of the population without clean cooking access, the main sources are the World Health Organization (WHO) Household Energy Database and IEA's Energy Balances. Both databases are regularly updated and form the baseline for WEO energy access scenarios to 2040.

The projections in the Stated Policies Scenario consider current and planned policies; recent progress; and population growth, economic growth, the urbanization rate, and the availability and prices of different fuels. The Net Zero Emissions by 2050 Scenario identifies least-cost technologies and fuels to reach universal access to both electricity and clean cooking facilities. For electricity access, the analysis incorporates a Geographic Information Systems (GIS) model based on open-access geospatial data, with technology, energy prices, electricity access rates and demand projections from the WEM. This analysis was developed in collaboration with the KTH Royal Institute of Technology, Division of Energy Systems Analysis (KTH-dESA), in Stockholm. Further details about the IEA methodology for energy access projections can be found at https://www.iea.org/reports/world-energy-model/sustainable-development-scenario-sds#abstract.

METHODOLOGY FOR RENEWABLE ENERGY PROJECTIONS

The annual updates to WEO projections reflect the broadening and strengthening of policies over time, including for renewables. The projections of renewable electricity generation are derived in the renewables submodule of the WEM, which projects the future deployment of renewable sources for electricity generation and the investment needed. The deployment of renewables is based on an assessment of the potential of and costs for each source (bioenergy, hydropower, photovoltaics, concentrating solar power, geothermal electricity, wind, and marine) in each of the 25 WEM regions. In all scenarios, IEA modelling incorporates a process of learning-by-doing that affects the costs. By including financial incentives for the use of renewables and nonfinancial barriers in each market, technical and social constraints, and the value each technology brings to system in terms of energy, capacity, and flexibility, the model calculates deployment as well as the resulting investment needs on a yearly basis for each renewable source in each region.

METHODOLOGY FOR ENERGY EFFICIENCY PROJECTIONS

The key energy efficiency indicator refers to GDP and total final energy demand. Economic growth assumptions for the short to medium term are based largely on those prepared by the Organisation for Economic Co-operation and Development, the International Monetary Fund, and the World Bank. Over the long term, growth in each WEM region is assumed to converge to an annual long-term rate that depends on demographic and productivity trends, macroeconomic conditions, and the pace of technological change.

Total final energy demand is the sum of energy consumption for each end use in each final demand sector. In each subsector or end use, at least six types of energy are shown: coal, oil, gas, electricity, heat, and renewables. The main oil products—LPG, naphtha, gasoline, kerosene, diesel, heavy fuel oil, and ethane—are modeled separately for each final demand sector.

In most of the equations, energy demand is a function of activity variables that are driven by the following factors:

- Socioeconomic variables: GDP and population are important drivers of sectoral activity variables that determine energy demand for each end use within each sector.
- End-user prices: Historical time series data for coal, oil, gas, electricity, heat, and biomass prices within each sector are compiled based on IEA's Energy Prices and Taxes database and several external sources. End-user prices are then used as an explanatory variable affecting the demand for energy services.
- Technological parameters include recycling in industry and material efficiency.

All 25 WEM regions for energy demand are modeled in considerable sectoral and end-use detail:

- Industry is separated into six subsectors (with the chemicals sector disaggregated into six subcategories).
- Building energy demand is separated into residential and services buildings, which are then separated into six end uses. Within the residential sector, appliances energy demand is separated into four appliance types.
- Transport demand is separated into nine modes, with considerable detail for road transport.

IRENA METHODOLOGY

IRENA scenarios. IRENA's scenarios outlined in this report were developed by the Renewable Energy Roadmaps (REmap) team at IRENA's Innovation and Technology Centre, in Bonn. Since 2014, this team has produced a succession of roadmaps with ambitious pathways for deploying low-carbon technologies to create a clean, sustainable energy future at the global, regional, and country levels.

The findings presented in this report are based on IRENA's 2022 flagship publication *World Energy Transitions Outlook: 1.5°C Pathway*. The Planned Energy Scenario provides a perspective on energy system developments based on governments' energy plans and other planned targets and policies that were in place as of early 2022. The 1.5°C Scenario describes an energy transition pathway aligned with the ambition of limiting the average increase in the global temperature by the end of the century to 1.5°C relative to pre-industrial levels. For more information on the scenarios, methodology and scope of this work, please visit www.irena.org/remap.

IRENA socioeconomic modelling. IRENA has been analyzing the socioeconomic implications of transition roadmaps since 2016. Based on a global econometric model with high regional and sectoral resolution (E3ME, from Cambridge Econometrics), IRENA's methodology holistically captures the multiple interactions between energy transition roadmaps with its accompanying policy baskets and global and national economic systems.

The resulting socioeconomic footprint is evaluated at a high level of detail, generating insights that inform policy making for a successful transition. Socioeconomic footprint results include GDP (aggregated economic activity); employment (economywide and with high resolution within the energy sector); and welfare (using an index with five dimensions—economic, social, environmental, distributional, and access—each informed by two indicators).

A detailed driver's methodology is used to facilitate understanding of the mechanisms producing the socioeconomic footprint results, providing clearer insights on the links between transition goals and policies and their resulting impacts.

WHO PROJECTIONS

Projected access rates, deficits in access, and fuel usage that are presented in Outlook chapter are estimated using the WHO Global Household Energy Model (detailed in the Methodological Notes for Chapter 2). The uncertainty of these estimates grows with projections further into the future, reflecting potential shifts in country trends based on their volatility during the data period.

The projections presented in this chapter are based on a hypothetical Business-as-Usual scenario derived from the current trends that assumes that no new policies or interventions (either positive or negative) occur. Thus, these scenarios serve as useful baselines for evaluating the impact of potential interventions. The scenarios are derived by extrapolating current trends into the future..

ANNEX 2.
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