CHAPTER 6 – GLOBAL PROSPECTS FOR SDG 7

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MAIN MESSAGES

- **The world fails to achieve all Sustainable Development Goal (SDG) 7 targets under current levels of ambition.** The New Policies Scenario of the International Energy Agency (IEA) shows that current and planned policies fall short of delivering universal access to affordable, reliable, sustainable, and modern energy for all by 2030. This means that in 2030 nearly 675 million people are projected to be without access to electricity, 2.3 billion people will not have clean cooking facilities, global energy-related CO2 emissions will continue to rise, and millions of premature deaths will still be caused by harmful indoor and outdoor local air pollution each year.

- **The outlook for electricity access:** Despite progress in all world regions, the world is not on track to achieve universal electricity access by 2030, with Sub-Saharan Africa at great risk of being left behind. The country-by-country analysis of policies, investment, and technologies that underpins the New Policies Scenario shows a projected electrification rate of 92% globally by 2030. Most countries in Asia are on track to deliver near-universal access by 2030, meaning that 90% of the population without access to electricity at that time is projected to live in Sub-Saharan Africa.

- **The outlook for access to clean cooking:** The world is far from being on track to achieve universal access to clean cooking facilities. Of the global population, 27%—or 2.3 billion people—are projected to remain without access to clean-cooking facilities in 2030. Even though near-universal access to electricity is achieved in Asia, 1.3 billion people are still projected to be without clean cooking access by 2030. Despite this slowly falling number, strong population growth hides some success: 900 million people are expected to gain clean cooking access over the period.

- **The outlook for renewable energy:** By 2030, the share of renewables is expected to grow to 21% of total final energy consumption (TFEC) under current and planned policies, from 17.5% today. Traditional uses of biomass are projected to remain a large component of renewable energy consumption; however, its share of total renewable consumption falls from 45% in 2015 to 25% in 2030. Therefore, the share of modern renewables grows at a faster relative pace than total renewables, from 10% in 2015 to 15% in 2030. Although renewable power generation is progressing rapidly, supportive policies for renewable transport and heat remain limited, preventing greater overall renewables penetration.

- **The outlook for energy efficiency:** Energy efficiency policies are expected to contribute to further reductions in global energy intensity, but at a rate not fast enough to bring the world on a sustainable pathway or to reach the SDG 7.3 target. Global energy intensity is expected to decrease by 2.4% per year on average between 2015 and 2030 in the New Policies Scenario, faster than the 2.2% improvement seen over 2010–15 but still short of the 2.6% annual improvement required to meet the SDG 7.3 target.

- **Achieving a sustainable energy future:** The IEA's Sustainable Development Scenario, released in 2017, describes an integrated pathway for the world's energy system to deliver on energy-related SDGs: to ensure universal access to affordable, reliable, sustainable, and modern energy services by 2030

(SDG 7); to substantially reduce the air pollution which causes deaths and illness (SDG target 3.9); and to take effective action to combat climate change (SDG 13). A central finding is that universal access to modern energy can be delivered without putting the climate objective at risk, bringing substantial co-benefits. Renewables and efficiency are the key mechanisms to drive forward the low-carbon transition and reduce pollutant emissions.

This chapter describes the results of global modeling exercises to understand whether current policy ambitions are sufficient for meeting the targets of SDG 7, and what additional actions are needed for success. The main two scenarios described are derived from the World Energy Outlook, IEA's flagship publication.

The New Policies Scenario—the central scenario—takes into account the policies and implementing measures affecting energy markets that had been adopted as of mid-2017, with relevant policy proposals, even though specific measures to put them into effect may yet to be fully developed. Because of the many institutional, political, and economic obstacles involved, and in some cases the lack of detail in announced intentions on how current commitments and plans will be implemented, this scenario assumes only cautious implementation. It includes, for example, the greenhouse gas and energy–related components of the Nationally Determined contributions pledged under the Paris Agreement (COP21).

The Sustainable Development Scenario (introduced in 2017; see box 6.1) lays out an integrated least-cost strategy for the achievement of three interlinked and important policy objectives related to access to energy services (SDG 7), reducing air pollution (SDG target 3.9), and combatting climate change (SDG 13). The Energy for All case is separate from the Sustainable Development Scenario and describes a pathway for delivering only on the target of SDG 7.1, universal access to modern energy.

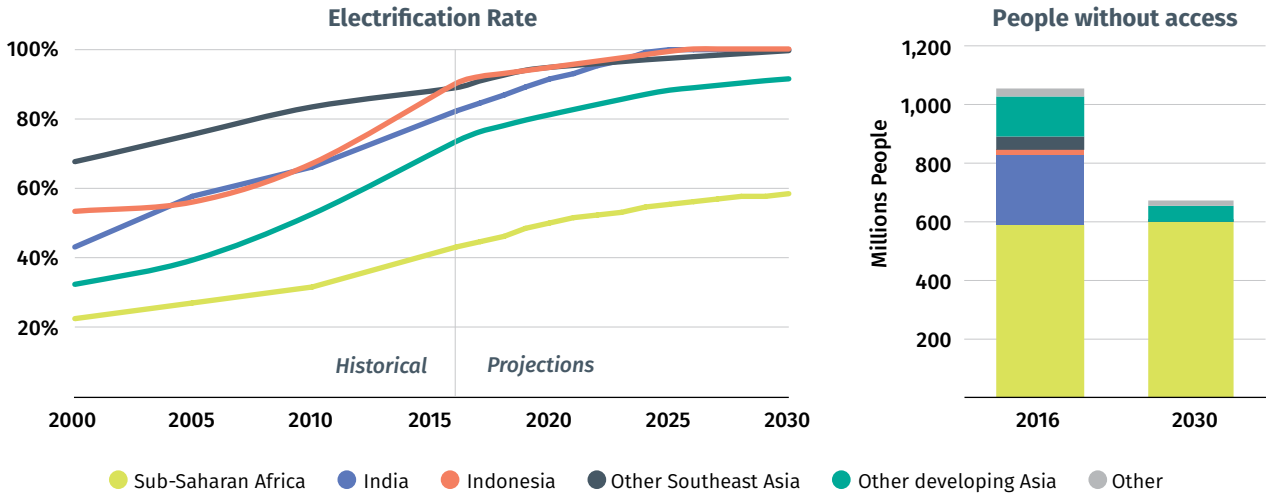
ELECTRICITY ACCESS

Despite progress in all world regions, the world is not on track to achieve universal electricity access by 2030, and Sub-Saharan Africa is at great risk of being left behind. The country-by-country analysis of policies, investment, and technologies that underpins IEA's New Policies Scenario shows a projected electrification rate of 92% globally by 2030, leaving about 675 million people without access by that date.

Despite this failure to achieve the indicator of SDG 7.1.1, many countries are on track to achieve universal electricity access, and over 600 million people will gain access over the period. Sustained progress and policy commitments in Asia mean that the region is projected to reach a 99% rate of electrification in 2030. This achievement is largely the result of India's tremendous electrification effort, which sees 250 million people gaining electricity access between now and the early 2020s, when the country reaches full access. In Latin America, nearly three-quarters of countries are on track to attain universal access by 2020, and by 2030 the region achieves near universal access, with Haiti the only country with an access rate below 90%.

The access deficit continues to become more concentrated in Sub-Saharan Africa. Despite a projected 15 percentage point increase in the access rate, bringing the access rate to almost 60% of the population, 600 million people still are projected to remain without access in 2030, as progress struggles to keep pace with population growth in many countries: Recent progress in Sub-Saharan Africa has been unevenly distributed, and in these projections, population growth overtakes progress—which is saturated by 2030.

FIGURE 6.1 • Electricity access rate and population without electricity by region in the New Policies Scenario



Source: IEA 2017a; www.iea.org/sdg

Note: The geographical groupings presented here are derived from the World Energy Outlook and are described in Annex 1 of the World Energy Model documentation: https://www.iea.org/media/weowebsite/2017/WEM_Documentation_WEO2017.pdf. They do not necessarily correspond to regional groupings used in other chapters of this report.

Analysis of energy balances and resources, population distribution, and infrastructure shows that energy and technology sources are changing rapidly, and are set to be transformative in the future. Since 2000, fossil fuels have been the source of 70% of new electricity access, and the centralized grid is the source for 99% of connections. In the New Policies Scenario, more than 60% of those who gain access by 2030 are projected to do so through generation from renewables, mostly solar and hydro. Grid extensions serve half of the newly connected, but in rural areas decentralized power systems are the most cost-effective solutions for more than two-thirds of those who gain access.

In the Energy for All Case, where universal access to electricity is achieved by 2030, the greatest challenge is to provide access to people living in the most remote areas in Sub-Saharan Africa. Geospatial analysis shows that decentralized systems are the least-cost option to supply electricity for nearly three-quarters of those concerned, but that grid expansion also has an important part to play. The analysis also shows that almost 90% of those gaining access over and above the projections in the New Policies Scenario do so through generation from renewables. The additional annual investment cost is $28 billion per year to 2030, equivalent to 1.7% of total global energy investment. Overcoming this challenge requires better policies: these include setting up dedicated institutions with the responsibility for electricity access, a focus on electrifying productive uses and public services, ensuring an enabling environment to allow the private sector to flourish, and allowing decentralized solutions to play a role.

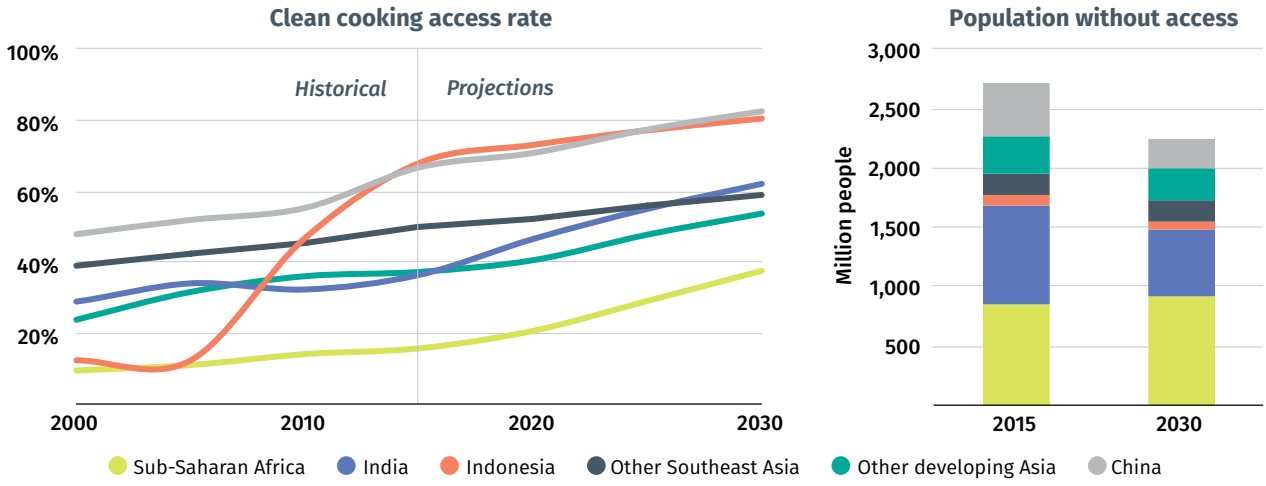
ACCESS TO CLEAN COOKING

The world is far from being on track to achieve universal access to clean cooking facilities. In 2030, 2.3 billion people—or 27% of the global population—are projected to remain without access to clean cooking facilities. Despite this slowly falling number, strong population growth hides some success: 900 million people are expected to gain access by 2030.

Unlike the case for electricity access, the clean cooking access deficit remains geographically dispersed. Although most countries in Asia are on track to achieve universal electricity access by 2030, over 1.3 billion people—31% of the population—will remain reliant on basic biomass cooking facilities, as well as coal and kerosene at that time. This represents some progress, although far from enough to achieve the target. Significant reductions in the population without access to clean fuels and stoves for cooking come from countries with dedicated policy initiatives—in particular China, India, and Indonesia—and from a switch in urban areas to liquefied petroleum gas (LPG).

In Sub-Saharan Africa, about 320 million people gain access to clean cooking facilities during the period to 2030, an estimated 100 million of them as a result of the intentions related to clean cooking pledges in countries' Nationally Determined Contributions. However, the population of Sub-Saharan Africa grows by 450 million people by 2030, and clean cooking efforts do not keep pace. Therefore, the number of people cooking with traditional uses of biomass is projected to increase to 820 million people by 2030, increasing demand.

FIGURE 6.2 • Clean cooking access rate and population without electricity by region in the New Policies Scenario



Source: IEA 2017a, based on WHO Household Energy Survey Database and IEA Energy Balances; www.iea.org/sdg.
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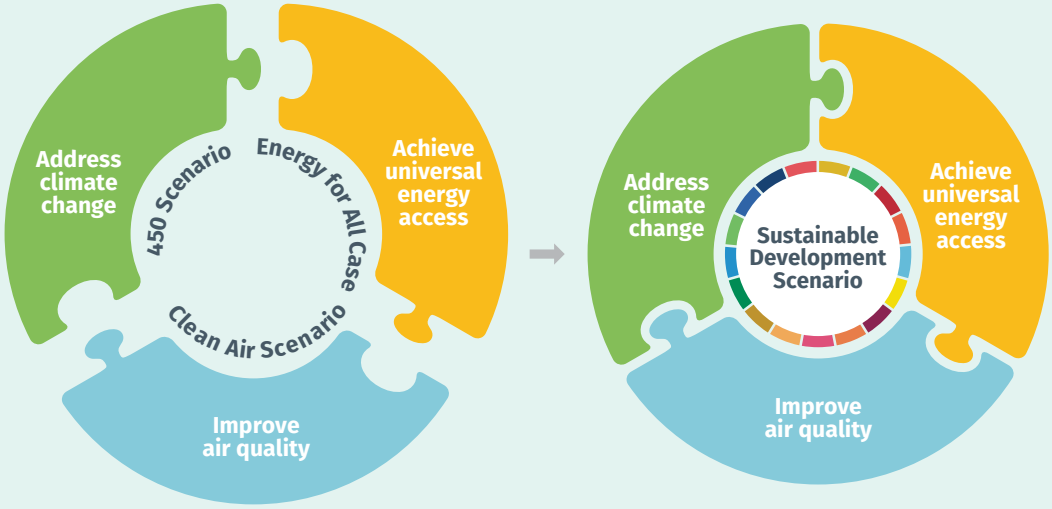
The IEA's Energy for All case describes what would be needed to deliver universal clean cooking to those 2.3 billion people who would be left without access under current trends (1.3 billion in Asia and over 900 million in Sub-Saharan Africa). This requires a major shift in the cooking fuel mix, with LPG the main source of access in urban areas and a mix of technologies, depending on geography and resources, in rural areas. Improved biomass cookstoves are likely to play an important role: although this solution is relatively low cost, there are significant challenges in scaling up their use and in ensuring that they perform to higher emissions standards.

The costs associated with delivering universal clean cooking access, $3 billion per year, are about one-tenth of those associated with delivering universal access to electricity, and the benefits are very significant. An estimated 1.8 million premature deaths related to household air pollution are avoided in 2030 by providing access to clean cooking for all, even though the effects of pollution in earlier years mean there are still about 700,000 premature deaths in 2030. Analysis also shows significant time savings: over 100 billion hours each year are currently spent gathering wood for fuel, mostly by women, and this time could be used for more productive purposes. Importantly, the SDG 7.1 target can be met without additional net greenhouse gas (GHG) emissions. The small rise in CO2 emissions arising from additional fossil fuel demand (0.2%) is more than offset by the net reduction in GHG emissions from reducing dependence on traditional uses of biomass for cooking, which largely result in methane. The actions policy makers need to take in order to achieve this target, outlined in Policy Brief #2, include translating commitments into concrete, implementable, and evidence-based domestic policies; improving coordination between the energy, education, development, and health sectors; and prioritizing better monitoring of household fuel use to measure the impact of interventions.

BOX 6.1 • A PATH FOR THE ENERGY SECTOR TO ACHIEVE ENERGY-RELATED SDG'S: THE IEA'S SUSTAINABLE DEVELOPMENT SCENARIO

The *World Energy Outlook 2017* introduced a new forward-looking, normative scenario—the Sustainable Development Scenario—that provides an energy sector pathway combining the fundamentals of sectoral energy policy with three closely associated but distinct policy objectives related to the SDGs: (1) to ensure universal access to affordable, reliable, sustainable, and modern energy services by 2030 (SDG 7); (2) to substantially reduce the air pollution that causes deaths and illness (SDG target 3.9); and (3) to take effective action to combat climate change (SDG 13). The objective is to lay out an integrated least-cost strategy for the achievement of these important policy objectives, alongside energy security, in order to show how the respective objectives can be reconciled, dealing with potentially conflicting priorities, so as to realize mutually supportive benefits. The new scenario provides a benchmark for measuring progress toward a more sustainable energy future, in contrast with the New Policies Scenario, which tracks current and planned policies.

FIGURE B6.1.1 • The Sustainable Development Scenario integrates main energy-related SDG targets



Source: IEA 2017b.

In the Sustainable Development Scenario, low-carbon sources double their share in the energy mix to 40% in 2040, all avenues to improve efficiency are pursued, coal demand goes into an immediate decline, and oil consumption peaks soon thereafter. Power generation is all but decarbonized, relying by 2040 on generation from renewables (over 60%) and nuclear power (15%) as well as a contribution from carbon capture and storage (6%)—a technology that plays an even more significant role in cutting emissions from the industry sector. Electric cars move into the mainstream quickly, but decarbonizing the transport sector also requires much more stringent efficiency measures across the board, notably for road freight. Renewables and efficiency are the key mechanisms to drive forward the low-carbon transition and reduce pollutant emissions.

Considering the interlinkages between them and aligning policy and market frameworks—notably in the residential sector—is essential to ensure cost-efficient outcomes. The provision of highly efficient appliances, combined with decentralized renewables, also plays a major role in extending full access to electricity and clean cooking, especially in rural communities and isolated settlements that are hard to reach with the grid. Looking to 2030, modern renewables reach 21% of TFEC, more than doubling today's share; and achieving the goal of universal access to clean cooking facilities reduces significantly traditional uses of biomass from the energy mix. SDG target 7.3 is exceeded in the Sustainable Development Scenario, with average annual improvements in global energy intensity need accelerating to 3.4% annually to achieve critical energy sector objectives

RENEWABLE ENERGY

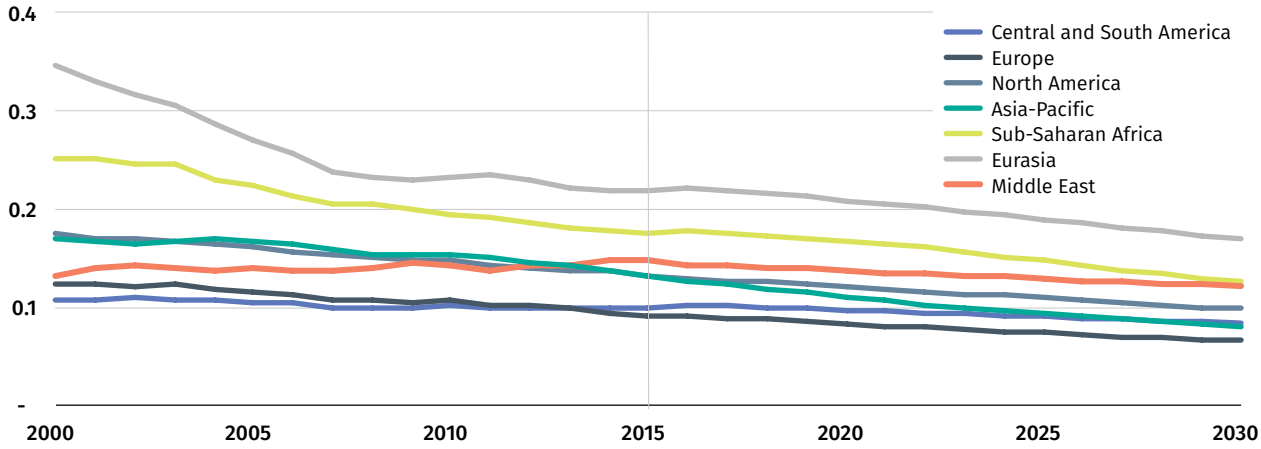
By 2030, the share of renewables is expected to grow to 21% of TFEC under current and planned policies, from 17.5% today. Traditional uses of biomass are projected to remain a large component of renewable energy consumption; however their share of total renewable consumption falls from 45% in 2015 to 25% in 2030. Therefore, the share of modern renewables grows at a faster relative pace than total renewables, increasing significantly from 8.6% in 2010 to 15% in 2030.

Modern renewable energy sources are anticipated to supply 35% of the incremental total final energy demand to 2030, more than any other fuel, backed by strong policy commitments and falling costs. Electricity generation from renewables is expected to overtake that from coal in the 2020s to supply 34% of electricity by 2030, from 23% in 2015. Power generation from wind and solar photovoltaic (PV) are the fastest-growing sources of renewable generation and are anticipated to contribute 35% and 26%, respectively, of the absolute increase in renewable electricity to 2030. Hydropower is projected still to account for nearly half of all renewable power generation in 2030.

Growth in renewables is not confined to the power sector. The direct use of renewables for heat and transport is also set to increase on the basis of current and planned policies, but at a much more limited pace: supportive policies are often fewer, costs sometimes higher, and adoption generally slower. In the New Policies Scenario, the share of renewables in transport grows to 5% in 2030 from 3% in 2015, and direct renewables used in buildings grows to 7% in 2030 from 5% in 2015 (excluding the traditional uses of biomass for cooking).

In IEA's central outlook, renewables contribute an increasing share of total primary energy demand in all regions, and grow in almost all sectors. China continues to be the leading country in renewable energy use and increases its share of global modern renewable energy supply from 15% in 2015 to nearly 20% in 2030. China is followed by the United States, the European Union, and India in renewable energy use in this outlook.

FIGURE 6.3 • Share of modern renewables in TFEC in the New Policies Scenario



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While there are many positive developments for renewables, especially for power generation, this progress is not sufficient to put the world on a sustainable track. The IEA's Sustainable Development Scenario shows a pathway for the global energy system to deliver on the main energy-related SDGs (See Box 1). In this scenario, modern renewables reach 21% of TFEC by 2030 and are especially instrumental in delivering universal electricity access, especially to rural access, to reduce air pollution and to bring about an early peak in CO_2 emissions.

BOX 6.2 • THE POTENTIAL OF RENEWABLE ENERGY TO 2050: A VIEW FROM IRENA'S REMAP ANALYSIS

The global imperative to achieve sustainable growth and limit climate change, combined with a rapid decline in costs and rising investment into renewable energy, has put in motion a transition of the way that energy is produced, distributed, and consumed. This Energy Transition will transform the energy system, from one largely based on fossil fuels to one based largely on renewable energy sources. When combined with significant improvements in energy efficiency, the new system will accelerate the decoupling of economic growth and energy demand.

We have now a good understanding that the accelerated deployment of renewable energy and energy efficiency measures are the key elements of the Energy Transition. According to the REmap analysis of the International Renewable Energy Agency (IRENA), the accelerated deployment of renewables and energy efficiency can achieve over 90% of the emissions reductions needed by 2050 to reach the below 2°C mark with 66% probability. Energy demand in 2050 would remain around today's level thanks to intensive energy efficiency improvements, despite significant population and economic growth. The share of renewable energy would meanwhile rise from about 15% of the primary energy supply in 2015 to about 66% by 2050.

Improvements in the energy intensity of the global economy would be achieved by a mix of measures. The most important ones would be energy efficiency measures in heating and fuel use, followed by energy efficiency measures in power generation and electrification of transport. Interestingly, some of the incremental energy intensity improvements could be attributed to renewable energy, highlighting the important synergies between energy efficiency and renewable energy. This includes efficiency gains from renewable energy–based heating, cooling, transport, and electrification coupled with renewable power.

The energy supply mix would change substantially. Under IRENA's REmap analysis, total global primary energy supply in 2050 would be below 500 exajoules (EJ) per year in 2050, slightly below today's level and 30% less than a scenario with continued use of current and planned policies in business as usual (reference case). The share of renewable energy in the total primary energy supply grows to about 66% by 2050. Total fossil fuel use in 2050 would be a third of today's level, with the use of coal declining the most and natural gas becoming the most important fossil fuel. The world would not run out of fossil fuels, but it would stop using the most challenging resources that have high production costs.

The power sector is currently on track to achieve the necessary emissions reductions. The world has witnessed accelerated deployment of solar and wind power on a global scale in recent years, based on technology innovations and dramatic cost reductions. But these ongoing efforts must continue, and more focus should be placed on power systems flexibility as the share of variable renewable power rises. Worldwide, electricity generation would increase to about 47,000 terawatt-hours (TWh) per year by 2050. Total electricity generation capacity would reach more than 18,000 gigawatts (GW) in the same year. Renewable energy technologies would generate an increasing share of that electricity. The renewable share would rise from an estimated 25% of total electricity generation in 2017 to 85% by 2050.

In IRENA's REmap analysis, the share of electricity in TFEC would need to increase to 40% by 2050. Electricity accounts for only about 20% of final energy use today. This would require a broader coupling between the power sector and end-use sectors such as transport, buildings, and industry. In transport, the number of electric vehicles would need to grow. It is critical that new buildings be of the highest efficiency and that existing ones be retrofitted and refurbished at an accelerating rate. Buildings and city designs should facilitate renewable electricity integration. Governments will have an important role in facilitation of enabling infrastructure such as recharging stations and smart grids.

As regards TFEC in end-use sectors (buildings, transport, and industry), under IRENA's REmap analysis, demand would remain flat compared to today's level, at about 340 EJ per year (but almost a third less than the reference case). Direct uses of renewable energy would grow from 10% to 50%. Notably, the share of final bioenergy use in TFEC would rise; at the same time, the use of traditional bioenergy would drop to almost zero and be partly replaced by modern bioenergy and electrification. Solar water heater use would see 10-fold growth for industry and buildings. Growth would also be observed in direct uses of geothermal heating. The oil share would decrease significantly, with transport relying more on biofuels and electricity.

Such an energy transition is affordable but will require additional investments in low-carbon technologies compared to the reference case. Further significant cost reductions will be major drivers for increased investments across the range of renewables and enabling technologies, but cumulative investment in all energy supply would need to increase from 93 trillion to 120 trillion over the 2015–50 timeframe.

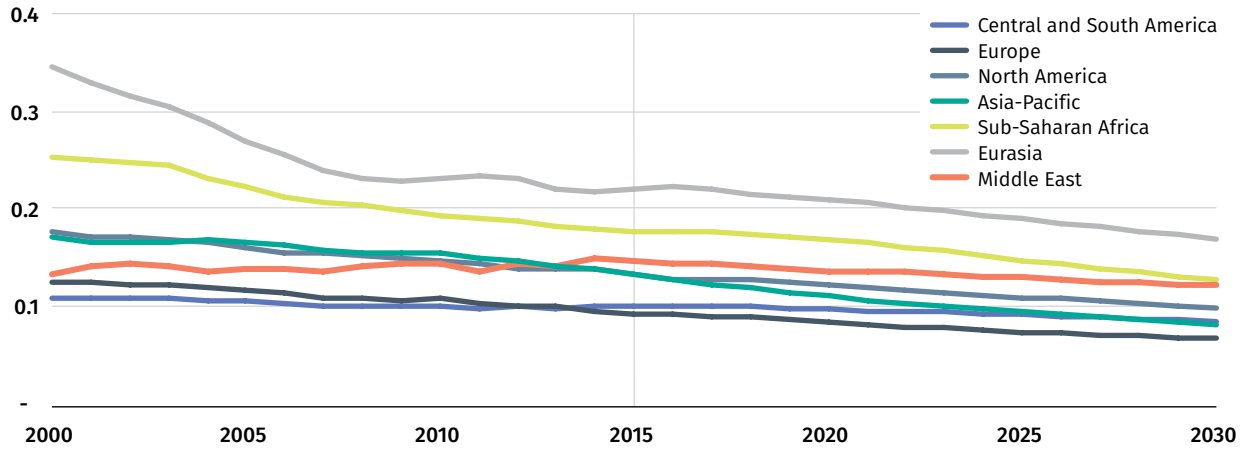
From a macroeconomic perspective, the energy transition can fuel economic growth, create new employment opportunities and enhance human health and welfare. Gross domestic product (GDP) would be boosted about 1% in 2050 compared to the reference case. Important structural economic changes would take place. Whereas fossil fuel industries would incur the largest reductions in sectoral output, those related to capital goods, services, and bioenergy would experience the highest increases. The energy sector (including energy efficiency) would create millions of additional jobs in 2050 compared to the reference case. Job losses in fossil fuels would be completely offset by new jobs in renewables, with more jobs being created by energy efficiency activities. The overall GDP improvement would induce further job creation in other economic sectors.

Improvements in human welfare, including economic, social, and environmental aspects, would generate benefits far beyond those captured by GDP. Savings from reduces externalities related to damages to human health and the environment would outweigh additional costs by as much as five times. However, today's markets are distorted: fossil fuel consumption is still subsidized in many countries and the true cost of burning fossil fuels, in the absence of a carbon price, is not accounted for. To unlock these benefits, the private sector needs clear and credible long-term policy frameworks that provide the right market incentives.

ENERGY EFFICIENCY

Energy efficiency policies are expected to contribute to further reductions in global energy intensity, but not at a rate fast enough to bring the world on a sustainable pathway or to reach the SDG 7.3 target. Global energy intensity is expected to decrease by 2.4% per year on average between 2015 and 2030 in the New Policies Scenario, faster than the 2.2% improvement seen over the 2010–15 period but still short of the 2.6% annual improvement required to meet the SDG 7.3 target. Although intensity improvements accelerate in nearly all world regions, emerging economies make the fastest improvements, with the Asia Pacific region decreasing energy intensity at a rate of 3.3% annually. A number of significant energy efficiency policies currently under development are expected to boost energy intensity reduction in the New Policies Scenario. These include the strengthening of mandatory energy performance regulations in various regions, as well as the implementation of new policy packages announced in the European Union and China. In absolute terms, the largest savings come from avoided coal use in industry in China, which can in large part be attributed to policies to phase out older, more inefficient coal-based capacity and reduce pollutant emissions. The next largest contributions come from reduced oil demand in the transport sectors of the United States and the European Union, where passenger light-duty vehicle (PLDV) fuel-economy standards are set to become more stringent.

FIGURE 6.4 • Energy intensity by region (TPES/GDP (toe per thousand 2010 USD PPP)) in the New Policies Scenario



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The Sustainable Development Scenario shows that, in order to bring the world on a sustainable energy path, average annual improvements in global energy intensity need to accelerate to 3.4% annually to achieve critical energy sector objectives, bringing about an early peak in CO2 emissions (SDG 13), delivering universal modern energy access by 2030, and reducing harmful air pollution.

CONCLUSIONS

Overall, the prospects for achieving the targets of SDG 7 have improved. The falling cost of renewable electricity is accelerating the deployment of low-carbon electricity and making decentralized electricity more affordable and accessible than ever before, and new policies are raising ambitions and improving the energy intensity of the global economy. However, global energy scenarios reflecting current and planned policies show that the world is far from being on track to achieve the targets of SDG 7. The IEA's Sustainable Development Scenario shows that delivering on energy-related SDGs—universal energy access, climate mitigation, and reduction of local air pollution—in an integrated manner is achievable, and would cost an additional $8 trillion, relative to current ambitions, through 2040. The objective is achievable; however, delivering on these goals, which are a prerequisite for many other SDGs, requires immediate and dramatic changes to the global energy system, including a peak in coal demand by 2020, a near-complete decarbonization of the power sector, and rapid electrification of many end uses.

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