SUSTAINABLE
ENERGY FOR ALL

PROGRESS TOWARD SUSTAINABLE ENERGY

GLOBAL TRACKING FRAMEWORK 2015 SUMMARY REPORT

PROGRESS TOWARD SUSTAINABLE ENERGY

SUMMARY REPORT

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FOREWORD

In September 2015 the international community will adopt a new generation of targets, the Sustainable Development Goals (SDGs), defining how we believe a better world should look and how we can achieve it. For the first time, energy looks set to be fully recognized as a fundamental pillar of development in its own right—a precondition for progress in a wealth of other areas from health and education to jobs and gender equality. Energy production and consumption also need to be sustainable, if we are to avert catastrophic changes to our climate that will affect us all.

The UN's Sustainable Energy for All (SE4All) initiative, a multistakeholder partnership uniting the public sector, private sector and civil society, is seen by many as the logical rallying point for action on a sustainable energy SDG. With its three interlinked targets—ensuring universal access to modern energy services, doubling the global rate of improvement in energy efficiency, and doubling the share of renewable energy in the world's energy mix, all by 2030—it provides a road map for a future in which ending energy poverty does not have to come at the expense of the planet.

But as inspiring as these ambitious targets are, the action needed to reach them can easily lose both momentum and direction if there is no clear way to gauge progress. We need to see what is or isn't working, what to celebrate, and where we need to push harder. We need milestones along the way. Targets alone are meaningless without a credible and broadly accepted way of measuring whether they are actually being met.

SE4All's first *Global Tracking Framework (GTF)* in 2013, produced by energy experts from 15 agencies under the leadership of the World Bank and the International Energy Agency (IEA), provided that monitoring system. Even-handed and methodologically rigorous, it drew on data up to 2010 to provide a comprehensive snapshot of the status of more than 180 countries in terms of energy access, action on energy efficiency and renewable energy, energy consumption, and policy measures taken by successful countries. It identified places where the greatest gains can and should be made in each of these areas, the challenges and the success stories.

Two years later, with that baseline in place, we can already start to measure whether action on sustainable energy is bearing fruit. This second edition of the *GTF,* coordinated once again by the World Bank and IEA along with the Energy Sector Management Assistance Program (ESMAP), and now with even broader support from more than 20 agencies, draws on new data from the period 2010–2012. It provides an update of how the world has been moving toward the three objectives over that period, assesses whether progress has been fast enough to ensure that the 2030 goals will be met, and sheds light on the underlying drivers of progress.

GTF 2015 also explores a number of complementary themes. It includes a new chapter that provides essential context on the complex links between energy and four other key development areas: food, water, health, and gender. It provides further analysis of the financial cost of meeting the SE4All objectives, as well as the geographical and technological distribution of the investments that need to be made. It explores the extent to which countries around the world have access to the technology needed to make progress toward the three targets. And it identifies the improvements in data collection methodologies and capacity building that will be needed to provide a more nuanced and accurate picture of progress over time.

Part of this will involve reflecting the kind of complexity on the ground that cannot be captured by simple binary questions such as: Does this household have electricity access or not? For example, it may have power, but only for a short time in the day, or suffer unpredictable outages. To address the shortcomings of reporting energy access in a binary fashion, a new multitier framework designed by the World Bank has been piloted in a few locations, and plans are under way to launch a global access survey that will allow such data to be available in a standardized way for many countries.

Similar efforts are needed for better tracking of energy efficiency, requiring detailed reporting on activities and energy consumption by sector and individual end use. Countries will need to put resources and effort into collecting and reporting this more nuanced data, and international organizations will need to aggregate information from disparate sources to produce a consistent overall view.

In some areas, *GTF 2015* shows clear advances toward the SE4All targets. That is a reason to celebrate, without becoming complacent. In other areas the picture is less positive—a reason to redouble our efforts. Most important, *GTF 2015* provides tangible findings that will help to galvanize and guide further action, within a coherent framework that is ready to underpin a future sustainable energy SDG.

—Kandeh Yumkella
Secretary General's Special Representative for Sustainable Energy for All

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Key findings

The first SE4ALL *Global Tracking Framework (GTF 2013)* established a consensus-based methodology and identified concrete indicators for tracking global progress toward the three SE4ALL objectives. One is to ensure universal access to modern energy services. The second is to double the global rate of improvement in energy efficiency. And the third is to double the share of renewable energy in the global energy mix. *GTF 2013* also presented a data platform drawing on national data records for more than 180 countries, which together account for more than 95 percent of the global population. And it documented the historical evolution of selected indicators over 1990–2010, establishing a baseline for charting progress.

GTF 2015 presents an update on how fast the world has been moving toward the goal of sustainable energy for all.

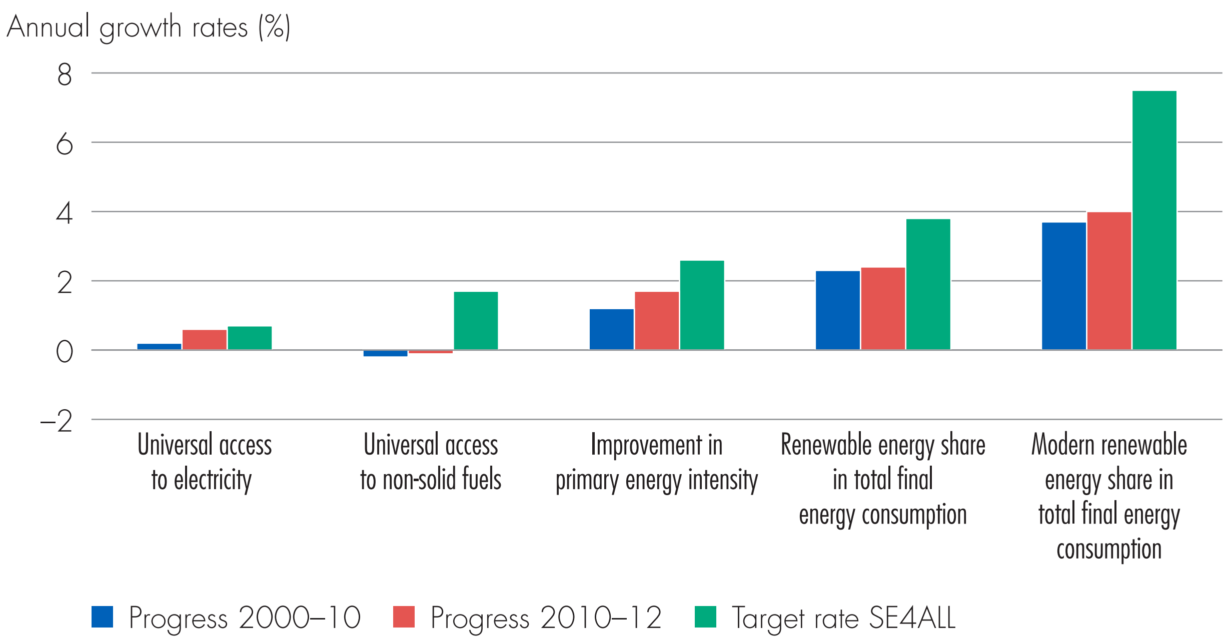
This second edition of the SE4ALL *Global Tracking Framework (GTF 2015)* provides an update on how fast the world has been moving toward the three objectives. Based on the latest data, it reports progress on selected indicators over the two-year tracking period 2010–12 and determines whether movement has been fast enough to meet the 2030 goals.

Overall progress over the tracking period falls substantially short of what is required to attain the SE4ALL objectives by 2030.

Across all dimensions of sustainable energy for all—whether access, efficiency, or renewables—the rate of progress during the 2010–12 tracking period falls substantially short of the rate that would be needed to ensure that the three objectives are met by 2030 (figure 1). Nevertheless, the 2010–12 tracking period does present some encouraging acceleration in progress relative to what was observed in prior decades.

Efforts must be redoubled to get back on track; particularly in countries with large access deficits and high energy consumption whose rate of progress carries substantial weight in the global aggregate.

Figure 1. **How far is the rate of progress from that required to attain SE4ALL?**



Source: World Bank Global Electrification database 2015; IEA, UN, and WDI data (2014); analysis by the International Renewable Energy Agency based on IRENA (2014).

Note: Figure shows average annual growth rates for access to electricity and non-solid fuels, and compound annual growth rates for renewable energy and energy efficiency.

Energy has a key enabling role in food security and nutrition.
Vanessa Lopes Janik/© World Bank

There have been notable advances in electrification—driven primarily by India—but progress in Africa remains far too slow.

The annual growth in access to electricity during the tracking period reached 0.6 percent, approaching the target growth rate of 0.7 percent required to reach universal access by 2030, and certainly much higher than the growth of 0.2 percent registered over 2000–2010 (see figure 1).

As a result, the global electrification rate rose from 83 percent in 2010 to 85 percent in 2012. This means that an additional 222 million people—mainly in urban areas—gained first time access to electricity; more people than the population of Brazil, and well ahead of the 138 million population increase that took place over the same period. Overall, the global electricity deficit declined from 1.2 billion to 1.1 billion. Global progress was driven by significant advances in India, where 55 million people gained access over 2010–12.

In order to advance towards universal access to electricity, countries need to expand electrification more rapidly than demographic growth. Out of the 20 countries with the largest electrification deficit, only 8 succeeded in doing so (figure 2a). For Sub-Saharan Africa as a whole—the region with by far the highest access deficit—electrification only just managed to stay abreast of population growth; although even this represents progress compared to earlier decades.

By contrast, access to clean cooking continues to fall behind population leading to negligible progress overall.

The annual growth in access to non-solid fuels during the tracking period was negative 0.1 percent, comparable to what was registered during the 2000–2010 period, and woefully short of the 1.7 percent target growth rate required to reach universal access by 2030 (see figure 1).

As a result, primary access to non-solid fuels barely rose from 58 percent in 2010 to 59 percent in 2012. This means that only 125 million additional people—mainly in urban areas—gained first time access to non-solid fuels; no more than the population of Mexico and falling behind the 138 million population increase that took place over the same period. Overall, the global access deficit barely moved from 2.9 billion; concentrated in rural areas of Africa and Asia. Out of the 20 countries with the largest access deficit, only 8 succeeded in expanding access to non-solid fuels more rapidly than population growth (figure 2b).

Traditional methods for measuring energy access significantly underestimate the scale of the challenge.

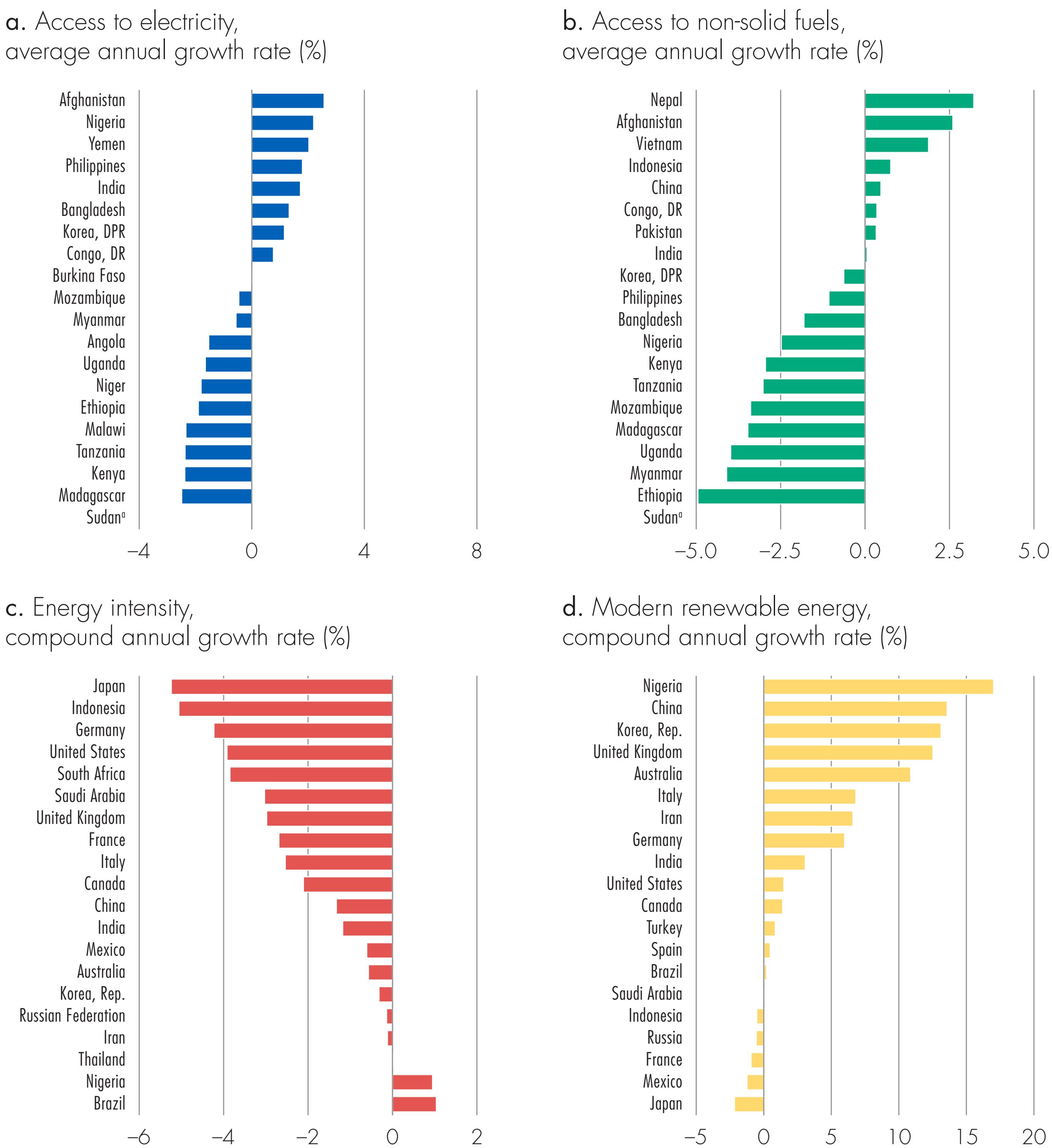
Traditional measures of energy access reported above, which focus on grid connections, are not able to capture broader deficiencies in the affordability, reliability and quality of service. This report presents an emerging multi-tier approach to access measurement that is able to capture these broader dimensions.

New evidence from the city of Kinshasa in the Democratic Republic of the Congo shows that—whereas traditional access indicators report 90 percent access to electricity due to widespread grid connections in the city—the multi-tier approach rates access at only 30 over 100 due to extensive limitations in hours of service, unscheduled blackouts and voltage fluctuations. The reality is that the streets of Kinshasa are dark on most nights and that few households can actually use the electrical appliances they own.

Progress in reducing global primary energy intensity over the tracking period was substantial, though still only two-thirds of the pace needed to reach the SE4ALL objective.

Primary energy intensity—the global proxy for energy efficiency, and influenced as well by changes in the

Figure 2. **High-impact countries, progress toward targets, 2010–12**



Source: IEA and UN data.

Note: Growth rate calculation involves two parameters—population with access and total population of the country.

a. Data from Sudan show a very high growth rate in access. This is not shown in the figure as it is due to a lower population in 2012 compared with 2010, resulting from the split with South Sudan.

structure of the world economy—improved by more than 1.7 percent a year over the tracking period, considerably more than in the base period 1990–2010. The incremental change in energy intensity from 2010 to 2012 alone avoided primary energy use of 20 exajoules (EJ) in 2012, or more energy than Japan used that year. Still, the rate of improvement is nearly a full percentage point slower than the SE4ALL objective of an average annual 2.6 percent improvement between 2010 and 2030 (see figure 1).

Eight of the top 20 energy consumers—collectively responsible for nearly three-quarters of global energy use in 2012—had intensity improvements exceeding the 2.6 percent a year objective (figure 2c). These were mainly high-income countries recovering from recession, including Japan, Germany, the United States, France, Italy, and Canada, demonstrating that mature economies can achieve significant economic growth decoupled from rising energy consumption. But several large emerging countries also had high rates of improvement, notably Indonesia, South Africa, and (in a reversal from previous performance) Saudi Arabia. Russia, the most energy-intensive of the group due in part to its large fossil fuel production, showed only a marginal decline in energy intensity. Among the top energy consumers, only Brazil and Nigeria experienced rising intensity in the tracking period.

Of end-use sectors, industry was the largest contributor to reduced energy intensity between 2000 and 2012, both as efficiency increased and as the share of output from energy-intensive products declined. Transport followed closely in contribution to lower intensity, since fuel economy standards have had a major impact even as motor vehicle use has surged. Energy supply sectors have seen some improvement in efficiency, as with the declining midstream losses in the natural gas industry. Electricity transmission and distribution losses are falling, and many countries are using more-efficient gas-fired plants. But continued expansion of coal-fired capacity has led the average thermal efficiency of fossil power generation to stagnate.

The growth of renewable energy final consumption continued to accelerate in recent years, but to achieve the SE4ALL objective, the rate of progress will need to increase over 50 percent.

The share of renewable energy in total final energy consumption (TFEC) grew from 17.8 percent in 2010 to 18.1 percent in 2010–12. This represents a net increment in annual RE consumption of 2.9 exajoules (EJ), equivalent to energy consumption of Pakistan or Thailand in 2012. The increment resulted from both an acceleration in the growth of renewable energy and a deceleration in the growth of TFEC. Global renewable energy consumption grew at a compound annual growth rate (CAGR) of 2.4 percent over the tracking period, while global final energy consumption grew at only 1.5 percent. But the annual growth to attain the SE4ALL objective in renewable energy—including traditional uses of solid biofuels—is estimated at 3.8 percent (see figure 1).

The consumption of modern renewables (which exclude solid biofuels used for traditional purposes) grew even more rapidly, at a compound annual growth rate of 4 percent. Still, an annual growth rate of 7.5% would be required to attain the SE4ALL objective with modern renewables.

Five out of the top 20 largest energy consumers succeeded in increasing their annual growth in the consumption of modern renewables above 7.5% during the tracking period 2010–12 (figure 2d). These countries included Nigeria, China, Korea, United Kingdom and Australia. In large middle income countries, such as China and Nigeria, increases in the share of modern renewables (such as hydro, wind and solar) were offset by reductions in the share of traditional uses of solid biofuels. Thanks largely to China, East Asia increased consumption of modern renewables more than other regions.

Modern energy provision is a critical enabler of universal health coverage.
Nick van Praag/© World Bank

The uptake of renewable energy was stronger in electricity generation than in heat production or transport during the tracking period. The share of renewable energy consumption in the electricity sector rose by 1.3 percent over the tracking period, compared with much smaller increases in heating at 0.3 percent and transport at 0.1 percent. In both tracking years, renewable energy power generation capacity additions accounted for half of all capacity additions.

Declining technology costs have certainly helped foster growth of renewable consumption. In particular, solar PV (photovoltaic) saw rapidly declining costs, with PV module prices halving between 2010 and 2012. Increased use of solar energy accounts for a fifth of the increase of modern renewable energy consumption over the tracking period, behind wind (a fourth) and hydro (a third).

Today's investment flows of $400 billion a year would need to triple to achieve the necessary pace of progress.

A partial explanation for slow progress on sustainable energy objectives is the shortfall in investment. Global investment in areas covered by the three objectives was estimated at around $400 billion in 2010, while requirements are in the range of $1.0–1.2 trillion annually, requiring a tripling of current flows (table 1).

Energy and water resources are inextricably tied together.

Grant County Public Utility District/© NREL 12487

The bulk of these resources are needed for energy efficiency and renewable energy—about $500 billion per year for each—although the shortfall in energy efficiency investment is substantially larger than the shortfall of investment

Table 1. **Annual global investment—actual and required ($ billion)**

Annual investment	**Universal access to modern energy services**	**Universal access to modern energy services**	**Doubling the global rate of improvement in energy efficiency**	**Doubling the share of renewable energy in the global mix**[a]	
Source	Electrification	Cooking	Energy efficiency	Renewable energy	Total
Actual for 2012[b]	9	0.1	130	258	397
Required to 2030[c]	45	4.4	560	442–650	1,051–1259
Gap	36	4.3	430	184–392	654–862

a. This is the range for significantly increasing the share of renewable energy in total final energy consumption.

b. The total assumes 2010 investment in access figures for 2012.

c. Estimates are derived from various sources: Energy access, electrification: *SE4ALL Finance Committee Report,* World Bank (2014); Energy access, cooking: Energy for All Scenario, *WEO* (IEA, 2012); Energy efficiency: 450 scenario, *WEO* (IEA, 2014); Renewable energy lower bound: *WEO* 450 (IEA, 2014), corresponds to a 29.4 percent renewable energy share in total final energy consumption by 2030; Renewable energy upper bound: REmap 2030 (IRENA, 2014), corresponds to a 36 percent renewable energy share in total final energy consumption by 2030.

Source: Prepared by authors.

in renewable energy. Additional investments for energy efficiency are particularly needed in the transport sector where a high volume of new vehicles is expected to be sold. For renewables, increased adoption of renewable energy targets signals strong interest in scaling up renewable energy, yet new policies in place will need to be combined with emerging financing mechanisms to lower the spectrum and size of financial risks.

In 2013–14, the SE4ALL Advisory Board convened a Finance Committee that brought together private commercial and development banks to further identify financing gaps and to propose concrete approaches for attracting more capital. The Committee identified four broad investment themes that could help mobilize $120 billion in incremental annual investment by 2020: green-bond market development, structures that use development finance institutions' de-risking instruments to mobilize private capital, insurance products that focus on removing specific risks, and aggregation structures that focus on bundling and pooling approaches for small-scale opportunities.[1]

Also imperative is transferring state-of-the-art knowledge and technologies to countries with less capacity to adopt sustainable energy.

Countries will need to access cutting-edge knowledge and technologies relevant to sustainable energy if they are to contribute to the global achievement of the three SE4ALL objectives. Trade data for a basket of clean technology products demonstrates that about three-quarters of low- and lower-middle-income countries are participating in trade in clean energy products, particularly solar PV and energy efficient lamps. Trade volumes have grown steeply over the last decade, even if they remain small in absolute terms. Thanks to China's growing role in the solar PV industry, developing countries became net exporters of clean technology products in 2007.

Access to affordable energy services can reduce both time and effort spent in productive labor. John Isaac/© World Bank

Nevertheless, access to clean technologies remains constrained by import taxes and other non-tariff barriers. For instance, 50–70% of low and lower middle income countries apply import taxes to small hydropower turbines, as against 20% of high income countries. Developing countries are also constrained by the technical and commercial capacity of institutions and companies, as well as by a shortage of relevant skills among workers.

Understanding the interactions between energy and such priority areas of development as water, food, health, and gender is fundamental to meeting the objectives of the SE4ALL.

Analysis of the nexus between energy systems and other key areas of development—water, food, health, and gender—suggests that numerous opportunities can arise from wider cross-sector perspectives and more holistic decision-making in energy.

For example, energy efficiency typically has positive and synergistic feedbacks to other resource systems. Efficient use of energy reduces the need for power generation and thus the need for cooling water. Water efficiency is also energy efficiency: using water more efficiently can cut electricity consumption, as lower water demand reduces the need for pumping and treating water. Exploring the co-benefits of water saving tied to energy efficiency, as well as the potential to save energy through water efficiency, can thus help secure additional benefits.

Renewable energy can be either water-efficient or water-intensive. PV panels and wind turbines require little water and are generally much more water-efficient than conventional sources of electricity. Hydropower depends fundamentally on water, and lower rainfall (perhaps due to greater variability and to climate change) could reduce electricity production from that source.

Access to energy and to other energy-intensive products, services, and facilities can increase farmer incomes and boost agricultural productivity. Agricultural machinery and inputs such as fertilizers and pesticides can raise yields for farmers. Better access to roads and freight services as well as refrigeration and processing facilities can improve market access while reducing the spoilage of food, thus increasing the productivity of land by reducing field-to-consumer losses and improving farmers' incomes.

Health, too, gains from sustainable energy services in community health clinics, through cost-effective and life-saving interventions. Clinics need reliable access to energy for running medical equipment, for storing supplies such as blood, vaccines, and antiretroviral drugs, for staying open after dark, and for helping retain qualified staff. And street lighting may increase women's and girls' mobility before sunrise and after dark and by improving security reduce the risk of gender-based violence.[2,3]

All these areas have numerous interwoven concerns, including access to services, long-term maintenance and sustainability, environmental impacts, and price volatility. These issues manifest themselves in different ways in each, but the impacts are often closely related. Identifying these linkages early can help in targeting synergies and preempting subsequent potential tensions.

Meeting the SE4ALL objectives will require the implementation of a transformational strategies and policies.

Attaining the SE4ALL objectives will require significantly reducing fossil-fuel based activities, supporting technology innovation, introducing new finance and business models, and implementing transformational strategies and policies. This will be critical in high-impact countries—those with large access deficits and high energy consumption—but also in countries that wish to move in the direction of sustainable energy.

Notes

1. SE4ALL Finance Committee Report 2014.
2. Cecelski and others 2005.
3. Doleac and Sanders 2012.

OVERVIEW

Overview

Sustainable Energy for All (SE4ALL) is a global initiative co-chaired by the secretary-general of the United Nations and the president of the World Bank. It draws the world's attention to three key development objectives for the energy sector by 2030—ensuring universal access to electricity and modern cooking solutions, doubling the rate of improvement of energy efficiency, and doubling the share of renewable energy (RE) in the global energy mix. These objectives have been endorsed by the UN General Assembly, which in 2011 declared 2012 the Year of Sustainable Energy for All and in 2012 made 2014–24 the Decade of Sustainable Energy for All.

The international community soon recognized the importance of a tracking system to gauge global progress toward the three objectives and to hold policymakers accountable. Since the energy sector did not feature among the Millennium Development Goals, such a comprehensive tracking system was not fully in place and needed to be assembled from a range of sources.

To meet this need, the first edition of the SE4ALL *Global Tracking Framework*—co-led by the World Bank/ESMAP and the International Energy Agency (IEA)—was published in 2013, accomplishing several tasks. First, it established a consensus-based methodology and identified concrete indicators for tracking global progress toward the SE4ALL objectives (table O.1). Second, it presented a supporting data platform drawing on national data records for more than 180 countries, which together account for more than 95 percent of the global population. Third, it documented the evolution of the indicators over 1990–2010, to provide a baseline for assessing progress during the SE4ALL 2010–30 period.

This second edition of the *GTF* updates how the world has been moving toward the three objectives over 2010–12. Based on the latest data from many national sources, it reports progress over this period and sheds light on the underlying drivers. It also assesses whether progress has been fast enough to meet the objectives for 2030.

The report explores complementary themes. It provides further analysis of the investment volumes and geographic and technological distributions needed to meet the SE4ALL objectives. It explores the extent to which countries around the world have access to the technology and knowledge to progress toward those objectives. And it identifies the improvements in data collection methodologies and capacity building that will be needed to provide a more nuanced and accurate picture of progress over time.

The report also introduces and explores "nexus" concepts focusing on the links between energy and four priority areas of development: water, food, human health, and gender. Links between most of these areas and energy are well established but often presented in isolation from each other. The analysis considers the existing data and indicators as well as the related gaps that might be filled for tracking aspects of SE4ALL's work related to these nexus issues.

Energy access

Ensuring universal access to modern energy

Electrification

The global electrification rate increased from 83 percent in 2010 to 85 percent in 2012, up from 76 percent in 1990 (figure O.1). The rate in urban areas stayed largely stable during this tracking period, rising by 1 percentage point from 95 to 96 percent, but that in rural areas rose from 70 to 72 percent. Among the regions, improvements have been notable in South Asia (75 to 79 percent), Sub-Saharan Africa (32 to 35 percent), and Oceania (25 to 29 percent).

The absolute population living without electricity fell from 1.2 billion to 1.1 billion during the tracking period. The population to be electrified by 2030 is today's access deficit of 1 billion plus the projected population growth between 2012 and 2030 of 1.5 billion. The access deficit in 2012 is overwhelmingly rural, the forecast population increment almost entirely urban. By region, the deficit remains overwhelmingly concentrated in Sub-Saharan Africa and South Asia. The 20 highest access-deficit countries account for 83 percent of the global deficit. India, with an

Table O.1. **Overview of central GTF indicators developed in 2013, rationale, and data source**

Objective	Central indicator	Observation	Data source
Ensure universal access to modern energy, including electricity and cooking	Percentage of population with an electricity connection	• The presence of an electricity connection is a prerequisite for receiving electricity supply, but does not guarantee it	National household surveys following internationally standardized questionnaires (such as Demographic and Health Surveys, Income and Expenditure Surveys, Living Standard Measurement Surveys, Multi-Indicator Cluster Surveys, and some censuses)
	Percentage of population with primary reliance on non-solid fuels	• Solid fuel use for cooking (wood, charcoal, dung, crop residues, etc.) in the developing world is often associated with inefficiency and undesirable health impacts, although the extent of these depend on the characteristics of the cookstove used and the behavioral practices of the user • Non-solid fuels tend to be associated with efficient and healthy cooking practices, with some exceptions such as kerosene • Many households rely on multiple fuels for cooking, hence the focus on the primary fuel the household relies on	
Double the rate of improvement of energy efficiency	Compound annual growth rate of total primary energy supply to gross domestic product (GDP) at purchasing power parity (PPP).	• Energy intensity is a proxy for energy efficiency • Primary energy demand also captures energy lost in various energy transformation processes • PPP measures of GDP avoid undervaluing the output of developing economies	National energy balances collected in standardized form by the International Energy Agency (IEA) for larger countries and by the UN for smaller countries
Double the share of renewable energy in the global energy mix	Percentage of total final consumption of energy from renewable sources	• Renewable sources are all those replenished as they are consumed (including wind, solar, hydro, geothermal, biomass, biofuels, and ocean) • Final energy consumption does not include thermal energy lost in transformation processes and thus provides a fairer comparison with renewable energy sources where no transformation losses take place.	

Source: Prepared by authors.

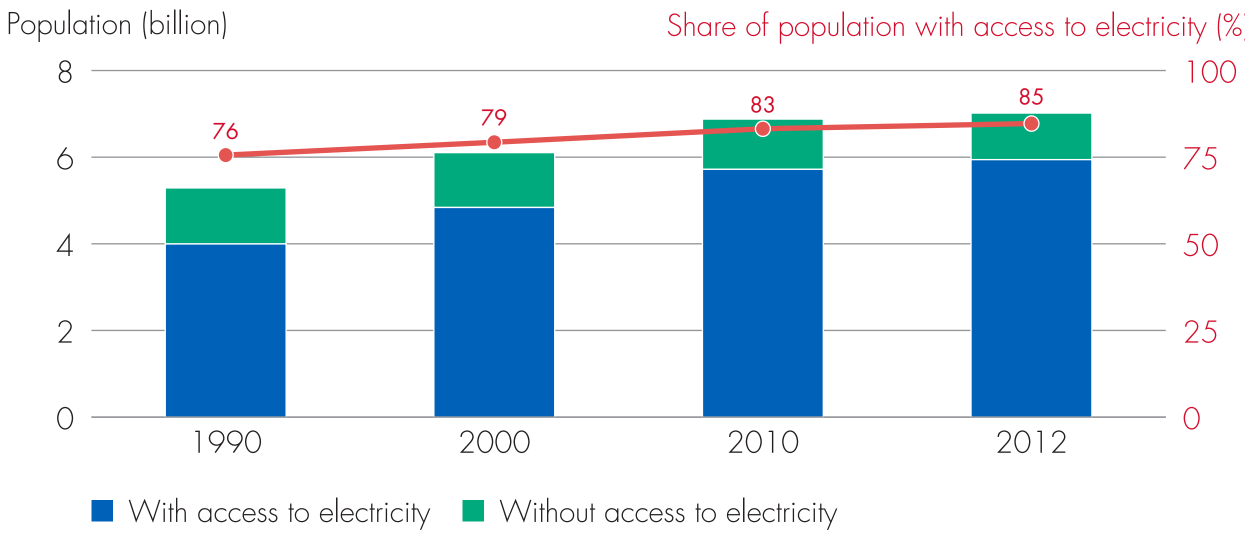
unelectrified population of 263 million, is followed by Nigeria (75 million) and Ethiopia (67 million).

The 222 million people who benefited from first-time access between 2010 and 2012 exceed the population of Brazil. The annual access increment of 111 million people marks a sharp acceleration from around 84 million people a year over 1990–2000 and 88 million in the subsequent decade. Yet universal access is still some distance away and requires an even higher annual pace of growth of 135 million from 2012 through 2030.

Urban areas accounted for 79 percent of the access increase between 2010 and 2012, about 34 percent of it in South Asia and 22 percent in Sub-Saharan Africa. Nationally, India was the highest absolute gainer at close to 55 million (figure O.2).

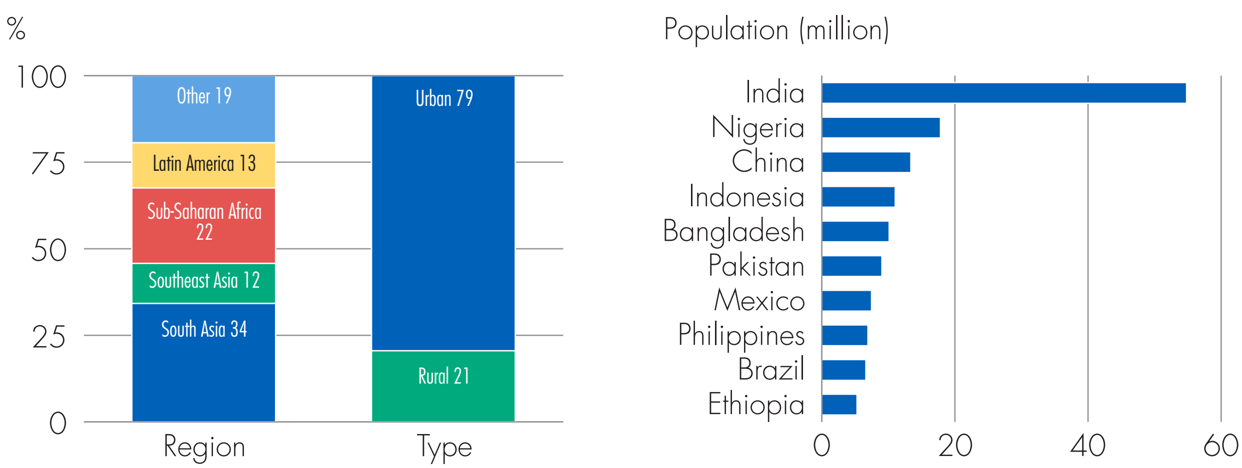
Although global electrification was faster than population growth over the tracking period—222 million against 138 million—regional experiences varied. Of the two largest access-deficit regions, South Asia's access outpaced its population increase by 54 million, while Sub-Saharan

Figure O.1. **Trends in access to electricity, 1990–2012**



Source: World Bank Global Electrification Database 2015.

Figure O.2. **Global access to electricity increment, 2010–12**



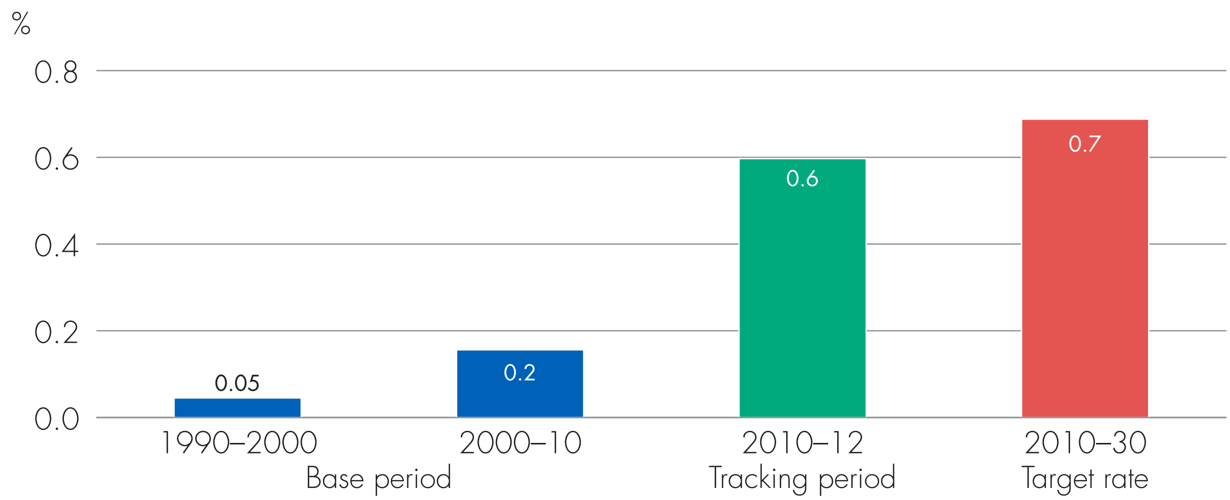
Source: World Bank Global Electrification Database 2015.

Africa's population growth equaled it. In all other regions of the world, access improvements stayed ahead of population increase.

Growth of the net increase in access over population increase was 0.6 percent a year during the tracking period, significantly higher than the average growth rates of the past two decades (figure O.3), and close to the required (or target) growth rate of 0.7 percent.

The recent experience of the regions is noteworthy compared not only with each other but also against their own historical performance. Every region improved in the tracking period from the historical period of 1990–2010. Even Sub-Saharan Africa, where as noted the access increase equaled the population increase in the tracking period, performed better than its historical reference period when access fell behind population. But the most promising performance was in South Asia, where the growth rate

Figure O.3. **Annual growth rate of access to electricity**



Source: World Bank Global Electrification Database 2015.

showed an impressive jump between the two periods (figure O.4).

Achieving the objective of universal electrification will depend critically on the top 20 access-deficit countries (the "high-impact" countries). Nine of them managed an access increase higher than or equal to the population increase in 2010–12, and eight of them achieved a growth rate higher than global annual growth rate of 0.6 percent. The rest saw no net increase in access or lagged behind the population increment (figure O.5).

Modern cooking

The global rate of access to non-solid fuels as the primary cooking fuel hardly budged from 58 percent to 59 percent between 2010 and 2012, compared with 48 percent in 1990 (figure O.6). The urban and rural access rates remained similar at 87 percent and 27 percent respectively during the tracking period. Among the regions, instances of improvement are limited to Caucasian and Central Asia, West Asia, Oceania, and East Asia, where the access rate rose by 2 percentage points.

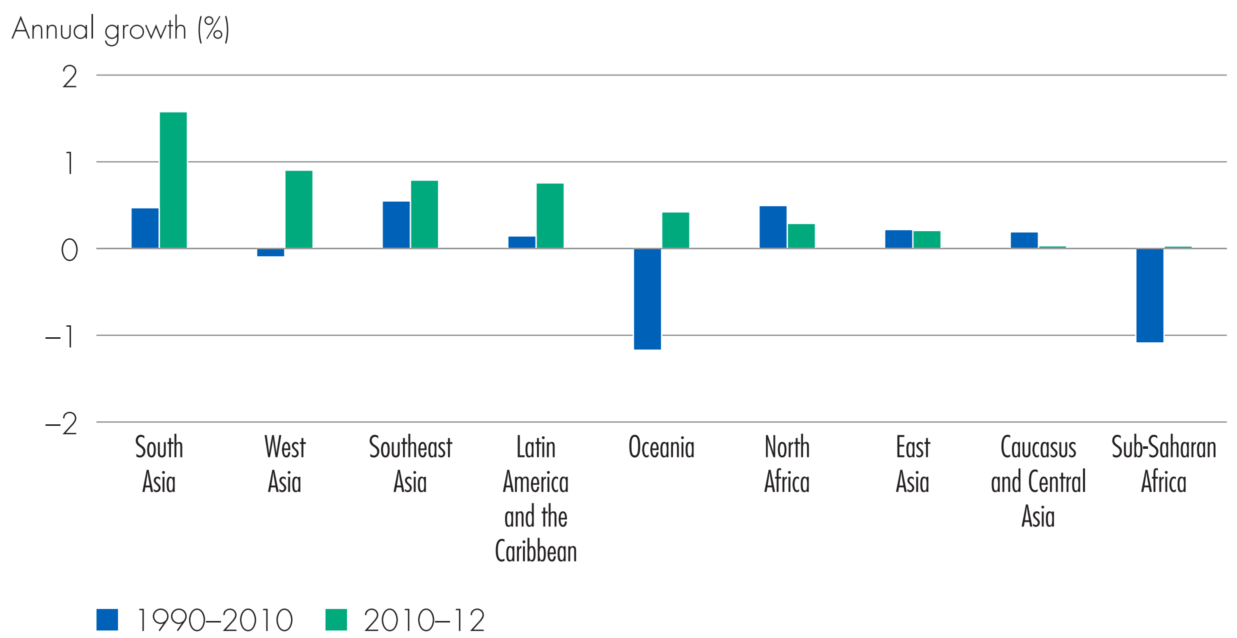
The absolute population living without access to non-solid fuels actually rose from 2.8 billion to 2.9 billion during the tracking period. The population to be served during the period to 2030 corresponds to the current access deficit plus the new population likely to be added (around 1.5 billion). While the access deficit in 2012 is a mix of rural and urban, the new population increment between 2012 and 2030 is almost entirely urban.

The access deficit remains overwhelmingly concentrated in South Asia, Sub-Saharan Africa, and East Asia and in rural areas everywhere. Even so, the urban challenge still accounts for 17 percent of the current access deficit. The 20 highest access deficit countries contribute 83 percent of the global deficit of a billion people. India and China, with the largest access deficits of 791 million and 610 million, are followed by Bangladesh and Nigeria, with 138 million and 127 million.

Thus, only 123 million people benefited from first-time non-solid fuel access during the tracking period, no more than the population of Mexico, a deceleration to around 63 million annually from historical progress of around 81 million over 1990–2000 and 62 million the following decade. This is much slower than the required annual pace of 222 million to reach the 2030 objective, which is unlikely to be attained without sharply accelerated performance.

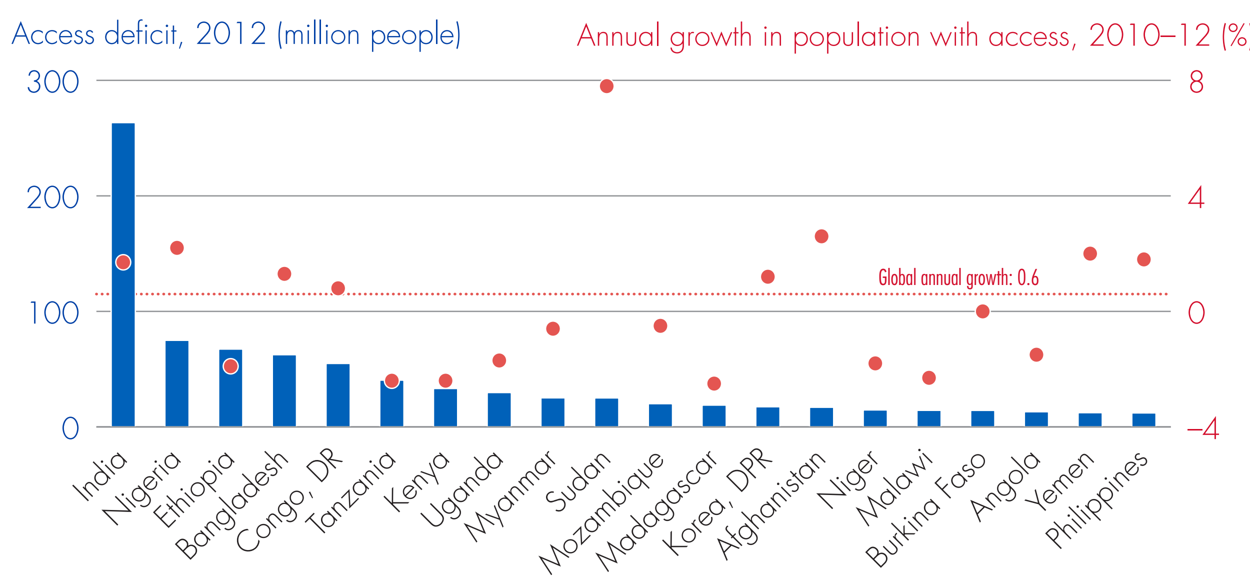
Urban areas saw almost all the access increase between 2010 and 2012 (figure O.7), with little net progress in rural areas. South Asia gained 18 percent of this new population having non-solid fuel access, with 19 percent in East Asia. Among countries, China was the highest absolute gainer, with close to 22 million over the tracking period, followed by India at 14 million. In Sub-Saharan Africa, South Africa is the other large gainer, with an access increase

Figure O.4. **Growth rate of access to electricity by region, 1990–2000 and 2010–12**



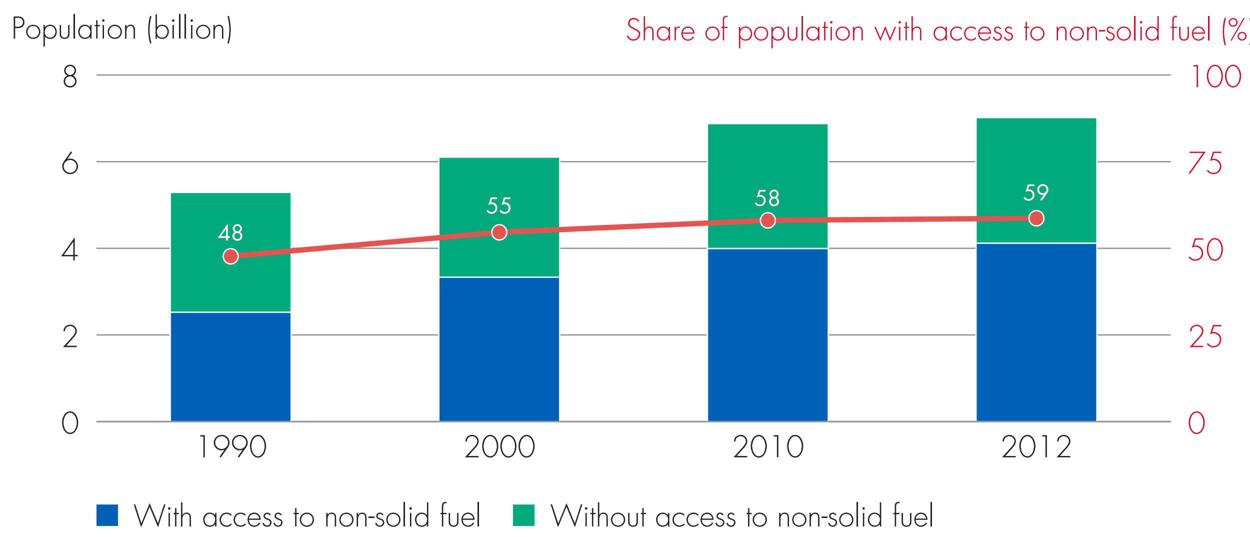
Source: World Bank Global Electrification Database 2015.

Figure O.5. **Access to electricity: Access deficit and growth in the 20 high-impact countries, 2010–12**



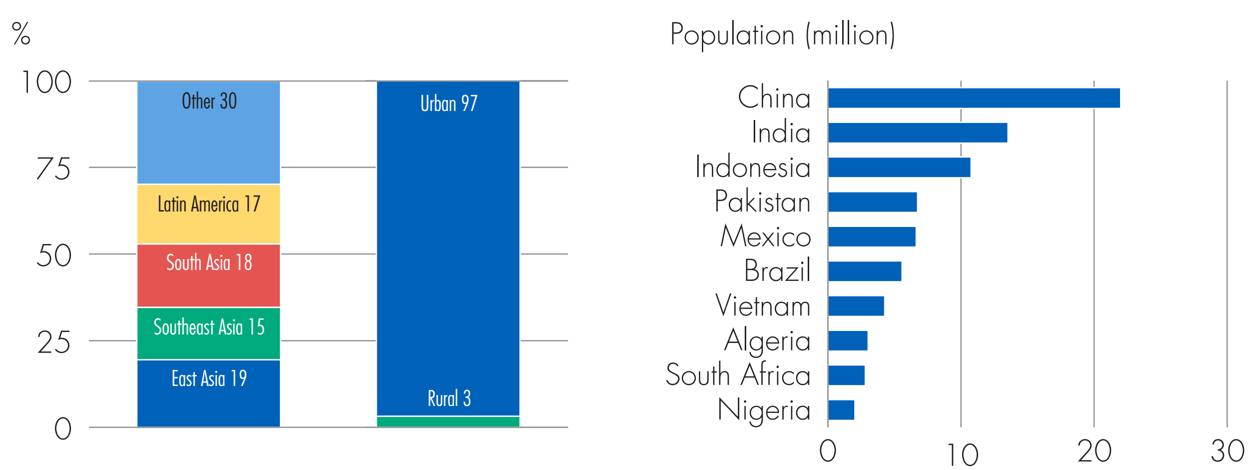
Source: World Bank Global Electrification Database 2015.

Figure O.6. **Evolution of access to non-solid fuels**



Source: WHO Household Energy Database 2015.

Figure O.7. **Global access to non-solid fuels increment, 2010–12**



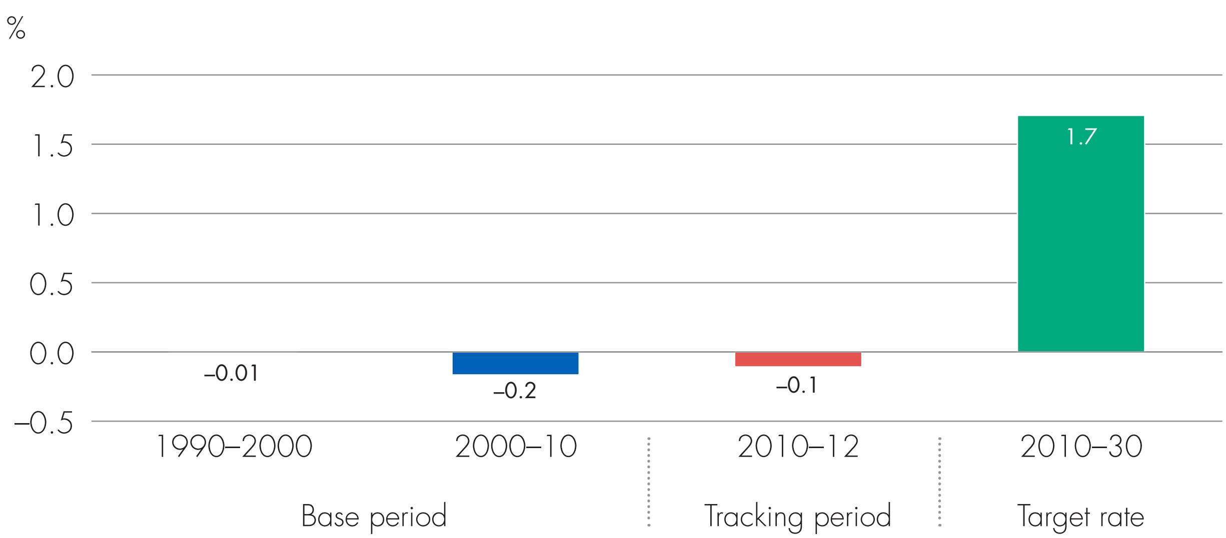
Source: WHO Household Energy Database 2015.

of 2.4 million, while Nigeria and Angola also made some progress in reducing the access deficit.

The world's growth in access did not keep pace with population growth in the tracking period. In fact, compared with the access increment of 123 million, the population rose by 138 million. In East Asia and South Asia, access expansion stayed ahead of the population increase by 12 million and 1 million, while in Sub-Saharan Africa it lagged the population increase by 38 million. In all other regions, access improvements stayed ahead of the population increase.

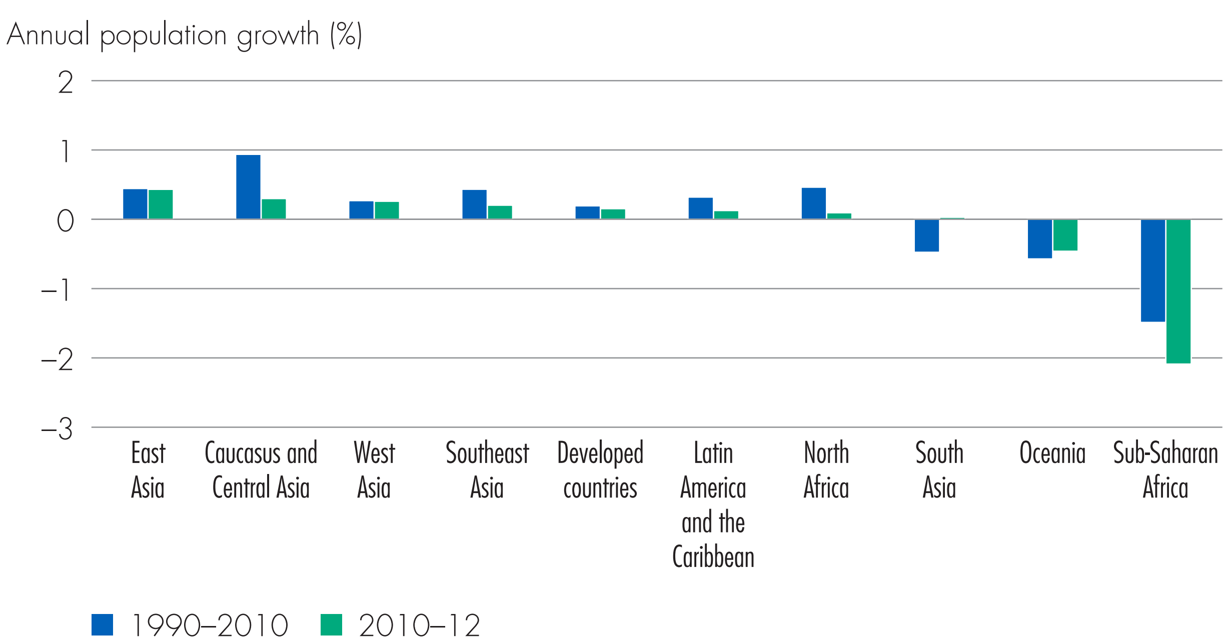
The growth of the net increase in access over population growth was –0.11 percent each year during the tracking period (figure O.8), continuing the negative growth of –0.2 percent annually between 2000 and 2010. (In 1990–2000, the access improvement at –0.01 percent annually just about kept pace with the population increase.) A comparison with

Figure O.8 **Annual growth rate of access to non-solid fuels**



Source: WHO Household Energy Database 2015.

Figure O.9. **Growth in population with access to non-solid fuels by region, 1990–2010 and 2010–12**

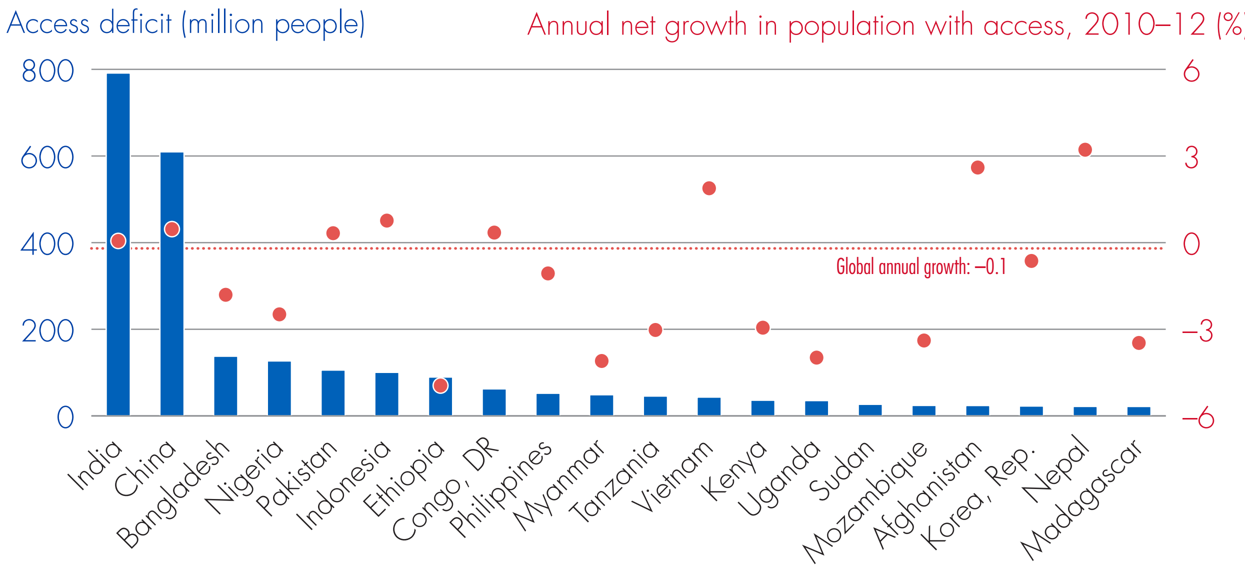


Source: WHO Household Energy Database 2015.

historical growth rate suggests that South Asia turned the corner in the tracking period after negative growth during 1990–2010. Sub-Saharan Africa lagged the farthest behind in both the historical and the tracking periods (figure 0.9).

The net increase falls dismally short of the pace required to meet the global objective of universal access to modern cooking solutions—1.7 percent (222 million) annually from 2012 to 2030. And the current indicator cannot capture

Figure O.10. **Access to non-solid fuels: Access deficit and growth in the 20 high-impact countries, 2010–12**



Source: WHO Household Energy Database 2015.

progress in the adoption of improved biomass cookstoves, which will be a big part of the solution.

The achievement of the SE4ALL objective of universal access will depend on the top 20 access-deficit countries. Only eight of them had an access increase higher than the population increase in 2010–12 and stayed above the global annual growth rate (figure O.10). The rest lagged behind the population increment.

Energy efficiency

Doubling the rate of improvement in energy efficiency

Global primary energy consumption grew at over 1.9 percent a year from 1990 to 2000, kept down by continual improvements in energy intensity. Had that not changed, energy consumption in 2012 would have been 25 percent higher (figure O.11). The incremental change in energy intensity from 2010 to 2012 alone (when primary energy use rose by 1.8 percent annually) avoided primary energy use of 20 exajoules (EJ) in 2012, or more energy than Japan used that year.

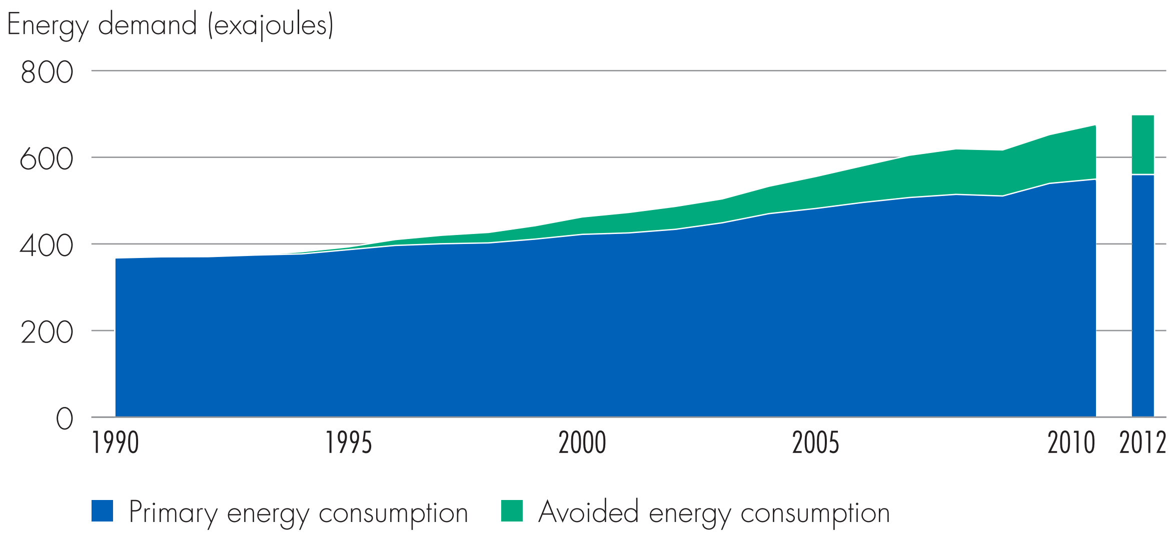
Progress in the tracking period

Primary energy intensity fell by more than 1.7 percent a year over the tracking period (figure O.12), far more than the average drop of about 1.3 percent a year from 1990 to 2010 and the 1.2 percent drop in 2000–2010. Still, even this recent improvement falls far short of the annual 2.6 percent needed between 2010 and 2030 to meet the SE4ALL objective of doubling the historical rate of decline in energy intensity.

The recent acceleration was driven primarily by high-income countries, whose compound annual growth rate of primary energy intensity fell even faster from 1.5 percent a year in the base period to 2.6 percent in the tracking period (figure O.13), taking them to the global target rate. Middle- and low-income countries, by contrast, experienced no such acceleration, although the pace remained relatively rapid. The striking exception is the upper-middle-income countries (UMICs), where the fall in primary energy intensity remained stubbornly low at around 0.5 percent a year. Owing in large part to rapid industrialization in these countries, energy intensity remains well above the global average.

In all the periods analyzed, upper-middle-income countries (UMICs)—with China the prime example—were by far the largest sources of avoided final energy consumption (figure O.14).[1] High-income countries (HICs) also contributed a great deal—one-third in the tracking period—demonstrating that large decoupling effects are not restricted to industrializing nations. Lower-middle-income countries (LMICs) saw a growing, but still small share of avoided final energy

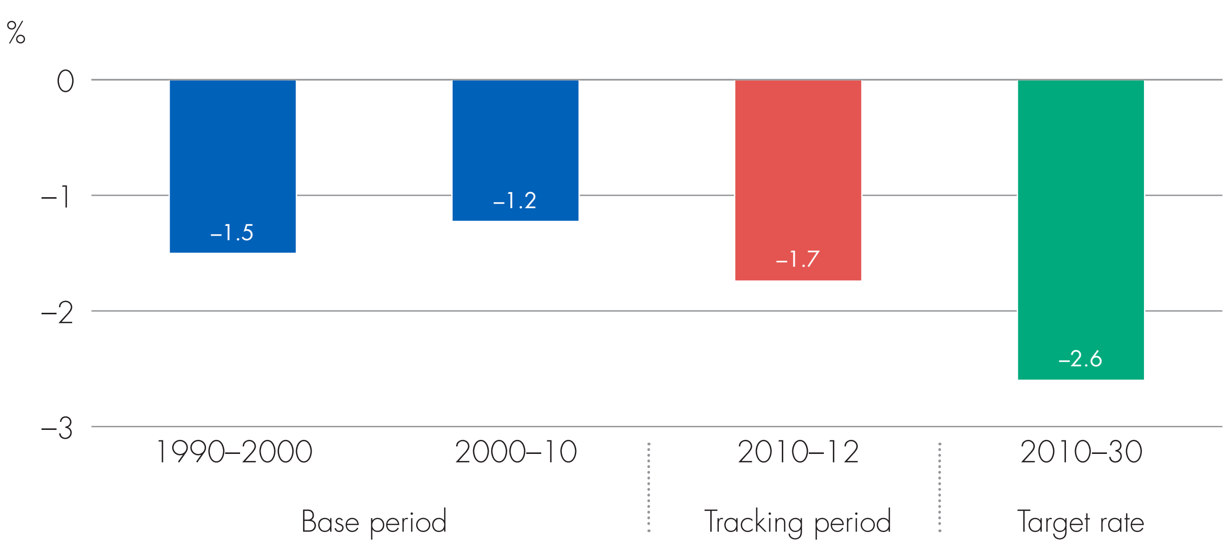
Figure O.11. **Actual and avoided global primary energy consumption due to declining energy intensity**



Source: Energy intensity decomposition analysis based on IEA, WDI, and UN data.

Note: Primary energy consumption is represented by total primary energy supply (TPES). Avoided energy consumption is estimated from the energy intensity component of decomposition analysis, with a base year of 1990; see annex 1 to chapter 3.

Figure O.12. **Rate of change in global energy intensity (CGAR, PPP) compared with target**

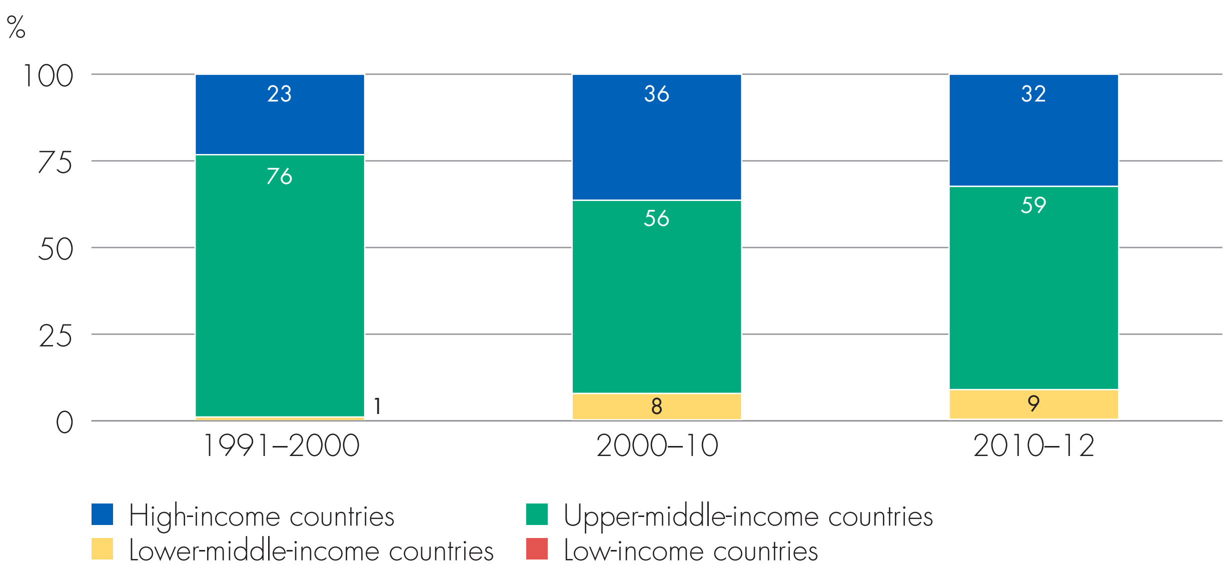


Source: IEA and WDI data.

Figure O.13. **Primary energy intensity by income group: rate of change and energy intensity**

Source: IEA and WDI data.

Figure O.14. **Share of avoided global final energy consumption by income group and time period**



Source: Energy intensity decomposition analysis based on IEA, WDI, and UN data.

Note: Avoided energy consumption is calculated relative to a base year of 1990.

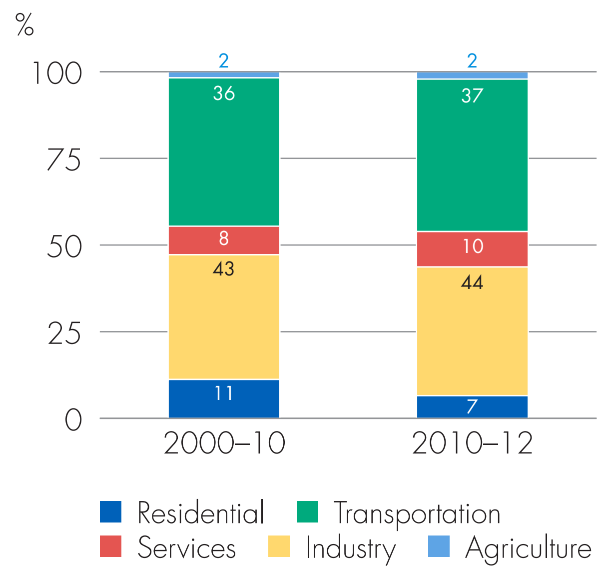
consumption in the tracking period, but low-income countries (LICs) did not exert an appreciable influence.

Among end-use sectors, industry was the largest contributor to reduced energy intensity between 2000 and 2012, followed closely by transport (figure O.15). Industry's energy efficiency has improved broadly, and many countries have set or strengthened their fuel economy standards. The relatively small contributions from the services and residential sectors points to a large store of potential future energy savings in buildings.

Provision of higher-quality energy in the form of electricity and gas contributes to national development, but it has a cost in rising conversion, transmission, and distribution losses. These rising inherent losses are partly offset by the introduction of more efficient technologies and better management to reduce loss rates from energy extraction and delivery. Attention to reducing leaks and better pipeline pressurization, for example, has led to a long-term decline in midstream gas sector losses. The picture is less rosy for electricity generation, because an ever-larger share of primary fossil energy is converted to electricity, and fossil fuels will continue to dominate the generation mix.

Technological progress means that the frontiers of efficiency for all fuels are constantly rising, but the average may not always follow (figure O.16). There has even been

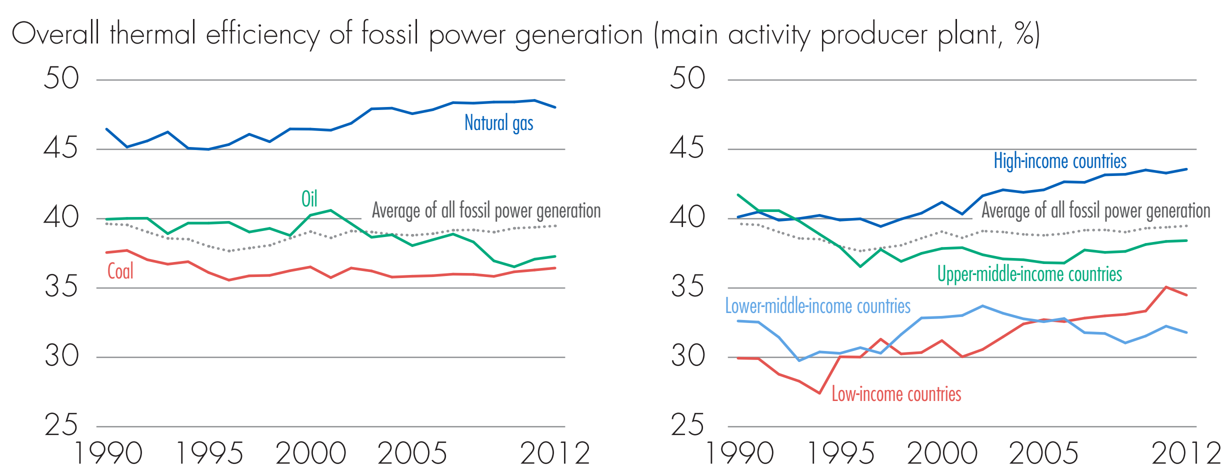
Figure O.15. **Share of avoided global final energy consumption by sector, 2000–12**



Source: Energy intensity decomposition analysis based on IEA, WDI, and UN data.

Note: Transport sector effects are based on global results of the IEA Mobility Model. These results cannot be disaggregated by country, region, or income group and are available only for 2000 and later.

Figure O.16. **Thermal efficiency of fossil power generation by fuel and income group**



Source: IEA data.

Note: Data are for main activity electricity plants, excluding, for instance, on-site power generation at industrial facilities.

a slight decline in the average efficiency of coal-fired power generation, due to rising self-use by power plants and the rapid construction of new coal-fired plants that do not use the best available technology. As coal dominates overall additions to generation capacity, average thermal efficiency of power supply has stagnated since 1990.

For transmission and distribution (T&D) losses, on the other hand, the trends are more promising. In 2012, global T&D losses of 1,880 terawatt-hours (TWh) were incurred, equivalent to 8.8 percent of worldwide generation that year. Loss rates have gradually fallen over the past decade, though trends vary widely among countries. Globally, the decline of 0.7 percentage points from 2002 to 2012 saved about 160 TWh a year, equivalent to Poland's electricity generation in 2013.

The regions that led the renewed decline in energy intensity in the tracking period included regions with high-income countries, like the European Union (EU) and North America, but also developing regions, notably Southeast Asia, and to a lesser extent Central Asia, Eastern Europe, and Sub-Saharan Africa (figure O.17). West Asia saw a decline in energy intensity, marking a turnaround, whereas North Africa exhibited a significant upward acceleration, attributable to the disruptions the region experienced at that time.

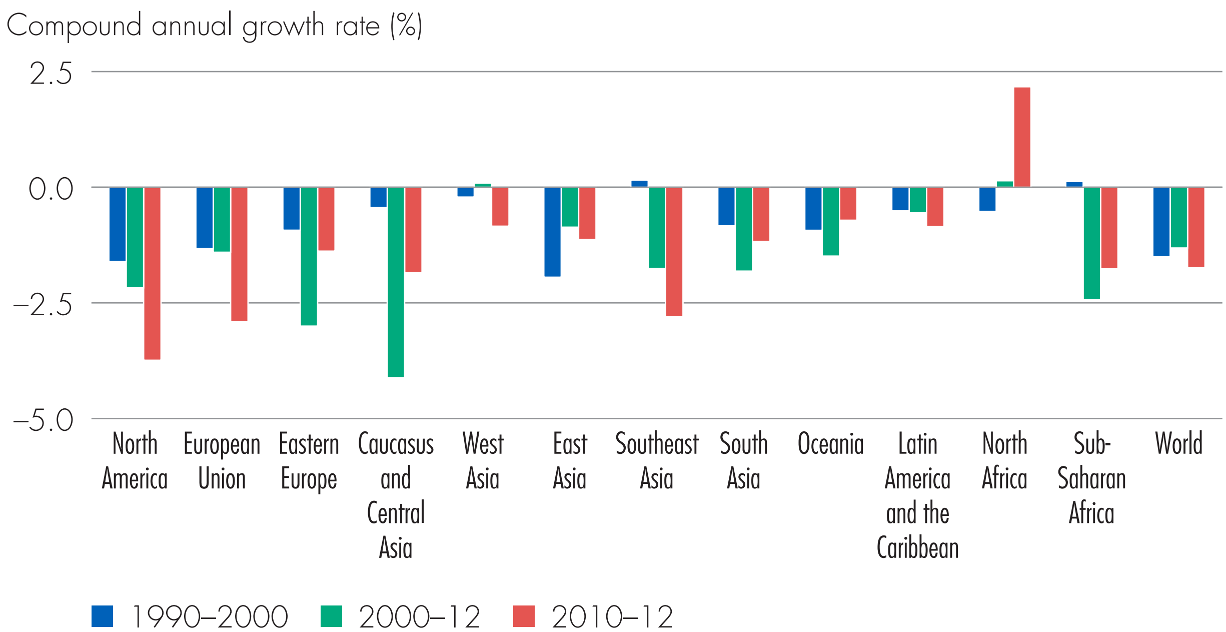
High-impact countries

The top 20 primary energy-consuming countries have a huge effect on achieving the global SE4ALL objective, as they were collectively responsible for nearly three-quarters of global energy use in 2012 (figure O.18). The top five alone accounted for more than half of all energy consumption.

China led the declines in intensity from 1990 to 2010, followed by the United Kingdom, India, and Nigeria, but a very different group emerged as leaders in the tracking period (figure O.19), when eight of the top 20 saw intensity declines exceeding 2.6 percent a year—showing that it is possible for mature economies to decouple economic growth from rising energy consumption.

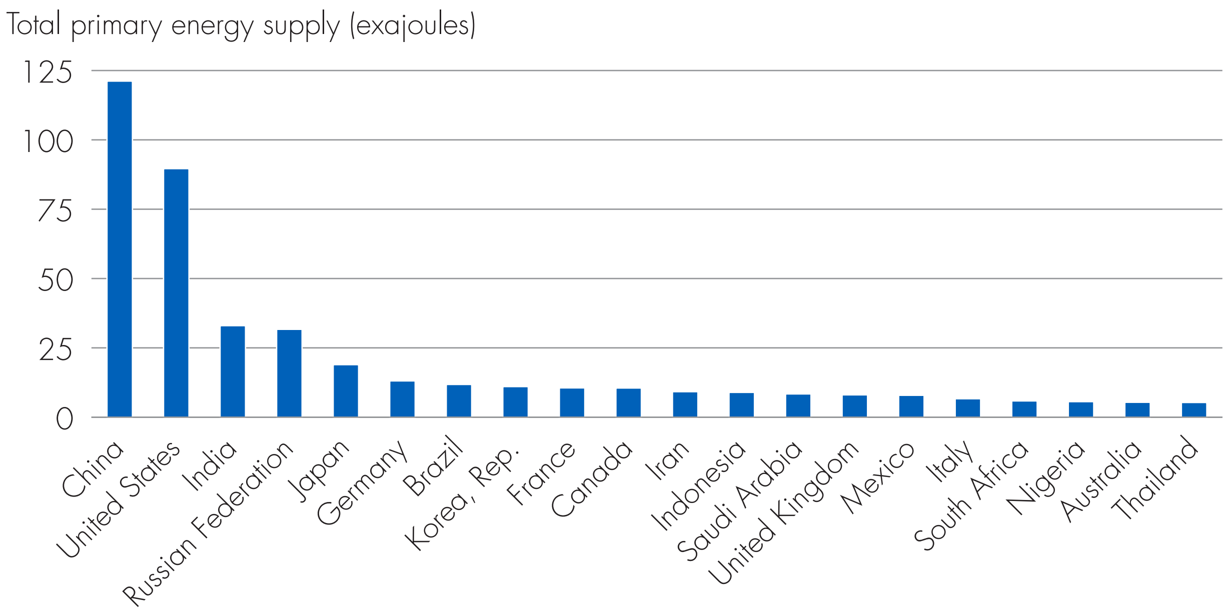
While high-income countries drove the global acceleration in reducing energy intensity after 2010, several large emerging countries—notably Indonesia, South Africa, and Saudi Arabia—also contributed. Russia, the most

Figure O.17. **Rate of improvement in primary energy intensity by region**



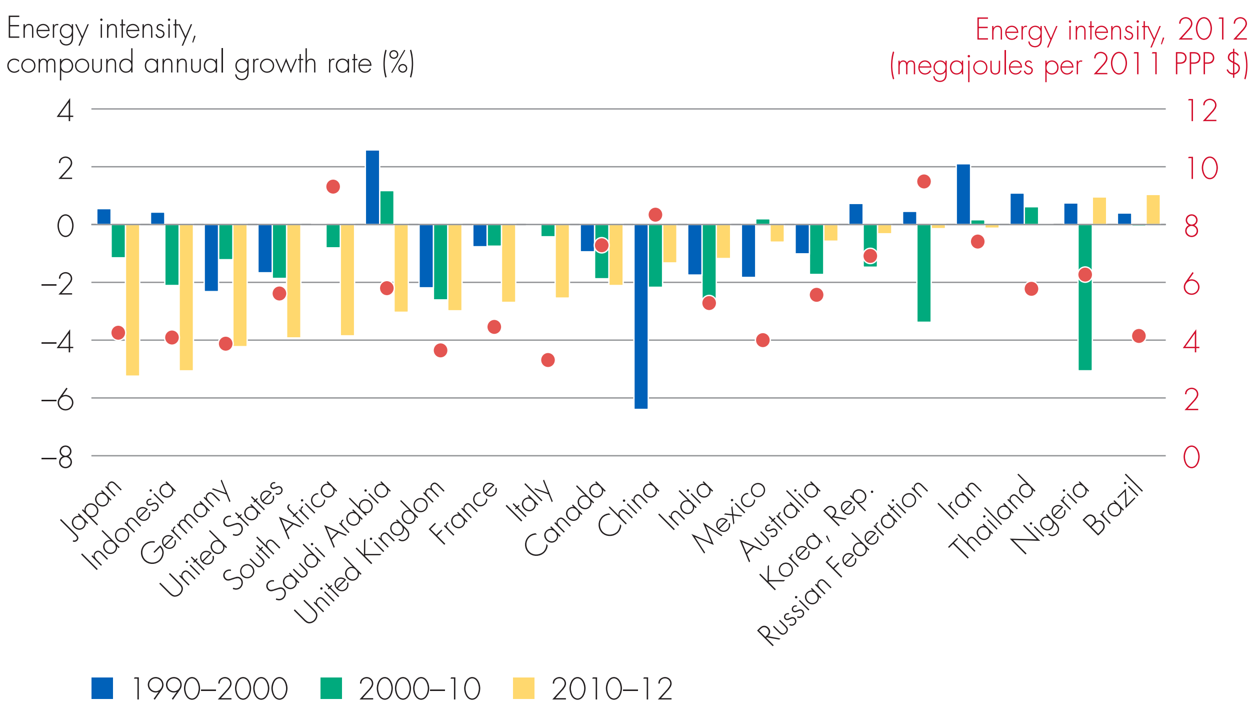
Source: IEA and WDI data.

Figure O.18. **Twenty largest primary energy consumers, 2012**



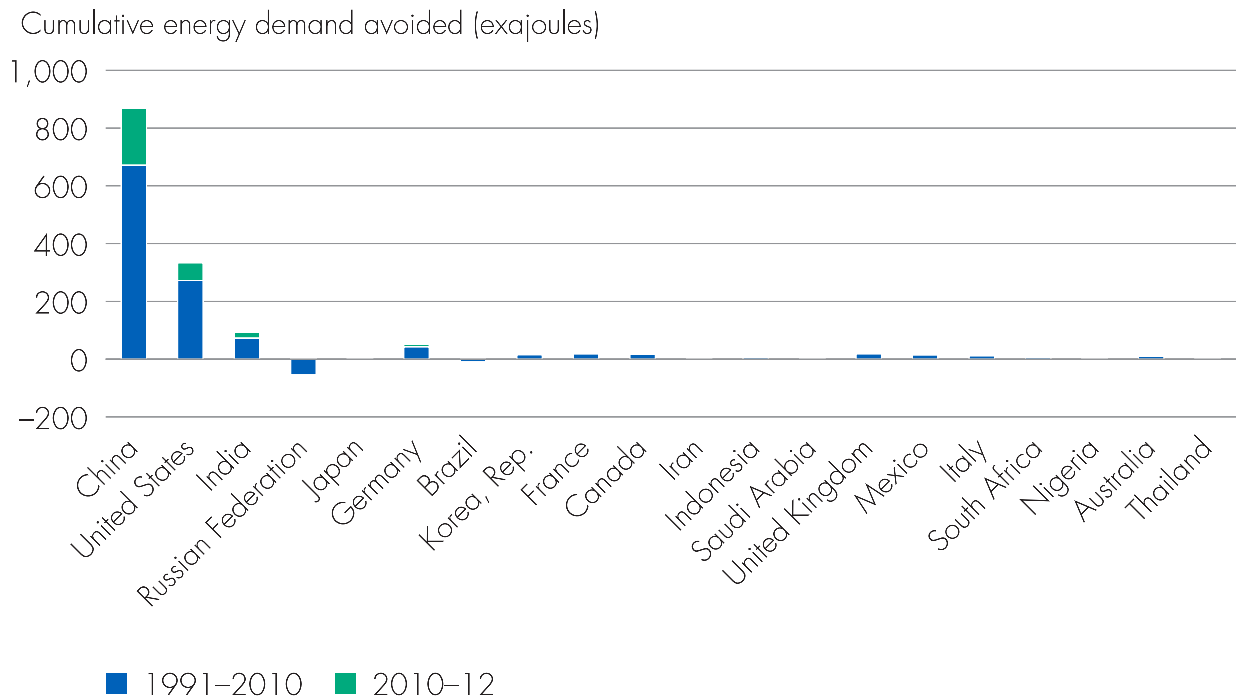
Source: IEA data.

Figure O.19. **Primary energy intensity trends, top 20 primary energy consumers in 2012**



Source: IEA and WDI data.

Figure O.20. **Avoided final energy consumption for top 20 primary energy consumers, 1990–2012**



Source: Energy intensity decomposition analysis based on IEA, WDI, and UN data.

Note: Avoided energy consumption is calculated relative to a base year of 1990.

energy-intensive of the group, showed only a marginal decline. Although during the two-decade base period intensity rose in four rapidly emerging countries—Brazil, Thailand, Iran, and Saudi Arabia—after 2010 only Brazil showed rising intensity. Saudi Arabia saw a major reversal, with intensity dropping by 3 percent a year during the tracking period.

On cumulative avoided energy consumption, many of the largest consumers play roles commensurate with their ranks as consumers (figure O.20). China, the United States, India, and to less extent Germany contributed to global energy savings on a large scale. Russia, because of a sharp rise in intensity in the early 1990s, actually subtracted from avoided energy demand over the period, even though from 2007 it began contributing positively. The contribution from Japan was quite small set against its rank as an energy consumer, as it suffered from low economic growth through most of the period and already had relatively low energy intensity.

Renewable energy

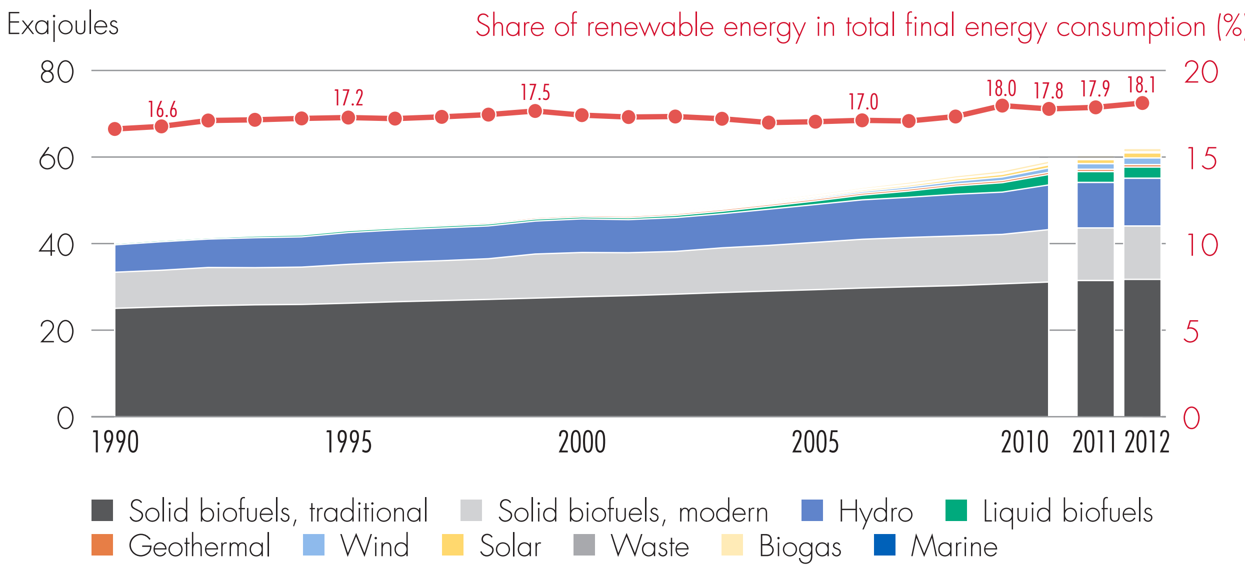
Doubling the share of renewable energy in total final energy consumption

On this third key development objective, the share of RE in total final energy consumption (TFEC) increased from 17.8 percent to 18.1 percent globally in the tracking period (figure O.21). This represents a net increment in RE consumption of 2.9EJ, equivalent to the entire national consumption of Pakistan or Thailand in 2012.

The average annual increase in the share of renewable energy over 2010–12 compares favorably with the previous 20 years. It was equivalent to 0.17 percentage points, up from 0.04 percentage points in the previous decade (figure O.22). But this still falls short of the average annual change of 0.89 percent required to meet the SE4ALL objective of doubling the renewable energy share from 2010 to 2030.

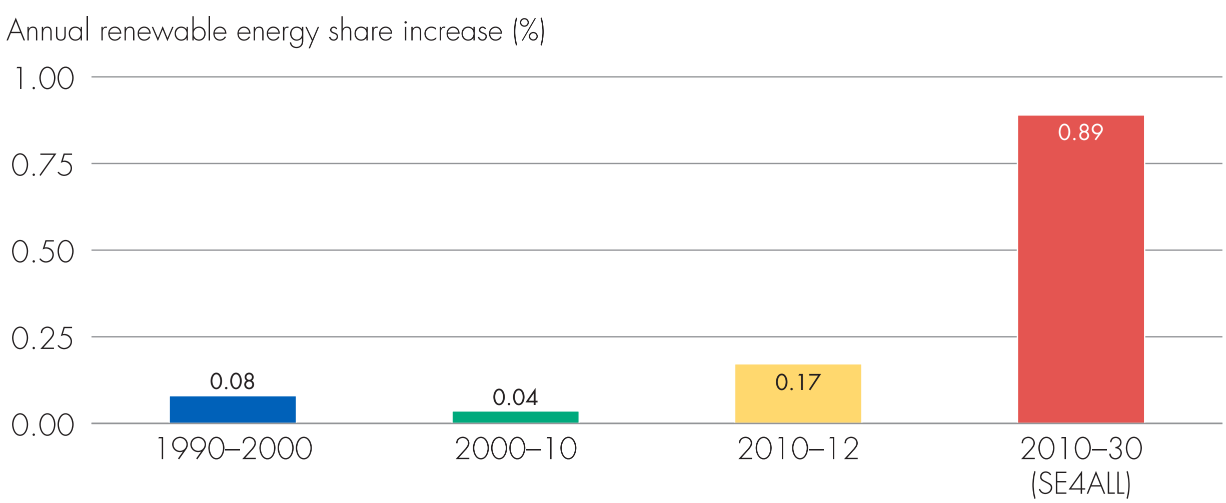
The growth of renewable energy consumption is outpacing the growth of total final energy consumption and the gap

Figure O.21. **Trends and RE share of total final energy consumption by source, 1990–2012**



Source: IEA and UN data.

Figure O.22 **Average annual increase of renewable energy share, actual and required**

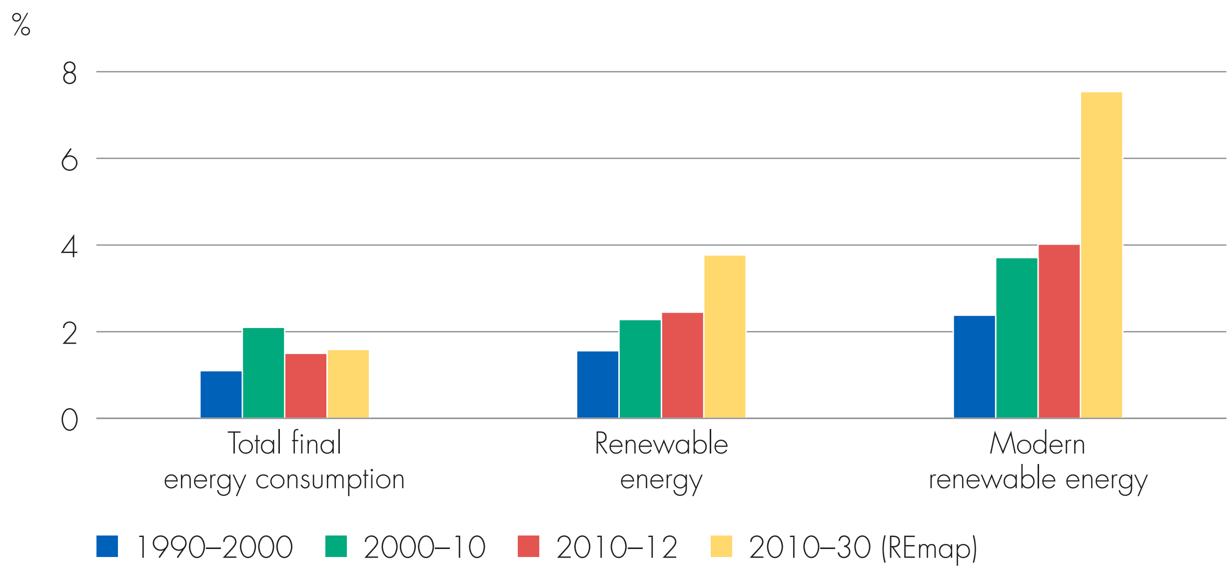


Source: IEA and UN data.

is widening. The compound annual growth rate (CAGR) of TFEC fell from 2.1 percent during 2000–10 to 1.5 percent over the tracking period, while the CAGR of RE increased from 2.3 percent to 2.4 percent (figure O.23). Excluding traditional solid biofuels, the CAGR accelerated from 3.7 percent in 2000–10 to 4.0 percent in 2010–12.[2] Still, IRENA's REmap 2030 study suggests that a renewable energy CAGR of 3.8 percent would be required between 2010 and 2030 to attain the SE4ALL RE objective, assuming a CAGR for TFEC on the order of 1.6 percent over the same period.[3]

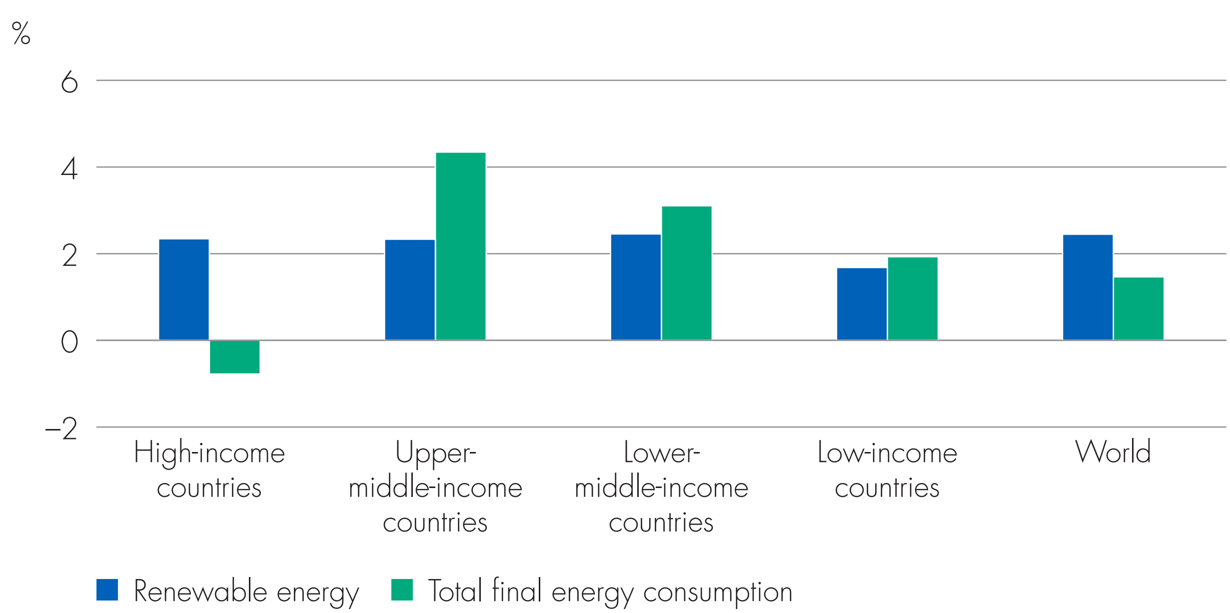
The global slowdown in the growth of TFEC over 2010–12 was mainly attributed to high-income economies where

Figure O.23. **Compound annual growth rate of total final energy consumption and renewable energy final consumption in different periods**



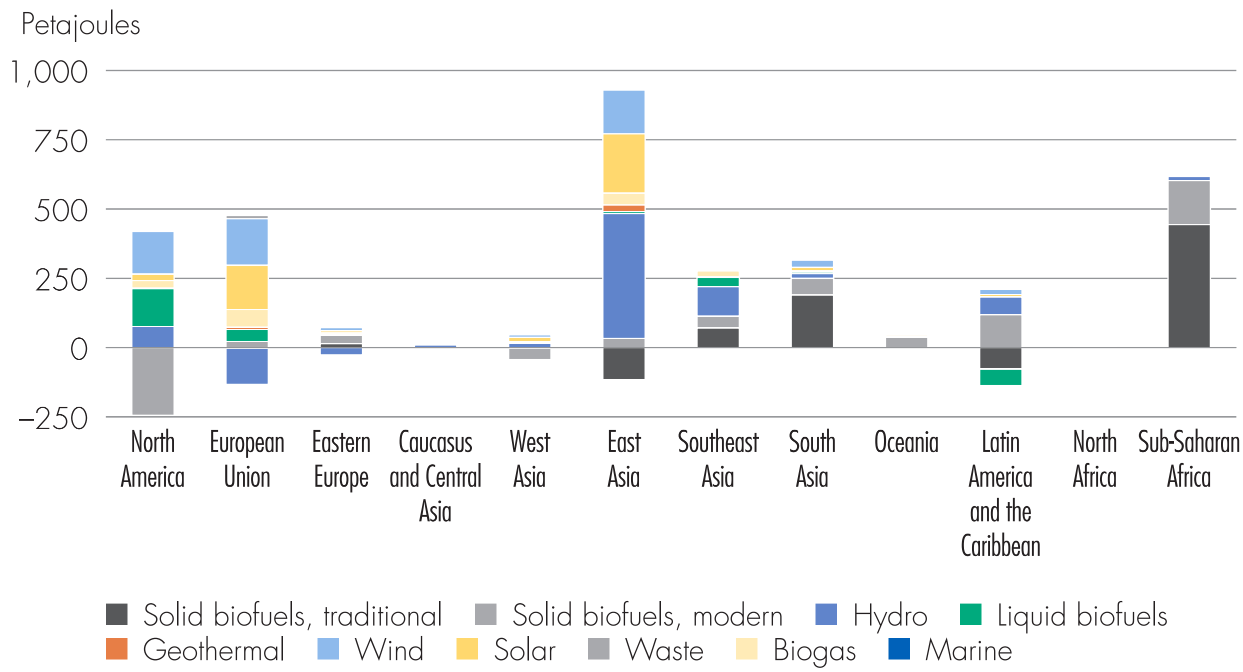
Source: IEA and UN data, 2014; analysis by the International Renewable Energy Agency based on IRENA (2014).

Figure O.24 **Compound annual growth rate of renewable energy consumption and total final energy consumption, 2010–12**



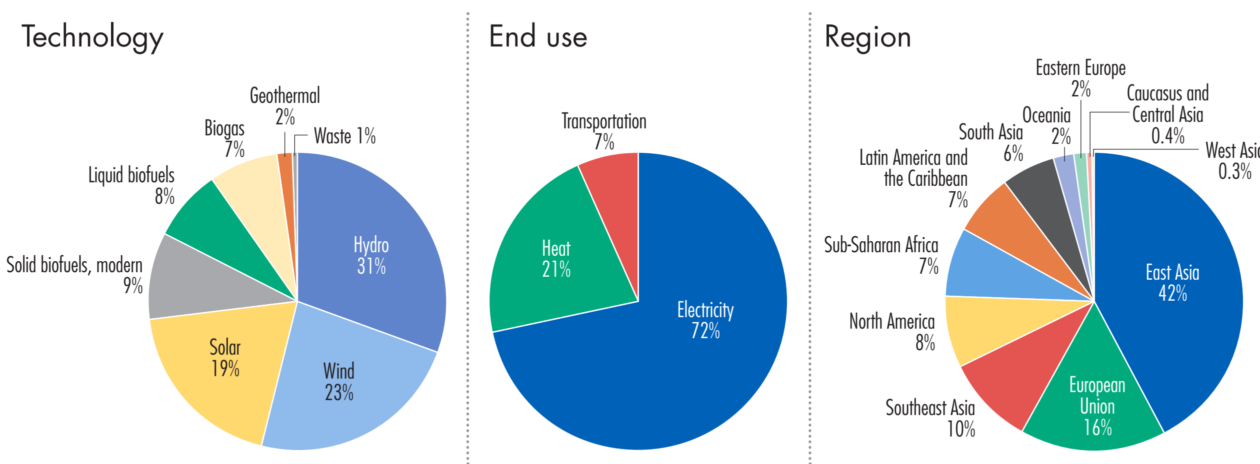
Source: IEA and UN data.

Figure O.25 **Renewable energy additions and retirements by region and resource type, 2010–12**



Source: IEA and UN data.

Figure O.26. **Composition of the net increment of modern renewable energy in total final energy consumption, 2010–12**



Source: IEA and UN data.

TFEC actually fell. The TFEC of middle- and low-income economies still grew faster than renewables' consumption growth in these countries (figure O.24).

The absolute increase of RE consumption over the tracking period was primarily driven by progress in East Asia, and to a lesser extent the EU, Southeast Asia, and North

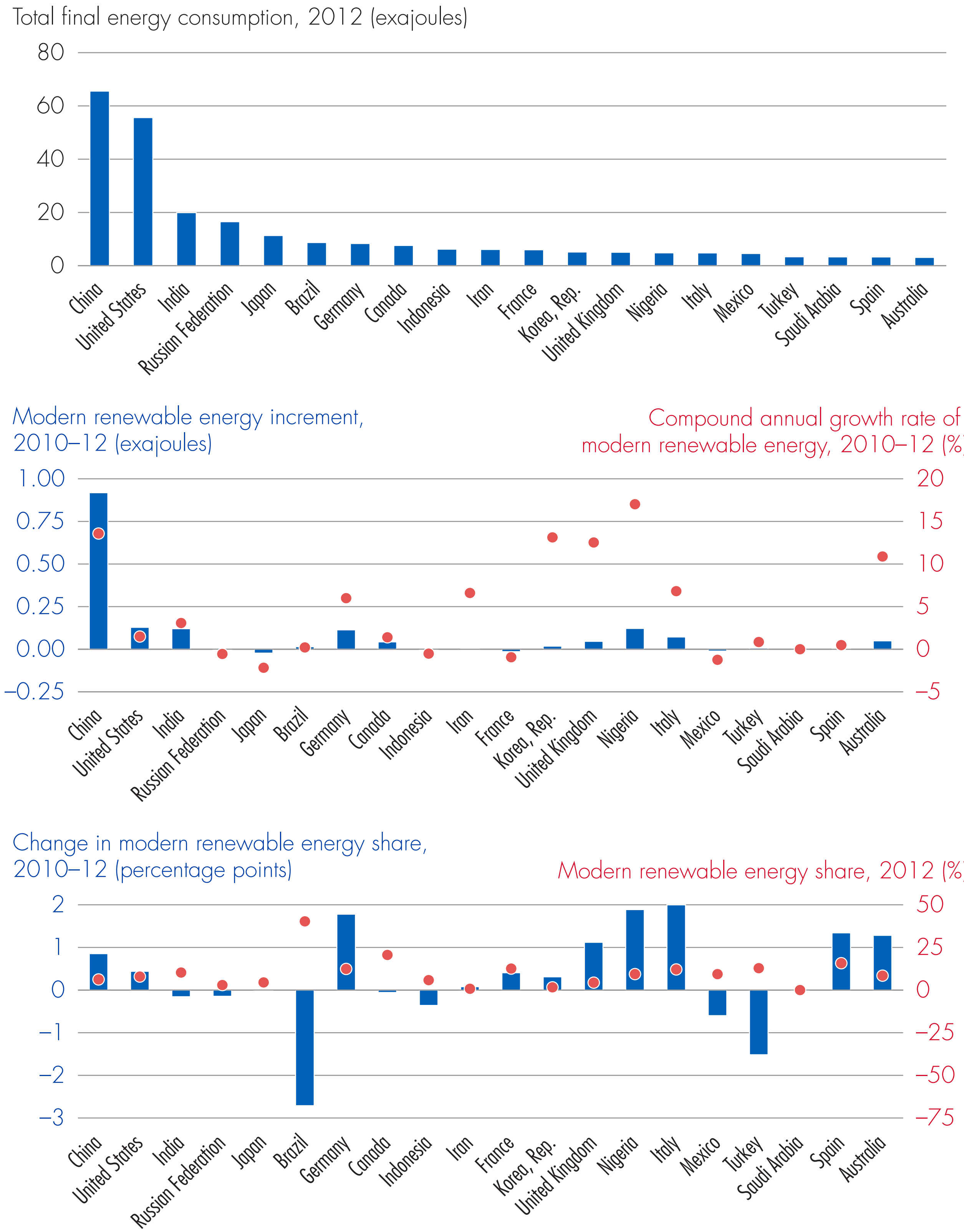
America (figure O.25). RE final consumption also grew rapidly in Sub-Saharan Africa, but this was driven almost entirely by the consumption of solid biofuels for traditional uses. By contrast, East Asia and Latin America showed steep reductions in traditional uses of solid biofuels, consistent with relative progress in the access to non-solid fuels in these regions (see figure O.7).

Excluding solid biofuels used for traditional purposes, the net increase of RE consumption over 2010–2012 is 2.3 EJ. By technology, increases in hydro, wind, and solar resources accounted for roughly three-quarters of the net increase; by end use, increases in electricity generation did the same; and by region, increases in East Asia, the EU, Southeast Asia, and North America also did the same (figure O.26).

Progress on RE partly reflects a significant scale-up in efforts by policymakers. From 2010 to early 2014, 35 more countries introduced RE targets, lifting the total to 144 from 109. Furthermore, 103 new regulatory policy instruments to promote RE were introduced globally in the period, with competitive bidding for grid-connected renewables and net metering for distributed generation by far the most popular. Continual reductions in the cost of key technologies have contributed to progress in RE deployment and a trend toward cost grid-parity in some technologies.

Doubling the share of RE in the global energy mix will depend on the top 20 countries with the largest TFEC (figure O.27). Over the tracking period, 15 of them increased their consumption of modern RE. In China and Nigeria, high growth of TFEC was exceeded by even higher growth of modern RE consumption, increasing the modern renewables share. In India, Russia, Brazil, and Turkey, TFEC grew faster than modern RE consumption, reducing that share.

Figure O.27. **Top 20 energy consuming economies: modern renewable energy increment, 2010–12**



Source: IEA and UN data.

Table O.2. **Annual global investment—actual and required ($ billion)**

Annual investment	Universal access to modern energy services	Universal access to modern energy services	Doubling the global rate of improvement in energy efficiency	Doubling the share of renewable energy in the global mix[a]	
Source	Electrification	Cooking	Energy efficiency	Renewable energy	Total
Actual for 2012[b]	9	0.1	130	258	397
Required to 2030[c]	45	4.4	560	442–650	1,051–1259
Gap	36	4.3	430	184–392	654–862

a. This is the range for significantly increasing the share of renewable energy in total final energy consumption.

b. The total assumes 2010 investment in access figures for 2012.

c. Estimates are derived from various sources: Energy access, electrification: *SE4ALL Finance Committee Report,* World Bank (2014); Energy access, cooking: Energy for All Scenario, *WEO* (IEA, 2012); Energy efficiency: 450 scenario, *WEO* (IEA, 2014); Renewable energy lower bound: *WEO* 450 (IEA, 2014), corresponds to a 29.4 percent renewable energy share in total final energy consumption by 2030; Renewable energy upper bound: REmap 2030 (IRENA, 2014), corresponds to a 36 percent renewable energy share in total final energy consumption by 2030.

Source: Prepared by authors.

Investment gap

To meet the three SE4ALL energy objectives, *Global Tracking Framework 2013* showed that doubling or tripling historical capital flows would be needed. It estimated that global investment in areas covered by the three objectives was around $400 billion in 2010, and that additional annual investments of at least $600 billion to $850 billion would be required to achieve the three objectives.

Since *GTF 2013* was published, new estimates of actual and required investment have been made for reaching the energy efficiency and RE objectives (table O.2). Actual investments remain near $400 billion, but the required investments rise to around $1,050–1,250 billion.[4] That implies an investment gap of around $650–850 billion and point to a tripling of annual investments to achieve the SE4ALL objectives.

Taking up this challenge, the SE4ALL Advisory Board convened a Finance Committee in 2013–14 that brought together private commercial and development banks to further assess the financing gaps and to propose concrete approaches for attracting more capital. The committee identified four broad investment themes that could help mobilize $120 billion in incremental annual investment by 2020: green-bond market development, structures that use development finance institutions' derisking instruments to mobilize private capital, insurance products that remove specific risks, and aggregation structures that bundle and pool for small-scale opportunities.[5]

Energy access

Estimates in the *World Energy Outlook (WEO)* suggest that a fivefold increase in capital is needed—from $9 billion actual investment in 2010 to an annual $45 billion until 2030 to meet the universal access objective.[6,7]

Regionally, Sub-Saharan Africa, South Asia, and East Asia and the Pacific face the largest access deficits. Nationally, investment needs are heavily concentrated, with 50 percent shared among the top 10 countries with the largest access deficits. Predictably, much of the investment opportunity lies in rural areas. Financing needs are concentrated in grid investments—almost 85 percent in grid and 15 percent in off-grid projects. For the former, financing is required for T&D projects and for generation; grants are needed to incentivize household connections and to make tariffs more affordable. For the latter, an annual investment of roughly $7 billion is needed to provide off-grid power to 620 million people.

The *WEO* projected cumulative investments of around $320 billion globally in power plants and new T&D lines, according to the IEA's latest New Policies Scenario, in which all investment commitments and policy pronouncements are realized.[8] This translates into an average annual investment of $19 billion to 2030, higher than historical estimates but not yet reaching the levels to attain the SE4ALL objective of universal access.

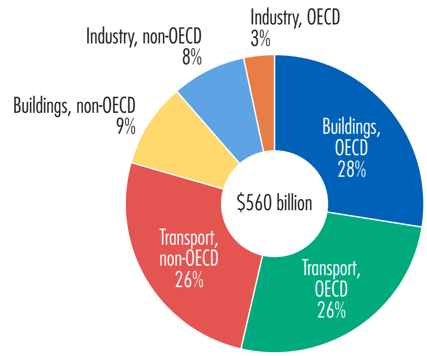
For modern cooking solutions, a 44-fold increase in capital is required—from $0.1 billion in 2010 to $4.4 billion annually until 2030—to meet the objective. According to the latest New Policies Scenario to 2030, around $11 billion of cumulative investments are projected in cleaner cooking technologies, such as liquefied petroleum gas (LPG) stoves, improved biomass stoves, and biogas digesters, or $0.6 billion a year. The IEA, in a special edition of *Africa Energy Outlook* (2014), projected investments in access to clean cooking in Sub-Saharan Africa at a cumulative $4.4 billion to 2030. The main component is the cost of improved or alternative cookstoves. It excludes the cost of infrastructure related to LPG, electricity, or natural gas distribution, and covers only the cost of the first stove and half the cost of a second stove, assuming that the path toward such investment becomes self-financing. Around 40 percent of the total is related to LPG cookstoves, 30 percent is for biogas digesters, and 30 percent is for solar cookers and improved biomass cookstoves.

Energy efficiency

To meet the SE4ALL objective, a quadrupling of current energy efficiency investment is needed, from about $130 billion in 2012 to an annual average of $560 billion through 2030. Transport is expected to account for slightly more than half the investment due to the sheer volume of new, more efficient cars and trucks projected to be sold and the high investment costs per unit of energy saved compared with other end-use sectors (figure O.28). The share of industrial energy efficiency investment is relatively low at 11 percent because much of the efficiency potential is already embedded, unit investment costs are lower, and most of the efficiency improvement occurs during stock turnover, which is slow.

From a regional perspective, Europe, developing Asia (mainly China and India), and North America dominate energy efficiency investment, accounting for almost 80 percent of the required investment through 2030 (figure O.29). This partly reflects the size of current energy consumption, but is also a consequence of current and planned policies. North America, Europe, and China, for example, are the world's largest car markets and have all adopted stringent

Figure O.28. **Share of annual average energy efficiency investment in the 450 Scenario by sector and region, 2014–30**



Source: IEA (2014).

Note: The OECD 450 Scenario in *WEO 2012* assumes different groups of countries adopt binding economywide emissions targets in successive steps, reflecting their economic development and responsibility for past emissions.

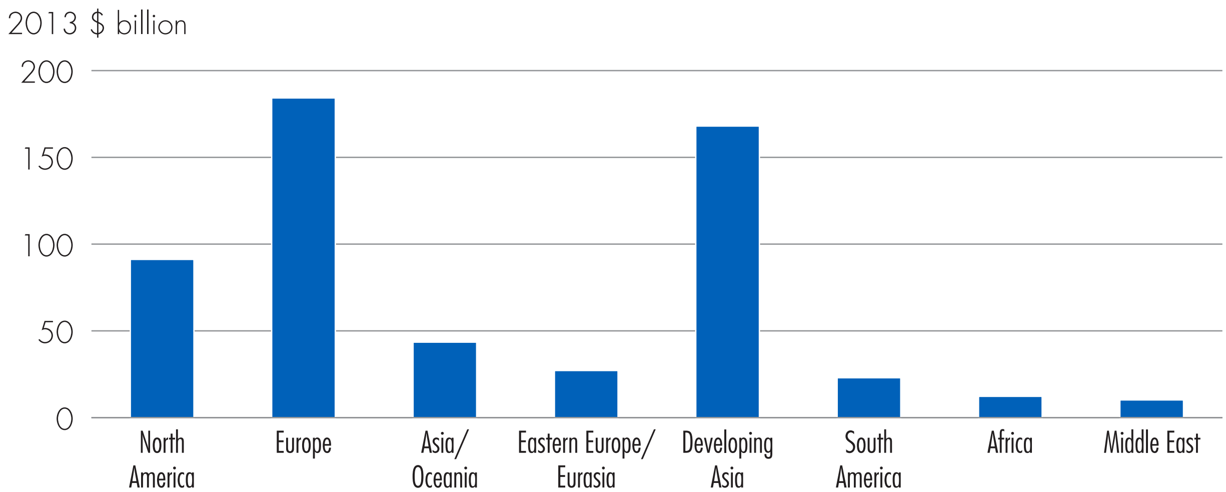
fuel-economy standards or emission standards for cars. Several other regions—such as Africa and the Middle East—account for far less investment than their share in final energy consumption, owing to, for example, smaller industrial capital stocks, different space conditioning needs, less cost-reflective energy prices, and the need to build capacity to set and enforce energy efficiency measures.

Renewable energy

Between 2010 and 2012, the global annual investment in RE increased by 13 percent from $228 billion to $258 billion, far short of the near doubling to steer toward the 450 ppm carbon dioxide concentration target (IEA, 2014) and a more than doubling to achieve the SE4ALL RE objective as estimated by REmap 2030 (IRENA, 2014).

The 450 Scenario of the *WEO* lays out a trajectory of energy investments in which RE accounts for 29.4 percent of TFEC by 2030.[9] This share lies below the 35.8 percent target of the SE4ALL agenda, thus the 450 Scenario of RE investment requirements presented here should be taken as conservative. Even so, the 450 scenario requires annual investment of $442 billion, implying a $184 billion investment gap. This gap is spread among regions, except OECD Europe, where annual investment in the last years has exceeded that required in the 450 Scenario (figure O.30). Broad policy commitments and plans announced by countries in the New Policies Scenario do not

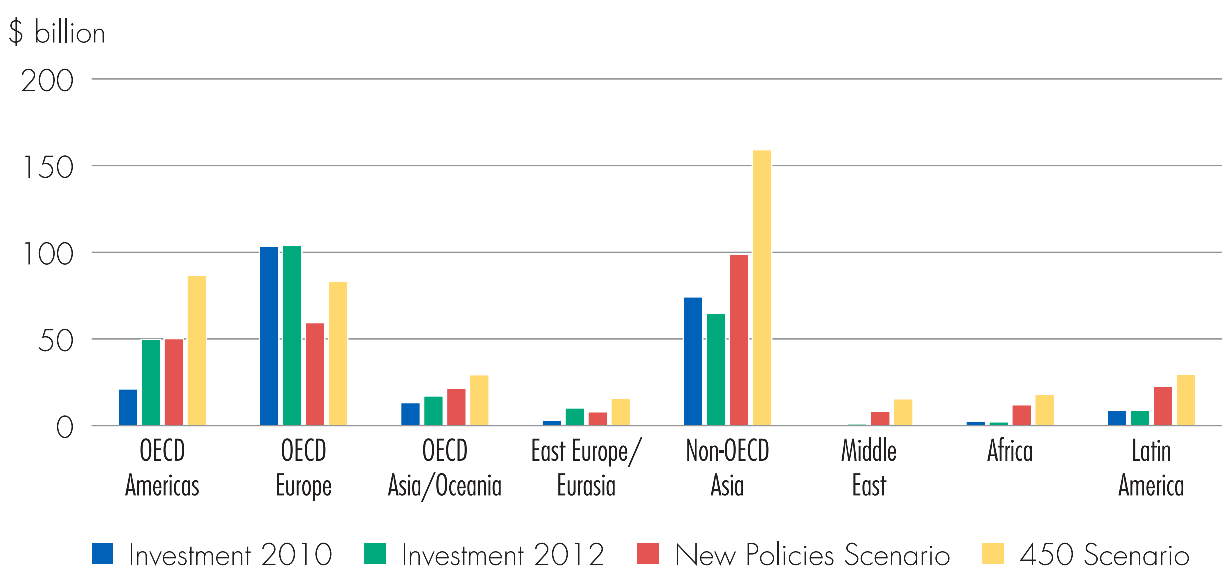
Figure O.29. **Annual average energy efficiency investment in the 450 Scenario by region, 2014–30**



Source: IEA (2014).

Note: The OECD 450 Scenario in *WEO 2012* assumes different groups of countries adopt binding economywide emissions targets in successive steps, reflecting their economic development and responsibility for past emissions.

Figure O.30. **Annual renewable energy investment, actual (2010 and 2012) and required by *World Energy Outlook's* New Policies and 450 Scenarios**



Source: IEA 2014.

Note: The regional classification is consistent with the *WEO*.

change the overall picture much, as global investment in that scenario totals $281 billion annually.[10]

REmap 2030 provides a pathway for scaling up renewables that is aligned to doubling the renewables share in TFEC. In REmap 2030, annual investment in renewable energy will have to be on the order of $650 billion, implying a nearly $400 billion investment gap in 2012 and requiring a 2.5-fold increase over 2012's investment volume. As in the *WEO* 450 scenario, the 2012 investment gap is highest in developing Asia (figure O.31). However, REmap 2030 requires relatively higher scale-ups in the economies of the Middle East, Africa, and Latin America.

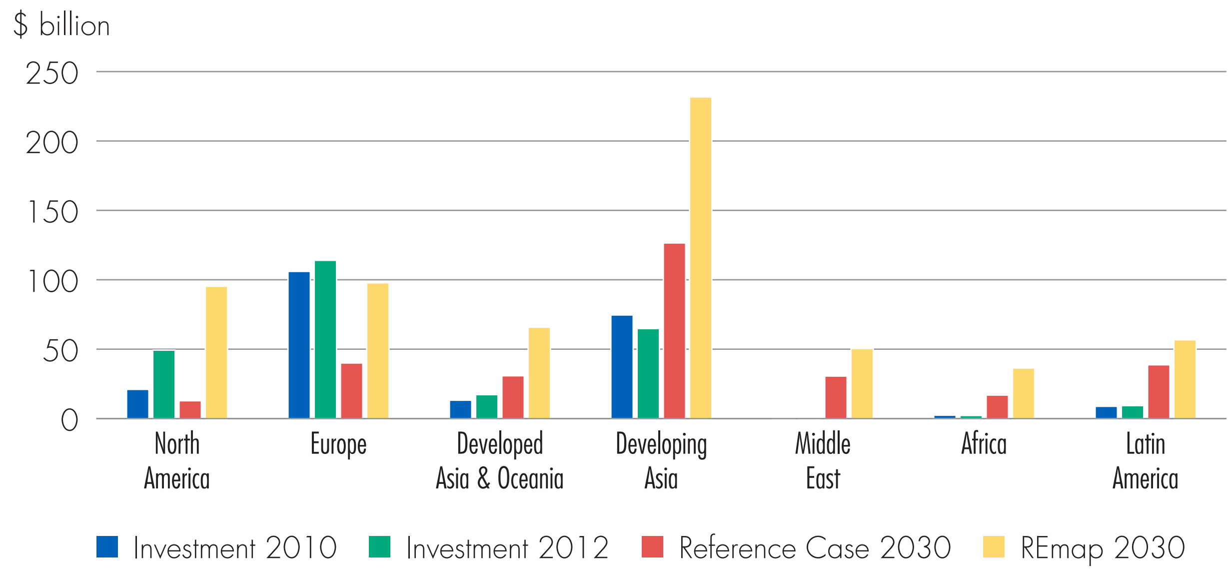
Both the 450 scenario and the REmap 2030 options analysis predict that more than a third of investment will occur in developing Asia and that the bulk of investment will focus on the power sector. But the pathways differ in their investments in technologies. While the *WEO* predicts wind and then hydro to be the largest recipient technologies of investments, REmap 2030 predicts solar to attract most investment, followed closely by wind (figure O.32). What is clear is that current investment is below that required, and current and planned policies are insufficient to address the gap.

Access to sustainable energy technologies

Countries will need to acquire cutting-edge technologies relevant to sustainable energy if they are to attain the three SE4ALL objectives. An initial perspective on how much countries are acquiring these key technologies comes from data on international trade, a proxy for access to a relatively narrow range of products.[11] Complementing the trade analysis is a review of tariff and non-tariff barriers to trade, as well as indicators for scientific journal citations and engineering qualifications, which give a sense of whether countries have the capacity to absorb and apply a technology even if they have access to it.

The trade analysis considers a basket of 12 products relevant to sustainable energy, including solar photovoltaic (PV) cells, light emitting diodes (LEDs), small hydro turbines (capacities below 1 megawatt [MW] and 1–10 MW), wind turbines, biodiesel fuels, insulation materials, fluorescent lamps, heat pumps, reversible heat pumps for air conditioning, electric vehicles, and portable electric lamps and parts of portable electric lamps.[12]

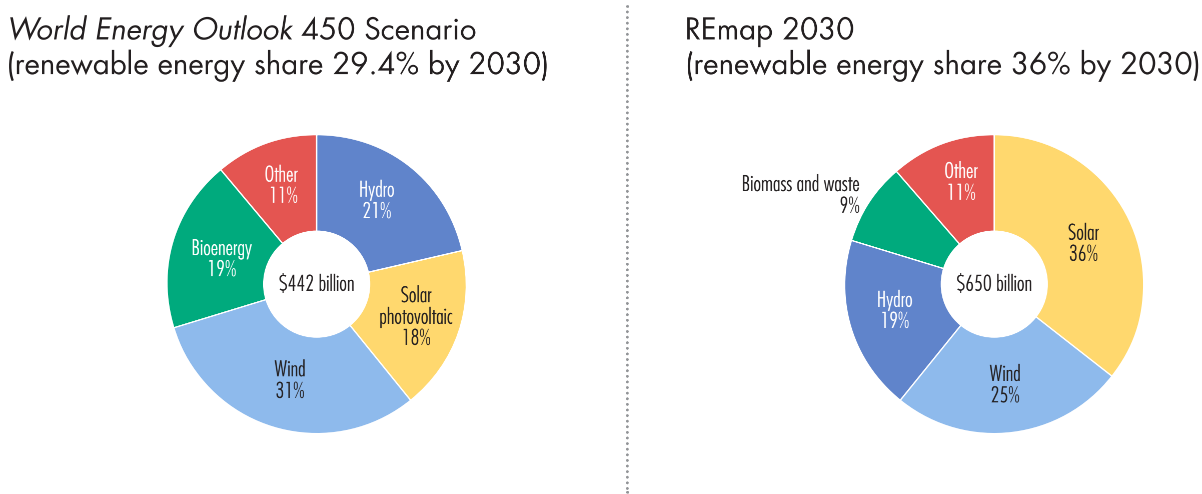
Figure O.31 **Annual renewable energy investment, actual (2010 and 2012) and required by REmap 2030**



Source: IEA 2014; analysis by the International Renewable Energy Agency based on IRENA (2014).

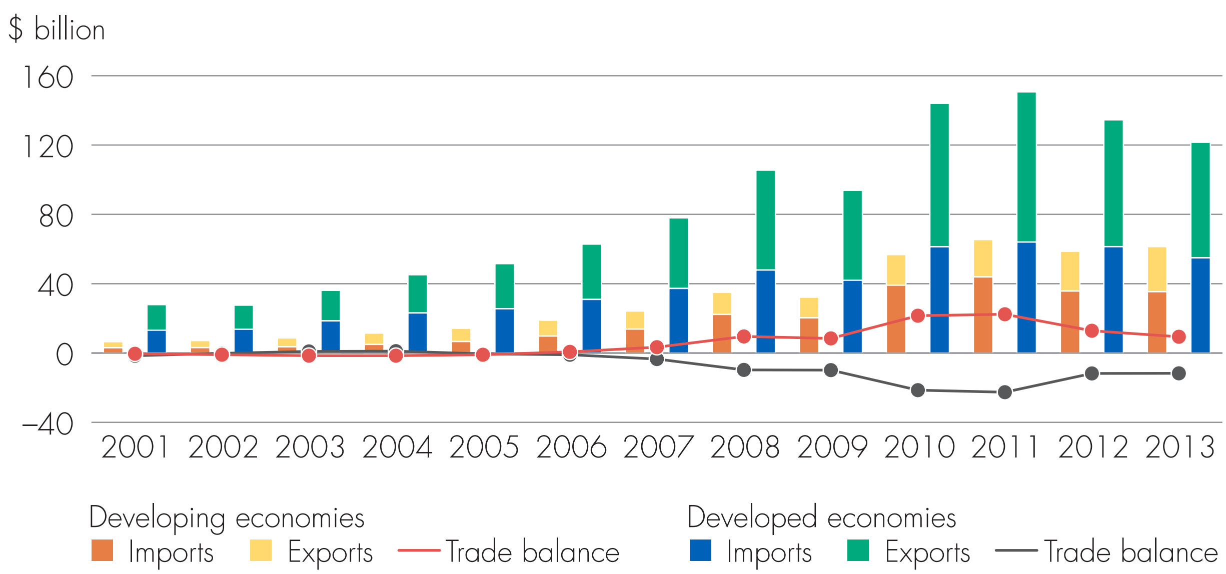
Note: The regional classification is adapted to align as much as possible with the *WEO*. The Reference Case (IRENA 2014) considers policies in place and currently under consideration.

Figure O.32. **Annual renewable energy investment requirement by technology**



Source: IEA 2014; analysis by the International Renewable Energy Agency based on IRENA (2014).

Figure O.33 **Balance of trade in technologies relevant to sustainable energy, 2001–13**



Source: World International Trade Solutions Database (World Bank 2015b).

Note: The 12 products in the trade basket are solar photovoltaic cells, light emitting diodes (LEDs), small hydro turbines (capacities below 1 megawatt [MW] and 1–10 MW), wind turbines, biodiesel fuels, insulation materials, fluorescent lamps, heat pumps, reversible heat pumps for air conditioning, electric vehicles, and portable electric lamps and parts of portable electric lamps.

Developing economies' share in this 12-product trade basket grew steeply in absolute terms in the decade 2001–11, although it has stabilized more recently. In 2013, trade in developing countries was about half the trade volume in developed countries (figure O.33). For the technologies selected, China alone accounts for 19 percent of the global trade value and for 56 percent of the developing-economy trade value, mainly due to its large volume of exports for solar PV cells. As groups, developing economies became net exporters and developed economies net importers after 2007.

Even though the value of trade for the basket in developing economies is still smaller than that of developed economies, a growing number of countries are trading some of these products (tables O.3, O.4, and O.5). Starting with RE, although low-income countries (LICs) and lower-middle-income countries (LMICs) accounted, for instance, only for about 4 percent of the global value of trade in solar PV cells/LEDs in 2013, 70–74 percent of countries in these income categories registered trade in this technology. Access to PV cells in LICs increased from two countries to 25 in 2001–13. The proportion of LICs with trade activity in wind turbines and small hydro turbines (1–10 MW) in 2013 was, however, very small, around 9 percent and 3 percent, and no LIC registered trade in biodiesel fuels that year.

In energy efficiency, access to fluorescent discharge lamps (CFLs), insulation materials, and electric- and gas-powered vehicles was acceptable across income levels in 2013, with 85 percent, 53 percent, and 71 percent of LICs trading these products, although again their contribution to the global value of trade was smaller than higher income countries. The number of lower income countries trading heat pumps has increased gradually: in 2013, 38 percent of LICs and 58 percent of LMICs traded these technologies.

In access to electricity, portable electric lamps with their own source of energy serve as a good proxy as they are a direct substitute for kerosene lamps and other forms of traditional lighting. In 2013, 81 percent of all countries had access to this technology. From 2001 to 2013, 29 LICs and LMICs gained access to this type of lamp, when the number of countries in the high-income group remained stable. Trade in parts of portable electric lamps tells a very different story, however, as in 2013 there were just 10 LICs and LMICs trading this product, suggesting that maintenance and repair of these lamps is constrained in lower income countries, which implies higher household energy expenditures.

The trade of small hydropower turbines is low across income groups, notably in LICs. A well-developed RE technology, it can help improve electricity access in rural areas, lower the unsustainable harvesting of solid biofuels, and be part of the solution for scaling up sustainable energy. But no more than three LICs and nine LMICs imported this

Table O.3 **Trade in products relevant to renewable energy, 2013**

Income group (number of countries)	Solar photovoltaic and LEDs HS Code 854140		Wind turbines HS Code 850231		Biodiesel HS Code 382600		Hydro turbines (1–10 MW) HS Code 841012	
	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)
Low income (34)	74	0.18	9	0.47	0	0.00	3	1.82
Lower middle income (50)	70	3.81	18	2.99	2	7.35	14	12.55
Upper middle income (55)	75	33.22	27	18.70	20	10.05	13	49.94
High income (75)	76	62.79	37	77.84	43	82.60	15	35.69
All (214)	74		26		21		12	
Total value		103.00		14.09		19.41		0.18

Source: World Integrated Trade Solutions database (World Bank 2015b).

Note: The estimation of the percentage of countries with access to the technology considers only countries with a trade value above US$100,000. The percentage contribution to the total value of trade is based on total amount traded; a similar estimation based on trade as a percentage of GDP is provided in chapter 5 (annex 3) of *Global Tracking Framework 2015*.

Table O.4 Trade in products relevant to energy efficiency, 2013

(%, unless otherwise specified)

Income group (number of countries)	Reversible heat pumps for air conditioning HS Code 841581		Heat pumps HS Code 841861		Fluorescent discharge lamps (CFLs) HS Code 853931		Insulation HS Code 701939, 680610 & 680690		Electric- and gas-powered vehicles HS Code 870390	
	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)
Low income (34)	18	0.47	38	0.22	85	0.69	53	0.23	71	0.93
Lower middle income (50)	36	2.98	58	1.32	82	6.61	65	3.91	66	6.73
Upper middle income (55)	65	36.86	78	10.29	85	48.07	79	18.5	75	6.21
High income (75)	63	59.69	71	88.17	79	44.63	76	77.36	73	86.13
All (214)	50		64		82		70		71	
Total value		4.98		4.31		11.64		11.26		6.80

Source: World Integrated Trade Solutions database (World Bank 2015b).

Note: The estimation of the percentage of countries with access to the technology considers only countries with a trade value above US$100,000. The percentage contribution to the total value of trade is based on total amount traded; a similar estimation based on trade as a percentage of GDP is provided in chapter 5 (annex 3) of *Global Tracking Framework 2015*.

Table O.5 Trade in products relevant to energy access, 2013

Income group (number of countries)	Portable electric lamps with their own source of energy HS Code 851310		Parts of portable electric lamps with their own source of energy HS Code 851390		Hydro turbines (<1 MW) HS Code 841011	
	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)	Access (%)	Value ($ billion)
Low income (34)	88	0.18	12	0.92	0	1.16
Lower middle income (50)	82	3.81	12	6.01	12	8.20
Upper middle income (55)	84	33.22	29	30.04	13	26.28
High income (75)	75	62.79	43	63.03	15	64.35
All (214)	81		27		11	
Total value		6.99		0.15		0.18

Source: World Integrated Trade Solutions database (World Bank 2015b).

Note: The estimation of the percentage of countries with access to the technology considers only countries with a trade value above US$100,000. The percentage contribution to the total value of trade is based on total amount traded; a similar estimation based on trade as a percentage of GDP is provided in chapter 5 (annex 3) of *Global Tracking Framework 2015*.

key technology in 2013 (in both the 0–1 and 1–10 MW capacity ranges).[13]

Access to sustainable energy technology is the result of many factors, not just trade but also energy demand, resource potential, market-formation policies, industrial policy (including manufacturing and local-content provisions), customs and trade regulations, cost relative to other options, and access to affordable finance. So, while trade data provide a good proxy for whether the most sophisticated or needed products are crossing boundaries (and reaching beneficiaries), the broader question of access to technologies requires all these factors to be considered, too, including countries' technical capacity for absorbing, adapting, and applying technologies. Data on engineering qualifications and number and quality (citations) of scientific journal papers delivered at country level, which are regarded as good proxies for technical capacity, show that knowledge transfer and training need to be significantly strengthened in lower income countries.

The energy nexus

A discussion of "nexus" issues is part of the *GTF* for the first time. Different from the other three main chapters, chapter 6 is conceptual rather than quantitative, introducing and exploring nexus concepts in four priority areas of development (water, food, human health, and gender) and their links to energy. Energy has links to, and influences, many other areas (such as education), but these four form the initial foray for the *GTF*. Links between most of these areas to energy are well established but often discussed in silos. Chapter 6 considers the existing data and indicators that might be useful for tracking aspects of SE4ALL's work related to these nexus issues and for highlighting gaps.

The energy interactions with these four areas, closely tied to energy services and energy systems, are fundamental to meeting the objectives of SE4ALL. Numerous opportunities will arise from more holistic decisionmaking in energy if wider cross-sectoral perspectives can be brought to bear. For instance:

- Renewable energy can be either water intensive or water efficient. PV panels and wind turbines require little water and are generally much more water efficient than conventional sources of electricity. Solar thermal, biomass, geothermal, and carbon sequestration and storage, in contrast, can be "thirsty" sources of electricity, depending on the cooling technologies, and can increase water intensity. Technology choice in clean energy provision can therefore have severe implications for water security. Hydropower depends fundamentally on water, and lower rainfall (perhaps due to greater variability and to climate change) could reduce electricity production from that source.

- Energy efficiency typically has positive and synergistic feedbacks to other resource systems. Efficient use of energy reduces the need for power generation and thus the need for cooling water. Water efficiency is also energy efficiency: using water more efficiently often cuts electricity consumption, as lower water demand reduces the need for pumping and treating water. Similarly, energy efficiency interventions like low-flow showerheads save energy by reducing the volume of water to be heated. Washing machines have become more energy efficient largely by using less water per load. Exploring the co-benefits in water saving tied to energy efficiency, as well as the potential to save energy through water efficiency, can therefore help secure additional benefits.

- Access to energy and to other energy-intensive products, services, and facilities can increase farmer incomes and boost agricultural productivity. Agricultural machinery and inputs such as fertilizers and pesticides can raise yields for farmers. Better access to transportation (roads and freight services) as well as refrigeration and processing facilities can improve market access while reducing spoilage of food. This can increase overall land productivity by reducing field-to-consumer losses and improve farmer incomes. Health, too, gains from sustainable energy services in developing-country community health clinics, through cost-effective and life-saving interventions. These clinics need reliable access to energy for running medical equipment, for storing supplies such as blood, vaccines, and antiretroviral drugs, for staying open after dark, and for helping retain qualified staff. Finally, street lighting may increase women's and girls' mobility after dark and in the early morning and, by improving security, reduce the risk of gender-based violence.[14,15]

All these areas have numerous interwoven concerns, including access to services, long-term maintenance and sustainability, environmental impacts, and price volatility. These issues manifest in different ways in each area, but the impacts are often closely related. Identifying the links early can help in targeting synergies and preempting subsequent potential tensions.

Energy and water

The trade-offs between energy and water have been gaining international attention in recent years as demand for both resources mounts and governments continue to struggle to ensure reliable supplies. About 748 million people still lack access to improved sources of drinking water—nearly half in Sub-Saharan Africa. And more than one-third of the global population—around 2.5 billion people—remain without access to improved sanitation.[16] It is expected that, by 2025, 1.8 billion people will live in countries or regions with absolute water scarcity, and two-thirds of the world's population could be in water-stress conditions.[17]

Energy and water resources are tightly enmeshed: large amounts of water are needed in almost all energy generation, including thermal power plants, hydropower, and biofuels, as well as in extraction of fossil fuels. Conversely, the water sector needs energy to extract, treat, and transport water, run municipal water and wastewater facilities, irrigate land, and desalinate water. Energy and water are both used in producing crops, including those to generate energy through biofuels. This relationship is the energy–water nexus (sometimes the energy–water–food nexus). These interdependencies could complicate solutions and make a compelling case to improve integrated water and energy planning.

Water indicators:

- Reliable and comprehensive data on the energy–water nexus are scarce.
- Indicators must track water withdrawal, consumption, and discharge, over time and space (at power plants).

Energy and food

Assessing the links between energy and food security requires understanding what food security means. The internationally agreed definition is that "Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Rome Declaration on World Food Security and World Food Summit Plan of Action; World Food Summit 1996). For this definition, food security has four dimensions—availability, access, utilization, and stability—which need to be fulfilled simultaneously.

Energy has a key enabling role in food security and nutrition. It is essential for agricultural processes, including irrigation, and is necessary at every stage of agrifood chains. Energy prices often influence the prices of agricultural inputs. Biofuels in particular are linked to all four dimensions of food security. At household level, better access to modern energy services may increase the quality of food by improving food conservation through refrigeration and by allowing proper cooking.

Food indicators:

- Data exist on inputs to "behind farm-gate" operations, on use of traditional fuels, and on effects of bioenergy development on food supplies and prices.
- Complementary indicators would include energy used to manufacture agrifood chain inputs, energy use beyond the farm-gate, and RE produced along agrifood chains.

Energy and health

Energy is a prerequisite for good health and a source of many serious health risks, notably air pollution, which comes from dirty fuels and inefficient technologies. Less appreciated is that much of it comes from inefficient strategies—for, say, housing, transport, and urban design. Optimizing the health benefits of energy access, efficiency, and use of renewables and minimizing energy-related risks are critical for achieving SE4ALL's three sustainable development objectives. Outdoor and household (indoor) air pollution are responsible for about 7 million premature deaths annually, making air pollution one of the largest single causes of premature mortality and morbidity worldwide.

Many other health risks are linked to a lack of modern energy access or inefficient energy use. Rudimentary solid fuel cookstoves or kerosene lamps, for instance, can be a factor in domestic injuries, such as burns and poisonings. Energy-inefficient buildings and homes require more heat and power, and vulnerable groups like the elderly also are at higher risk of stroke, heart failure, and other acute events related to extreme weather and heat or cold exposure.[18] Increased incidence of asthmas, allergies, and respiratory illnesses are associated with chronic damp and cold conditions that are more common in energy-inefficient dwellings, particularly affecting the poor, the elderly, and children. In urban areas, physical inactivity and traffic injury rates among pedestrians tend to be higher when public transport is inefficient, leaving people reliant on private motor vehicles that burn more energy and produce more air pollution per unit of travel than efficient rapid transit modes.[19]

Health indicators:

- Existing indicators approximate exposure and burden of disease from indoor and outdoor air pollution. Measurement of electricity access in health care facilities is being developed.

- Efforts should be reinforced to improve indicators on the energy–health nexus, including safety standards for cooking solutions, and exposure rates to indoor air pollution from heating and lighting.

Energy and gender

The energy–gender nexus emerged as a discourse in development at the Beijing Conference in 1995.[20] As highlighted in the 2012 *World Development Report* (*WDR*) and the 2014 *World Survey on the Role of Women in Development*,[21] gender equality is critical for development across all sectors.[22] Access to sustainable energy can liberate men and women from drudgery and free time for leisure, rest, and investing in human capital. However, women in most developing countries suffer more than men from energy deficits and energy poverty.[23]

The energy–gender nexus reflects energy demands based on women and men's roles that are met through energy supply chains of different degrees of formality (from self-collection to commercial provision).[24] At household level, men generally take the final decision about energy access. At macro level, decisions about policy instruments (including incentives to encourage a transition to cleaner energy) require gender analysis and gender budgeting to avoid inadvertent gender blindness or bias in energy policies.[25] Most links of the chain offer entry points for women to be a target group in three areas—time poverty and drudgery reduction, economic empowerment, and health and safety gains.

Gender indicators:

- Existing surveys and databases shed light on the relationships between gender and energy, providing information on time poverty, women's economic empowerment, and mortality and morbidity.

- Quantitative assessments of the differential impacts of energy on women, men, girls, and boys are few.

The data revolution for sustainable development

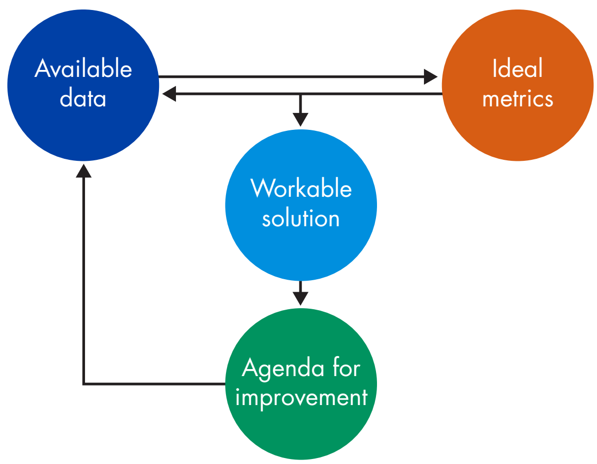
The November 2014 report, "A World That Counts," underscores the pressing need to upgrade capacity and resources to more accurately measure and track the dimensions of sustainable development.[26] Improving data is a development agenda in its own right, and can better focus targeting of existing resources and spur new economic opportunities. Gaps can be overcome through new investment and strengthened capacity.

A new funding stream to support the data revolution for sustainable development should be endorsed. That will require assessing the scale of investments, capacity development, and technology transfer, especially for LICs, and developing proposals for mechanisms to leverage the creativity and resources of the private sector. Funding will also be needed for an education program to improve the capacity and data literacy of the public, information intermediaries, and public servants to break down barriers between people and data.

The *GTF* seeks to catalyze such a data revolution for the energy sector. The philosophy in the first *GTF* was to balance the ideal metric that best captures progress in the energy sector with the constraints posed by the need to use data sets already at hand for all countries in the world, so that tracking could be truly global. That report achieved a workable solution with reasonable and widely available proxy indicators, while acknowledging that they were less than ideal in some ways, and that the *GTF* should simultaneously set an agenda for gradually improving data (figure O.34).

Since 2013, progress has been significant in developing improved metrics for energy access. The first *GTF* proposed and consulted on a conceptual framework for measuring access to electricity and to modern cooking using multitier approaches. The framework went beyond traditional binary measures of presence or absence of an electricity connection or primary use of non-solid fuels, proposing eight attributes of energy supply to determine

Figure O.34 **Improving measurement and tracking**



Source: Prepared by authors.

whether a user has effective access, and to what degree: capacity, availability, reliability, quality, affordability, legality, convenience, and health and safety. Increasing levels of these attributes were required to achieve higher tiers of energy access

This framework has since been elaborated by developing tools for capturing data for energy supply attributes, including a survey instrument that has been piloted in half a dozen country contexts. The results show that this approach is a much more refined way of measuring energy access. For example, Kinshasa city in the Democratic Republic of Congo, which reports a 90 percent access rate under the traditional binary measurement, scores only 30 on a scale of 0 to 100 on the binary metric that reflects all eight attributes of energy supply (box O.1). Similar multitier metrics have also been conceptualized and piloted to measure energy access for household cooking, productive engagement, and community facilities. A global survey based on the multitier approach is planned for 2015.

Other issues of measuring energy efficiency and the sustainability of biomass under RE are equally pressing. Energy efficiency—the relationship between energy inputs and physical outputs—cannot be directly measured at global level. Instead, energy intensity—the amount of GDP produced for every unit of energy consumed—is widely used as an imperfect proxy. Going beyond this would require more detailed disaggregation of data to sectors, subsectors, and individual end-use activities. That would entail both improving the resolution of the national energy balances that characterize where energy is consumed in each country and obtaining complementary information on the physical outputs associated with energy consumption in each sector—for example, freight-kilometers of transportation or square meters of office space. A recent IEA energy-efficiency statistics manual provides a solid methodological basis for doing so.[27] But building capacity for countries to apply this methodology and collect all the supporting data poses a major challenge.

National and international entities already (or could) have roles in building capacity to better track energy efficiency. National governments are the only entities with the responsibility and authority to collect and publicly report the statistics to construct national energy efficiency indicators, while international and regional energy organizations are important in developing and promulgating standardized approaches to energy efficiency indicators. For an international initiative like SE4ALL to produce a set of detailed tracking indicators ultimately requires sufficient information provided by a plurality of the most important countries and organizations, and sufficient resources accompanied by a mandate to sustain a reporting activity.

To go further, tracking requires a consensus-building process that would make decisions—first, on which indicators to pursue to secure meaningful, global tracking indicators, and second, on which key sectors, segments, and activities, as well as countries. This would include identifying the keeper and reporter of global energy efficiency indicators, specifying the range of information needed from countries, identifying bodies that prepare and carry out associated capacity building, and generating the technical assistance to establish and maintain surveying and reporting capacities. This process would also identify the necessary funding, including investment capital, and possible sources.

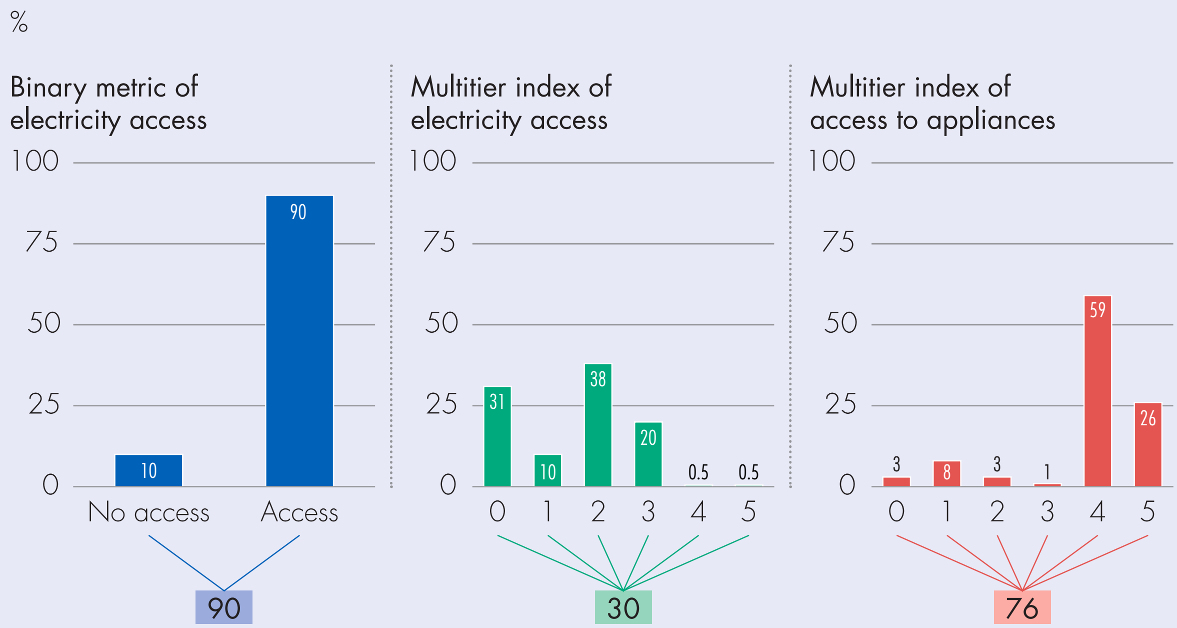
Switching to the sustainability of biomass, about half of what we know as RE takes the form of traditional use, often by households in developing countries for cooking and heating. The volumes used this way are imperfectly estimated at present, and little is known about whether the associated wood and charcoal are harvested and produced sustainably.

Measuring and tracking the sustainable use of solid biofuels—and bioenergy in general—at country level is extremely complex for at least four reasons. First, the assessment of sustainability relates to multiple dimensions (economic, environmental and social) with their own set of indicators. Second, the assessment of sustainability is

Box O.1 Pilot Implementation of a Multitier Framework in Kinshasa

A multitier analysis for Kinshasa demonstrated how an attribute-based multitier approach provides a deeper picture of the state of energy access, helps conduct a gap analysis that points to the reasons for access deficiency, and suggests possible approaches for alleviating them.

Binary or multitier measurement of access to electricity in Kinshasa



The binary measurement indicates that 90 percent of the people in Kinshasa city have access to electricity—implying that only an incremental access challenge remains. The multitier metric presents a very different picture. With an energy supply index of 30 (on a scale of 0 to 100), the city's households have poor access to electricity, despite a high rate of grid connectivity (close to 87 percent). More than three-quarters of the households (79 percent) are on tier 2 or below, and most of the remaining households are on tier 3.

The multitier framework also allows for a gap analysis that examines why households are stuck at lower levels and the interventions that may help them. While about 10 percent of the households do not have a connection, another 21 percent join them on tier 0, despite being grid connected, because they receive less than four hours of supply each day or less than one hour in the evening. Furthermore, 48 percent of households are held at tiers 1 and 2 because of quality of supply issues (low voltage) and less than eight hours of supply a day. Interventions can therefore be more accurately designed to address the access deficiencies that affect each of these sets of households.

Source: Prepared by authors.

applied at a "situation" level (zone, project, subregion), such that several assessments are needed for national estimates. Third, because measurement is data-intensive and few data are in the form required for a comprehensive or even pragmatic assessment, harvesting data is intensive and expensive. And fourth, periodic tracking would require an organizational structure and data collection platform that few countries now have.

A pragmatic approach to roughly assessing progress on the sustainable development and use of bioenergy regularly could rely on a mix of proxy, semiquantitative, and qualitative measurements. That mix could include estimating the wood harvested in excess of the incremental growth rate at national level (or estimating the fraction of nonrenewable biomass) with the methodology recently proposed and applied by Bailis and others[28]; assessing and monitoring of bioenergy sustainability at national level using Global Bioenergy Partnership indicators; and estimating the amount or share of land used under certification schemes.[29] The adoption of any of these approaches would require the consensus of, among others, international agencies, international statistics groups, and national governments. Table O.6 summarizes the challenges in measuring and tracking the SE4ALL objectives and the wider agenda for improving data availability and quality.

The Open Working Group on Sustainable Development Goals of the UN General Assembly adopted a document proposing 17 sustainable development goals (SDGs) and 169 targets (United Nations 2014).[30] SDG 7 on Energy—Ensure access to affordable, reliable, sustainable, and modern energy for all—includes the following targets and means of implementation (7a and 7b):

- *Target 7.1* By 2030, ensure universal access to affordable, reliable, and modern energy services.
- *Target 7.2* By 2030, increase substantially the share of renewable energy in the global energy mix.
- *Target 7.3* By 2030, double the global rate of improvement in energy efficiency.
- *Target 7a* By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
- *Target 7b* By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries and small island developing states.

The indicators in *GTF 2015* correspond closely to the targets articulated by the Open Working Group.

Table O.6 **Challenges in measuring and tracking SE4ALL objectives and proposed actions for improving data**

	Challenge	Actions
Energy access	Binary measurement of energy, with or without connection, does not capture the nuances of energy supply	A multitier metric for electricity and modern cooking solutions was proposed in *GTF* 2013 to present access as a combination of seven attributes of energy supply. Preparations are under way to launch a global access survey that will ramp up the ability to evaluate energy access. New frameworks for productive uses, community facilities, and small-lighting solutions, presented in this *GTF*, will be pilot-tested to ensure the reliability of results before global roll-out.
Energy efficiency	Energy efficiency, the relationship between energy inputs and physical outputs, would require a set of more-disaggregated data across countries than energy intensity	A consensus-building process could choose key sectors, end-use activities, and countries for which to develop more meaningful global tracking indicators. It would prioritize indicators, specify required information, and identify needed technical assistance and financial resources.
Renewable energy	Measurement and tracking of the sustainable use of solid biofuels is based on the assumption that all solid biomass consumed in developing economies is used in a traditional way	International organizations and statistics groups, and national governments, have initiated steps to agree on methodologies to progressively account for the sustainable use of solid biofuels in energy statistics. A roadmap of actions that considers approaches already piloted could include: *Short term:* Use proxy, semiquantitative, and qualitative measurements, including proportion of land following established good practice and share of land under certification schemes. Emerging methodologies allow the fraction of wood fuel (firewood and charcoal) used in a nonrenewable or unsustainable way to be quantified, based on spatially explicit assessments. *Medium term:* The assessment and monitoring of bioenergy sustainability could be progressively conducted at national level in high-impact countries using Global Bioenergy Partnership indicators, though not annually due to the complexity and funding needs. Thus periodic tracking would be more challenging under this approach.
	Other data and methodological constraints	Definitions and data collection in distributed renewable energy power generation for grid-connected and off-grid systems need to be improved. With regards to renewable energy policy, it would be desirable to convert existing targets into a common metric to allow the estimation of an aggregate global target.

Source: Prepared by authors.

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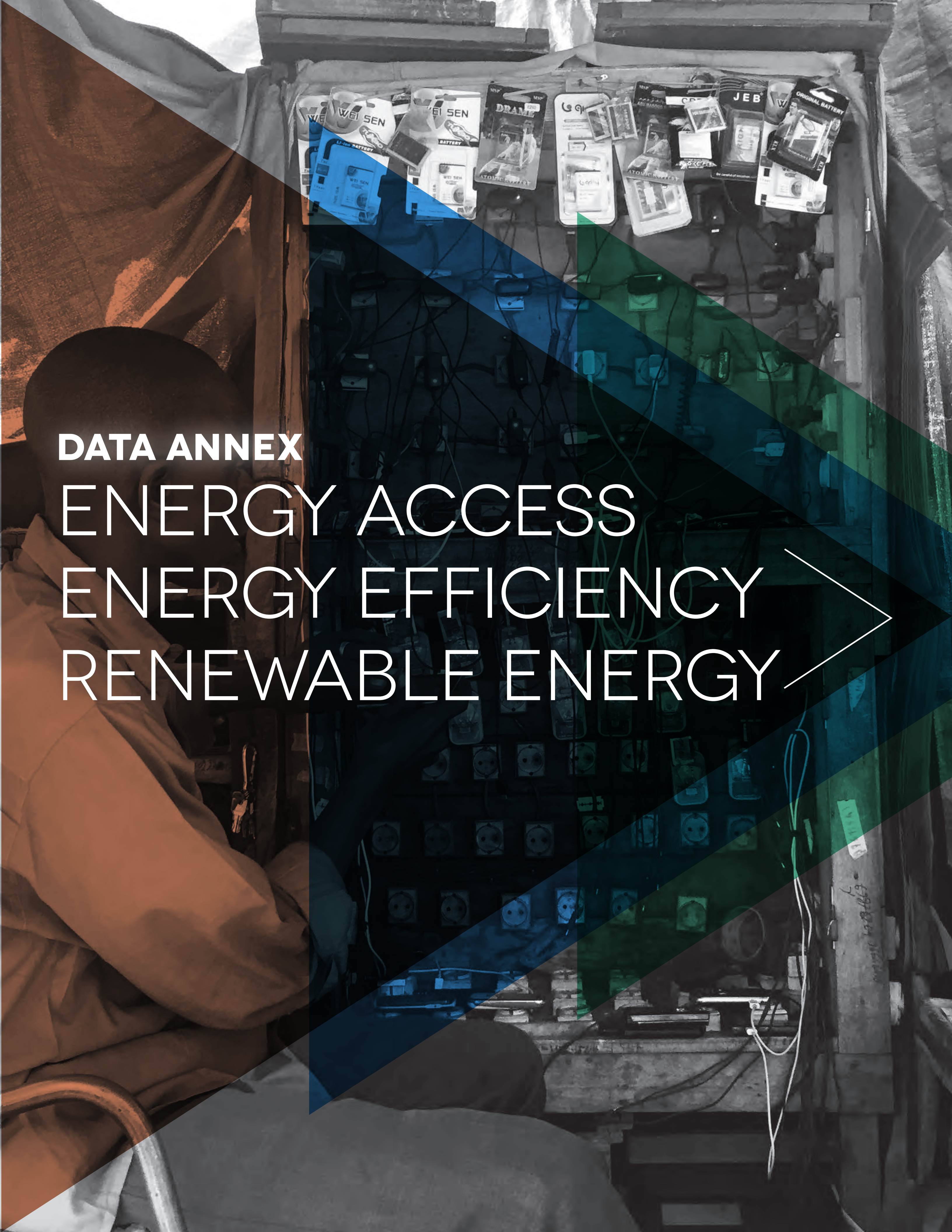
Notes

1. Worldwide, roughly one-third of total primary energy supply is attributable to energy production, conversion, refining, transmission, and distribution. The remaining two-thirds is final energy consumption in end uses.
2. Analyzing the net increment with and without the contribution of traditional solid biofuels—which include primary solid biofuels and charcoal—is important as they are assumed to be used in a non-sustainable way by the residential sector in developing economies. It is expected that the attainment of the SE4ALL objective of universal access to modern energy will reduce the consumption of solid biomass used for traditional purposes and therefore make the SE4ALL objective on renewable energy easier to achieve. Chapter 4 discusses in more detail the challenge of defining and measuring bioenergy. Renewable energy resources that exclude solid biofuels for traditional uses are here referred to as modern renewable energy resources.
3. REmap 2030 (IRENA 2014) is an energy options analysis that provides a roadmap toward doubling the share of renewable energy in TFEC between 2010 and 2030.
4. Actual investment fell from $417 billion in 2010 to $397 billion in 2012, largely reflecting IEA methodological updates in calculating energy efficiency investments. This decline in energy-efficiency investments was partly offset by an increase of $30 billion in RE investment.
5. World Bank and others 2014.
6. http://www.worldenergyoutlook.org/publications/weo-2014.
7. *WEO;* IEA 2014.
8. IEA 2014.
9. IEA 2014.
10. IEA 2014.
11. Products are identified at the six-digit level of the Harmonized System (HS) subheadings of the Harmonized Commodity Classification and Coding System (UN COMTRADE Database).
12. The product known as a photosensitive semi-conductor device (HS Code 854140) aggregates both photovoltaic cells (whether or not assembled in modules or made up into panels) and LEDs.
13. There is growing consolidation of companies manufacturing hydro turbines globally: in 2013 just five countries accounted for 65 percent of exports of small hydro turbines (China, Germany, Austria, the United States, and Italy). Very few developing countries have developed value chains for manufacturing small turbines, and those that have generally have little production capacity and a narrow range of capacity scales. Only one LIC and two LMICs export small hydropower turbines (India, Democratic Republic of Congo, and Sri Lanka).
14. Cecelski and others 2005.
15. Doleac and Sanders 2012.
16. WHO/UNICEF 2014.
17. WWAP 2012.
18. Röbbel 2011.
19. Hosking 2011.
20. Clancy and others 2011.
21. UN Women 2014.
22. World Bank 2012.
23. Defined as an absence of sufficient choice in accessing adequate, affordable, reliable, clean, high-quality, safe, and benign energy services to support economic and human development (Clancy and others 2003; UNIDO/UN Women 2013).
24. Detailed reviews of the energy–gender nexus may be found in Clancy and others 2011, Köhlin and others 2011, and World Bank 2005.
25. Clancy 2009.
26. Produced by an Independent Expert Advisory Group on a Data Revolution for Sustainable Development for the UN Secretary-General; IEA 2014b.
27. Independent Expert Advisory Group 2014.
28. Bailis and others 2015.
29. Bailis and others 2015.
30. United Nations 2014b.



DATA ANNEX

ENERGY ACCESS
ENERGY EFFICIENCY
RENEWABLE ENERGY

DATA ANNEX: ENERGY ACCESS

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SA	Afghanistan	35	37	41	43	32	83	2010 DHS[b]	4	14	19	19	4	72	WHO[c]
DEV	Albania	100	100	100	100	100	100	Assumption	36	51	60	62	42	84	WHO[c]
NA	Algeria	94	98	99	100	100	100	Estimate	86	96	100	100	100	100	WHO[c]
Oceania	American Samoa	49	53	56	59	45	60	Estimate							
DEV	Andorra	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SSA	Angola	28	31	35	37	6	83	2011 DHS[b]	2	21	40	44	10	79	WHO[c]
LAC	Antigua and Barbuda	81	85	88	91	80	100	Estimate	86	95	100	100	100	100	Assumption
LAC	Argentina	88	92	94	100	96	100	Estimate	83	93	98	99	100	100	WHO[c]
CCA	Armenia	94	98	100	100	100	100	2010 DHS[b]	8	49	85	93	95	100	WHO[c]
LAC	Aruba	81	85	88	91	80	100	Estimate							
DEV	Australia	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Austria	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
CCA	Azerbaijan	93	96	100	100	100	100	Estimate	54	74	90	93	82	100	WHO[c]
LAC	Bahamas	92	96	100	100	100	100	Estimate	100	100	100	100	100	100	Assumption
WA	Bahrain	87	91	94	98	93	98	Estimate	100	100	100	100	100	100	Assumption
SA	Bangladesh	22	32	55	60	49	90	2011 DHS[b]	7	11	11	11	2	44	WHO[c]
LAC	Barbados	81	85	88	91	80	100	Estimate	94	99	100	100	99	100	WHO[c]
DEV	Belarus	100	100	100	100	100	100	Assumption	82	93	99	100	97	100	WHO[c]
DEV	Belgium	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
LAC	Belize	91	95	99	100	100	100	Estimate	73	82	85	86	76	97	WHO[c]
SSA	Benin	22	25	28	38	15	68	2012 DHS[b]	2	6	6	6	2	11	WHO[c]
DEV	Bermuda	100	100	100	100	100	100	Assumption							
SA	Bhutan	66	68	72	76	53	100	Estimate	23	44	60	63	49	98	WHO[c]
LAC	Bolivia, Plurinational State of	67	66	80	91	73	99	2012 SEDLAC	51	65	74	76	39	95	WHO[c]
DEV	Bosnia and Herzegovina	94	99	100	100	100	100	Assumption	52	50	43	42	24	69	WHO[c]
SSA	Botswana	37	40	43	53	24	71	2011 Census	37	51	61	62	39	90	WHO[c]
LAC	Brazil	93	97	98	100	97	100	2012 SEDLAC	77	87	93	94	66	96	WHO[c]
SEA	Brunei Darussalam	66	69	73	76	67	79	Estimate	100	100	100	100	100	100	Assumption
DEV	Bulgaria	100	100	100	100	100	100	Assumption	70	81	87	89	100	100	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SSA	Burkina Faso	6	7	13	13	1	49	2010 DHS[b]	2	4	5	5	2	20	WHO[c]
SSA	Burundi	0	4	5	7	1	59	2012 DHS[b]	2	2	2	2	2	2	WHO[c]
SEA	Cambodia	19	17	31	31	19	91	2010 DHS[b]	2	6	11	11	4	49	WHO[c]
SSA	Cameroon	29	46	49	54	19	88	2011 DHS[b]	14	20	22	22	4	41	WHO[c]
DEV	Canada	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SSA	Cape Verde	58	59	67	71	47	84	Estimate	46	59	67	69	33	88	WHO[c]
LAC	Cayman Islands	81	85	88	91	80	91	Estimate							
SSA	Central African Republic	3	6	10	11	8	15	2010 MICS	2	2	3	3	2	3	WHO[c]
SSA	Chad	0	2	4	6	3	18	2011 MICS	2	5	5	5	2	10	WHO[c]
DEV	Channel Islands	100	100	100	100	100	100	Assumption							
LAC	Chile	95	99	99	100	98	100	2011 SEDLAC	77	87	92	93	55	97	WHO[c]
EA	China	94	98	100	100	100	100	Estimate	35	47	54	55	17	84	WHO[c]
EA	China, Hong Kong SAR	100	100	100	100	100	100	Estimate							
EA	China, Macau SAR	81	84	88	91	72	91	Estimate							
LAC	Colombia	92	97	97	97	88	100	2012 GEIH-National	72	81	85	86	50	98	WHO[c]
SSA	Comoros	42	45	52	69	61	85	2012 DHS[b]	13	21	25	26	10	54	WHO[c]
SSA	Congo	24	21	37	42	12	59	2012 DHS[b]	3	15	23	25	5	36	WHO[c]
SSA	Congo, Dem. Rep. of the	6	7	15	16	6	36	2012 Census	2	3	5	5	2	11	WHO[c]
LAC	Costa Rica	91	98	98	100	99	100	2012 ENAHO	76	87	93	94	81	98	WHO[c]
SSA	Cote d'Ivoire	37	51	59	56	29	88	2012 DHS[b]	12	18	19	19	2	35	WHO[c]
DEV	Croatia	100	100	100	100	100	100	Assumption	74	85	91	92	81	95	WHO[c]
LAC	Cuba	93	97	100	100	95	100	Estimate	82	89	93	93	88	96	WHO[c]
LAC	Curacao	81	85	88	91	80	91	Estimate							
DEV	Cyprus	96	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Czech Republic	100	100	100	100	100	100	Assumption	84	95	100	100	100	100	WHO[c]
DEV	Denmark	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SSA	Djibouti	43	46	50	53	13	65	Estimate	79	84	84	84	23	84	WHO[c]
LAC	Dominica	84	88	92	93	80	99	Estimate	60	78	91	94	100	100	WHO[c]
LAC	Dominican Republic	78	90	98	98	97	99	Estimate	68	81	89	91	77	96	WHO[c]
SEA	East Timor	32	34	38	42	27	78	Estimate	5	8	7	7	2	21	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
LAC	Ecuador	89	94	97	97	92	100	2012 ENEMDU	75	87	95	96	85	100	WHO[c]
NA	Egypt	96	98	100	100	100	100	Estimate	88	97	100	100	100	100	WHO[c]
LAC	El Salvador	77	87	92	94	86	98	2012 Census	42	62	76	79	51	93	WHO[c]
SSA	Equatorial Guinea	57	61	65	66	43	93	2011 DHS[b]	28	43	53	55	25	91	WHO[c]
SSA	Eritrea	23	32	33	36	12	100	Estimate	16	28	35	36	13	66	WHO[c]
DEV	Estonia	100	100	100	100	100	100	Assumption	72	82	87	88	70	95	WHO[c]
SSA	Ethiopia	10	13	23	27	8	100	Estimate	4	6	3	2	2	18	WHO[c]
DEV	Faeroe Islands	100	100	100	100	100	100	Assumption							
Oceania	Fiji	49	53	56	59	45	72	Estimate	45	54	59	60	30	85	WHO[c]
DEV	Finland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	France	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
Oceania	French Polynesia	49	53	56	59	45	72	Estimate							
SSA	Gabon	73	74	82	89	45	98	2012 DHS[b]	45	63	76	79	31	89	WHO[c]
SSA	Gambia	18	34	31	35	26	41	Estimate	2	4	5	5	2	6	WHO[c]
CCA	Georgia	97	100	100	100	100	100	Estimate	44	51	53	54	16	87	WHO[c]
DEV	Germany	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SSA	Ghana	31	45	61	64	41	85	2010 MICS	2	8	15	17	4	29	WHO[c]
DEV	Greece	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Greenland	100	100	100	100	100	100	Assumption							
LAC	Grenada	81	85	88	91	80	100	Estimate	72	89	100	100	100	99	WHO[c]
Oceania	Guam	49	53	56	59	45	60	Estimate							
LAC	Guatemala	72	78	78	79	72	85	2011 ENCOVI	38	40	37	37	10	71	WHO[c]
SSA	Guinea	14	16	20	26	3	74	2012 DHS[b]	2	2	2	2	2	3	WHO[c]
SSA	Guinea-Bissau	51	54	57	61	21	100	Estimate	2	2	2	2	2	4	WHO[c]
LAC	Guyana	72	75	77	79	75	91	Estimate	74	86	92	93	91	99	WHO[c]
LAC	Haiti	31	31	34	38	15	72	2012 DHS[b]	3	8	8	8	4	16	WHO[c]
LAC	Honduras	64	67	80	82	66	97	2011 INE	34	43	48	49	17	79	WHO[c]
DEV	Hungary	100	100	100	100	100	100	Assumption	70	81	87	89	100	100	WHO[c]
DEV	Iceland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SA	India	51	62	75	79	70	98	2012 NSS	22	31	35	36	12	72	WHO[c]
SEA	Indonesia	67	88	94	96	93	99	2012 DHS[b]	23	42	56	59	29	82	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SA	Iran, Islamic Republic of	94	98	98	100	97	100	Estimate	88	96	100	100	100	100	WHO[c]
WA	Iraq	92	94	98	100	97	100	Estimate	87	95	98	99	95	100	WHO[c]
DEV	Ireland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Isle of Man	100	100	100	100	100	100	Assumption							
DEV	Israel	96	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Italy	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
LAC	Jamaica	85	86	92	93	87	98	Estimate	62	76	86	88	77	94	WHO[c]
DEV	Japan	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
WA	Jordan	95	100	99	100	99	100	2012 DHS[b]	88	97	100	100	100	100	WHO[c]
CCA	Kazakhstan	94	97	100	100	100	100	Estimate	72	83	89	90	80	97	WHO[c]
SSA	Kenya	11	15	23	23	7	58	2010 DHS[b]	19	20	17	16	3	49	WHO[c]
Oceania	Kiribati	49	53	56	59	45	77	Estimate	34	46	53	54	100	100	WHO[c]
EA	Korea, Dem. People's Rep. of	20	22	26	30	13	41	Estimate	2	6	8	8	3	11	WHO[c]
EA	Korea, Republic of	94	98	100	100	100	100	Estimate	81	100	100	100	100	100	WHO[c]
DEV	Kosovo	100	100	100	100	100	100	Assumption							
WA	Kuwait	87	91	94	98	93	98	Estimate	100	100	100	100	100	100	Assumption
CCA	Kyrgyzstan	97	100	100	100	100	100	2012 DHS[b]							WHO[c]
SEA	Lao People's Dem. Rep.	52	46	66	70	55	98	2011 agriculture survey	3	5	3	2	2	11	WHO[c]
DEV	Latvia	100	100	100	100	100	100	Assumption	78	88	93	94	78	99	WHO[c]
WA	Lebanon	93	95	100	100	100	100	Estimate	93	100	100	100	100	100	Assumption
SSA	Lesotho	6	5	17	21	10	47	Estimate	36	39	38	38	19	93	WHO[c]
SSA	Liberia	0	1	4	10	1	19	2013 DHS[b]	2	2	2	2	2	2	WHO[c]
NA	Libya	97	100	100	100	100	100	Estimate	90	99	100	100	100	100	Assumption
DEV	Liechtenstein	100	100	100	100	100	100	Assumption							
DEV	Lithuania	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Luxembourg	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Macedonia, Former Yugoslav Rep. of	93	95	99	100	100	100	Assumption	53	62	66	67	43	84	WHO[c]
SSA	Madagascar	9	11	14	15	8	61	2013 DHS[b]	2	2	2	2	2	2	WHO[c]
SSA	Malawi	3	5	9	10	2	37	2012 DHS[b]	2	2	3	3	2	11	WHO[c]
SEA	Malaysia	93	96	99	100	100	100	Estimate	82	94	100	100	100	98	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SA	Maldives	94	96	100	100	100	100	Estimate	42	68	88	92	95	98	WHO[c]
SSA	Mali	12	17	17	26	12	50	2012 DHS[b]	2	2	2	2	2	3	WHO[c]
DEV	Malta	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
Oceania	Marshall Islands	49	53	56	59	45	65	Estimate	74	74	69	68	8	92	WHO[c]
SSA	Mauritania	12	15	18	22	4	46	Estimate	18	32	40	42	20	66	WHO[c]
SSA	Mauritius	97	99	100	100	100	100	Estimate	83	93	98	99	99	98	WHO[c]
LAC	Mexico	96	98	99	99	97	100	2012 SEDLAC	76	83	85	85	53	95	WHO[c]
Oceania	Micronesia, Federated States of	49	53	56	59	45	100	Estimate	43	53	57	58	100	100	WHO[c]
DEV	Moldova, Republic of	92	95	99	100	100	100	Assumption	73	84	90	91	86	100	WHO[c]
DEV	Monaco	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
EA	Mongolia	80	83	86	90	70	99	Estimate	15	27	35	37	10	54	WHO[c]
DEV	Montenegro	100	100	100	100	100	100	Assumption	60	63	62	62	47	84	WHO[c]
NA	Morocco	49	71	99	100	100	100	Estimate	81	91	96	97	85	100	WHO[c]
SSA	Mozambique	6	7	15	20	5	55	2011 DHS[b]	2	2	4	4	2	10	WHO[c]
SEA	Myanmar	43	47	49	52	31	95	Estimate	2	5	7	7	2	19	WHO[c]
SSA	Namibia	26	37	44	47	17	94	Estimate	26	37	44	45	15	83	WHO[c]
SA	Nepal	70	73	76	76	72	97	2011 DHS[b]	22	24	21	20	14	70	WHO[c]
DEV	Netherlands	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
Oceania	New Caledonia	49	53	56	59	45	68	Estimate							
DEV	New Zealand	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
LAC	Nicaragua	71	72	73	78	43	100	2009 SEDLAC	24	37	45	46	9	72	WHO[c]
SSA	Niger	6	7	9	14	5	62	2012 DHS[b]	2	2	3	3	2	7	WHO[c]
SSA	Nigeria	42	45	48	56	34	84	2013 DHS[b]	23	26	25	25	11	55	WHO[c]
DEV	Norway	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
WA	Oman	87	91	94	98	93	99	Estimate	100	100	100	100	100	100	Assumption
SA	Pakistan	60	80	91	94	91	100	2013 DHS[b]	7	25	38	41	14	84	WHO[c]
Oceania	Palau	49	53	56	59	45	62	Estimate	92	98	98	98	100	100	WHO[c]
LAC	Panama	81	85	88	91	80	94	Estimate	73	81	84	85	70	98	WHO[c]
Oceania	Papua New Guinea	8	11	15	18	10	72	Estimate	4	19	30	32	13	71	WHO[c]
LAC	Paraguay	86	93	97	98	96	99	2011 Census	35	48	56	58	30	78	WHO[c]
LAC	Peru	69	73	85	91	73	98	2012 DHS[b]	38	53	63	65	14	89	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SEA	Philippines	65	71	83	88	82	94	2013 DHS[b]	42	47	46	46	22	64	WHO[c]
DEV	Poland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Portugal	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
LAC	Puerto Rico	81	85	88	91	80	91	Estimate							
WA	Qatar	87	91	94	98	93	98	Estimate	90	98	100	100	100	100	Assumption
DEV	Romania	100	100	100	100	100	100	Assumption	63	73	78	79	56	96	WHO[c]
DEV	Russian Federation	100	100	100	100	100	100	Assumption	82	93	98	99	91	99	WHO[c]
SSA	Rwanda	2	6	11	18	8	62	2012 Census	2	2	2	2	2	2	WHO[c]
LAC	Saint Lucia	81	85	88	91	80	100	Estimate	65	83	97	99	97	96	WHO[c]
Oceania	Samoa	80	89	100	100	93	100	Estimate	36	40	39	38	23	71	WHO[c]
DEV	San Marino	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
SSA	Sao Tome and Principe	50	53	57	60	47	68	Estimate	8	20	27	29	16	42	WHO[c]
WA	Saudi Arabia	87	91	94	98	93	99	Estimate	92	99	100	100	100	100	Assumption
SSA	Senegal	26	37	57	57	27	88	Estimate	32	38	39	39	8	69	WHO[c]
DEV	Serbia	100	100	100	100	100	100	Assumption	49	61	67	69	46	87	WHO[c]
SSA	Seychelles	97	99	100	100	17	100	Estimate	78	91	99	100	100	100	Assumption
SSA	Sierra Leone	6	9	12	14	1	47	2013 DHS[b]	6	6	2	2	2	2	WHO[c]
SEA	Singapore	100	100	100	100	99	100	Estimate	100	100	100	100	100	100	Assumption
DEV	Slovak Republic	100	100	100	100	100	100	Assumption	83	94	100	100	100	99	WHO[c]
DEV	Slovenia	100	100	100	100	100	100	Assumption	78	89	95	96	100	100	WHO[c]
Oceania	Solomon Islands	13	16	19	23	13	62	Estimate	9	12	9	9	5	44	WHO[c]
SSA	Somalia	22	26	29	33	17	58	Estimate	2	2	4	5	4	5	WHO[c]
SSA	South Africa	65	66	83	85	67	97	Estimate	60	75	85	87	67	96	WHO[c]
SSA	South Sudan	0	0	2	5	3	12	2012 Census	2	2	2	2	2	2	WHO[c]
DEV	Spain	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	WHO[c]
SA	Sri Lanka	78	81	85	89	86	100	Estimate	12	21	25	26	15	66	WHO[c]
LAC	St. Kitts and Nevis	81	85	88	91	80	100	Estimate	100	100	100	100	100	100	Assumption
LAC	St. Martin (French part)	81	85	88	91	80	92	Estimate							
LAC	St. Vincent and the Grenadines	67	71	75	76	32	100	Estimate	48	78	100	100	100	100	Assumption
SSA	Sudan	23	25	29	33	18	62	Estimate	2	8	25	28	16	42	WHO[c]
LAC	Suriname	95	100	100	100	100	100	Estimate	70	81	87	89	75	94	WHO[c]

		Access to electricity (% of population)							Access to non-solid fuel (% of population)						
		Total				Rural	Urban		Total				Rural	Urban	
Region	Country	1990	2000	2010	2012	2012	2012	Latest available source[a]	1990	2000	2010	2012	2012	2012	Latest available source[a]
SSA	Swaziland	29	32	35	42	24	100	2010 MICS	26	34	38	38	20	87	WHO[c]
DEV	Sweden	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	Switzerland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
WA	Syrian Arab Republic	85	87	93	96	81	100	Estimate	85	96	100	100	100	100	WHO[c]
CCA	Tajikistan	95	99	100	100	100	100	2012 DHS[b]	21	45	65	69	58	95	WHO[c]
SSA	Tanzania, United Republic of	7	9	15	15	4	46	Estimate	2	5	4	4	2	15	WHO[c]
SEA	Thailand	80	83	100	100	100	100	Estimate	35	56	73	76	62	86	WHO[c]
SSA	Togo	10	17	28	31	9	68	2010 MICS	2	2	4	5	2	9	WHO[c]
Oceania	Tonga	80	86	92	96	83	100	Estimate	27	43	53	55	54	91	WHO[c]
LAC	Trinidad and Tobago	91	95	99	100	99	100	Estimate	88	97	100	100	100	100	Assumption
NA	Tunisia	93	95	100	100	100	100	Estimate	84	94	100	100	100	100	WHO[c]
WA	Turkey	100	100	100	100	100	100	Estimate	80	90	95	96	100	100	WHO[c]
CCA	Turkmenistan	95	100	100	100	100	100	Estimate	89	98	100	100	100	100	WHO[c]
LAC	Turks and Caicos Islands	81	85	88	91	80	92	Estimate							
Oceania	Tuvalu	35	37	41	45	32	57	Estimate	38	61	79	82	100	100	WHO[c]
SSA	Uganda	7	9	15	18	8	71	Estimate	2	3	3	3	2	10	WHO[c]
DEV	Ukraine	93	96	100	100	100	100	Assumption	81	91	95	96	89	99	WHO[c]
WA	United Arab Emirates	87	91	94	98	93	99	Estimate	86	97	100	100	100	100	WHO[c]
DEV	United Kingdom of Great Britain and Northern Ireland	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
DEV	United States of America	100	100	100	100	100	100	Assumption	100	100	100	100	100	100	Assumption
LAC	Uruguay	96	97	99	100	95	100	2012 Census	90	97	99	99	81	100	WHO[c]
CCA	Uzbekistan	97	100	100	100	100	100	Estimate	70	81	87	88	79	100	WHO[c]
Oceania	Vanuatu	18	19	24	27	18	55	Estimate	16	18	16	15	5	47	WHO[c]
LAC	Venezuela, Bolivarian Republic of	98	99	100	100	100	100	Estimate	93	96	94	94	78	98	WHO[c]
SEA	Vietnam	88	89	96	99	98	100	2011 MICS	2	25	47	51	36	82	WHO[c]
LAC	Virgin Islands (U.S.)	81	85	88	91	80	91	Estimate							
WA	West Bank and Gaza	87	91	94	98	93	99	Estimate							
WA	Yemen	38	41	45	48	33	79	Estimate	52	62	67	68	52	100	WHO[c]
SSA	Zambia	13	17	19	22	6	47	Estimate	4	13	17	17	3	42	WHO[c]
SSA	Zimbabwe	28	34	37	40	16	78	Estimate	33	34	30	30	6	84	WHO[c]

Aggregated by income level

	Access to electricity (% of population)						Access to non-solid fuel (% of population)					
	Total				Rural	Urban	Total				Rural	Urban
	1990	2000	2010	2012	2012	2012	1990	2000	2010	2012	2012	2012
High income: non-OECD	90	93	95	97	92	98	91	97	99	99	94	100
High income: OECD	100	100	100	100	100	100	98	100	100	100	100	100
Low income	20	24	32	34	21	66	6	9	9	9	4	22
Lower middle income	58	68	77	81	72	95	27	38	43	45	21	80
Upper middle income	93	96	98	99	98	99	52	63	70	71	35	94

Aggregated by region

		Access to electricity (% of population)						Access to non-solid fuel (% of population)					
		Total				Rural	Urban	Total				Rural	Urban
		1990	2000	2010	2012	2012	2012	1990	2000	2010	2012	2012	2012
CCA	Caucasus and Central Asia	95	99	100	100	100	100	59	74	83	85	74	98
DEV	Developed countries	100	100	100	100	100	100	94	97	98	99	95	100
EA	Eastern Asia	93	97	98	99	99	99	36	48	54	56	17	89
LAC	Latin America and Caribbean	89	93	95	96	87	99	71	80	85	86	52	94
NA	Northern Africa	85	92	99	100	100	100	86	95	99	99	97	100
Oceania	Oceania	21	23	25	29	17	71	13	25	32	34	16	83
SA	Southern Asia	52	63	75	79	70	97	22	31	36	36	13	83
SEA	Southeastern Asia	70	80	88	90	83	98	25	40	52	54	31	81
SSA	Sub-Saharan Africa	23	26	32	35	15	69	13	17	18	18	7	37
WA	Western Asia	89	89	91	93	80	98	82	90	94	95	87	98
World	World	76	79	83	85	72	96	48	55	58	59	27	87

Note: DEV is developed countries. CCA is Caucasus and Central Asia. EA is Eastern Asia. LAC is Latin America and Caribbean. NA is Northern Africa. SA is Southern Asia. SEA is Southeastern Asia. SSA is Sub-Saharan Africa. WA is Western Asia. DHS is Demographic and Health Survey. ENAHO is Encuesta Nacional de Hogares (National Household Survey). ENCOVI is Encuesta Nacional de Condiciones de Vida (National Survey of Quality of Life). ENEMDU is Encuesta de Empleo, Desempleo y Subempleo (National Survey on Employment, Unemployment and Underemployment). GEIH is Gran Encuesta Integrada de Hogares (Large Integrated Household Survey). INE is Instituto Nacional de Estadística Survey (National Statistical Office Survey). MICS is Multiple Indicators Cluster Survey. NSS is National Sample Survey. SEDLAC is Socio-Economic Database for Latin America and the Caribbean.

a. Provides the name and date of the latest household survey from which the figure is taken, indicates that the figure is an estimate based on the statistical model described in annex 2 or chapter 2, or indicates that the figure is based on the assumption of universal access in countries classified by the United Nations as developed.

b. Demographic and Health Surveys report data on percentage of households with access to electricity rather than percentage of population.

c. Data are from the WHO Global Health Observatory at http://apps.who.int/gho/data/node.main.134?lang=en (accessed 15 January 2015).

DATA ANNEX: ENERGY EFFICIENCY

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Afghanistan[c]	UN/WDI	—	10.2	—	17.92	—	3.1	4.6	3.1	8.5	11.43	23.40	–85	–253
Albania	IEA/WDI	–5.37	–3.25	–4.32	–2.94	7.7	3.2	3.0	–1.0	0.6	–3.41	–2.41	230	47
Algeria	IEA/WDI	0.29	0.06	0.18	4.28	3.5	3.6	3.9	–0.5	5.1	1.23	4.22	573	151
Angola	IEA/WDI	1.68	–4.68	–1.55	–1.86	5.6	4.1	4.0	–0.3	–0.2	–1.42	–1.18	340	12
Antigua and Barbuda	UN/WDI	–5.99	2.64	–1.77	0.34	6.9	4.8	4.9	0.7	2.3	0.72	0.30	6	–2
Argentina	IEA/WDI	–1.53	–1.28	–1.41	–3.57	5.5	4.1	3.9	–1.4	–0.6	–1.04	–2.32	5,129	2,282
Armenia	IEA/WDI	–9.09	–5.40	–7.27	3.24	24.4	5.4	5.7	–7.7	5.3	–7.79	1.69	3,343	574
Aruba	UN/WDI	n.a.	n.a.	n.a.	n.a.	11.6	126.5	127.4	7.7	1.4	8.94	1.30	–22	–2
Australia	IEA/WDI	–1.01	–1.73	–1.37	–0.57	7.4	5.6	5.6	–1.3	–1.1	–1.59	–0.79	9,710	2,319
Austria	IEA/WDI	–1.25	0.30	–0.48	–3.29	4.5	4.1	3.8	0.0	–3.3	–0.19	–3.57	502	177
Azerbaijan	IEA/WDI	–1.65	–12.78	–7.38	7.50	15.6	3.4	3.9	–5.3	4.8	–8.47	4.61	5,939	2,022
Bahamas	UN/WDI	–6.36	3.00	–1.79	–10.57	7.4	5.2	4.1	4.2	0.1	7.53	1.29	–25	–2
Bahrain	IEA/WDI	–1.21	–0.72	–0.97	–2.09	12.5	10.3	9.8	–0.8	–2.0	0.53	–2.78	476	80
Bangladesh	IEA/WDI	–1.08	–0.49	–0.79	–2.19	4.7	4.0	3.8	0.5	0.4	–1.18	–1.62	–275	–234
Barbados[c]	UN/WDI	–5.14	1.91	–1.68	1.23	8.0	5.7	5.8	–0.6	–3.4	0.39	–3.04	25	6
Belarus	IEA/WDI	–4.84	–5.84	–5.34	1.64	23.1	7.7	8.0	–3.8	–2.6	–4.79	–2.00	8,682	2,584
Belgium	IEA/WDI	–0.27	–1.05	–0.66	–4.63	6.7	5.9	5.3	–0.4	–2.8	–0.87	–1.50	637	407
Belize	UN/WDI	–0.04	–5.64	–2.88	0.03	9.0	5.0	5.0	0.8	–3.2	0.76	–1.26	–26	–4
Benin	IEA/WDI	–2.62	2.30	–0.19	–0.90	10.2	9.8	9.7	3.1	0.2	–0.11	–0.63	–517	–138
Bermuda	UN/WDI	–3.59	–1.61	–2.61	–2.98	4.2	2.5	2.3	3.2	–3.5	6.84	–4.94	–15	–1
Bhutan	UN/WDI	–3.11	–5.41	–4.27	–3.03	30.0	12.6	11.8	5.5	0.9	0.91	–3.16	–452	–74
Bolivia, Plurinational State of	IEA/WDI	4.37	–1.20	1.55	1.33	4.3	5.9	6.0	0.8	–0.1	1.33	–1.07	–286	–107
Bosnia and Herzegovina[c]	IEA/WDI	–16.55	–0.05	–8.67	1.44	47.3	7.7	7.9	–5.9	–1.3	–10.28	–0.42	7,180	1,144
Botswana	IEA/WDI	–0.96	–1.72	–1.34	–5.37	4.6	3.5	3.1	–1.3	2.7	–0.23	–3.61	174	44
Brazil	IEA/WDI	0.40	–0.06	0.17	1.04	3.9	4.1	4.1	0.5	1.8	0.19	1.62	–9,559	–2,279
British Virgin Islands	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Brunei Darussalam	IEA/WDI	1.02	1.73	1.37	6.85	3.7	4.8	5.5	1.8	–1.6	2.83	4.34	–113	–48
Bulgaria	IEA/WDI	–2.87	–4.34	–3.60	0.04	13.9	6.7	6.7	–5.7	0.8	–4.36	1.01	10,781	1,867
Burkina Faso	UN/WDI	–7.01	0.76	–3.20	–2.36	14.1	7.4	7.0	–1.5	2.0	–3.45	–1.66	401	85

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Burundi	UN/WDI	0.86	1.44	1.15	–2.05	10.8	13.5	13.0	6.8	–0.3	8.53	–2.12	–813	–123
Cambodia[d]	IEA/WDI	–2.97	–3.76	–3.36	–2.55	—	5.8	5.5	–1.3	1.2	–4.20	–1.71	463	60
Cameroon	IEA/WDI	1.01	–2.27	–0.64	–4.04	6.5	5.7	5.3	–2.1	–0.3	–1.27	–1.63	800	292
Canada	IEA/WDI	–0.94	–1.88	–1.41	–2.11	10.1	7.6	7.3	–1.0	–1.1	–1.33	–0.56	17,499	4,142
Cape Verde	UN/WDI	–4.38	–1.01	–2.71	11.77	4.8	2.8	3.5	1.8	21.7	–3.36	18.02	–11	–6
Cayman Islands	UN/WDI	0.00	1.63	0.81	2.13	3.1	3.7	3.8	0.6	2.2	0.63	2.40	6	–1
Central African Republic	UN/WDI	–4.11	–2.28	–3.20	–0.42	13.8	7.2	7.2	–7.7	–7.5	–5.31	–4.85	417	111
Chad	UN/WDI	0.22	–7.39	–3.66	–2.26	7.9	3.7	3.6	n.a.	–1.6	3.24	–2.69	–670	–78
Chile	IEA/WDI	–0.34	–1.73	–1.04	4.01	4.8	3.9	4.2	–0.2	–0.7	–0.95	–2.45	306	114
China	IEA/WDI	–6.40	–2.17	–4.31	–1.33	20.7	8.6	8.3	–3.5	–1.7	–5.49	–2.73	671,451	196,036
China, Hong Kong SAR	IEA/WDI	0.62	–3.52	–1.47	–1.31	2.4	1.7	1.7	–0.3	–1.3	–1.58	–0.51	–897	14
China, Macao SAR	UN/WDI	1.98	–8.87	–3.59	–14.08	1.3	0.6	0.5	–1.8	–8.8	–2.86	–9.39	–3	2
Colombia	IEA/WDI	–1.97	–2.08	–2.02	–4.46	3.9	2.6	2.4	–2.0	2.1	–2.50	1.00	3,565	953
Comoros	UN/WDI	2.46	1.25	1.86	3.29	4.0	5.8	6.1	0.1	2.9	3.55	4.01	1	0
Congo	IEA/WDI	–0.93	1.76	0.41	2.29	2.6	2.8	2.9	–0.4	–1.7	0.02	1.84	102	3
Congo, Dem. Rep. of the	IEA/WDI	7.70	–1.01	3.26	–4.94	11.2	21.2	19.1	0.9	–1.6	3.62	–5.03	–1,980	–251
Cook Islands	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Costa Rica	IEA/WDI	0.28	0.55	0.42	–3.77	3.1	3.4	3.1	–1.8	–5.5	–0.38	–5.31	465	158
Cote d'Ivoire	IEA/WDI	2.16	2.88	2.52	9.56	4.9	8.1	9.7	0.6	8.1	1.70	8.27	–109	–124
Croatia	IEA/WDI	0.08	–1.46	–0.69	–2.83	4.8	4.1	3.9	–0.4	–1.8	–0.09	–2.63	17	57
Cuba	IEA/WDI	–1.68	–6.05	–3.89	–3.33	5.2	2.3	2.2	–4.6	0.0	–5.85	–1.33	3,181	758
Cyprus	IEA/WDI	0.40	–1.46	–0.54	–3.55	4.3	3.9	3.6	–0.3	–2.9	–0.17	–3.89	3	20
Czech Republic	IEA/WDI	–2.39	–2.47	–2.43	–2.48	10.9	6.7	6.4	–2.0	–2.7	–3.09	–2.97	4,326	1,310
Denmark	IEA/WDI	–1.84	–0.15	–1.00	–5.97	4.3	3.5	3.1	–0.5	–4.4	–0.88	–4.71	1,077	239
Djibouti[c]	UN/WDI	3.04	–0.50	1.26	–24.66	4.8	6.1	3.5	1.1	–1.7	2.15	–3.04	–21	–2
Dominica	UN/WDI	4.61	–0.41	2.07	–0.83	2.2	3.3	3.2	3.3	0.4	3.37	1.18	–7	–1
Dominican Republic	IEA/WDI	–0.28	–4.76	–2.54	–1.10	4.8	2.9	2.8	–2.4	1.4	–1.47	–0.53	622	290
Ecuador	IEA/WDI	1.32	0.21	0.76	–2.57	3.6	4.1	3.9	–0.7	–1.7	–0.13	–1.50	623	179
Egypt	IEA/WDI	–1.89	1.10	–0.41	1.62	4.0	3.7	3.8	–0.5	–0.5	–0.53	0.72	2,920	602
El Salvador	IEA/WDI	0.24	–1.25	–0.51	–0.19	4.3	3.9	3.9	–1.9	0.0	–1.94	0.19	216	102
Equatorial Guinea	UN/WDI	–18.50	10.19	–5.23	4.74	15.4	5.3	5.8	0.5	4.7	–14.63	–0.63	41	20

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Eritrea[d]	IEA/WDI	n.a.	–0.37	n.a.	–4.08	—	5.0	4.6	–3.7	–0.6	–4.30	–3.89	152	36
Estonia[c]	IEA/WDI	–6.77	–1.67	–4.25	–7.14	19.9	8.3	7.2	–3.5	–5.5	–4.79	–6.88	2,421	435
Ethiopia	IEA/WDI	0.46	–4.65	–2.13	–4.34	28.6	18.6	17.0	1.0	1.3	–2.43	–5.29	–3,776	–460
Falkland Islands (Malvinas)	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Fiji	UN/WDI	0.02	–0.49	–0.23	–4.16	4.2	4.0	3.7	0.4	–1.1	0.69	–1.79	21	–1
Finland	IEA/WDI	–0.75	–0.48	–0.62	–5.34	8.5	7.6	6.8	–1.1	–1.3	–0.91	–3.07	2,475	595
France	IEA/WDI	–0.77	–0.75	–0.76	–2.69	5.5	4.7	4.5	–1.3	–2.3	–0.78	–3.53	18,194	4,723
French Guiana	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
French Polynesia	UN/WDI	n.a.	n.a.	n.a.	n.a.	—	—	—	1.7	–0.1	n.a.	n.a.	–16	–3
Gabon	IEA/WDI	0.54	1.67	1.10	–3.80	2.7	3.4	3.1	1.1	–1.4	1.09	–4.63	–90	–26
Gambia	UN/WDI	0.01	–0.25	–0.12	–1.27	5.8	5.7	5.5	0.3	–1.4	1.27	–0.07	26	3
Georgia	IEA/WDI	–4.73	–5.07	–4.90	2.23	13.5	4.9	5.2	–3.4	4.4	–4.30	2.49	1,543	316
Germany	IEA/WDI	–2.32	–1.22	–1.77	–4.23	6.0	4.2	3.9	–1.6	–3.7	–1.68	–3.84	42,472	8,838
Ghana	IEA/WDI	–0.55	–3.67	–2.12	–6.51	8.0	5.2	4.6	–2.3	–4.1	–3.09	–5.53	895	271
Gibraltar	IEA/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.0	0.0	n.a.	n.a.	n.a.	n.a.
Greece	IEA/WDI	0.02	–1.81	–0.90	5.49	4.3	3.6	4.0	–1.0	4.3	–0.74	1.66	2,449	302
Grenada	UN/WDI	2.31	1.73	2.02	–0.05	2.7	4.1	4.1	1.5	0.2	1.94	–1.69	–4	–1
Guadeloupe	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Guatemala	IEA/WDI	0.64	0.42	0.53	0.63	3.9	4.3	4.4	–0.6	–1.8	–0.01	–2.25	455	85
Guinea	UN/WDI	–2.19	–0.77	–1.49	–1.76	16.7	12.3	11.9	–1.5	0.5	–1.46	–1.49	540	95
Guinea-Bissau	UN/WDI	0.79	–0.25	0.27	–0.24	14.4	15.2	15.1	–1.7	–0.5	0.53	–0.34	56	17
Guyana	UN/WDI	–1.76	–1.42	–1.59	0.77	10.9	7.9	8.0	–0.3	1.3	–1.58	1.29	92	25
Haiti[c]	IEA/WDI	n.a.	6.46	n.a.	–0.62	—	10.6	10.5	2.1	–1.9	2.77	–3.45	–380	–75
Honduras	IEA/WDI	–0.94	0.18	–0.38	1.57	6.3	5.9	6.1	–2.0	0.9	–0.96	0.47	785	141
Hungary	IEA/WDI	–1.65	–1.66	–1.66	–4.27	6.8	4.9	4.5	–1.6	–5.6	–1.89	–5.31	3,212	667
Iceland	IEA/WDI	1.44	3.40	2.42	0.91	11.7	18.9	19.3	1.2	–0.9	0.14	–0.24	–81	–35
India	IEA/WDI	–1.75	–2.62	–2.18	–1.18	8.4	5.4	5.3	–1.6	0.3	–3.16	–1.73	72,812	19,706
Indonesia	IEA/WDI	0.43	–2.11	–0.85	–5.06	5.4	4.5	4.1	–1.1	–3.0	–1.27	–3.63	6,997	4,383
Iran, Islamic Rep. of[c]	IEA/WDI	2.10	0.17	1.13	–0.12	5.9	7.4	7.4	0.1	–0.1	1.07	–1.99	–4,516	523
Iraq[c]	IEA/WDI	n.a.	0.48	n.a.	0.08	—	4.0	4.0	1.1	1.9	–4.81	2.34	–2,449	–528
Ireland[c]	IEA/WDI	–3.87	–1.96	–2.92	–4.80	5.6	3.1	2.8	–1.3	–3.1	–2.41	–5.91	1,242	303

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Israel	IEA/WDI	–0.97	–0.94	–0.96	–1.60	5.3	4.3	4.2	–0.2	–5.2	–0.64	–4.67	552	172
Italy	IEA/WDI	–0.02	–0.42	–0.22	–2.54	3.6	3.5	3.3	–0.8	–1.5	–0.27	–1.45	11,426	1,978
Jamaica	IEA/WDI	1.43	–4.10	–1.37	0.86	6.6	5.0	5.1	–1.4	3.1	–1.46	1.56	95	35
Japan	IEA/WDI	0.55	–1.15	–0.30	–5.24	5.0	4.7	4.3	–0.4	–1.7	–0.60	–2.48	1,580	2,796
Jordan	IEA/WDI	–1.04	–2.30	–1.68	0.96	6.1	4.4	4.5	–1.5	1.7	–1.99	1.67	344	135
Kazakhstan	IEA/WDI	–3.51	–1.33	–2.42	–2.05	14.8	9.0	8.7	2.0	–3.8	–4.13	–2.53	–2,946	–732
Kenya	IEA/WDI	0.92	–0.63	0.14	–2.54	9.5	9.7	9.3	–0.4	–1.6	–0.12	–2.88	457	149
Kiribati	UN/WDI	0.85	4.69	2.75	–4.89	3.5	6.0	5.4	n.a.	n.a.	6.01	–5.79	–4	–1
Korea, Dem. People's Rep. of	IEA/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Korea, Republic of	IEA/WDI	0.73	–1.47	–0.38	–0.32	7.5	7.0	6.9	–1.8	–1.3	–1.72	–1.42	15,093	4,987
Kuwait[c]	IEA/WDI	5.46	0.86	n.a.	–2.42	—	5.6	5.3	–0.7	0.7	2.56	–0.08	1,025	374
Kyrgyzstan	IEA/WDI	–7.37	–2.28	–4.86	19.06	20.5	7.6	10.7	–3.3	22.5	–5.55	21.73	720	129
Lao People's Dem. Rep.	UN/WDI	–3.62	–5.80	–4.72	–9.01	8.2	3.1	2.6	–0.6	–0.8	–5.00	–5.87	48	15
Latvia	IEA/WDI	–4.23	–1.66	–2.95	–7.26	9.1	5.0	4.3	–2.5	–6.4	–2.47	–7.56	1,617	293
Lebanon	IEA/WDI	2.78	–3.03	–0.17	3.85	3.9	3.8	4.1	0.6	6.0	–0.10	4.79	–710	14
Lesotho	UN/WDI	0.44	4.89	2.64	–2.81	6.9	11.6	11.0	n.a.	–0.4	18.76	–2.65	–206	–73
Liberia	UN/WDI	–0.22	–2.61	–1.42	–5.09	40.7	30.5	27.5	–3.3	–0.2	–0.09	–4.60	31	37
Libya[c]	IEA/WDI	3.10	–1.67	n.a.	3.70	—	4.7	5.1	–2.7	2.4	n.a.	11.56	1,961	246
Lithuania	IEA/WDI	–4.73	–4.29	–4.51	–2.43	11.5	4.6	4.4	–3.9	–3.7	–3.97	–3.97	3,499	617
Luxembourg	IEA/WDI	–4.95	–0.18	–2.59	–2.35	6.6	3.9	3.7	–2.5	–3.9	–1.96	–2.00	1,337	228
Macedonia, Former Yugoslav Rep. of	IEA/WDI	1.67	–1.75	–0.05	0.27	5.1	5.0	5.1	0.6	–1.4	0.32	–0.42	–279	–19
Madagascar	UN/WDI	2.54	–0.73	0.89	0.76	5.3	6.3	6.4	–2.0	–0.8	0.16	0.24	267	82
Malawi	UN/WDI	–0.42	–2.71	–1.57	–1.42	14.3	10.5	10.2	–1.3	–1.1	–3.03	–1.78	179	31
Malaysia	IEA/WDI	1.18	–0.26	0.45	–1.67	5.0	5.5	5.3	–0.1	–0.3	–0.43	–3.64	–3,312	210
Maldives[c]	UN/WDI	4.38	0.97	2.66	–0.18	2.8	4.7	4.7	n.a.	2.1	5.71	1.09	–18	–5
Mali	UN/WDI	–0.93	–3.66	–2.31	0.75	5.2	3.2	3.3	–0.9	–1.2	–2.77	–0.04	93	39
Malta	IEA/WDI	–5.30	0.68	–2.36	–12.20	4.8	3.0	2.3	–0.4	–1.7	–1.90	–1.90	9	3
Martinique	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mauritania	UN/WDI	–11.74	–1.59	–6.81	28.07	19.5	4.8	7.8	–4.1	0.9	–1.10	–0.58	743	240
Mauritius	UN/WDI	–1.76	–0.61	–1.19	–1.98	8.2	6.5	6.2	–2.8	–1.1	–2.37	–3.10	397	100
Mexico	IEA/WDI	–1.83	0.20	–0.82	–0.61	4.8	4.0	4.0	–0.9	–1.9	–0.95	–2.06	14,604	2,444

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		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Moldova, Republic of	IEA/WDI	–1.98	–3.29	–2.64	–4.75	17.5	10.2	9.3	0.9	–4.5	–2.65	–4.69	–381	–35
Mongolia	IEA/WDI	–3.44	–2.65	–3.04	–6.75	15.2	8.2	7.1	–3.3	1.7	–3.71	–4.38	904	208
Montenegro[d]	IEA/WDI	n.a.	–1.30	n.a.	–5.26	—	5.8	5.2	–1.5	–2.0	–4.18	–4.26	0	0
Montserrat	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Morocco	IEA/WDI	1.37	–0.52	0.42	1.48	3.1	3.4	3.5	–0.1	–1.3	0.60	0.96	–83	44
Mozambique	IEA/WDI	–3.33	–4.19	–3.76	–4.28	42.1	19.5	17.9	–1.3	–6.0	–3.84	–9.01	1,310	381
Myanmar	IEA/WDI	–4.94	–9.96	–7.48	–1.65	15.6	3.3	3.2	–2.0	2.0	–7.26	–0.69	3,194	1,190
Namibia	IEA/WDI	1.08	–0.36	n.a.	–2.60	—	3.5	3.3	1.3	–1.5	0.55	–2.59	–72	–12
Nepal	IEA/WDI	–1.49	–1.52	–1.51	–4.49	10.8	8.0	7.3	–1.7	–2.6	–1.53	–4.49	987	143
Netherlands	IEA/WDI	–2.01	–0.03	–1.02	–2.80	6.0	4.9	4.6	–1.0	–2.4	–1.09	–2.85	4,843	1,284
Netherlands Antilles	IEA/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
New Caledonia	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	–0.1	0.1	n.a.	n.a.	n.a.	n.a.
New Zealand	IEA/WDI	–0.18	–1.84	–1.02	–0.60	6.9	5.6	5.5	–1.3	–0.9	–1.44	–2.20	1,680	340
Nicaragua	IEA/WDI	–1.12	–1.18	–1.15	0.46	6.7	5.3	5.4	–1.5	–2.7	–1.32	–3.37	260	66
Niger	UN/WDI	0.92	–6.00	–2.60	0.60	10.6	6.2	6.3	–1.5	–3.3	–1.45	–4.72	–69	58
Nigeria	IEA/WDI	0.75	–5.06	–2.20	0.95	9.6	6.2	6.3	–0.9	0.4	–2.25	–0.02	2,071	1,585
Norway	IEA/WDI	–1.46	0.69	–0.39	–7.00	4.8	4.5	3.9	–0.5	–4.2	–1.53	–4.70	2,155	363
Oman	IEA/WDI	1.52	6.03	3.75	3.69	3.3	7.0	7.5	n.a.	n.a.	5.83	4.42	–1,517	–987
Pakistan	IEA/WDI	0.16	–1.35	–0.60	–2.51	5.5	4.8	4.6	0.2	–1.3	–0.62	–1.68	–3,027	–145
Palau[c]	UN/WDI	2.14	4.64	3.39	–4.14	—	12.3	11.3	1.3	0.1	2.48	–4.61	0	0
Panama	IEA/WDI	0.50	–2.21	–0.86	–4.26	3.4	2.8	2.6	–1.4	–4.4	–0.92	–4.92	189	108
Papua New Guinea	UN/WDI	–2.87	1.64	–0.64	–7.31	13.9	12.3	10.5	–1.9	–4.0	–2.30	–6.31	730	155
Paraguay	IEA/WDI	–0.12	–1.16	–0.64	0.43	5.1	4.4	4.5	–1.2	–1.2	–0.94	0.33	457	110
Peru	IEA/WDI	–1.61	–0.91	–1.26	0.08	3.6	2.8	2.8	–1.3	–3.2	–1.88	–3.37	2,512	452
Philippines	IEA/WDI	0.49	–4.42	–2.00	–2.58	4.8	3.2	3.1	–2.9	–3.8	–2.73	–4.40	5,036	1,576
Poland	IEA/WDI	–5.04	–2.59	–3.82	–4.42	11.4	5.3	4.8	–3.5	–5.9	–3.09	–5.36	44,701	9,095
Portugal	IEA/WDI	0.90	–1.13	–0.12	–2.39	3.7	3.6	3.4	0.3	–5.1	0.31	–3.93	–1,217	18
Puerto Rico	UN/WDI	1.85	1.80	1.83	–0.28	0.6	0.9	0.9	–0.8	–3.6	2.04	–0.82	–78	–7
Qatar[c]	IEA/WDI	–1.30	–2.66	–1.98	7.18	7.9	5.3	6.1	–1.3	2.8	–1.98	0.21	731	552
Reunion	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Romania	IEA/WDI	–3.63	–4.47	–4.05	–1.47	10.0	4.4	4.2	–4.0	–0.3	–4.47	–0.27	14,740	2,734

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Russian Federation	IEA/WDI	0.46	–3.38	–1.48	–0.14	12.8	9.5	9.5	0.0	–0.9	–2.50	–1.90	–54,550	1,703
Rwanda	UN/WDI	4.14	–1.60	1.23	–12.45	5.7	7.3	5.6	–2.0	–15.4	–0.36	–17.52	–27	64
Saint Kitts and Nevis	UN/WDI	–1.29	4.19	1.41	2.57	3.1	4.0	4.3	2.5	1.7	1.78	1.98	–8	–1
Saint Lucia	UN/WDI	4.20	–0.25	1.95	1.76	2.6	3.9	4.0	1.5	3.9	2.37	1.70	–13	–2
Saint Pierre and Miquelon	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saint Vincent and the Grenadines	UN/WDI	2.97	1.76	2.36	0.75	2.3	3.7	3.7	1.7	0.4	1.98	0.70	–12	–2
Samoa	UN/WDI	–1.27	0.58	–0.35	3.37	5.0	4.7	5.0	–0.1	7.8	19.49	4.26	–3	–1
Sao Tome and Principe[c]	UN/WDI	0.49	–0.91	–0.21	–1.35	6.1	5.8	5.7	1.8	–1.2	0.40	–1.98	–7	–1
Saudi Arabia	IEA/WDI	2.58	1.17	1.88	–3.03	4.3	6.2	5.8	–0.7	–3.4	0.96	–2.41	1,501	2,216
Senegal	IEA/WDI	0.48	0.92	0.70	–0.25	5.1	5.8	5.8	0.2	–0.2	0.83	0.13	35	–6
Serbia	IEA/WDI	2.29	–2.33	–0.05	–3.53	7.7	7.7	7.1	0.8	–6.6	–0.35	–2.10	–1,047	–118
Seychelles	UN/WDI	11.90	0.21	5.89	–10.84	1.8	5.7	4.5	3.2	–6.8	8.63	–17.21	44	6
Sierra Leone	UN/WDI	2.79	–4.98	–1.17	–6.94	11.7	9.2	8.0	–1.5	–3.5	–0.72	–6.82	82	22
Singapore	IEA/WDI	–2.04	–2.53	–2.28	–4.76	4.6	2.9	2.6	–2.8	–2.3	–0.41	–3.89	3,295	871
Slovakia	IEA/WDI	–2.01	–4.53	–3.28	–5.62	11.0	5.7	5.0	–1.2	–2.4	–3.91	–7.68	24	338
Slovenia	IEA/WDI	–0.62	–1.43	–1.03	–0.75	6.5	5.3	5.2	–0.6	–0.4	–0.77	0.04	–94	51
Solomon Islands	UN/WDI	–1.99	–1.99	–1.99	–6.69	10.1	6.8	5.9	–1.9	–2.9	–1.98	–5.53	38	7
Somalia	UN/WDI	n.a.	n.a.	n.a.	n.a.	—	—	—	–2.0	–0.7	n.a.	n.a.	370	66
South Africa	IEA/WDI	0.03	–0.81	–0.39	–3.85	10.9	10.1	9.3	–0.9	–1.2	–1.01	–1.80	5,500	1,295
Spain	IEA/WDI	0.26	–1.55	–0.65	–0.25	4.1	3.6	3.6	0.1	–2.2	–0.19	–3.12	–4,896	1
Sri Lanka	IEA/WDI	–0.96	–3.45	–2.21	0.45	4.1	2.6	2.6	–1.4	–0.1	–2.53	–2.06	590	233
Sudan	IEA/WDI	–3.12	–3.76	–3.44	7.13	9.3	4.6	5.3	–1.1	–2.0	–2.47	6.54	939	273
Suriname	UN/WDI	3.50	–0.23	1.62	–4.30	7.4	10.2	9.4	4.6	–7.0	4.29	–7.64	–376	–39
Swaziland	UN/WDI	6.38	–1.28	2.47	1.10	4.7	7.7	7.8	0.2	0.6	1.48	0.52	–207	–21
Sweden	IEA/WDI	–1.97	–1.44	–1.71	–2.61	7.8	5.6	5.3	–1.8	–3.9	–1.68	–4.36	5,731	1,650
Switzerland	IEA/WDI	–0.82	–1.23	–1.03	–2.51	3.4	2.8	2.6	–0.4	–3.2	–0.77	–3.57	0	287
Syrian Arab Republic	IEA/WDI	–1.58	–1.66	–1.62	–16.50	8.6	6.2	4.3	–1.2	–14.2	–2.66	–14.33	1,433	471
Tajikistan	IEA/WDI	0.61	–7.44	–3.50	–5.02	11.5	5.7	5.1	0.1	–7.3	–3.38	–5.09	–183	21
Thailand	IEA/WDI	1.09	0.62	0.85	0.01	4.9	5.8	5.8	–0.5	3.1	–0.06	0.91	1,575	112
Timor-Leste[d]	UN/WDI	n.a.	n.a.	n.a.	n.a.	—	—	—	0.0	0.0	n.a.	n.a.	n.a.	n.a.
Togo	IEA/WDI	3.02	1.77	2.39	–5.00	10.3	16.6	15.0	1.0	–2.5	2.24	–6.12	–111	–26

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Tonga	UN/WDI	0.20	–0.04	0.08	–7.00	3.5	3.6	3.1	1.4	–8.3	22.74	–10.12	–3	0
Trinidad and Tobago	IEA/WDI	1.88	1.63	1.75	–2.04	15.2	21.6	20.7	0.2	0.1	0.18	0.89	221	–25
Tunisia	IEA/WDI	–0.73	–1.13	–0.93	–2.77	4.6	3.9	3.6	–1.3	–2.5	–0.99	–3.25	621	236
Turkey	IEA/WDI	0.09	–0.53	–0.22	–0.02	3.8	3.6	3.6	–0.3	1.5	–0.49	1.18	1,545	211
Turkmenistan	IEA/WDI	0.77	–3.15	–1.21	–5.93	23.9	18.8	16.6	–1.4	–3.6	–1.76	–4.52	–900	405
Turks and Caicos Islands	UN/WDI	9.66	15.65	12.61	1.38	0.5	5.4	5.6	3.3	0.7	6.34	0.54	n.a.	n.a.
Uganda	UN/WDI	–4.31	–4.72	–4.51	–2.76	24.4	9.7	9.1	–2.0	–0.5	–4.43	–2.80	1,284	422
Ukraine	IEA/WDI	2.03	–4.21	–1.14	–6.26	19.3	15.4	13.5	–0.9	–4.0	–1.62	–3.64	–1,105	2,120
United Arab Emirates	IEA/WDI	0.53	2.16	1.34	0.38	4.1	5.3	5.4	0.7	3.7	0.80	3.20	–151	–626
United Kingdom of Great Britain and Northern Ireland	IEA/WDI	–2.19	–2.61	–2.40	–2.98	6.3	3.9	3.6	–1.4	–3.2	–2.24	–3.69	18,294	4,870
United Republic of Tanzania	IEA/WDI	0.24	–2.62	–1.20	–1.90	16.0	12.6	12.1	–0.1	–0.1	–1.35	–2.27	163	45
United States of America	IEA/WDI	–1.67	–1.86	–1.77	–3.92	8.7	6.1	5.6	–1.6	–4.9	–1.74	–3.60	272,173	61,236
Uruguay	IEA/WDI	–0.17	–0.06	–0.11	0.80	3.2	3.1	3.1	–0.5	–2.3	0.14	–3.51	175	38
Uzbekistan	IEA/WDI	1.11	–8.00	–3.55	–2.22	31.1	15.1	14.4	6.0	3.4	–3.77	–1.03	–16,687	–1,655
Vanuatu	UN/WDI	1.71	0.10	0.90	11.69	3.5	4.2	5.3	n.a.	23.2	8.93	14.62	–8	–1
Venezuela, Bolivarian Rep. of	IEA/WDI	0.53	–0.21	0.16	–3.96	6.4	6.6	6.1	0.2	–4.1	0.73	–5.71	–288	292
Viet Nam	IEA/WDI	–2.52	0.78	–0.88	–0.78	7.5	6.3	6.2	0.3	0.9	–1.57	–0.20	1,280	–16
Western Sahara	UN/WDI	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Yemen	IEA/WDI	0.85	1.84	1.34	–2.38	2.6	3.4	3.2	1.4	–2.0	1.57	0.81	–149	–7
Zambia	IEA/WDI	0.71	–2.62	–0.97	–2.17	11.5	9.4	9.0	–0.4	1.0	–1.14	–1.72	69	42
Zimbabwe	IEA/WDI	–1.00	3.98	1.46	–5.52	14.7	19.6	17.5	–0.8	–0.9	1.75	–5.34	899	130

Aggregated by region

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
Northern America	IEA/WDI	–1.61	–1.86	–1.73	–3.74	8.8	6.2	5.8	–1.63	–3.19	–1.70	–3.25	289,657	65,378
Europe	IEA/WDI	–1.41	–1.10	–1.26	–2.90	5.4	4.2	4.0	–1.13	–2.33	–1.19	–3.13	120,193	28,741
Eastern Europe	IEA/WDI	–0.93	–3.32	–2.13	–1.38	13.4	8.7	8.5	–1.96	–1.31	–2.80	–2.56	15,691	19,648
Caucasian and Central Asia	IEA/WDI	–0.44	–4.56	–2.52	–1.85	18.7	11.2	10.8	–1.87	–1.40	–3.57	–1.16	–19,997	–1,832
Western Asia	IEA/WDI	–0.51	0.28	–0.12	–0.84	5.1	5.0	4.9	–0.39	–1.77	–1.55	–0.18	13,348	4,962
Eastern Asia	IEA/WDI	–1.94	–0.81	–1.38	–1.13	9.9	7.5	7.3	–2.23	–1.86	–2.44	–2.09	688,128	204,043
South Eastern Asia	IEA/WDI	0.15	–1.55	–0.70	–2.80	5.4	4.7	4.4	–1.31	–3.11	–1.26	–2.17	18,577	8,401
Southern Asia	IEA/WDI	–0.83	–1.94	–1.39	–1.17	7.3	5.5	5.4	–2.62	–2.25	–2.09	–1.88	66,013	19,892
Oceania	IEA/WDI	–0.93	–1.64	–1.29	–0.71	7.4	5.7	5.6	–1.30	–0.75	–1.56	–1.07	12,163	2,816
Latin America and Caribbean	IEA/WDI	–0.57	–0.47	–0.52	–0.82	4.6	4.1	4.1	–0.48	–0.73	–0.58	–1.04	23,003	6,102
Northern Africa	IEA/WDI	–0.39	–0.26	–0.32	2.17	4.1	3.8	4.0	–0.99	2.50	–0.51	2.43	6,931	1,552
Sub-Saharan Africa	IEA/WDI	0.08	–2.57	–1.25	–1.40	10.4	8.1	7.9	–3.41	–3.78	–1.40	–1.52	11,302	4,697
World[e]	IEA/WDI	–1.50	–1.23	–1.36	–1.74	8.0	6.1	5.8	–1.31	–2.11	–1.72	–2.11	1,257,655	366,865

Aggregated by income group

Country	Source[b]	Primary energy intensity improvement, compound annual growth rate (%)				Level of primary energy intensity (megajoules per 2011 PPP $)			Decomposition analysis, compound annual growth rate[a] (%)		Final energy intensity improvement, compound annual growth rate (%)		Cumulative avoided energy consumption (petajoules)	
		1990–2000	2000–10	1990–2010	2010–12	1990	2010	2012	1990–2010	2010–12	1990–2010	2010–12	1991–2010	2011–12
High-income economies	IEA/WDI	–1.30	–1.44	–1.37	–2.58	7.3	5.6	5.3	–0.77	–1.32	–1.56	–2.55	431,864	118,727
Upper-middle-income	IEA/WDI	–2.37	–0.53	–1.45	–0.54	8.8	6.6	6.5	–2.39	–0.86	–2.12	–1.44	739,744	214,997
Lower-middle-income	IEA/WDI	–1.96	–2.62	–2.29	–1.86	8.6	5.4	5.2	–3.21	–2.65	–2.59	–1.63	83,566	31,494
Low-income	IEA/WDI	–0.82	–2.91	–1.87	–1.74	11.7	8.0	7.7	–2.59	–1.98	–1.98	–2.86	2,480	1,648

Source: IEA World Energy Statistics and Balance (2014); UN Energy Statistics (2014); World Development Indicators (2014).

a. The decomposition analysis adopts the logarithmic mean divisia index method I, which is detailed in annex 2 of chapter 5. Values in blue indicate that a country has fewer than 20 years of historical data available, and values in red indicate that a country has fewer than 10 years of historical data available. Caution should be used when comparing CAGRs of decomposition analysis and energy intensity for both sets of countries.

b. The IEA World Energy Statistics and Balances provides country level data for 138 countries that account for more than 99 percent of global energy consumption. The rest of the countries are lumped together in three regional groups and reported in an aggregated manner. To increase the country-level coverage, UN Energy Statistics are used for the 68 countries not reported separately by the IEA. However, a number of differences between the two data sources—namely, the application of different methodologies to estimate the use of primary solid biofuels (biomass) and the fact that the UN data were available only through 2010, at the latest—called for an adjustment of the UN data to allow for a fair comparison of energy intensity levels among countries.

c. GDP data were estimated to fill gaps in time series.

d. First available data were used for countries for which 1990 data were unavailable: Cambodia (1995), Eritrea (1992), Montenegro (2005), and Timor-Leste (2002).

Note: For some countries for which energy data were available but GDP data were not, no energy intensity figure is shown. (Energy intensity is a derivative of both energy consumption and GDP.)

DATA ANNEX: RENEWABLE ENERGY

Country	Source	Share in total final energy consumption (%): Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%): Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Afghanistan	UN[c]	42.4	56.5	19.3	9.7	5.9	0.0	3.7	0.0	0.0	0.0	0.0	0.0	64.6	—	208.6
Albania	IEA	24.9	41.0	37.9	38.2	8.6	2.5	26.5	0.0	0.0	0.6	0.0	0.0	90.3	100.0	78
Algeria	IEA	0.2	0.6	0.3	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.0	1.1	1,178
Angola	IEA	72.3	75.5	54.9	57.2	53.3	1.3	2.6	0.0	0.0	0.0	0.0	0.0	49.7	70.9	474
Antigua and Barbuda	UN[c]	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	4
Argentina	IEA	8.9	11.0	9.0	8.8	0.7	2.2	4.1	1.7	0.1	0.0	0.0	0.0	27.9	23.8	2,280
Armenia	IEA	1.9	6.2	9.0	6.6	0.0	0.4	6.1	0.0	0.0	0.0	0.0	0.0	34.3	28.9	87
Aruba	UN[c]	0.8	0.1	0.1	6.3	0.3	0.0	0.0	0.0	6.0	0.0	0.0	0.0	9.4	10.6	6
Australia	IEA	8.0	8.4	7.3	8.4	0.0	5.4	1.4	0.4	0.6	0.5	0.0	0.2	20.6	9.6	3,121
Austria	IEA	25.2	26.5	30.6	34.5	0.0	16.6	13.6	2.0	0.8	0.8	0.1	0.6	69.9	74.5	1,066
Azerbaijan	IEA	0.3	1.6	3.1	2.8	1.1	0.3	1.5	0.0	0.0	0.0	0.0	0.0	15.0	7.9	299
Bahamas	UN[c]	—	—	0.9	1.6	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	—	—	18
Bahrain	IEA	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	—	140
Bangladesh	IEA	72.0	59.5	42.0	38.3	38.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.7	1.6	978
Barbados	UN[c]	18.9	13.6	9.8	9.4	0.1	9.3	0.0	0.0	0.0	0.0	0.0	0.0	—	—	13
Belarus	IEA	0.8	4.9	7.0	7.2	2.9	4.1	0.0	0.2	0.0	0.0	0.0	0.0	0.3	0.6	736
Belgium	IEA	1.3	1.5	5.3	7.4	0.0	4.4	0.1	1.1	0.7	0.6	0.0	0.6	40.1	12.8	1,436
Belize	UN[c]	37.0	24.1	35.6	25.3	0.2	13.6	11.5	0.0	0.0	0.0	0.0	0.0	53.1	87.7	10
Benin	IEA	93.7	70.3	51.5	50.6	42.1	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	145
Bermuda	UN[c]	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	9
Bhutan	UN[c]	96.5	95.2	91.7	90.0	77.7	0.4	11.4	0.0	0.0	0.0	0.0	0.4	98.9	23.5	60
Bolivia, Plurinational State of	IEA	37.4	29.1	31.7	28.0	5.7	19.5	2.8	0.0	0.0	0.0	0.0	0.0	30.1	33.8	267
Bosnia and Herzegovina	IEA	7.3	19.4	19.9	15.3	5.8	0.1	9.4	0.0	0.0	0.0	0.0	0.0	50.0	29.9	127
Botswana	IEA	47.1	35.7	26.4	23.9	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	85
Brazil	IEA	49.8	42.8	47.0	43.6	3.3	19.4	14.7	5.7	0.2	0.2	0.0	0.0	81.0	82.5	8,708
British Virgin Islands	UN[c]	100.0	1.6	1.1	—	—	—	—	—	—	—	—	—	—	—	—
Brunei Darussalam	IEA	0.7	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	0.1	40

Country	Source	Share in total final energy consumption (%) Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%) Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Bulgaria	IEA	1.9	8.3	14.4	15.8	8.4	2.7	1.8	0.9	0.7	0.6	0.4	0.2	37.1	11.4	380
Burkina Faso	UN[c]	92.4	86.5	85.3	79.1	78.0	0.7	0.4	0.0	0.0	0.0	0.0	0.0	13.4	24.5	137
Burundi	UN[c]	82.6	93.2	96.8	96.6	94.9	0.6	1.1	0.0	0.0	0.0	0.0	0.0	98.2	—	88
Cambodia[d]	IEA	82.5	81.1	73.3	72.6	55.3	15.3	2.0	0.0	0.0	0.0	0.0	0.0	39.3	37.7	197
Cameroon	IEA	81.6	84.5	78.6	78.1	66.3	6.7	5.1	0.0	0.0	0.0	0.0	0.0	71.5	73.0	256
Canada	IEA	20.6	20.5	19.9	20.6	0.0	4.9	14.2	1.0	0.4	0.0	0.0	0.1	71.4	63.2	7,609
Cape Verde	UN[c]	—	1.7	1.5	18.2	17.5	0.0	0.0	0.0	0.7	0.0	0.0	0.0	23.9	5.5	6
Cayman Islands	UN[c]	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	5
Central African Republic	UN[c]	93.9	86.0	81.0	94.0	37.8	53.4	2.8	0.0	0.0	0.0	0.0	0.0	56.8	74.1	17
Chad	UN[c]	95.1	97.9	92.3	90.4	89.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	—	—	63
Chile	IEA	34.0	31.4	27.0	30.3	0.0	23.7	6.4	0.0	0.1	0.1	0.0	0.0	37.9	36.4	1,014
China	IEA	32.3	27.7	18.8	18.4	12.1	0.2	3.9	0.1	0.4	0.9	0.3	0.5	28.2	23.9	65,558
China, Hong Kong SAR	IEA	1.1	0.6	0.7	—	—	—	—	—	—	—	—	—	—	—	—
China, Macao SAR	UN[c]	0.7	0.2	0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	—	—	22
Colombia	IEA	38.3	28.0	28.6	26.3	7.1	5.4	13.6	0.1	0.0	0.0	0.0	0.0	67.9	79.6	1,029
Comoros	UN[c]	1.0	1.0	1.3	46.1	45.6	0.0	0.5	0.0	0.0	0.0	0.0	0.0	4.5	11.5	3
Congo	IEA	66.7	72.7	50.6	48.2	44.3	1.2	2.8	0.0	0.0	0.0	0.0	0.0	80.4	61.2	50
Congo, Dem. Rep. of the	IEA	92.0	97.2	96.2	96.0	73.6	19.3	3.1	0.0	0.0	0.0	0.0	0.0	—	99.6	825
Cook Islands	UN[c]	—	—	—	—	—	—	—	—	—	—	—	—	1.6	—	—
Costa Rica	IEA	55.7	32.7	41.9	38.6	4.9	13.2	16.2	0.0	1.2	0.0	3.1	0.0	69.3	91.8	142
Cote d'Ivoire	IEA	80.2	64.7	75.4	74.4	65.3	7.6	1.5	0.0	0.0	0.0	0.0	0.0	52.4	26.4	291
Croatia	IEA	13.5	17.5	19.4	20.0	7.1	1.1	10.1	0.6	0.7	0.1	0.1	0.2	51.8	48.7	244
Cuba	IEA	44.3	35.7	16.3	18.9	0.2	14.7	0.1	3.8	0.0	0.0	0.0	0.0	1.2	3.7	259
Cyprus	IEA	0.5	3.1	6.4	8.4	0.5	0.6	0.0	1.1	1.0	4.5	0.1	0.6	10.0	5.4	62
Czech Republic	IEA	2.7	4.9	9.5	10.9	0.0	7.5	0.5	1.2	0.1	0.6	0.0	1.0	26.4	9.3	963
Denmark	IEA	7.3	10.9	21.4	27.6	0.0	15.6	0.0	1.8	6.7	0.3	0.0	3.2	43.2	48.3	566
Djibouti	UN[c]	—	—	—	34.8	34.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	—	6
Dominica	UN[c]	23.6	11.3	9.1	11.9	4.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0	39.4	37.4	2
Dominican Republic	IEA	34.3	22.3	25.9	13.2	5.9	4.8	2.5	0.0	0.0	0.0	0.0	0.0	18.5	10.7	220

Country	Source	Share in total final energy consumption (%)												Renewable energy as share of (%)		Total final energy consumption[b] (petajoules)
		Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Electricity capacity	Electricity generation	
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Ecuador	IEA	23.2	19.6	12.4	13.4	2.2	2.4	8.7	0.0	0.0	0.0	0.0	0.0	42.7	54.9	430
Egypt	IEA	8.6	8.2	6.1	5.5	1.6	1.7	2.0	0.0	0.2	0.0	0.0	0.0	12.3	9.0	2,044
El Salvador	IEA	67.1	50.9	34.8	34.0	15.5	8.4	5.5	0.0	0.0	0.0	4.6	0.0	46.8	64.0	111
Equatorial Guinea	UN[c]	82.0	53.2	15.4	29.2	29.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	5.6	6.3	13
Eritrea[d]	IEA	88.3	71.2	77.2	80.4	76.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.6	22
Estonia	IEA	3.3	19.9	25.1	24.9	0.0	23.9	0.1	0.1	0.8	0.0	0.0	0.1	15.2	12.3	119
Ethiopia	IEA	95.6	94.3	94.5	93.5	91.6	0.8	1.1	0.0	0.0	0.0	0.0	0.0	91.7	99.4	1,547
Falkland Islands (Malvinas)	UN[c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fiji	UN[c]	16.4	13.0	15.5	13.0	1.7	0.0	11.3	0.0	0.0	0.0	0.0	0.0	53.7	55.2	16
Finland	IEA	24.6	31.7	33.5	39.1	0.0	30.0	6.9	1.2	0.2	0.0	0.0	0.8	38.4	40.5	1,009
France	IEA	10.4	9.3	12.3	12.6	0.0	6.4	2.7	1.9	0.7	0.2	0.1	0.5	55.6	14.9	5,987
French Guiana	UN[c]	12.5	8.0	34.4	—									89.6	—	—
French Polynesia	UN[c]	100.0	9.2	8.6	9.1	0.4	0.0	8.8	0.0	0.0	0.0	0.0	0.0	21.0	26.8	8
Gabon	IEA	78.3	74.5	63.0	69.6	53.4	13.0	3.2	0.0	0.0	0.0	0.0	0.0	41.0	41.7	77
Gambia	UN[c]	58.9	50.3	41.0	49.7	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	11
Georgia	IEA	12.8	47.3	39.9	28.7	8.8	1.7	17.9	0.0	0.0	0.0	0.3	0.0	60.8	74.5	123
Germany	IEA	2.1	3.8	10.8	12.4	0.0	4.8	0.8	1.6	1.8	1.3	0.0	2.1	48.9	22.9	8,339
Ghana	IEA	80.6	74.7	66.5	49.5	33.1	9.1	7.3	0.0	0.0	0.0	0.0	0.0	54.6	67.1	284
Gibraltar	IEA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Greece	IEA	7.8	7.5	11.1	13.9	0.0	7.2	2.0	0.8	1.7	1.9	0.1	0.2	27.4	16.7	685
Grenada	UN[c]	6.4	7.0	8.8	10.2	9.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.0	—	3
Guadeloupe	UN[c]	7.8	0.6	5.5	—									13.2	—	—
Guatemala	IEA	75.0	62.7	67.0	66.2	59.3	3.0	3.7	0.0	0.0	0.0	0.2	0.0	43.0	66.9	357
Guinea	UN[c]	92.6	89.6	88.9	74.1	72.8	0.5	0.8	0.0	0.0	0.0	0.0	0.0	32.2	28.4	139
Guinea-Bissau	UN[c]	70.8	50.1	37.4	88.5	80.8	7.7	0.0	0.0	0.0	0.0	0.0	0.0	—	—	26
Guyana	UN[c]	28.1	41.5	46.7	35.4	4.7	30.7	0.0	0.0	0.0	0.0	0.0	0.0	3.7	—	27
Haiti	IEA	81.1	76.0	70.5	83.1	78.7	4.2	0.2	0.0	0.0	0.0	0.0	0.0	22.8	13.9	123
Honduras	IEA	70.1	55.1	49.8	53.4	37.5	11.5	3.9	0.0	0.5	0.0	0.0	0.0	39.1	43.7	182
Hungary	IEA	3.9	5.2	9.1	10.2	0.0	7.5	0.1	1.1	0.4	0.0	0.7	0.3	9.4	7.6	602

Country	Source	Share in total final energy consumption (%)												Renewable energy as share of (%)		Total final energy consumption[b] (petajoules)
		Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Electricity capacity	Electricity generation	
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Iceland	IEA	62.2	66.1	76.7	78.1	0.0	0.0	36.9	0.0	0.0	0.0	41.2	0.1	95.7	100.0	112
India	IEA	57.5	52.6	42.4	39.0	28.7	7.9	1.8	0.0	0.4	0.1	0.0	0.0	26.4	15.6	19,925
Indonesia	IEA	58.7	44.7	37.4	37.1	31.2	4.3	0.7	0.4	0.0	0.0	0.5	0.0	16.8	11.4	6,211
Iran, Islamic Republic of	IEA	1.3	0.4	0.7	—									17.8	—	—
Iraq	IEA	1.6	0.3	1.6	1.6	0.0	0.1	1.5	0.0	0.0	0.0	0.0	0.0	20.2	8.8	1,003
Ireland	IEA	2.3	2.0	5.2	7.0	0.0	1.9	0.6	0.8	3.0	0.1	0.0	0.5	26.6	19.2	420
Israel	IEA	5.8	6.0	8.5	8.7	0.0	0.1	0.0	0.0	0.0	8.5	0.0	0.0	2.1	0.8	553
Italy	IEA	3.8	5.1	10.0	12.1	0.0	3.8	3.1	1.4	1.0	1.5	0.5	0.7	37.2	31.0	4,805
Jamaica	IEA	7.6	11.5	12.1	14.7	9.4	4.5	0.5	0.0	0.3	0.0	0.0	0.0	8.3	8.8	81
Japan	IEA	4.4	3.9	4.2	4.5	0.0	1.6	2.2	0.0	0.1	0.3	0.1	0.1	15.0	12.0	11,339
Jordan	IEA	2.8	2.1	3.0	3.1	0.1	0.0	0.1	0.0	0.0	2.9	0.0	0.0	0.6	0.4	204
Kazakhstan	IEA	1.4	2.5	1.2	1.4	0.1	0.0	1.2	0.0	0.0	0.0	0.0	0.0	12.7	8.4	1,720
Kenya	IEA	77.7	81.8	77.1	78.5	75.2	0.2	2.3	0.0	0.0	0.0	0.8	0.0	57.6	75.2	556
Kiribati	UN[c]	39.5	30.9	1.1	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	1
Korea, Dem. People's Rep. of	IEA	7.7	9.8	12.0	16.0	0.0	8.8	7.1	0.0	0.0	0.0	0.0	0.0	—	70.2	509
Korea, Republic of	IEA	1.6	0.7	1.3	1.6	0.0	0.5	0.3	0.2	0.1	0.1	0.1	0.4	3.4	1.3	5,148
Kuwait	IEA	0.2	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	514
Kyrgyzstan	IEA	7.9	37.3	22.5	22.5	0.0	0.1	22.4	0.0	0.0	0.0	0.0	0.0	78.9	93.5	144
Lao People's Dem. Rep.	UN[c]	96.7	91.3	90.1	86.5	73.5	0.0	12.2	0.0	0.0	0.7	0.0	0.0	93.4	67.8	72
Latvia	IEA	17.6	35.8	35.3	40.4	17.0	12.5	9.0	0.6	0.3	0.0	0.0	1.0	73.7	66.6	164
Lebanon	IEA	11.5	5.0	5.0	5.0	2.3	0.3	1.9	0.0	0.0	0.5	0.0	0.0	9.8	6.8	180
Lesotho	UN[c]	—	100.0	100.0	40.5	35.2	0.0	5.3	0.0	0.0	0.0	0.0	0.0	100.0	—	47
Liberia	UN[c]	95.4	90.5	92.5	84.4	84.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	85
Libya	IEA	3.1	2.1	2.1	1.7									—	—	413
Lithuania	IEA	3.1	17.6	22.6	24.3	11.8	7.5	1.5	1.3	1.9	0.0	0.0	0.2	13.5	26.1	199
Luxembourg	IEA	1.7	6.8	3.7	4.1	0.0	1.1	0.5	1.3	0.4	0.2	0.0	0.6	28.6	11.0	160
Macedonia, Former Yugoslav Rep. of	IEA	2.4	19.4	23.0	16.5	9.4	1.0	5.5	0.0	0.0	0.0	0.5	0.0	35.9	16.7	76
Madagascar	UN[c]	86.4	78.5	82.8	78.4	43.7	33.1	1.5	0.0	0.0	0.0	0.0	0.0	30.3	32.6	119

Country	Source	Share in total final energy consumption (%)												Renewable energy as share of (%)		Total final energy consumption[b] (petajoules)
		Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Electricity capacity	Electricity generation	
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Malawi	UN[c]	86.1	76.9	81.3	78.7	35.1	36.6	6.9	0.1	0.0	0.0	0.0	0.0	99.3	57.4	63
Malaysia	IEA	14.0	8.6	6.2	6.8	4.5	0.2	1.8	0.3	0.0	0.0	0.0	0.0	12.4	7.4	1,625
Maldives	UN[c]	—	—	—	3.1	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	4
Mali	UN[c]	91.6	88.9	88.3	83.5	78.9	1.5	3.1	0.0	0.0	0.0	0.0	0.0	51.6	28.2	58
Malta	IEA	—	—	0.3	2.6	0.2	0.0	0.0	1.3	0.0	0.6	0.0	0.5	2.7	1.1	14
Martinique	UN[c]	2.3	1.6	1.6	—	—	—	—	—	—	—	—	—	0.3	—	—
Mauritania	UN[c]	40.9	42.6	35.1	32.2	32.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.1	—	39
Mauritius	UN[c]	51.9	14.6	6.9	34.0	1.3	15.1	1.3	0.0	0.1	0.0	0.0	0.2	24.5	22.2	67
Mexico	IEA	14.3	12.5	10.0	9.4	0.0	6.7	2.0	0.0	0.2	0.1	0.4	0.0	23.9	15.0	4,582
Moldova, Republic of	IEA	0.8	4.6	4.3	4.7	3.2	0.6	0.9	0.0	0.0	0.0	0.0	0.0	11.6	4.6	92
Mongolia	IEA	1.8	4.9	3.7	3.2	2.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	—	123
Montenegro[d]	IEA	n.a	n.a	48.9	46.2	23.4	2.3	20.4	0.0	0.0	0.0	0.0	0.0	75.8	51.9	29
Montserrat	UN[c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Morocco	IEA	8.5	6.7	7.2	11.3	4.6	5.2	1.0	0.0	0.5	0.0	0.0	0.0	25.9	8.6	577
Mozambique	IEA	93.1	92.5	89.6	88.4	66.7	9.1	12.6	0.0	0.0	0.0	0.0	0.0	89.8	99.9	312
Myanmar	IEA	90.9	80.2	84.9	78.7	72.7	2.4	3.6	0.0	0.0	0.0	0.0	0.0		72.4	596
Namibia[d]	IEA	38.9	38.2	30.2	32.9	13.2	0.0	19.6	0.0	0.0	0.1	0.0	0.0	67.1	97.8	65
Nepal	IEA	95.1	88.3	88.3	84.7	79.3	1.0	2.8	0.0	0.0	0.0	0.0	1.6	92.5	99.5	418
Netherlands	IEA	1.2	1.5	3.6	4.7	0.0	1.7	0.0	0.7	1.0	0.1	0.0	1.1	14.9	12.2	1,942
Netherlands Antilles	IEA	—	—	—		—	—	—	—	—	—	—	—	—	—	—
New Caledonia	UN[c]	40.2	15.9	8.0	3.7	0.0	0.0	3.3	0.0	0.4	0.0	0.0	0.0	23.2	15.2	43
New Zealand	IEA	29.2	28.9	31.5	30.8	0.0	8.9	14.4	0.0	1.3	0.1	5.9	0.2	71.0	71.8	500
Nicaragua	IEA	70.4	62.4	53.8	53.1	41.6	7.7	1.2	0.0	1.0	0.0	1.5	0.0	38.1	42.8	89
Niger	UN[c]	86.8	93.9	73.7	79.7	78.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	—	0.0	70
Nigeria	IEA	88.4	86.9	88.8	86.5	77.1	9.0	0.4	0.0	0.0	0.0	0.0	0.0	35.0	19.7	4,829
Norway	IEA	59.3	60.3	56.9	58.0	0.0	6.0	50.1	0.7	0.5	0.0	0.0	0.7	95.5	98.0	756
Oman	IEA	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	717
Pakistan	IEA	57.5	51.1	46.0	45.5	37.8	4.7	3.0	0.0	0.0	0.0	0.0	0.0	30.9	31.1	2,886
Palau	UN[c]	—	—	6.8	2.6	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	n.a.	15.0	2

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		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Panama	IEA	43.7	34.4	24.1	22.9	8.4	2.9	11.6	0.0	0.0	0.0	0.0	0.0	61.3	62.9	140
Papua New Guinea	UN[c]	70.4	66.4	66.7	52.5	43.9	5.2	3.3	0.0	0.0	0.0	0.0	0.0	38.9	30.2	115
Paraguay	IEA	78.5	70.4	64.1	62.7	21.1	23.9	15.9	1.8	0.0	0.0	0.0	0.0	99.9	100.0	186
Peru	IEA	39.4	32.2	30.2	28.2	13.6	1.7	10.6	2.2	0.0	0.1	0.0	0.0	36.8	55.2	651
Philippines	IEA	51.0	34.9	28.8	29.4	14.2	8.0	3.0	1.2	0.0	0.0	3.0	0.0	32.0	28.4	999
Poland	IEA	2.5	6.9	9.5	11.1	0.0	8.7	0.2	1.3	0.5	0.0	0.0	0.2	10.9	10.4	2,596
Portugal	IEA	27.1	20.0	27.9	25.6	0.0	13.5	3.2	1.9	5.9	0.7	0.1	0.3	52.8	42.5	636
Puerto Rico	UN[c]	1.8	0.7	0.7	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	3.6	0.9	64
Qatar	IEA	—	—	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	—	479
Reunion	UN[c]	38.9	16.5	17.6	—	—	—	—	—	—	—	—	—	30.8	—	—
Romania	IEA	3.4	16.5	24.0	21.7	14.7	1.7	3.4	1.0	0.7	0.0	0.1	0.1	40.5	25.4	933
Russian Federation	IEA	3.8	3.5	3.3	3.2	0.3	0.4	2.5	0.0	0.0	0.0	0.0	0.0	20.5	15.6	16,524
Rwanda	UN[c]	84.4	89.4	87.9	86.3	75.3	9.7	1.2	0.0	0.0	0.0	0.0	0.0	65.7	42.3	54
Saint Kitts and Nevis	UN[c]	67.4	23.3	—	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	—	2
Saint Lucia	UN[c]	—	—	—	2.3	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	4
Saint Pierre and Miquelon	UN[c]	—	—	1.7	—	—	—	—	—	—	—	—	—	3.7	—	—
Saint Vincent and the Grenadines	UN[c]	18.0	10.6	7.9	5.0	2.2	0.0	2.9	0.0	0.0	0.0	0.0	0.0		14.9	3
Samoa	UN[c]	100.0	49.6	44.5	22.2	18.0	1.7	2.5	0.0	0.0	0.0	0.0	0.0	28.6	21.7	4
Sao Tome and Principe	UN[c]	62.2	35.7	35.4	42.4	41.6	0.0	0.8	0.0	0.0	0.0	0.0	0.0	25.0	6.4	2
Saudi Arabia	IEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	3,315
Senegal	IEA	55.6	47.7	42.5	51.4	49.2	1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.3	9.8	113
Serbia	IEA	15.5	23.5	20.3	19.6	11.3	1.0	7.2	0.0	0.0	0.0	0.1	0.0	32.7	25.7	348
Seychelles	UN[c]	—	—	—	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	5
Sierra Leone	UN[c]	95.6	90.6	71.2	80.4	56.3	22.9	1.2	0.0	0.0	0.0	0.0	0.0	66.7	36.0	53
Singapore	IEA	0.2	0.3	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.5	1.4	419
Slovakia	IEA	2.2	3.7	10.9	10.5	—	—	—	—	—	—	—	—	42.5	19.3	388
Slovenia	IEA	12.4	15.9	18.8	19.3	0.0	11.2	5.6	1.1	0.0	0.4	0.6	0.4	51.5	27.8	202
Solomon Islands	UN[c]	68.4	87.0	75.3	65.1	65.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	5

Country	Source	Renewable energy				Share in total final energy consumption (%): Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%): Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Somalia	UN[c]	100.0	96.3	94.8	94.3	65.8	28.6	0.0	0.0	0.0	0.0	0.0	0.0	—	—	97
South Africa	IEA	16.6	18.2	18.7	16.9	13.7	2.9	0.2	0.0	0.0	0.1	0.0	0.0	2.7	1.0	2,777
Spain	IEA	10.5	8.0	14.8	15.7	0.0	5.2	1.8	2.7	4.4	1.3	0.0	0.2	47.4	29.6	3,293
Sri Lanka	IEA	78.1	64.2	62.0	60.9	39.8	18.4	2.6	0.0	0.1	0.0	0.0	0.0	48.9	29.2	402
Sudan	IEA	73.3	81.6	66.6	64.0	41.2	18.7	4.1	0.0	0.0	0.0	0.0	0.0	69.3	70.1	472
Suriname	UN[c]	36.0	17.1	18.3	20.2	3.6	1.5	15.1	0.0	0.0	0.0	0.0	0.0	45.9	49.2	23
Swaziland	UN[c]	84.3	46.8	35.7	39.9	24.4	8.5	7.0	0.0	0.0	0.0	0.0	0.0	40.3	—	37
Sweden	IEA	34.1	40.9	47.4	49.9	0.0	27.3	16.7	2.0	1.5	0.0	0.0	2.3	87.6	59.1	1,303
Switzerland	IEA	16.9	18.5	21.2	22.7	0.0	4.5	14.6	0.1	0.0	0.3	1.5	1.6	96.6	59.5	821
Syrian Arab Republic	IEA	2.4	1.9	1.4	2.4	0.0	0.1	2.3	0.0	0.0	0.0	0.0	0.0		10.4	367
Tajikistan	IEA	29.6	62.4	57.3	58.0	0.0	0.0	58.0	0.0	0.0	0.0	0.0	0.0	92.4	99.6	86
Tanzania, United Republic of	IEA	94.8	94.3	90.7	88.2	68.4	19.2	0.6	0.0	0.0	0.0	0.0	0.0	66.8	29.1	800
Thailand	IEA	33.6	22.0	22.8	23.0	8.7	11.2	1.0	1.3	0.0	0.1	0.0	0.7	9.8	8.3	3,050
Timor-Leste	UN[c]	—	—	43.1	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	—
Togo	IEA	78.7	77.1	76.1	72.7	60.3	9.1	3.4	0.0	0.0	0.0	0.0	0.0	78.3	84.7	83
Tonga	UN[c]	—	0.4	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	1
Trinidad and Tobago	IEA	1.2	0.5	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	—	156
Tunisia	IEA	14.5	14.2	14.6	13.0	12.1	0.2	0.1	0.0	0.2	0.5	0.0	0.0	4.1	1.7	298
Turkey	IEA	24.6	17.3	14.2	12.8	0.0	4.3	5.0	0.1	0.5	1.0	1.9	0.1	39.0	27.2	3,359
Turkmenistan	IEA	0.3	0.0	0.0	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	702
Turks and Caicos Islands	UN[c]	—	—	—	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—	1
Uganda	UN[c]	96.1	94.6	88.8	90.0	86.2	2.7	1.1	0.0	0.0	0.0	0.0	0.0	91.2	42.9	403
Ukraine	IEA	0.7	1.3	2.9	2.8	1.4	0.4	0.9	0.0	0.0	0.0	0.0	0.0	14.7	5.7	2,805
United Arab Emirates	IEA	—	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	—	2,060
United Kingdom of Great Britain and Northern Ireland	IEA	0.7	1.0	3.2	4.4	0.0	1.2	0.3	0.8	1.2	0.2	0.0	0.6	10.0	11.4	5,053
United States of America	IEA	4.2	5.4	7.6	7.9	0.0	2.8	1.6	2.0	0.8	0.2	0.1	0.4	12.9	12.0	55,615
Uruguay	IEA	44.8	38.8	52.3	46.4	7.9	26.0	11.5	0.8	0.2	0.0	0.0	0.0	55.5	61.7	155
Uzbekistan	IEA	1.3	1.2	2.6	2.4	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	13.8	21.4	1,409

Country	Source	Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%) Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		Share in total final energy consumption (%)														
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Vanuatu	UN[c]	100.0	68.9	41.6	28.8	27.9	0.0	0.8	0.0	0.0	0.0	0.0	0.0	10.7	13.6	3
Venezuela, Bolivarian Rep. of	IEA	11.8	14.1	12.5	11.2	0.5	1.0	9.7	0.0	0.0	0.0	0.0	0.0	61.5	64.8	2,112
Viet Nam	IEA	76.1	58.0	34.8	35.6	22.4	5.2	8.0	0.0	0.0	0.0	0.0	0.0	36.4	43.6	2,144
Western Sahara	UN[c]	—	—	—		—	—	—	—	—	—	—	—	—	—	—
Yemen	IEA	2.1	1.2	1.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	—	225
Zambia	IEA	82.9	89.9	90.7	88.2	66.4	11.7	10.0	0.0	0.0	0.0	0.0	0.0	99.6	99.7	292
Zimbabwe	IEA	64.1	70.2	80.8	75.6	66.0	5.0	4.6	0.0	0.0	0.0	0.0	0.0	36.8	60.0	363

Aggregated by region

Country	Source	Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%) Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		Share in total final energy consumption (%)														
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Northern America	IEA/WDI	6.0	7.1	9.0	9.4	—	3.1	3.1	1.9	0.8	0.1	0.1	0.3	18.2	18.6	63,224
Europe	IEA/WDI	8.1	9.4	14.1	15.6	0.3	6.4	4.0	1.4	1.6	0.7	0.2	1.0	33.6	29.8	39,917
Eastern Europe	IEA/WDI	3.0	4.2	5.4	4.9	0.6	2.0	1.9	0.2	0.1	0.0	0.0	0.1	17.5	13.0	25,083
Caucasian and Central Asia	IEA/WDI	3.1	5.2	4.4	3.4	0.0	0.0	3.4	—	0.0	—	—	—	28.6	25.8	4,062
Western Asia	IEA/WDI	8.2	5.8	4.3	4.2	0.1	1.1	1.7	0.0	0.1	0.6	0.5	0.0	11.4	8.7	13,728
Eastern Asia	IEA/WDI	22.2	19.1	15.3	15.0	9.4	0.4	3.4	0.1	0.4	0.7	0.2	0.4	20.8	17.4	84,953
South Eastern Asia	IEA/WDI	52.2	37.9	31.1	31.7	22.9	5.5	2.2	0.5	0.0	0.0	0.4	0.2	15.9	17.5	15,304
Southern Asia	IEA/WDI	50.9	43.4	34.8	33.1	25.2	5.9	1.7	0.0	0.3	0.1	—	0.0	24.4	14.9	30,784
Oceania	IEA/WDI	15.0	15.6	15.1	13.1	1.5	5.9	3.3	0.4	0.7	0.4	0.8	0.2	24.2	19.2	3,688

Country	Source	Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%) Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		Share in total final energy consumption (%)														
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
Latin America and Caribbean	IEA/WDI	32.3	28.2	29.0	27.7	4.4	11.4	9.1	2.4	0.1	0.1	0.1	0.0	52.5	55.7	23,293
Northern Africa	IEA/WDI	6.5	6.2	5.0	10.6	6.0	3.1	1.4	—	0.1	0.0	—	—	9.6	8.0	4,982
Sub-Saharan Africa	IEA/WDI	72.5	74.6	75.4	71.2	62.7	6.8	1.6	0.0	0.0	0.0	0.0	0.0	26.0	20.9	14,772
World[e]	IEA/WDI	16.6	17.4	17.8	18.1	9.3	3.6	3.2	0.8	0.5	0.3	0.2	0.3	28.5	20.9	342,105

Aggregated by income group

Country	Source	Renewable energy				Solid biofuels, traditional	Solid biofuels, modern	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Others (biogas, renewable waste, marine)	Renewable energy as share of (%) Electricity capacity	Electricity generation	Total final energy consumption[b] (petajoules)
		Share in total final energy consumption (%)														
		1990	2000	2010	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012
High-income economies	IEA/WDI	5.9	6.8	8.9	9.5	0.1	3.7	2.9	1.2	0.8	0.3	0.1	0.4	22.7	18.8	152,968
Upper-middle-income	IEA/WDI	25.2	23.4	18.5	17.8	8.7	2.7	4.4	0.6	0.3	0.6	0.2	0.3	30.0	23.9	140,564
Lower-middle-income	IEA/WDI	43.4	45.8	40.1	39.5	30.5	6.4	2.2	0.1	0.2	0.1	0.1	0.0	27.2	21.2	48,817
Low-income	IEA/WDI	70.3	77.6	75.4	75.0	65.2	6.8	2.9	0.0	0.0	0.0	0.1	0.1	53.8	55.1	9,255

Source: IEA World Energy Statistics and Balances (2014), UN Energy Statistics.

Note: — indicates that data are not available.

a. See annex 3 of chapter 5 for the method used to calculate share of renewable energy consumption in total final energy consumption.

b. Derived by subtracting non-energy use from total final consumption.

c. The latest available UN data are for 2009.

d. First available data were used for countries for which 1990 data were unavailable: Cambodia (1995), Eritrea (1992), Montenegro (2005), and Namibia (1991).

e. World values are greater than the sum of values for countries because world values include marine and aviation bunkers.

SUSTAINABLE
ENERGY FOR ALL

The SE4ALL *Global Tracking Framework* full report, summary report, key findings, PowerPoint presentation, and associated datasets can be downloaded from the following website:

http://trackingenergy4all.worldbank.org
#endenergypoverty

The Sustainable Energy for All indicators can also be found at World Development Indicators:
http://data.worldbank.org/wdi

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ESMAP Energy Sector Management Assistance Program
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