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OVERVIEW

GLOBAL TRACKING FRAMEWORK


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GLOBAL TRACKING FRAMEWORK

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FOREWORD

At the 2012 Rio+20 Conference on Sustainable Development, world leaders agreed to develop a set of Sustainable Development Goals. For many, the Sustainable Energy for All (SE4ALL) initiative launched that year—a year designated to highlight that same theme—and backed by a global coalition of public and private sector organizations, as well as civil society, is an illustration of what a Sustainable Development Goal for the energy sector would look like.

SE4ALL seeks to achieve, by 2030, universal access to electricity and safe household fuels, a doubled rate of improvement of energy efficiency, and a doubled share of renewable energy in the global energy mix. As the Millennium Development Goals process has shown, measurable goals that enjoy widespread consensus can mobilize whole societies behind them. An issue for any set of goals is how to measure progress towards their achievement. This can be tricky on methodological and political grounds. In the light of this challenge, the rigor and even-handedness evident in this first SE4ALL Global Tracking Framework is all the more welcome.

A team of energy experts from 15 agencies worked under the leadership of the World Bank and the International Energy Agency to produce this comprehensive snapshot of the status of more than 170 countries with respect to energy access, action on energy efficiency and renewable energy, and energy consumption. The report's framework for data collection and analysis will enable us to monitor progress on the SE4ALL objectives from now to 2030. It is methodologically sound and credible. It produces findings that are conclusive and actionable.

The report also shows how different countries can boost progress toward sustainable energy. Reaching universal energy access depends decisively on actions in some 20 "high-impact" countries in Africa and Asia. Attaining the global objectives for energy efficiency and renewable energy hinges on efforts in some 20 developed and emerging economies that account for 80 percent of global energy consumption. Finally, the report identifies a number of "fast-moving" countries whose exceptionally rapid progress on the triple energy agenda since 1990 provides not just inspiration, but know-how that can help us replicate their success elsewhere.

In many respects, what you measure determines what you get. That is why it is critical to get measurement right and to collect the right data, which is what this report has done. It has charted a map for our achievement of sustainable energy for all and a way to track progress. Let the journey begin!

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

ACKNOWLEDGMENTS

The development of the Global Tracking Framework was made possible by exceptional collaboration within a specially constituted Steering Group led jointly by the World Bank/Energy Sector Management Assistance Program (ESMAP) and the International Energy Agency (IEA).

Members of the Steering Group include the Global Alliance for Clean Cookstoves ("the Alliance"), the International Institute for Applied Systems Analysis (IIASA), the IEA, the International Partnership for Energy Efficiency Cooperation (IPEEC), the International Renewable Energy Agency (IRENA), Practical Action, the Renewable Energy Network for the 21st Century (REN21), UN Energy, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the United Nations Foundation, the United Nations Industrial Development Organization (UNIDO), the World Bank, the World Energy Council (WEC), and the World Health Organization (WHO).

The Steering Group's collaboration was made possible by agreement among the senior management of the member agencies, many of whom were represented on the Sustainable Energy for All High Level Group in 2012. Vijay Iyer (World Bank) and Fatih Birol (IEA), with Rohit Khanna (ESMAP), oversaw the development of the Global Tracking Framework. Directors of other Steering Group agencies provided important strategic input: Radha Muthiah (GACC); Nebojsa Nakicenovic (IIASA); Amit Bando (IPEEC); Adnan Amin (IRENA); Simon Trace (Practical Action); Christine Lins (REN21); Kandeh Yumkella (UN Energy); Richenda van Leeuwen (UN Foundation); Veerle Vanderweerd (UNDP); Mark Radka (UNEP); Marina Ploutikhina (UNIDO); Christoph Frei (WEC); and Maria Neira (WHO).

The technical work on the Global Tracking Framework was coordinated by Vivien Foster (World Bank) and Dan Dorner (IEA).

The chapter on access to energy (chapter 2) was prepared by a working group comprising World Bank/ESMAP and IEA, GACC, Practical Action, UNDP and WHO. The main contributing authors were Sudeshna Ghosh Banerjee, Mikul Bhatia, Elisa Portale, and Nicolina Angelou (World Bank/ESMAP); Dan Dorner, Jules Schers, and Nora Selmet (IEA); Carlos Dora, Heather Adair-Rohani, Susan Wilburn, and Nigel Bruce (WHO); and Simon Trace (Practical Action). Substantive comments were also provided by Radha Muthiah, Ranyee Chiang, and Sumi Mehta (GACC); Drew Corbin (Practical Action); Stephen Gitonga (UNDP); and Venkata Ramana Putti (WB/ESMAP). Dr Francis Vella, Edmond Villani Chair of Economics, Georgetown University provided expert guidance to the team for the development of the World Bank Global Electrification Database.

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The two rounds of public consultation were coordinated by Simon Trace, Helen Morton, and Lucy Stevens from Practical Action and benefited from use of the REN21 online consultation platform. More than 100 stakeholders participated in the process. The first consultation event was organized by Sandra Winkler at WEC as part of the WEC Executive Assembly in Monaco, November 2012. The second consultation was facilitated by Christine Lins of REN21, as a side event of the World Future Energy Summit in Abu Dhabi, January 2013.

The report has also benefitted from dialogue with the following government agencies:

Germany (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung – BMZ, Deutsche Gesellschaft für Internationale Zusammenarbeit – GIZ, Kreditanstalt für Wiederaufbau – KfW);

Netherlands (Energieonderzoek Centrum Nederland – ECN); Norway (Ministry of Foreign Affairs – MFA);

United Kingdom (Department for International Development – DFID); and

United States (Department of State – DOS, Office of Energy Efficiency and Renewable Energy – EERE).

The design and publication of the final documents was coordinated by Ryan Hobert and Daniel Laender at the UN Foundation in collaboration with Nicholas Keyes of ESMAP. The creation of the online data platform was undertaken by Shaida Badiee, Neil Fantom, and Shelley Liu and Jonathan Davidar of the World Bank.

The report was edited by Steven B. Kennedy and designed by Eighty2degrees. The communications and launch process was coordinated by Christopher Neal at the World Bank and Cynthia Scharf at the United Nations.

The work was largely funded by the participating agencies of the Steering Group. Financial support from ESMAP and DFID was critical in covering certain costs.

OVERVIEW

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In declaring 2012 the "International Year of Sustainable Energy for All," the UN General Assembly established three global objectives to be accomplished by 2030: to ensure universal access to modern energy services,[1] to double the global rate of improvement in global energy efficiency, and to double the share of renewable energy in the global energy mix. Some 70 countries have formally embraced the Secretary General's initiative, while numerous corporations and agencies have pledged tens of billions of dollars to achieve its objectives. As 2012 drew to a close, the UN General Assembly announced a "Decade of Sustainable Energy for All" stretching from 2014 to 2024. The Secretary General provided a compelling rationale for SE4ALL in his announcement of the new program. For further information about the SE4ALL initiative, please go to www.sustainableenergyforall.org. The SE4ALL Global Tracking Framework full report, overview paper, executive summary and datasets can be downloaded from: www.worldbank.org/se4all.

The SE4ALL objectives are global objectives, applying to both developed and developing countries, with individual nations setting their own domestic targets in a way that is consistent with the overall spirit of the initiative. Because countries differ greatly in their ability to pursue each of the three objectives, some will make more rapid progress in one area while others will excel elsewhere, depending on their respective starting points and comparative advantages as well as on the resources and support that they are able to marshal.

The three SE4ALL objectives, though distinct, form an integrated whole. Because they are related and complementary, it is more feasible to achieve all three jointly than it would be to pursue any one of them individually. In particular, achievement of the energy efficiency objective would make the renewable energy objective more feasible by slowing the growth in global demand for energy. Tensions between the goals also exist, though they are less pronounced than the complementarities. One possible tension between the objectives is that the achievement of universal access to modern cooking solutions will tend to shift people from reliance on traditional biomass, a renewable source of energy, to greater reliance on non-solid fuels that are typically (though not always) based on fossil fuels.

To sustain momentum for the achievement of the SE4ALL objectives, a means of charting global progress over the years leading to 2030 is needed. The Global Tracking Framework described in this report provides a system for regular global reporting, based on rigorous—yet practical—technical measures. Although the technical definitions required for the framework pose significant methodological challenges, those challenges are no more complex than those faced when attempting to measure other aspects of development—such as poverty, human health, or access to clean water and sanitation—for which global progress has long been tracked.

For the time being, the SE4ALL tracking framework must draw upon readily available global databases, which vary in their usefulness for tracking the three central variables of interest. Over the medium term, the framework includes a concerted effort to improve these databases as part of the SE4ALL initiative (table O.1). This report lays out an agenda for the incremental improvement of available global energy databases in those areas likely to yield the highest value for tracking purposes.

While global tracking is very important, it can only help to portray the big picture. Appropriate country tracking is an essential complement to global tracking and will allow for a much richer portrait of energy sector developments. Global tracking and country tracking need to be undertaken in a consistent manner, and the Global Tracking Framework provides guidance that will be of interest to all countries participating in the SE4ALL initiative.

[1] The SE4ALL universal access goal will be achieved only if every person on the planet has access to modern energy services provided through electricity, clean cooking fuels, clean heating fuels, and energy for productive use and community services.

	IMMEDIATE	MEDIUM TERM
Global tracking	Proxy indicators already available for global tracking, with all data needs (past, present, and future) already fully met	Indicators that are essential for global tracking and that would require a feasible incremental investment in global energy data systems over the next five years
Country-level tracking	Not applicable	Indicators highly suitable for country-level tracking and desirable for global tracking

TABLE O.1 **A PHASED AND DIFFERENTIATED APPROACH TO SELECTING INDICATORS FOR TRACKING**

The SE4ALL Global Tracking team was able to construct global energy databases that cover a large group of countries —ranging from 181 for clean energy and 212 for modern energy services—that cover an upwards of 98 percent of the world's population (table O.2). The data on energy access (electrification and cooking fuels) draw primarily on household surveys, while those pertaining to renewable energy and energy efficiency are primarily from national energy balances. Indicators for individual countries can be found in the data annex to this report, as well as on-line through the World Bank's Open Data Platform: http://data.worldbank.org/data-catalog.

CATEGORY	DATA SOURCES	COUNTRY COVERAGE (% OF GLOBAL POPULATION)
Electrification	Global networks of household surveys plus some censuses	212 (100)
Cooking fuels	Global networks of household surveys plus some censuses	193 (99)
Energy intensity	IEA and UN for energy balances WDI for GDP and sectoral value added	181 (98)
Renewable energy	IEA and UN for energy balances REN 21, IRENA, and BNEF for complementary indicators	181 (98)

TABLE O.2 **OVERVIEW OF DATA SOURCES AND COUNTRY COVERAGE UNDER GLOBAL TRACKING**

NOTE: IEA = INTERNATIONAL ENERGY AGENCY; UN = UNITED NATIONS; REN 21 = RENEWABLE ENERGY NETWORK FOR THE 21ST CENTURY; IRENA = INTERNATIONAL RENEWABLE ENERGY AGENCY; BNEF = BLOOMBERG NEW ENERGY FINANCE; WDI = WORLD DEVELOPMENT INDICATORS (WORLD BANK); GDP= GROSS DOMESTIC PRODUCT.

The SE4ALL global tracking framework sets 2010 as the starting point against which the progress of the initiative will be measured. The framework provides an initial system for regular global reporting, based on indicators that are technically rigorous and at the same time feasible to compute from current global energy databases, and that offer scope for progressive improvement over time. For energy access, household survey evidence is used to determine the percentage of the population with an electricity connection and the percentage with access to non-solid fuels.[2] Solid fuels are defined to include both traditional biomass (wood, charcoal, agricultural and forest residues, dung, and so on), processed biomass (such as pellets and briquettes), and other solid fuels (such as coal and lignite). As a proxy for energy efficiency, the framework takes the compound annual growth rate of energy intensity of gross domestic product (GDP) measured in purchasing power parity (PPP) terms, complemented by supporting analysis of underlying factors as well as sectoral disaggregation. For renewable energy, the indicator is the share of total final

[2] *Non-solid fuels* include (i) liquid fuels (for example, kerosene, ethanol, and other biofuels), (ii) gaseous fuels (for example, natural gas, liquefied petroleum gas [LPG], biogas), and (iii) electricity.

energy consumption[3] deriving from all renewable sources (bioenergy, aerothermal, geothermal, hydro, ocean, solar, wind). Further methodological details and directions for future improvement are provided below and described extensively in the main report.

In addition to measuring progress at the global level, the report sheds light on the starting point for regional and income groupings. It also identifies two important categories of countries: high-impact countries, whose efforts will be particularly critical to the achievement of the objectives globally; and fast-moving countries, which are already making rapid progress toward the SE4ALL goals and may have valuable policy and implementation lessons to share.

Scenarios based on the various existing global energy models—such as the World Energy Model of the International Energy Agency (IEA) and the Global Energy Assessment (GEA) of the International Institute for Applied Systems Analysis (IIASA)—clarify the scale of the challenge involved in meeting the SE4ALL objectives. In particular, they illustrate the combinations of technological change, policy frameworks, and financing flows that will be needed to reach the objectives. They also shed light on the relationship between the three objectives, as well as the differential contributions to global targets across world regions based on respective comparative advantage.

Development of the Global Tracking Framework has been made possible through a unique partnership of international agencies active in the energy knowledge space. The steering group for the framework is co-chaired by the World Bank and its Energy Sector Management Assistance Program (ESMAP, a multidonor technical assistance trust fund administered by the World Bank) and the IEA. Members of the group are the Global Alliance for Clean Cookstoves (the Alliance), IIASA, the International Partnership for Energy Efficiency Cooperation (IPEEC), the International Renewable Energy Agency (IRENA), Practical Action, the Renewable Energy Network for the 21st Century (REN21), the United Nations Development Programme, UN–Energy, the United Nations Environment Programme, the United Nations Foundation, the United Nations Industrial Development Organization (UNIDO), the World Energy Council (WEC), and the World Health Organization (WHO). Experts from all of these agencies have collaborated intensively in the development of this report.

The report also benefited from two rounds of public consultation. The first round, which took place in October 2012, focused on the proposed methodology for global tracking. It was launched by a special session of the World Energy Council's Executive Assembly in Monaco. The second round, in February 2013, focused on data analysis. It was preceded by a consultation workshop held in conjunction with the World Future Energy Summit in Abu Dhabi in January 2013. The consultation documents reached more than a hundred organizations drawn from a broad cross-section of stakeholders and covering a wide geographic area. This report benefited greatly from the contributions of those organizations.

Achieving universal access to modern energy services

By some measures, progress on access to modern energy services was impressive over the 20 years between 1990 and 2010. The number of people with access to electricity increased by 1.7 billion, while the number of those with access to non-solid fuels for household cooking increased by 1.6 billion. Yet this expansion was offset by global population growth of 1.6 billion over the same period. As a result, the global electrification rate increased only modestly, from 76 to 83 percent, while the rate of access to non-solid fuels rose from 47 to 59 percent (figure O.1). In both cases, this represents an increase in access of about one percentage point of global population annually.

[3] Though technically energy cannot be consumed, in this report the term energy consumption means "quantity of energy applied", following the definition in ISO 50001:2011 and the future standard ISO 13273-1 Energy efficiency and renewable energy sources - Common international terminology Part 1: Energy Efficiency.

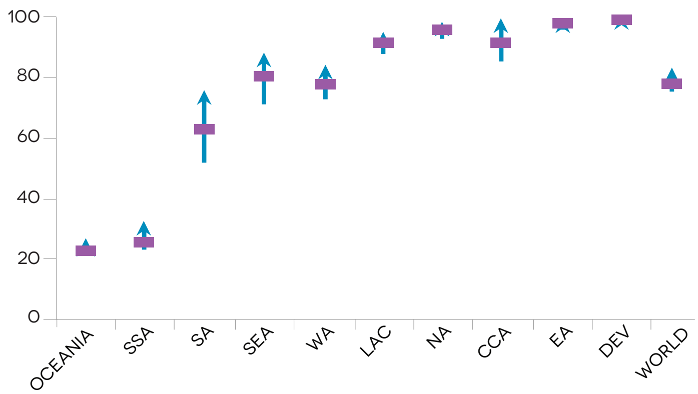

FIGURE O.1A **GLOBAL AND REGIONAL TRENDS IN ELECTRIFICATION 1990–2010, PERCENT**

FIGURE O.1B **GLOBAL AND REGIONAL TRENDS IN ACCESS TO NON-SOLID FUEL 1990–2010, PERCENT**

1990 2000 2010

SOURCE: WORLD BANK GLOBAL ELECTRIFICATION DATABASE, 2012. INDICATORS (WORLD BANK); WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.

NOTE: ACCESS NUMBERS IN MILLIONS OF PEOPLE. CCA = CAUCASUS AND CENTRAL ASIA; DEV = DEVELOPED COUNTRIES; EA = EASTERN ASIA; LAC = LATIN AMERICA AND CARIBBEAN; NA = NORTHERN AFRICA; SEA = SOUTH-EASTERN ASIA; SA = SOUTHERN ASIA; SSA = SUB-SAHARAN AFRICA; WA = WESTERN ASIA.

Starting point

The starting point for global electrification against which future progress will be measured is 83 percent in 2010. The SE4ALL global objective is 100 percent by 2030.

Electrification rates likely overestimate access to electricity. The reason is that some of those with access to an electricity connection receive a service of inadequate quantity, quality, or reliability of supply, which prevents them from reaping the full benefits of the service. A proxy for supply problems (albeit an imperfect one) is the average residential electricity consumption derived from the IEA World Energy Statistics and Balances (2012a). Globally, the average household electricity consumption was around 3,010 kilowatt-hours (kWh) per year in 2010. However, average household electricity consumption varies considerably ranging from over 6,000 kWh in developed countries to around 1,000 kWh in underserved regions of South Asia and Sub-Saharan Africa.

The starting point for access to non-solid fuels for household cooking against which future progress will be measured is 59 percent in 2010. The SE4ALL global objective is 100 percent by 2030.

Modern cooking solutions[4] are important because they curtail harmful indoor air pollution that leads to the loss of lives of 3.5 million people each year, mainly women and children; they also improve energy efficiency. Similar to electrification, rates of access to non-solid fuel do not fully capture access to modern cooking solutions. The reason for this is that an unknown and likely growing percentage of those without access to non-solid fuels may nonetheless be using acceptable cooking solutions based on processed biomass (such as fuel pellets) or other solid fuels paired with stoves exhibiting overall emissions rates at or near those of liquefied petroleum gas (LPG). At present, it is not possible to adequately measure the number of households in this situation. It is believed to be relatively small but is expected to grow over time as governments and donors place growing emphasis on more advanced biomass cookstoves as a relatively low-cost and accessible method of improving the safety and efficiency of cooking practices. These and other methodological challenges associated with the measurement of energy access are more fully described in box O.1.

[4] The term "modern cooking solutions" will be used throughout this document and includes solutions that involve electricity or gaseous fuels (including liquefied petroleum gas), or solid/liquid fuels paired with stoves exhibiting overall emissions rates at or near those of liquefied petroleum gas.

BOX O.1 Methodological challenges in defining and measuring energy access

There is no universally agreed-upon definition of energy access, and it can be a challenge to determine how best to capture issues such as the quantity, quality, and adequacy of service, as well as complementary issues such as informality and affordability. Because currently available global databases only support binary global tracking of energy access (that is, a household either has or does not have access, with no middle ground), this is the approach that will be used to determine the starting point for the SE4ALL Global Tracking Framework. Based on an exhaustive analysis of existing global household survey questionnaires, the following binary measures will be used:

- Electricity access is defined as availability of an electricity connection at home or the use of electricity as the primary source for lighting.
- Access to modern cooking solutions is defined as relying primarily on non-solid fuels for cooking.

An important limitation of these binary measures is that they do not capture improvements in cookstoves that burn solid fuels, nor are they able to register progress in electrification through off-grid lighting products. In the case of electricity, the binary measure fails to take into account whether the connection provides an adequate and reliable service, which it may often fail to do.

A variety of data sources—primarily household surveys (including national censuses) and in a few cases, utility data—contribute to the measurement of access. Two global databases—one on electricity and another on non-solid fuel—have been compiled: the World Bank's Global Electrification Database and WHO's Global Household Energy Database. IEA data on energy access were also reviewed in the preparation of these databases. Both databases encompass three datapoints for each country—around 1990, around 2000, around 2010. Given that surveys were carried out infrequently, statistical models have been developed to estimate missing datapoints.

While the binary approach serves the immediate needs of global tracking, there is a growing consensus that measurements of energy access should be able to reflect a continuum of improvement. A candidate multi-tier metric put forward in this report for medium-term development under the SE4ALL initiative addresses many of the limitations of the binary measures described above:

For electricity, the recommended new metric measures the degree of access to electricity supply along various dimensions. This is complemented by a parallel multi-tier framework that captures the use of key electricity services.

For cooking, the candidate proposal measures access to modern cooking solutions by measuring the technical performance of the primary cooking solution (including both the fuel and the cookstove) and assessing how this solution fits in with households' daily life.

For medium term country tracking, the further development of the multi-tier metric can be substantially strengthened by rigorous piloting of questionnaires, certification, and consensus building in SE4ALL opt-in countries. The metric is flexible and allows for country-specific targets to be set to adequately account for varying energy challenges. For medium-term global tracking, a condensed version of the new metric would support a three-tier access framework requiring only marginal improvements in existing global data collection instruments.

The SE4ALL universal access goal will be achieved only if every person on the planet has access to modern energy services provided through electricity, clean cooking fuels, clean heating fuels, and energy for productive use and community services. Although global tracking of energy sources for heating, community services, and productive uses will not be possible in the immediate future, it is recommended that an approach to track them at the country level be developed in the medium term.

With respect to electricity, the global access deficit amounts to 1.2 billion people. Close to 85 percent of those who live without electricity (the "nonelectrified population") live in rural areas, and 87 percent are geographically concentrated in Sub-Saharan Africa and South Asia (figure O.2). For cooking, the access deficit amounts to 2.8 billion people who primarily rely on solid fuels. About 78 percent of that population lives in rural areas, and 96 percent are geographically concentrated in Sub-Saharan Africa, Eastern Asia, Southern Asia, and South-Eastern Asia.

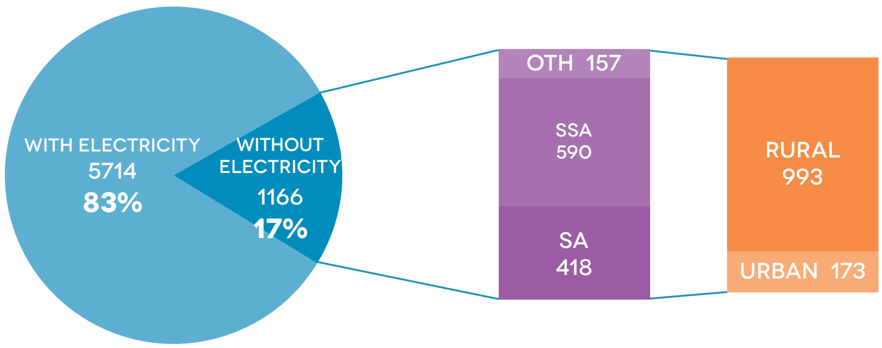

FIGURE O.2A **SOURCE OF ELECTRIFICATION ACCESS DEFICIT, 2010**

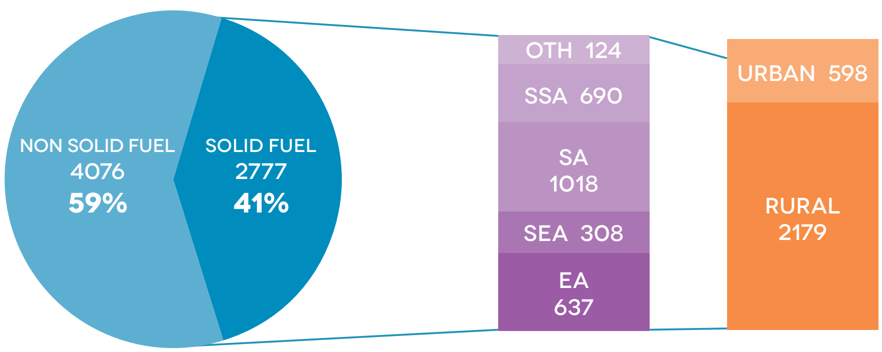

FIGURE O.2B **SOURCE OF NON-SOLID FUEL ACCESS DEFICIT, 2010**

SOURCE: WORLD BANK GLOBAL ELECTRIFICATION DATABASE, 2012; WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.
NOTE: ACCESS NUMBERS IN MILLIONS OF PEOPLE. EA = EASTERN ASIA; SEA = SOUTH-EASTERN ASIA; SA = SOUTHERN ASIA; SSA = SUB-SAHARAN AFRICA; OTH = OTHERS.

Most of the incremental electrification over the period 1990–2010 was in urban areas, where electrification increased by 1.7 percent of the population annually, about twice the rate in rural areas (0.8). However, even with this significant expansion, electrification only just kept pace with rapid urbanization in the same period, so that the overall urban electrification rate remained relatively stable, growing from 94 to 95 percent across the period. By contrast, more modest growth in rural populations allowed the electrification rate to increase more steeply, from 61 to 70 percent, despite a much lower level of electrification effort overall in the rural space. The rate of increase in access to non-solid fuel over the two decades was higher in urban areas, at around 1.7 percent of the population annually, with the overall urban access rate rising from 77 to 84 percent. Rural growth in non-solid fuel use was as low as 0.6 percent annually on average, while overall access in rural areas grew from 26 to 35 percent. Thus, most of the expansion in energy access between 1990 and 2010 was in urban areas, while most of the remaining deficit in 2010 was in rural areas (figure O.3).

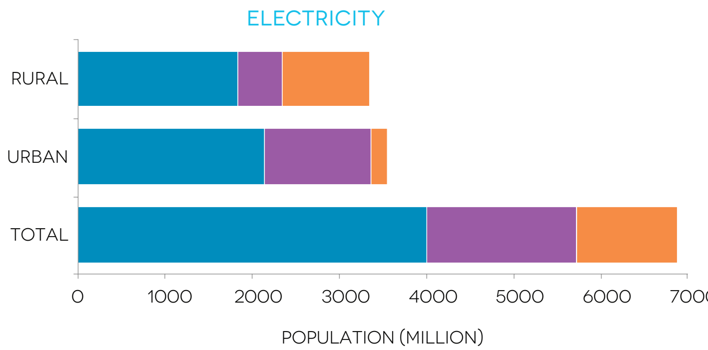

FIGURE O.3A **GLOBAL TRENDS IN ACCESS TO ELECTRICITY, 1990–2010, POPULATION MILLION**

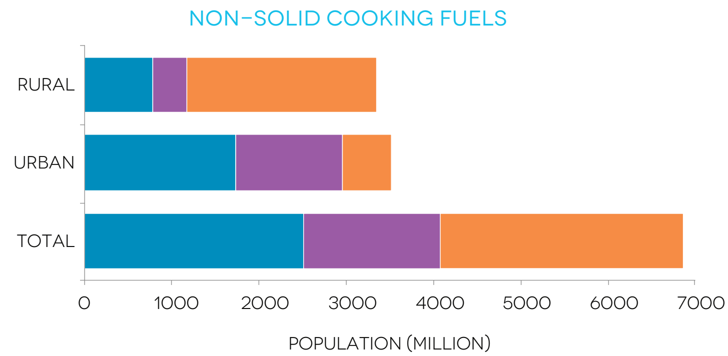

FIGURE O.3B **GLOBAL TRENDS IN ACCESS TO NON-SOLID FUEL, 1990–2010, POPULATION MILLION**

POPULATION WITH ACCESS IN 1990 · INCREMENTAL ACCESS IN 1990–2010 · POPULATION WITHOUT ACCESS IN 2010

SOURCE: WORLD BANK GLOBAL ELECTRIFICATION DATABASE, 2012; WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.

High-impact countries

The achievement of universal access to modern energy will depend critically on the efforts of 20 high-impact countries. Together, these countries account for more than two-thirds of the population presently living without electricity (0.9 billion people) and more than four-fifths of the global population without access to non-solid fuels (2.4 billion people). This group of 20 countries is split between Africa and Asia (figure O.4). For electricity, India has by far the largest access deficit, exceeding 300 million people, while for non-solid cooking fuel India and China each have access deficits that exceed 600 million people.

The access challenge is particularly significant in Sub-Saharan Africa, which is the only region where the rate of progress on energy access fell behind population growth in 1990–2010, both for electricity and for non-solid fuels. Among the 20 countries with the highest deficits in access, 12 are in Sub-Saharan African countries; of those, eight report an access rate below 20 percent. Similarly, among the 20 countries with the lowest rates of use of non-solid fuel for cooking, nine are Sub-Saharan African countries, of which five have rates of access to non-solid fuel below 10 percent.

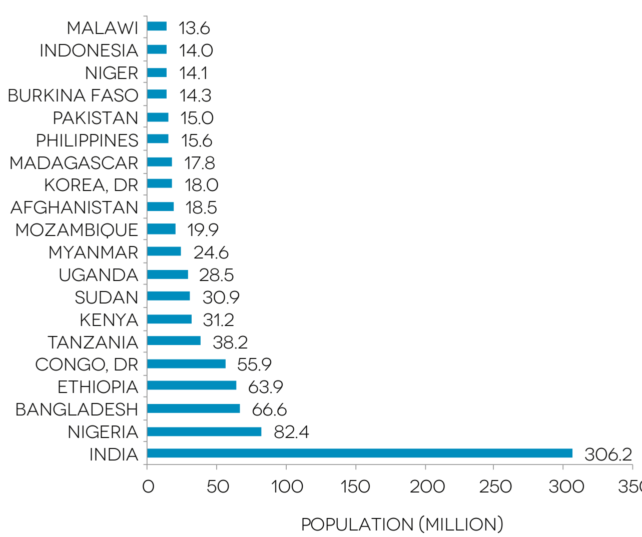

FIGURE O.4A **THE 20 COUNTRIES WITH THE HIGHEST DEFICIT IN ACCESS TO ELECTRICITY, 2010, POPULATION MILLION**

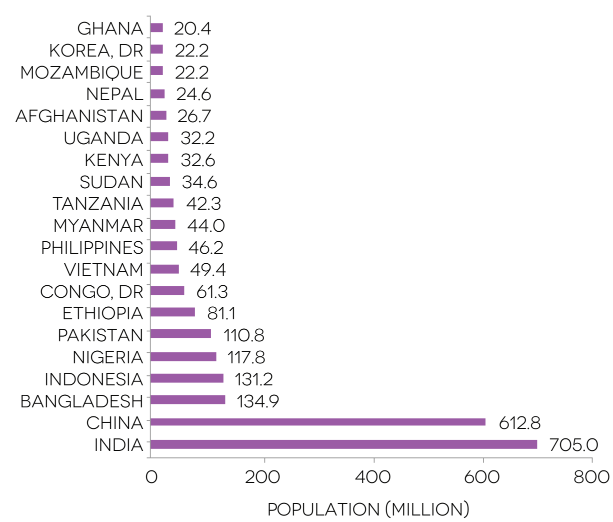

FIGURE O.4B **THE 20 COUNTRIES WITH THE HIGHEST DEFICIT IN ACCESS TO NON-SOLID FUEL, 2010, POPULATION MILLION**

SOURCE: WORLD BANK GLOBAL ELECTRIFICATION DATABASE, 2012; WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.
NOTE: DR = "DEMOCRATIC REPUBLIC OF."

Fast-moving countries

In charting a course to universal access, it will be important to learn from those countries that have successfully achieved universal energy access and those that have advanced the fastest toward this goal during the last two decades. The 20 countries that have made the most progress provided electricity to an additional 1.3 billion people in the past two decades. India has made particularly rapid progress, electrifying an average of 24 million annually since 1990, with an annual growth rate of 1.9 percent. Similarly, the 20 countries that have made the most progress on the cooking side—most of them in Asia—moved 1.2 billion people to non-solid fuel use. Whereas the global annual average increase in access was 1.2 percent for electrification and 1.1 percent for non-solid fuels, the countries making the most progress in scaling up energy access reached an additional 3–4 percent of their population each year (figures O.5 and O.6).

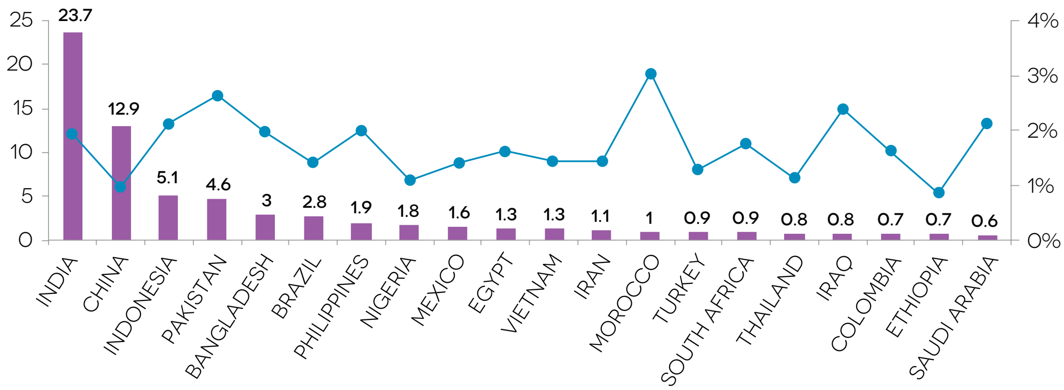

FIGURE O.5 **THE 20 COUNTRIES WITH THE GREATEST ANNUAL INCREASES IN ACCESS TO ELECTRICITY, 1990–2010**

ANNUAL INCREMENTAL ACCESS (MILLION PEOPLE) ANNUAL GROWTH IN ACCESS (%)

SOURCE: WORLD BANK GLOBAL ELECTRIFICATION DATABASE, 2012.

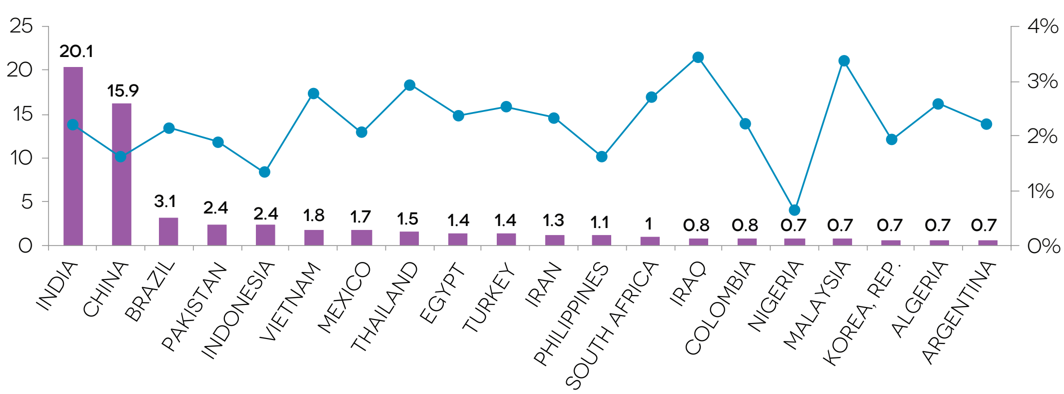

FIGURE O.6 **THE 20 COUNTRIES WITH THE GREATEST ANNUAL INCREASES IN ACCESS TO NON-SOLID FUELS, 1990–2010**

ANNUAL INCREMENTAL ACCESS (MILLION POEPLE) ANNUAL GROWTH IN ACCESS (%)

SOURCE: WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.

Scale of the challenge

If the global trends observed during the last two decades were to continue, the SE4ALL objective of universal access would not be met. The IEA's World Energy Outlook for 2012 (IEA 2012b) projects that under a New Policies Scenario that reflects existing and announced policy commitments, access rates would climb to just 88 percent by 2030, still leaving almost a billion people without access to electricity (figure O.7). Access to electricity would improve for all regions except Sub-Saharan Africa, which is expected soon to overtake developing Asia as the region with the largest electrification deficit. By comparison, the GEA projects 84 percent access to electricity by 2030 under business-as-usual assumptions.

The IEA projects that under the New Policies Scenario access to non-solid fuel would climb to 70 percent in 2030, leaving the number of people without access to non-solid fuels largely unchanged at 2.6 billion by the end of the period (figure O.7b). By comparison, the GEA projects 64 percent access to non-solid fuels by 2030 under business-as-usual assumptions.

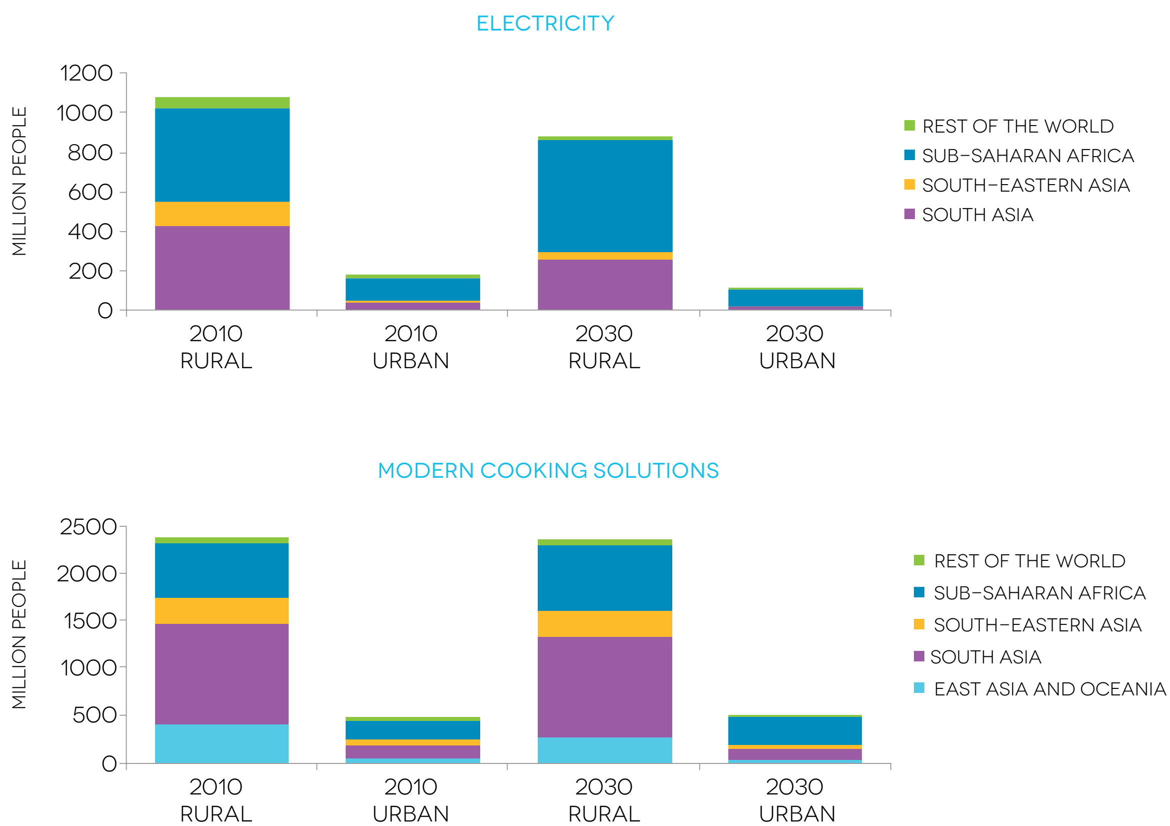

FIGURE O.7 **NUMBER OF PEOPLE WITHOUT ACCESS IN RURAL AND URBAN AREAS, BY REGION, 2010 AND 2030**

SOURCE: IEA 2012B.

Looking ahead, population growth over the next 20 years is expected to occur entirely in urban areas. Thus, while today's access deficit looks predominantly rural, considerable future electrification efforts in urban areas will be needed simply to keep electrification rates constant.

According to the IEA, achieving universal access to electricity by 2030 will require an average annual investment of $45 billion (compared to $9 billion estimated in 2009). More than 60 percent of the incremental investment required would have to be made in Sub-Saharan Africa and 36 percent in developing Asia. Universal access to modern cooking solutions by 2030 will require average annual investment of around $4.4 billion, a relatively small sum in global terms but a large increase compared with negligible current annual investments of about $0.1 billion.

IIASA's 2012 GEA provides estimates (based on different assumptions than those used by the IEA) of the cost of reaching universal access, which amount to $15 billion per year for electricity and $71 billion per year for modern cooking solutions. The higher estimate for modern cooking solutions is based on the assumption that providing universal access will not be feasible without fuel subsidies of around 50 percent for LPG, as well as microfinance (at an interest rate of 15 percent) to cover investments in improved cookstoves.

The IEA estimates that achievement of universal access for electricity and modern cooking solutions would add only about 1 percent to global primary energy demand over current trends. About half of that additional demand would likely be met by renewable energy and the other half by fossil fuels, including a switch to LPG for cooking. As a result, the impact of achieving universal access on global CO2 emissions is projected to be negligible, raising total emissions by around 0.6 percent in 2030.

Several barriers must be overcome to increase access to electrification and modern cooking solutions. A high level of commitment to the objective from the country's political leadership and the mainstreaming of a realistic energy access strategy into the nation's overall development and budget processes are important. So are capacity building for program implementation, a robust financial sector, a legal and regulatory framework that encourages investment, and active promotion of business opportunities to attract the private sector. In some cases, carefully designed and targeted subsidies may also be needed. Nonfinancial barriers to the expansion of access include poor monitoring systems and sociocultural prejudices.

Doubling the rate of improvement of energy efficiency

The energy intensity of the global economy (the ratio of the quantity of energy consumption per unit of economic output) fell substantially during the period 1990–2010, from 10.2 to 7.9 megajoules per U.S. dollar (2005 dollars at PPP).[5] This reduction in global energy intensity was driven by cumulative improvements in energy efficiency, offset by growth in activity, resulting in energy savings of 2,276 EJ over the 20-year period (figure O.8). Strong demographic and economic growth around the world caused global primary energy supply to continue to grow at a compound annual rate of 2 percent annually over the period, nonetheless improvements in energy intensity meant that global energy demand in 2010 was more than a third lower than it would otherwise have been.

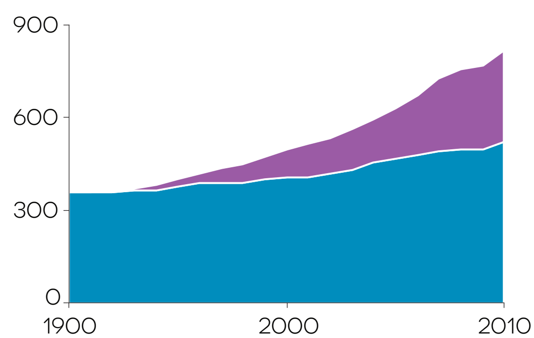

FIGURE O.8 **ENERGY SAVINGS OWING TO REALIZED IMPROVEMENTS IN ENERGY INTENSITY (EXAJOULES)**

PRIMARY ENERGY CONSUMPTION   AVOIDED ENERGY CONSUMPTION

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A; UN ENERGY STATISTICS DATABASE.

[5] Countries with a high level of energy intensity use more energy to create a unit of GDP than countries with lower levels of energy intensity. Throughout the report, energy intensity is measured in primary energy terms and GDP at PPP unless otherwise specified. More details on the accounting methodology and the terminology used can be found in the energy efficiency chapter of the report.

Starting point

Globally, energy intensity decreased at a compound annual growth rate (CAGR) of –1.3 percent over the 20 years between 1990 and 2010. The rate of improvement slowed considerably during the period 2000–2010, however, to a CAGR of –1.0, compared to –1.6 per year for 1990–2000 (figure O.9a).

With the starting point for measuring future progress in global energy efficiency under the SE4ALL, set as –1.3 percent, the SE4ALL global objective is therefore a CAGR in energy intensity of –2.6 percent for the period 2010–2030.[6]

Energy intensity is an imperfect proxy for underlying energy efficiency (defined as the ratio between useful output and the associated energy input). Indeed, the global rate of improvement of global energy intensity may over- or understate the progress made in underlying energy efficiency. This is because energy intensity is affected by other factors, such as shifts in the structure of the economy over time, typically from less energy-intensive agriculture to higher energy-intensive industry and then back toward lower energy-intensive services. A review of the methodological issues in measuring energy efficiency is presented in box O.2.

Statistical techniques that allow for the confounding effects of factors other than energy efficiency to be partially stripped out reveal that the adjusted energy intensity trend with a CAGR of –1.6 could be significantly higher than the unadjusted CAGR of –1.3 (figure O.9b). The effect of this adjustment is particularly evident for the period 2000–2010, when globalization led to a major structural shift toward industrialization in emerging economies, partially eclipsing their parallel efforts to improve energy efficiency.

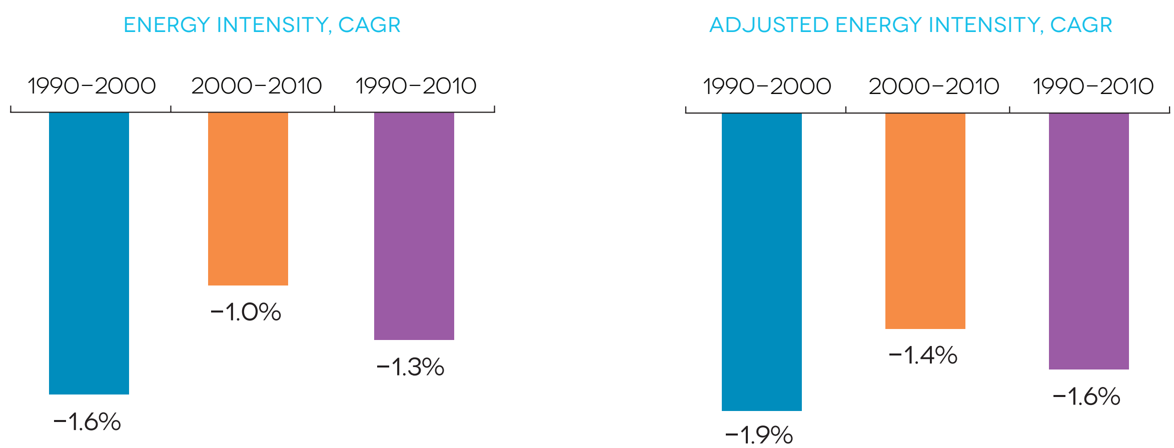

FIGURE O.9 **RATE OF IMPROVEMENT IN GLOBAL ENERGY INTENSITY, 1990–2010 (PPP TERMS)**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A.
NOTE: PPP = PURCHASING POWER PARITY; CAGR = COMPOUND ANNUAL GROWTH RATE. "ADJUSTED ENERGY INTENSITY" IS A MEASURE DERIVED FROM THE DIVISIA DECOMPOSITION METHOD THAT CONTROLS FOR SHIFTS IN THE ACTIVITY LEVEL AND STRUCTURE OF THE ECONOMY.

[6] When measured in final energy terms, the compound annual growth rate is –1.5 percent for the period 1990–2010. Thus the goal is –3.0 percent on average for the next 20 years.

BOX O.2 Methodological challenges in defining and measuring energy efficiency

Energy efficiency is defined as the ratio between useful outputs and associated energy inputs. Rigorous measurement of this relationship is possible only at the level of individual technologies and processes, and the data needed for such measures are available only for a handful of countries. Even where data are available, they result in hundreds of indicators that cannot be readily used to summarize the situation at the national level.

For these reasons, energy intensity (typically measured as energy consumed per dollar of gross domestic product, GDP) has traditionally been used as a proxy for energy efficiency when making international comparisons. Energy intensity is an imperfect proxy for energy efficiency because it is affected not only by changes in the efficiency of underlying processes, but also by other factors such as changes in the volume and sectoral structure of GDP. These concerns can be partially addressed by statistical decomposition methods that allow confounding effects to be stripped out. Complementing national energy intensity indicators with sectoral ones also helps to provide a more nuanced picture of the energy efficiency situation.

Calculation of energy intensity metrics requires suitable measures for GDP and energy consumption. GDP can be expressed either in terms of market exchange rate or purchasing power parity (PPP). Market exchange rate measures may undervalue output in emerging economies because of the lower prevailing domestic price levels and thereby overstate the associated energy intensity. PPP measures are not as readily available as market exchange rate measures, because the associated correction factors are updated only every five years.

Energy consumption can be measured in either primary or final energy terms. While it may make sense to use primary energy for highly aggregated energy intensity measures (relative to GDP) because it captures intensity in both the production and use of energy, it is less meaningful to use it when measuring energy intensity at the sectoral or subsectoral level, where final energy consumption is more relevant.

Based on a careful analysis of these issues and of global data constraints, the SE4ALL Global Tracking Framework for energy efficiency will:

- Rely primarily on energy intensity indicators
- Use PPP measures for GDP and sectoral value-added
- Use primary energy supply for national indicators and final energy consumption for sectoral indicators
- Complement those indicators with energy intensity of supply and of the major demand sectors
- Provide a decomposition analysis to at least partially strip out confounding effects on energy intensity
- Use a five-year moving average for energy intensity trends to smooth out extraneous fluctuations

For the purposes of global tracking, data for the period 1990–2010 have been compiled from energy balances for 181 countries published by the International Energy Agency and the United Nations. These are complemented by data on national and sectoral value-added from the World Bank's World Development Indicators.

Looking ahead, significant international efforts are needed to improve the availability of energy input and output metrics across the main sectors of the economy to allow for more meaningful measures of energy efficiency.

Global final energy consumption can be broadly divided among the following major economic sectors: agriculture, industry, residential, transport, and services. For the purpose of initial global tracking, residential, transport, and services are aggregated into a single category of "other sectors" owing to data limitations. Industry is by far the most energy-intensive of these sectors, consuming around 6.8 megajoules per 2005 dollar in 2010, compared with 5.5 for "other sectors" (residential, transport, and services) and 2.1 for agriculture.[7] The most rapid progress in reducing energy intensity has come in the agricultural sector, which recorded a CAGR of –2.2 percent during 1990–2010 (figure O.10a). Although progress was significantly slower in the industry and other sectors, due to their much-higher levels of energy consumption they made far larger contributions to global energy savings than did agriculture during the same period (figure O.10b).

By contrast, the ratio of final to primary energy consumption, which provides a measure of the overall efficiency of conversion in the energy supply industry, actually deteriorated during the period 1990-2010, falling from 72 to 68 percent. This reflects relatively little improvement in the efficiency of the electricity supply industry over the same period. The efficiency of thermal generation (defined as the percentage of the energy content of fossil fuels that is converted to electricity during power generation) improved only slightly from 38 to 39 percent, while transmission and distribution losses remained almost stagnant at around 9 percent of energy produced. Gas supply losses fell a little more steeply, from 1.4 to 0.9 percent.

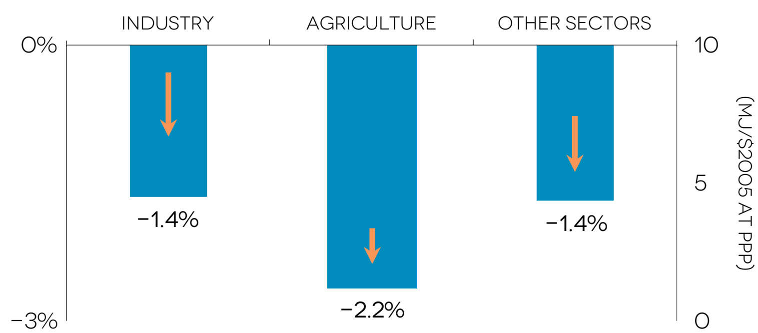

FIGURE O.10A **ENERGY INTENSITY TRENDS BY SECTOR (PPP TERMS)**

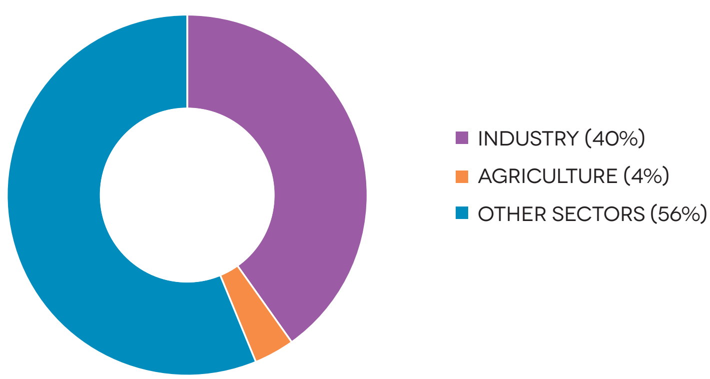

FIGURE O.10B **SHARE OF CUMULATIVE ENERGY SAVINGS BY SECTOR**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A.
NOTE: "OTHER SECTORS" INCLUDE RESIDENTIAL, TRANSPORT, AND SERVICES. CAGR = COMPOUND ANNUAL GROWTH RATE; EI = ENERGY INTENSITY; PPP = PURCHASING POWER PARITY.

7 Owing to data limitations, in this report the category "other sectors" includes transport, residential, services, and others. The medium- and long-term methodology considers them separately.

The rate of progress on energy intensity varied dramatically across world regions over the period 1990–2010. At one end of the spectrum, the Caucasus and Central Asia region achieved a CAGR of –3.2 percent while nonetheless remaining the region with the highest energy intensity (figure O.11a). At the other end, Western Asia (also known as the Middle East) was the only region to show a deteriorating trend in energy intensity, with a CAGR of +0.8 percent. Overall, 85 percent of the energy savings achieved between 1990 and 2010 were contributed by Eastern Asia and the developed countries (figure O.11b).

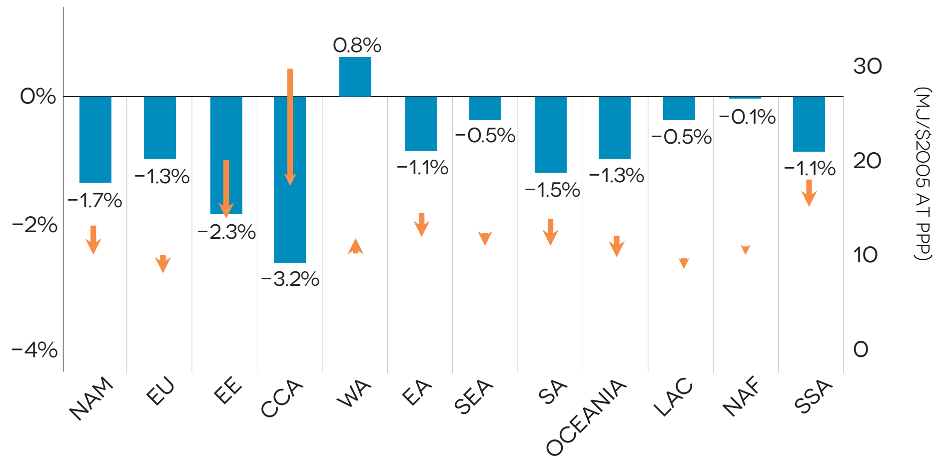

FIGURE O.11A **ENERGY INTENSITY TRENDS BY REGION (PPP TERMS)**

CAGR 1990−2010 (LEFT) | EI IN 1990 (RIGHT) | EI IN 2010 (RIGHT)

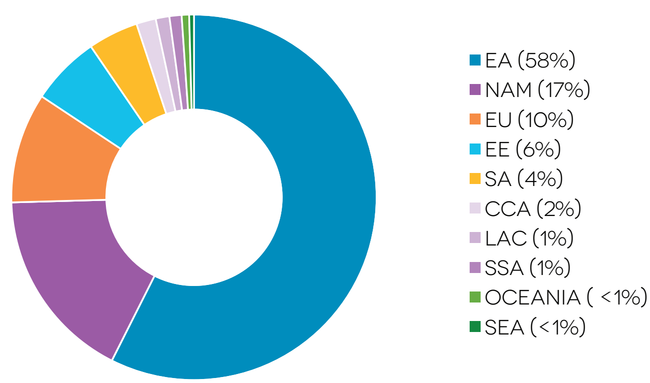

FIGURE O.11B **SHARE OF CUMULATIVE ENERGY SAVINGS BY REGION**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A; UN ENERGY STATISTICS DATABASE.
NOTE: PPP = PURCHASING POWER PARITY; CAGR = COMPOUND ANNUAL GROWTH RATE; EI = ENERGY INTENSITY; NAM = NORTH AMERICA; EU = EUROPE; EE = EASTERN EUROPE; CCA = CAUCASUS AND CENTRAL ASIA; WA = WESTERN ASIA; EA = EASTERN ASIA; SEA = SOUTH−EASTERN ASIA; SA = SOUTHERN ASIA; LAC = LATIN AMERICA AND THE CARIBBEAN; NAF = NORTHERN AFRICA; SSA = SUB−SAHARAN AFRICA.

High-impact countries

Energy consumption is distributed unequally across countries, almost to the same degree as income. The 20 largest energy consumers account for 80 percent of primary energy consumption, with the two largest consumers (the United States and China) together accounting for 40 percent of the total (figure O.12). The achievement of the global objective of doubling the rate of improvement of energy efficiency will therefore depend critically on energy consumption patterns in these countries.

As of 2010, the high-income countries (with the exception of Saudi Arabia) show the lowest energy intensity relative to GDP. Nevertheless, energy consumption per capita varies hugely across this group, from 110 gigajoules per capita in Western Europe to 300 in North America. By contrast, the middle-income countries (with the exception of Russia and Kazakhstan) show much lower levels of per capita energy consumption but vary widely in their energy intensities. In particular, energy intensities in Latin America are comparable to those found in Western Europe, whereas in the Ukraine and Uzbekistan they are exceptionally high (figure O.13).

The gap between the world's most and least energy-intensive economies is wide—more than tenfold. At one extreme, the most energy-intensive countries—a heterogenous mix of the countries of the former Soviet Union and those of Sub-Saharan Africa—report intensities of 20–30 megajoules per 2005 PPP dollar (figure O.13). At the other extreme, the least energy-intensive countries—predominantly small island developing states with exceptionally high energy costs—report intensities of 2–4 megajoules per 2005 PPP dollar (figure O.14). Even among the 20 largest energy consuming countries, energy intensities range from more than 12 megajoules per 2005 PPP dollar in Ukraine, Russia, Saudi Arabia, South Africa, and China to less than 5 in the United Kingdom, Spain, Italy, Germany, and Japan.

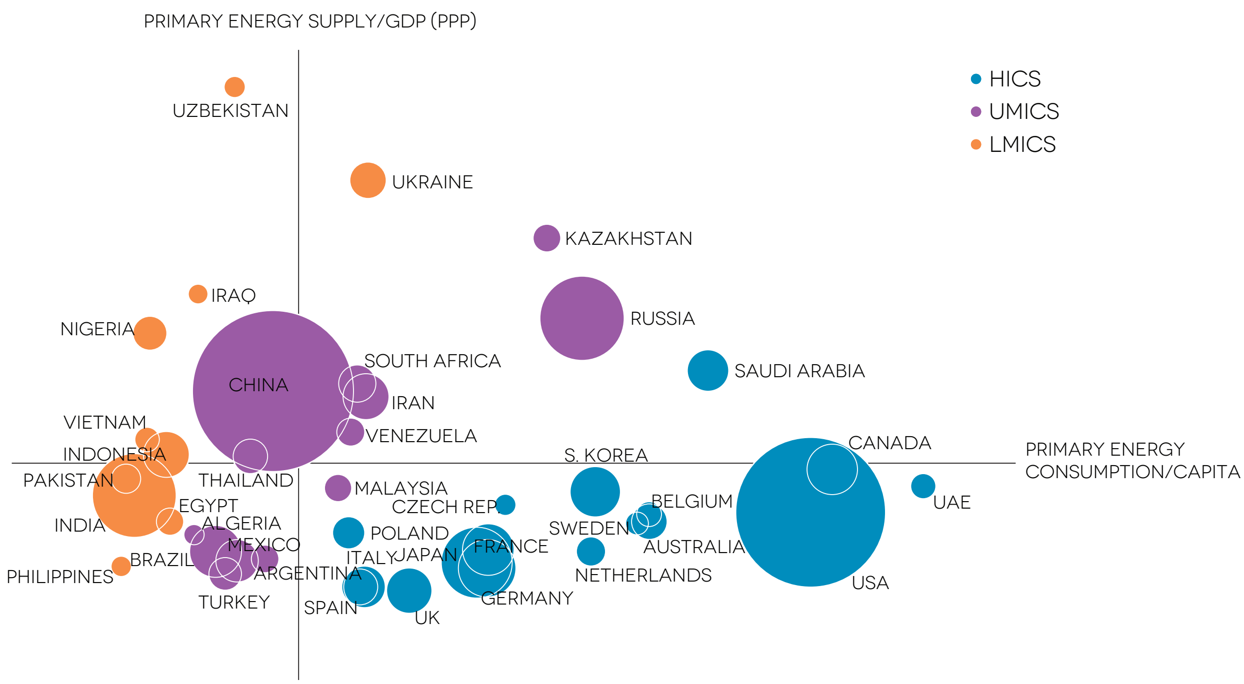

FIGURE O.12 **ENERGY INTENSITY (PPP) VS. ENERGY CONSUMPTION PER CAPITA IN 40 LARGEST ENERGY CONSUMERS, 2010**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A.

NOTE: VALUES ARE NORMALIZED ALONG THE AVERAGE. BUBBLE SIZE REPRESENTS VOLUME OF PRIMARY ENERGY CONSUMPTION. PPP = PURCHASING POWER PARITY. GDP = GROSS DOMESTIC PRODUCT; PPP = PURCHASING POWER PARITY; HICS = HIGHER-INCOME COUNTRIES; UMICS = UPPER-MIDDLE-INCOME COUNTRIES; LMICS = LOWER-MIDDLE-INCOME COUNTRIES; UAE = UNITED ARAB EMIRATES.

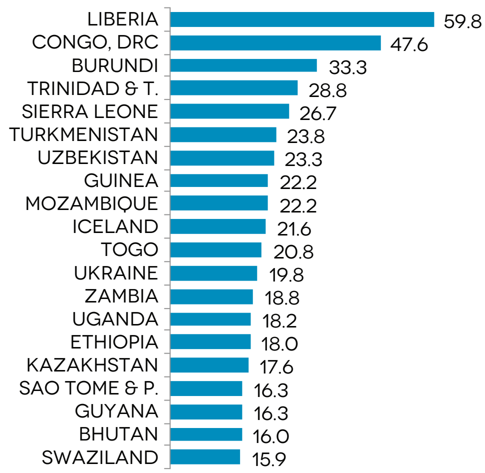

FIGURE O.13 **COUNTRIES WITH HIGHEST ENERGY INTENSITY LEVEL IN 2010 (MJ/$2005)**

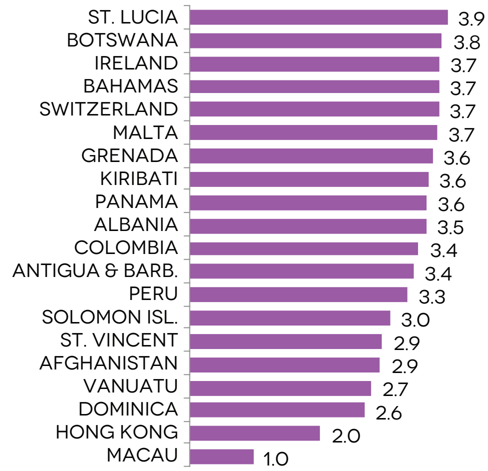

FIGURE O.14 **COUNTRIES WITH LOWEST ENERGY INTENSITY LEVEL IN 2010 (MJ/$2005)**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A; UN ENERGY STATISTICS DATABASE.
NOTE: PPP = PURCHASING POWER PARITY; DR = "DEMOCRATIC REPUBLIC OF."

Fast-moving countries

In doubling the rate of energy efficiency improvement globally, it will be important to learn from those countries that made the most rapid progress toward this goal during the 20 years between 1990 and 2010. While the global CAGR of energy intensity was only –1.3 percent over the period 1990–2010, 20 countries achieved rates of –4.0 percent or greater (figure O.15). The countries making the most rapid progress on energy intensity often started out with particularly high levels of energy intensity—notably China, the countries of the former Soviet Union, and several countries in Sub-Saharan Africa (figure O.16). By far the largest absolute energy savings have been made by China, where energy efficiency efforts have yielded savings equivalent in magnitude to the energy used by the country over the same time frame. Savings in the United States, the European Union, and India have also been globally significant.

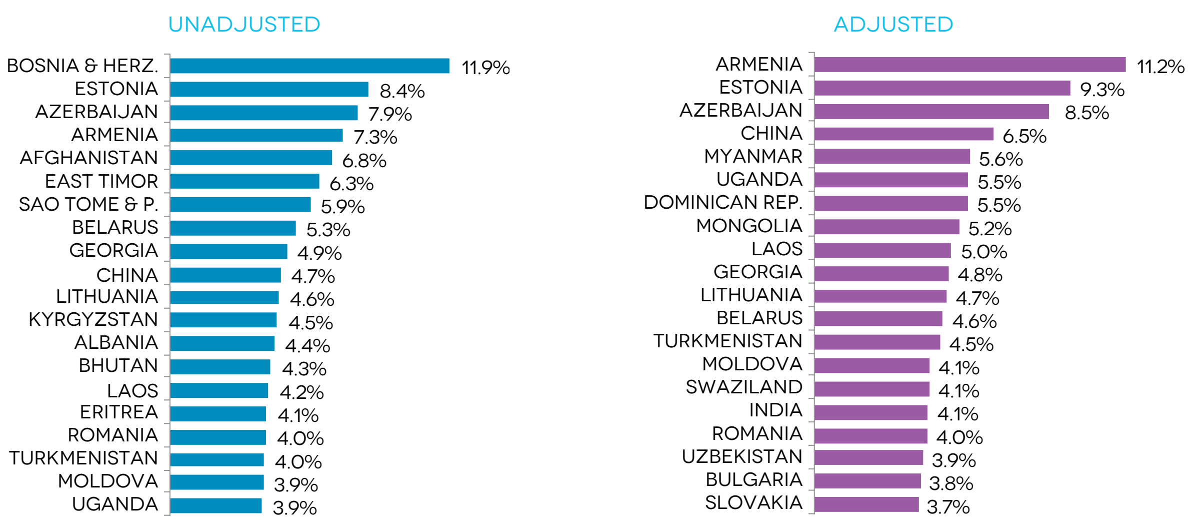

FIGURE O.15 **REDUCTIONS IN ENERGY INTENSITY OF 20 FASTEST-MOVING COUNTRIES, CAGR, 1990–2010 (PPP TERMS)**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A; UN ENERGY STATISTICS DATABASE.
NOTE: CAGR = COMPOUND ANNUAL GROWTH RATE. "ADJUSTED ENERGY INTENSITY" IS A MEASURE DERIVED FROM THE DIVISIA DECOMPOSITION METHOD THAT CONTROLS FOR SHIFTS IN THE ACTIVITY LEVEL AND STRUCTURE OF THE ECONOMY.

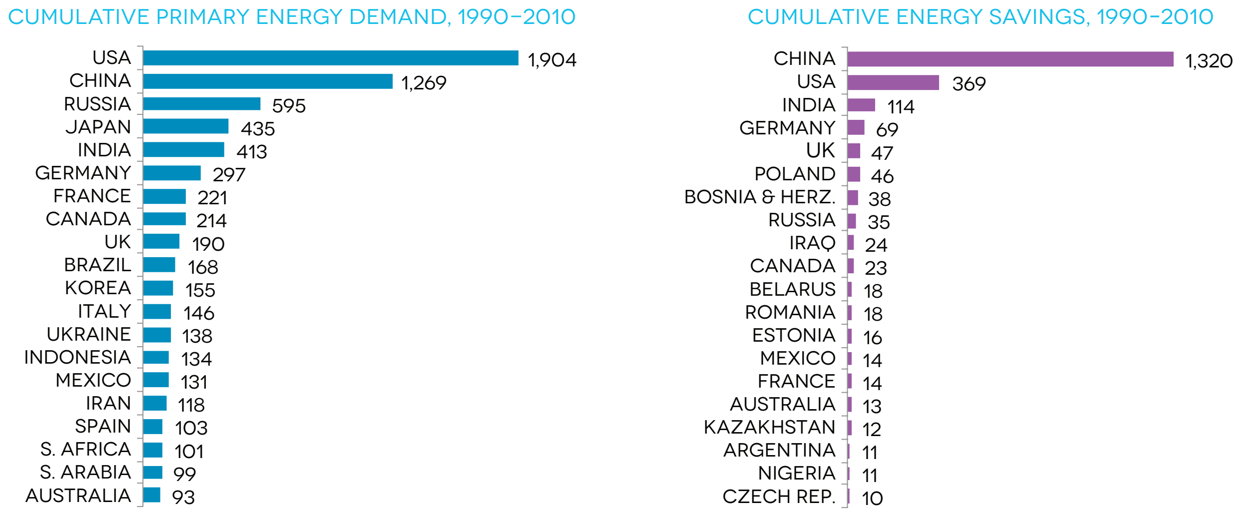

FIGURE O.16 **LARGEST CUMULATIVE CONSUMERS OF PRIMARY ENERGY, AND CUMULATIVE ENERGY SAVINGS AS A RESULT OF REDUCTIONS IN ENERGY INTENSITY, 1990–2010 (EXAJOULES)**

SOURCE: BASED ON WORLD DEVELOPMENT INDICATORS, WORLD BANK; IEA 2012A; UN ENERGY STATISTICS DATABASE.
NOTE: BOSNIA & = BOSNIA & HERZEGOVINA.

Scale of the challenge

Looking ahead, analysis from the IEA's World Energy Outlook 2012 indicates that energy efficiency policies currently in effect or planned around the world would take advantage of just a third of all economically viable energy efficiency measures. The current or planned uptake of available measures is highest in the industrial sector at 44 percent, followed by transport at 37 percent, power generation at 21 percent, and buildings at 18 percent.

Recent analysis shows that the existing potential for cost-effective improvements in energy efficiency goes far beyond what will be captured through current and planned policies (referred to as the New Policies Scenario in figure O.17; IEA 2012b). Under an Efficient World Scenario that exploits all cost-effective improvements, it would be possible to improve energy intensity by an average CAGR of –2.8 percent through 2030, more than double historic rates and even somewhat beyond the SE4ALL objective. About 80 percent of the energy savings that are achievable under this scenario would result from measures taken by energy consumers in end-use sectors, with much of the remaining 20 percent attributable to fuel switching and supply-side efficiency measures. By far the largest potential for energy efficiency improvements is to be found in developing Asia.

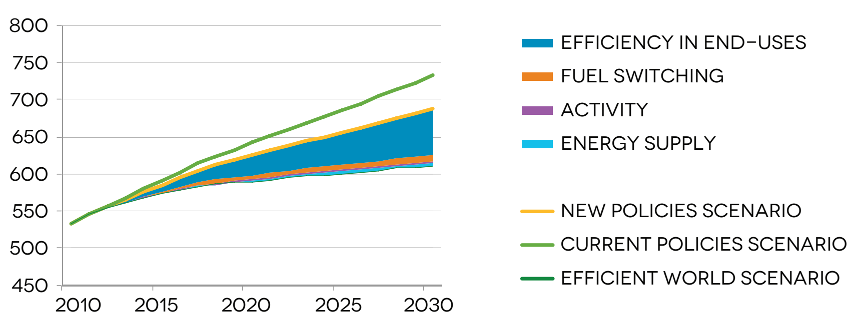

FIGURE O.17 **CHANGE IN GLOBAL PRIMARY ENERGY DEMAND BY MEASURE BETWEEN IEA EFFICIENT WORLD SCENARIO AND IEA NEW POLICIES SCENARIO, 2010–2030 (EXAJOULES)**

SOURCE: IEA 2012B.

The Efficient World Scenario would slow the CAGR of global energy demand to 0.6 percent through 2030, compared with an anticipated 1.3 percent under current and planned policies. It should be noted that even the Efficient World Scenario does not bring about an overall decline in global energy demand over the period 2010–2030.

Mobilizing these improvements would call for cumulative additional investments of close to $400 billion annually through 2030, more than triple historic levels. These investments—although high—would offer the prospect of rapid payback, giving a boost to the global economy of $11.4 trillion over the same period. As in the case of renewable energy, achieving change on this scale is contingent on the adoption of a strong set of energy policy measures, including the phasing out of fossil-fuel subsidies, the provision of price signals for carbon emissions, and the adoption of strict energy efficiency standards.

IIASA's GEA presents six scenarios that meet all three SE4ALL objectives while also meeting the requirement to limit global temperature increases to 2°C. All six of these scenarios require CAGRs for energy intensity on the order of –3.0 percent annually. Achieving the global objective would entail CAGRs for energy intensity in the range of –4.0 to –6.0 percent for Asia and the former Soviet Union (figure O.18).

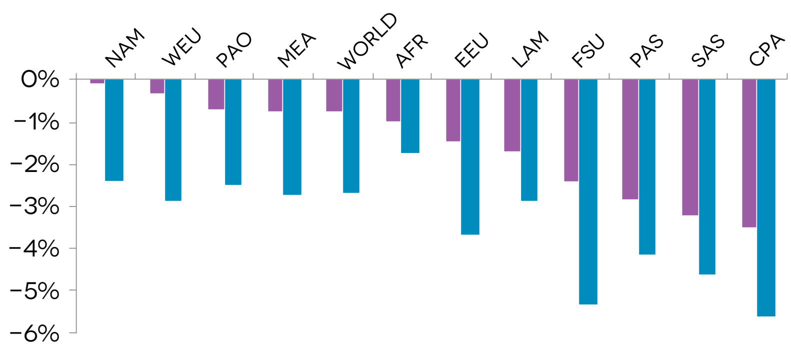

FIGURE O.18 **ANNUAL RATE OF IMPROVEMENT IN PRIMARY ENERGY INTENSITY: IIASA GLOBAL ENERGY ASSESSMENT BASELINE VS. SE4ALL SCENARIO, CAGR, 2010–2030**

BASELINE ■ SE4ALL

SOURCE: IIASA (2012).
NOTE: ON THE CHART ABOVE GDP IS MEASURED AT MARKET EXCHANGE RATE AND PRIMARY ENERGY IS MEASURED USING DIRECT EQUIVALENT METHOD AS OPPOSED TO THE PHYSICAL CONTENT METHOD USED ELSEWHERE. CAGR = COMPOUND ANNUAL GROWTH RATE. NAM = NORTH AMERICA; WEU = WESTERN EUROPE; PAO = PACIFIC OECD; MEA = MIDDLE EAST AND NORTH AFRICA; AFR = SUB-SAHARAN AFRICA; EEU = EASTERN EUROPE; LAM = LATIN AMERICA; FSU = FORMER SOVIET UNION; PAS = PACIFIC ASIA; SAS = SOUTH ASIA; CPA = CENTRALLY PLANNED ASIA.

Doubling the share of renewable energy in the global energy mix

The amount of energy provided from renewable sources for electricity, heating, and transportation has expanded rapidly since 1990, and particularly since 2000, with a compound annual growth rate (CAGR) of 1.5 percent during 1990–2000 and 2.4 percent during 2000–2010.[8] Global consumption of renewable energy grew from 40 exajoules (EJ) in 1990 to almost 60 EJ in 2010 (figure O.19). Yet as the consumption of energy from renewable sources rose, global TFEC grew at a comparable pace of 1.1 percent during 1990–2000 and 2.0 percent during 2000–2010. As a result, the share of renewable energy in the total final energy consumption remained relatively stable, growing from 16.6 percent in 1990 to 18.0 percent in 2010.

[8] Nuclear energy is not considered renewable.

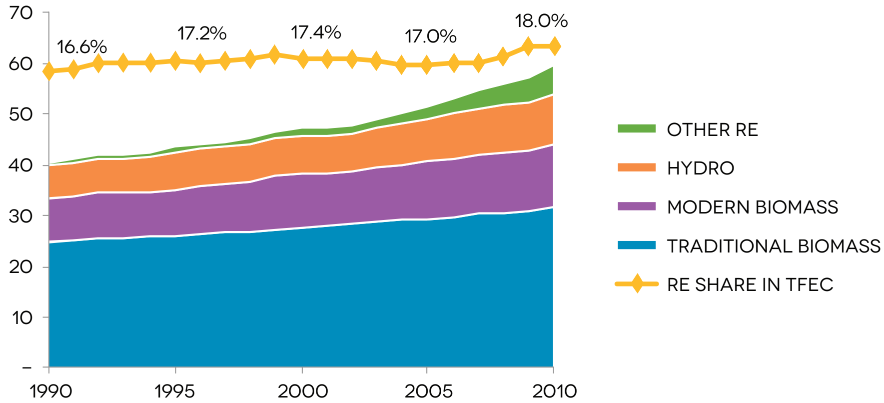

FIGURE O.19 **WORLD CONSUMPTION OF RENEWABLE ENERGY (EXAJOULES) AND SHARE OF RENEWABLE ENERGY IN TFEC (%)**

SOURCE: IEA 2012A.
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION; RE = RENEWABLE ENERGY.

Focusing specifically on electricity, power generation from renewable sources increased from 2,300 terawatt-hours (TWh) in 1990 to 4,160 TWh in 2010. The increase in electricity generation from renewable sources is equivalent to the combined electricity output of Russia and India in 2010. Global electricity generation almost doubled in the 20-year period, growing from 11,800 TWh in 1990 to 21,400 TWh in 2010, which is equivalent to the combined electricity generation of China, the United States, and India in 2010. As of 2011, renewable energy sources accounted for more than 20 percent of global power generated, 25 percent of global installed power generation capacity, and half of newly installed power generation capacity added that year. More than 80 percent of all renewable electricity generated globally was from hydropower.

The starting point

The starting point for the share of renewable energy in total final energy consumption against which future progress will be measured is estimated to be at most 18 percent of TFEC in 2010, reflecting uncertainties over whether some types of renewable energy usage (notably traditional biomass) meet sustainability criteria (figure O.20). The implied SE4ALL global objective is up to 36 percent by 2030.

It is estimated that traditional biomass accounts for about half of the renewable energy total, although data on these traditional usages are imprecise, and the sustainability of these sources cannot be reliably gauged.[9] A further quarter of the renewable energy total relates to modern forms of bioenergy, and most of the remainder is hydropower. Remaining forms of renewable energy—including wind, solar, geothermal, waste, and marine—together contribute barely 1 percent of global energy consumption, though they have been growing at an exponential rate. For example, wind power grew at a CAGR of 25.0 percent and solar at 11.4 percent, compared with a growth rate of slightly over 1 percent for traditional biomass (figure O.21).

An examination of the methodological issues of measuring the renewable energy share can be found in box O.3.

[9] The UN Food and Agriculture Organization defines traditional biomass as "woodfuels, agricultural by-products, and dung burned for cooking and heating purposes." In developing countries, traditional biomass is still widely harvested and used in an unsustainable and unsafe way. It is mostly traded informally and non-commercially. So-called modern biomass, by contrast, is produced in a sustainable manner from solid wastes and residues from agriculture and forestry.

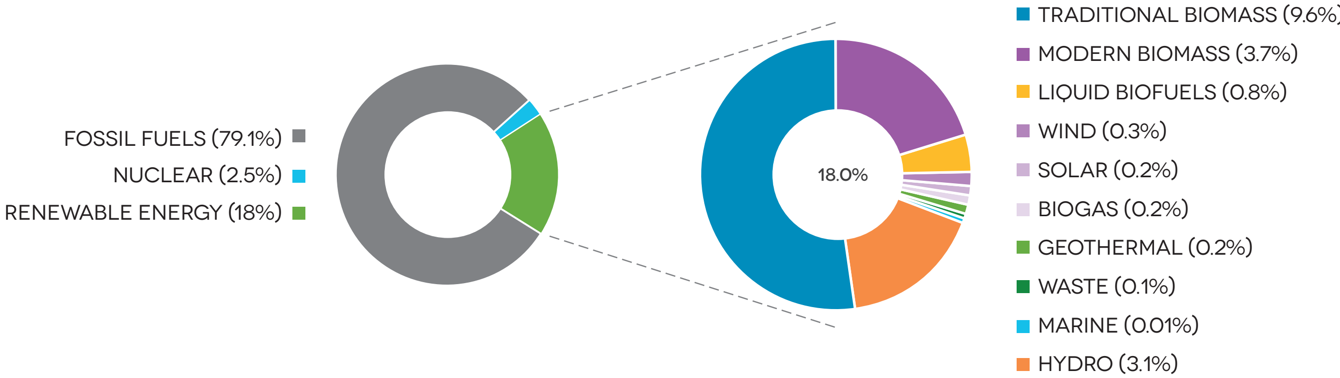

FIGURE O.20 **SHARE OF RENEWABLE ENERGY IN GLOBAL TFEC, 2010**

SOURCE: IEA 2012A.
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION;

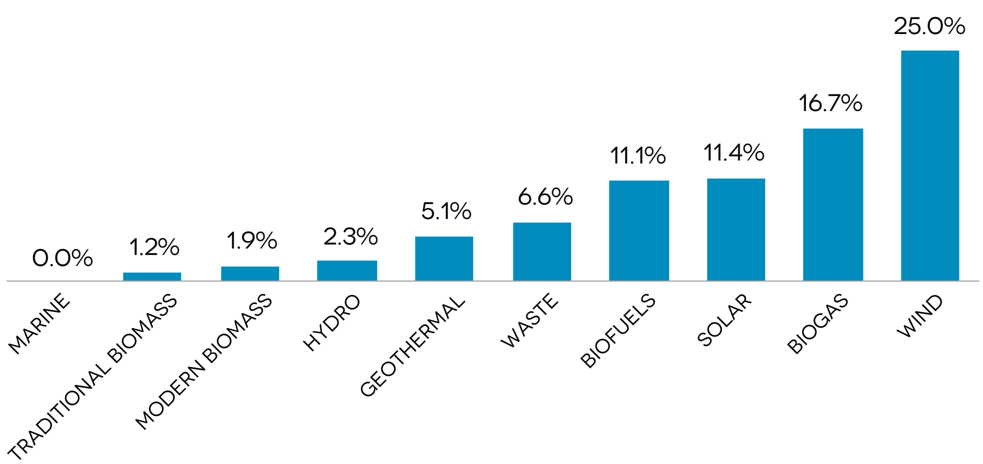

FIGURE O.21 **COMPOUND ANNUAL GROWTH RATES (CAGRS) BY RENEWABLE ENERGY SOURCE, 1990–2010**

SOURCE: IEA 2012A.

Box O.3 Methodological challenges in defining and measuring renewable energy

There are various definitional and methodological challenges in measuring and tracking the share of renewable energy in the global energy mix used for heating, electricity, and transportation.

First, while there is a broad consensus among international organizations and government agencies on what constitutes renewable energy, their legal and formal definitions vary slightly in the type of resources included and the sustainability considerations taken into account. For the purposes of the SE4ALL Global Tracking Framework, it is important that the definition of renewable energy should be specific about the range of sources to be included, should embrace the notion of natural replenishment, and should espouse sustainability. But the data and agreed-upon definitions needed to determine whether renewable energy—notably biomass—has been sustainably produced are not currently available. Therefore, it is proposed that, as an interim measure for immediate tracking purposes, renewable energy should be defined and tracked without the application of specific sustainability criteria. Accordingly, its broad definition is as follows:

"Renewable energy is energy from natural sources that are replenished at a faster rate than they are consumed, including hydro, bioenergy, geothermal, aerothermal, solar, wind, and ocean."

Second, an important methodological choice is whether tracking should be undertaken at the primary level of the energy balance or on the basis of final energy. Power generation from fossil fuels leads to substantial energy losses in conversion, leading to a discrepancy between primary energy, or fuel input, and final energy, or useful energy output. Since renewable energy sources do not have fuel inputs, they are only reported in final energy terms; expressing them in primary terms would require the use of somewhat arbitrary conversion factors.

Third, the high aggregation levels and data gaps in certain categories of available data repositories still limit the analysis. Data gaps have also been identified in the areas of distributed generation and off-grid electricity services. An additional challenge is related to measuring the heat output from certain renewable sources of energy such as heat pumps and solar water heaters. These missing components of renewable energy are relatively small in scale at present but are expected to grow significantly through 2030, making it increasingly important to develop methodologies and systems for capturing the associated data.

For the purposes of global tracking, data for the period 1990–2010 have been compiled from energy balances for 181 countries published by the International Energy Agency and the United Nations. Those data will be complemented by indicators on: (i) policy targets for renewable energy and adoption of relevant policy measures; (ii) technology costs for each of the renewable energy technologies; and (iii) total investment in renewable energy from the Renewable Energy Network 21, the International Renewable Energy Agency, and Bloomberg New Energy Finance, respectively.

Looking ahead, significant international efforts are needed to improve data collection methodologies and bridge identified data gaps. In particular, there is a need to develop internationally agreed-upon standards for sustainability for each of the main technologies, which can then be used to assess the degree to which deployment meets the highest sustainability standards. This is particularly critical in the case of biomass, where traditional harvesting practices can be associated with deforestation.

Looking across regions, it is striking that lower-income regions, such as Africa and Asia, have the highest shares of renewable energy, ranging from 20 to 60 percent. These shares declined significantly in 1990–2010, however, in part due to decreased reliance on traditional biomass for cooking and wider adoption of non-solid cooking fuels (figure O.22). By contrast, higher-income regions such as Europe and America present much lower shares of renewable energy (in the range of 10 to 15 percent), although those shares grew steadily over the two decades. Overall, Africa and Asia alone accounted for about two-thirds of global share of renewable energy in TFEC in 2010, while Europe and North America together contributed about 20 percent (figure O.23).

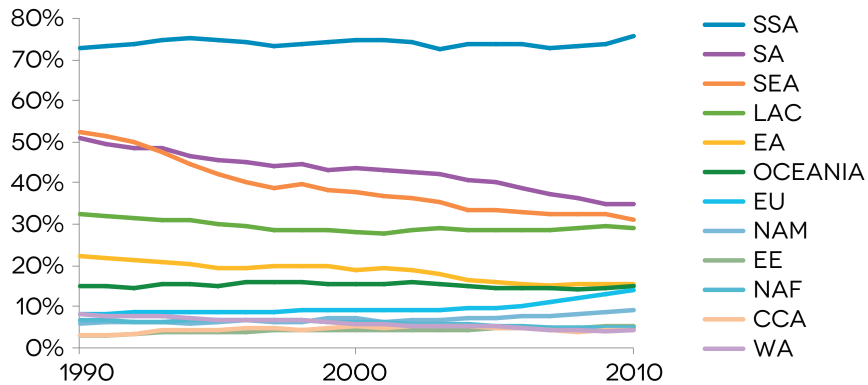

FIGURE O.22 **EVOLVING RENEWABLE ENERGY SHARE BY REGION, 1990–2010 (PERCENTAGE OF TOTAL FINAL ENERGY CONSUMPTION)**

SOURCE: IEA 2012A.
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION; RE = RENEWABLE ENERGY. CCA = CAUCASUS AND CENTRAL ASIA; EA = EASTERN ASIA; LAC = LATIN AMERICA AND CARIBBEAN; NAF = NORTHERN AFRICA; SEA = SOUTH-EASTERN ASIA; SA = SOUTHERN ASIA; SSA = SUB-SAHARAN AFRICA; WA = WESTERN ASIA; EU = EUROPE.

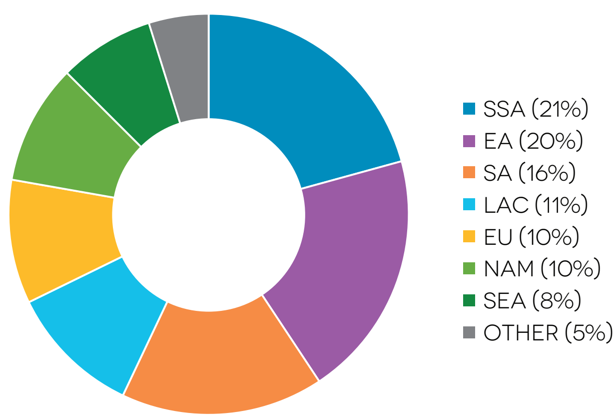

FIGURE O.23 **REGIONAL CONTRIBUTIONS TO GLOBAL RENEWABLE ENERGY 2010 (PERCENTAGE CONTRIBUTION TO THE GLOBAL SHARE OF RENEWABLE ENERGY IN TFEC)**

SOURCE: IEA 2012A.
NOTE: CCA = CAUCASUS AND CENTRAL ASIA; EA = EASTERN ASIA; LAC = LATIN AMERICA AND CARIBBEAN; NAF = NORTHERN AFRICA; SEA = SOUTH-EASTERN ASIA; SA = SOUTHERN ASIA; SSA = SUB-SAHARAN AFRICA; WA = WESTERN ASIA; EU = EUROPE; OTHER = ALL OTHER REGIONS.

If we confine attention to power generation only, the regional picture for the share of renewable energy in the electricity mix looks quite different. Latin America and Caribbean emerges as the region with by far the highest share of renewable energy in the electricity generation portfolio of 56 percent, which is more than twice the level in the next highest regions – Caucuses and Central Asia, Europe, Oceania and Sub-Saharan Africa – all of them above 20 percent. Globally, 80 percent of renewable electricity generation is found evenly spread across just four regions: East Asia, Europe, Latin America and Caribbean and North America.

High-impact opportunities

Substantial potential exists for further tapping of renewable energy sources. Studies have consistently found that the technical potential for renewable energy use around the globe is substantially higher than projected global energy demand in 2050. The technical potential for solar energy is the highest among the renewable energy sources, but there is also substantial untapped potential for biomass, geothermal, hydro, wind, and ocean energy. Available data suggest that most of this technical potential is located in the developing world. For instance, at least 75 percent of the world's unexploited hydropower potential is found in Africa, Asia, and South America, and about 65 percent of total geothermal potential is found in countries that are not members of the Organisation for Economic Co-operation and Development (OECD). The solar belt—that is, the tropical latitudes that have the highest solar irradiance across the globe—endows many developing countries with a high potential for solar-based power generation and heating.

Despite the major technical potential of renewable energy, large-scale adoption will ultimately depend on economic factors. The costs of renewable energy—particularly wind and solar—have been falling steeply and are expected to fall further as the scale of production increases. As a result, renewable energy sources—in particular hydropower, wind, and geothermal—are increasingly competitive in many environments, while solar energy is becoming competitive in some environments. Nevertheless, it is still challenging for renewable energy to compete financially with conventional fossil-fuel alternatives, particularly given that the local and global environmental impact of these conventional sources of energy is not fully reflected in costs. The further integration of renewable energy sources into the public electricity supply system also calls for more proactive expansion of both transmission grids and backup capacity for handling higher levels of variability in the production of wind and solar energy and this further adds to the associated cost. The relatively high capital costs of renewable energy, even when overall lifecycle costs may be lower, adds further to the financing challenge.

Fast-moving countries

Over the 20 years between 1990 and 2010, renewable energy technologies matured and became more widely adopted. Both developed and developing countries are increasingly motivated by the social benefits offered by renewable energy, including enhanced energy security, reduced greenhouse gas emissions and local environmental impacts, increased economic and industrial development, and more options for reliable and modern energy access. Today, about 120 countries—more than half of them developing countries—have a national target related to renewable energy. Moreover, 88 countries have introduced price- or quantity-based incentives for renewable energy. Just over half of those countries are in the developing world.

Almost 80 percent of renewable energy other than traditional biomass has been produced and consumed by high-income and emerging economies, most notably China, the United States, Brazil, Germany, India, Italy, and Spain (figure O.24). The technology of focus differs from case to case, with China focusing mainly on hydropower; the United States on liquid biofuels; Brazil, Germany, and India on modern biomass; and Spain on wind power. Those countries moving most rapidly, such as China and Germany, experienced average annual rates of growth of 8–12 percent in 1990–2010. As of 2010, the countries with the highest shares of renewable energy (excluding traditional biomass) were Norway, Sweden, and Tajikistan, where the shares were about 50 percent (figure O.25). Many other emerging countries—among them Argentina, Mexico, Turkey, Indonesia, Philippines, and a few African countries—are starting to show progress in adopting policies to scale up renewables.

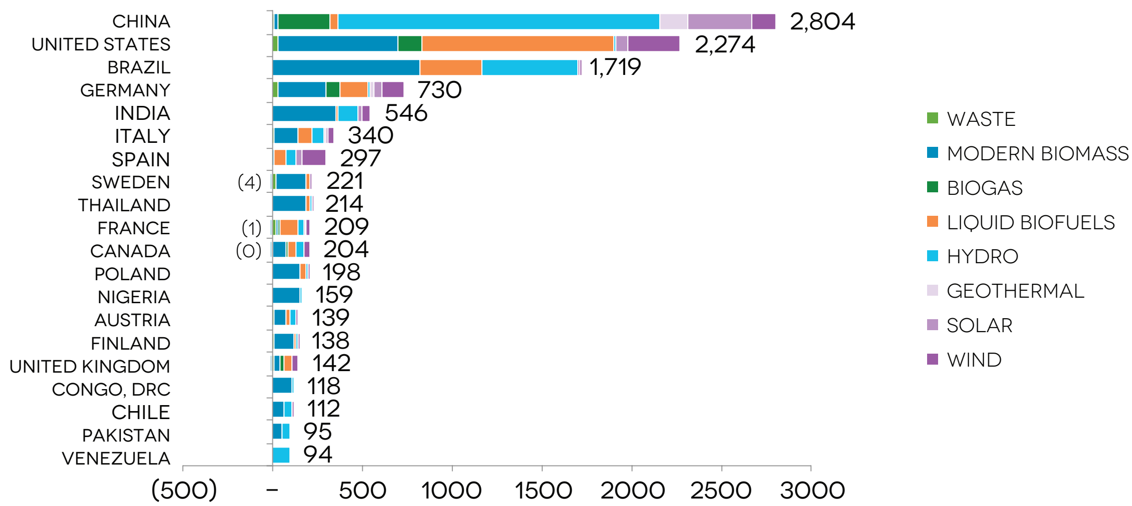

FIGURE O.24 **VOLUME OF INCREMENTAL CONSUMPTION OF RENEWABLE ENERGY (EXCLUDING TRADITIONAL BIOMASS), 1990–2010 (PETAJOULES)**

SOURCE: IEA 2012A.
NOTE: "INCREMENTAL CONSUMPTION" INDICATES ADDITIONAL CONSUMPTION OF RENEWABLE ENERGY OVER AND ABOVE THE LEVEL OF CONSUMPTION IN 1990. DRC = DEMOCRATIC REPUBLIC OF CONGO.

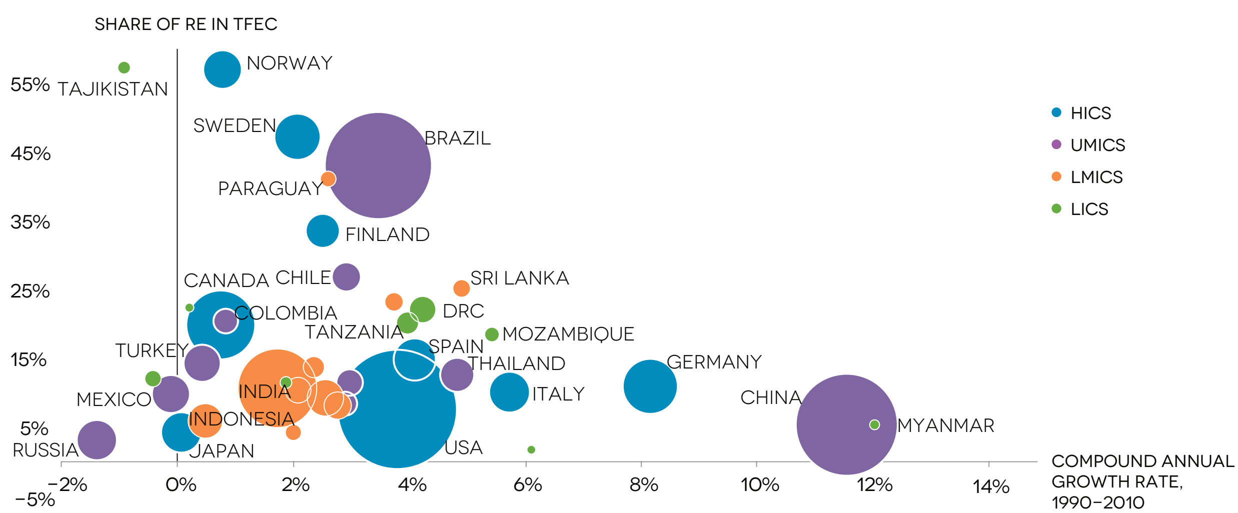

FIGURE O.25 **SHARE OF RENEWABLE ENERGY IN TOTAL FINAL ENERGY CONSUMPTION AND COMPOUND ANNUAL GROWTH RATE IN CONSUMPTION OF RENEWABLE ENERGY, 2000–10**

SOURCE: IEA 2012A.
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION; CAGR = COMPOUND ANNUAL GROWTH RATE; RE = RENEWABLE ENERGY. FIGURE EXCLUDES TRADITIONAL BIOMASS, BUT INCLUDES THE USE OF MODERN BIOMASS. CONGO AND TANZANIA APPEAR DUE TO THEIR HIGH USE OF MODERN BIOMASS IN THE INDUSTRIAL SECTOR. NEGATIVE CAGRS SHOWN DENOTE A REDUCTION IN THE USE OF NON-TRADITIONAL SOLID BIOMASS (MOST NOTABLY IN INDUSTRY) IN TURKEY, MEXICO, AND INDONESIA. UNLABELED BUBBLES REPRESENT COUNTRIES WITH A LOW SHARE OF RE IN TFEC AND A LOW CAGR.

Scale of the challenge

If current trends were to continue, the expansion of renewable energy would barely keep pace with the projected expansion of global energy demand. Consequently, the expected renewable energy share in 2030 would be no greater than 19.4 percent—barely one percentage point higher than it is today.

Furthermore, if current overall growth in energy demand continues, renewable energy consumption would have to triple, growing at an annual rate of 5.9 percent—or two and a half times the current growth rate—in order meet the target of doubling by 2030. Given that traditional biomass (representing about half of renewable energy use in 2010) is not expected to expand greatly, the annual growth rate for other forms of renewable energy would have to be in double digits.

By contrast, if overall energy demand were to stabilize (due to greater energy efficiency, for example), doubling the renewable energy contribution would require an annual growth rate of 3.5 percent, or a 50 percent increase over the levels observed in 1990–2010. This analysis highlights the critical linkage between the SE4ALL objectives for renewable energy and energy efficiency.

Several agencies and organizations have modeled scenarios of the evolution of renewable energy. These vary greatly in terms of their methodologies (that is, forecasting versus goal-seeking) as well as their assumptions about the prevailing policy environment. A review of energy modeling scenarios by the Intergovernmental Panel on Climate Change finds that more than half of 116 scenarios indicate a renewable energy share in total primary energy supply of less than 17 percent by 2030, with the highest cases projecting a renewable energy share of 43 percent (figure O.26). Those scenarios in which renewable energy shares rise above the 30 percent mark typically assume a strong package of policy measures, such as elimination of fossil-fuel subsidies, imposition of carbon pricing, aggressive pursuit of energy efficiency, sustained support for research and development of emerging renewable technologies, and the advent of advanced transport fuels and technologies.

Achieving the SE4ALL renewable energy objective within a supportive policy environment will call for sustained global investments in the range of $250 to $400 billion per year, depending on the pace of growth in energy demand. Financing for renewable energy rose exponentially in 2000–2010, reaching $277 billion in 2011. Only the last four years of this period, however, saw an investment exceeding the bottom of the required range; the total investment over the ten-year period amounted to an annual average of just $120 billion.

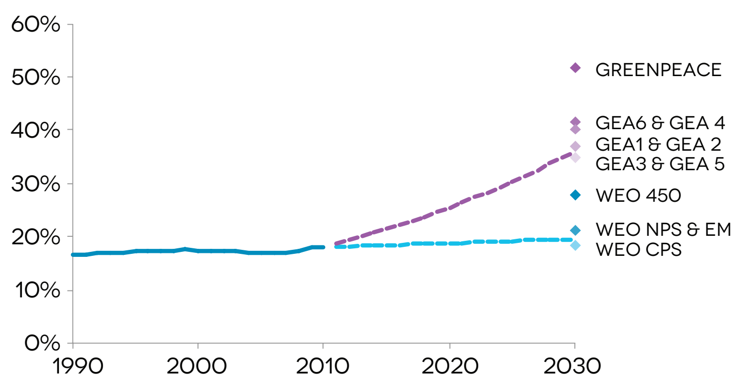

FIGURE O.26 **PROJECTIONS OF SHARE OF RENEWABLE ENERGY IN TFEC, 1990–2030**

% RE – HISTORICAL   % RE – TRENDS CONTINUED   % RE – SE4ALL TARGET GROWTH RATE

SOURCE: IEA (2012B): GREENPEACE INTERNATIONAL (2012); IIASA (2012); EXXONMOBIL (2012).
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION; RE = RENEWABLE ENERGY; WEO = WORLD ENERGY OUTLOOK; GEA = GLOBAL ENERGY ASSESSMENT; NPS = NEW POLICIES SCENARIO (IEA); CPS = CURRENT POLICIES SCENARIO (IEA); EM = EXXONMOBIL; SEFA = SUSTAINABLE ENERGY FOR ALL (SE4ALL).

The way forward

On the basis of the Global Tracking Framework, it is possible to establish the following starting points against which progress will be measured under the SE4ALL initiative: the rate of access to electricity and primary non-solid fuel will have to increase from 83 and 59 percent in 2010, respectively, to 100 percent by 2030; the rate of improvement of energy intensity will need to double from –1.3 percent in 1990–2010 to –2.6 percent in 2010–30; and the share of renewable energy in the global energy mix will need to double from an estimated 18 percent in 2010 to up to 36 percent by 2030 (table O.3).

	OBJECTIVE 1		OBJECTIVE 2	OBJECTIVE 3
	Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global energy mix
Proxy indicator	Percentage of population with electricity access	Percentage of population with primary reliance on non-solid fuels	Rate of improvement in energy intensity*	Renewable energy share in TFEC
Historic reference 1990	76	47	–1.3	16.6
Starting point 2010	83	59		18.0
Objective for 2030	100	100	–2.6	36.0

TABLE O.3 **SE4ALL HISTORIC REFERENCES, STARTING POINTS, AND GLOBAL OBJECTIVES (%)**

SOURCE: AUTHORS.
NOTE: TFEC = TOTAL FINAL ENERGY CONSUMPTION
*Measured in primary energy terms and GDP at purchasing power parity

While progress in all countries is important, achievement of the global SE4ALL objectives will depend critically on progress in the 20 high-impact countries that have a particularly large weight in aggregate global performance. Two overlapping groups of 20 high-impact countries in Asia and Africa account for about two-thirds of the global electrification deficit and four-fifths of the global deficit in access to non-solid fuels (figure O.27). Meeting the universal access objective globally will depend to a considerable extent on the progress that can be supported in these countries. A third group of 20 high-income and emerging economies accounts for four-fifths of global energy consumption. Therefore, the efforts of those high-impact countries to accelerate improvements in energy efficiency and develop renewable energy will ultimately determine the global achievement of the corresponding targets.

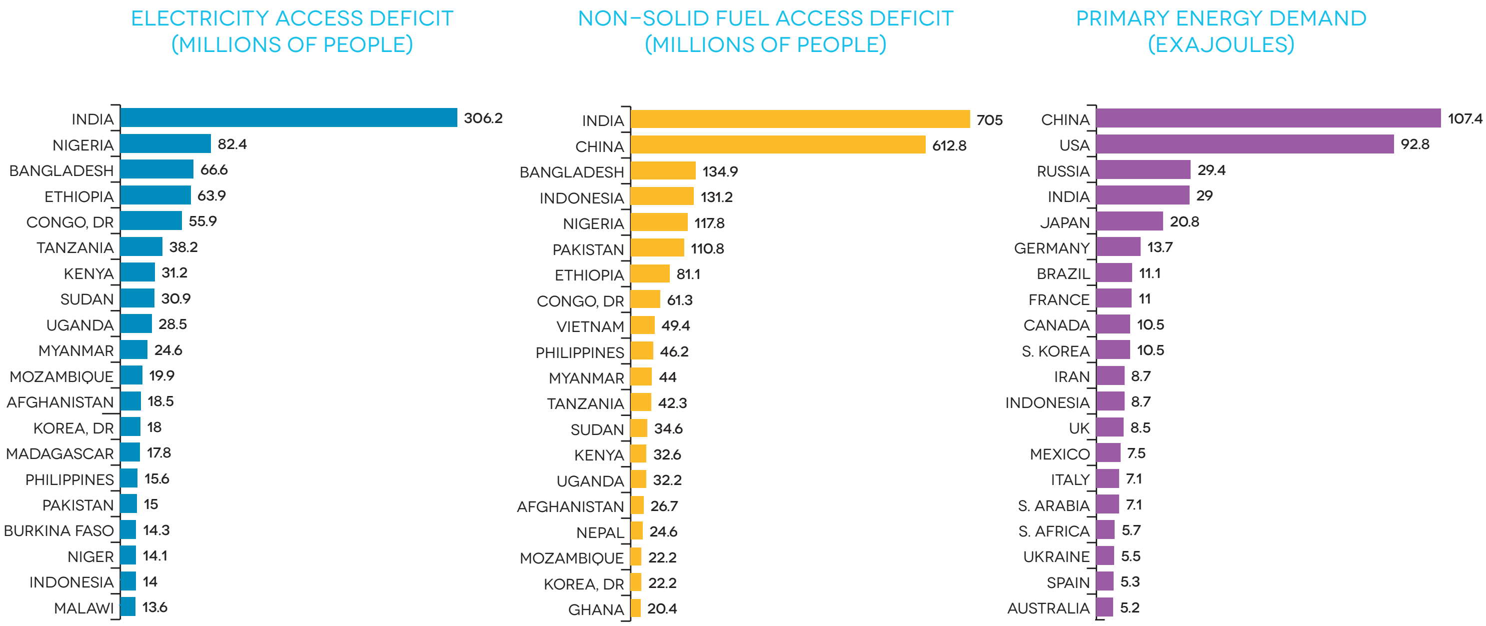

FIGURE O.27 **OVERVIEW OF HIGH-IMPACT COUNTRIES**

SOURCE: IEA, WB GLOBAL ELECTRIFICATION DATABASE, WHO GLOBAL HOUSEHOLD ENERGY DATABASE.
NOTE: DR = "DEMOCRATIC REPUBLIC OF."

In charting a course toward the achievement of the SE4ALL objectives, it will also be important to learn from the experience of the fast-moving countries that made the most progress during the 20 years between 1990 and 2010 (figure O.28). China and (to a lesser extent) India stand out as both high-impact and fast-moving countries on all three aspects of energy sector development.

In the case of electrification and cooking, even the most rapidly moving countries have not expanded access by more than 3–4 percentage points annually. In the case of energy efficiency, the countries with the most rapid improvements in energy intensity have seen CAGRs of minus 4–8 percent annually. In the case of renewable energy, the most rapidly moving countries experienced CAGRs of 10–20 percent (excluding traditional biomass).

AVERAGE ANNUAL RATE OF IMPROVEMENT (%)	GLOBAL AVERAGE	FAST MOVING COUNTRIES
Electrification	1.2	2.5 to 3.7
Non-solid fuel use	1.1	2.2 to 4.0
Energy intensity	1.3	3.9 to 11.9
Renewable energy [w/o trad. biomass]	3.0	7.0 to 18.2

TABLE O.4 **FAST MOVING COUNTRIES RELATIVE TO GLOBAL AVERAGE, AVERAGE ANNUAL RATE OF IMPROVEMENT (%)**

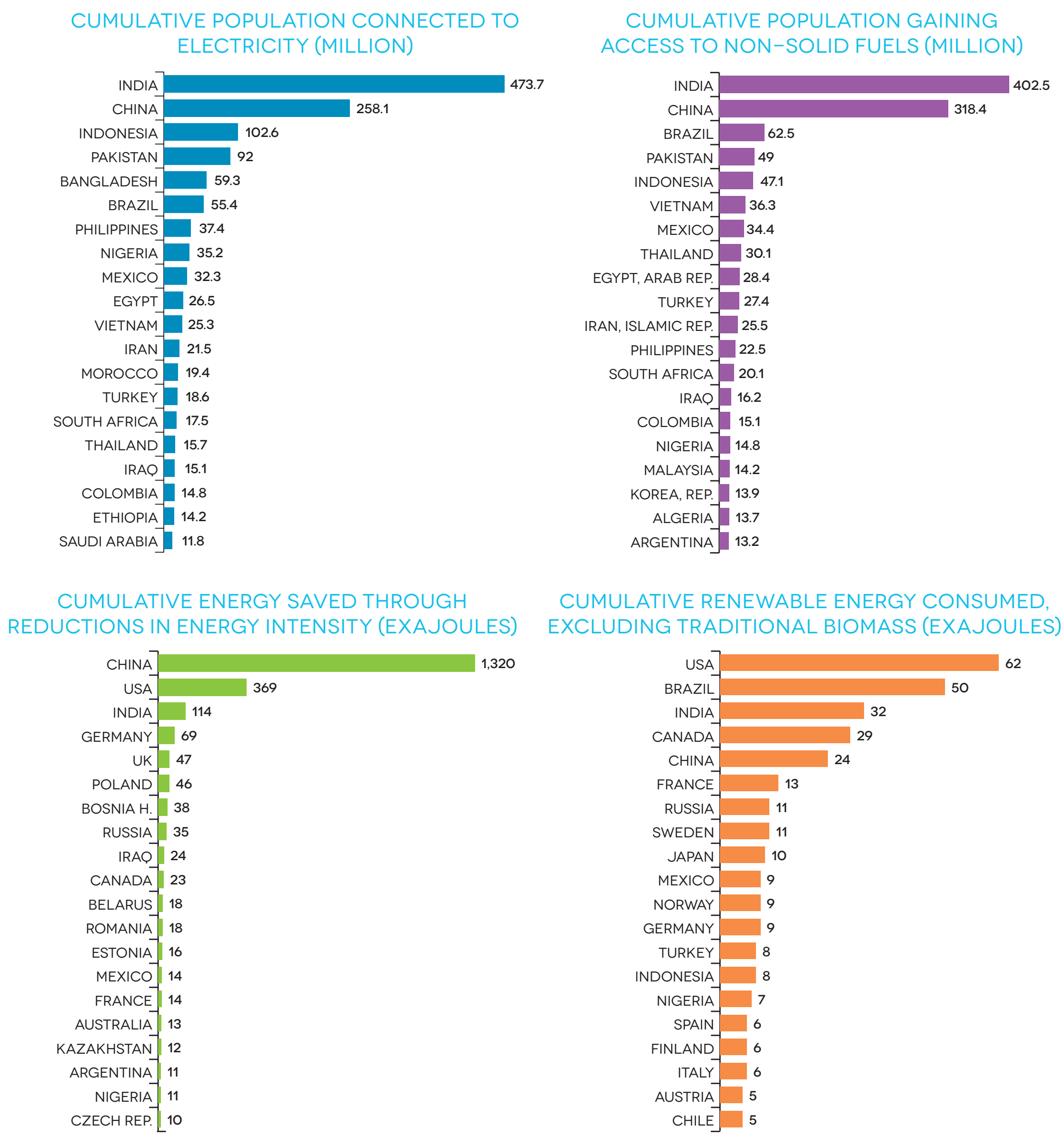

FIGURE O.28 **OVERVIEW OF FAST MOVING COUNTRIES (1990–2010)**

SOURCE: IEA, UN, WB GLOBAL ELECTRIFICATION DATABASE, WHO GLOBAL HOUSEHOLD ENERGY DATABASE.
NOTE: BOSNIA H. = BOSNIA AND HERZEGOVINA.

Global energy model scenarios enable us to gauge the scale of the global challenge of achieving the SE4ALL objectives. Based on these scenarios, it is clear that business as usual will not suffice (table O.4). With regard to universal access, business as usual would leave 12–16 percent and 31–36 percent of the world's population in 2030 without electricity and non-solid fuels, respectively. Implementing all currently available energy efficiency measures with reasonable payback periods would be enough to meet or even exceed the SE4ALL objective. However, numerous barriers prevent wider adoption of many of those measures, so that the current uptake ranges from around 20 percent for power generation and building construction to around 40 percent for manufacturing and transportation. Furthermore, few scenarios point to renewable energy shares above 30 percent by 2030.

Existing global investment in the areas covered by the three SE4ALL objectives was estimated at around $400 billion in 2010 (table O.5). The additional annual investments required to achieve the three objectives are tentatively estimated to be at least $600–800 billion—a doubling or tripling of current levels. The bulk of those investments is associated with the renewable energy and energy efficiency objectives, with access-related expenditures representing a relatively small share (10–20 percent) of the incremental costs.

The global energy models also help to clarify the kinds of policy measures that would be needed to reach the Secretary General's three sustainable energy objectives. The WEO and GEA coincide in highlighting the importance of phasing out fossil-fuel subsidies, adopting measures to provide price signals for carbon, embracing stringent technology standards for energy efficiency, and carefully designing and targeting subsidies to increase access.

In addition, global models help to clarify the likely pattern of efforts to achieve the SE4ALL objectives across geographical regions based on starting points, potential for improvement, and comparative advantage. On energy access, greatest efforts are needed in Sub-Saharan Africa and South Asia. For energy efficiency, the highest rates of improvement are projected at around –4 percent annually in Asia (particularly China) and the countries of the former Soviet Union. For renewable energy, Latin America and Sub-Saharan Africa (with its strong reliance on traditional biomass) emerge as the regions projected to reach the highest share of renewable energy in 2030—in excess of 50 percent, compared to the 20–40 percent range in much of the rest of the world (table O.6).

	OBJECTIVE 1		OBJECTIVE 2	OBJECTIVE 3
	Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global mix
Percentage in 2030	Population with electricity access	Population with primary reliance on non-solid fuels	Global rate of improvement in energy intensity*	Renewable energy share in total final energy consumption
IEA scenarios				
New policies	88	69	–2.3	20
Efficient world	88	69	–2.8	22
450	n.a.	n.a.	–2.9	27
GEA scenarios				
Baseline	84	64	–1.0	12
GEA Pathways	100	100	–3.0 to –3.2	34 to 41
2^0 Celsius	n.a.	n.a.	–1.8 to –3.2	23 to 41

TABLE O.5 **OVERVIEW OF PROJECTED OUTCOMES FOR 2030 FROM IEA WORLD ENERGY OUTLOOK AND IIASA GLOBAL ENERGY ASSESSMENT**

SOURCE: IEA (2012) AND IIASA (2012).
n.a. = NOT APPLICABLE.

* IEA scenarios are presented in primary energy terms while GEA scenarios in final energy terms (GDP at purchasing power parity in both cases)

	OBJECTIVE 1		OBJECTIVE 2	OBJECTIVE 3	
Average annual investment 2010–30 (US$ billion)	Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global mix	Total
	Electrification	Cooking	Energy efficiency	Renewable energy	
Actual for 2010	9.0	0.1	180	228	417.1
Additional from WEO	45.0	4.4	393	>>174	>>616.4*
Additional from GEA	15.0	71.0	259–365	259–406	604–858**

TABLE O.6 **OVERVIEW OF PROJECTED ANNUAL INVESTMENT NEEDS FOR 2010–2030 FROM WORLD ENERGY OUTLOOK AND GLOBAL ENERGY ASSESSMENT**

SOURCE: IEA (2012) AND IIASA (2012).

* WEO estimates are taken to be those closest to the corresponding SE4ALL objective: the Energy for All Scenario in the case of universal access, the Efficient World Scenario in the case of energy efficiency, and the 450 Scenario in the case of renewable energy. The 450 Scenario corresponds to a 27 percent renewable energy share, which is significantly below the SE4ALL objective. The Efficient World Scenario corresponds to a –2.8 percent CAGR for global energy intensity, which is significantly above the SE4ALL objective.

** GEA estimates that a further $716–910 billion would be needed annually for complementary infrastructure and broader energy sector investments not directly associated with the three objectives.

	OBJECTIVE 1				OBJECTIVE 2		OBJECTIVE 3	
	Universal access to modern energy services				Doubling global rate of improvement of energy efficiency		Doubling share of renewable energy in global mix	
	Percentage of population with electricity access		Percentage of population with primary reliance on non-solid fuels		Rate of improvement in energy intensity*		Renewable energy share in total final energy consumption	
	2010	SE4ALL	2010	SE4ALL	1990–2010	SE4ALL	2010	SE4ALL
Sub-Saharan Africa	32	100	19	100	1.1	2.2–2.4	56	60–73
Centrally Planned Asia	98	100	54	100	5.2	3.6–3.9	17	27–31
Central and Eastern Europe	100	100	90	100	3.1	2.6–3.0	8	28–36
Former Soviet Union	100	100	95	100	2.4	3.7–4.3	6	27–48
Latin America and Caribbean	95	100	86	100	0.7	2.6–3.0	25	49–57
Middle East and North Africa	95	100	99	100	-0.9	1.8–2.1	3	13–17
North America	100	100	100	100	1.7	2.4–2.6	8	26–34
Pacific OECD	100	100	100	100	0.7	2.9–3.4	6	30–41
Other Pacific Asia	89	100	57	100	1.2	3.6–4.0	18	30–37
South Asia	74	100	38	100	2.9	2.7–2.9	47	25–32
Western Europe	100	100	100	100	1.1	3.2–3.5	11	27–43
World	83	100	59	100	1.5	3.0–3.2	17	34–41

TABLE O.7 **GLOBAL ENERGY ASSESSMENT: REGIONAL PROJECTIONS UNDER SE4ALL SCENARIOS**

SOURCE: IIASA (2012). ACCESS TO ELECTRICITY FOR 2010 IS FROM WB GLOBAL ELECTRIFICATION DATABASE, 2012. ACCESS TO NON-SOLID FUEL FOR 2010 IS FROM WHO GLOBAL HOUSEHOLD ENERGY DATABASE, 2012.

* Measured in final energy terms and GDP at purchasing power parity

Moreover, the global energy models clarify how the three SE4ALL objectives interact with one another and contribute to addressing global concerns, such as climate change. The IEA finds that energy efficiency and renewable energy are mutually reinforcing—neither one on its own is sufficient to contain global warming to 2°C. Furthermore, achieving universal access to modern energy would lead to a negligible increase—only 0.6 percent—of global carbon dioxide emissions. The GEA estimates that the probability of limiting global warming to 2°C increases to between 66 and 90 percent when the SE4ALL objectives for renewable energy and energy efficiency are simultaneously met, higher than if either objective was met individually (Rogelj and others 2013). The achievement of the universal access objective for modern cooking, which would increase reliance on typically fossil-fuel-based and non-solid fuels for cooking, would have a small offsetting effect, reducing the share of renewable energy in the global mix by some two percentage points, with a negligible impact on the probability of achieving the 2°C target.

In conclusion, the Global Tracking Framework has constructed a robust data platform capable of monitoring global progress toward the SE4ALL objectives on an immediate basis, subject to improvement over time. Looking ahead, the consortium of agencies that has produced this report recommends a biannual update on the status of the three SE4ALL objectives that will build on this framework.

While the methodology here developed provides an adequate basis for basic global tracking, there are a number of significant information improvements that would be desirable to implement in the medium term. To effectively monitor progress through 2030 incremental investments in energy data systems will be essential over the next five years, both at the global and national levels. These represent relatively cost-effective high-impact improvements, whose implementation would be contingent on the availability of financial resources. For energy access, the focus will be to go beyond binary measures to a multi-tier framework that better captures the quantity and quality of electricity supplied, as well as the efficiency, safety, and convenience of the cookstoves that are used for cooking, including those that make use of biomass. For energy efficiency, the main concern is to strengthen country capacity to produce more disaggregated data on sectoral and subsectoral energy consumption that are fully integrated with associated output measures from the key energy consuming sectors. In the case of renewable energy, the main priority will be to improve the ability to gauge the sustainability of different forms of renewable energy, and most particularly the use of traditional biomass. These are all required to ensure that high-performing policies are developed that effectively target tangible results. Developing the capability of countries to develop and respond to such improved indicators is in itself a significant task.

Finally, given the scale of the challenge inherent in meeting the three SE4ALL objectives for energy, it is clear that a combination of bold policy measures with a supportive regulatory and institutional environment is required to support the requisite ramp-up of delivery capacity and financial flows to the sector. A detailed analysis of the policy environment at the country level lies beyond the immediate scope of this Global Tracking Framework, which has focused on the monitoring of global progress toward outcomes. Such an analysis, however, would be an important focus for future work in support of the SE4ALL initiative.

	RECOMMENDED TARGETING OF EFFORT OVER NEXT FIVE YEARS
Energy access	Work to improve energy questionnaires for global networks of household surveys. Pilot country-level surveys to provide more precise and informative multi-tier measures of access to electricity and clean cooking Develop suitable access measures for heating.
Energy efficiency	Integrate data systems on energy use and associated output measures. Strengthen country capacity to collect data on sectoral (and ideally subsectoral process) intensities. Improve data on physical activity drivers (traffic volumes, number of households, floor space, etc.). Improve data on energy efficiency targets, policies, and investments.
Renewable energy	Improve data and definitions for bio-energy and sustainability. Capture renewable energy used in distributed generation. Capture renewable energy used off-grid and in micro-grids. Promote a more harmonized approach to target-setting.

TABLE O.8 **MEDIUM-TERM AGENDA FOR THE IMPROVEMENT OF GLOBAL ENERGY DATABASES**

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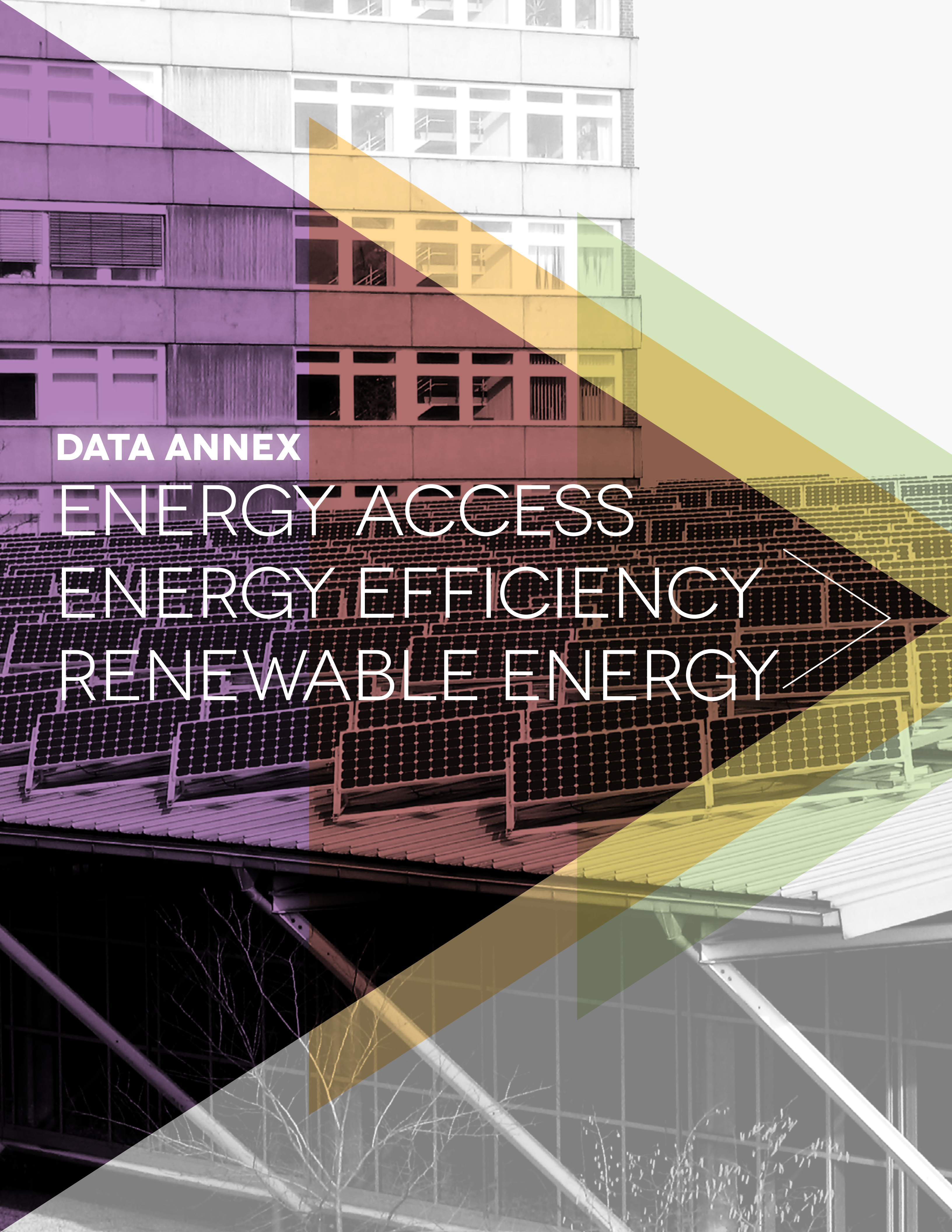

DATA ANNEX

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**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
SA	Afghanistan	35	37	41	29	81	NRVA 2007/08	< 5	9	15	5	66	Other2007
DEV	Albania	100	100	100	100	100	DHS 2008	36	50	61	49	89	DHS2008
NA	Algeria	94	98	99	98	100	COMELEC 2007	86	> 95	> 95	> 95	> 95	MICS2006
Oceania	American Samoa	49	53	56	43	57	Estimate						
DEV	Andorra	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
SSA	Angola	28	31	35	6	55	DHS 2011	< 5	16	45	11	84	DHS2006
LAC	Antigua and Barbuda	81	85	88	74	100	Estimate	86	> 95	> 95	> 95	> 95	Other2007
LAC	Argentina	81	85	88	74	89	Estimate	83	94	> 95	> 95	> 95	Other2001
CCA	Armenia	94	98	100	100	100	DHS 2005	15	50	81	51	> 95	NatSur2008
LAC	Aruba	81	85	88	74	100	Estimate						
DEV	Australia	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Austria	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
CCA	Azerbaijan	93	96	100	99	100	DHS 2006	48	72	93	81	> 95	DHS2006
LAC	Bahamas	81	85	88	74	91	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
WA	Bahrain	87	91	94	90	95	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
SA	Bangladesh	22	32	55	43	88	HIES 2010	9	11	9	5	37	DHS2007
LAC	Barbados	81	85	88	74	100	Estimate	> 95	> 95	> 95	> 95	> 95	NatCen2000
DEV	Belarus	100	100	100	100	100	HBS 2009	81	92	> 95	94	> 95	MICS2005
DEV	Belgium	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
LAC	Belize	81	85	88	74	100	Estimate	71	81	88	82	> 95	NatCen2010
SSA	Benin	22	25	28	9	52	DHS 2006	< 5	6	9	5	14	DHS2006
DEV	Bermuda	100	100	100	100	100	Assumption						
SA	Bhutan	66	68	72	50	100	DHS 2007	22	42	60	45	> 95	MICS2010
LAC	Bolivia, Plurinational State of	74	77	80	55	93	DHS 2008	55	64	71	27	94	DHS2008
DEV	Bosnia and Herzegovina	94	99	100	98	100	HBS 2007	42	50	55	31	83	MICS2005
SSA	Botswana	37	40	43	43	43	BAIS III 2008	35	50	63	38	90	NatSur2007
LAC	Brazil	92	97	99	94	100	NatCen2009	81	89	94	64	> 95	WHS2003
SEA	Brunei Darussalam	66	69	73	64	75	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
DEV	Bulgaria	100	100	100	100	100	HIS 2007	77	87	93			Estimate

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
SSA	Burkina Faso	6	7	13	1	47	DHS 2010	< 5	< 5	8	5	23	NatSur2007
SSA	Burundi	0	4	5	1	41	DHS 2010	< 5	< 5	< 5	< 5	5	MICS2005
SEA	Cambodia	19	17	31	19	81	DHS 2010	< 5	6	11	5	45	DHS2010
SSA	Cameroon	29	46	49	14	82	NatCen2006	6	17	25	5	41	MICS2005
DEV	Canada	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
SSA	Cape Verde	58	59	67	44	81	DHS 2005	51	61	68	33	90	NatSur2007
LAC	Cayman Islands	81	85	88	74	88	Estimate						
SSA	Central African Republic	3	6	9	5	16	Estimate	< 5	< 5	< 5	< 5	5	MICS2006
SSA	Chad	0	2	4	0	15	DHS 2004	< 5	< 5	12	6	27	Other2005
DEV	Channel Islands	100	100	100	100	100	Assumption						
LAC	Chile	95	98	100	98	100	ENEMDU 2010	76	86	94	53	> 95	N atCen2002
EA	China	94	98	100	98	100	Electric Company 2010	36	47	54	19	70	NatCen2005
EA	China, Hong Kong SAR	100	100	100	100	100	Estimate						
EA	China, Macau SAR	86	90	93	90	93	Estimate						
LAC	Colombia	90	93	97	91	99	NatCen2010	74	81	86	49	> 95	DHS2010
SSA	Comoros	42	45	48	37	77	Estimate	11	21	29	15	58	Other2004
SSA	Congo	24	21	37	9	53	DHS 2009	< 5	14	23	5	33	DHS2009
SSA	Congo, Dem. Rep. of the	6	7	15	3	39	DHS 2007	< 5	< 5	7	5	14	DHS2007
LAC	Costa Rica	93	95	99	98	100	ENCOVI 2010	77	87	94	86	> 95	NatSur2009
SSA	Cote d'Ivoire	37	51	59	37	80	DHS 2005	13	19	22	5	35	MICS2005
DEV	Croatia	100	100	100	100	100	Assumption	73	84	92	82	> 95	WHS2003
LAC	Cuba	94	97	100	93	100	Estimate	93	94	91	77	94	Other2008
LAC	Curacao	81	85	88	74	88	Estimate						
DEV	Cyprus	96	100	100	100	100	Assumption	> 95	> 95	> 95			Assumption
DEV	Czech Republic	100	100	100	100	100	HBS 2009	82	94	> 95	> 95	> 95	WHS2003
DEV	Denmark	100	100	100	100	100	Assumption	> 95	> 95	> 95			Assumption
SSA	Djibouti	43	46	50	10	61	PRSP 2004	84	87	87	21	90	NatSur2006
LAC	Dominica	85	88	91	100	87	Estimate	58	80	> 95	> 95	> 95	NatCen2001

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
LAC	Dominican Republic	78	92	98	94	100	NatCen2010	63	80	93	85	> 95	DHS2007
SEA	East Timor	32	34	38	24	74	DHS 2010	< 5	8	8	< 5	21	DHS2009
LAC	Ecuador	90	93	97	93	100	NatCen2010	73	87	> 95	87	> 95	NatCen2006
NA	Egypt	96	98	100	99	100	DHS 2008	93	> 95	> 95	> 95	> 95	DHS2005
LAC	El Salvador	77	88	92	82	97	INE 2010	50	65	78	49	93	NatSur2007
SSA	Equatorial Guinea	22	26	29	14	52	Estimate	18	21	23			Estimate
SSA	Eritrea	23	32	33	9	79	Estimate	14	28	40	15	73	DHS2002
DEV	Estonia	100	100	100	100	100	Assumption	72	82	89	69	> 95	WHS2003
SSA	Ethiopia	10	13	23	5	85	DHS 2011	7	6	< 5	< 5	27	DHS2005
DEV	Faeroe Islands	100	100	100	100	100	Assumption						
Oceania	Fiji	49	53	56	43	68	Estimate	45	56	63			Other1996
DEV	Finland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	France	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
Oceania	French Polynesia	49	53	56	43	68	Estimate						
SSA	Gabon	73	74	82	35	89	CWIQ 2005	50	64	74	25	86	Other2006
SSA	Gambia	18	34	31	23	37	Estimate	< 5	< 5	9	5	12	MICS2005
CCA	Georgia	97	100	100	100	100	HBS 2009	45	51	54	15	88	MICS2005
DEV	Germany	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
SSA	Ghana	31	45	61	38	82	DHS 2008	< 5	9	16	5	28	DHS2008
DEV	Greece	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Greenland	100	100	100	100	100	Assumption						
LAC	Grenada	81	85	88	74	100	Estimate	69	89	100	100	100	NatCen2001
Oceania	Guam	49	53	56	43	57	Estimate						
LAC	Guatemala	76	79	82	68	96	NatCen2006	36	41	43	18	73	WHS2003
SSA	Guinea	14	16	20	3	53	DHS 2005	< 5	< 5	< 5	< 5	< 5	DHS2005
SSA	Guinea-Bissau	51	54	57	19	100	Estimate	< 5	< 5	< 5	< 5	< 5	MICS2006
LAC	Guyana	72	75	78	72	91	DHS 2009	74	85	93	91	> 95	DHS2009
LAC	Haiti	31	31	34	12	54	DHS 2006	< 5	6	9	5	16	DHS2005
LAC	Honduras	75	77	81	64	97	NatCen2010	32	42	49	14	81	DHS2005

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
DEV	Hungary	100	100	100	100	100	HBS 2007	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Iceland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
SA	India	51	62	75	67	93	NSSO 2009	13	29	42	14	77	NatSur2006
SEA	Indonesia	67	88	94	89	99	DHS12 2010	33	41	45	23	80	DHS2007
SA	Iran, Islamic Republic of	94	98	98	95	100	Ministry of Energy 2006	88	> 95	> 95	> 95	> 95	Natcen2006
WA	Iraq	92	94	98	94	100	IAU Iraq / UN Factsheet 2011	89	> 95	> 95	91	> 95	MICS2005
DEV	Ireland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Isle of Man	100	100	100	100	100	Assumption						
DEV	Israel	96	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Italy	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
LAC	Jamaica	70	87	92	84	99	Ministry of Energy, 2008;	62	77	89			NatCen2001
DEV	Japan	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
WA	Jordan	95	100	99	99	100	DHS 2009	88	> 95	> 95	> 95	> 95	DHS2009
CCA	Kazakhstan	94	97	100	98	100	HBS 2008	71	83	91	77	> 95	MICS2005
SSA	Kenya	11	15	23	8	71	DHS 2008	18	20	20	5	61	DHS2010
Oceania	Kiribati	49	53	56	43	73	Estimate	34	45	54			Estimate
EA	Korea, Dem. People's Rep. of	20	22	26	10	37	Fund for Peace 2008; IEA est	< 5	7	9	5	11	NatCen2008
EA	Korea, Republic of	86	90	93	90	94	Estimate	80	> 95	> 95	> 95	> 95	Other1998
DEV	Kosovo	100	100	100	100	100	HBS 2009						
WA	Kuwait	87	91	94	90	94	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
CCA	Kyrgyzstan	97	100	100	100	100	HBS 2008	49	59	66	47	90	MICS2005
SEA	Lao People's Dem. Rep.	52	46	66	52	94	LECS4 2008	< 5	5	< 5	< 5	11	NatSur2007
DEV	Latvia	100	100	100	100	100	Assumption	77	87	95	78	> 95	WHS2003
WA	Lebanon	93	95	100	99	100	Other	92	> 95	> 95	> 95	> 95	Other1996
SSA	Lesotho	6	5	17	7	43	DHS 2009	37	39	39	20	94	DHS2009
SSA	Liberia	0	1	4	1	7	DHS 2011	< 5	< 5	< 5	< 5	5	DHS2009

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
NA	Libya	97	100	100	99	100	Estimate	89	> 95	> 95	> 95	> 95	Estimate
DEV	Liechtenstein	100	100	100	100	100	Assumption						
DEV	Lithuania	100	100	100	100	100	HBS 2008	77	87	93			Assumption
DEV	Luxembourg	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Macedonia, Former Yugoslav Rep. of	93	95	99	98	100	HBS 2006	52	61	67	48	78	MICS2005
SSA	Madagascar	9	11	14	9	25	DHS 2011	< 5	< 5	< 5	< 5	5	NatCen2009
SSA	Malawi	3	5	9	4	37	DHS 2010	< 5	< 5	< 5	< 5	11	DHS2010
SEA	Malaysia	93	96	99	98	100	HIS/BA 2009	78	92	> 95	> 95	> 95	WHS2003
SA	Maldives	94	96	100	100	100	DHS 2009	36	65	92	91	> 95	DHS2009
SSA	Mali	12	17	17	3	42	DHS 2006	< 5	< 5	< 5	< 5	5	DHS2006
DEV	Malta	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
Oceania	Marshall Islands	49	53	56	43	61	Estimate	80	76	68	8	92	Other2007
SSA	Mauritania	12	15	18	2	42	EPCV 2005	20	32	42	21	66	MICS2007
SSA	Mauritius	97	99	100	100	100	Estimate	81	93	> 95	> 95	> 95	NatSur2004
LAC	Mexico	95	98	99	98	100	NatCen2010	75	82	86	61	> 95	NatCen2010
Oceania	Micronesia, Federated States of	49	53	56	43	100	Estimate	45	53	59			NatCen2005
DEV	Moldova, Republic of	92	95	99	98	99	DHS 2005	72	82	89	79	> 95	DHS2005
DEV	Monaco	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
EA	Mongolia	80	83	86	67	100	LSMS 2005	19	25	28	5	43	MICS2005
DEV	Montenegro	100	100	100	100	100	Assumption	56	65	72	46	85	MICS2005
NA	Morocco	49	71	99	97	100	DHS 2003	81	91	> 95	87	> 95	DHS2004
SSA	Mozambique	6	7	15	2	45	DHS 2009	< 5	< 5	5	5	10	MICS2008
SEA	Myanmar	43	47	49	28	92	IHLCA 2010	< 5	< 5	8	5	17	Other2004
SSA	Namibia	26	37	44	15	92	DHS 2006	26	37	45	14	83	DHS2006
SA	Nepal	70	73	76	72	100	DHS 2011	26	23	18	10	67	DHS2006
DEV	Netherlands	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
Oceania	New Caledonia	49	53	56	43	64	Estimate						
DEV	New Zealand	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
LAC	Nicaragua	72	73	74	43	96	ENAHO 3 2005	23	36	46	9	71	NatSur2006

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
SSA	Niger	6	7	9	2	46	DHS 2006	< 5	< 5	< 5	< 5	6	DHS2006
SSA	Nigeria	42	45	48	35	62	DHS 2010	26	28	26	10	54	DHS2008
DEV	Norway	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
WA	Oman	87	91	94	90	96	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
SA	Pakistan	60	80	91	88	98	PSLM 2010-11	12	26	36	11	71	NatSur2006
Oceania	Palau	49	53	56	43	58	Estimate	90	> 95	> 95			Other1997
LAC	Panama	81	85	88	74	93	Estimate	75	80	82	73	> 95	LSMS2008
Oceania	Papua New Guinea	8	11	15	8	63	LSMS 2006	5	17	27	11	72	LSMS1996
LAC	Paraguay	90	92	97	94	99	NatCen2010	46	50	51	20	68	NatSur2009
LAC	Peru	69	72	85	60	93	NatCen2010	38	52	64	25	92	NatSur2010
SEA	Philippines	65	71	83	73	94	DHS 2008	40	47	50	34	76	DHS2008
DEV	Poland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Portugal	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
LAC	Puerto Rico	81	85	88	74	88	Estimate						
WA	Qatar	87	91	94	90	94	Estimate	92	> 95	> 95	> 95	> 95	NatCen2010
DEV	Romania	100	100	100	100	100	HBS 2009	65	75	83	63	> 95	Other2002
DEV	Russian Federation	100	100	100	100	100	HBS 2009	91	> 95	> 95	92	> 95	MICS2005
SSA	Rwanda	2	6	11	4	40	EICV 3 2011	< 5	< 5	< 5	< 5	5	NatSur2007
LAC	Saint Lucia	81	85	88	74	100	Estimate	63	86	100	100	100	Estimate
Oceania	Samoa	80	89	100	90	100	Estimate	30	40	47	25	73	DHS2009
DEV	San Marino	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
SSA	Sao Tome and Principe	50	53	57	44	65	DHS 2008	9	20	29	15	42	DHS2008
WA	Saudi Arabia	87	91	94	90	95	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
SSA	Senegal	26	37	57	27	97	DHS 2011	19	35	49	17	86	NatSur2008
DEV	Serbia	100	100	100	100	100	Estimate	49	60	68	41	89	MICS2005
SSA	Seychelles	22	26	29	14	42	Estimate	80	93	> 95	> 95	> 95	Other2002
SSA	Sierra Leone	6	9	12	1	29	DHS 2008	7	5	< 5	< 5	5	DHS2008
SEA	Singapore	66	69	73	64	73	Estimate	> 95	> 95	> 95	> 95	> 95	Estimate
DEV	Slovak Republic	100	100	100	100	100	Assumption	81	93	> 95	> 95	> 95	WHS2003

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	Country	1990	2000	2010	2010	2010	Latest available Source/year	1990	2000	2010	2010	2010	Latest available Source/year
DEV	Slovenia	100	100	100	100	100	Assumption	76	88	> 95	> 95	> 95	WHS2003
Oceania	Solomon Islands	13	16	19	10	57	Estimate	10	12	10	5	43	NatSur2007
SSA	Somalia	22	26	29	14	54	Estimate	< 5	< 5	< 5	< 5	5	MICS2005
SSA	South Africa	65	66	83	64	94	GHS 2011	61	75	85	63	94	NatSur2010
SSA	South Sudan	0	0	2	1	5	NatCen2010						
DEV	Spain	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	WHS2003
SA	Sri Lanka	78	81	85	83	96	HIES 2009	11	20	25	15	66	NatSur2009
LAC	St. Kitts and Nevis	81	85	88	74	100	Estimate	73	81	86			Estimate
LAC	St. Martin (French part)	81	85	88	74	100	Estimate						
LAC	St. Vincent and the Grenadines	67	70	73	29	100	Estimate	31	65	> 95	> 95	> 95	NatSur2007
SSA	Sudan	23	25	29	15	57	Other HH 2010	< 5	7	21	13	24	NatCen2008
LAC	Suriname	97	100	100	100	100	Estimate	70	81	88			MiCS2006
SSA	Swaziland	29	32	35	22	85	DHS 2006	22	35	45	25	87	DHS2006
DEV	Sweden	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	Switzerland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
WA	Syrian Arab Republic	85	87	93	78	100	Other HH 2010	84	> 95	> 95	> 95	> 95	MICS2005
CCA	Tajikistan	95	99	100	99	100	LSMS 2003	14	41	66	53	94	MICS2005
SSA	Tanzania, United Republic of	7	9	15	4	46	DHS 2010	< 5	< 5	6	5	16	DHS2010
SEA	Thailand	93	96	100	97	100	Household Energy Consumption Survey 2010	37	57	74	57	90	MICS2005
SSA	Togo	10	17	28	6	64	QUIBB 2006	< 5	< 5	6	5	7	NatSur2006
Oceania	Tonga	80	86	92	80	100	Estimate	28	44	57	53	92	NatCen2006
LAC	Trinidad and Tobago	93	95	99	98	100	Other HH 2009	81	93	> 95	> 95	> 95	MICS2006
NA	Tunisia	93	95	100	99	100	COMELEC 2007	82	94	> 95	> 95	> 95	MICS2006
WA	Turkey	100	100	100	100	100	HBS 2009	79	90	> 95	> 95	> 95	Other1999
CCA	Turkmenistan	95	100	100	100	100	HBS 2009	86	> 95	> 95	> 95	> 95	DHS2000
LAC	Turks and Caicos Islands	81	85	88	74	89	Estimate						
Oceania	Tuvalu	35	37	41	29	53	Estimate	33	58	81			Other2002

		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
SSA	Uganda	7	9	15	5	67	DHS 2011	< 5	< 5	< 5	< 5	11	DHS2009
DEV	Ukraine	93	96	100	100	100	DHS 2007	79	90	> 95	89	> 95	DHS2007
WA	United Arab Emirates	87	91	94	90	95	Estimate	86	> 95	> 95	> 95	> 95	WHS2003
DEV	United Kingdom of Great Britain and Northern Ireland	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
DEV	United States of America	100	100	100	100	100	Assumption	> 95	> 95	> 95	> 95	> 95	Assumption
LAC	Uruguay	92	96	99	93	100	SEDLAC 2009	89	> 95	> 95	87	> 95	NatSur2006
CCA	Uzbekistan	97	100	100	100	100	Estimate	69	80	89	80	> 95	MICS2005
Oceania	Vanuatu	18	19	24	15	50	Estimate	17	18	16	6	49	MICS2007
LAC	Venezuela, Bolivarian Rep. of	99	100	100	100	100	SEDLAC 2010	85	> 95	> 95	> 95	> 95	NatCen2001
SEA	Vietnam	88	89	96	95	99	LSMS 2006	< 5	24	44	29	78	NatCen2009
LAC	Virgin Islands (U.S.)	81	85	88	74	89	Estimate						
WA	West Bank and Gaza	87	91	94	90	96	Estimate						
WA	Yemen	38	41	45	31	75	Estimate	52	61	67	49	> 95	MICS2006
SSA	Zambia	13	17	19	3	43	DHS 2007	5	13	17	5	39	DHS2007
SSA	Zimbabwe	28	34	37	13	75	DHS 2011	32	34	34	6	84	DHS2006

AGGREGATED BY INCOME LEVEL		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
	High income: non-OECD	88	90	92	89	93		71	74	81	77	86	
	High income: OECD	99	100	100	100	100		99	100	100	99	100	
	Low income	20	24	32	19	64		7	9	9	6	25	
	Lower middle income	58	68	77	69	91		25	37	46	21	75	
	Upper middle income	93	96	98	96	99		53	64	71	36	85	

AGGREGATED BY REGION		ACCESS TO ELECTRICITY (% OF POPULATION)						ACCESS TO NON-SOLID FUEL (% OF POPULATION)					
		TOTAL			RURAL	URBAN		TOTAL			RURAL	URBAN	
Region	**Country**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**	**1990**	**2000**	**2010**	**2010**	**2010**	**Latest available Source/year**
CCA	Caucasus and Central Asia	95	99	100	99	100		58	73	85	74	98	
DEV	Developed Countries	100	100	100	100	100		95	98	99	96	100	
EA	Eastern Asia	93	96	98	97	98		37	48	55	35	76	
LAC	Latin America and Caribbean	88	92	95	84	98		73	81	86	57	94	
NA	Northern Africa	85	92	99	99	100		88	96	100	99	100	
Oceania	Oceania	21	23	25	14	65		14	24	31	21	73	
SA	Southern Asia	52	63	75	67	94		16	30	40	23	78	
SEA	Southeastern Asia	71	81	88	80	97		29	40	48	27	77	
SSA	Sub-Saharan Africa	23	26	32	14	63		14	17	19	6	42	
WA	Western Asia	89	89	91	78	97		83	90	95	86	99	
	WORLD	76	79	83	70	95		47	54	59	35	84	

NOTE: THE SOURCE FIELD GIVES EITHER (A) THE NAME AND DATE OF THE HOUSEHOLD SURVEY FROM WHICH THE FIGURE IS TAKEN; OR (B) INDICATES THAT THE FIGURE IS AN ESTIMATE BASED ON THE STATISTICAL MODEL DESCRIBED IN ANNEX 2 OF CHAPTER 2; OR (C) IS BASED ON THE ASSUMPTION OF UNIVERSAL ACCESS IN COUNTRIES CLASSIFIED BY THE UNITED NATIONS AS DEVELOPED.

NOTE: DEVELOPED COUNTRIES (DEV) ARE CONSIDERED TO HAVE ACCESS RATES OF 100 PERCENT. CCA = CAUCASUS AND CENTRAL ASIA; EA = EASTERN ASIA; LAC = LATIN AMERICA AND CARIBBEAN; NA = NORTHERN AFRICA; SA = SOUTHERN ASIA; SEA = SOUTH-EASTERN ASIA; SSA = SUB-SAHARAN AFRICA; WA = WESTERN ASIA; BAIS=BOTSWANA AIDS IMPACT SURVEY III; COMELEC= MAGHREB ASSOCIATION OF THE ELECTRICITY SECTOR; CWIQ= CORE WELFARE INDICATORS QUESTIONNAIRE SURVEY; DHS = DEMOGRAPHIC AND HEALTH SURVEY; EICV=INTEGRATED HOUSEHOLD LIVING CONDITIONS SURVEY IN RWANDA; EPCV=PERMANENT LIVING CONDITIONS; GHS=GENERAL HOUSEHOLD SURVEY; HBS = HOUSEHOLD BUDGET SURVEY; IES = INTEGRATED EXPENDITURE SURVEY; HIES=HOUSEHOLD INCOME AND EXPENDITURE SURVEYS; HIS = INTEGRATED HOUSEHOLD SURVEY; HIS/BA= HOUSEHOLD INCOME AND BASIC AMENITIES SURVEY REPORT; LECS=LAO EXPENDITURE AND CONSUMPTION SURVEY; LSMS = LIVING STANDARD MEASUREMENT SURVEY; MICS=MULTIPLE INDICATORS CLUSTER SURVEY; NRVA=NATIONAL RISK AND VULNERABILITY ASSESSMENT; NSSO=NATIONAL SAMPLE SURVEY ORGANIZATION; QUIBB=QUESTIONNAIRE DES INDICATEURS DE BASE DU BIENETRE; WHS=WORLD HEALTH SURVEY.

DATA ANNEX: ENERGY EFFICIENCY

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOMPOSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Afghanistan	UN/WDI	–15.81	3.12	–6.83	11.8	2.9	8.93**	–2.04	—	—	2,993
Albania	IEA/WDI	–5.28	–3.49	–4.39	8.7	3.5	-2.88*	–3.84	84.0	94.2	1,227
Algeria	IEA/WDI	0.30	0.34	0.32	5.9	6.3	—	1.10	57.4	67.0	–909
Angola	IEA/WDI	1.68	–4.41	–1.41	7.7	5.8	-0.29	–1.23	77.0	79.9	184
Antigua and Barbuda	UN/WDI	–1.49	3.44	0.94	2.8	3.4	—	–2.83	—	—	6
Argentina	IEA/WDI	–1.63	–2.19	–1.91	7.9	5.4	-1.83	–1.43	65.3	72.0	11,171
Armenia	IEA/WDI	–9.13	–5.49	–7.33	30.9	6.8	-11.22	–7.97	84.0	73.1	3,756
Aruba	UN/WDI	—	—	—	—	—	—	—	—	—	—
Australia	IEA/WDI	–1.07	–1.56	–1.32	8.9	6.8	-1.27	–1.73	65.6	60.4	13,162
Austria	IEA/WDI	–1.25	0.16	–0.55	5.3	4.8	-0.36	–0.40	79.4	81.7	1,774
Azerbaijan	IEA/WDI	–2.93	–12.70	–7.95	32.2	6.1	-8.47*	–8.22	61.2	57.6	10,415
Bahamas	UN/WDI	–2.75	3.78	0.46	3.4	3.7	—	8.38	—	—	66
Bahrain	IEA/WDI	–2.38	–0.64	–1.51	20.6	15.2	—	–1.51	54.5	54.6	1,535
Bangladesh	IEA/WDI	–0.89	–0.54	–0.71	6.8	5.9	-1.36	–1.48	86.2	73.8	1,558
Barbados	UN/WDI	–1.10	2.36	0.61	3.6	4.1	0.59	–3.36	—	—	11
Belarus	IEA/WDI	–4.80	–5.80	–5.30	29.1	9.8	-4.63	–5.55	75.7	71.9	17,682
Belgium	IEA/WDI	–0.28	–0.98	–0.63	8.1	7.1	-0.84	–0.48	66.4	68.5	2,489
Belize	UN/WDI	0.49	–6.34	–2.98	9.7	5.3	—	–3.17	—	—	78
Benin	IEA/WDI	–2.87	2.22	–0.36	13.0	12.1	—	–0.28	86.4	87.8	282
Bermuda	UN/WDI	—	—	—	—	—	—	—	—	—	—
Bhutan	UN/WDI	–2.66	–5.83	–4.26	38.3	16.0	—	0.04	—	—	528
Bolivia, Plurinational State of	IEA/WDI	–0.11	3.00	1.43	5.3	7.1	—	1.19	82.6	78.7	–371
Bosnia and Herzegovina	IEA/WDI	–22.25	–0.12	–11.87	119.7	9.6	-0.80**	–13.37	69.7	49.6	37,653
Botswana	IEA/WDI	–1.79	–1.90	–1.84	5.5	3.8	-2.13	–1.14	71.4	82.4	426
Brazil	IEA/WDI	0.39	–0.06	0.17	5.5	5.7	0.42	0.15	79.5	79.3	–4,973
British Virgin Islands	UN/WDI	—	—	—	—	—	—	—	—	—	—
Brunei Darussalam	IEA/WDI	1.10	1.67	1.38	5.8	7.6	—	6.29	19.9	51.3	–257
Bulgaria	IEA/WDI	–2.99	–4.35	–3.67	18.2	8.6	-3.81	–4.55	61.0	50.8	7,280

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Burkina Faso	UN/WDI	–5.54	0.47	–2.58	21.2	12.6	-3.35*	–3.01	—	—	1,738
Burundi	UN/WDI	2.15	2.30	2.23	21.4	33.3	—	8.81	—	—	–652
Cambodia	IEA/WDI	–2.97	–3.75	–3.43	13.7	7.6	—	–4.20	0.0	84.8	–2,635
Cameroon	IEA/WDI	1.01	–2.07	–0.54	8.2	7.4	-2.30**	–1.30	95.4	81.9	–189
Canada	IEA/WDI	–1.00	–1.82	–1.41	11.7	8.8	-1.15	–1.31	76.3	77.8	23,448
Cape Verde	UN/WDI	1.62	0.16	0.88	3.7	4.4	—	–0.56	—	—	–16
Cayman Islands	UN/WDI	—	—	—	—	—	—	—	—	—	—
Central African Republic	UN/WDI	–4.09	–0.11	–2.12	18.3	11.9	—	–3.57	—	—	218
Chad	UN/WDI	0.89	–5.70	–2.46	12.9	7.9	—	5.90	—	—	488
Chile	IEA/WDI	–0.34	–1.73	–1.04	6.4	5.2	-1.10	–1.18	79.2	77.0	2,391
China	IEA/WDI	–7.07	–2.18	–4.65	30.5	11.8	-6.48	–5.64	76.0	61.6	1,319,738
China, Hong Kong SAR	IEA/WDI	0.52	–3.59	–1.56	2.7	2.0	—	–1.54	60.1	60.3	773
China, Macao SAR	UN/WDI	2.83	–8.56	–3.04	1.8	1.0	—	–4.13	—	—	71
Colombia	IEA/WDI	–1.97	–1.76	–1.86	5.0	3.4	-2.50	–2.43	78.1	69.5	5,746
Comoros	UN/WDI	2.45	2.50	2.47	2.9	4.7	—	7.69	—	—	–9
Congo	IEA/WDI	–0.92	1.38	0.22	3.8	4.0	—	–0.04	77.8	73.9	16
Congo, Dem. Rep. of the	IEA/WDI	9.66	–1.26	4.06	21.5	47.6	—	4.38	89.8	95.6	–7,220
Cook Islands	UN/WDI	—	—	—	—	—	—	—	—	—	—
Costa Rica	IEA/WDI	–1.31	0.29	–0.51	4.4	4.0	-1.55	–1.41	89.2	74.5	254
Cote d'Ivoire	IEA/WDI	2.18	2.47	2.32	7.6	12.0	1.90	1.33	66.6	54.8	–1,645
Croatia	IEA/WDI	0.10	–1.68	–0.80	5.9	5.0	-0.32	–0.23	72.1	80.7	138
Cuba	IEA/WDI	—	—	—	—	—	—	—	79.7	56.7	—
Cyprus	IEA/WDI	0.43	–1.44	–0.51	5.4	4.9	0.01	–0.04	64.2	70.5	–5
Czech Republic	IEA/WDI	–2.30	–2.57	–2.44	12.2	7.4	-3.05	–3.02	69.2	61.3	10,499
Denmark	IEA/WDI	–1.84	–0.24	–1.04	5.6	4.5	-0.83	–0.92	75.9	77.7	1,919
Djibouti	UN/WDI	2.81	–0.26	1.26	5.2	6.7	—	4.03	—	—	–42
Dominica	UN/WDI	3.96	–0.02	1.95	1.8	2.6	—	–0.18	—	—	–8
Dominican Republic	IEA/WDI	0.55	–4.40	–1.96	6.2	4.2	-5.53**	–1.80	65.8	68.0	462

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Ecuador	IEA/WDI	1.10	–0.40	0.35	4.5	4.9	-0.29	–0.18	87.5	78.8	–591
Egypt	IEA/WDI	–1.89	1.16	–0.38	7.4	6.8	-0.33*	–0.61	70.8	67.6	1,860
El Salvador	IEA/WDI	0.24	–1.31	–0.54	5.3	4.7	-3.27	–1.97	82.1	61.3	–8
Equatorial Guinea	UN/WDI	–11.08	6.53	–2.67	11.0	6.4	—	–11.87	—	—	808
Eritrea	IEA/WDI	–7.26	–1.45	–4.08	25.6	12.1	—	–4.30	0.0	69.2	–640
Estonia	IEA/WDI	–14.62	–1.77	–8.42	60.8	10.5	-9.26	–9.10	60.6	52.3	15,850
Ethiopia	IEA/WDI	–0.45	–2.25	–1.36	23.6	18.0	-2.68	–1.39	95.1	94.3	1,668
Falkland Islands (Malvinas)	UN/WDI	—	—	—	—	—	—	—	—	—	—
Fiji	UN/WDI	–1.04	–3.67	–2.36	7.9	4.9	—	–1.13	—	—	52
Finland	IEA/WDI	–0.76	–0.55	–0.66	10.3	9.0	-1.04	–0.99	78.4	73.3	1,178
France	IEA/WDI	–0.77	–0.70	–0.73	6.6	5.7	-0.74	–0.87	63.9	62.1	13,508
French Guiana	UN/WDI	—	—	—	—	—	—	—	—	—	—
French Polynesia	UN/WDI	—	—	—	—	—	—	—	—	—	—
Gabon	IEA/WDI	0.49	1.54	1.02	3.6	4.4	-0.13*	1.17	85.4	88.0	–136
Gambia	UN/WDI	0.65	–0.03	0.31	6.5	7.0	—	0.80	—	—	–8
Georgia	IEA/WDI	–4.73	–5.08	–4.91	17.6	6.4	-4.82	–4.20	72.3	83.9	1,552
Germany	IEA/WDI	–2.32	–1.20	–1.76	7.2	5.0	-1.81	–1.71	68.6	69.3	69,126
Ghana	IEA/WDI	–0.41	–3.74	–2.09	16.5	10.8	-3.17	–2.18	81.7	80.2	1,003
Gibraltar	IEA/WDI	—	—	—	—	—	—	—	78.1	83.8	—
Greece	IEA/WDI	0.02	–1.90	–0.94	5.1	4.2	—	–0.73	67.6	70.5	1,431
Grenada	UN/WDI	1.68	2.20	1.94	2.5	3.6	-0.29**	–1.48	—	—	–12
Guadeloupe	UN/WDI	—	—	—	—	—	—	—	—	—	—
Guatemala	IEA/WDI	0.65	0.46	0.55	6.2	6.9	-0.33	0.05	91.4	82.7	–94
Guinea	UN/WDI	–1.74	–4.20	–2.98	40.6	22.2	—	–3.31	—	—	1,645
Guinea-Bissau	UN/WDI	–0.68	1.37	0.34	8.6	9.2	—	1.73	—	—	1
Guyana	UN/WDI	–1.18	–2.10	–1.64	22.7	16.3	0.49	–2.45	—	—	137
Haiti	IEA/WDI	2.94	1.21	2.07	6.4	9.7	—	2.77	79.1	90.6	–556
Honduras	IEA/WDI	–0.95	0.25	–0.35	7.7	7.2	—	–1.22	98.1	82.2	106

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOMPOSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Hungary	IEA/WDI	–1.64	–1.67	–1.65	8.8	6.3	-1.85	–1.74	71.8	70.6	3,906
Iceland	IEA/WDI	1.44	3.41	2.42	13.4	21.6	0.57	0.58	78.6	54.7	–450
India	IEA/WDI	–1.72	–2.98	–2.35	12.5	7.8	-4.09	–3.25	79.5	66.0	114,220
Indonesia	IEA/WDI	0.40	–2.15	–0.88	11.2	9.3	-1.73	–1.24	80.9	75.3	9,891
Iran, Islamic Rep. of	IEA/WDI	2.10	0.96	1.53	8.5	11.6	1.63	1.30	78.9	75.4	–22,350
Iraq	IEA/WDI	–10.76	4.80	–3.29	30.2	15.5	—	–4.81	75.7	55.2	23,829
Ireland	IEA/WDI	–1.16	–1.87	–1.52	5.1	3.7	-0.93	–1.25	74.0	78.1	2,155
Israel	IEA/WDI	–1.60	–0.14	–0.88	5.8	4.8	—	–0.57	60.7	64.6	1,963
Italy	IEA/WDI	–0.01	–0.45	–0.23	4.6	4.4	-0.14	–0.37	78.4	76.2	1,220
Jamaica	IEA/WDI	1.42	–3.05	–0.84	8.0	6.8	-0.62	–0.97	70.3	68.5	–90
Japan	IEA/WDI	0.55	–1.17	–0.31	5.6	5.3	-0.45	–0.54	68.3	65.3	–2,328
Jordan	IEA/WDI	–1.04	–2.16	–1.60	13.1	9.5	-2.27	–2.13	71.1	64.0	714
Kazakhstan	IEA/WDI	–3.51	–0.52	–2.02	26.5	17.6	-3.26*	–3.63	81.2	58.3	12,434
Kenya	IEA/WDI	0.66	–0.48	0.09	13.4	13.6	-0.82	–0.23	70.2	65.8	–424
Kiribati	UN/WDI	1.54	3.49	2.51	2.2	3.6	—	12.22	—	—	–1
Korea, Dem. People's Rep. of	IEA/WDI	—	—	—	—	—	—	—	82.3	86.6	—
Korea, Republic of	IEA/WDI	1.14	–1.22	–0.05	8.0	7.9	-1.36	–0.55	69.7	63.0	–5,171
Kuwait	IEA/WDI	5.46	0.57	2.99	6.2	11.2	—	2.56	43.4	39.9	–5,800
Kyrgyzstan	IEA/WDI	–7.04	–1.97	–4.54	28.3	11.2	—	–4.69	92.2	89.4	2,131
Lao People's Dem. Rep.	UN/WDI	–3.20	–5.12	–4.16	13.4	5.7	-4.95	–5.83	—	—	814
Latvia	IEA/WDI	–4.56	–1.85	–3.21	12.3	6.4	-2.87	–2.45	81.6	95.4	1,853
Lebanon	IEA/WDI	2.78	–2.26	0.23	4.8	5.1	—	0.46	58.2	61.0	–598
Lesotho	UN/WDI	1.28	–2.59	–0.67	12.2	10.6	—	–3.58	—	—	10
Liberia	UN/WDI	0.42	–2.40	–1.00	73.1	59.8	—	0.97	—	—	–125
Libya	IEA/WDI	3.10	–2.82	0.09	7.7	7.9	—	0.92	48.5	57.1	–2,712
Lithuania	IEA/WDI	–4.73	–4.46	–4.60	14.6	5.7	-4.75	–3.69	64.8	78.2	3,839
Luxembourg	IEA/WDI	–5.04	–0.28	–2.69	8.8	5.1	-1.86	–2.13	82.1	92.0	1,533
Macedonia, Former Yugoslav Rep. of	IEA/WDI	1.66	–1.62	0.01	6.4	6.4	0.65	0.16	60.9	62.9	–361

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Madagascar	UN/WDI	2.31	0.55	1.43	10.3	13.7	—	0.54	—	—	–721
Malawi	UN/WDI	–2.03	–2.43	–2.23	16.8	10.7	—	–2.96	—	—	536
Malaysia	IEA/WDI	0.96	–0.18	0.39	7.5	8.1	-1.12*	–0.02	64.7	59.6	–4,062
Maldives	UN/WDI	8.17	4.64	6.39	2.7	9.3	—	5.53	—	—	–132
Mali	UN/WDI	–1.25	–3.41	–2.34	10.6	6.6	—	–3.48	—	—	445
Malta	IEA/WDI	–5.30	0.64	–2.38	6.0	3.7	—	–1.82	38.4	43.0	262
Martinique	UN/WDI	—	—	—	—	—	—	—	—	—	—
Mauritania	UN/WDI	–7.19	–0.35	–3.83	20.3	9.3	-1.99*	–1.77	—	—	839
Mauritius	UN/WDI	–0.37	–0.79	–0.58	7.3	6.5	-2.40	–1.95	—	—	81
Mexico	IEA/WDI	–1.70	0.30	–0.71	6.1	5.3	-0.58	–1.08	68.7	63.7	13,954
Moldova, Republic of	IEA/WDI	–3.33	–4.52	–3.92	24.4	11.0	-4.13	–3.72	67.4	70.4	893
Mongolia	IEA/WDI	–3.46	–3.10	–3.28	26.8	13.7	-5.21	–4.34	87.0	69.7	1,020
Montenegro	IEA/WDI	n.a	–1.30	–1.30	5.7	5.4	—	–4.18	0.0	53.8	–193
Montserrat	UN/WDI	—	—	—	—	—	—	—	—	—	—
Morocco	IEA/WDI	1.56	–0.04	0.76	4.3	5.0	0.92	1.01	71.9	75.6	–1,076
Mozambique	IEA/WDI	–3.33	–3.88	–3.61	46.3	22.2	-3.51	–3.59	80.3	80.6	3,587
Myanmar	IEA/WDI	—	—	—	—	—	-5.60*	—	88.0	92.1	—
Namibia	IEA/WDI	1.08	0.40	0.74	4.3	5.0	-0.67*	0.55	98.3	94.5	–116
Nepal	IEA/WDI	–1.49	–1.52	–1.50	17.9	13.2	-2.49	–1.52	99.5	99.1	1,315
Netherlands	IEA/WDI	–2.01	–0.06	–1.04	7.0	5.7	-1.07	–0.85	74.8	77.6	10,284
Netherlands Antilles	IEA/WDI	—	—	—	—	—	—	—	42.9	48.4	—
New Caledonia	UN/WDI	—	—	—	—	—	—	—	—	—	—
New Zealand	IEA/WDI	–0.05	–1.65	–0.85	8.3	7.0	-1.18	–1.34	77.4	70.2	1,236
Nicaragua	IEA/WDI	–0.71	–1.44	–1.08	11.3	9.1	-1.21	–1.27	73.8	71.0	139
Niger	UN/WDI	1.57	–8.58	–3.64	16.6	7.9	0.21**	–3.65	—	—	394
Nigeria	IEA/WDI	–0.24	–3.92	–2.10	21.4	14.0	—	–1.92	89.1	92.4	11,078
Norway	IEA/WDI	–1.46	0.69	–0.39	6.4	5.9	-1.08	–1.53	83.0	65.9	3,339
Oman	IEA/WDI	2.01	4.53	3.26	6.4	12.3	—	2.53	44.5	38.6	–2,035

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Pakistan	IEA/WDI	0.11	–1.62	–0.76	9.9	8.5	-1.09	–0.90	84.8	82.6	2,196
Palau	UN/WDI	2.14	4.98	3.55	5.9	11.8	—	4.58	—	—	–16
Panama	IEA/WDI	0.54	–2.31	–0.90	4.3	3.6	-2.52**	–1.05	82.5	80.0	88
Papua New Guinea	UN/WDI	–2.17	–2.66	–2.42	11.4	7.0	-2.01	–4.02	—	—	585
Paraguay	IEA/WDI	0.49	–1.72	–0.62	7.6	6.7	—	–0.91	95.3	89.9	0
Peru	IEA/WDI	–1.61	–0.89	–1.25	4.2	3.3	-1.76	–1.92	87.9	76.8	2,749
Philippines	IEA/WDI	0.50	–4.40	–1.98	7.6	5.1	-2.98	–2.77	69.2	58.8	3,660
Poland	IEA/WDI	–5.04	–2.49	–3.77	13.8	6.4	-3.17	–3.09	59.6	68.7	46,298
Portugal	IEA/WDI	0.96	–1.10	–0.07	4.3	4.3	0.57	–0.02	79.7	80.5	–1,178
Puerto Rico	UN/WDI	—	—	—	—	—	—	—	—	—	—
Qatar	IEA/WDI	3.79	–0.99	1.37	7.9	10.3	—	1.25	54.1	52.8	–3,106
Reunion	UN/WDI	—	—	—	—	—	—	—	—	—	—
Romania	IEA/WDI	–3.63	–4.46	–4.05	14.3	6.3	-4.04	–4.18	69.3	67.5	17,593
Russian Federation	IEA/WDI	0.46	–3.39	–1.49	19.7	14.6	-2.12	–2.04	71.1	63.5	34,769
Rwanda	UN/WDI	4.50	–6.04	–0.91	10.3	8.6	—	–1.18	—	—	–364
Saint Kitts and Nevis	UN/WDI	–1.66	5.82	2.01	3.5	5.1	—	–1.34	—	—	–9
Saint Lucia	UN/WDI	4.31	1.14	2.71	2.3	3.9	—	–3.61	—	—	–29
Saint Pierre and Miquelon	UN/WDI	—	—	—	—	—	—	—	—	—	—
Saint Vincent and the Grenadines	UN/WDI	3.09	0.40	1.74	2.0	2.9	—	–2.84	—	—	–12
Samoa	UN/WDI	–0.85	–1.70	–1.27	5.7	4.4	—	15.76	—	—	9
Sao Tome and Principe	UN/WDI	–9.71	–1.96	–5.92	55.2	16.3	—	–4.78	—	—	120
Saudi Arabia	IEA/WDI	2.63	1.90	2.27	8.0	12.6	1.93	2.45	60.1	62.2	–27,204
Senegal	IEA/WDI	0.48	–0.54	–0.03	6.6	6.6	0.05	0.16	64.1	66.6	–9
Serbia	IEA/WDI	2.17	–1.98	0.07	9.2	9.3	-0.15	–0.03	62.7	61.4	–2,344
Seychelles	UN/WDI	12.83	1.44	6.99	2.3	9.0	—	10.06	—	—	–139
Sierra Leone	UN/WDI	6.72	–5.61	0.37	24.8	26.7	—	0.03	—	—	–1,071
Singapore	IEA/WDI	–2.02	0.13	–0.95	6.3	5.2	-1.49	1.61	43.5	72.4	1,790
Slovakia	IEA/WDI	–2.01	–4.51	–3.27	13.3	6.8	-3.72	–3.95	73.9	64.1	5,047

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Slovenia	IEA/WDI	–0.62	–1.48	–1.05	7.3	5.9	-2.05*	–0.57	64.7	71.3	365
Solomon Islands	UN/WDI	–1.82	–2.65	–2.24	4.7	3.0	—	–3.46	—	—	24
Somalia	UN/WDI	—	—	—	—	—	—	—	—	—	—
South Africa	IEA/WDI	0.03	–1.19	–0.58	13.6	12.1	-1.43	–1.69	56.1	44.9	229
Spain	IEA/WDI	0.27	–1.57	–0.65	4.9	4.3	0.01	–0.23	67.3	73.3	1,031
Sri Lanka	IEA/WDI	–0.96	–3.28	–2.13	6.7	4.3	-3.02*	–2.43	96.1	90.4	1,529
Sudan	IEA/WDI	–3.28	–4.12	–3.70	16.3	7.7	-2.26	–3.00	57.1	66.1	5,749
Suriname	UN/WDI	0.44	–2.74	–1.17	13.3	10.5	4.54	0.64	—	—	14
Swaziland	UN/WDI	7.43	–1.09	3.08	8.7	15.9	-4.12	1.75	—	—	–442
Sweden	IEA/WDI	–1.97	–1.33	–1.65	9.4	6.7	-1.78	–1.61	68.0	68.7	6,984
Switzerland	IEA/WDI	–0.78	–1.18	–0.98	4.5	3.7	-0.71	–0.75	76.7	80.3	1,413
Syrian Arab Republic	IEA/WDI	–0.86	–1.57	–1.21	12.0	9.4	-1.71	–1.94	72.7	62.7	2,033
Tajikistan	IEA/WDI	0.61	–7.04	–3.29	14.2	7.2	-3.14	–3.35	88.2	87.1	250
Thailand	IEA/WDI	1.09	0.62	0.85	7.8	9.3	0.08	1.08	68.8	72.0	–6,918
Timor-Leste	UN/WDI	n.a	–6.29	–6.29	7.9	4.7	—	–5.08	—	—	–61
Togo	IEA/WDI	3.02	0.33	1.66	15.0	20.8	—	1.26	67.0	61.9	–414
Tonga	UN/WDI	2.35	2.55	2.45	3.6	5.9	—	1.32	—	—	–11
Trinidad and Tobago	IEA/WDI	2.70	1.46	2.08	19.1	28.8	—	3.00	62.0	74.2	–2,185
Tunisia	IEA/WDI	–0.70	–1.57	–1.14	5.6	4.5	-1.41	–1.11	73.6	74.1	744
Turkey	IEA/WDI	0.13	–0.60	–0.23	5.0	4.8	-0.68	–0.38	76.0	73.8	2,360
Turkmenistan	IEA/WDI	0.64	–8.35	–3.96	53.5	23.8	-4.52	–4.93	70.2	57.3	5,128
Turks and Caicos Islands	UN/WDI	—	—	—	—	—	—	—	—	—	—
Uganda	UN/WDI	–3.64	–4.11	–3.87	40.1	18.2	-5.55**	–4.00	—	—	6,622
Ukraine	IEA/WDI	2.04	–4.34	–1.20	25.2	19.8	-0.94	–1.47	59.6	56.5	–3,410
United Arab Emirates	IEA/WDI	0.53	1.89	1.21	6.4	8.2	—	0.77	79.3	72.7	–3,685
United Kingdom of Great Britain and Northern Ireland	IEA/WDI	–2.06	–2.59	–2.32	6.7	4.2	-1.99	–2.24	66.9	68.1	47,052
United Republic of Tanzania	IEA/WDI	0.19	–2.64	–1.24	19.2	14.9	—	–1.40	89.8	86.8	837

COUNTRY	DATA SOURCE[a]	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
United States of America	IEA/WDI	–1.65	–1.78	–1.71	10.1	7.1	-1.67	–1.70	67.5	67.7	368,527
Uruguay	IEA/WDI	–0.17	0.07	–0.05	4.2	4.1	0.21	–0.01	85.8	86.6	78
Uzbekistan	IEA/WDI	1.11	–7.85	–3.47	47.3	23.3	-3.91	–3.76	75.4	71.0	3,859
Vanuatu	UN/WDI	2.27	–0.51	0.87	2.3	2.7	—	7.96	—	—	–2
Venezuela, Bolivarian Rep. of	IEA/WDI	0.53	–0.04	0.25	9.7	10.2	0.78*	–0.12	63.2	58.7	–799
Viet Nam	IEA/WDI	–2.52	0.22	–1.16	12.5	9.9	-2.39	–1.61	89.9	81.9	7,495
Western Sahara	UN/WDI	—	—	—	—	—	—	—	—	—	—
Yemen	IEA/WDI	0.84	–0.05	0.39	4.9	5.3	0.47*	0.41	72.1	72.2	–470
Zambia	IEA/WDI	0.79	–2.80	–1.02	23.0	18.8	-1.67	–1.18	79.5	76.9	5
Zimbabwe	IEA/WDI	—	—	—	—	—	—	—	85.7	87.8	—

AGGREGATED BY REGION	DATA SOURCE	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
Northern America	IEA/WDI	–1.59	–1.78	–1.68	10.2	7.3	–1.62	–1.66	68.4	68.7	391,975
Europe	IEA/WDI	–1.41	–1.10	–1.25	6.5	5.0	–1.12	–1.21	69.6	70.2	223,096
Eastern Europe	IEA/WDI	–1.26	–3.34	–2.30	18.7	11.8	–2.65	–2.65	68.2	63.4	140,558
Caucasian and Central Asia	IEA/WDI	–0.84	–5.59	–3.24	30.3	15.7	–3.55	–4.15	76.3	63.2	39,526
Western Asia	IEA/WDI	0.55	1.00	0.77	7.1	8.3	0.41	0.42	67.1	62.6	–10,469
Eastern Asia	IEA/WDI	–1.84	–0.35	–1.10	11.8	9.5	–2.11	–1.89	73.2	62.3	1,314,102
South Eastern Asia	IEA/WDI	0.17	–1.16	–0.50	9.1	8.2	–1.48	–0.66	74.2	71.8	9,718
Southern Asia	IEA/WDI	–0.86	–2.11	–1.49	11.1	8.2	–2.71	–2.16	80.3	70.1	101,857
Oceania	IEA/WDI	–0.95	–1.60	–1.27	8.8	6.8	–1.33	–1.73	68.5	62.4	15,038
Latin America and Caribbean	IEA/WDI	–0.52	–0.38	–0.45	6.1	5.6	–0.44	–0.56	73.6	72.1	27,714
Northern Africa	IEA/WDI	–0.18	0.07	–0.06	6.4	6.4	–0.46	0.20	64.0	67.4	–2,093
Sub-Saharan Africa	IEA/WDI	0.03	–2.19	–1.08	15.5	12.4	–1.36	–1.18	76.8	75.4	24,624
World	IEA/WDI	–1.61	–0.99	–1.30	10.0	7.7	–1.63	–1.53	71.7	68.0	2,275,646

AGGREGATED BY REGION	DATA SOURCE	RATE OF PRIMARY ENERGY INTENSITY IMPROVEMENT, CAGR (%)			LEVEL OF PRIMARY ENERGY INTENSITY, (MJ/$2005 PPP)		DECOM-POSITION ANALYSIS, CAGR (%)	RATE OF FINAL ENERGY INTENSITY IMPROVEMENT, CAGR (%)	FINAL TO PRIMARY ENERGY RATIO		CUMULATIVE ENERGY SAVINGS (PJ)
		1990–2000	2000–2010	1990–2010	1990	2010	1990–2010	1990–2010	1990	2010	1990–2010
High income	IEA/WDI	–1.03	–1.25	–1.14	7.9	6.3	–0.61	–1.18	68.4	67.8	608,778
Upper middle income	IEA/WDI	–2.59	–1.13	–1.86	14.1	9.7	–2.62	–2.47	72.5	64.1	1,462,534
Lower middle income	IEA/WDI	–1.92	–2.70	–2.31	14.0	8.8	–3.15	–2.62	75.0	70.3	191,629
Low income	IEA/WDI	–0.79	–1.97	–1.38	16.2	12.2	–2.50	–1.40	89.0	88.6	12,706

SOURCE: IEA WORLD ENERGY STATISTICS AND BALANCE (2012); UN ENERGY STATISTICS (2012); WORLD DEVELOPMENT INDICATORS (2012).

[a] 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 2009, AT THE LATEST—CALLED FOR AN ADJUSTMENT OF THE UN DATA TO ALLOW FOR A FAIR COMPARISON OF ENERGY INTENSITY LEVELS AMONG COUNTRIES.

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.)

FIRST AVAILABLE DATA WERE USED FOR SOME COUNTRIES FOR WHICH 1990 WERE NOT AVAILABLE: CAMBODIA (1995), ERITREA (1992), MONTENEGRO (2005), AND TIMOR-LESTE (2002). GDP DATA WERE ESTIMATED TO FILL GAPS IN TIME SERIES FOR THE FOLLOWING COUNTRIES: AFGHANISTAN, BARBADOS, BOSNIA AND HERZEGOVINA, DJIBOUTI, ESTONIA, HAITI, IRAQ, IRAN (ISLAMIC REPUBLIC OF), IRELAND, KUWAIT, LIBYA, MALDIVES, PALAU, QATAR, AND SAO TOME AND PRINCIPE.

* Country has less than 20 years of historical data available. Caution should be used when comparing CAGRs of decomposition analysis and energy intensity for country.

** Country has less than 10 years of historical data available. Caution should be used when comparing CAGRs of decomposition analysis and energy intensity for country.

DATA ANNEX: RENEWABLE ENERGY

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geo-thermal	Other	Electricity capacity	Electricity generation	
Afghanistan	UN	42.4	56.5	19.3	12.2	—	7.0	—	—	—	—	—	76.5	87.2	72
Albania	IEA	24.9	41.0	37.9	9.7	1.4	26.4	—	—	0.4	—	—	90.1	100.0	77
Algeria	IEA	0.2	0.6	0.3	0.3	0.0	0.0	—	—	—	—	—	2.5	0.4	1,044
Angola	IEA	72.3	75.5	54.9	51.3	1.3	2.4	—	—	—	—	—	43.1	67.3	451
Antigua and Barbuda	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Argentina	IEA	8.9	11.0	9.0	0.6	2.0	5.3	1.1	0.0	—	—	—	27.8	28.6	2,052
Armenia	IEA	1.9	6.2	9.0	—	0.1	8.9	—	0.0	—	—	—	33.5	39.5	74
Aruba	UN	0.8	0.1	0.1	0.1	—	—	—	—	—	—	—	11.3	—	6
Australia	IEA	8.0	8.4	7.3	—	4.6	1.3	0.4	0.5	0.4	—	0.1	18.7	8.9	2,940
Austria	IEA	25.2	26.5	30.6	—	15.1	11.5	2.0	0.6	0.7	0.1	0.6	72.9	66.4	1,083
Azerbaijan	IEA	0.3	1.6	3.1	—	—	3.1	—	0.0	—	—	—	15.5	18.4	263
Bahamas	UN	—	—	0.9	—	0.9	—	—	—	—	—	—	—	—	29
Bahrain	IEA	—	—	—	—	—	—	—	—	—	—	—	0.0	—	221
Bangladesh	IEA	72.0	59.5	42.0	41.4	0.0	0.6	—	—	—	—	—	4.0	3.9	883
Barbados	UN	18.9	13.6	9.8	0.7	9.1	—	—	—	—	—	—	—	—	13
Belarus	IEA	0.8	4.9	7.0	2.9	3.9	0.0	0.2	0.0	—	—	0.0	0.3	0.4	719
Belgium	IEA	1.3	1.5	5.3	—	3.2	0.1	1.2	0.3	0.2	0.0	0.4	16.9	6.9	1,425
Belize	UN	37.0	24.1	35.6	—	20.1	15.5	—	—	—	—	—	48.9	92.3	9
Benin	IEA	93.7	70.3	51.5	42.9	8.7	—	—	—	—	—	—	1.6	0.7	134
Bermuda	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	9
Bhutan	UN	96.5	95.2	91.7	81.3	0.4	10.0	—	—	—	—	—	98.9	100.0	54
Bolivia, Plurinational State of	IEA	37.4	29.1	31.7	13.1	15.8	2.9	—	—	0.0	—	—	30.1	34.0	240
Bosnia and Herzegovina	IEA	7.3	19.4	19.9	5.9	0.1	13.9	—	—	—	—	—	49.2	46.9	126
Botswana	IEA	47.1	35.7	26.4	26.4	0.0	—	—	—	0.0	—	—	—	—	77
Brazil	IEA	49.8	42.8	47.0	4.0	20.3	15.2	7.3	0.1	0.2	—	—	78.7	84.8	8,108
British Virgin Islands	UN	100.0	1.6	1.1	1.1	—	—	—	—	—	—	—	—	—	1
Brunei Darussalam	IEA	0.7	—	—	—	—	—	—	—	—	—	—	—	—	70
Bulgaria	IEA	1.9	8.3	14.4	8.3	2.0	3.0	0.2	0.4	0.1	0.4	0.0	26.7	12.6	360

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
Burkina Faso	UN	92.4	86.5	85.3	84.1	0.8	0.4	—	—	—	—	—	12.7	18.9	125
Burundi	UN	82.6	93.2	96.8	95.7	0.4	0.7	—	—	—	—	—	98.1	98.4	84
Cambodia	IEA	82.5	81.1	73.3	57.6	15.6	0.1	—	—	0.0	—	—	5.2	4.9	178
Cameroon	IEA	81.6	84.5	78.6	66.7	6.7	5.2	—	—	—	—	—	72.2	73.2	243
Canada	IEA	20.6	20.5	19.9	—	5.3	13.5	0.6	0.4	0.0	—	0.1	58.9	60.9	7,266
Cape Verde	UN	—	1.7	1.5	1.0	—	—	—	0.5	—	—	—	3.1	1.7	3
Cayman Islands	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	4
Central African Republic	UN	93.9	86.0	81.0	47.1	31.2	2.6	—	—	—	—	—	56.8	99.9	17
Chad	UN	95.1	97.9	92.3	91.1	1.2	—	—	—	—	—	—	—	—	82
Chile	IEA	34.0	31.4	27.0	—	19.4	7.4	—	0.1	—	—	—	38.0	40.2	954
China	IEA	32.3	27.7	18.8	13.5	0.0	3.6	0.1	0.2	0.6	0.3	0.5	25.1	17.5	59,740
China, Hong Kong SAR	IEA	1.1	0.6	0.7	0.7	0.0	—	—	0.0	—	—	—	0.0	0.0	338
China, Macao SAR	UN	0.7	0.2	0.2	—	0.2	—	—	—	—	—	—	—	—	17
Colombia	IEA	38.3	28.0	28.6	8.2	6.6	13.7	0.1	0.0	—	—	—	67.1	72.1	894
Comoros	UN	1.0	1.0	1.3	—	—	1.3	—	—	—	—	—	16.7	11.6	1
Congo	IEA	66.7	72.7	50.6	47.5	0.0	3.1	—	—	—	—	—	80.4	76.9	45
Congo, Dem. Rep. of the	IEA	92.0	97.2	96.2	74.1	19.7	2.4	—	—	—	—	—	98.6	99.6	950
Cook Islands	UN	—	—	—	—	—	—	—	—	—	—	—	1.1	—	0
Costa Rica	IEA	55.7	32.7	41.9	9.0	13.1	16.3	—	0.8	—	2.6	—	67.6	93.3	144
Cote d'Ivoire	IEA	80.2	64.7	75.4	65.7	7.8	1.9	—	—	—	—	—	49.4	28.8	218
Croatia	IEA	13.5	17.5	19.4	0.1	5.9	12.9	0.0	0.2	0.1	0.1	0.1	47.0	60.7	263
Cuba	IEA	44.3	35.7	16.3	0.8	11.5	0.1	3.9	—	0.0	—	—	1.3	3.2	252
Cyprus	IEA	0.5	3.1	6.4	0.5	0.9	—	0.9	0.1	3.7	0.0	0.2	5.8	1.3	69
Czech Republic	IEA	2.7	4.9	9.5	—	7.0	0.7	1.0	0.1	0.2	—	0.6	10.4	6.9	1,019
Denmark	IEA	7.3	10.9	21.4	—	14.4	0.0	0.2	3.8	0.1	0.0	2.9	37.0	32.1	615
Djibouti	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	5
Dominica	UN	23.6	11.3	9.1	4.2	—	4.9	—	—	—	—	—	80.4	25.0	1
Dominican Republic	IEA	34.3	22.3	25.9	16.1	7.5	2.4	—	—	—	—	—	9.4	11.4	237

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
Ecuador	IEA	23.2	19.6	12.4	4.0	1.8	6.6	—	0.0	—	—	—	44.7	51.6	372
Egypt	IEA	8.6	8.2	6.1	1.8	1.9	2.2	—	0.3	—	—	—	12.4	9.9	1,792
El Salvador	IEA	67.1	50.9	34.8	16.0	8.7	5.9	—	—	—	4.3	—	47.4	65.1	107
Equatorial Guinea	UN	82.0	53.2	15.4	15.2	—	0.2	—	—	—	—	—	2.6	7.0	10
Eritrea	IEA	88.3	71.2	77.2	73.8	3.3	—	—	—	0.0	—	—	1.3	0.6	21
Estonia	IEA	3.3	19.9	25.1	—	24.5	0.0	—	0.4	—	—	0.1	6.6	8.1	120
Ethiopia	IEA	95.6	94.3	94.5	92.7	0.7	1.0	—	—	—	0.0	—	90.1	99.4	1,310
Falkland Islands (Malvinas)	UN	—	—	—	—	—	—	—	—	—	—	—	10.0	—	1
Fiji	UN	16.4	13.0	15.5	2.6	—	12.8	—	—	—	—	—	51.0	57.4	12
Finland	IEA	24.6	31.7	33.5	—	27.6	4.6	0.6	0.1	0.0	—	0.6	31.5	30.1	1,051
France	IEA	10.4	9.3	12.3	—	6.7	2.8	1.6	0.4	0.1	0.1	0.6	21.5	13.8	6,314
French Guiana	UN	12.5	8.0	34.4	7.9	2.1	24.3	—	—	—	—	—	90.1	90.1	9
French Polynesia	UN	100.0	9.2	8.6	0.5	—	8.1	—	—	—	—	—	25.3	28.7	9
Gabon	IEA	78.3	74.5	63.0	48.4	11.8	2.8	—	—	—	—	—	41.0	44.2	78
Gambia	UN	58.9	50.3	41.0	41.0	—	—	—	—	—	—	—	—	—	10
Georgia	IEA	12.8	47.3	39.9	12.6	1.9	23.5	—	—	—	1.9	0.0	62.8	92.5	103
Germany	IEA	2.1	3.8	10.8	—	4.6	0.7	1.8	1.4	0.6	0.2	1.4	36.3	16.7	8,504
Ghana	IEA	80.6	74.7	66.5	44.1	15.7	6.7	—	—	—	—	—	59.4	83.6	311
Gibraltar	IEA	—	—	—	—	—	—	—	—	—	—	—	—	—	5
Greece	IEA	7.8	7.5	11.1	—	4.7	3.2	0.7	1.2	1.1	0.1	0.1	26.7	18.3	769
Grenada	UN	6.4	7.0	8.8	8.1	0.7	—	—	—	—	—	—	1.4	—	3
Guadeloupe	UN	7.8	0.6	5.5	0.5	—	1.0	—	3.7	0.3	—	—	11.0	15.0	18
Guatemala	IEA	75.0	62.7	67.0	59.7	4.1	3.0	—	—	—	0.2	—	43.5	66.9	354
Guinea	UN	92.6	89.6	88.9	87.3	0.5	1.1	—	—	—	—	—	31.6	52.4	114
Guinea-Bissau	UN	70.8	50.1	37.4	7.1	30.3	—	—	—	—	—	—	—	—	6
Guyana	UN	28.1	41.5	46.7	26.6	20.1	—	—	—	—	—	—	4.0	—	31
Haiti	IEA	81.1	76.0	70.5	60.2	10.0	0.3	—	—	—	—	—	20.7	30.2	87
Honduras	IEA	70.1	55.1	49.8	41.7	3.0	5.1	—	—	—	—	—	36.3	46.1	157

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
Hungary	IEA	3.9	5.2	9.1	—	6.7	0.1	1.1	0.3	0.0	0.6	0.3	9.8	8.1	674
Iceland	IEA	62.2	66.1	76.7	—	—	38.5	—	—	—	38.2	0.0	95.3	100.0	108
India	IEA	57.5	52.6	42.4	31.7	8.5	1.7	0.0	0.3	0.1	—	—	27.0	14.2	17,569
Indonesia	IEA	58.7	44.7	37.4	31.6	4.4	0.9	0.0	—	—	0.5	—	17.8	16.0	6,177
Iran, Islamic Republic of	IEA	1.3	0.4	0.7	0.0	0.2	0.5	—	0.0	—	—	0.0	13.8	4.2	5,983
Iraq	IEA	1.6	0.3	1.6	—	0.1	1.5	—	—	—	—	—	24.9	9.5	855
Ireland	IEA	2.3	2.0	5.2	—	1.7	0.4	0.8	2.0	0.1	—	0.3	20.2	13.1	460
Israel	IEA	5.8	6.0	8.5	—	0.1	0.0	0.0	0.0	8.4	—	0.0	1.9	0.2	562
Italy	IEA	3.8	5.1	10.0	—	3.2	3.7	1.5	0.7	0.2	0.5	0.3	24.7	25.8	5,033
Jamaica	IEA	7.6	11.5	12.1	8.4	3.0	0.5	—	0.2	—	—	—	5.2	6.4	86
Japan	IEA	4.4	3.9	4.2	—	1.3	2.2	—	0.1	0.2	0.1	0.1	10.6	10.1	11,915
Jordan	IEA	2.8	2.1	3.0	0.1	0.0	0.1	—	0.0	2.8	—	0.0	0.6	0.5	188
Kazakhstan	IEA	1.4	2.5	1.2	0.1	0.0	1.1	—	—	—	—	—	11.8	9.7	1,816
Kenya	IEA	77.7	81.8	77.1	74.2	0.2	1.9	—	0.0	—	0.8	—	58.1	69.5	529
Kiribati	UN	39.5	30.9	1.1	1.1	—	—	—	—	—	—	—	—	—	1
Korea, Dem. People's Rep. of	IEA	7.7	9.8	12.0	—	6.6	5.4	—	—	—	—	—	52.6	61.9	672
Korea, Republic of	IEA	1.6	0.7	1.3	—	0.2	0.2	0.3	0.1	0.1	0.0	0.4	3.4	1.2	4,982
Kuwait	IEA	0.2	—	—	—	—	—	—	—	—	—	—	—	—	513
Kyrgyzstan	IEA	7.9	37.3	22.5	—	0.1	22.3	—	—	—	—	—	79.9	91.0	106
Lao People's Dem. Rep.	UN	96.7	91.3	90.1	80.6	—	9.0	—	—	0.5	—	—	97.4	92.3	66
Latvia	IEA	17.6	35.8	35.3	17.7	9.7	6.9	0.6	0.1	—	—	0.2	72.8	54.9	173
Lebanon	IEA	11.5	5.0	5.0	2.6	0.2	1.8	—	—	0.4	—	—	12.1	5.3	161
Lesotho	UN	—	100.0	100.0	—	—	100.0	—	—	—	—	—	100.0	100.0	1
Liberia	UN	95.4	90.5	92.5	92.5	—	—	—	—	—	—	—	—	—	74
Libya	IEA	3.1	2.1	2.1	2.1	0.0	—	—	—	—	—	—	—	—	347
Lithuania	IEA	3.1	17.6	22.6	12.7	6.2	1.7	1.0	0.7	—	0.0	0.2	8.2	19.2	189
Luxembourg	IEA	1.7	6.8	3.7	—	1.2	0.5	1.1	0.2	0.1	—	0.5	7.8	8.3	162
Macedonia, Former Yugoslav Rep. of	IEA	2.4	19.4	23.0	10.1	1.0	11.0	0.3	—	—	0.6	—	35.9	33.5	75

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geo-thermal	Other	Electricity capacity	Electricity generation	
Madagascar	UN	86.4	78.5	82.8	53.5	27.6	1.8	—	—	0.0	—	—	34.4	58.2	114
Malawi	UN	86.1	76.9	81.3	38.5	36.4	6.4	—	—	—	—	—	99.7	85.5	59
Malaysia	IEA	14.0	8.6	6.2	4.6	0.3	1.3	0.0	—	—	—	0.0	8.3	6.2	1,557
Maldives	UN	—	—	—	—	—	—	—	—	—	—	—	0.1	—	2
Mali	UN	91.6	88.9	88.3	85.4	1.4	1.5	—	—	—	—	—	51.6	55.2	62
Malta	IEA	—	—	0.3	—	—	—	—	—	0.3	—	—	0.3	—	15
Martinique	UN	2.3	1.6	1.6	0.2	0.8	—	—	0.0	0.6	—	—	0.3	2.8	23
Mauritania	UN	40.9	42.6	35.1	35.1	—	—	—	—	—	—	—	36.9	—	33
Mauritius	UN	51.9	14.6	6.9	0.5	5.4	1.1	—	0.0	—	—	—	24.3	4.8	33
Mexico	IEA	14.3	12.5	10.0	—	7.0	2.3	—	0.1	0.1	0.4	0.0	21.6	17.6	4,408
Moldova, Republic of	IEA	0.8	4.6	4.3	—	4.0	0.3	—	—	—	—	—	11.6	2.2	75
Mongolia	IEA	1.8	4.9	3.7	2.6	1.1	—	—	—	—	—	—	0.1	—	96
Montenegro	IEA	n.a.	n.a.	48.9	5.6	0.4	42.9	—	—	—	—	—	75.8	66.0	18
Montserrat	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Morocco	IEA	8.5	6.7	7.2	3.4	0.6	2.7	—	0.5	—	—	—	23.7	18.5	500
Mozambique	IEA	93.1	92.5	89.6	71.2	7.8	10.7	—	—	—	—	—	89.7	99.9	344
Myanmar	IEA	90.9	80.2	84.9	79.5	2.6	2.8	—	—	—	—	—	46.7	67.7	535
Namibia	IEA	38.9	38.2	30.2	13.8	0.0	16.4	—	—	0.0	—	—	63.4	84.9	63
Nepal	IEA	95.1	88.3	88.3	84.3	1.0	2.3	—	—	—	—	0.6	92.1	99.9	424
Netherlands	IEA	1.2	1.5	3.6	—	1.5	0.0	0.5	0.6	0.1	0.0	0.8	14.5	9.5	2,064
Netherlands Antilles	IEA	—	—	—	—	—	—	—	—	—	—	—	9.4	—	29
New Caledonia	UN	40.2	15.9	8.0	0.2	0.0	7.0	—	0.7	—	—	—	23.2	23.1	19
New Zealand	IEA	29.2	28.9	31.5	—	8.8	15.7	0.0	1.0	0.1	5.6	0.2	68.3	73.4	497
Nicaragua	IEA	70.4	62.4	53.8	44.4	6.9	1.3	—	0.4	—	0.8	—	31.6	37.0	92
Niger	UN	86.8	93.9	73.7	71.0	2.8	—	—	—	0.0	—	—	—	0.0	39
Nigeria	IEA	88.4	86.9	88.8	79.6	8.8	0.4	—	—	—	—	—	32.9	24.4	4,373
Norway	IEA	59.3	60.3	56.9	—	6.2	49.2	0.6	0.4	—	—	0.5	93.6	95.8	796
Oman	IEA	—	—	—	—	—	—	—	—	—	—	—	—	—	265

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
Pakistan	IEA	57.5	51.1	46.0	37.9	4.7	3.4	—	—	—	—	—	29.6	33.7	2,777
Palau	UN	—	—	6.8	—	—	6.8	—	—	—	—	—	n.a.	11.8	1
Panama	IEA	43.7	34.4	24.1	11.3	2.9	10.0	—	—	—	—	—	47.4	57.0	126
Papua New Guinea	UN	70.4	66.4	66.7	56.9	6.6	3.3	—	—	—	—	—	38.9	27.3	89
Paraguay	IEA	78.5	70.4	64.1	23.1	25.9	13.8	1.2	—	—	—	—	99.9	100.0	179
Peru	IEA	39.4	32.2	30.2	17.7	1.5	10.4	0.6	0.0	0.0	—	—	39.9	57.9	610
Philippines	IEA	51.0	34.9	28.8	15.1	7.5	2.3	0.9	0.0	0.0	3.0	—	33.1	26.3	988
Poland	IEA	2.5	6.9	9.5	—	7.5	0.3	1.4	0.2	0.0	0.0	0.1	6.5	6.9	2,718
Portugal	IEA	27.1	20.0	27.9	—	13.5	7.5	1.9	4.3	0.4	0.2	0.2	45.5	52.8	722
Puerto Rico	UN	1.8	0.7	0.7	—	—	0.7	—	—	—	—	—	2.8	0.7	67
Qatar	IEA	—	—	—	—	—	—	—	—	—	—	—	—	—	397
Reunion	UN	38.9	16.5	17.6	1.1	10.8	5.1	—	0.7	—	—	—	38.7	40.0	41
Romania	IEA	3.4	16.5	24.0	16.2	1.9	5.3	0.5	0.1	0.0	0.1	0.0	30.9	33.1	914
Russian Federation	IEA	3.8	3.5	3.3	0.3	0.4	2.6	—	0.0	—	0.0	—	20.5	16.1	16,133
Rwanda	UN	84.4	89.4	87.9	86.8	0.5	0.6	—	—	0.0	—	—	47.6	40.0	51
Saint Kitts and Nevis	UN	67.4	23.3	—	—	—	—	—	—	—	—	—	—	—	2
Saint Lucia	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Saint Pierre and Miquelon	UN	—	—	1.7	—	—	—	—	1.7	—	—	—	2.3	3.5	0
Saint Vincent and the Grenadines	UN	18.0	10.6	7.9	3.1	—	4.8	—	—	—	—	—	14.9	17.1	2
Samoa	UN	100.0	49.6	44.5	32.5	3.1	8.9	—	—	—	—	—	—	45.1	2
Sao Tome and Principe	UN	62.2	35.7	35.4	33.5	—	1.9	—	—	—	—	—	42.9	35.7	2
Saudi Arabia	IEA	0.0	0.0	0.0	0.0	0.0	—	—	—	—	—	—	—	—	3,005
Senegal	IEA	55.6	47.7	42.5	41.5	0.2	0.8	—	—	0.0	—	—	0.3	10.4	91
Serbia	IEA	15.5	23.5	20.3	11.0	0.7	8.6	—	—	—	0.1	—	26.6	31.8	367
Seychelles	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	8
Sierra Leone	UN	95.6	90.6	71.2	52.2	18.9	0.1	—	—	—	—	—	52.9	31.8	58
Singapore	IEA	0.2	0.3	0.4	—	—	—	—	—	—	—	0.4	0.2	1.3	532
Slovakia	IEA	2.2	3.7	10.9	—	5.2	3.8	1.6	0.0	0.0	0.0	0.2	23.0	21.6	433

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geo-thermal	Other	Electricity capacity	Electricity generation	
Slovenia	IEA	12.4	15.9	18.8	—	11.2	5.8	0.9	—	0.1	0.5	0.3	35.5	29.2	207
Solomon Islands	UN	68.4	87.0	75.3	75.3	—	—	—	—	—	—	—	—	—	4
Somalia	UN	100.0	96.3	94.8	67.0	27.8	—	—	—	—	—	—	—	—	89
South Africa	IEA	16.6	18.2	18.7	15.1	3.2	0.3	—	0.0	0.1	—	—	2.0	1.0	2,405
Spain	IEA	10.5	8.0	14.8	—	4.7	3.6	1.7	3.8	0.8	0.0	0.2	38.8	32.5	3,628
Sri Lanka	IEA	78.1	64.2	62.0	36.9	20.4	4.7	—	0.0	0.0	—	—	52.0	52.5	370
Sudan	IEA	73.3	81.6	66.6	43.3	20.8	2.5	—	—	—	—	—	69.3	49.0	437
Suriname	UN	36.0	17.1	18.3	6.4	0.6	11.2	—	—	—	—	—	46.1	53.9	25
Swaziland	UN	84.3	46.8	35.7	24.6	6.4	4.7	—	—	—	—	—	40.3	47.3	35
Sweden	IEA	34.1	40.9	47.4	—	27.3	15.4	1.7	0.8	0.0	—	2.1	62.1	55.3	1,368
Switzerland	IEA	16.9	18.5	21.2	—	4.4	13.7	0.0	0.0	0.2	1.3	1.6	68.9	56.7	858
Syrian Arab Republic	IEA	2.4	1.9	1.4	—	0.0	1.3	—	—	—	—	—	10.8	5.6	505
Tajikistan	IEA	29.6	62.4	57.3	—	—	57.3	—	—	—	—	—	91.2	96.6	84
Tanzania, United Republic of	IEA	94.8	94.3	90.7	70.6	19.0	1.1	—	—	—	—	—	66.8	58.0	729
Thailand	IEA	33.6	22.0	22.8	10.2	10.9	0.7	1.0	—	0.0	0.0	0.0	8.9	5.6	2,780
Timor-Leste	UN	n.a.	n.a.	43.1	43.1	—	—	—	—	—	—	—	—	—	3
Togo	IEA	78.7	77.1	76.1	64.3	9.2	2.6	—	—	—	—	—	78.8	76.2	69
Tonga	UN	—	0.4	2.0	2.0	—	—	—	—	—	—	—	—	—	2
Trinidad and Tobago	IEA	1.2	0.5	0.2	0.2	0.0	—	—	—	—	—	—	0.3	—	232
Tunisia	IEA	14.5	14.2	14.6	13.9	0.4	0.1	—	0.1	—	—	—	3.2	1.2	291
Turkey	IEA	24.6	17.3	14.2	—	6.3	5.1	0.0	0.3	0.4	2.0	0.0	35.1	26.4	2,948
Turkmenistan	IEA	0.3	0.0	0.0	—	—	0.0	—	—	—	—	—	0.0	0.0	511
Turks and Caicos Islands	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Uganda	UN	96.1	94.6	88.8	85.5	2.6	0.7	—	—	—	—	—	68.5	58.6	390
Ukraine	IEA	0.7	1.3	2.9	1.4	0.4	1.2	—	0.0	—	—	—	10.1	7.2	2,856
United Arab Emirates	IEA	—	0.1	0.1	—	0.1	—	—	—	—	—	—	0.0	—	1,799
United Kingdom of Great Britain and Northern Ireland	IEA	0.7	1.0	3.2	—	0.9	0.2	0.9	0.6	0.1	0.0	0.6	10.0	6.8	5,435

COUNTRY	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
United States of America	IEA	4.2	5.4	7.6	—	3.2	1.4	1.9	0.5	0.1	0.1	0.3	12.9	10.1	57,173
Uruguay	IEA	44.8	38.8	52.3	8.3	26.3	17.7	—	0.1	—	—	—	60.2	89.0	148
Uzbekistan	IEA	1.3	1.2	2.6	—	0.0	2.6	—	—	—	—	—	14.9	21.0	1,226
Vanuatu	UN	100.0	68.9	41.6	39.7	—	1.1	—	0.8	—	—	—	10.7	19.0	2
Venezuela, Bolivarian Rep. of	IEA	11.8	14.1	12.5	1.1	1.0	10.5	—	—	—	—	—	61.5	64.9	1,853
Viet Nam	IEA	76.1	58.0	34.8	24.5	5.6	4.7	—	—	—	—	—	36.4	29.1	1,924
Western Sahara	UN	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Yemen	IEA	2.1	1.2	1.0	—	1.0	—	—	—	—	—	—	—	—	211
Zambia	IEA	82.9	89.9	90.7	68.0	12.0	10.8	—	—	—	—	—	99.6	99.7	260
Zimbabwe	IEA	64.1	70.2	80.8	69.2	5.2	6.4	—	—	—	—	—	33.4	50.2	352

AGGREGATED BY REGION	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
Northern America	IEA	6.0	7.1	9.0	—	3.4	2.8	1.7	0.5	0.1	0.1	0.3	18.2	16.3	64,439
Europe	IEA	8.1	9.4	14.1	0.3	6.0	4.1	1.3	1.1	0.3	0.3	0.8	33.6	26.0	42,078
Eastern Europe	IEA	3.0	4.2	5.4	1.1	1.8	2.1	0.3	0.0	0.0	0.0	0.0	17.5	13.8	25,902
Caucasian and Central Asia	IEA	3.1	5.2	4.4	0.4	0.1	3.9	—	0.0	—	0.0	0.0	28.6	28.2	4,184
Western Asia	IEA	8.2	5.8	4.3	0.0	1.6	1.5	0.0	0.1	0.6	0.5	0.0	11.4	7.4	11,697
Eastern Asia	IEA	22.2	19.1	15.3	10.4	0.3	3.2	0.1	0.2	0.5	0.2	0.4	20.8	14.8	77,743
South Eastern Asia	IEA	52.2	37.9	31.1	23.4	5.5	1.5	0.3	0.0	0.0	0.4	0.0	15.9	14.1	14,741
Southern Asia	IEA	50.9	43.4	34.8	26.7	6.1	1.6	0.0	0.2	0.0	—	0.0	24.4	14.0	28,007
Oceania	IEA	15.0	15.6	15.1	4.3	4.8	4.0	0.3	0.5	0.3	0.7	0.1	24.2	22.2	3,867
Latin America and Caribbean	IEA	32.3	28.2	29.0	5.1	11.5	9.3	2.9	0.1	0.1	0.1	0.0	52.5	56.5	22,000
Northern Africa	IEA	6.5	6.2	5.0	2.5	1.0	1.4	—	0.2	—	—	—	9.6	7.2	3,974
Sub-Saharan Africa	IEA	72.5	74.6	75.4	65.3	8.5	1.6	—	0.0	0.0	0.0	—	26.0	22.7	16,368
World	IEA	16.6	17.4	18.0	9.6	3.7	3.1	0.8	0.3	0.2	0.2	0.3	23.9	19.4	329,834

AGGREGATED BY INCOME LEVEL	DATA SOURCE	SHARE (%) OF RE IN TFEC			SHARE (%) IN TFEC IN 2010								RE SHARE (%) IN 2010 OF:		TOTAL FINAL ENERGY CONSUMPTION (PJ) IN 2010
		1990	2000	2010	Traditional biomass	Modern biomass	Hydro	Liquid biofuels	Wind	Solar	Geothermal	Other	Electricity capacity	Electricity generation	
High income	IEA	6.2	7.0	9.3	0.0	3.9	2.8	1.3	0.6	0.2	0.2	0.4	20.7	16.6	138,623
Upper middle income	IEA	18.8	19.6	16.7	8.4	2.6	4.1	0.6	0.1	0.3	0.2	0.2	27.0	22.1	120,299
Lower middle income	IEA	45.1	47.6	43.2	34.2	6.7	2.0	0.0	0.1	0.0	0.1	0.0	26.5	20.7	48,666
Low income	IEA	61.9	73.7	74.2	63.9	6.7	3.4	—	0.0	0.0	0.1	0.0	56.3	59.1	7,410

SOURCES: IEA WORLD ENERGY STATISTICS AND BALANCES (2012), UN ENERGY STATISTICS.

NOTE: OWING TO UNAVAILABILITY OF DATA FOR 1990, THE FIRST AVAILABLE DATA WERE USED FOR THE FOLLOWING COUNTRIES: CAMBODIA (1995), ERITREA (1992), KOSOVO (2000), MONTENEGRO (2005), AND NAMIBIA (1991). THE LATEST AVAILABLE UN DATA ARE FOR 2009. WORLD IS GREATER THAN THE SUM OF COUNTRIES BECAUSE WORLD INCLUDES MARINE AND AVIATION BUNKERS.

— = DATA NOT AVAILABLE.

The report's framework for data collection and analysis will enable us to monitor progress on the SE4ALL objectives from now to 2030. It is methodologically sound and credible. It produces findings that are conclusive and actionable. In many respects, what you measure determines what you get. That is why it is critical to get measurement right and to collect the right data, which is what this report has done. It has charted a map for our achievement of sustainable energy for all and a way to track progress. Let the journey begin!

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

SUSTAINABLE
ENERGY FOR ALL

The SE4ALL Global Tracking Framework full report, overview paper, executive summary and associated datasets can be downloaded from the following website:

www.worldbank.org/se4all

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