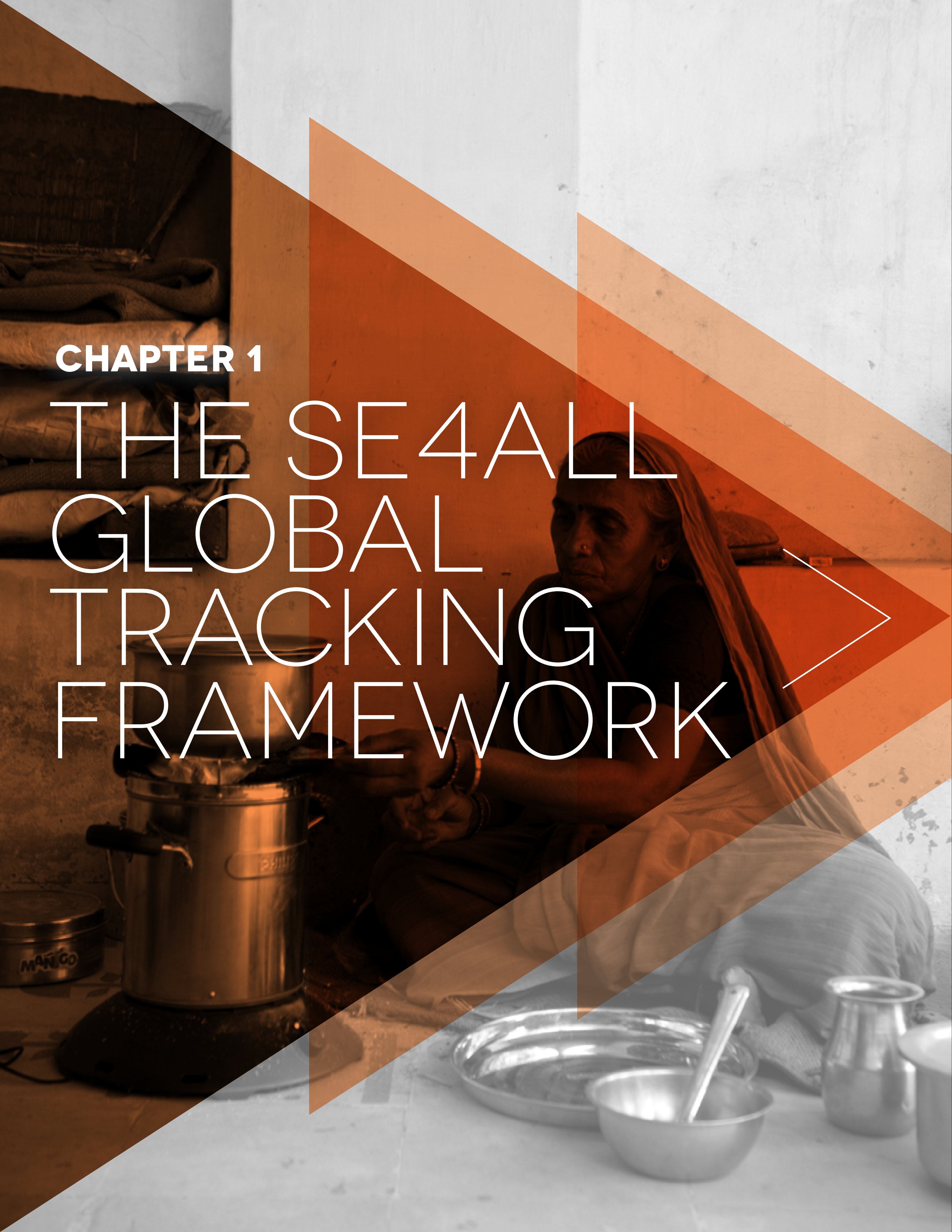

CHAPTER 1

THE SE4ALL GLOBAL TRACKING FRAMEWORK

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At the behest of the UN Secretary General, the UN General Assembly declared 2012 the International Year of Sustainable Energy for All. The Secretary General's Sustainable Energy for All (SE4ALL) initiative has three critical objectives to be achieved globally by 2030: (i) to ensure universal access to modern energy services; (ii) to double the global rate of improvement in energy efficiency; and (iii) to double the share of renewable energy in the global energy mix.

SE4ALL is rapidly establishing itself as a catalyst for public-private action toward the achievement of the Secretary General's three declared energy objectives. At the UN Conference on Sustainable Development in Rio de Janeiro (Rio+20) in June 2012, more than 60 countries opted into SE4ALL; that number has subsequently risen above 70. In addition, corporations and agencies have pledged tens of billions of dollars to the initiative. This combined effort will amount to an expansion of energy access to hundreds of millions of people worldwide. As 2012 drew to a close, the UN General Assembly announced that 2014–24 would be the Decade of Sustainable Energy for All.

The need for a global tracking framework

Given the need to sustain global attention on the SE4ALL objectives over the 20 years to 2030, it was soon recognized that a mechanism to track global progress from the starting point would be an important component of the initiative. The mechanism would also enable tracking of country-level information and therefore allow stakeholders to highlight successful experiences and identify areas where additional effort may be needed.

The resulting Global Tracking Framework complements the SE4ALL initiative's accountability framework, which provides transparent recognition and tracking of voluntary commitments to the initiative by specific institutions, thereby facilitating feedback, learning, and action. At the level of individual commitments, stakeholders are responsible for establishing milestones to record their progress for annual reporting.

The Global Tracking Framework was commissioned by the original SE4ALL High-Level Group, which has since been replaced by the SE4ALL Advisory Board. The objectives set for the Global Tracking Framework were three: (i) to build consensus among all relevant institutions about the best methodology for tracking progress toward the three SE4ALL objectives through 2030; (ii) to apply that methodology, with the year 2010 as the starting point for the three objectives; and (iii) to provide a road map for the gradual improvement of the Global Tracking Framework through 2030.

Responsibility for the development of the Global Tracking Framework was assigned to a Steering Group of international energy-knowledge institutions with a history of strong engagement in the SE4ALL initiative. The Steering Group is co-chaired by the World Bank/Energy Sector Management Assistance Program (ESMAP) and the International Energy Agency (IEA). Its members are:

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

Global versus country objectives

The three SE4ALL objectives are conceived of as 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, depending on where they can make the greatest contribution to the global effort. Some countries may be able to set national targets that are more ambitious than the global ones, while the energy situation of others may restrict them to more modest targets.

For example, energy access remains a pressing concern in many low- and middle-income countries. In high-income countries, on the other hand, universal access to modern energy has largely been achieved, even if some challenges of energy poverty may remain.

In many cases, improving energy efficiency is the cheapest way to expand the energy supply. Once again, however, the potential to improve energy efficiency varies significantly across countries depending on the structure of their economies, the nature of their climate and, in particular, how aggressively they have pursued energy efficiency policies in the past.

For many developed and developing countries, renewable energy offers promise as a means of improving energy security, reducing the environmental impact of energy use, and promoting economic development. The availability of renewable energy resources around the globe varies greatly in extent and composition, however, affecting the degree to which individual countries may scale up the contribution of renewable energy to their overall energy mix.

Already, more than 70 countries have opted into the SE4ALL initiative. These countries are developing individual country action plans in which they will articulate their own national targets within the context of the global SE4ALL framework. Overall, if all countries make their best efforts in the areas in which they have the most to contribute the global targets may be attained.

The interconnected SE4ALL objectives

The three SE4ALL objectives—though distinct—were conceived as an integrated whole. The three objectives are mutually supportive. In other words, it is more feasible to achieve the three objectives together than it would be to pursue them individually.

To illustrate this idea, consider the links between energy access and energy efficiency. The achievement of universal energy access contributes to boosting energy efficiency and becomes more feasible as a result of advances in energy efficiency. For example, a significant share of global energy consumption is traceable to household cooking and heating, yet in many developing countries the traditional methods used to do so have thermal efficiencies as low as 10–20 percent. Providing universal access to modern cooking solutions can help to shift households away from cooking on open fires in favor of improved cooking stoves and non-solid fuels, which would significantly improve a given country's overall energy efficiency. At the same time, on the electricity side, improvements in energy efficiency enable existing power generation capacity to go further, thereby leaving more energy available to meet the need for basic electricity access. Finally, improved energy efficiency makes energy more affordable by reducing the implicit price of energy services, which helps to support the expansion of access.

Improving energy efficiency also has the potential to arrest the growth of global energy consumption, making it possible to meet the SE4ALL objective of doubling the contribution of renewable energy with a lower level of installed capacity.

Improvements in energy access and renewable energy are also fundamentally related. The rollout of renewable energy technologies, such as mini-grids and home systems, opens up new possibilities for providing electricity to the most remote and dispersed populations. Furthermore, as part of the transition to modern cooking solutions, some households will substitute unsustainable forms of traditional biomass (such as wood and charcoal) for more sustainable forms (such as wood pellets). Other households will eventually substitute solid fuels derived from renewable biomass for non-solid fuels (such as liquid petroleum gas) that are fossil-fuel based, however, with potentially offsetting effects on the share of renewable energy.

Toward a global tracking framework

Concepts, data, and methodology

While the three SE4ALL pillars—energy access, energy efficiency, and renewable energy—make sense intuitively, a formal Global Tracking Framework necessitates rigorous technical definitions of improvement in those areas that can be measured consistently across countries and over time. In the case of energy access, even coming up with a definition is conceptually challenging and subject to ongoing technical debate. In the case of energy efficiency, direct measurement is very demanding in data terms, and it may be necessary to rely on proxies such as energy intensity. In the case of renewable energy, on the other hand, deciding on a definition may be more straightforward, but choices still have to be made between alternative technical measures (with regard to sustainability, for example).

Providing rigorous technical definitions surely comes with significant challenges, but these are no greater in complexity than those faced in many other areas of development—such as poverty, human health, or water and sanitation—where the global community has already pushed ahead in tracking global progress.

The development of sound technical definitions must necessarily be informed by a thorough understanding of the different global databases that are currently available. However compelling a definition may be, it is of little use for global tracking if corresponding time series data are unavailable for the vast majority of the countries involved. In the case of energy efficiency, for example, very detailed indicators are available for a small group of countries, but these data are of limited value for global tracking. There is often a trade-off, therefore, between the precision of an indicator and the scope of country coverage. The development of a tractable definition requires an iterative process that shuttles between the underlying concepts of interest and the constraints of data availability. Accordingly, the next three chapters will map out the conceptual issues involved in the definition of indicators, review the availability of relevant global databases, and propose an accommodation of the two.

While the immediate basis for global tracking is constrained by what is already available, the quality and scope of global energy databases can be improved over time. To that end, this report also identifies incremental improvements to global energy databases that would significantly improve the resolution of the global tracking process and that could be implemented in a five-year, medium-term scenario. Each chapter distinguishes between the immediate tracking methodology and the proposed medium-term improvements (table 1.1). A detailed road map for ongoing improvements to global tracking will be presented in the closing chapter.

In some cases, the development of global energy databases with the ideal level of detail and disaggregation desired for tracking purposes may be beyond the realm of feasibility, even over a five-year period. Nevertheless, as mentioned above, SE4ALL is designing country action plans and programs for the countries that have opted into the initiative. It is highly desirable that these country action programs use a standardized tracking framework, one that is consistent with the Global Tracking Framework while still allowing for a more refined and detailed account of the countries' individual energy situation. Therefore, each chapter will also identify which indicators may best be captured at the country level.

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

TABLE 1.1 **FRAMEWORK FOR IDENTIFYING SUITABLE GLOBAL AND COUNTRY-LEVEL TRACKING INDICATORS**

While the main focus of the methodology will be on the development of a headline global tracking indicator, supporting indicators may also be helpful or necessary to interpret the headline indicator. For example, the headline indicator proposed to proxy for economy-wide energy efficiency will be complemented by measures of energy intensity in four key sectors of the economy. In other cases, tracking of complementary indicators can indicate that intermediate steps are being taken that should support more rapid progress over time. For example, in the case of renewable energy, it is important to track policy commitments and technology costs, which are key drivers of the scaling up of renewable energy.

Historic trends and a starting point

The year 2010 was chosen as a starting point for SE4ALL because it is the most recent year for which all necessary data were available at the time of writing the report. It also provides a round 20-year period (2010–30) over which progress on the SE4ALL initiative can be charted. Once the methodology for choosing indicators is defined and the appropriate data sources identified, it becomes possible to compute starting-point indicators for the year 2010, against which progress can be tracked. The chapters that follow will report the reference indicators for each of the initiative's three objectives—both globally and for large geographical and income groupings—to improve understanding of the variation around the current global average.

The starting-point indicators become much more meaningful when they are placed in the context of recent historical trends. Subsequent chapters will show trends for the 20 years leading up to 2010. Ultimately, an examination of progress over the past two decades will help to clarify what has been achieved and to permit comparisons with what needs to be achieved over the next 20 years if the SE4ALL objectives are to be met.

Country performance

The SE4ALL objectives are global, and progress toward them will be evaluated on a global basis. At the same time, global progress reflects the sum of efforts across the countries involved. Accelerating progress toward the achievement of the SE4ALL objectives requires targeting efforts where they are likely to have the greatest impact, as well as identifying countries that have made rapid progress in the past and that may have valuable experiences to share with others. Countries will need to understand their respective starting points to inform their individual target-setting processes. For these reasons, the report provides a data annex that lists starting point indicators for the more than 180 countries for which data are available. This is accompanied by an on-line database on the World Bank's World Development Indicators platform where all the global tracking indicators can be downloaded: http://data.worldbank.org/data-catalog.

In order to draw attention to high-impact countries, subsequent chapters will identify countries that have the greatest opportunity to make substantial progress on any of the SE4ALL objectives, particularly those whose efforts will have greatest impact on the achievement of the global targets. Ongoing international efforts must pay special attention to addressing the challenges faced by these high-impact countries and providing the support necessary for further progress; without success in these countries, the global targets are unlikely to be reached.

Many countries are already doing well and have been making rapid progress on one or more of the three energy objectives. These fast-moving countries can provide others with policy lessons and concrete experience on the ground. The global effort to achieve the three SE4ALL objectives will need to reflect a clear understanding of what has worked in these countries and why. Facilitation of knowledge exchanges between fast-moving and high-impact countries promises to be particularly valuable.

The good news is that some countries are both high-impact and fast-moving, which suggests that opportunities for progress are already being seized.

The scale of the challenge

How difficult will it be to reach the SE4ALL objectives? Comparing the road ahead with that already travelled provides some sense of the scale of the challenge. In addition, important insights can be gleaned by examining some of the major recent global energy modeling exercises that project future trends in energy access, energy efficiency, and renewable energy.

The outcomes of these modeling exercises ultimately depend on underlying assumptions about technological change, policy adoption, and finance. Some, such as the IEA's World Energy Outlook, focus on projecting trends from the underlying variables and gauging the resulting impact on energy-system outcomes. Others, such as the IIASA's Global Energy Assessment, focus more on setting specific targets for the global energy system and determining the technology, policy, and financing inputs that would make reaching those targets feasible. In both cases, the results are highly informative, even if direct comparisons between models may not be possible (box 1.1).

This report will draw on this important body of material to ascertain how challenging it will be to meet the SE4ALL targets. In particular, it will examine what combinations of technology, policy, and finance may be needed for success. The models can also inform understanding of the relationship between the three objectives and their potential for mutual reinforcement. Finally, they can help to clarify how the achievement of different objectives is likely to draw differentially on different regions of the world, based on their starting points and comparative advantages.

It was not possible within the time available to prepare the report to commission modeling exercises of scenarios designed specifically for the Global Tracking Framework. Instead, the report relies on preexisting scenarios, many of which are related to SE4ALL. As a result, however, the reporting of results is limited to what is already available in the literature and could not be standardized within this report.

BOX 1.1. Global energy projections as a tool for understanding the scale of the SE4ALL challenge

The IEA's World Energy Model

The World Energy Model (WEM) is a large-scale model designed to simulate energy markets. It is the principal tool used to generate detailed sector-by-sector and region-by-region projections for the World Energy Outlook (WEO) scenarios. Developed over many years, the model consists of four main modules: final energy consumption (covering residential services, agriculture, industry, transport, and nonenergy use); energy transformation, including power generation and heat, refinery/petrochemicals, and other transformation; biomass supply; and fossil-fuel supply. The model's outputs include energy flows by fuel, investment needs and costs, CO_2 emissions, and end-user pricing. It is a partial equilibrium model; major macroeconomic assumptions are exogenously determined.

The WEM is data intensive and covers the whole global energy system. Much of the data on energy supply, transformation and demand, and energy prices is obtained from the IEA's own databases of energy and economic statistics. Various external sources provide additional data.

The current version of WEM covers energy developments in 25 regions through 2035. Twelve large countries are individually modeled. The WEM is designed to analyze:

- *Global and regional energy prospects.* These include trends in demand, supply availability and constraints, international trade, and energy balances by sector and by fuel through 2035.

- *Environmental impact of energy use.* Estimates of CO_2 emissions from fuel combustion are derived from the projections of energy consumption. Greenhouse gases and local pollutants are also estimated in order to link WEM with other models.

- *Effects of policy actions and technological changes.* Alternative scenarios analyze the impact of policy actions and technological developments on energy demand, supply, trade, investments, and emissions.

- *Investment in the energy sector.* The model evaluates investment requirements in the fuel supply chain needed to satisfy projected energy demand through 2035. Alternative scenarios also evaluate demand-side investment requirements.

The WEM covers energy supply, energy transformation, and energy demand. The majority of the end-use sectors use stock models to characterize the energy infrastructure. In addition, energy-related CO_2 emissions and investment in energy developments are specified. Though the general model is built up as a simulation model, specific costs play an important role in determining the share of technologies in satisfying energy service demand. In some parts of the model, Logit and Weibull functions are used to determine the share of technologies based on their specific costs. This includes investment costs, operating and maintenance costs, fuel costs and, in some cases, the costs of emitting CO_2.

The main exogenous assumptions of the model concern economic growth, demographics, international fossil-fuel prices, and technological developments. Electricity consumption and electricity prices dynamically link the final energy demand and transformation sector. Demand for primary energy is an input for the supply modules. Complete energy balances are compiled at a regional level, and the CO_2 emissions of each region are then calculated using derived CO_2 factors. The time horizon of the model goes out to 2035, with annual time steps. Each year, the model is recalibrated to the latest available data point.

Main model outputs and data of the WEO scenarios can be downloaded from:
http://www.worldenergyoutlook.org/weomodel/.

The IIASA's Global Energy Assessment

IIASA's MESSAGE model was used for the development of the Global Energy Assessment (GEA) scenarios. MESSAGE is a systems engineering model for medium- to long-term energy-system planning, energy-policy analysis, and scenario development. The model represents the energy system in detail, from resource extraction, trade, conversion, transport, and distribution, to the provision of energy end-use services such as light, space conditioning, industrial production processes, and transportation. Specific features of the model include the explicit modeling of the vintaging of long-lived infrastructure, with assumptions regarding costs, penetration rates, and resource constraints based on literature surveys. In addition to the energy system, the model also includes generic representations of agriculture and the forestry sector, which allows incorporation of a full basket of greenhouse gas and air pollutant emissions (CO_2, CH_4, N_2O, NOx, PM2.5, CO, SO_2, BC, OC, SF6, volatile organic compounds, and various halocarbons).

The current version of MESSAGE operates on the level of 11 world regions and can be used for short- to medium-term energy planning to 2030 as well as for long-term scenario analysis to 2100. The modeling framework and the results provide core inputs for major international assessments and scenarios studies, such as the Intergovernmental Panel on Climate Change (IPCC), the World Energy Council (WEC), the European Commission, the German Advisory Council on Global Change (WBGU), and other multinational and national organizations. Principal applications of the model include the development of global and regional energy transformation pathways to address adverse social, environmental, and economic impacts of the energy systems. In the context of the GEA, the model was applied for the assessment of costs and benefits of the transformation in the following areas:

- Climate change
- Air pollution
- Energy access
- Energy security

MESSAGE is a technology-rich optimization model. It minimizes total discounted energy system costs and provides information on the utilization of domestic resources, energy imports and exports, trade-related monetary flows, investment requirements, the types of production or conversion technologies selected (technology substitution), pollutant emissions, and interfuel substitution processes, as well as temporal trajectories for primary, secondary, final, and useful energy. MESSAGE is coupled to the macroeconomic model MACRO for the assessment of macroeconomic feedbacks and internally consistent projections of energy demand and prices. Further linkages with IIASA's GLOBIOM (agricultural) model allow the assessment of land, forest, and water implications of energy systems. Finally, an explicit linkage to IIASA's GAINS air pollution framework allows the assessment of health impacts of energy systems.

Main model outputs and data of the GEA scenarios can be downloaded at the interactive GEA scenario database: http://www.iiasa.ac.at/web-apps/ene/geadb/.

The remainder of the report

The remainder of this report follows through on the framework laid down in this introductory chapter. Chapters 2-4 present a detailed discussion of energy access, energy efficiency, and renewable energy. Each chapter begins by addressing concepts, methodology, and sources of data and then goes on to present the starting point in 2010, to identify high-impact and fast-moving countries, and to sketch out the scale of the global challenge. Chapter 5 lays down a road map for future global tracking of progress toward the objectives through 2030—proposing a number of improvements that look to be feasible in the medium term—before synthesizing the main substantive conclusions of the report.