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Energy Perspectives to Achieve Sustainability and Climate Targets

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International efforts to achieve universal energy access by 2030 can succeed - but only if significant investments are made in research and development to decarbonize energy systems and improve efficiencies, and if the resulting innovation and technological advancements are deployed rapidly and equitably.

Unless major transformational changes occur, **energy demand** by 2030 is expected to increase as much as 50 percent, compared with 2005 levels. **Greenhouse gas emissions** and other damaging substances such as **black carbon** - generated largely through the production and use of fossil fuel-based energy - are rising, despite efforts by many countries to curb these emissions. Coupled with the growing demand for energy and the pressing environmental challenge of anthropogenic **climate change** is the realization that energy access lies at the heart of many other key challenges in global development. Attainment of the **United Nations Millennium Development Goals**, for example - specifically those of maternal health, universal education, gender equity, and **environmental sustainability** - is compromised in a world where nearly 3 billion people, predominantly in the developing world, have no access to **clean energy services** and consequently cook with solid fuels. And the gap between those with and without energy access is growing.

The human and environmental imperatives for "**closing this energy gap**" and breaking the **systemic poverty cycle** are many, and include **reducing the severe impacts on human health, enhancing economic development, and achieving environmental sustainability.**



UNIDO Director General Kandeh Yumkella

Associated with these imperatives is that of personal freedom. This dimension was encapsulated in a recent statement by [United Nations Industrial Development Organization \(UNIDO\) Director General Kandeh Yumkella](#), who stated, "... energy systems bring freedom - freedom for individuals to have information ... to be creative ... to have light. This is not about political freedom but individual freedom."

Also embodied in this freedom is the ability to cook a meal without inhaling toxic fumes, and the opportunity to attend school or to be employed instead of spending hours each day collecting wood for cooking and lighting. The realization of these opportunities, taken for granted by those living in the developed world, must become options for the nearly one-third of humanity who currently lack access to modern energy. Energy systems in current use are also directly responsible for around 3 million premature deaths annually, through their harmful impact on health.

It is not surprising, then, that achieving access to modern energy services is the central objective of the following international initiatives:

In January 2011 the United Nations General Assembly declared 2012 the [International Year of Energy Access for All](#), with the [United Nations Secretary General Ban Ki-moon](#) calling for "...a global clean energy revolution - a revolution that makes energy available and affordable for all."



In June 2011 universal access to modern energy services was the central theme of the [Vienna Energy Forum](#), hosted by UNIDO, the Austrian Federal Ministry for European and International Affairs, and the International Institute for Applied Systems Analysis (IIASA). The event involved 1,200 participants from 125

countries representing policy makers, civil servants, scientists, energy experts, and NGOs, who reached a consensus that universal energy access, while optimistic, is achievable.

Most recently, in September 2011 the United Nations Secretary-General **Ban Ki-moon** launched a new energy access initiative and a high-level group to implement it. The initiative seeks to achieve the goal of **Sustainable Energy for All by 2030** by meeting three interlinked global targets:

- Achieving universal access to modern energy services;
- Doubling the rate of improvement in energy efficiency; and
- Doubling the share of renewable energy in the world's energy mix.

These targets (or goals) are consistent with those reached by delegates at the **Vienna Energy Forum**.

Looking forward, in November 2011 the **UN Framework Convention on Climate Change, Conference of the Parties** meeting (**COP17**) commences in **Durban**. The objective of the Convention is "to stabilize **greenhouse gas** concentrations at a level that will prevent dangerous human interference with the climate system." And in May 2012, all eyes will be on **Rio de Janeiro** where the **Rio+20, United Nations Conference on Sustainable Development**, will mark the **20th anniversary of the 1992 United Nations Conference on Environment and Development** and the **10th anniversary of the 2002 World Summit on Sustainable Development in Johannesburg**. The aim of the Rio+20 Conference is to gain renewed political commitment for sustainable development and to assess the progress to date in implementing the outcomes of the major summits on sustainable development. One of the two themes of the Conference is establishing a **green economy** in the context of **sustainable development** and **poverty eradication**; again the linkages to energy access and human and environmental imperatives are intertwined.



Rio de Janeiro is 2012 hosting the UN Conference on Sustainable Development.

The mobilization of international concern on energy issues, coupled with new research undertaken by **IIASA** and a large team of the world's leading energy analysts, policy advisors, and academics involved in the **Global Energy Assessment (GEA)**, provides a sense of optimism that the goals mentioned above are both affordable and achievable - but only if substantial investments are made in innovation and technological research that leads to **decarbonization** of energy systems. The subsequent and sustained investment in technology diffusion, making these technologies broadly accessible, is equally critical. What is still missing is a roadmap that builds on national and regional energy plans for how the goals espoused by governments and the international community can be achieved.

IIASA energy research and the IIASA-initiated and -led **GEA** provide some of the science-based rationale needed to develop such a roadmap. **GEA** is the first global energy assessment that analyzes energy in a fully integrated way, linking all aspects of the energy system such as urban infrastructure, transport and housing, health, and land and water use. It considers all energy sources including **fossil fuels**, **renewable sources**, and **nuclear options** as part of its four broad scenarios. The assessment, which is fully independent of government or industry and which follows scientific review protocols similar to those adopted by the **Intergovernmental Panel on Climate Change** and peer-reviewed journals, provides a science-based rationale for how governments and communities can address energy access and energy security issues, and offers specific guidance on how the aforementioned goals could be achieved and at what cost.

- **Goal 1. Achieving universal access to modern energy services:** Analysts for the assessment conclude that universal access to electricity and **clean cooking** can be achieved by 2030 with investments of approximately US\$40 billion per year. While seemingly high, this figure represents only about 3 percent of current energy investments or 8 percent of **energy subsidies**, and would thus appear to be financially feasible with appropriate institutional frameworks and incentive structures. This investment would bring significant collateral benefits by largely eliminating indoor air pollution, including the high burden of **black carbon emissions** so harmful to human health and the environment.
- **Goal 2. Doubling the rate of improvement in energy efficiency (or energy intensity):** The scenarios developed for **GEA** show that

energy efficiency improvements are the most important option in the transformation toward more **sustainable energy** futures. They require up-front investments and integrated, inter-sectoral approaches for realizing the potential efficiency levels. In the building sector, for example, energy for heating and cooling can be cost-effectively reduced by up to 90 percent of current use. Furthermore, by 2020, present and foreseen technologies can reduce energy consumption of new appliances, IT, and other equipment in buildings by up to 65 percent of current use levels. Efficiencies in this sector are significant because buildings, from construction through to demolition, account for 40 percent of global energy demand and are responsible for one-third of energy-related **CO₂** emissions. As the building sector is one of the highest users of energy globally, such spectacular increases in efficiency could have a major impact on energy demand and supply. Similarly, in the transport sector major gains can be achieved through broader use of **alternative fuels** such as electricity, hydrogen and biofuels, and better transport infrastructure - but most importantly through a shift from individual to collective transportation modes.

- **Goal 3. Doubling the share of renewable energy in the world's energy mix:** This goal corresponds to doubling the current 15 percent



Krafla Geothermal Power Station, Iceland.

share of **renewables** in final energy. The potential of renewable energy sources is immense, given their wide availability. However, significant technological investments and upscaling are required to realize this potential. Renewables improve resilience and energy security, through reduced dependency on oil, coal, and gas supplies, and are likely to create jobs and local income. **Smart grid** and off-grid solutions are often already cost competitive and can bring energy services to rural areas, while more centralized and large-scale solutions such as "smart" super grids might be more compatible with growing urbanization in the world. The transformation toward high shares of renewable sources is also a fundamental prerequisite to decarbonizing the global economy.

Of the 27 Key Principles contained in the **Rio Declaration on Environment and Development**, the majority can be strongly linked to human actions relating to energy: its use, its availability, and its sustainability. Nearly 15 years have passed since the negotiation of the **Kyoto Protocol**, in which countries agreed to reduce their **greenhouse gas emissions** - emissions generated in large part through the production and use of energy. As we head toward 2012, the **International Year of Energy for All**, and **Rio+20**, we have reason to be optimistic. We have much of the necessary knowledge and, importantly, the commitment of organizations such as the United Nations and many governments around the world to confront and resolve these fundamental environmental and human issues.

Note: Following the **Rio+20 Summit**, the **International Institute for Applied Systems Analysis (IIASA)**, in June 2012, will host its 40th Anniversary Conference: *Worlds Within Reach - From Science to Policy*. This international event will address the research and policy challenges associated with energy and climate change, food and water, and poverty and equity. It will also debate the role and capacity of integrated systems analysis to inform the global sustainability goals that were addressed at, and raised as a result of, the Rio+20 Conference. More about this event can be found on the IIASA Web site at: <http://www.iiasa.ac.at/conference2012/>

About the author: Professor Nebojsa Nakicenovic is deputy director of the International Institute for Applied Systems Analysis and director of the Global Energy Assessment. Among his many international roles he is a member of the Technical Group of the UN Secretary-General's High-level Group on *Sustainable Energy for All*; member of the Advisory Council of the German Government on Global Change (WBGU); member of the Renewable Energy Policy Network for the 21st Century (REN21) Steering Committee; lead author of Fifth Assessment Report of the IPCC; and was a coordinating lead author of the IPCCs, second, third, and fourth Assessment Reports.

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