Global Energy Assessment
Toward a Sustainable Future

IIASA

GEA

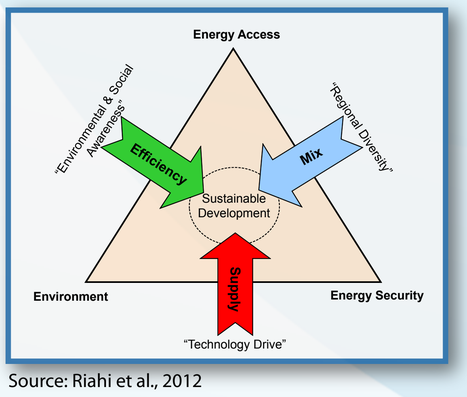
The Global Energy Challenge

Major transformations are required if future energy systems are to be affordable, safe, secure and environmentally sound. The Global Energy Assessment (GEA) goals address the following challenges:

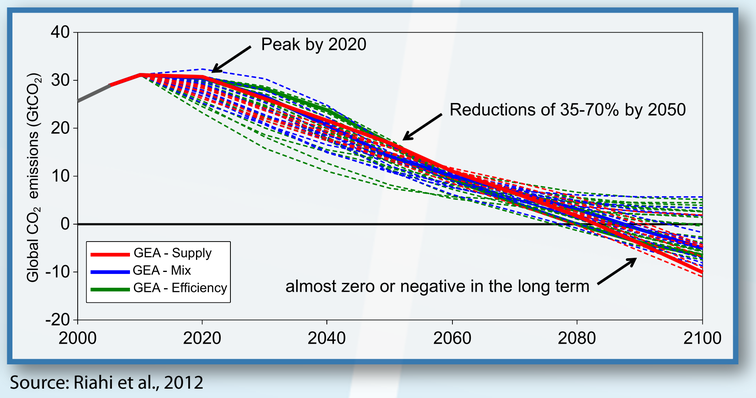
- Providing clean and affordable energy services for all;
- Increasing energy security for all nations, regions and communities;
- Reducing greenhouse gas emissions to limit global warming to less than 2°C above pre-industrial levels;
- Reducing indoor and outdoor air pollution from fuel combustion and its adverse impacts on human health; and
- Reducing the adverse and ancillary risks associated with energy systems.

A Grand Transformation of Global Energy Systems

GEA analysis shows that in order to simultaneously meet the GEA goals, a grand transformation of energy systems worldwide is required. By assessesing a broad range of resources, technologies, and policy options which support such transformations, GEA identifies forty-one alternative options or 'pathways' which simultaneously meet all of the goals and increase prosperity and well-being.



Source: Riahi et al., 2012

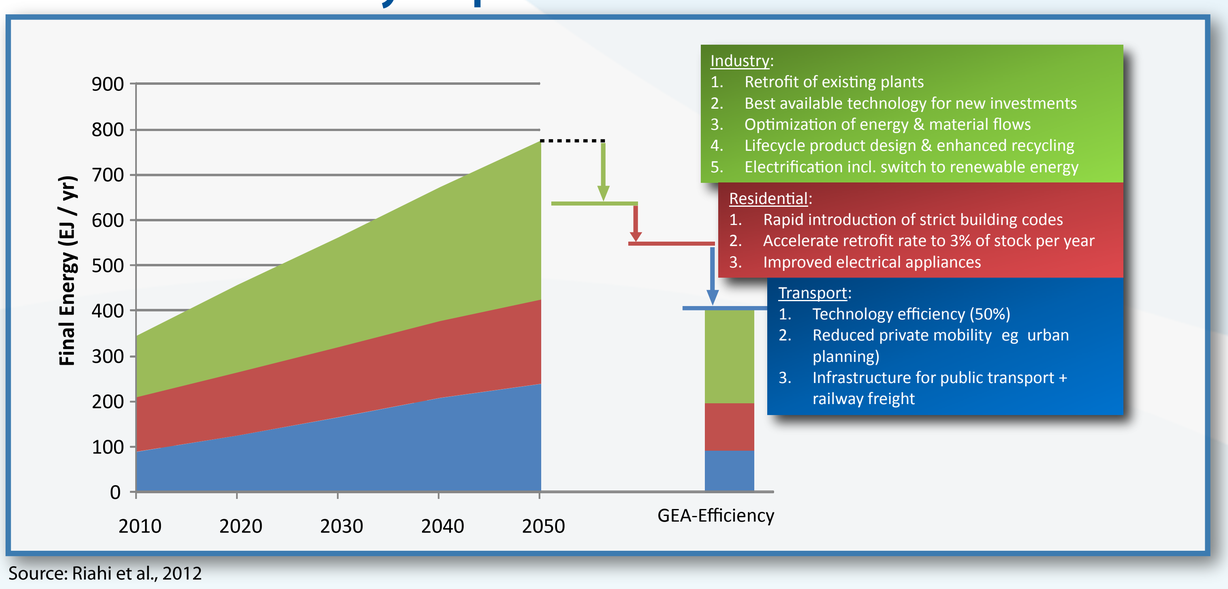


Source: Riahi et al., 2012

GEA indicates that a transformation towards sustainable future energy systems requires:

- immediate action and the avoidance of "lock-in" to energy demand and supply patterns counterproductive to sustainability goals.
- radical improvements in energy efficiency, especially in end-use, focusing on both new developments and retrofits;
- decarbonisation through the rapid escalation of investments in through greater shares of renewable energy and smart grids enabling more effective utilization of renewables technologies; and
- universal access to modern forms of energy and cleaner cooking through micro-financing and subsidies.

End-Use Efficiency Improvements



Source: Riahi et al., 2012

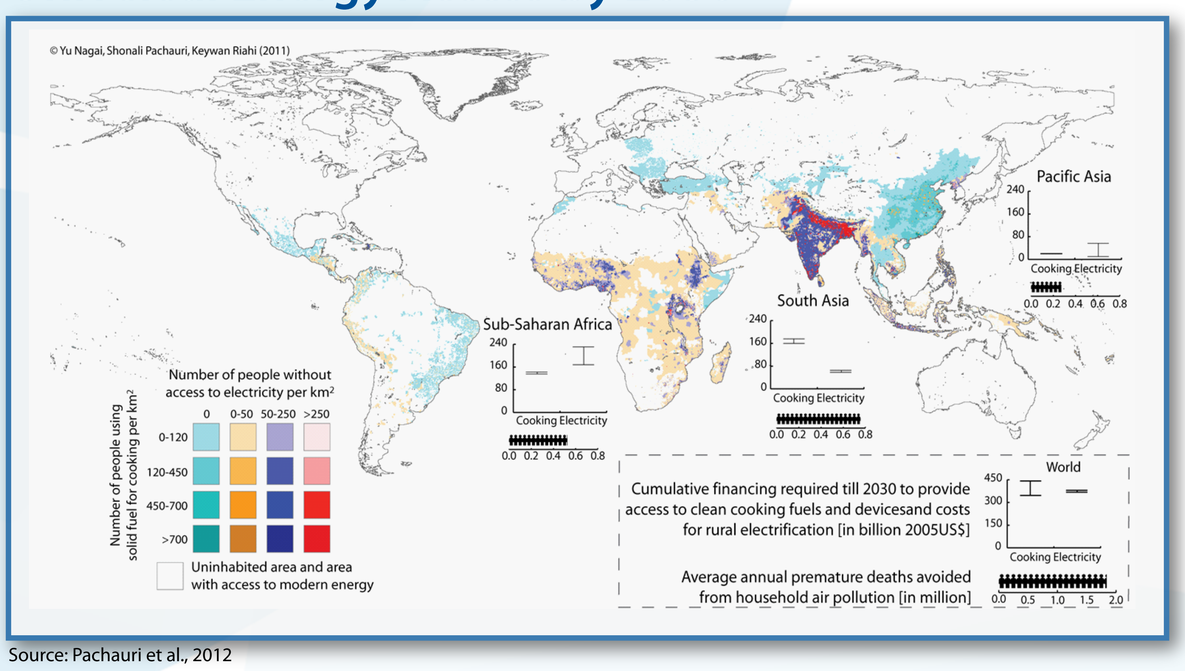
Energy Efficiency is an Immediate and Effective Option: Efficiency improvements are proving to be the most cost-effective, near-term option for getting onto a pathway of energy systems transformation (Chapter 17; Riahi et al., 2012).

Renewable Energies

Renewable energies are abundant, widely available, and increasingly cost-effective. The share of renewable energy in global primary energy could increase from the current 30% to 75% and in some regions exceed 90% by 2050. Renewable energy technologies are suitable for both centralized and off-grid distributed systems (Chapter 11; Turkenburg et al., 2012). The major technological and economic challenges for deployment of renewable energies are:

- reducing costs through learning and scale-up;
- creating a flexible investment environment that provides the basis for scale-up and diffusion;
- integrating renewable energies into the energy system; and
- enhancing research and development to support new technologies.

Universal Energy Access by 2030



Source: Pachauri et al., 2012

Universal access to electricity and cleaner cooking fuels and stoves can be achieved by 2030, but requires innovative institutions, enabling mechanisms and targeted policies (Chapter 19; Pachauri et al., 2012).

Stable Investment Regimes and Policies are Essential

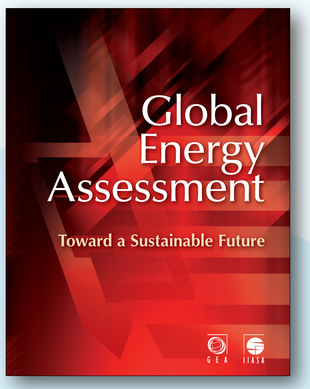
Policies to enable rapid transformations of energy systems must contain incentives for large-scale deployment of energy efficiency, renewable energy, and advanced energy system technologies. GEA analysis indicates that global investments in energy systems will need to increase from present annual levels of about $1.3 trillion to $1.7–2.2 trillion (about 2% of current world GDP). Reallocating energy subsidies, particularly those related to mainstream fossil fuels and nuclear energy, can help support the initial deployment of new energy systems. Additionally, publicly funded research needs to be reoriented toward energy efficiency, renewable energy, and advanced energy systems, since current efforts in these areas are inadequate to enable the required transformations.

GEA Pathways Database

Visit the interactive online database which documents the results and assumptions used in the GEA transformation pathways. The IIASA database serves as a central data-repository for the dissemination of GEA scenario information.

GEA comprises essentially one single normative scenario of the transition to a sustainable energy system. Within this single scenario, alternative pathways are developed, which describe transformations towards normative objectives for energy access, environmental impacts of energy conversion and use, and energy security. All pathways fulfill these objectives by reaching specific and clear targets. See Chapter 17 of the report for more information (Riahi et al., 2012). Visit and use the database, available at:

www.iiasa.ac.at/web-apps/ene/geadb



About the Book

The Global Energy Assessment is a multi-stakeholder initiative involving over 300 authors and 200 anonymous reviewers, and assesses the energy challenges of our rapidly changing world. It identifies the urgent need for a comprehensive strategy to resolve the issues facing sustainable development. Implementation of this strategy relies on strong commitments from policy- and decision-makers to achieve a transformation of the global energy system. Coordinated by IIASA, GEA was led by energy experts from around the world and is the first ever fully integrated energy assessment that analyzes energy challenges, opportunities and strategies, for developing, industrialized and emerging economies. It is supported by government and non-governmental organizations, the United Nations Systems, and the private sector.

Additional Information

Visit: www.globalenergyassessment.org