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IIASA Overview

IIASA is embarking on a number of new initiatives in cooperation with its National Member Organizations, building on the Institute's existing strengths in research cooperation and training.

IIASA's history of strength in energy scenarios and policy, combined with its status as a neutral venue for international cooperation, made it the ideal institution to serve as coordinator for the Global Energy Assessment (GEA), the first fully integrated assessment of the global energy system. This six-year project involving over 500 energy experts from around the world as authors and reviewers produced an 1800-page report that was published by Cambridge University Press in September 2012, and which is now available for free download on the internet. The results of that assessment are being used by energy policy makers around the world, notably in the UN Secretary General's Sustainable Energy for All (SE4All) initiative.

In the same tradition, IIASA has entered a partnership with UNESCO, the World Water Council and the International Water Association to organize a multi-year World Water Scenarios Initiative to examine water futures and solutions. Launched just this week, the initiative will develop projections at regional and global levels, tested in a multi-model framework, in conjunction with policy maker and stakeholder consultations to define the questions that the models will be designed to address.

These two flagship projects and their ongoing follow-up activities will involve every IIASA NMO country, as energy and water are universal issues. In addition, IIASA is working with its NMOs to design and develop other flagship research initiatives that are critical to global processes, but are of more direct interest to specific regions. Two of these concern sustainable development of the global tropics (of particular interest to IIASA's NMOs in Brazil, Malaysia, Indonesia and Australia) and understanding and dealing with Arctic environmental change (of particular interest to NMOs in Russia, Finland, Sweden, Norway, and the U.S.). These policy-relevant flagship projects will be complemented by IIASA's proposed Global Think Tank of leading figures from the international political, academic, business and NGO communities.

IIASA is also exploring new ways to build on its successful Young Scientists Summer Program (YSSP), which trains 50 advanced doctoral students from around the world each summer, and on the Institute's small, high quality postdoctoral program. This winter, IIASA is cooperating with its South African NMO in a pilot regional YSSP program in Bloemfontein, South Africa. And at the next Council meeting, IIASA's NMOs will consider a proposal for an International Graduate School of Excellence involving a global network of postdoctoral fellows working at affiliated research institutions around the world on different aspects of a single complex issue, all of whom will spend 3-4 months each year at IIASA as a group.

Many of these initiatives grew from or were informed by discussions at IIASA's 40th Anniversary Conference, held in Vienna and Laxenburg on 24-26 October 2012. The results of that Conference, which focused on ways in which cooperative research could help to address the conundrums facing a world that is approaching the limits of planetary boundaries, are described in the policy brief in the accompanying material.

History of IIASA

In October 1972 representatives of the Soviet Union, United States, and 10 other countries from the Eastern and Western blocs met in London to sign the charter establishing the International Institute for Applied Systems Analysis (IIASA). It was the culmination of six years' effort, initiated by US President Lyndon Johnson and USSR Premier Alexey Kosygin, and continued and finalized under U.S. President Richard Nixon. The Institute's founding marked the beginning of a remarkable project to use scientific cooperation to build bridges across the Cold War divide and to confront growing global problems on an international scale.

In the 1970s most research organizations focused on national issues. Few encouraged researchers from different countries or disciplines to work together for the greater good. To achieve its ambitious research vision, IIASA would have to break down the barriers between nations and disciplines. This it did, building international interdisciplinary teams that used advanced systems analysis to study innumerable global challenges, both long-standing and emerging. For example, a study on water pollution carried out by a team of IIASA chemists, biologists, and economists in the 1980s is still the basis of modern water policy design in Japan, the USA, and the former USSR.

The refurbished Schloss Laxenburg near Vienna was made available by the Austrian government shortly after the foundation of IIASA in 1972. The Schloss has been the Institute's home for nearly four decades.

When the Cold War ended, IIASA's sponsoring countries could have said "mission accomplished" and disbanded the Institute. However, as well as helping foster mutual understanding among scientists from East and West, IIASA had shown the scientific benefits of different nationalities and disciplines working together toward common goals. This approach has been widely adopted, for example, in the Intergovernmental Panel on Climate Change (IPCC) and the International Geosphere-Biosphere Programme (IGBP).

Thus the Institute remained, and in the 1990s broadened its mandate to achieve a greater global focus. Today IIASA brings together a wide range of scientific skills to provide science-based insights into critical policy issues in international and national debates on global change, with three central research focuses.

IIASA has 21 National Member Organizations (NMOs). NMO countries account for over half the world's population (59%) and production (63%). They include not only the world's four largest economies, but also some of fastest-growing economies in the developing world.

For more information please see IIASA's Charter.

Nobel Prize Winners at IIASA

In 1975, Tjalling C. Koopmans and Leonid Kantarovich were jointly awarded the Nobel prize in Economics for their work on optimal allocation of resources that was useful to many industries around the world, notably transport companies. Koopmans was from the Netherlands and Kantarovich was from the Soviet Union. Interestingly, in spite of the Cold War, both of them were working at IIASA. They were joined by George Dantzig, a world famous American mathematician. It was an exciting time of research and discovery. Kantarovich had invented linear programming, and Dantzig had invented the simplex method, based on Kantorovich's work. The simplex method of solving linear programming problems is still used by airlines, transportation firms and oil companies around the world today to solve scheduling problems. It has been called the most important mathematical programming discovery of the twentieth century.

IIASA's scientists have been lead authors and contributing authors for many of the IPCC's Assessment Reports. As collective authors, IIASA researchers have been jointly awarded the Nobel Peace Prize (with Al Gore and other IPCC authors) in 2007, and the Sheikh Zayed International Prize for the Environment in 2005, among many others.

These distinguished scholars were also peers of two more Nobel Prize winners who regularly visited IIASA for extended periods from the 1990s onward. Paul Crutzen was awarded the Nobel Prize in Chemistry, 1995 for his findings that led to the discovery of the ozone hole. Tom Schelling (Economics, 2005) "for having enhanced our understanding of conflict and cooperation through game-theory analysis." Professor Schelling moved between the worlds of research and application, working for the Marshall Plan, the White House, as well as Harvard, the University of Maryland, and IIASA. One of his papers even served as inspiration for Stanley Kubrick's film Dr. Strangelove.

Examples of Early Research

In 1978, IIASA held a conference that resulted in one of the first international assessments of climate change, then known as the carbon dioxide problem. 40 authors from 11 countries contributed technical papers.

1981: IIASA conducted the first comprehensive, truly global assessments of energy issues resulting in the internationally acclaimed report, *Energy in a Finite World*. 140 scientists from 19 countries contributed to the assessment.

1986: IIASA scholars publish *Sustainable Development of the Biosphere*, rapidly accepted by the science community as the core scientific text on sustainable development.

IIASA's Research and Programs

IIASA researches real world problems using cutting-edge science. It provides practical and independent insights into today's most pressing global issues relating to the environment, society and technology. It has also been a leading contributor for 40 years to the development and refinement of assessment and decision-support methodologies, global databases, and analytical tools.

The institute concentrates its research efforts within three core global problem areas:

- Energy and Climate Change;
- Food and Water;
- Poverty and Equity.

Much of IIASA's research on these problem areas builds on the institute's strong research history, but with a shift in emphasis that recognizes the transformational nature of the modern world. To ensure that the research is relevant and produces useable results, the work is being conducted in the context of what is driving the global transformation, how the methods of systems analysis can be improved to find the most effective solutions, and how policymakers at national and international levels can best implement those solutions. Systems analysis at IIASA is based on quantitative models, databases, and analytical tools that allow researchers to look at complex problems in a holistic and integrated way. The goal of systems analysis is to highlight the impacts and trade-offs of different policy choices while preserving the complexity of the analysis. The trademark of IIASA's research is that it is crosscutting, so the work done in one research program is connected to the work in another program. This approach is designed to meet the institute's mission of "developing solutions to global problems for the benefit of humankind."

Programs

<u>Advanced Systems Analysis</u>

- Goals: to develop advanced systems analysis through advancing the uses of mathematical models and analytical techniques to investigate complex systems with a focus on an integrated, interdisciplinary approach.
- Activities: The new research program focuses on three themes: (1) Advances in assessment of dynamical system; (2) systemic risks and robust solutions; and (3) integrated modeling and decision support. The institute is also encouraging exploration and discussion among IIASA's methodological researchers and selected external experts in order to present promising new work through an ongoing Advanced Systems Analysis Forum. Through both methodological projects and applied systems analysis demonstration projects, the forum works to advance the state of the art in systems analysis.

<u>Energy</u>

- Goals: to better understand the nature of alternative future energy transitions, their implications for human well-being and the environment and how they might be shaped and directed by current and future decision makers. The Program will contribute to addressing the challenges confronting the global energy system by pursuing three main areas of research.
- Activities: (1) evaluate the social, economic, development, technological, environmental, security and other issues linked to energy to provide the technical and scientific basis needed to address the major energy challenges of tomorrow; (2) developing new methods and modeling techniques for exploring alternative energy pathways, with a focus on the "next generation" of both systems-engineering and other modeling approaches; and (3) longer-term research, informed by (1) and (2), on energy investment requirements looking at the development, deployment and financing needs and

opportunities associated with a range of energy technologies, systems and infrastructures in a more dynamic context.

Evolution and Ecology

- Goals: To analyze and forecast how ecological and evolutionary dynamics shape populations and communities based on novel methods for understanding complex adaptive systems.
- Activities: Adaptive dynamics theory; evolutionary fisheries management; evolution of cooperation; evolving biodiversity.

Ecosystem Services and Management

- Goals: To understand the state, ecological thresholds and buffering capacities of ecosystems in a changing world. By using advanced theories of applied systems analysis, new information technologies and integrated biophysical, social and economic modeling techniques, ESM is charting possible pathways to the future by linking ecosystems, society, policy and governance.
- Activities: (1) developing special Earth observation tools as a depository of new, verified information on the extent, condition, vitality and dynamics of ecosystems and related landscapes; (2) using IIASA's integrating modeling to look at the link between ecosystems and food, the potential for increasing food supplies in the future, and the overall security of the food supply; (3) assessing global forests and other natural ecosystems as a source of food, fodder, livestock, and energy; and (4) developing projects to better understand the role of ecosystems in a functioning Earth system.

Mitigation of Air Pollution and Greenhouse Gases

- Goal: To develop cost-effective solutions that integrate technical, economic, physical, and ecological aspects of atmospheric pollution.
- Activities: Model development for assessment of air pollution and greenhouse gas control at different scales; networking; practical policy application.

Transitions to New Technologies

- Goal: The longer-term strategic goal of the program is to contribute to an improved understanding the dynamics and impacts of technological change beyond simplistic "black box" representations; to develop models that operationalize core features of technology innovation and diffusion dynamics; and to improve the representation of technological change in environmental policies and instruments, particularly in the area of climate change.
- Activities: (1) Perform empirical case studies and models that describe the development and diffusion of new technologies in time and space; (2) Assess the economic, social and environmental implications of technology diffusion scenarios; and (3) Assist policy making in developing operational methods that capture, and policy instruments that account for, the main features of technological innovation and diffusion, in particular technology dynamics, uncertainty, and potential increasing returns.

Risk, Policy and Vulnerability

- Goals: To do applied policy research combining new methods for modeling complex risk systems, stresses and the vulnerability of social, economic and ecological systems, with an understanding of the social institutions governing their management.

- Activities: Global change and catastrophic risk modeling and management; insurance and risk transfer for vulnerable countries; complex systems modeling.

World Population

- Goal: To study population dynamics in the context of socioeconomic development and the environment.
- Activities: Population forecasting; forecasting human capital (population by level of education and health status); population aging and challenges to social security; population-development-environment case studies; population and sustainable development.

Flagship Projects

Global Energy Assessment:

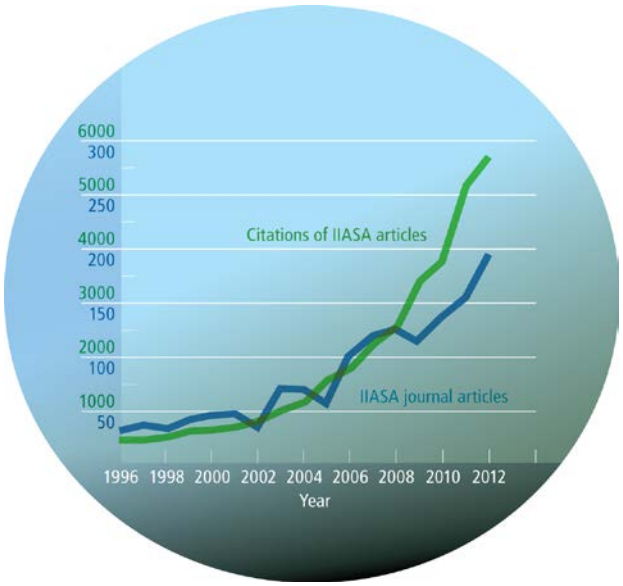
The Global Energy Assessment (GEA), released in 2012, defines a new global energy policy agenda – one that transforms the way society thinks about, uses, and delivers energy. The comprehensive assessment involved specialists from a range of disciplines, industry groups, and policy areas, and provides policy-relevant analysis and guidance to governments and intergovernmental organizations, decision-support material to the commercial sector (energy service companies, investors and others), and analysis relevant to academic institutions. It provides technical guidance for implementing measures aimed at mitigating climate change and sustainable consumption of resources

World Water Scenarios

Water Futures and Solutions: World Water Scenarios, is a partnership between IIASA, UNESCO, the World Water Council and the Korean Government. It aims to provide a scientific basis for responding to worldwide water challenges by testing possible optional solutions against a number of scenarios for socio-economic change, and bringing together decision makers to discuss a common vision for the future.

Key Statistics

Journal Articles and Citations	**2010**	**2011**	**2012**	**2013 (up to August)**
Peer-reviewed journal articles according to SCOPUS	143	164	200	171
Citations of IIASA publications according to SCOPUS	3951	5150	6128	5213



IIASA researchers take part in 60 advisory boards and steering committees, including:

- UN Secretary General Technical Group on Sustainable Energy for All
- Advisory Council of the German Government on Global Change (WBGU)
- Scientific Steering Group of the UNEP Black Carbon Assessment
- UN World Water Scenarios
- UN Food and Agriculture Organization Land and Water Division

IIASA collaborates with almost 300 institutions from nearly 40 countries.