The seven critical issues at Rio+20

In June 2012 world leaders, along with thousands of participants from governments, the international community, the private sector, and NGOs came together to shape the ways we can reduce poverty, advance social equity, and ensure environmental protection on an ever more crowded planet. This meeting, Rio+20, the United Nations Conference on Sustainable Development, also saw IIASA participate in various events (page 4).

Discussions at Rio+20 highlighted seven areas which need priority attention; these include energy, sustainable cities, food security and sustainable agriculture, water, oceans, disaster readiness, and decent jobs. This issue of Options presents some of IIASA’s work in each of the seven areas. Our research shows the crucial advice that science can bring to achieving the sustainability goals of Rio+20. In particular, it shows the value that systems analysis brings to resolving complex, global issues. Systems analysis is not a narrowly focused, single disciplinary science, but multi-scale, integrated, and interdisciplinary. Only such an approach can succeed in examining issues from social, economic, and environmental perspectives; from local, national, and international perspectives; and from the perspective of all stakeholders. This allows systems analysis to identify the co-benefits, the trade-offs, and the negative consequences of policy decisions before they are made.

Features in this Options cover the multi-year and multidisciplinary study of the Global Energy Assessment, which was launched at Rio+20 and shows that energy access for all by 2050 is possible with co-benefits of limiting warming to 2°C, improving air quality and human health, and stimulating economic growth within a green economy framework (page 16). Building on this expertise, IIASA with UN Water and the World Water Council will undertake a similar international, integrated assessment on water resources beginning this year (page 9). Researching the energy needs and uses of cities in an integrated way reveals strategies for energizing our increasingly urban world in a sustainable way (page 22). Other articles show the impact of IIASA’s systems analysis such as its influence on China’s food policy (page 10).

On a personal note, this Options is my first as IIASA’s Director/CEO. It is a great honor to lead an Institute with 40 years of experience of applying international and interdisciplinary research to global problems. It is also a great privilege to work with so many talented researchers and partners to establish IIASA as a global hub for systems science that underpins solutions to global problems for the benefit of humankind.

I hope you enjoy reading about IIASA’s work and encourage you to find out more about the enormous strengths of systems analysis as a research tool by taking part in our 40th anniversary conference in October 2012 (page 24).
2 editorial
The 7 critical issues at Rio+20

4 research highlights
IIASA at Rio+20 ■ US and European energy supplies vulnerable to climate change ■ Planet Under Pressure ■ Study shows health, food security benefits from climate change actions ■ Carbon payments for forest conservation would dramatically reduce species extinctions ■ Picky females promote diversity

6 research in the pipeline
Energy and the environment ■ Limiting global warming ■ Lessening the impact of climate change ■ Envisioning the future ■ Assessing sustainable practices ■ Threats from linked disasters ■ Anticipating natural disasters

8 work in progress
8 A comprehensive comparison of climate change models ■ The ISI-MIP project is comparing climate models in a common framework to create a clearer picture of climate impacts
9 Alternative water futures ■ IIASA is bringing its experience in scenario development and global assessments to a new partnership with UN-Water to explore alternative futures for the world’s water and its use to 2050

10 getting research into practice
10 Who will feed China’s livestock? ■ Findings from a multi-year, multidisciplinary research effort into the future for China’s agriculture is contributing to the Chinese government’s policy making process at both national and local levels
11 Linking climate change, extreme events, and risk ■ Understanding climate extremes and socioeconomic vulnerabilities

26 regional focus
26 africa Risk perception is barrier to solar power ■ Securing energy access in sub-Saharan Africa
27 americas Fertility plays role in US party politics ■ Measuring the health costs of urban growth in Peru
28 asia Heat stress poses significant threat to crops ■ Finding synergies in Asia’s energy system
29 europe Modeling cost-effective environmental improvements ■ EU forests could absorb less carbon

30 iiasa news
publications IIASA’s most cited 2011 journal articles

31 day in the life
Anna Scolobig ■ Postdoctoral Scholar with IIASA’s Risk, Policy and Vulnerability Program

12 feature articles
12 Preserving ocean resources ■ Promoting sustainable management of fisheries and other ocean resources is critical for future generations
13 Sustainability & green job creation ■ Projects using local labor, manufacturing, & technology can create significant job growth
14 Climate change & socioeconomic development ■ A cooperative framework puts climate change into the context of human socioeconomic development
16 Toward a sustainable future ■ A comprehensive, integrated analysis of how to transform energy systems to meet the world’s multiple energy challenges—namely, providing affordable, safe, secure, and environmentally sound energy for all

22 The urban energy challenge ■ What can be done to make cities more sustainable in terms of energy?

24 Worlds Within Reach: From Science to Policy ■ IIASA 40th Anniversary Conference, 24–26 October 2012: Program
GLOBAL CHANGE

Planet Under Pressure

Planet Under Pressure 2012 was the largest gathering of global change scientists leading up to Rio+20, the United Nations Conference on Sustainable Development. Eighteen IIASA staff members participated in various panels, poster sessions, and on- and off-site events in the conference which concluded that “the continued functioning of the Earth system as it has supported the well-being of human civilization in recent centuries is at risk.” Sessions involving IIASA staff scrutinized topics ranging from convergent global megatrends through global hydrocarbon endowments to pressures on agriculture from increased bioenergy demand.

ENERGY AND WATER

US and European energy supplies vulnerable to climate change

Higher water temperatures and reduced river flows in Europe and the United States in recent years have resulted in reduced production, or temporary shutdown, of several thermoelectric power plants, resulting in increased electricity prices and raising concerns about future energy security in a changing climate. As thermoelectric (nuclear or fossil-fueled) power plants supply 91% and 78% of total electricity in the USA and Europe, respectively, disruption to their operation is a significant concern for the energy sector.

A study published online on 3 June in *Nature Climate Change* projects further disruption to supply, with a likely decrease in thermoelectric power-generating capacity of 6–19% in Europe and 4–16% in the United States during summer for the period 2031–2060, due to lack of cooling-water. The likelihood of extreme (>90%) reductions in thermoelectric power generation will, on average, increase by a factor of three.

Compared to other water use sectors (e.g., industry, agriculture, domestic use), the thermoelectric power sector is one of the largest water users in the USA (at 40%) and in Europe (43% of total surface water withdrawals). While much of this water is “recycled,” the power plants rely on consistent volumes of water, at a particular temperature, to prevent overheating. In addition, both the USA and Europe have strict environmental standards with regard to the volume and temperature of water withdrawn for cooling of power plants. Reduced water availability and higher water temperatures—caused by increasing ambient air temperatures associated with climate change—are therefore significant issues that can increase conflicts between environmental aims and electricity supply.


SUSTAINABLE DEVELOPMENT

IIASA at Rio+20

Rio+20 saw world leaders and thousands of participants from governments, the private sector, NGOs, and other groups come together to define pathways to a safer, more equitable, cleaner, greener, and more prosperous world for all.

Making sustainable energy for all a reality was high on the agenda at Rio+20 as energy plays such a key role in addressing challenges ranging from sustainable economic development through poverty eradication to climate protection. Energy was also the focus of IIASA’s contribution to the historic conference. On 19 June, as part of the UN Energy Day, IIASA and its partners released the key findings of the Global Energy Assessment (GEA)—the first ever fully integrated study of the global energy system (see page 16). A day earlier, a side-event, organized by IIASA and the Stockholm Environment Institute, featured IIASA research that has contributed to the GEA, including studies on achieving universal energy access and on quantifying the multiple co-benefits of an integrated approach to energy transformation.

Other IIASA researchers presented their work among others on current and future carbon emissions in Brazil; tackling extreme events in climate adaptation (page 11); and science, technology, and innovation for sustainable development.
**Research highlights**

**SHORT-LIVED CLIMATE FORCERS**

Study shows health, food security benefits from climate change actions

Research published in the journal *Science* highlighted 14 key air pollution control measures that, if implemented, could slow the pace of global warming, save millions of lives, and boost agricultural production. The study, led by Drew Shindell of NASA’s Goddard Institute for Space Studies (GISS), finds that focusing on these measures could slow global mean warming 0.5°C (0.9°F) by 2050, prevent between 0.7 and 4.7 million premature deaths each year and increase global crop yields by up to 135 million tons per season. While all regions of the world would benefit, countries in Asia and the Middle East would see the biggest health and agricultural gains from emission reductions.

The team of experts from around the world considered about 400 control measures based on existing, proven technology, whose effects are included in IIASA’s GAINS model, but focused their analysis on 14 measures that, according to the GAINS model, would have the greatest climate benefit. All 14 would curb the release of either black carbon or methane, pollutants that harm human or plant health while simultaneously exacerbating climate change.

“We’ve shown that implementing specific practical emissions reductions chosen to maximize climate benefits would also have important ‘win-win’ benefits for human health and agriculture,” said Shindell.

**REDD**

Carbon payments for forest conservation would dramatically reduce species extinctions

A study published in *Nature Climate Change* shows that while the current rate of deforestation threatens to cause massive species extinctions worldwide, prompt implementation of an effective carbon payment system to avoid deforestation could reduce extinctions by more than three-quarters.

The United Nations’ Framework Convention on Climate Change has approved the creation of a system of financial incentives to avoid carbon emissions from deforestation and forest degradation (REDD) as part of the next climate agreement. Many of the world’s carbon-rich regions, like the tropical forests of Indonesia, the Congo Basin, and the Amazon, are also exceptional for their biodiversity, and carbon-based incentives are thus expected to have substantial side benefits for global biodiversity conservation. This study is the first to provide a clear global analysis of how much, where, and when these biodiversity benefits would occur. Its findings will inform ongoing negotiations of the new climate agreement and subsequent planning and implementation.

The international team of authors used an advanced global land-use model cluster, in particular IIASA’s G4M, and comprehensive biodiversity data to predict the impacts of deforestation on biodiversity. Three different analyses project that at least 9% and as much as 27% of 4,514 forest-dependent mammal and amphibian species would become extinct if the current rate of deforestation continues over this century. A fourth analysis involving many more species suggested that current deforestation rates will, by 2100, eliminate more than 36,000 plants and animals that occur only in “biodiversity hotspots.” Financial incentives for conserving forests that value their carbon at US$25 per ton of CO2 could avoid between 84% and 93% of these extinctions, while preventing 4.3 billion tonnes of CO2 emissions annually by 2020.

**BIODIVERSITY**

Picky females promote diversity

Picky females play a critical role in the survival and diversity of species, according to a new *Nature* study by researchers from the University of British Columbia (UBC) and IIASA.

To date, biodiversity theories have focused on the role played by adaptations to the environment: the species best equipped to cope with a habitat would win out, while others would gradually go extinct. The new study presents the first theoretical model demonstrating that selective mating alone can promote the long-term coexistence of species—such as frogs, crickets, grasshoppers and fish—which share the same ecological adaptations and readily interbreed.

Overcoming the long-held belief that species can stably coexist only if they differ in their ecological adaptations, this study is opening up new vistas on understanding and protecting the grandeur of biological diversity, according to the authors.

**BIODIVERSITY**

The new *Nature* study on "picky females" may explain how cichlids, a fish found in Lake Victoria in Africa, can coexist in high diversity in the same habitat. (Photo credit: Ole Seehausen, Fish Ecology and Evolution, Eawag, Switzerland)

INCREASING DEMAND

Energy and the environment

With the International Energy Agency (IEA) estimating that global energy demand will increase 40–50% by 2030 (compared to 2003), scientists and policymakers are growing increasingly concerned about the sustainability of the current energy system and what pressures future energy development will place on the environment.

To better understand and predict the environmental impact of future energy development, IIASA is working with 11 other research organizations in a four-year project called EnerGEO. Project researchers use an array of models, including IIASA’s MESSAGE, GLOBIOM, and RAINS/GAINS models, to study the interactions between land use and energy sectors, bioenergy technologies and air pollution, and the water demands of new energy technologies. The goal is to link large-scale energy models projecting medium- to long-term scenarios to more detailed, smaller-scale models to improve projects, policy recommendations, and environmental assessments.

By linking energy system models with ecosystem, land-use, and atmospheric models, the researchers will build a framework that will result in a global observation strategy for monitoring and predicting the impact of energy resource exploitation on the environment.

www.energeo-project.eu

CLIMATE CHANGE

Lessening the impact

For societies to effectively cope with anthropogenic climate change, ambitious policies are needed that encourage transition from carbon-intensive to low-carbon economies. IIASA researchers, working with a score of other research institutes on the European Commission-funded “Assessment of Climate Change Mitigation Pathways” (AMPERE) project, are using the MESSAGE model to analyze the effects of different low-carbon technologies on mitigation pathways.

www.feem-project.net/limits

FUNDAMENTAL RESTRUCTURING

Limiting global warming

To limit climate change warming to 2°C above pre-industrial levels— a target agreed to by more than 100 countries—researchers must find ways to dramatically cut carbon dioxide and other greenhouse gas emissions. Understanding that such a transformation necessitates a fundamental restructuring of the way energy and land are managed, researchers from IIASA and eight other institutions are assessing a series of questions that are critical for developing climate policies that can achieve the stringent 2° goal.

Their investigations are part of the European Commission-funded “Restructuring Systems to Limit Climate Change” (LIMITS) project. The project’s focus is on technological challenges, economics, required policy regimes, implementation obstacles, and local and national air quality and energy security impacts.

IIASA researchers are using the MESSAGE-MACRO integrated assessment model to analyze the benefits of climate mitigation and the implications for strategies intended to achieve the 2° goal. They are also examining the historical trends in the diffusion of technology to determine how the development of technology might occur in the future. IIASA’s GLOBIOM model is being used to assess the environmental and economic implications of land use changes under the 2° scenarios.

www.feem-project.net/limits

www.energeo-project.eu
PARADIGM SHIFTS

Envisioning the future

Facing a world in which dramatic shifts are expected in the economic, social, technological, and environmental spheres, IIASA researchers are participating in a European Commission-funded project to model possible paradigm shifts and develop scenarios to help policymakers plan for the future. A central goal of IIASA and the 10 other PASHMINA Consortium partners is to avoid the historical tendency to see the future as a continuation of the past and instead envision a future significantly different from the present.

IIASA’s role is to integrate existing energy and land-use models (GLOBIOM and BEWHERE) with models from other consortium members and adapt them to make long-range forecasts more sensitive to the anticipated paradigm shifts. With more complex models detailing an array of scenarios, policymakers can better anticipate which options to follow and which to avoid. It is essential to examine the trade-offs and the costs and benefits of different strategies in order to identify robust solutions to problems that are exacerbated by limited resources and a changing climate.

PATTERNS CHANGING

Anticipating natural disasters

Global warming is expected to alter natural disaster patterns in Europe, and IIASA researchers working in the European Commission-funded “Climate Change and Natural Disasters” (CHANGES) project are modeling those anticipated changes to assist emergency preparedness officials and to train young scientists in the risk management skills needed to respond to future disasters.

The changing climate is expected to affect patterns of flooding, landslides, severe erosion, snow avalanches, and wind storms. Such events may be more severe, more frequent, and in new locations because of climate change, and this shifting pattern is likely to trigger changes in socioeconomic development in at-risk areas.

IIASA researchers are assessing Europe’s current vulnerability to natural disasters and then, using models and historical damage catalogues, will analyze the anticipated changes in ecosystems and land use patterns in relation to global change and future socioeconomic development. IIASA is also involved in case studies analyzing the development of risk governance strategies in France, Italy, Poland and Romania.

LIFE-CYCLE IMPACTS

Assessing sustainable practices

To develop better analytical tools to examine the life-cycle impacts of goods, services, and activities, IIASA researchers are working with 15 other research groups on a European Commission-funded project to examine the environmental costs of production methods for everything from fish to auto manufacturing.

As part of this project, called “Life Cycle Impacts of Goods, Services, Activities” (LC-IMPACT), IIASA researchers are developing better ways to characterize the effects of forest, cropland, and livestock management practices. Several of IIASA’s models, including EPIC, G4M, and BEWHERE, are being modified to meet LC-IMPACT’s goal of creating better analytical tools.

Through several case studies, project researchers will be able to compare the new assessment tools with existing tools and then provide quantitative information on various sources of uncertainty in life cycle impact assessment methods and related issues.
Researchers from the Potsdam Institute for Climate Impact Research (PIK) and IIASA are coordinating a new project that brings together more than 30 climate models in order to conduct the first comprehensive comparison of computer-based simulations to better determine climate change impacts that go beyond projections of physical changes. The models are being provided by more than two dozen research groups from around the globe and, for the first time, sectors including ecosystems, agriculture, water supplies, and health will be scrutinized in a common framework.

The project, the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP), aims to provide fast-track outcomes for the IPCC’s Fifth Assessment Report (AR5), due to be completed in 2014, and will then develop a longer-term coordinated impact assessment effort.

“The time has come for this comparison,” said IIASA Director Pavel Kabat, who noted that “a multi-model cross-sectoral approach to projections of climate change impacts has not been available in the past.” In an interview with the journal Nature, Dr. Kabat said that climate change impact research is “lagging behind physical climate sciences. Impact models have never been global and their output is often sketchy. It is a matter of responsibility to society that we do better.”

Nature observed that researchers have built dozens of climate-related models, but have not systematically compared their performance, resulting in climate impact literature that is “as inconclusive as it is encyclopedic.” Hans Joachim Schellnhuber, the director of PIK, echoed that perspective, noting that until now there have been comprehensive model comparisons for the physics of climate systems, for the economy of climate protection, and for impacts on specific sectors. To address all climate impacts at once is both ambitious and necessary.

“It provides an essential strengthening of the grounds for the 2014 IPCC report,” he said.

IIASA’s GLOBIOM model, which assesses competition for land use between agriculture, bioenergy, and forestry, is one of the models involved in the comparison. GLOBIOM is itself an integrated model that analyzes the production of food, forest fiber, and bio-fuels together to enable policymakers to avoid serious land use conflicts and improve efficiency.

A key driver for the project is the international community’s goal of limiting the global temperature increase due to greenhouse gas emissions to 2°C. Although the goal is 2°C, the increasing levels of emissions of greenhouse gases is setting the world on a path to a 3°C or more increase, and that difference could have drastic impacts.

“Achieving a 2°C world is much more ambitious and costly than a 3°C world,” ISI background documents say. “Therefore there is a great need for comprehensive understanding and quantification of the differences between multiple levels of global warming in terms of impacts from climate change.”

For the first phase of the ISI-MIP research teams that maintain global impact models that analyze agriculture, ecosystems, infrastructure, and health will be provided with pre-processed input data that includes climate and socioeconomic data based on the World Climate Research Program’s Coupled Model Intercomparison Project (CMIP5) using as many scenarios as are available, and the Shared Socioeconomic Pathways (SSPs). The pre-processed data is intended to ensure basic harmonization of the comparisons.

Dr. Kabat noted that IIASA scientists and other researchers “have access to sophisticated models, vast quantities of high-quality data from many sectors and regions, and an urgency to deliver a highly integrative analysis of our current knowledge about global impacts of climate change. We are confident that this project can deliver such an analysis.”

Further information Visit the ISI-MIP Web site at www.pik-potsdam.de/research/climate-impacts-and-vulnerabilities/projects/Externally_RD2/isi-mip or e-mail isi-mip@pik-potsdam.de
What does the future hold for the world’s water resources? According to the United Nations World Water Assessment Programme (WWAP), we are simply not sure. More than ten years ago, under the sponsorship of the World Water Council, researchers developed a set of global water scenarios to address that question. Since then technology and socioeconomic conditions in the world have altered dramatically, both within and outside the water sector, and change continues to accelerate. So now new water scenarios are urgently needed, scenarios which, IIASA’s Dr. Bill Cosgrove points out, must incorporate the key driving forces of today such as climate change, globalization, and security.

Managing the world’s water resources is an increasingly complex challenge. Yet, says IIASA’s Director/CEO Prof. Pavel Kabat, we know less and less about water resources and how they are being used. This is creating new risks and uncertainties for global water management. In response to this challenge, IIASA and UN-Water are conducting a World Water Scenarios Project to provide a set of alternative futures of the world’s water and its use to 2050.

While scenarios are not projections, forecasts, or predictions, they provide a useful tool for identifying a possible range of future outcomes. Where future water resources are concerned, scenarios are particularly useful because of the difficulties of gaining a long-term perspective. While it would seem logical to use forecasting techniques to estimate future water use and water resources, in practice this is not possible. While forecasts may be reliable over the short term, predictive forecasts become untrustworthy over months, years, and decades due to our currently limited understanding of human and ecological processes. Moreover, future water conditions will depend very largely on human decisions that are yet to be made.

Through developing a second generation of global water scenarios to 2050, the World Water Scenarios Project aims to build more robustness into decision making on water and its use. In the first phase of this process, researchers set out to analyze the evolution of ten major external forces (driver) that have direct and indirect consequences for water resources. These ten drivers include agriculture, climate change and variability, demography, economy, and security and politics. Cross-sectoral qualitative and quantitative analysis of the combined impact of these drivers will be used to inform the next phase of the World Water Scenarios Project.

IIASA joined the project at the start of this second phase and currently hosts the project secretariat under the joint leadership of Prof. Kabat and Dr. Cosgrove. Building on its experience in scenario development and recent work with the Global Energy Assessment (see page 16), IIASA will partner with UN-Water to produce a set of world water scenarios for the World Water Forum to be held in South Korea in 2015.

The approach for developing this new set of scenarios involves an iterative process of building qualitative scenarios and constructing simulation models, employing a Scenario Focus Group (SFG) which will engage a globally representative group of decision makers supported by scenario experts, stakeholders, data experts, and modelers. Some of the diversity of the alternative futures for the global water situation has already been identified for the SFG in a small-scale, preliminary exploration completed in 2012. The “Five Stylized Scenarios” report highlights five possible trajectories for the world water system to 2050. These five scenarios—for example “techno-world,” in which the pace of technological innovation accelerates but water resources become an increasingly limiting factor for future economic growth—offer plausible evolutions from the current situation depending on how the major driving forces develop and interact.

According to IIASA water researcher Dr. David Wiberg, “Building on this earlier work, the integrated picture that will result from the World Water Scenarios Project will play an essential role in identifying coherent sets of policy and management actions that can help achieve the sustainable development and use of water resources at the global, regional, national, and subnational levels.”


Prof. Pavel Kabat is IIASA’s Director/CEO, Dr. Bill Cosgrove is a Senior Research Scholar, Dr. David Wiberg a Research Scholar, both in IIASA’s Water Program.
Who will feed China’s livestock?

Findings from a multiyear, multidisciplinary research effort into the future for China’s agriculture are contributing to the Chinese government’s policymaking process.
Linking climate change, extreme events, and risk

Understanding climate extremes and socioeconomic vulnerabilities

In March the IPCC released a landmark report that assesses not only the link between climate change and an increase in extreme events associated with droughts and heavy precipitation, but the risks to broad populations from such events and the options individuals, communities and countries have to both prepare for and recover from natural disasters. The report, entitled “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation,” is called “SREX.”

The purpose of SREX is not simply to catalogue the impacts of climate change on extreme events, but to understand climate extremes in combination with socioeconomic vulnerabilities and exposure to risk in order to develop better policies to avoid, prepare for, respond to and recover from natural disasters. IIASA economist Reinhard Mechler, one of the lead authors, is focusing on the economic costs resulting from climate change, and he notes that while the changing climate has already led to an increase in the severity and frequency of some climate extremes, translating those increases into economic losses is not straightforward.

“We know from the report that climate change has led to an increase in extreme events and will continue to do so,” Dr. Mechler says. “However, contrary to what we would expect, we do not yet see that climate change has led to an increase in losses.”

There are important caveats to be kept in mind, including deficiencies in the global databases reporting the loss data. The databases report impacts in regions with high insurance coverage (often estimates of total loss are scaled up from insured losses) and thus tend to underreport losses in developing countries, where there is less insurance. Moreover, the databases underreport losses resulting from droughts, which is the key hazard for many regions. Drought losses are particularly difficult to assess as they are not clustered in time and space like other events, such as floods.

Over the period 2000–2008, Africa had 15% of all disaster events around the globe, while only 0.6% of global losses were reported for this region.

Understanding why there is not a concurrent increase in monetary losses is also linked to the way communities have responded to the increasing risk. “The studies have not looked extensively at vulnerabilities or risk reduction,” Dr. Mechler says. The vulnerability is offset in some places by better construction and preparation, but it is a complex equation that must balance risk, vulnerability, and exposure.

Regions of Florida in the USA have a history of being struck by hurricanes, so buildings are constructed with hurricanes in mind, reducing their vulnerability and risks. But parts of Florida that were almost devoid of people 100 years ago are now crowded, so exposure has dramatically increased the potential and actual losses. “Singling out the contribution of climate change to losses from extremes by correcting for changes in hazard, exposure, and vulnerability is a tricky task,” Dr. Mechler says. “The SREX report came to the conclusion that today we cannot show how climate change increases monetary losses, but there is all the evidence to expect that in the future it will be there.

As another key contribution to the report, Dr. Mechler and colleagues suggest a “low regrets” approach may be particularly conducive for dealing with extreme events in climate adaptation. This approach is somewhat different from the more traditional “no-regrets” or “win–win” solutions that suggest an optimal course of action.

The “low-regrets” approach is attractive because it takes into account the large uncertainties associated with extreme events and climate change and holds that efforts can start today. Low-regrets measures would “provide benefits under current climate and a range of future climate change scenarios and are available starting points for addressing projected trends in exposure, vulnerability, and climate extremes,” Dr. Mechler says.

The “low regrets” approach also encourages climate scientists to think more about short-term actions to lessen the risk from extreme events, as well as the uncertainty surrounding projections of impacts. Climate scientists tend to work with long time horizons, Dr. Mechler says. We are suggesting that scientists look into the short term as extreme events and climate variability need further emphasis. “We need to adapt today.”

Further information IPCC SREX homepage at ipcc-wg2.gov/SREX

Dr. Reinhard Mechler is a Senior Research Scholar with IIASA’s Risk, Policy and Vulnerability Program.
Oceans are one of the areas being given “priority attention” at the Rio+20 Conference on Sustainable Development, with experts noting that oceans drive the global systems that make Earth habitable for humans. “Our rain water, drinking water, weather, climate, coastlines, much of our food, and even the oxygen in the air we breathe, are all ultimately provided and regulated by the sea,” a Rio+20 statement on oceans says.

One key to sustainability in the oceans, and by extension food and jobs for millions of people, is more astute management of fisheries, and IIASA scientists are deeply involved in a host of projects that would mitigate several of the problems plaguing the oceans—overfishing, loss of biodiversity, and fisheries-induced evolution.

Researchers in IIASA’s Evolution and Ecology Program (EEP), led by evolutionary biologists Ulf Dieckmann and Mikko Heino, are developing tools that integrate the biological, social, and economic aspects of fishery systems to help create management options that promote sustainable fisheries. The research recognizes that fisheries have at least four subsystems that are connected in a powerful feedback loop—the natural system, the resultant ecosystem services, the management system, and the associated socioeconomic system. Each subsystem consists of complex components that deal with everything from multi-species population dynamics to multi-fleet fisheries.

A recent article in the journal *Science*, co-authored by Mikko Heino, proposes a strategy of balanced harvesting to “more effectively mitigate adverse ecological effects of fishing while supporting sustainable fisheries.” This strategy, which “challenges present management paradigms,” distributes “a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in a ecosystem, in proportion to their natural productivity, so that the relative size and species composition is maintained.”

EEP is also investigating how to improve the regulation of open resources—such as fish stocks in the oceans—by integrating elements of successful small-scale, bottom-up regulations into large-scale, top-down regulations. Such regulations are needed to ensure that common goods and open-access resources—everything from clean air and the global climate to fish stocks and aquatic ecosystems—are equitably and fairly available to everyone. The research draws on advances in game theory, choice theory, cooperative phenomena, and agent-based modeling to explore how top-down regulations can be improved to better protect open-access resources and prevent overexploitation.

A Rio+20 brief on oceans issues notes that in 2008 fish provided three billion people with at least 15% of their animal protein, and fishing provided livelihoods for about 540 million people. “Apart from food and livelihood provision,” the brief says, “oceans represent a natural resource with respect to the travel and tourism, mining, telecommunication and transportation industries.” The oceans, which cover 72% of the Earth’s surface, also absorb about 30% of global CO2 emissions.

The brief also notes that the UN Commission on Sustainable Development will undertake a two-year review of oceans, marine life, and linked issues involving “small island developing states.”


Contact Ulf Dieckmann (dieckmann@iiasa.ac.at); Mikko Heino (heino@iiasa.ac.at)
One of the critical issues at the Rio+20 United Nations Conference on Sustainable Development is how to move toward more sustainable energy sources while at the same time creating "green jobs" to lessen the severe unemployment problems in developing countries. Indeed, a Rio+20 briefing document on green jobs cites statistics indicating that the number of green jobs in the world could increase from 2.3 million to 20 million by 2030 if the proper steps are taken. To that end, researchers with IIASA’s Risk, Policy and Vulnerability (RPV) Program have analyzed job creation pathways linked to the large-scale concentrated solar power (CSP) development being planned for North Africa. The region suffers from high unemployment with one of the highest unemployment rates in the world among young people and women, with only 45.3% of the population of “active age” being employed. For those who are employed, 42% are working poor, earning less than US$2 per day.

North Africa is already home to three CSP plants that are in operation or under construction, and plans call for much larger plants in Morocco (500 MW), Algeria (240 MW) Egypt (110 MW) and Tunisia (50 MW). Much of the electricity generated by these plants would go to Europe through high voltage transmission lines.

Research by IIASA’s Nadejda Komendantova and Anthony Patt found that if development, technology transfer, and construction of the plants involve not only local workers, but local development, manufacturing, and supply chains, then as many as 125,000 direct job-years could be created by the CSP projects if 20 GW of solar capacity are deployed. That number, compared to only 40,000 job years if much of the development and manufacturing is done outside of the region, is a key issue in creating sustainable green jobs in developing countries.

“"We find that horizontal technology transfer, when more than half of all components are manufactured locally, would bring three times more job-years to North Africa than vertical technology transfer, and that the greatest number of jobs are induced in the service industries,” the researchers wrote in their analysis.

Vertical transfer typically involves construction of turn-key power stations, with all necessary technology and components being manufactured abroad and imported to host countries, while the ownership remains in foreign hands. To minimize the risk of losing intellectual property, the researchers wrote, management and technical staff are nationals of developed countries while cheap local labor does the construction work. Even when the ownership of the power plant is mixed or is further transferred to local government or private companies, the turn-key approach involves only limited transfer of knowledge or skills to local manufacturers.

In contrast, horizontal technology transfer is a joint venture between a foreign and local company and includes technical and business training, as well as establishing local industries for manufacturing of components. The venture is a more lengthy process, the researchers noted, “but it allows embedding of technology within [a] local population and economy, which can eventually allow local partners to fund, manufacture, operate, and maintain the new technologies themselves.”

The conclusions of the study showed, in the case of the CSP projects, the clear benefits of horizontal transfer in creating green jobs, especially if 15% of Europe’s electricity demand is covered by imported electricity from North Africa, which translates to 700 Twhy. If 40% of component manufacturing were local, then total direct and indirect job-years would be 430,000 and the induced employment would generate more than two million job-years. If the horizontal transfer were 100% in terms of local manufacturing, then six million job-years in induced employment would result.

Over 20 years, this would lead to annual employment of between 100,000 and 300,000 people, while under vertical technology transfer, fewer than 100,000 job-years would be created.

Concern over green jobs is not limited to the RPV Program at IIASA. Scientists in the Ecosystems Services and Management (ESM) Program noted the importance of linking green jobs to bioenergy in a paper presented in the Proceedings of the International Conference of the International Boreal Forest Research Association (IBFRA 2011), in Krasnoyarsk, Russia. The paper found that enhancing bioenergy production in the European part of Russia could create green jobs. To install an additional 2,219 MW of bioenergy production, about 4,500 workers would be needed during construction and about 2,000 people would be employed permanently in the biomass supply and processing sector. Another 500 long-term jobs would be created in the resulting new power plants.

Although green jobs alone are not an answer to the UN’s global employment challenge to create some 63 million new jobs by 2050, coordinated global action and investments of about US$1.8 trillion might lead to 13 million new green jobs by mid-century, according to the UN.


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A cooperative framework puts climate change into the context of human socioeconomic development

In the wake of the completion of the four Representative Concentration Pathways (RCPs) earlier this year, scientists at IIASA and elsewhere are developing new projections that analyze the interaction between human socioeconomic development and climate change through the use of narrative storytelling.

These new projections, called Shared Socioeconomic Pathways (SSPs), define five possible paths that human societies could follow over the next century. The pathways are part of a new cooperative research framework that is expected to improve interdisciplinary analysis and assessment of climate change, its impacts, and the options societies have for mitigation and adaptation.

The idea for the SSPs came several years ago from the three key groups involved in climate science research—climate modelers (CM), integrated assessment modelers (IAM), and the impacts, adaptation, and vulnerability community (IAV). Although the RCPs provide input that is essential for climate modelers, they need to be complemented by socioeconomic and ecological data that the other research groups currently lack.

The SSPs respond to that limitation by allowing the IAM and IAV groups to study the impact of socioeconomic factors at the radiative forcing levels that define the RCPs. Researchers can use the new scenarios, according to the SSP background document, to project impacts, to explore the extent to which adaptation and mitigation could reduce projected impacts, and to estimate the cost of action and inaction.

“The new process is about developing scenarios in a more timely manner and in a more integrated fashion so the groups in the research community can talk to each other and jointly design scenarios,” says Keywan Riahi, head of IIASA’s Energy Program and a co-chair for the working group developing quantitative IAM scenarios for the SSPs. “The RCPs were developed and passed to the climate community to analyze what physical changes could occur due to climate change. In parallel with that is the socioeconomic dimension which is explored with the SSPs. This is a flexible framework for a better integrated climate science community.”

As with the RCPs, IIASA is hosting the SSP database. The five narratives are:

- **SSP1 (Sustainability)** A world making relatively good progress toward sustainability, with ongoing efforts to achieve development goals while reducing resource intensity and fossil fuel dependency. It is an environmentally aware world with rapid technology development, and strong economic growth, even in low-income countries.

- **SSP2 (Middle of the road)** This “business-as-usual” world sees the trends typical of recent decades continuing, with some progress toward achieving development goals. Dependency on fossil fuels is slowing decreasing. Development of low-income countries proceeds unevenly.

- **SSP3 (Fragmentation)** A world that is separated into regions characterized by extreme poverty, pockets of moderate wealth, and a large number of countries struggling to maintain living standards for a rapidly growing population.

- **SSP4 (Inequality)** A highly unequal world in which a relatively small, rich global elite is responsible for most of the greenhouse gas emissions, while a larger, poor group that is vulnerable to the
impact of climate changes, contributes little to the harmful emissions. Mitigation efforts are low and adaptation is difficult due to ineffective institutions and the low income of the large poor population.

- **SSP5 (Conventional Development)** A world in which conventional development oriented toward economic growth as the solution to social and economic problems. Rapid conventional development leads to an energy system dominated by fossil fuels, resulting in high greenhouse gas emissions and challenges to mitigation.

“The (climate change) community converged on the five archetype SSPs, which describe how the future might unfold in alternative directions,” Riahi said. The IIASA Energy Program, which developed the RCP scenario of relatively high greenhouse gas emissions, is working in collaboration with IIASA’s World Population (POP) and Ecosystems Services Management (ESM) programs to develop data for use in all of the SSPs, as well as a specific focus on the fragmented world of SSP3.

“We’re collaborating with Petr Havlík (an ESM scientist) so that we can have an internally consistent picture of energy and land use changes and analyze the important feedbacks from energy to land, between food, fiber and fuel,” Riahi said. “We’re developing a completely new set of tools to feed into the SSPs, and we want to use that momentum to come up with the next generation of IIASA’s integrated framework. That framework would combine tools with different disciplinary perspectives and operate at different special scales.”

Havlík is translating the SSP narratives with respect to land use into parameters for IIASA’s GLOBIOM model and linking it to the MESSAGE model. “The SSPs are basically input into the models,” Havlík said. “The SSPs create harmonized input that can be used by the models.” Some of the qualitative data he is working with looks at land use over time, including productivity, crop yields, and livestock production and analyzes the environmental impact of agricultural and forestry production, particularly in terms of GHG emissions. “The models will be very sensitive to future land productivity under different [SSP] projections, and will be able to look at low-, middle- and high-income countries and model the impact of low and middle income countries catching up with high income countries productivity on the land use change and biomass supply,” he said.

Wolfgang Lutz, leader of IIASA’s World Population Program, said he became involved in the SSP program in part because past socioeconomic models have typically only used total population size of a country and gross domestic product (GDP) to characterize development.

“The world needs to do better than just total population size and GDP,” he said. “There are many more important dimensions on the human side, and in our recent work we have projected populations by age, sex, and level of educational attainment. If you have it broken down that way, then instead of just one population number, you also cover the gender dimension, differences between age groups, and education as key indicators of empowerment in many respects.

“The important issues that come from knowing the age and education breakdown of a particular population reveal details about such things as future productivity, and how one generation might replace another. Gender is another overriding social concern, Lutz said, and “we for the first time make explicit the gender in socioeconomic modeling. We have education, migration, and death rates, all by age and gender.”

The population data provided by Lutz and colleagues in the population program is being used by all the other teams involved in the SSP project. “In this human core of the SSPs, IIASA has the monopoly on the data,” Lutz said. “Since we are the only ones doing such projections by education they are also the basis for everyone when it comes to the translation of these alternative trends into economic growth and other variables for the SSPs.”

The researchers are doing a basic, fast-track version of the SSPs in order to have the projections included in the IPCC’s Fifth Assessment Report, due out in 2014. The first round of research results must be submitted for review by January, Riahi said. After that, the scientists will turn to developing more elaborate models that can look at data on a regional and subregional scale.

“Now we want specific characterizations of such things as land use change and the linkage to energy changes,” Riahi said. “In the next phase you may want to go deeper and ask what are the subnational income distributions and how are the poor affected in different countries. That opens up a host of questions about institutional effectiveness and governmental structures.”

A separate benefit of the SSP project is that it has been “a vehicle for more integrated work within IIASA,” Riahi said. “This has been a very fruitful internal collaboration.”

Further information Representative Concentration Pathways (RCP) database at: www.iiasa.ac.at/Research/ENE

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A comprehensive, integrated analysis of how to transform energy systems to meet the world’s multiple energy challenges—namely, providing affordable, safe, secure, and environmentally sound energy for all.

Since before the Industrial Revolution, societies have relied on increasing supplies of energy to meet their need for goods and services (see figure “World Primary Energy Use”). Major changes in current trends are required if future energy systems are to be affordable, safe, secure, and environmentally sound. There is an urgent need for a sustained and comprehensive strategy to help resolve the following challenges:

- Providing affordable energy services for the well-being of the 7 billion people today and the 9 billion people projected in 2050
- Improving living conditions and enhancing economic opportunities, particularly for the 3 billion people who cook with solid fuels today and the 1.4 billion people without access to electricity
- Increasing energy security for all nations, regions, and communities
- Reducing global energy system 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 impacts on human health
- Reducing the adverse effects and ancillary risks associated with some energy systems to safe and acceptable levels

Major transformations in energy systems are required to meet these challenges and to increase prosperity.

The Global Energy Assessment (GEA) assessed a broad range of resources, technologies, and policy options, and identified a number of “pathways” through which energy systems could be transformed to simultaneously address all of the above challenges. The key findings are presented on the following pages.

**Energy systems can be transformed to support a sustainable future**

The GEA analysis demonstrates that a sustainable future requires a transformation from today’s energy systems to those with: (i) radical improvements in energy efficiency, especially in end use, and (ii) greater shares of renewable energies and advanced energy systems with carbon capture and storage (CCS) for both fossil fuels and biomass. The analysis ascertained that there are many ways to transform energy systems and many energy portfolio options. Large, early, and sustained investments, combined with supporting policies, are needed to implement and finance change. Many of the investment resources can be found through forward-thinking domestic and local policies and institutional mechanisms that can also support their effective delivery. Some investments are already being made in these options, and should be strengthened and widely applied through new and innovative mechanisms to create a major energy system transformation by 2050.
The Global Energy Assessment (GEA) is a science-based assessment of the global energy system. The study examines not only the major challenges that all face in the 21st Century, and the importance of energy to each, but also the resources that we have available and the various technological options, the integrated nature of the energy system and the various enablers needed, such as policies and capacity development. Central to the integrated analysis of the energy system has been a novel scenario exercise exploring some 40 pathways that satisfy simultaneously the following normative social and environmental goals:

- Stabilizing global climate change to 2°C above pre-industrial levels to be achieved in the 21st Century
- Enhanced energy security by diversification and resilience of energy supply (particularly the dependence on imported oil)
- Eliminating household and ambient air pollution
- Universal access to modern energy services by 2030

Without question, a substantial transformation of the energy system is required to achieve these goals. Such a transformation offers significant benefits across multiple economic and social objectives as shown by the GEA analyses. These synergies make the solutions offered by the GEA highly attractive. For example, the Ministerial Declaration from the Vienna Energy Forum in June 2011 and the Action Agenda of the UN Secretary General’s High-Level Group on “Sustainable Energy for All” reflect aims outlined in GEA, specifically:

- Ensure universal access to modern forms of energy for all by 2030
- Reduce global energy intensity by 40% by 2030
- Increase the share of renewables by 30% by 2030

The GEA has brought together contributions from about 500 independent experts (300 authors and 200 anonymous reviewers) from academia, business, government, intergovernmental, and non-governmental organizations from all regions of the world since it was established in 2006. The final report is published by Cambridge University Press and is also available online at www.globalenergyassessment.org.

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**WORLD PRIMARY ENERGY USE**

The growth of global primary energy with two clear development phases, the first characterized by a shift from reliance on traditional energy sources to coal, hydro, biomass, and nuclear energy during the second half of the 20th century. New renewables such as solar and wind are hardly discernible in the figure. Biomass refers to traditional biomass until the most recent decades, when modern biomass became more prevalent and now accounts for a significant share. Source: Grubler A et al. (2012). Chapter 1—Energy Primer. In: Global Energy Assessment—Toward a Sustainable Future, IIASA, Vienna, Austria and Cambridge University Press, Cambridge, UK and New York, NY, USA.
An effective transformation requires immediate action

Long infrastructure lifetimes mean that it takes decades to change energy systems. Thus immediate action is needed to avoid lock-in of invested capital into energy systems and associated infrastructure that are not compatible with sustainability goals. For example, by 2050 almost three-quarters of the world population is projected to live in cities. The provision of services and livelihood opportunities to growing urban populations in the years to come presents a major opportunity for transforming energy systems and avoiding lock-in to energy supply and demand patterns that are counterproductive to sustainability goals.

Energy efficiency is an immediate and effective option

Efficiency improvement is proving to be the most cost-effective, near-term option with multiple benefits, such as reducing adverse environmental and health impacts, alleviating poverty, enhancing energy security and flexibility in selecting energy supply options, and creating employment and economic opportunities. Research shows that required improvements in energy efficiency particularly in end use can be achieved quickly. For example:

- Retrofitting buildings can reduce heating and cooling energy requirements by 50–90% (see figure “Energy Efficiency”).
- New buildings can be designed and built to very high energy performance levels, often using close to zero energy for heating and cooling.
- Electrically powered transportation reduces final energy use by more than a factor of three, as compared to gasoline-powered vehicles.
- A greater integration between spatial planning and travel that emphasizes shorter destinations and enhances opportunities for flexible and diverse choices of travel consolidating a system of collective, motorized, and non-motorized travel options offers major opportunities.
- Through a combination of increased energy efficiency and increased use of renewable energy in the industry supply mix, it is possible to produce the increased industrial output needed in 2030 (95% increase over 2005) while maintaining the 2005 level of GHG emissions.

A portfolio of strong, carefully targeted policies is needed to promote energy efficient technologies and address, inter alia, direct and indirect costs, benefits, and any rebound effects.
Renewable energies are abundant, widely available, and increasingly cost-effective

The share of renewable energy in global primary energy could increase from the current 17% to between 30% and 75%, and in some regions exceed 90%, by 2050. If carefully developed, renewable energies can provide many benefits, including job creation, increased energy security, improved human health, environmental protection, and mitigation of climate change. The major challenges, both technological and economic, are:

- Reducing costs through learning and scale-up
- Creating a flexible investment environment (see figure “Renewable Energy”) that provides the basis for scale-up and diffusion
- Integrating renewable energies into the energy system
- Enhancing research and development to ensure technological advances
- Assuring the sustainability of the proposed renewable technologies

While there remain sound economic and technical reasons for more centralized energy supplies, renewable energy technologies are also well suited for off-grid, distributed energy supplies.

Major changes in fossil energy systems are essential and feasible

Transformation toward decarbonized and clean energy systems requires fundamental changes in fossil fuel use, which currently dominates the energy landscape. This is feasible with known technologies:

- CO₂ capture and storage (CCS), which is beginning to be used, is key. Expanding CCS will require reducing its costs, supporting scale-up, assuring carbon storage integrity and environmental compatibility, and securing approval of storage sites.
- Growing roles for natural gas, the least carbon-intensive and cleanest fossil fuel, are feasible, including for shale gas, if related environmental issues are properly addressed.
- Coprocessing of biomass and coal or natural gas with CCS, using known technologies, is important for coproducing electricity and low-carbon liquid fuels for transportation and for clean cooking. Adding CCS to such coproduction plants is less costly than for plants that make only electricity.

Strong policies, including effective pricing of greenhouse gas emissions, will be needed to fundamentally change the fossil energy system.
Universal access to modern energy carriers and cleaner cooking by 2030 is possible

Universal access to electricity and cleaner cooking fuels and stoves can be achieved by 2030; however, this will require innovative institutions, national and local enabling mechanisms, and targeted policies, including appropriate subsidies and financing (see figure “Energy Access”). The necessary technologies are available, but resources need to be directed to meet these goals. Universal access is necessary to alleviate poverty, enhance economic prosperity, promote social development, and improve human health and wellbeing. Enhancing access among poor people, especially women, is thus important for increasing their standard of living.

Universal access to clean cooking technologies will substantially improve health, prevent millions of premature deaths, and lower household and ambient air pollution levels, as well as the emissions of climate-altering substances.

An integrated energy system strategy is essential

An integrated approach to energy system design for sustainable development is needed—one in which energy policies are coordinated with policies in sectors such as industry, buildings, urbanization, transport, food, health, environment, climate, security, and others, to make them mutually supportive. The use of appropriate policy instruments and institutions can help foster a rapid diffusion and scale-up of advanced technologies in all sectors to simultaneously meet the multiple societal challenges related to energy. The single most important area of action is efficiency improvement in all sectors. This enhances supply-side flexibility, allowing the GEA challenges to be met without the need for technologies such as CCS and nuclear.

Energy options for a sustainable future bring substantial, multiple benefits for society

Combinations of resources, technologies, and policies that can simultaneously meet global sustainability goals also generate substantial and tangible near-term local and national economic, environmental, and social development benefits. These include, but are not limited to, improved local health and environment conditions, increased employment options, productivity gains, improved social welfare and decreased poverty, more resilient infrastructure, and improved energy security. Synergistic strategies that focus on local and national benefits are more likely to be implemented than measures that are global and long-term in nature. Such an approach emphasizes the local benefits of improved end-use efficiency and increased use of renewable energy, and also helps manage energy-related global challenges. These benefits make the required energy transformations attractive from multiple policy perspectives and at multiple levels of governance.

Sociocultural changes as well as stable rules and regulations will be required

Crucial issues in achieving transformational change toward sustainable future include non-technology drivers such as individual and public awareness, community and societal capacities to adapt to changes, institutions, policies, incentives, strategic spatial planning, social norms, rules and regulations of the marketplace, behavior of market actors, and societies’ ability to introduce through the political and institutional systems measures to reflect externalities. Changes in cultures, lifestyles, and values are also required. Effective strategies will need to be adopted and integrated into the fabric of national sociocultural, political, developmental, and other contextual factors, including recognizing and providing support for the opportunities and needs of all nations and societies.

Policies, regulations, and stable investment regimes will be essential

A portfolio of policies to enable rapid transformation of energy systems must provide the effective incentive structures and strong signals for the deployment at scale of energy-efficient technologies and energy supply options that contribute to the overall sustainable development. The GEA pathways indicate that global investments in combined energy efficiency and supply will need to increase to between US$1.7–2.2 trillion per year compared to present levels of about US$1.3 trillion per year (about 2% of current world gross domestic product) including end-use components. Policies should encourage integrated approaches across various sectors and promote the development of skills and institutional capacities to improve the investment climate. Examples include applying market-oriented regulations such as vehicle emissions standards and low carbon fuel standards, as well as renewable portfolio standards to accelerate the market penetration of clean energy technologies and fuels. Reallocating energy subsidies, especially the large subsidies provided in industrialized countries to fossil fuels without CCS, and nuclear energy, and pricing or regulating GHG emissions and/or GHG-emitting technologies and fuels can help not only support the initial deployment of new energy systems, both end-use and supply, but also make infrastructures energy efficient. Publicly financed research and development needs to accelerate and be reoriented toward energy efficiency, renewable energy and CCS. Current research and development efforts in these areas are grossly inadequate compared with the future potentials and needs.

Global Energy Assessment (GEA) Council

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Further information

The full Global Energy Assessment (GEA) report is published by Cambridge University Press (CUP) (www.cambridge.org) and is available online at www.globalenergyassessment.org. The Web site includes an interactive scenario database that documents the GEA pathways. The text and figures in this article are reproduced with the permission of CUP.
Based on even the lowest forecasts of urbanization, the world will not only be 70% urban by 2050, but the world urban population will also be larger than the entire global population today. Addressing the specific energy issues raised by an increasingly urbanized world is one aim of the recently launched Global Energy Assessment (GEA). Coordinated by IIASA and involving many of the world’s leading energy and urbanization experts, the GEA aims to provide the first ever fully integrated energy assessment analyzing energy challenges, opportunities, and strategies for developing, industrialized and emerging economies. “Our objective within this major undertaking,” explains Arnulf Grubler, who is Convening Lead Author for the GEA’s chapter on urban energy systems, “was to use a systemic perspective to focus on the specific energy challenges and opportunities represented by increasing urbanization and provide a better understanding of urban energy use.”

More than half of the global population already lives in urban settlements. Urban areas, moreover, are projected to absorb almost all the global population growth to 2050, amounting to some additional three billion people. Ensuring the provision of affordable, secure and clean energy in this increasingly urbanized world presents a significant challenge. What can be done to make cities more sustainable in terms of energy?
Providing robust measurements of urban energy use was a key initial aim. Measuring the energy use of cities, however, is no easy task, with the difficulties compounded by the absence of widely agreed measurement concepts, systems boundaries, and data-reporting formats. In the GEA, researchers provide the first-ever comparative assessment of existing approaches to measuring urban energy use and discuss advantages and shortcomings of alternative energy and emission accounting methods at an urban scale. Based on a synthesis of entirely new data on energy use in cities, the GEA concludes that urban energy use already accounts for 60–80% of global energy use. Energy-wise the world is already predominantly urban.

New findings outlined in the GEA, however, suggest that the traditional view of urban systems as being resource-wasteful in terms of energy may be misplaced. The GEA data set reveals that in many industrialized countries the per capita direct, final energy use of city dwellers is often lower than the national average. This is partly due to differences in economic structure (more services) and also higher population densities (less single family dwellings). More crucially, it reflects the fact that public transport, which is not economically viable in low-density suburban or rural areas, reduces urban transport energy demand.

A further novel finding is the identification of a new urban North-South divide in terms of energy intensiveness. Whereas OECD cities (even in North America or Australia) generally have lower (direct) final energy use compared to their respective national averages, most cities in developing countries have higher per capita consumption levels than the national average. In other words, urban dwellers in developing economies use substantially more energy per capita than their rural compatriots—a reflection of much higher average urban incomes as well as the frequent location of industrial activities in urban areas in emerging economies.

Despite these variations, it is clear that urban energy use will continue to grow further as a fraction of total global energy needs. In addition, the ability to provide affordable, secure and clean energy will become ever more critical for the successful operation of cities and the well-being of their inhabitants. Already several hundred million urban dwellers in low- and middle-income nations lack access to electricity and are unable to afford cleaner, safer fuels. Many live in informal settlements where they also lack basic services such as water, sanitation and transport. Rapid migration rates and urban population growth can quickly overwhelm the provision of basic urban services, particularly to the poorest urban dwellers. How can the energy challenges posed by rapid urbanization best be addressed?

In the past, it seemed sufficient to face these challenges with essentially up-stream (supply-side) policy interventions. Now, the potential of supply-side measures such as increased reliance on renewable energies at the urban scale appears comparatively limited. New GEA estimates, for example, suggest that locally harvested renewables can, at best, provide 1% of the energy needs of a megacity and just a few percentage points in smaller, low-density cities.

Future energy sustainability challenges, Grubler points out, will need to be tackled primarily by action in urban settings. And priorities for urban energy and sustainability policies, researchers suggest, should focus where local decision making and funding also provides the largest leverage effects. Crucially, these actions and policies will need to focus on demand management including, for example, a drive toward more energy efficient buildings, the structuring of urban form and density in ways that are conducive to energy efficient housing, as well as the provision of high-quality public transport services (i.e., the promotion of energy-efficient and eco-friendly public transport and non-motorized mobility options) and, lastly, greater urban energy systems integration.

The GEA chapter also provides a novel quantification of the impacts on urban energy use of alternative policies drawing on an novel spatially explicit, combined agent-based and optimization model labelled SynCity. Admittedly, such a demand-side focus at the urban scale will require a paradigm shift compared to the traditional, more supply-side energy policy focus at national scale.

A common characteristic of sustainable urban energy systems options, Grubler explains, is that they are usually systemic; for example, the integration of land-use and urban transport planning that extends beyond traditional administrative boundaries; the increasing integration of urban resource streams, including water, wastes, and energy that can further both resource (e.g. heat) recovery and improve environmental performance; and the reconfiguration of urban energy systems to enable step changes in efficiency.

Yet, this systemic perspective reveals a new kind of “governance paradox.”

Whereas the largest policy leverages are from systemic approaches and policy integration, these policies are also the most difficult to implement and require that policy fragmentation and uncoordinated, dispersed decision making be overcome. The urban governance paradox is compounded by weak institutional capacities, especially in small- and medium-sized cities that are the focus of projected urban growth, as well as from the legacies of market deregulation and privatization that have made integrated urban planning and coordinated energy, transport, and other infrastructural policy approaches more difficult to design and even more difficult to implement.

However, there are good reasons for cautionary optimism, Grubler concludes. The task ahead is to leverage fully the innovation potential of cities and to scale up successful experiments into transformative changes in energy systems. Hence, in the drive for greater energy sustainability in the cities of the future, individual and collective learning, transfer of knowledge, and sharing experiences and information across cities and among stakeholders will have a key role to play.

Further information

Arnulf Grubler is an expert on the interplay between energy and technology systems and their implications on the environment, in particular on climate change. He shares his time between leading the Transitions to New Technologies research program at IIASA, and teaching graduate students at Yale University.
Today’s world is undergoing major transformations, characterized by increased globalization, fundamental shifts in economic and political power, escalating environmental challenges, and unpredictable social conflict. IIASA’s 40th Anniversary Conference will examine the many sustainability and development challenges such transformations impose and explore options for resolving these challenges. Building on the outcome of Rio+20, the United Nations Conference on Sustainable Development, the IIASA Conference will use systems analysis to explore “future worlds” that accommodate our collective needs and aspirations, while living within, and respecting, planetary boundaries. Speeches, panel discussions, interactive sessions, and poster displays will provide participants the opportunity to delve into the future worlds and analyze the different paths to reaching them.

Conference Program

24 OCTOBER 2012—HOFBURG
OPENING
Welcome statements by the IIASA Directorate and invited dignitaries, followed by a high-level panel session.

A WORLD IN TRANSFORMATION—EXPECTATION, POTENTIAL, REALITY
Understanding current global change and how people, institutions, and technology might combine to determine the dynamics as well as the direction of change.

Session 1: Global Transformations—Understanding the World We Live In and Its Possible Futures
What are the global transformations (intended and unintended) that humanity and the planet are undergoing?

Session 2: Drivers of Global Change—People, Institutions, and Technology: A Systems Perspective
While demographic, economic, and technological developments are generally recognized as basic drivers of transformative change, the interactions of their dynamics present a major challenge and an area of significant new insights.

A WORLD OF INTEGRATED SOLUTIONS—THE POWER OF SYSTEMS ANALYSIS (Part I)
Systems analysis can provide integrated, science-based solutions to major global challenges through in-depth analyses that include the spatial and temporal dynamics of each challenge in order to optimize interventions by anticipating synergistic effects and unintended consequences.

Session 3: Respecting Nature’s Boundaries for a Fair and Secure World—Food and Water
How can new technologies, investment strategies, policies, and institutional innovations ensure that there are not only sufficient food and water resources for the planet, but that those resources are developed in such a way that environmental sustainability objectives are met and that everyone, importantly those living in poverty, receive their share?

Session 4: The Multiple Co-benefits of a Cleaner, More Equitable World—Energy and Climate Change
How can a low-carbon energy system be established that also acts as the catalyst for green growth, sustainable development, and resource efficient economies?
25 OCTOBER 2012—HOFBURG

A WORLD OF INTEGRATED SOLUTIONS—THE POWER OF SYSTEMS ANALYSIS (Part II)

Session 5: Eliminating the Unacceptable Social Ills of the 21st Century—Poverty and Equity
What opportunities genuinely exist for alleviating poverty and, drawing on the tools of systems analysis, what new, visionary ideas can be offered to regional, national and international bodies to help avert further poverty and build resilience in communities most at risk?

Session 6: Addressing the Challenges Concurrently—The Formidable Tools of Systems Analysis
Systems Analysis provides a lens by which the many interlinked drivers and potential consequences of social, economic, environmental and political change can be examined, and actions or policies formulated that anticipate synergies and unintended consequences to optimize interventions.

ALTERNATIVE WORLDS—NEW CONCEPTS AND NEW UNDERSTANDING

Reflecting on the discussions that take place during Rio+20, this session will explore the alternative, more sustainable, and more just worlds that could emerge from transformational change across various levels.

Session 7: New Concepts of Development
The green growth paradigm requires changing the way we think about global, national and personal development, development that must now be based on a fully integrated concept.

Session 8: Systems Analysis and Integrated Assessments
Session 9: Worlds Within Reach—The Way Forward
A creative interactive session, involving some of the most innovative thinkers of our time, to discuss what “future worlds” are possible, and what obstacles must be overcome to make these worlds a reality.

26 OCTOBER 2012—LAXENBURG

RESEARCH FOR A CHANGING WORLD

The final day of the Conference focuses on research that is able to identify and further develop solutions to the global challenges discussed during the Conference’s first two days.

Morning Plenary
How can IIASA and its global networks, including its core funders, IIASA’s National Member Organizations, and private industry, contribute to the research challenges posed by global transformations?

Parallel Sessions
1. Securing Ecosystem Services: Food and Water
2. Integrating Models of Socio-Ecological Systems
3. Synergies and Trade-offs among Multiple Sustainable Development Objectives
4. Assessing Education, Human Capital and Vulnerability

Roundtable Discussions
1. Social versus Technological Solutions
2. How to Meet our Needs in the Face of Pressures on Ecosystems
3. Green Growth
4. Bridging the Science-policy Gap
5. Optimal versus Sub-optimal Solutions
6. Green Entrepreneurship: Corporate Social Responsibility and Sustainability

Breakout Activities
A considerable amount of time will be reserved between sessions to experience IIASA in a multitude of ways: there will be multi-media exhibits with demonstrations and tutorials of IIASA tools, an extended poster session (the best of which will be awarded in the final plenary) and tours of IIASA’s premises.

Closing Plenary
A summary of the Conference and awards for the best posters.

ALL DAYS—Scientific posters and IIASA exhibition

Confirmed speakers include:
Heads of State, Nobel Prize Winners, and many more; see back cover of this Options.

Further information and to register:
conference2012.iiasa.ac.at
ENERGY

Risk perception is barrier to solar power

The development of solar power in North Africa is currently hampered by the difficulties of raising high levels of foreign direct investment from the private sector. Based on interviews with stakeholders, IIASA research suggests that regulatory risks are the greatest barrier to investment.

All large energy projects involve a measure of technical and market risk, but as the figure shows, potential investors in North Africa view regulatory, political, and force majeure risks as their most serious concerns. Explaining these differing risks, IIASA’s Nadejda Komendantova says: “Regulatory risks are associated with the complexity and corruption of bureaucratic procedures as well as the instability of national regulations. Political risks are linked to low levels of political stability in a country, and force majeure risks arise from natural and man-made disasters, including terrorism.”

Stable regulation and efficient procedures at regional and national levels are clearly important to potential investors. “Our study highlights the importance of identifying those policies and programs that can best reduce regulatory risks or help stakeholders to manage the risks that are there, such as through innovative financial schemes such as public–private partnerships,” Komendantova points out.

Building the capacities of North African countries to develop, implement, and enforce sound regulations in a transparent manner could be an important step in promoting renewable energy cooperation with Europe. Moreover, finding ways to address the perceived risks of doing business in North Africa could reap enormous benefits. Estimates suggest, for example, that solar power investment in North Africa could provide European electricity consumers with potential savings of more than €200 billion.


Dr. Nadejda Komendantova is a Research Scholar in IIASA’s Risk, Policy and Vulnerability Program.

ELECTRICITY

Securing energy access in sub-Saharan Africa

If current trends continue, more people in Africa will be without access to modern energy services in 2030 than today. How can the goal of universal access to electricity services in sub-Saharan Africa by 2030 be achieved? To inform debate on how to secure this goal, IIASA researchers and partners constructed several simple scenarios for the sub-Saharan African power sector to 2030.

“Our aim is to help improve understanding about the overall scale of the effort that would be required to reach universal access to electricity services in sub-Saharan Africa,” IIASA’s Morgan Bazilian points out. Most existing projections by international organizational, regional bodies, national governments, and power companies forecast a threefold increase in installed generation capacity occurring by 2030. But, based on several simple energy access scenarios, researchers show that this increase would be insufficient to meet even modest definitions of universal access.

“Our scenarios demonstrate that more than a tenfold increase in generation capacity would be required to provide full access—even at relatively modest levels of electricity consumption,” says Bazilian. “This equates to a 13% average annual growth rate, compared to a historical one in the last two decades of 1.7%.”

Some kind of jump-start is required to move the growth pathway onto this new trajectory, researchers conclude. This is likely to entail a mix of both large-scale projects, as well as a host of distributed generation, the integration of large amounts of renewable energy, and new ways to conceive of power system planning.


Dr. Morgan Bazilian is a Guest Research Scholar in IIASA’s Transitions to New Technologies Program and Special Advisor to the Director-General of UNIDO on international energy and climate policy.
POLITICAL DEMOGRAPHY

Fertility plays role in US party politics

Differing fertility rates could play a role in deciding America’s long-term political future. In the first study of its kind, IIASA researchers applied demographic projection techniques to political party preference in America. “Findings suggest the effects of migration, fertility, and age structure on the make-up of electorates have been greatly neglected,” argues IIASA’s Anne Goujon.

Based on US survey and census data, researchers projected possible changes in party allegiance between America’s Republican and Democratic parties up to 2043 and beyond. Projections suggest that the Democrats will gain 2–3% more support than the Republicans by 2043, mainly through immigration. But, as the long-run projections show, the higher fertility of Republicans may eventually offset that advantage.

The fertility of women who support the Republican party has been rising at an increasing pace relative to that of their Democrat counterparts since the 1950s and has now reached parity. However, Republican’s total fertility rates (TFR) are expected to decline more slowly than that of the Democrats. Hence, by 2043 Republicans could have a TFR of 1.8 compared to a TFR of 1.4 for Democrats. This scenario would have a negligible impact on party preference by 2043. But if it were to continue into the very long run (i.e., beyond 2100), the Republican fertility advantage would, in the event of reduced immigration, result in support for the Republicans overtaking that of the Democrats.

“Fertility differences between political parties take even longer than immigration to produce changes in party support, but may bring more significant socio-political change than immigration over the course of the century,” Goujon concludes.


Dr. Anne Goujon is a Research Scholar in IIASA’s World Population Program.

ENVIRONMENT

Measuring the health costs of urban growth in Peru

A 295% increase in gastrointestinal problems from 1990–2007 among the city dwellers of Arequipa, Peru, is one of the adverse impacts of rapid urban growth identified by a new IIASA study.

Located in southern Peru, Arequipa experienced a 35% increase in population from 659,244 in 1990 to 892,250 in 2007. In this 18-year period the urban area of Arequipa increased by more than 14% and water use grew by 35%. This combination of population growth and land-use changes altered the quantity and quality of water in the Chili River which runs through Arequipa.

Crucially, due to increases in housing, garbage, sewage, and impervious surface induced runoff, and the decrease in river flow, the fecal and total coliform counts (i.e., indicators of water polluted by bacteria) increased exponentially in the Chili River. In some cases, total coliform counts surpassed permissible levels by more than 900%. “This may explain why gastrointestinal health problems increased so markedly between 1990 and 2007,” IIASA’s Brian Fath points out.

Arequipa’s population is forecast to reach over one million by 2017. The Chili River is the city’s only source of water for human, agricultural, commercial, and industrial use. Using data from satellite remote sensing and geographical information systems to determine change in land cover, researchers predict that such urban demand combined with competition for water from other sectors such as agriculture and industry will jeopardize sustaining future urban growth. Furthermore, due to the lack of land use planning, part of the newly urbanized area is located in the direction of the active Misti volcano, representing a danger for families living within the 15 km radius of the volcano.


Dr. Brian Fath is a Research Scholar in IIASA’s Advanced Systems Analysis Program.
AGRICULTURE

Heat stress poses significant threat to crops

Temperate and sub-tropical regions in Asia face significant risk of crop loss due to climate change, say IIASA researchers. Previous studies have concluded that mainly tropical and sub-tropical agriculture will suffer from climate change. But a new study concludes that Central and Eastern Asia, the northern part of the Indian subcontinent as well as Central North America have large agricultural areas at risk.

The reason, explains former IIASA scholar Edmar Teixeira, is that the productivity of important agricultural crops is drastically reduced when they experience peaks of high temperatures (lasting even just a few hours) at critical points during the reproductive period. Short occurrences of extremely high temperatures result in “crop heat stress.” And heat stress events, researchers point out, are likely to become more frequent with global warming.

Using the FAO/IIASA Global Agro-Ecological Zones Model (GAEZ), researchers undertook a spatial assessment of heat stress risk at a global level for four key crops: wheat, maize, rice, and soybean. Findings identified “hot-spots” of likely heat stress with the most affected lands located in continental regions at high latitudes, particularly in the Northern Hemisphere between 40 and 60 degrees north.

“Overall, our results suggest that heat stress imposes an increasing risk to agricultural production, although the degree of impact differs with crop type and region,” says Dr. Teixeira. Wet-land rice, for example, was the crop with the most intensely affected areas. Without mitigation measures to combat climate change or the implementation of local adaptive technologies, countries with extensive agricultural lands in continental regions at high latitudes may experience significant crop losses, researchers conclude.

Investment in local adaptive measures such as development of resistant varieties and changes in crop management are necessary to minimize risks to global food supply.

Further information


Dr. Edmar Teixeira is a former IIASA Postdoctoral Scholar.

ENERGY

Finding synergies in Asia’s energy system

Rapid and sustained economic growth in Asia over recent decades has created huge demands for energy as well as large increases in air pollution and greenhouse gas emissions. Using scenario analyses, IIASA researchers explored the energy challenges faced by Asian countries, particularly the interactions of climate policy with energy security, air pollution, and energy access. Findings indicate that enormous synergies are to be gained between climate change mitigation measures, measures to reduce air pollution and the pursuit of greater energy security and access.

Researchers explored scenarios using IIASA’s MESSAGE integrated assessment modeling framework. MESSAGE is a global systems engineering optimization model used for medium to long-term energy system planning, energy policy analysis, and scenario development.

Findings show that stringent climate policy can improve the energy security of individual countries and regions, and that achieving near-term air pollution reduction and health objectives is greatly furthered by climate change mitigation. For example, improving access to clean energy services for the poor will reduce indoor air pollution and possibly greenhouse gas emissions. Reducing indoor air pollution could save up to 0.8 million Asian lives annually, and up to 1.8 million deaths in Asia could be prevented by reducing outdoor air pollution.

Energy security and air pollution control currently receive more attention from policymakers than climate change mitigation, say researchers. But a more integrated approach to energy policymaking would achieve synergies in addressing these challenges and make the resulting reductions in costs more apparent.

Further information


Dr. Oscar van Vliet is a Research Scholar in IIASA’s Energy Program.
**ENVIRONMENT**

**Modeling cost-effective environmental improvements**

Using an integrated modeling technique, IIASA researchers have identified a range of measures that policymakers could adopt to improve European air quality and reduce greenhouse gas emissions at least cost.

Environmental policies in Europe have successfully eliminated the most visible and immediate harmful effects of air pollution in the last decades, says IIASA’s Markus Amann. “However, even at present rates, Europe’s emissions to the atmosphere pose a significant threat to human health, ecosystems, and the global climate, though in a less visible and immediate way.”

A host of measures are available to further reduce emissions in the future. "Many of the ‘easiest’ reduction measures—the ‘low hanging fruits’—have already been harvested,” Amann points out. Further action will therefore place higher demands on economic resources, especially at a time when resources are strained by economic crisis.

Using IIASA’s integrated assessment model, GAINS (Greenhouse gas—Air pollution Interactions and Synergies), researchers have developed a baseline projection of the future development of emissions and air quality in Europe in the absence of future policy measures, and assessed the potential and costs for further environmental improvements. GAINS highlights, for example, “maximum technically feasible emission reduction” measures that could further cut the loss in human statistical life expectancy due to air pollution by 50% (i.e., from 5 to 2.5 months).

Such analysis, including the costs involved, is helping to inform current negotiations on the revision of the Gothenburg Protocol under the Convention on Long-range Transboundary Air Pollution.


Dr. Markus Amann is Leader of IIASA’s Mitigation of Air Pollution and Greenhouse Gases Program.

**BIOENERGY**

**EU forests could absorb less carbon**

European forests have been intensively managed for many decades, yet have still formed a significant “sink” for absorbing carbon from the atmosphere. New IIASA projections, however, highlight the possibility that EU forests’ carbon absorption capacity could decline over the next few decades.

The success of EU forests in absorbing carbon has been due to a variety of factors, most importantly that European forests’ growth rates have been higher than past harvest rates. But any future changes in forest management practices—particularly the increased use of forest-based biomass for energy purposes—could impact on the capacity of EU forests to store carbon.

In other words, a potential conflict exists between climate policies targeting carbon storage in forests and the increased use of forest-based biomass for energy purposes.

Researchers explored this trade-off at the European scale using concrete policy scenarios (an EU baseline scenario and an EU reference scenario including additional bioenergy and climate policies) until 2030. Their projections suggest the net carbon dioxide sink in EU forests is expected to decline under the baseline scenario—falling by 25–40% in 2030 compared to 2010. The drivers of this decline are a projected increase in demand for wood for energy and material use combined with shifts in the forest structure toward older forests that lower the strength of forest carbon accumulation.

Better understanding of the trade off between carbon storage and increased use of forest-based biomass is needed, researchers argue, if the use of wood for bioenergy is to be a climate effective strategy.


Dr. Hannes Böttcher is a Research Scholar in IIASA’s Ecosystems Services and Management Program.
IIASA’s most cited 2011 journal articles

The following papers published by IIASA researchers in 2011 have the most citations according to SCOPUS—the independent database of peer-reviewed literature (accessed in May 2012). IIASA would like to congratulate all the authors.

A large and persistent carbon sink in the world’s forests
The terrestrial carbon sink has been large in recent decades, but its size and location remain uncertain. Using forest inventory data and long-term ecosystem carbon studies, the researchers estimate a total forest sink of 2.4 ± 0.4 petagrams of carbon per year globally for 1990 to 2007. [25 citations]
Journal: Science 333(6045)

Anthropogenic sulfur dioxide emissions: 1850–2005
The researchers construct a new annual estimate of anthropogenic global and regional sulfur dioxide emissions for 1850–2005. These sulfur aerosols impact human health, ecosystems, agriculture, and global and regional climate. They find global emissions peaked in the early 1970s and decreased until 2000, but have since increased due to growing emissions in China, international shipping, and developing countries in general. [25 citations]
Authors: Smith SJ, van Aardenne J, Klimont Z, Andres RJ, Volke A, Delgado Arias S
Journal: Atmospheric Chemistry and Physics 11(3)

The representative concentration pathways: An overview
This paper presents the development process and main characteristics of the Representative Concentration Pathways (RCPs). The RCPs describe a wide range of potential futures for the main drivers of climate change: greenhouse gas and air pollutant emissions and land use; and have been developed for the climate modeling community as a basis for simulations of the world’s future climate. [20 citations]
Journal: Climatic Change 109(1)

The RCP greenhouse gas concentrations and their extensions from 1765 to 2300
The paper presents the greenhouse gas concentrations for the Representative Concentration Pathways (RCPs) and their extensions beyond 2100, the Extended Concentration Pathways (ECPs). These projections include all major anthropogenic greenhouse gases and are a result of a multi-year effort to produce new scenarios for climate change research. [18 citations]
Journal: Climatic Change 109(1)

Sustainability indicator development—Science or political negotiation?
This paper argues that the development of sustainability indicators is a process of both scientific “knowledge production” and of political “norm creation.” By comparing five cases of sustainability indicator development processes (three science-led and two led by intergovernmental processes), the researchers find that the political norm creation dimension is not fully recognized in science-led processes and discuss the implications. [14 citations]
Authors: Rametsteiner E, Pülzl H, Alkan-Olsson J, Frederiksen P
Journal: Ecological Indicators 11(1)

Evolution of anthropogenic and biomass burning emissions of air pollutants at global and regional scales during the 1980–2010 period
The research assesses different inventories of global and regional anthropogenic and biomass burning emissions for 1980–2010. Large discrepancies between the global and regional emissions are identified, which shows that there is still no consensus on the best estimates for surface emissions of atmospheric compounds. At the global scale, anthropogenic emissions of carbon monoxide, nitrogen oxides, and sulfur dioxide show the best agreement for most years, although agreement does not mean uncertainty is low. [13 citations]
Journal: Climatic Change 109(1)

*Designates IIASA staff (former and current)
Anna Scolobig

As a postdoctoral scholar in IIASA's Risk, Policy and Vulnerability Program, Anna’s research interests include the social dimensions of environmental change and public participation in science for policy. She is a former lecturer in the theories and techniques of social research at the University of Trieste, Italy.

“My passion is sailing,” Anna Scolobig says as she walks toward the Schloss and her office in IIASA’s Risk, Policy and Vulnerability Program.

“My father was a captain in the Italian Navy. I started sailing when I was five.”

She talks about racing sailboats with her father as she grew up in Trieste, Italy, and the joy that still comes from being on the water. “Moving through the sea, feeling the wind, that is my favorite place to be,” she says.

Anna, 33, is a research scholar who has followed an unusual path into science in general and her specialty, risk governance, in particular. When she was young, she followed the example of her mother, who was the national president of AGESCI, the Italian youth scouting organization. When Anna wasn’t sailing, she says, “I lived in nature. A passion in my life was biology and animals and I grew up with all of the possibilities.”

Her world also included the war in what was then Yugoslavia, just over the border from Trieste. “I went there after the war to do volunteer work,” she says. “I was thinking that people have to know what went on, that there was bombing with [depleted] uranium bombs. And after having been in Sarajevo, I wanted to be a journalist—a war journalist.”

To reach that goal, Anna studied journalism at Italy’s University of Udine, receiving her degree, with honors, in 2003. Her thesis, on the uncertainties and risks from cell-phone-generated electromagnetic fields, reflected her interest on how humans cope with risk that they create. After receiving her degree, she went to a book presentation on environmental risk, and her path into science was set. She wanted to work with the person who wrote the book, and she did, joining a group studying mass emergencies at the Institute of International Sociology of Gorizia.

“It was hard to do a Ph.D. in this field [sociology of risk] because there was no set course of study in Italian Universities,” she says. As she worked toward her Ph.D. she was granted research positions in Spain, the United Kingdom, Portugal, and Germany. In 2008 she received her Ph.D. in sociology and, after serving as a lecturer at the University of Trieste, came to IIASA in 2010. The focus of much of her IIASA work has been the recently completed Safeland Project, in which she worked with the residents of the landslide-prone southern Italian town of Nocera Inferiore to create risk-management and mitigation processes.

“People have their own views so you let working groups consolidate around the different views of risk mitigation,” she says. In the end, the groups are encouraged to arrive at a “clumsy solution” that allows all points of view to be represented. The approach is built upon a methodology for deliberative processes developed by IIASA’s Risk Policy and Vulnerability research team.

Anna talks intensely and at length about the project and her months working in Nocera Inferiore and nearby Salerno to resolve conflicts and encourage residents to find common ground. Then she stops and smiles: “I really like what I do.”

A day in the life of Anna Scolobig

06:00 Wake up
06:30 Very strong espresso, then have breakfast and read
09:00 Arrive at IIASA and begin work: writing, collecting or analyzing data, reading, meeting colleagues or stakeholders, organizing fieldwork. (During the past two years, Anna spent six months in Southern Italy doing field work. This meant organizing a participatory process, a questionnaire survey, several meetings with local stakeholders, as well as conducting communication and education activities.)
19:00 Head home from work
20:00 Dinner and activities varying from meeting friends to reading novels to watching movies to yoga, running, …
23:30 Bedtime
IIASA 40th Anniversary Conference
24–26 October 2012
Hofburg Congress Center, Vienna, Austria and IIASA, Laxenburg, Austria

Speakers include:
- H.E. Dr. Heinz Fischer The Federal President of the Republic of Austria
- H.E. Dr. Václav Klaus President of the Czech Republic
- Mr. Ban Ki-moon (Video Message), United Nations Secretary-General
- H.E. Dr. Karlheinz Töchterle Federal Minister for Science and Research, Austria
- H.E. Mr. Nikolaus Berlakovich Federal Minister for Agriculture, Forestry, Environment and Water, Austria
- Prof. Dr. Joseph Alcamo United Nations Environment Programme (UNEP)
- Prof. Petr Aven (to be confirmed) Chairman of the Board of Directors, Alfa Bank, Russia
- Prof Lidia Brito Director, Division of Science Policy and Sustainable Development, United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Prof. Paul Crutzen Emeritus, Max Planck Institute for Chemistry, Germany; Nobel Prize (Chemistry)
- Prof. Dr. Ottmar Edenhofer Co-Chair, Working Group III, Intergovernmental Panel on Climate Change
- Dr. Nina Fedoroff Science and Technology Adviser to the Secretary of State of the United States
- Prof. Jose Goldemberg University of Sao Paulo, former Secretary of State for Science and Technology and Minister of State for Education, Brazil
- Ms. Yolanda Kakabadse President, WWF International
- Prof. Ralph L. Keeney Professor of Decision Sciences, Duke University, USA
- Prof. Dr. Yuan-Tseh Lee President, International Council for Science; Nobel Prize (Chemistry)
- Prof. Jacqueline McGlade Executive Director, European Environmental Agency (EEA)
- Prof. Dr. Dirk Messner Director of the German Development Institute/Deutsches Institut für Entwicklungspolitik (DIE), Vice Chair of the German Advisory Council on Global Change (WGBU)
- Dr. Berrien Moore III Vice President for Weather and Climate Programs, University of Oklahoma, USA
- Prof. Mohan Munasinghe Chairman, Munasinghe Institute for Development, Colombo, Sri Lanka
- Dr. Adil Najam Vice Chancellor, Lahore University of Management Sciences (LUMS), Pakistan
- Dr. Sunita Narain Director General, Centre for Science and Environment, India
- Dr. Rajendra K. Pachauri Chairman, Intergovernmental Panel on Climate Change (IPCC); Director-General, The Energy and Resources Institute, India
- Prof. Katherine Richardson Professor of Biological Oceanography and Leader, Sustainability Science Centre, University of Copenhagen, Denmark
- Prof. Johan Rockström Executive Director, Stockholm Resilience Centre; Former Executive Director of the Stockholm Environment Institute
- Prof. Dr. Carlo Rubbia Scientific Director, Institute for Advances Sustainability Studies (IASS) e.V., Germany
- Prof. Thomas Schelling Distinguished Professor, University of Maryland, USA; Nobel Prize (Economics)
- Prof. Hans Joachim Schellnhuber Director, Potsdam Institute for Climate Impact Research (PIK), Germany
- Prof. Björn Stigson Former President, World Business Council for Sustainable Development
- Dr. Soogil Young Chairman, Presidential Committee on Green Growth, Republic of Korea
- Mr. Kandeh K. Yumkella Chair, UN-Energy; Director General, United Nations Industrial Development Organization (UNIDO)

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