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Worlds Within Reach— From Science to Policy

IIASA 40th Anniversary Conference

In October 2012, IIASA brought together over 800 leading scientists and experts from a diverse range of disciplines, regions, and institutions to explore the power of science to find future “worlds within reach” and to chart a path “from science to policy.”

The conference showed how systems analysis can diagnose complex problems and deliver smart solutions with multiple benefits for both the planet and its people. Above all, the event sought to replace pessimism with what several called “narratives of hope.”

This Brief summarizes the conference from the perspective of science journalist Fred Pearce of *The Guardian* and *New Scientist*.

Key points

- The \$70-trillion global economy dominates key planetary life-support systems like the carbon, nitrogen, and water cycles. We are thus obliged to become active planetary stewards, given the growing possibility of human and environmental catastrophe.
- This requires a “new Enlightenment” that combines new technologies in energy, genomics, and information technology with new lifestyles to ensure a more efficient use of the world’s resources.
- Reducing poverty and inequities is essential to achieving those goals, and vital to helping the most vulnerable adapt to inevitable climate change.
- Avoiding planetary boundaries and achieving better human lives need not be in conflict. With a world urban population expected to double, greener more “livable” cities are vital. Universal access to electricity can deliver release from poverty, improved well-being, and, if properly planned, the safeguarding of the environment.
- Stable or declining human numbers are essential for a sustainable future. But, thanks to falling fertility, there is now a high probability of peak population by the middle of the century. Humans should be seen as a resource: having brains to think as well as just mouths to feed. The key to unlocking that resource is education. The world needs a drive to achieve secondary education for all, from which half the global population is still excluded.
- There is continuing uncertainty about whether the world is best fed by using new technologies to maximize food production, or by concentrating on helping poor small farmers to do better. Resolving this issue will be vital in protecting essential ecosystems, such as rainforests, and finding new paths to sustainable development in the tropics. This is a key task for systems science.
- The world needs new forms of governance to handle challenges such as resource scarcity, water shortages, and climate change. Business needs to make sustainable investments in the new planetary stewardship. But it also needs new regulatory regimes to encourage long-term investment in sustainable technologies.
- Systems analysis has come of age. The scientific community is vital for analyzing global problems, developing better technologies, and encouraging new aspirations and lifestyles. But scientists cannot determine society’s path. They can, and should, however, guide it.





Left to right: Prof. Dr. Pavel Kabat, Director/CEO IIASA; H.E. Prof. Dr. Ir. H. Gusti Muhammad Hatta, Minister of Research and Technology, Republic of Indonesia; Prof. Dr. Nina Fedoroff, Chair, AAAS Board of Directors; Mr. Michel Jarraud, Secretary-General, WMO; Prof. Dr. Yuan-Tseh Lee, Nobel Prize Recipient (Chemistry) and President, ICSU; Prof. Dr. Carlo Rubbia, Nobel Prize Recipient (Physics) and Scientific Director, IASS; Prof. Thomas Schelling, Nobel Prize Recipient (Economics) and Distinguished Professor, University of Maryland; H.E. Prof. Dr. Karlheinz Töchterle, Federal Minister for Science and Research of Austria; H.E. Dr. Heinz Fischer, Federal President of the Republic of Austria

Introduction

Human society faces multiple crises. Economic development is destroying the natural wealth on which it ultimately depends. The planet's life-support systems are at risk. Should we despair? Or can we grasp the moment to transform our civilization, halting the damage and creating a greener and fairer world for our children?

IIASA's 40th anniversary conference explored the power of science to find future "worlds within reach" and to chart a path "from science to policy." Above all, it sought to replace pessimism with what several called "narratives of hope."

All agreed that science—and especially interdisciplinary systems analysis—was fundamental to progress. Some argued that the more scientists could be in charge of the great transformation the better. But others warned against hubris. Science is only part of the complex systems of decision-taking. Trust is more important than control. Science should remain "on tap rather than on top."

Reaching boundaries

First, the problem. Our means of meeting the aspirations of a rising world population are in danger of unraveling. Columbia University economist [Jeffrey Sachs](#) spoke of a "growing catastrophe" as our \$70-trillion global economy "bears down on the environment" that sustains it. We are sometimes exceeding what [Johan Rockström](#) of the Stockholm Resilience Institute calls "planetary boundaries."

The production of energy from fossil fuels is changing the atmosphere's chemistry and the climate. We extract geological resources such as hydrocarbons, metals, and underground water with little thought for the future. Our consumption of renewable resources, whether forests or soils or the contents of our rivers, is often far in excess of what nature can sustain.

We directly consume around a fifth of all the plant matter growing on the planet. Thanks to our trashing of natural ecosystems, the Earth is suffering what biologists call the sixth great extinction of species. By dominating the vital carbon, nitrogen, water, and other cycles, we have created what some call a new era on Earth—the anthropocene.

Transformations

The question now is whether the cascade of technological innovation that has allowed human numbers to quadruple over the past century to more than seven billion, will doom our society—or whether it can generate a new phase of innovation that will make the anthropocene sustainable rather than a short cataclysmic era in the history of our species and our planet.

If humanity is to thrive, we have to transform how we do things. That, as most at the conference agreed, requires both technological and behavioral change. To work, these must reinforce each other, with technology encouraging greener and less resource-intensive lifestyles, as well as new lifestyles, aspirations, and social norms which will determine the choice of technologies. It also requires a reordering of society and economics to shun the short-termism that has driven economic growth in recent decades, and to take a longer view.

"I have great hope that we can manage the anthropocene," said IIASA Deputy Director [Nebojsa Nakicenovic](#). "After all, we have worked such synergies before." By delivering cheap fossil fuels to replace manual labor in the 19th century, the industrial revolution allowed the abolition of slavery. So perhaps in the 21st century, information technology, the coming revolutions in nanotechnology and genomics, and transformed systems for delivering energy and mobility, might allow us to banish our old wasteful ways, embrace much more efficient use of geological and biological resources, and improve the efficiency of energy use.

In the early years of the 21st century, resource use peaked in many Western countries, despite continuing rises in living standards. Were optimists right to suggest that our well-being might soon be decoupled from resource and energy use?

Reaching the poorest

Looking after the planet requires looking after the poor, too. Especially the poorest, who have gained least from recent technological advances and the globalization of the world economy. As many as three billion people remain without some basic essentials like clean water and cooking fuels, sanitation, reliable electricity, or roads to get their farm products to market.



Left to right: **Dr. Norman Neureiter**, Acting Director, Center for Science, Technology & Security Policy, AAAS; **Mrs. Estelle Raiffa**; **Prof. Dr. Nebojsa Nakicenovic**, Deputy Director/Deputy CEO, IIASA and Professor, Vienna University of Technology; **Prof. Dr. William Nordhaus**, Sterling Professor of Economics, Yale University; **Prof. Howard Raiffa**, First IIASA Director and Frank Plumpton Ramsey Professor of Managerial Economics Emeritus, Harvard Business and Harvard Kennedy Schools; **H.E. Dr. Ban Ki-moon**, United Nations Secretary-General.

Planetary unsustainability was created by “affluence not poverty,” said Rockström. Yet it will be the poor who are in the front line as the environment deteriorates. Some 95% of all deaths from natural disasters occur in developing countries, said IIASA’s **Joanne Linnerooth-Bayer**. They lived on dangerous marginal land that nobody else wanted: beside swollen rivers, on low-lying coasts and the driest desert fringes, or beneath hillsides prone to landslips.

Martin Rees, Britain’s Astronomer Royal, who has written a book that called the 21st century *Our Final Century*, listened glumly. “We can all be techno-optimists, but it is these intractable issues that make some of us pessimistic.” Poverty should be at the top of everyone’s agenda, including that of environmentalists.

Martin Parry, a co-chair of the Intergovernmental Panel on Climate Change’s last assessment, said humanity had no choice but to adapt to a much warmer world, and that fighting poverty was the best insurance policy. Climate change will increasingly affect “the weak, the poor, the elderly, the marginalized. Reducing poverty and increasing equity is absolutely key to confronting climate change.” It could halve the number of extra people at risk.

Demography

One session moderator warned that “population is growing exponentially.” Will ever-rising human numbers wreck all our good intentions?

IIASA demographer **Wolfgang Lutz** denied that population increase underlies world problems. Population growth rates are declining. Women are having half as many children as they did 40 years ago. The average is now below 2.5 children per woman, and falling. Half the world lives in countries with fertility rates at or below replacement levels. “There is a high probability of a peak in world population in the 21st century and then a decline,” he said.

This was good news. But however many people there are, he said, we need to make them useful citizens. “We think of population as a problem. But people are also a resource.” The key is education. Half the world’s children now get a secondary education. Everywhere, the countries making biggest advances in their economies—and in lowering their fertility rates—were those that invested most in

education, especially of women. He named China, South Korea, and even Iran, which has seen its fertility rate crash from over 7 to under 2 since the 1980s. Better education could cut world population by a billion below expected levels by 2050, he estimated.

Lutz then offered “a new narrative” for the world. An optimistic one. “Let’s educate everybody. Let’s use our brains. That is good for societies, for the environment and for ourselves.” Looking further ahead, Lutz envisaged a world in which our numbers may stabilize and begin to shrink gradually—to perhaps between 2 and 6 billion by 2200, all of them “well-educated and healthy.”

Planetary stewardship

A sustainable future had a number of essential building blocks. Stabilized population was one. Vigorous technology diffusion to make more efficient and effective use of the world’s resources was another, complemented by changes in our behavior. But it wouldn’t happen, most agreed, without good far-sighted governance. We have no choice but to undertake “active stewardship of the planet,” said **Katherine Richardson** of the University of Copenhagen.

Here there was widespread pessimism about the current state of affairs. Environmental governance had so far been a disaster. The Earth Summit in Rio de Janeiro in 1992 had flunked the challenge. “They didn’t even want to admit there are limits,” Richardson said. Having watched nations fail to agree new targets for curbing climate change, Parry asked: “Where are the world leaders? I don’t have confidence that the UN has the institutions in place.” **Adil Najam**, vice-chancellor of the Lahore University of Management Sciences in Pakistan, told his Vienna audience: “We live on a third-world planet, and we are trying to govern it as if it were Austria. We need different types of mechanisms.”

Some tasks were hard, but others made obvious sense. There are many synergies between human development and environmental protection. Science could help by uncovering policy interventions that have multiple benefits: on climate change, agricultural productivity, health, poverty, and much else. The conference heard many such “win-win” ideas.

One was greener cities. Currently more than three billion people live in urban areas. That number could double after mid-century.



Most existing cities are monuments to bad governance. They harbor poverty, bad health and pollution, while suffering from gridlock and destroying surrounding countryside. “If we build new cities like old cities, we can forget about sustainability,” said [Bjorn Stigson](#), former president of the World Business Council for Sustainable Development. “New cities must be cutting-edge”, agreed [Bill Colglazier](#), chief scientific adviser to US Secretary of State Hillary Clinton.

The good news was that innovation could happen anywhere. Colglazier had been to Medellin in Colombia. Synonymous till a decade ago with drugs cartels, Medellin was now embracing a “new vision” of urbanization. The city has won plaudits for its innovative social urbanism, with the construction of trams, wastewater treatment plants, and architecturally prized public buildings in poor neighbourhoods. The best news was that there was no damaging trade-off between cities that were great to live in and those that were energy-efficient and “sustainable.” The two went together. Good governance was key.



Among the rural poor, better and healthier living could also go hand in hand with fighting climate change and reducing air pollution, said IIASA’s [Keywan Riahi](#). Over 2.7 billion people rely on solid biomass for cooking. The soot from inefficient stoves kills between one and two million women and children a year. It is also an important driver of climate change. A global push for more efficient stoves would both save lives and reduce the near-term rate of climate change, added IIASA’s [Zbigniew Klimont](#).

Some saw access to electricity as the key to unlocking this double gain. A fifth of the world does not have access to electricity. The whole of sub-Saharan Africa—more than 800 million people—has less electricity-generating capacity than Spain, said IIASA’s [Shonali Pachauri](#). And half of that is in one country, South Africa.

Lack of energy services underpins poverty as well as bad living conditions. Most OECD countries have achieved a high ranking in the UN’s Human Development Index by using at least 100 gigajoules of energy per capita per year, around half the OECD average, said IIASA’s [Narasimha Rao](#). Electricity allows farmers to pump water for irrigation and boosts non-farm enterprises such as simple crop processing, raising them out of poverty. No energy means low income, which perpetuates energy exclusion, said [Ogunlade Davidson](#), former Minister of Energy and Water Resources of Sierra Leone. A UN goal of universal access to electricity by 2030 was achievable, Pachauri said. It was a potential game-changer, a single intervention with multiple benefits.





Left to right: **Mr. Chin-min Lee**, Special Advisor to the Director/CEO, IIASA; **H.E. Ambassador Hyun Cho**, Permanent Mission of the Republic of Korea to the International Organizations in Vienna; **Mr. Rainer Honeck**, Concertmaster, Vienna Philharmonic; **Prof. Dr. Pavel Kabat**, Director/CEO IIASA; **Mr. Yu Nagai**, Research Assistant, Energy Program, IIASA; **Prof. Ogunlade R. Davidson**, Professor, Mechanical Engineering, University of Sierra Leone; **Dr. Youba Sokona**, Co-Chair, IPCC; **Prof. Dr. Lidia Brito**, Director, Division of Science Policy and Sustainable Development, UNESCO.

Forests versus food

Can we feed a world of 9 or 10 billion people? Some thought it impossible. **Yuan-Tseh Lee**, a Nobel prize-winner and President of the International Council for Science, said this would require 80% more food by 2050, and “we will not be able to do it.” Others remembered that a similar question had been asked 40 years ago, when it was feared the “population bomb” could cause billions to die of hunger. But we have doubled food production since, and most believed it was possible to do it again. The question was how. Was high-tech farming the route? And would more nature, especially tropical forests, have to be sacrificed in the quest?

Nina Fedoroff, Chair, AAAS Board of Directors and Distinguished Visiting Professor at the King Abdullah University of Science and Technology, backed high-tech for high production. Technology and agribusiness could deliver both improved yields and greater resource efficiency. “We need to professionalize farming, with new crops, and new technology such as GMOs,” she said. She spoke of a Saudi company producing prawns that had found ways to deliver animal protein with a tenth of the inputs needed to produce beef. Feeding the world was easy if agribusiness was given its head. “The problems are policy, financial, and regulatory, particular over GMOs.”

But **Parviz Koohafken** of the UN’s Food and Agriculture Organization said high-tech agriculture was having huge environmental impacts. It was part of the problem rather than part of the solution. It mined irreplaceable underground water reserves, spread agrochemicals, damaged soils, and contributed around a quarter of the gases that cause climate change. Despite all that it “failed to feed the poorest.” Instead, he backed boosting the output of poor farmers through low-tech solutions like better access to markets and cheaper fertiliser. “Small farmers still feed more than 60% of the world. They are the challenge and the opportunity,” he said.

Might a reliance on small farmers mean sacrificing the forests? **Frances Seymour**, former director of the International Centre for Forestry Research, said not. One of the more pernicious myths, she said, was that forests impeded food production. In fact, she said, “forests provide food security, through fruits and nuts, bushmeat, and swidden farming” for their inhabitants. Deforestation often

created empty stomachs rather than full granaries. It was, in any case, agribusiness that destroys forests, not peasant farmers.

And the world’s new leviathan of agricultural production, Brazil, was taking a similar view. After a decades-long assault on the Amazon rainforest, it had concluded that forest destruction “has been an economic failure and hasn’t alleviated poverty,” said **Carlos Nobre** of Brazil’s science ministry. It now believed that saving the Amazon was the right development path. It had reduced deforestation rates by two-thirds in the past decade, the period during which its economy had taken off.

Brazil was now charting a new path of “sustainable development of the tropics,” he said. Saving the Amazon will protect the country’s climate, soils, and river flows, while delivering development for its people and a more productive farming system. He hoped these concepts would spread across the tropics. “I’d like to see us here in ten years time with deforestation halted,” he said, “because countries had seen other ways of doing development.” **Pavel Kabat**, IIASA’s Director/CEO, added that, with three major rainforest nations—Malaysia, Indonesia, and Brazil—now all members of IIASA, the Institute was well-placed to develop a “big tropical land agenda” to meet the challenge.

Doing the business

Most agreed that business had to be at the heart of the new planetary stewardship. The forces of global capitalism had to be harnessed. It had to be a very different kind of business, and a very different kind of capitalism. But the prize was huge, said Stigson. The drive for sustainability was “the biggest business opportunity ever.” He foresaw a “green race,” in which “those that understand it can grab that opportunity.” Kabat agreed. The green agenda was not a threat to business, but an opportunity and “an innovation driver.”

Stigson saw two roadblocks: governments and the financial community. Investing in sustainability may be profitable in the long term, but in the short term it was expensive and capital-intensive. Low-carbon energy sources had high construction costs—whether erecting wind turbines and solar panels, or building nuclear power plants. The low running costs would only deliver later. Similarly, water-efficient irrigation systems were more expensive to build than simply flooding a field, but made sense in the long run, especially if the alternative was running out.



Left to right: [Prof. Dr. Alexei D. Gvishiani](#) (speaker), Russian Academy of Sciences and IIASA Council Member; [Prof. Dr. Buzz Holling](#) (speaker), Former IIASA Director and Emeritus Eminent Scholar and Professor in Ecological Sciences, University of Florida; [Prof. Dr. Ralph L. Keeney](#), Professor of Decision Sciences, Duke University; [Mrs. Janet Keeney](#); [Mrs. Carla Levien](#); [Dr. Roger Levien](#), Former IIASA Director, Founder – Strategy & Innovation Consulting, and US NMO Member.

"To be resource-efficient you need to be capital-intensive," agreed Nakicenovic. That applied to consumers as well as producers. There was little point in covering the landscape with wind turbines and solar panels if consumers carried on leaking heat out of their homes, buying gas-guzzling cars, and taking their vacations in Hawaii. More than half the cost-effective ways to mitigate climate change related to the efficient use of energy, said IIASA's Charlie Wilson, yet "current innovation efforts are too much towards the energy supply side."

Cambridge economist [Michael Grubb](#) said greener consumer behavior required greener consumer products. Technology and behavior went together and could reinforce each other. Most people were not green evangelists but could be encouraged to live greener lives if it were made easy. They would leave their cars at home if the train service was good and cheap. "In most buildings you can cut energy use by 50% and recoup the investment in lower energy bills within six years," said Stigson. Yet "the building market doesn't drive efficiency." New social norms and new building regulations were both required.

But while many in business saw the benefits of the long view, and the profits to be made, the financiers who put up the cash for investment were not playing ball, Stigson said. While large corporations thought decades ahead, "the financial community is looking at the next quarter at best." One way forward was to change the tax systems and regulatory frameworks to increase the incentives for resource efficiency, the reduction of waste, and social responsibility. That required governments to change the rules for business.

A few governments were picking up the challenge, Stigson said. The conference heard from [Soogil Young](#), chairman of South Korea's Presidential Committee on Green Growth, who said his country was leading the way to creating a "global architecture of green growth," focusing on long-term investment to reduce greenhouse gas emissions,



ensure energy security, promote green industry, and improve the quality of life for its citizens. It would take time, but the benefits of green growth for Korea will "far outweigh the costs," he said.

Global governance and national sovereignty

The national state is part of the problem, said Yale environmental economist [William Nordhaus](#). National governments are locked into narrow views of short-term national interests. They stonewall most international initiatives aimed at addressing global problems. As human society bumped up against planetary boundaries, the range of issues that needed addressing urgently was increasing, and the failure of nation states to address them grew more glaring.

One such "planetary boundary" issue highlighted at the conference was water. [David Grey](#), a water policy expert formerly with the World Bank, said "water needs to shift from being a local to a global issue." A first priority was the management of water that crossed national frontiers. Africa alone has 60 international rivers where water needed to be shared between upstream and downstream nations.

With giant dams potentially allowing upstream nations to hold back the entire flow of major rivers, downstream countries feared the consequences—sometimes with reason, and sometimes not. Yet, there is no global agreement on managing such flows.

Habitual hydrological secrecy made matter worse, he said. Most upstream countries hid data on river flows from their downstream neighbors. India rarely told Bangladesh what flows were coming down the Ganges. The result was unnecessary damage and deaths from flooding. Egypt saber rattled whenever nations upstream on the River Nile drew up plans to abstract water for irrigation. Yet, in reality, "you could take as much water out of the river in East Africa as you want and Egypt would never notice the difference." Some basic ground rules about being good hydrological neighbors could work wonders.

Action on climate change similarly suffers from governmental paralysis, crippled by what game theorists call the "free rider problem."



The economic burdens from cutting emissions were felt within nations, while the environmental benefits were only manifested globally. Everyone feared that others would avoid the burdens but garner the benefits. That was why the Kyoto Protocol had foundered as more and more members left, said Nordhaus.

But he offered the conference an interesting solution that was neither global nor local. He called for the creation of climate clubs. Countries could be encouraged to join the clubs voluntarily, accepting tough rules on their emissions in return for real benefits from club membership. The European Union, despite its current problems, was the obvious success story of such a club. Countries paid their dues—including, in recent years, taking measures on climate change—in order to become part of the world's largest free trade zone.

A future global climate club, or clubs, would impose carbon taxes on members to curb emissions. But outsiders would have to pay even higher carbon-calibrated trade tariffs if they wanted to sell goods to members of the club. It was a possible model for fighting climate change—rooted in both economic and game theory. With UN climate talks for a post-Kyoto treaty stalled, the formula got the conference talking.

Science “on top or on tap”?

Science had the answers to the world's problems, and the world should follow its blueprint. That, as one member of the audience noted, was the subtext of the conference, with its implicit call to go from “science to policy.” Scientific illiteracy among public and policymakers made scientific hegemony more urgent, many said. [Gerhard Glatzel](#) of the Austrian Academy of Sciences despaired that “the decisions of the people increasingly reflect pre-Enlightenment thinking. Science fails to get embedded in the logic of people.”

“The problem is that science makes progress, but the policy system cannot take advantage,” said [Thomas Schelling](#), Nobel Prize-winning economist from the University of Maryland. “How can you scare the American people enough [to act on climate change] and do it legitimately?” he asked. “I’m not sure we can.”



What was needed, some said, was new “narratives” that engaged people. We needed less data and more simple stories about what had gone wrong and what should be done. But they could backfire. “Al Gore used the narrative of fear and inconvenient truth. It didn’t work,” said [Kandeh Yumkella](#), Director-General of the UN Industrial Development Organization and Special Representative to the UN Secretary-General’s 2012 initiative on sustainable development, Sustainable Energy for All (SE4All). Others called for “narratives of hope.” Colglazier, from his vantage point as science adviser to the US Secretary of State, said successful narratives required an understanding of people’s “needs and values.”

But when did narratives become political advocacy? The danger, said [Andrew Johnson](#) of Australia’s Commonwealth Scientific and Industrial Research Organisation, was that scientists who left their data behind and engaged in advocacy for particular policy solutions lose the trust of the public and policymakers. In Australia, “many scientists moved into policy advocacy,” he said. “Trust has been lost.”

[Diana Liverman](#) of the University of Arizona reminded the meeting that non-scientists had reasons to be cautious of even the best-intentioned scientific pronouncements. Scientists had got a lot wrong in the past. She remembered the models of world food supplies from the 1970s, when most researchers were predicting widespread hunger. The model predictions were “way off,” she said. “We didn’t realize how adaptable farmers were, nor how rapidly fertility would decline from the 1970s.”

Science didn’t know everything, and should be careful to admit it, said [Berrien Moore III](#) of the University of Oklahoma. On climate change, it knew “for sure” the fundamentals of how human emissions of greenhouse gases were stoking up climate change. But it didn’t yet know how sensitive the climate system was to those gases, and might never be able to predict confidently the likely resulting changes to our weather—such as precipitation patterns.

[William Clark](#) of Harvard, one of the pioneers of systems science, said scientists had to be humble, both about their diagnoses of the world’s fever, and about their prescriptions for curing it. “The idea that science figures it out and tells society what to do is WRONG,” he said. “It doesn’t work. It is not defensible.” We don’t just need science, he said. “We need knowledge, local practical knowledge. And people have to trust it. It is not just a transfer [of science] to the great unwashed. We have to provide support, not instructions.”



Dr. Jill Jäger, Independent Scholar and Former Deputy Director, IIASA.

Conclusions

A picture began to emerge from the conference. Kabat said that systems analysis had come of age and that IIASA was at the fore. Smart systems thinking could diagnose complex problems and deliver smart solutions with multiple benefits for both the planet and its people. Among these solutions, a drive for universal access to electricity could provide a leg-up out of poverty for the poor, while also saving lives, cutting air pollution, and fighting climate change. And a global push on education could deliver better and healthier lives, a smaller future global population, and more brains fit to tackle technological challenges and embrace solutions for sustainable governance.

Dirk Messner of the German Development Institute was optimistic that such things could be achieved. He saw “an emerging legitimacy for change” that would deliver “a culture of long-term thinking, of participation, of fairness.” Good things could happen. Virtue could gain ground.

In this new “social contract,” business and financiers, shorn of their predatory instincts by a world that rewarded long-term thinking, could develop new technologies. Technologies that were both radically more resource-efficient and encouraged consumers to be more interested in maximizing happiness than income. Where business and consumers led, politicians would follow.

Where to? Perhaps to a world like that envisioned by Lutz. A world of six billion or fewer people, all healthy and educated, living content lifestyles in sustainable economies.

Far from retreating into a pre-Enlightenment era, we could be on the verge of a new Enlightenment, built on ideas about sustainability. Nobody should doubt the scale of the task. “A new social contract with a new value base is an enormous enterprise,” said Rockström. “It is a huge responsibility.” But then, like it or not, we are now the new stewards of the planet.

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The information contained in this brief is drawn from the IIASA 40th Anniversary Conference, Worlds within Reach—From Science to Policy, held in Austria from 24–26 October 2012. More information, including presentations and videos, is available on the conference Web site:

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