Annual Report 2001

ALLIANCE FOR GLOBAL SUSTAINABILITY

Content

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Norsk Hydro agreed to support the AGS at the IAB level, but has not yet accepted the invitation to appoint a member to the IAB.

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Summary

The Alliance for Global Sustainability (AGS) is pleased to introduce its first published Annual Report concerning the year 2001. It is clear from the results of progress reported that the AGS Coordinators have worked hard to implement the recommendations put forward in the AGS Business and Development Plan 2001, which was approved by the Governing Board in January 2001. We are gratified by the progress that has been made and optimistic about the prospects for the future of the AGS in making a substantial contribution to global sustainable development. There is a clear need for top-flight research to address the world's pressing need for new technologies and models for decision making that will enhance progress toward sustainable development.

In 2001, the AGS made substantial progress in a number of areas. Highlights reported here include:

- A significant increase in membership on the IAB and pledges of support over the next five years will go far to secure the future of the AGS. Nine new members of the IAB have each pledged support of USD 200'000 per year for five years.
- The addition of a fourth academic member to the alliance: Chalmers University of Technology, Gothenborg, Sweden.
- Significant progress in scientific research to address critical issues in sustainability, especially in developing countries.
- Support provided to more than 60 research projects engaged over 125 faculty and more than 250 graduate students around the world.
- Publication of AGS research results in a new international book series, "Science and Technology: Tools for Sustainable Development".
- Growing synergy among the AGS projects.
- Expansion of academic programs on sustainability within the member institutions.
- Successful implementation of the AGS Youth Environmental Summit, a two-week intensive educational program on global sustainability issues.
- Development of a Management Plan to streamline operations and outreach for the worldwide dissemination of the AGS results.

As we look to the future, the AGS faces both challenges and opportunities. The events of September 11 have diverted the world's attention from sustainable development to issues of security and safety. At the same time, they remind us of the critical need to address issues that lie at the intersection of environmental and economic goals in order to improve the quality of life for all of the world's citizens. Time is of the essence. As the AGS looks forward to the next phase, it must work even harder to build partnerships with all stakeholders – in business and industry, in government and civil society – to bring the resources of this tremendous research partnership to bear on solving these problems.

Introduction

The year under review represents a watershed in AGS history. The AGS enters its second five-year phase with an additional member university, Chalmers University of Technology, Gothenburg, an increased number of committed members serving on its International Advisory Board (IAB), renewed commitment of the Presidents of the four AGS universities, and approval by its Governing Board to support 15 new projects that transcend disciplinary and geographical boundaries in support of sustainable development.

The Presidents of the AGS universities each confirmed their commitment to raise USD 600'000 per year over the next five years to ensure the stability of the AGS. The 2001 university commitments supplement the investment of USD 1 million by each of the founding universities to launch the AGS at their institutions. In 2001, The Knut and Alice Wallenberg Foundation provided USD 1 million to support the entry of Chalmers into the AGS.

These funds add to support provided in Phase I of the AGS under the leadership of Dr. Stephan Schmidheiny whose vision and generosity made creation of the AGS possible. In 1997, he pledged USD 10 million over five years to support core activities of the AGS. In 2001, Dr. Schmidheiny contributed an additional USD 2 million in bridge funds to support the AGS in its transition to Phase II.

Equally important to ensuring a strong foundation for the AGS is the consistent support of the V. Kann Rasmussen Foundation whose significant contributions in support of MIT's multi-disciplinary environmental initiatives has made MIT's participation in the AGS possible. In 2001, the Foundation committed USD 300'000 per year for three years to continue support of MIT's activities in the AGS. In addition to providing resources needed to support the core activities of the AGS, both Dr. Schmidheiny and Mr. Lars Kann-Rasmussen serve on the IAB where they contribute their vision to the attainment of sustainability goals through application of the best scientific and technological resources.

Major support for AGS efforts to break new ground in effective cooperation between industry and academia has also been made possible by generous support of corporate sponsors like ABB, which has provided USD 1 million per year over the past three years. The funds support AGS core activities and made possible the AGS China Energy Technology Program (CETP).

In Japan both the Tokyo Electric Power Co. and the Ebara Corp. have sustained and strengthened UT-AGS activities with significant contributions of 10 million Yen per year over four years from 1997-2001. Both corporations have pledged to continue support of the AGS for five years (2001-2005) and have named new representatives to the IAB.

In 2001 AGS coordinators focused on implementation of the Business and Development Plan approved by the AGS Governing Board in January, with endorsement of the IAB. This Plan highlights three objectives:

- recruit new IAB members (lynchpin of the AGS funding strategy);
- expand with caution the number of member universities who form the core of the AGS, and
- develop and implement a lean and efficient management strategy that will promote effectiveness of the AGS.

Attainment of these objectives ensures an infrastructure that will support realization of AGS objectives in Research, Education, and Outreach. In the following report, we provide a summary of progress towards meeting these objectives and a view over the horizon to the outlook for the AGS in 2002.

Investments

AGS funds are allocated to expenditures for research, education, and operations. Nearly eighty percent of the budget is applied to core activities which include investments in research and education initiatives. On expenditures of USD 3,085 million in 2001, the AGS made the following investments:

Research	USD	2'175'000	71%
Education	USD	220'000	7%
Operations	USD	690'000	22%[1]

Investments by Category

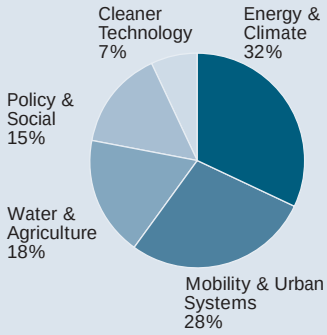

Figure 1

As called for in the Business and Development Plan, over the next three years, the AGS expects to increase the core budget for research, augment the percentage of funds invested in education initiatives to 10% of capital budgeted for core activities, and reduce the percentage of operations costs to 15% of total expenditures.

Scientific Research for Sustainable Development

Research that supports global society's transition to sustainable development is the primary focus of the AGS. Following its first review and assessment of the strengths and weaknesses of the AGS research portfolio in a 1999 mapping exercise, AGS identified its primary strengths in water, energy, and mobility. In 2001, investments in these areas accounted for 68% of allocations for research.

The AGS investment of USD 2,175 million in 2001 supports 15 projects over two years. This brings the total AGS direct investment in scientific research to USD 11,11 million over five years.

Significantly, the direct investment of AGS funds into scientific research has leveraged other resources to address the complex sustainability issues inherent in ensuring water, energy and mobility for global development

1 Includes outreach , e.g. development and maintenance of AGS Web sites, administrative costs, and participation in the Annual Meeting at 3 partner universities USD 600'000; central activities of the International Office USD 35'000, and USD 55'000 for development consultant services.

Investment in Research Projects 1997-1999 Leverage effect

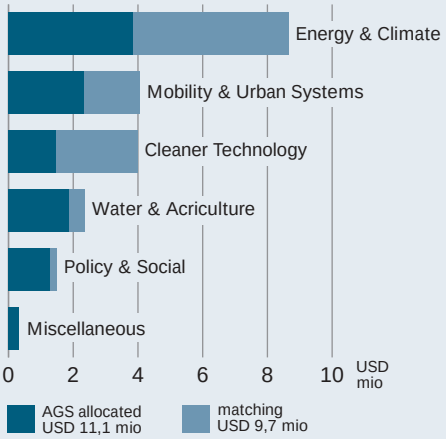

Figure 2

now and in the future. In the inaugural three year period (1997-1999), the AGS leveraged over USD 20 million for research on sustainable development at the founding member universities. Of the USD 20 million raised for research on sustainability at these institutions, USD 9,74 million added directly to AGS projects.

Figure 2 shows the leveraged funds for research on sustainability in AGS focus areas. The AGS is still receiving input from Principal Investigators regarding leveraged funds in 2000 and 2001.

Investment in research in 2001 deepened the AGS commitment to ongoing projects that are identifying solutions to current problems. Issues addressed in these continuing projects include the environmental and health effects of coke-making in China, arsenic poisoning of drinking water wells in Bangladesh (a problem that is likely to develop in other highly populated regions of the world), methodologies for better decision making (e.g. the China Energy Technology Project with ABB), and uncertainties surrounding the science of climate change.

Figure 3 provides an overview of the AGS Research Portfolio 1997-2001. It highlights major areas of research and illustrates the development of work in specific areas from problem identification and basic understanding to the development of methodological tools to address problems and the implementation of results.

Research highlights are included in Appendix A to this report. Detailed information on the AGS research portfolio is available on the AGS International Web site: www.globalsustainability.org.

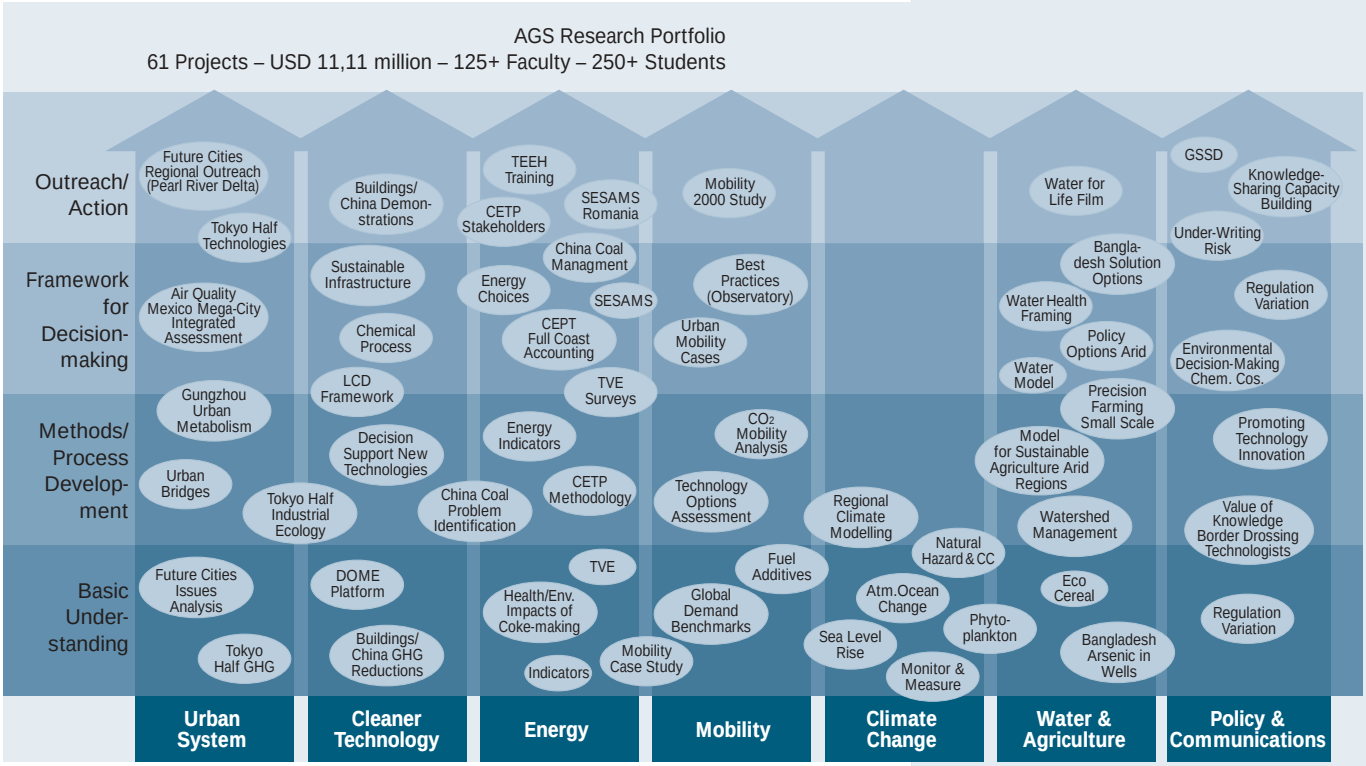

Figure 3

It is the mission of the AGS to support policy-ready research that contributes to changing patterns of behavior and to improving policy and decision making for sustainable development. The AGS focuses on the scientific, technological and social issues that lie at the intersection of environmental and economic goals. In 1999 the AGS carried out an evaluation of the research portfolio in order to assess strengths and weaknesses. The resulting report of this mapping exercise revealed a number of barriers and constraints to progress in sustainable development. These impediments include a lack of robust data on causes and effects of man's activities, and physical and institutional infrastructures that, once in place, are difficult to change. Through research and application of our results, the AGS contributes to moving beyond these barriers. Following are examples from the year in review.

Value: Transposing Research to Action

Reducing GHG emissions in developed and developing countries: The DOME platform for integrated modeling to better understand complex problems and assess solution options to them has been under continuous

Integrated Modeling to reduce GHG

development in the AGS since 1997. It has been tested in specific industry contexts (Ford and Boeing) for product development and is now being applied to the Tokyo Half Millenium Project to evaluate technologies for reducing emissions of greenhouse gases. Discussions with policy makers and stakeholders have been initiated in Japan. Results are expected to be useful in evaluation of CDM projects proposed in the context of the Kyoto Protocol. Stakeholder dialogues organized by the AGS team aim at consensus building to support rapid and fair adoption of new technologies.

Reduce Health and Environmental Impacts of Coke and Steel Industries in China

A global analysis of the coke and steel sectors in the developing world: The AGS project team has identified sources of health and environmental impact from the production of coke in China, the world's largest coke producer. They have developed tools to address current problems which contribute to improving health and environmental conditions now. In order to make the analytical tools developed in the AGS project accessible to local populations, the research team has conducted education and training programs in China and will distribute them more broadly in the future. Coke managers from around the world have learned about this research, and are tapping into it through direct contact, training, and conferences with AGS researchers.

Introduce Sustainable Building Technologies

Reducing GHG emissions in buildings with new applications of low-cost low-polluting technologies in China: Principal Investigators carried out three workshops and training sessions for developers, building managers and users in China in 2001. They have since been invited by the Chinese Ministry of Construction to develop a set of green building standards for residential and commercial buildings throughout China. The project is an example of AGS commitment to translating research into action.

Facilitate Adoption of new Technologies

Facilitating adoption of new technologies for sustainable development is the goal of the AGS project on "breakthroughs" to new sustainable technologies. Principal Investigators are working with policy makers in the Netherlands, the US, and Japan to develop a policy framework that will encourage acceptance of new technologies. Researchers are currently working with several other AGS projects to test their findings and hypotheses, e.g. in the Tokyo Half Project to explore adoption of new technologies in developed countries to reduce GHG emissions.

Identify Global Mobility Challenges

AGS mobility researchers in 2001 joined forces with the World Business Council for Sustainable Development (WBCSD) and a consulting firm in the US to study world challenges in meeting future global demand for transportation. The resulting report released in November 2001 concluded that several "grand challenges" must be addressed if the worldwide commu-

nity hopes to improve the outlook for sustainable mobility. Of particular relevance to the AGS, concerned as it is with conducting policy-ready research, is the need to develop institutional capacity to address complex, long-term issues that will facilitate the technological progress that will be necessary to meet global demand for sustainable mobility.

Identify Infrastructure Needs of Future Cities

The Future Cities project is working with municipal authorities in Guangzhou, China to address potential impediments to sustainable development in the region stemming from rapid development of the city. AGS research identified potential steps to address issues in water delivery and consumption accounting (using inter alia demand side management policy instruments), municipal and industrial wastewater treatment, traffic congestion, and building local capacity to improve residential environments . Effective solutions will require close cooperation with other municipalities in the Pearl River Delta and the team is exploring means to extend the project to the regional level.

Help ensure a Cleaner Water Supply in Bangladesh

AGS researchers have identified promising measures to ensure *a sustainable water supply system in the arsenic-affected Asian environment.* The finding that the pumping of irrigation wells causes high levels of dissolved arsenic in drinking water wells has important implications for national mitigation policies and public health. The team has found that installing drinking water wells beneath irrigation wells could provide clean drinking water. Under these conditions, it is possible that replacing less than 10% of the wells in Bangladesh could reduce health problems associated with the wells by more than 50%.

Measure and Monitor Earth's Atmosphere

AGS research is leading to the *development of innovative experimental techniques for local and global management of the Earth's atmosphere.* Improved measurement of atmospheric trace gases and the development of new spectroscopic methods for guiding air quality modeling studies will lead to better understanding of how the global climate system works and how our own activities may be influencing it. Dissemination of the knowledge generated by this project to decision makers and potential users is a key aspect of the research. Synergy with other existing AGS projects will provide important benefits to the AGS program.

Improve Air Quality in the Mexico Mega-City

The Mexico City Air Quality project has developed techniques that will enable measurement results to be properly interpreted and contribute to more robust policies for improving air quality at local, regional, and global levels. Scholars involved in these projects are working with other AGS Principal Investigators to make data generated by the projects usable by local officials and the public. These projects include *the China Coal* initiative, the

China Energy and Technology Project (CETP), and the *China Technology-Energy-Environment-Health (TEEH)* initiative on the coke and steel sectors.

In 2001, the *CETP* came to fruition. Using the AGS project development model, Figure 4 illustrates the CETP project evolution from problem identification to outreach. The timeframe for this initiative was two years. Results are to be published in the AGS book series on "Science and Technology: Tools for Sustainable Development" (Kluwer Academic Publishers) and disseminated worldwide.

AGS Research in Action

The China Energy Technology Project

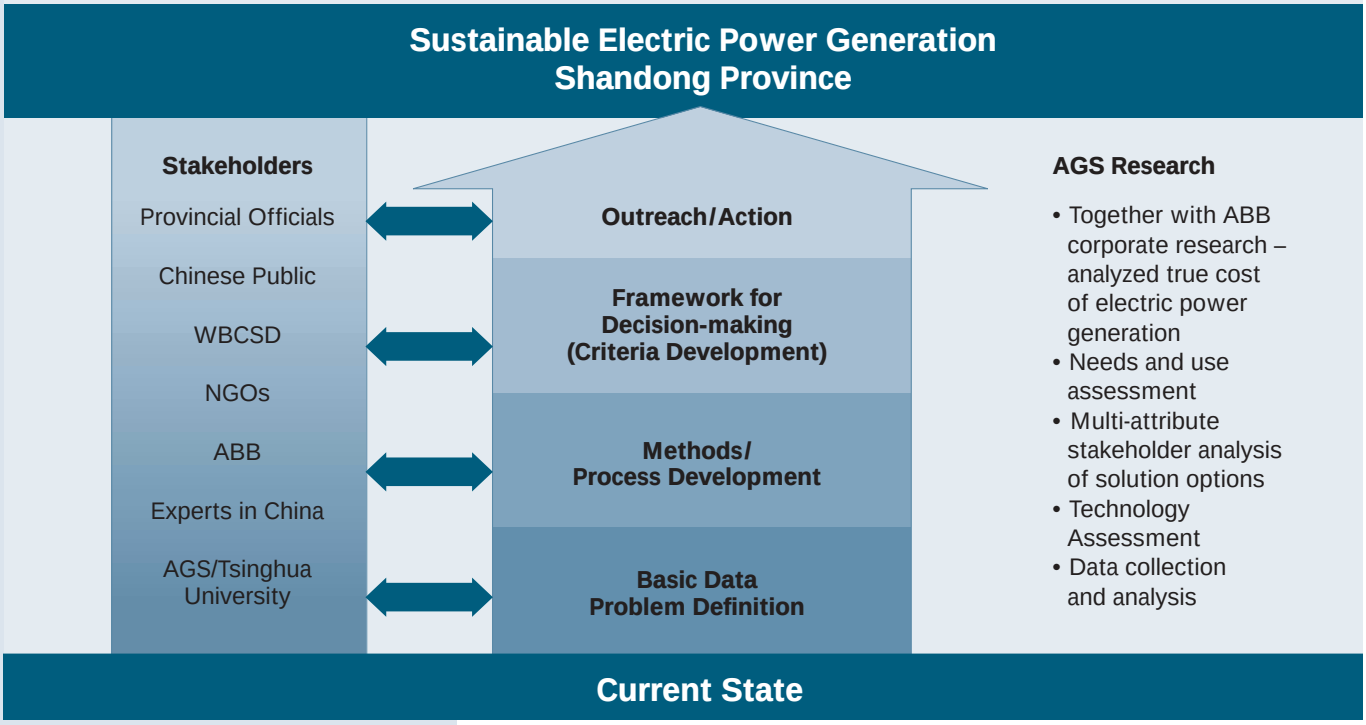

Figure 4

Synergy and new Projects Extend The AGS Research Portfolio

In January 2001, the AGS reported results of the second mapping review of the AGS research portfolio, noting two areas that could be better represented in the portfolio: information technologies and materials sciences.

In the project on *"the Value of Knowledge"* researchers are examining the role of information technology applications to promote sustainable development through effective use of knowledge networks in decentralized R&D and Technology Development Centers, and through exploration and

development of means for better knowledge sharing between and within firms, countries, and regions of the world. AGS researchers in this arena have contributed to the work of several working groups of the WBCSD.

Web based Tools for Decision Making

A number of the methods for improved decision making being developed in the AGS are, or can be Web based. Principal Investigators on projects that are developing technologies and methods for improving decision making for sustainable development are working across project lines to develop means to make these tools accessible to local officials and the public in both developed and developing countries. In 2001, project synergies were explored between the DOME, SESAMS (stakeholder dialogue model for improved decision making in providing electricity), the Tokyo Half Project, Value of Knowledge, the CETP initiative, and the Global System for Sustainable Development. The latter is exploring development of a multi-lingual Web based tool for sharing knowledge on sustainable development.

Managing Rise of the World's Mega-cities: A Galvanizing Issue for AGS

In 2001, the AGS Governing Board also strengthened the research portfolio with additional support for research on managing the mega-cities of the world – an issue that will dominate the 21st century. Today, 47% of the world's population lives in urban areas. By 2030, the percentage of the world's population living in cities will rise to over 60%. Most of this demographic shift will occur in developing regions, which are already hard pressed to meet the needs of their burgeoning urban populations for clean drinking water and proper sanitation, transportation that does not foul the air, and clean energy and electricity to support growth and development. In 2001, AGS projects investigating integrated management of the mega-cities included the Mexico City Metropolitan Area Integrated Assessment of Air Pollution; the Future Cities initiative focused on the Pearl River Delta of China and the Tokyo Half Project. Ongoing work in projects on mobility, water, and energy also focus on meeting needs in growing urban environments and the special challenges that this growth raises. Two of the first books in the AGS book series with Kluwer Academic Publishers will disseminate initial results of this research worldwide. In the future, AGS may be a focal point for research on managing the rise of the mega-cities.

Education: Preparing the Next Generation of Leaders for Sustainable Development

As noted in our brochure, "Sustainability Pays Dividends" the AGS believes that a sense of social responsibility for the future of the planet and environmental awareness should be a part of the education of every student. The AGS is producing graduates committed to sustainability and who understand the tools available to them to achieve such goals, no matter where they work. Working on AGS projects introduces some of the world's brightest students to the multi-disciplinary collaborative style of problem-solving essential to balancing environmental, social, and economic needs.

Expanding Educational Opportunities in Sustainability at Member Schools

Improving Education for Sustainable Development within our Institutions
Educational activities focused on sustainability at each of the AGS institutions have increased since the inception of the AGS. By 2001, each of the institutions had established a local AGS program that serves as a seedbed for faculty and student initiatives on sustainability through research and educational opportunities.

Massachusetts Institute of Technology (MIT) increased the number of Martin Family Graduate Fellows in Sustainability in 2001 with the addition of 20 graduate student fellows nominated by senior faculty representatives of every school and department within the university. This brings the number of graduate students who have been introduced to this honorary society, which is aimed at supporting the development of young leaders committed to sustainable development, to over 50. In 2001 MIT hired an Education Program Manager in the Laboratory for Energy and the Environment to help develop case studies in environment and sustainability for use across the curriculum and to coordinate outreach. The MIT/AGS initiative also organizes weekly seminars for faculty and students on the environment and sustainability.

The Swiss Federal Institute of Technology Zurich (ETHZ) is building its educational initiative in sustainability through reorganization of the curriculum that will provide more opportunities for multi-disciplinary education at graduate and under-graduate levels. In 2001, ETH Zurich launched plans for a new Institute for Environmental Policy and Decision Making to facilitate the creation of multi-disciplinary programs.

The University of Tokyo (UT) program provides special funds to support AGS related student activities. UT students have created a local UT Student Community on sustainability. Now 112 students participate in the initiative with working groups that focus on Environmental Policy and Environmental Business. UT is strengthening inter-disciplinary education and research on environment and sustainability through the Institute of Environmental Studies, which was established in 1999.

Chalmers University of Technology is moving into a new phase in environmental education with plans to develop five new international Masters programs. These programs include Energy and the Environment and Environmentally Sustainable Engineering. A team of AGS professors helped improve one of the two existing environmental programs through a review, and vision for the future report, which was presented to the President in October 2001.

Sharing Knowledge with Students around the World

Youth Environmental Summit (YES)

In January 2001 the AGS Governing Board authorized the AGS to expand its pilot Youth Environmental Summit program to offer two two-week sessions in Braunwald, Switzerland. Faculty representatives on the AGS Education Task Force organized the two academic sessions and social programs. The response was tremendous: out of more than 200 applications received, 75 students from 35 countries were selected to participate. Core faculty and students in the YES program are drawn from the AGS members. Student participants are selected for their academic ability, interest in sustainable development, and diversity. This ensures a growing network of young leaders throughout the world who are educated about the AGS approach to research and problem solving. Participants in the program receive a certificate of successful completion based on fulfillment of course requirements including development of a case study.

Youth Environmental Summit

Students led Network for Sustainable Development

World Student Community

The success of YES is reflected in the growing student network that it has fostered. In both the pilot year (2000) and in 2001, students participating in YES self-organized into a World Student Community (WSC) for sustainable development. This community played an active and highly visible role at the AGS Annual Meeting in Lausanne, Switzerland in January 2001, and officially created the WSC on sustainable development in December 2001. The WSC is organizing a student-driven academic symposium on sustainable development to precede the 2002 Annual Meeting in Costa Rica. In addition, YES has spawned student initiatives in research across national borders, and has fostered synergies among existing programs.

The MIT-based "Think Cycle" program is a student-driven initiative that provides a global network of smart young engineers and scientists who are committed to applying their skills in problem solving to meet the needs of the world's poorest populations. As a result of participation of "Think Cycle" representatives in YES 2001, the network is being extended to other participants around the world. A similar ETH-based student initiative is developing a Web based platform for sharing tools to improve sustainable product development.

Challenges and Opportunities

Evaluations and expressions of interest indicate a high degree of satisfaction in the YES initiative and related programs among students, faculty, and external participants, including local industries and government. The success of the YES program has raised both challenges and opportunities for the AGS. Three YES challenges are being addressed by AGS coordinators:

- Management and program development;
- Curriculum and program evaluation;
- Funding for AGS education initiatives.

A faculty oversight board representing the four partner institutions was formed to evaluate the YES program in order to help AGS Faculty Coordinators develop recommendations for future program development and planning. The evaluation report will be submitted to the AGS Governing Board in February 2002. In 2001, fund raising among local industries and government resulted in recuperation of direct costs of running the program in 2001 and an exploration of potential for future fund raising to help cover the costs of faculty participation in the program. Faculty time in the pilot and first year phase has been voluntary and supported by the AGS partner institutions. As program demand increases, AGS will have to determine how these costs will be allocated and recuperated.

Outreach

All AGS projects are required to include an action plan for translating the results of the research to action beyond normal venues for dissemination of academic knowledge through publications and presentations. In 2001, a number of the mature AGS projects entered the implementation phase providing workshops and education and training sessions for decision makers in developed and developing countries. Examples include the mid-career training course for decision makers in Mexico on methodologies and tools for assessing and mitigating air pollution in the Mexico Mega-City. As a result of the outreach activities of this project, the Mexican Government has already adopted some of the recommendations stemming from the research findings. Workshops to implement AGS results have also been conducted for other projects including China Coal, sustainable buildings, the China Energy Technologies Project, and the Guangzhou future cities project. Beyond our progress in achieving the AGS goal of going a step beyond usual academic practice, the AGS in 2001 also strengthened its centralized outreach activities.

Bringing the AGS to a Broader Audience
At the invitation of Dr. Schmidheiny and with agreement of the AGS Governing Board, we organized the first Annual Meeting (AM) of the AGS to be held in a developing country. The AM 2002 is held in San José, Costa Rica, in cooperation with the Instituto Centro Americano de Administración de Empresas (INCAE). Significant representation from Latin America is expected, providing an opportunity to focus on sustainability issues in the region and on ways in which the AGS can help address them.

Throughout its history, the AGS has recognized the importance of industry as an agent for change in moving societies to pathways for sustainable development. In 2001, the AGS held its first technical level meeting to share information and results of the tools that have been and are being developed in AGS research with representatives of business and industry. The meeting, held at our new member, Chalmers University of Technology, focused on "AGS Research: Implications for Industry". Approximately 20 companies participated, many of them new to the AGS. Plans are underway for the second Technical Meeting in 2002.

The AGS Book Series: Science and Technology –
Tools for Sustainable Development
In 2001, the AGS completed its agreement with Kluwer Academic Publishers to develop an international book series on sustainable development. The purpose of the series is to ensure broad dissemination of AGS research results and publish other works of relevance to attainment of AGS goals. By the end of 2001, two books were completed and in pro-

duction in the Kluwer Academic Series, four are in final editing stages, three are in final manuscript development, and several others are under discussion. Criteria for inclusion in the AGS series include relevance to sustainability and the goals of the AGS reflect the highest standards of scholarship and scientific inquiry, undergo peer review, and appeal to a broad public audience. The audience for these books includes faculty and students in science, engineering and the social sciences, as well as practitioners and decision makers in government and industry, and the concerned public. The list of current titles and members of the series advisory committee are presented in Appendix B.

Interactions with other Organizations

In addition to project level interactions with industry and government decision makers at all levels, the AGS is also represented in interactions with a broad spectrum of organizations throughout the world. In 2001, coordinators made presentations on the AGS in a number of international forums including the Second International Summit on Sustainable Development hosted by the Tata Energy Research Institute in New Delhi, India; the OECD Global Forum on "Sustainable Development in the New Economy"; the International Transdisciplinarity Conference held at ETH; the Aspen, Colo. Symposium on Sustainable Development in SE Asia (sponsored by the SE Asian Development Bank), and at a number of regional conferences and symposiums.

The AGS continues its affiliations with the World Business Council on Sustainable Development (WBCSD) and has participated in advisory and analytical roles in WBCSD projects including working groups on: Mobility 2000; Innovation, Technology, Society and Sustainability; and Sustainability in the Market Place.

IAB Expansion

The AGS Business and Development Plan approved by the AGS Governing Board with endorsement in January 2001 outlines a strategy for expansion of the IAB over five years from nine members in 2001 to 30 members by 2005. Of these, approximately 20 are expected to come from corporations with the remainder from government and civil society, invited for their personal commitment to and achievements in promoting sustainable development. The expectation is that the institutions represented by corporate board members will each commit financing of USD 200'000 per year to the AGS core. In 2001, 12 new members joined the AGS Board, bringing the total number to 20.

Management

The AGS has functioned as a virtual organization for the first five years. It now needs a stronger framework to support its activities in organizing multi-disciplinary, integrated research teams and to reach goals in education and outreach. Recognizing this, in 2001 AGS coordinators developed a draft management plan to implement recommendations in the Business Plan. The draft plan affirms the structure for AGS decision making as outlined in the Business and Development Plan and clarifies duties of the International Office (IO), established at ETH in 2000. The purpose is to better position the AGS on an international level, to make the organization more administratively responsive to the strategies and goals of its Advisory and Governing Boards, and to facilitate organizational efficiency. Strengthening of the IO is intended to improve communications among the partners and externally, provide a focal point for information on AGS activities, and ensure regular reporting on AGS activities to the IAB and AGS leadership. The Management Plan was approved by coordinators in October 2001 and put into operation with the creation of the Executive Board (EB) of AGS Faculty Coordinators.

Outlook

At the outset of its second five-year period, the AGS is poised to consolidate its strengths and realize its potential as a major force for constructive, sustainable progress in the new century before us. Leading technical institutions like our own have a special role to play in meeting the challenge of sustainable development. With the support of a growing and strengthened advisory board of thought leaders from around the world, we will have the resources to put our strengths to this purpose and serve as a model for others. In order to realize this potential in the next year, we have to keep our attention focused on results oriented research, and help our Principal Investigators to develop venues for outreach and implementation of their results.

Improve Management and Operations

The AGS will only continue its progress with improved management. The addition of a new member, enlarged International Advisory Board, and increased number of projects requires more efficient coordination. The aims of the new management plan are to streamline decision making, avoid duplication of effort and be more effective in communication and outreach to all AGS stakeholders. At the same time, the AGS will focus on ensuring these objectives while maintaining a lean administrative framework that relies on the strengths of the member institutions with support provided by the International Office.

Focus on Results oriented Research

Looking ahead to 2002 and beyond, AGS must address several important challenges. The first is to keep our focus on results oriented research. One way to achieve this is through development of research partnerships with agents of change in business, government, and civil society to address specific problems. Models exist in the Mexico City Integrated Assessment of Air Pollution initiative, and the CETP project in China.

Strengthen Education and Outreach

In piloting the YES education initiative, we have learned about the need and demand for the initiative and the role that AGS can play in preparing the next generation of leaders in sustainability, world wide. In 2002, we will assess this role and determine the prospects for growth of this initiative.

Build partnerships

When it comes to sustainability, we are all students, at the frontier of establishing a new paradigm for development. The AGS has long recognized that partners in industry and government are crucial to this endeavor. In order to maximize the dissemination of the tools that are emerging from AGS research, the AGS must consider potential new venues for knowledge sharing with industry and government. Successful experiments in this context include the Mexico City and sustainable buildings projects. In 2002, the AGS will explore the feasibility of developing this capability in other contexts.

External Review and Evaluation

In the five years since creation of the the AGS, we have conducted two extensive reviews of our portfolio and internal interviews with Principal Investigators involved in AGS research, to identify our strengths for carrying out multi-disciplinary research and our priorities. The AGS has launched over 50 research initiatives focused on global sustainability. We have focused primarily on research that will contribute to meeting burgeoning needs for water, energy, and mobility throughout the world. It is now time to take stock of this initiative and conduct a review and evaluation of progress towards meeting the objectives set forth in 1996. AGS Coordinators are developing a framework for carrying out this evaluation in the early part of 2002, beginning with the March 2002 meeting of the IAB.

Highlights of AGS Research Results 1997-2001

Appendix A

In 1999 the AGS consolidated its research portfolio into three main focus areas: mobility, energy, and water and agriculture. Cross-cutting research is also carried out on urban systems, cleaner technologies, policies and institutions, and climate change. This focus has led to significant progress in producing and disseminating results, engaging stakeholders, and implementing results.

Mobility

Enhanced mobility is both an end that directly enhances well-being and a means to further human development and well-being. There is, however, a growing realization that sustaining even present levels of mobility, let alone accommodating anticipated growth in demand, will require difficult trade-offs. (From the proposal "Towards Global Sustainable Mobility" to the WBCSD, MIT: October 9, 2000) AGS research on mobility is extensive in moving towards understanding and reconciling these factors.

- Report "Mobility 2000" (with working group of WBCSD) provides a comprehensive overview of global transportation demand and identifies major challenges to ensuring sustainable transport around the world.
- A supplement to the third edition of the International Mobility Observer provides succinct descriptions and references on innovative transportation policies and developments on a global scale.
- There are comprehensive models for forecasting worldwide demand and implications of transportation trends for controlling greenhouse gases.
- Selection through the MIT/AGS mobility initiative to partner with WBCSD Working Group on Mobility to carry out a major long-range study of global mobility demand. The first phase of the work now underway is a "benchmarking» study, "Mobility 2000», that assesses the current state of mobility in the developed and developing world, and the current and emerging challenges to its sustainability.
- It provides examination of a large number of urban and national case studies.
- There is comprehensive assessment of new fuel and vehicle technologies for passenger cars.
- It provides demonstration of the technological/chemical life cycle of renewable energy systems for transportation (e.g. assessment of moving from bio-mass to methyl to hydrogen to use of hydrogen in fuel cells).

Energy

Energy production and consumption lie at the very heart of economic development. While ensuring that energy demand by the world's burgeoning population is met, all countries of the world today are concerned with achieving the "3-e's": environmental protection, energy security, and economic development. The AGS energy portfolio aims to shed light on sustainable ways to meet the goals of the "3-e's".

- The AGS/ABB partnership project CEPT developed a methodology for true cost accounting for electricity in emerging markets taking energy technologies and their environmental impacts into full account.
- AGS researchers have studied the health and environmental impacts of coke making, one of the highest energy-use industrial sectors in China, identified sources of problems, and developed measures for reducing such impacts. They are now working with local (Shandong Province) officials and other stakeholder groups to implement effective measures for mitigating problems.
- The China coal project analyzed the problem of polluting emissions from the hundreds of thousands of coal-fired boilers in small and medium sized industries in China. Alternative technologies have been developed for greater boiler efficiency and cleaner coal combustion. Researchers are now analyzing existing international trade and finance programs to promote use of more environmentally effective technologies for coal.
- The SESAMS Model provides the means for estimating true costs of providing electricity, taking into account technology options and their environmental input; methodology for including stakeholder dialogues in assessment process (applications in Switzerland, China, Romania).

Integration of Energy and GHG Issues

- Development of a computer platform to facilitate connection of technology models that can be distributed over the Internet (DOME) (application of the platform in Tokyo).
- Interactive software tools to:
  - Characterize spatial distribution of demand for energy and material services;
  - Analyze physical attributes and costs of technology options;
  - Synthesize energy and mass flows in cities;
  - Simulate the entire industrial ecology system of urban regions (the application in Tokyo-goal is to identify means to cut CO2 emissions in half without compromising overall services);
  - Support stakeholder involvement in the modeling process.

Climate Change Science (filling gaps)

- Development of more robust models to predict sea-level changes over next century.
- Means to accurately monitor and measure atmospheric trace compounds (in progress).
- Characterization of regional scale climate predictability (especially important to developing regions).

Water and Agriculture

Access to water is a key condition for food production and economic development. Water shortages contribute to poverty and starvation and severely constrain industrial development. Yet today, more than 2 billion people are living in areas of the planet affected by severe water stress and that number is expected to grow to over 4 billion over the next 25 years. What can be done to alter this sobering prediction?

- Techniques for accurate diagnosis of nutrient requirements (precision farming for small-scale applications) (application/testing in Switzerland and Japan, published results).
- Analysis and development of tools for improved watershed management: means to bridge gaps between surface and ground water use and between supply vs. wastewater treatment and conservation vs. re-use: comparative case studies to test analysis. A book and a film on watershed management are in production.
- Analysis of arsenic polluted areas in Bangladesh; development of guidelines for sustainable water use and treatment (in progress); testing and recommendations for low-cost filtration technology.
- Methodologies to assess sustainability of current agricultural activities worldwide, but especially in arid and semi-arid regions, and to assess future options to ensure water and food.
- A completed general hydrologic-economic model for analyzing sustainability of irrigated agriculture (especially in arid and semi-arid regions).
- Evaluation of three general types of policies (developed and tested in Australia; application in Africa).
- Integrated analysis of water availability, food security (in progress).

Policies and Institutions

Policies and Institutions are the building blocks for transitions to sustainable pathways to development. The AGS is working towards development of a coherent theory of clean development and improvement in methodologies for decision making at all levels in both the public and private sectors. Our intention is to contribute to a paradigm shift in policies and structures for sustainable development.

- Framework to support environmental decision making in chemical companies (case studies/thesis).
- Analysis of techniques for promoting technological innovation for sustainable development.
- Policy input across project areas.
- Implications of cross national variation in environmental regulation. A book has been completed and is now in revision stage.

Cleaner Technology

Technology will play an important role in moving toward sustainable development. Clearly, there is a high level of interest in ensuring that new technologies are developed to meet society's needs in an environmentally sound way and that they are introduced in ways that accomplish effective results. Thus the AGS is committed to going beyond the development of new technologies to understanding the barriers and constraints to their adoption. The AGS is working across a number of fronts to ensure the introduction of environmentally sound technologies for sustainable development in such applications as:

- Coal-fired boilers in China;
- Coke-making industry;
- Energy systems;
- Environmentally sound building technologies especially to meet burgeoning demand in the developing world;
- Automobile technology option assessments;
- Distance learning tools and an inter-active/multi-lingual Web based database on sustainable development.

For further information visit the AGS International Web site at:
www.globalsustainability.org

AGS Book Series

Appendix B

The aim of this series is to provide timely account, by authoritative scholars, of the results of cutting edge research into emerging barriers to sustainable development, and methodologies and tools to help governments, industry and civil society overcome them. The work presented in the series will draw mainly on results of the research being carried out in the AGS.

Science and Technology: Tools for Sustainable Development

The level of presentation is for graduate students in natural, social and engineering sciences as well as policy and decision makers around the world in government, industry and civil society.

Series Editor: Dr. Joanne M. Kauffman
Massachusetts Institute of Technology

Series Editor

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Current titles in production

Air Quality in the Mexico Mega-City: An Integrated Assessment
Mario M. Molina and Luisa T. Molina, editors (February 2002)

Future Cities: Dynamics and Sustainability
Fred Moavenzadeh, Keisuke Hanaki, Peter Baccini, editors (March 2002)

Energy for China's Future: the China Energy Technology Program
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Wolfgang Wimmer and Rainer Zuest, editors (expected spring 2002)

Sustainable Electricity: Balancing Economic and Environmental Performance Under Competition
Stephen Connors, Adrian Gehorghe, Warren Schenler, editors
(expected summer 2002)

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