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OPTIONS

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In 1986 IIASA underwent considerable internal reorganization and realignment in order to concentrate on the main thrusts of its research strategy, to ensure the relevance of its research, and to improve overall efficiency.

1986 marked the beginning of a new phase for IIASA, with the full implementation of the research strategy decided in 1985. The future of the Institute will rest on a new and different foundation, one that relies on a broader constituency and greater relevance.

This broader constituency is already reflected in the establishment of IIASA's Advisory Board, whose 62 members from 20 countries include leading figures from the industrial, financial, scientific and policy communities, while the new activities being studied, such as management training and the investigation of technological risks, demonstrate the Institute's orientation towards relevant interdisciplinary applied research.

This function is enhanced by IIASA's unique and valuable role as a meeting-point for institutions in both East and West, and as a catalyst for new ideas and fresh approaches.

This fundamental role is highlighted in this issue of Options. We have selected a few typical conferences, workshops and roundtables, which also illustrate the different approaches of the various reporters.

In 1986, IIASA also implemented the strategy of sponsored research. One example is the case study of Shanxi Province in the People's Republic of China, which is also described in this issue.

Less attention is given in this issue to our other ongoing Programs: Environment; System and Decision Sciences; Population; and Technology, Economy and Society. However, these, and a final summary of the Food and Agriculture Program, will be dealt with in more detail in subsequent issues.

CONTENTS December 1986

Technology and Employment

The Austrian Federal Ministry of Science and Research, the Institute for Socio-Economic Research and Technology Assessment (ISET) of the Austrian Academy of Sciences and IIASA jointly organized the *International Conference on Technology Alternatives and Employment: Policy Options to the Year 2000*, held at Schloss Laxenburg on 24-26 March. The meeting brought together more than 140 participants from 15 countries, including leading researchers, decision makers, representatives of trade unions, finance, etc.

At the macroeconomic level, the epochal change that has taken place since the 1970s has turned attention to the specific economic problems of small countries. Their position was analyzed and some tentative solutions offered. It was recommended that "offensive" policies be followed, but ones based on cooperation: to complement the usual cooperation of small with big countries, there should be cooperation of small countries with small countries. It was pointed out that many problems, of both East and West, have a similar character, so cooperation can help to find solutions. Science, it was shown, is being called upon more often to help with recent problems.

In applying science and technology on a company level, many changes are presently emerging which have to be identified. A company faces a changing information and resource environment; furthermore, procedures that provided efficiency in one environment may fail in another.

Many new technologies will emerge between now and the year 2000. They will create some new jobs in manufacturing, but not enough to absorb the problems elsewhere. The main character of work must change (hours, schedules, supervision, incentives, etc.) in order to make more use of the technological developments.

It was shown that this situation is more or less valid for all advanced economies. The first and most important element of "reindustrialization" is education and training. The second is the transfer of knowledge to industry. In order to do this it is necessary to have a better understanding of the industry-infrastructure interface, and to find the optimal mix of small and large companies, etc.

The biggest impact on employment is expected from information technology, and therefore several speakers addressed this issue. The results of a statistical analysis indicate that, contrary to the general view, employment has risen with information creation and handling, because of increased productivity (and output). The increase in output increased demand even more. The general impact of information technology varies from country to country (from zero to 10 percent of the total labor force).

Another presentation was consistent with this view. It showed that the quantitative impact of new technologies can be positive, negative or neutral, depending on the assumptions made regarding the level of aggregation, direct and indirect effects, adjustment time lags, etc. There are also two existing and conflicting views on requirements.

An analysis of the UK scene showed that information technology is not so labor saving, as it leads to increases in both labor and capital productivity. The effects of this will be a more rapid substitution of capital for labor, in some sectors, and an exchange of old capital for a more "intelligent" one.

In diffusing technology, labor can help significantly, if properly involved. It was stressed that we must find mechanisms to channel help from those who benefit from new technology to those who are at a disadvantage. This can also be valid for whole regions, as the study by an international team suggested.

New Members of the Council.

IIASA is glad to welcome two new members to the Council: **Academician Ladislav Kubicek,** of the Czechoslovak Committee for IIASA, and **Professor Douglas T. Wright,** of the Canadian Committee for IIASA. Academician Kubicek, Scientific Secretary of the Czechoslovak Academy of Sciences, and Deputy Chairman of the State Commission for Scientific, Technical and Investment Development, succeeds **Ing. Pavel Majersky.** Professor Wright, President of the University of Waterloo, succeeds **Senator Michael J.L. Kirby.** In recognition of his important contributions to IIASA, the Council has awarded the title of IIASA Honorary Scholar to Senator Kirby.

IIASA's Research Strategy

As the Institute moves into 1987 it will be operating according to strategy, i.e. four major Programs, some exploratory sponsored research activities, and a catalytic clearinghouse activity. The four Programs constituting the core activities are:

* System and Decision Sciences
* Population
* Environment
* Technology, Economy and Society

The focus of the research at IIASA is on work of relevance to real decision-makers, as well as to the systems analysis scholarly community. There exists a need – which the Institute attemps to satisfy – for clear-cut, applicable, user-friendly, and timely results which are of tangible present and future value to three main groups of users:

a) governments and their specialized agencies,
b) industrial firms, and
c) international agencies.

The emphasis is on critical, front-end thinking about what is to be achieved, how to go about this realistically, who will use the results, and how they can be communicated to the user community in a timely and readily-understood manner.

It is IIASA's conviction that the time to involve the users is at the beginning of a program, so that the end product is tailored to their needs. The fact that all four core Programs are attracting external funding is an indication of the value which the industrial, financial and policy communities place on their usefulness.

The Methane Age

On 14-16 May in Sopron (Hungary), 24 participants from seven countries discussed the future of world methane at an IIASA Task Force Meeting on *The Methane Age*. The objective of the meeting, which was cosponsored by the Hungarian Committee for Applied Systems Analysis, was to identify the important determinants and issues in the future of natural gas supply, demand and use. At the same time, top-level scientists, industrialists and decision makers present at the workshop recommended topics for further study and collaboration, and in-house exploration at IIASA. The wide spectrum of interests represented provided extensive coverage of the issues, allowing for an excellent overview of the situation in gas.

IIASA-tested methodology on market penetration was applied in describing the long-term future of natural gas. An increase in the share of gas for primary energy consumption was predicted for well into the next century, although there are technical problems such as transport that may change in the future.

IIASA research on the evolution of methane technologies was presented. During recent years gas production has become progressively uncoupled from oil, leading to the autonomous development of methane gas markets, and a large potential improvement of methane technologies. This result supports the hypothesis that natural gas may become the predominant world energy source.

It was pointed out that the peculiarities of natural gas regulations in the US warrant particular attention. Despite this special situation in the US, there are promising opportunities for future natural gas use in the world. In addition, it is often the case that no separate exploration is required independently of oil. Not taking into account the resource potential of natural gas, especially at greater depths, has led to distorted energy policies based on the alleged scarcity of this energy carrier.

It was also pointed out that gas has some disadvantages compared with oil. It is not easily stored and transported and is a much less concentrated source of energy. The most probable scenario is the "provincial role". To assume this role, gas must be competitively priced in relation to electricity and petroleum, at the point of use or burnertip.

The wide variety of non-conventional sources of gas, potentially surpassing the conventional ones many times over, were assessed. These are natural gas produced by reactions of ultradeep carbon with a prior organic ancestry, and abiogenic gas with no biological history.

Several speakers pointed out the difficulty in accommodating the energy forecasts from several institutions with the recent gas market situation in the US. One must take into account the "gas bubble" created by conservation measures, heavy drilling in the late 1970s and early 1980s, and inter-fuel switching. The possibility of abrupt changes in prices when the bubble disappears was not excluded.

Technology is expected to play a significant, if not yet fully identified, role in increasing the proportion of natural gas in energy consumption. Existing advances in material research, electronics and various processes (higher bit ratio, increased economy, new methods of drilling, etc.) can potentially increase the efficiency of gas exploration. Technology will also be a key element in expanding the use of natural gas.

The potential of the gas turbine combined cycle system was assessed, as were possible ways to higher efficiency and better performance and reliability of these systems. Here one has to take into account the high perfection reached by the competing diesel engines, burning the heaviest residual oil, with efficiencies up to 53 percent. Due to a different thermal cycle, gas turbines cannot even approach this efficiency without cogeneration. In some countries (US) regulations prevent the use of gas for power generation, and thus create a barrier to the acquisition of combined cycle systems by utilities.

The final session was devoted to conclusions and recommendations for further work at IIASA. From the discussions the following can be summarized:

* Methane use can be studied as a part of the field of the dynamics and impacts of new technologies.
* It was agreed that it would be useful to study the role of countries endowed with large gas reserves (Algeria, Australia, the Near and Middle East in general) and the impact of increased gas trade on world trade.
* This study requires a systems approach because both the technology and methane as an energy source act in an international economic environment.
* IIASA could provide the appropriate structure and coherence required for the studies on methane and establish confidence in a methane resource data base with information from those who consider gas separate from oil.
* There is a gap in the knowledge of the technology-economy relationship in methane exploration and use. The gas producers indicated that they would appreciate it if the whole "causal technological chain" from drilling to burners could be assessed economically. This constitutes an important input for decision making in the exploration area.
* As for the study itself, the major cost elements trend should be identified over a 20 to 40 year span and their effect disaggregated. This should show what the potential is for methane price reduction.
* The widespread use of methane will have an impact on the other utility networks, especially on electricity. The trend will obviously be towards large-scale dispersed systems. There is a need for new policy measures to secure cooperation between a gas network and a "companion" electric power network.

1986 Peccei Scholarship Awards.

Yuri Kuznetsov (USSR), **Yuri Ledayev** (USSR) and **Peter Tallos** (Hungary) – jointly, and **Steven Underwood** (USA) were the 1986 recipients of the Peccei Scholarships. These awards have been granted by IIASA annually since 1984 to outstanding participants in its Young Scientists' Summer Program (YSSP), dedicated to the late Dr. Aurelio Peccei. The scholarship provides funds for a further research stay at IIASA. Honorable mentions were also awarded to **Darcie Booth** (Canada), **Thomas Büttner** (GDR) and **Michael Sutton** (USA) for their outstanding scholastic achievements during the 1986 YSSP.

Aging and the Family

The *IIASA Conference on Aging and the Family* was held in Sopron (Hungary) on 3-5 September. It was cosponsored by the Hungarian Committee for Applied Systems Analysis and was attended by more than 40 scholars from 14 countries in Eastern and Western Europe and North America.

Aging is the process of change in a population's age distribution that gives more weight to higher age groups and increases the mean age of the population. Population aging has recently attracted the attention of scientists as well as policy makers. Several research institutions have established programs to investigate the consequences of aging in industrialized societies. The major focus of this research is usually on economic and social security issues.

Another very relevant social institution, the family, has also seen significant changes over the last decade in all industrialized nations. The nuclear two-generation family is still dominant but has lost significance compared with the period of the postwar baby boom. Not only is the number of children decreasing and childlessness increasing, but a lower incidence of marriage, booming divorce rates, and an increasing prevalence of cohabitation have changed the role of the family. How can this changed family cope with the consequences of aging, and how does the aging process itself influence the structure of the family? These were the major questions to be addressed at the conference.

The conference was a first effort towards the study of the interaction of aging and the family

Since 1983 IIASA has studied issues related to aging in its Population Program. More recently, demographic analysis of changing family and kinship patterns has also come into IIASA's research focus. In contrast to other fields such as mortality and fertility analysis, neither the study of aging nor of the family has a clear and generally accepted methodology. Hence, a wide spectrum of approaches and techniques (from purely mathematical to descriptive to purely qualitative) have been applied at micro- and macro-levels by scholars to investigate these phenomena.

For this reason the conference convened by IIASA in Sopron was intended to be a first effort towards the study of the interrelationships between aging and the family, with an international perspective. Because substance and method can hardly be disentangled in this field, the conference was simultaneously an attempt to consider appropriate methods for the study of aging, the family, and the links between aging and the family.

Twenty-five presentations were made at the conference, which was organized around the topics of analytical frameworks, kinship networks, country case studies, and cross-national studies. The contributions were rather heterogeneous with respect to substantive focus and methodology. They could be grouped into three distinct clusters that can be located in a three-dimensional space. One dimension refers to the substantive focus, ranging from age-structural considerations to economic and health care issues relating to the family. The second dimension concerns analytical approaches, ranging from purely mathematical to descriptive empirical, and on to qualitative statements and speculative approaches. The third dimension refers to the level of analysis, distinguishing between micro- or macro-approaches.

The first cluster includes the majority of statements. They are all descriptive in a more or less quantitative way, mostly referring to a specific country. The substantive focus ranges from future developments in the age structure (aging only) to family formation and dissolution (family only). Most papers lie between those extremes, and many of them also include economic and health care questions as intermediate factors. All studies in this first cluster are clearly on the macro-level. They describe the problem from several perspectives and show that more research is needed to focus the analysis more clearly and develop standards for international comparisons.

The second cluster includes six papers that all operate on a micro-level and focus on family and kinship patterns. All these papers also have a clear mathematical-methodological orientation. Four of them present micro-simulation models designed to estimate kinship patterns or family/household structures implied by certain sets of transition probabilities. Such models seem to be very flexible and have the potential of showing the implications of certain trends in family formation and dissolution. They avoid the problems of the traditional family-life-cycle approach by allowing for divorces, single parent families, and other non-traditional behaviors.

The third cluster consists of some more qualitative statements on the role of the family in an aging society. An interesting point of discussion was the difference between Hungary, where the family has apparently become more important in the care of the elderly, and Austria, where the introduction of institutionalized home care seems to have completely changed the patterns of family help. The interaction between aging and changes in the family will certainly be of increasing concern in industrialized nations in the near future. This conference represented a beginning as regards its scientific study.

Honors and Awards.

Director Thomas H. Lee was awarded the Davies Medal for Engineering Achievement for 1986 by the Rensselaer Polytechnic Institute, Troy, New York, USA. Professor Lee was also elected a Fellow of the American Association for the Advancement of Science (AAAS).

Dr. Sten Nilsson, of the Biosphere Project, was awarded the 1986 Scientific Achievement Award of the International Union of Forestry Research Organizations (IUFRO).

Professor Ted Munn, Leader of the Environment Program, was elected a Fellow of the Royal Society of Canada.

Academician Leonardas Kairiukstis, Deputy Leader of the Environment Program, was elected a Member of the Presidium of the Lithuanian SSR Academy of Sciences.

Mr. Joseph Alcamo and **Dr. Jerzy Bartnicki,** of the Acid Rain Project, were awarded the 1985 Scientific Prize of the Director of the Polish Institute for Meteorology and Water Management in Warsaw.

Dr. Evka Razvigorova, of the Management and the Technological Life Cycle Project, was elected a Fellow of the International Academy of Management, in recognition of her commitment to excellence in the science and art of management.

Energy, Technology and the Economy

The *International Roundtable on Energy, Technology and the Economy*, jointly sponsored by the Electric Power Research Institute (USA), the Gas Research Institute (USA), Shell International (UK), and the Central Research Institute of the Electric Power Industry (Japan), and held October 28-30 at IIASA, produced important insights into the future energy outlook and a valuable energy information network. As a meeting, it was a resounding success, as evidenced by the enthusiastic support expressed for a follow-on roundtable in 1988. There were 29 formal technical presentations and 55 participants from 15 nations around the world.

The event provided a useful state-of-the-art summary of expert knowledge on the linkage between energy form, technological innovation and economic productivity; and the relationships between economic development, technological innovation, and energy use. Two areas of wide agreement are seen as particularly relevant: first, historical studies amply demonstrate the historical as well as prospective value of electrotechnologies to improvements in industrial productivity and domestic living standards. As a result, electrification is a continuing worldwide trend. Second, there is growing evidence that industrialized nations are going through important qualitative changes in consumption and production patterns and in technology development. These changes have caused and will continue to add significant uncertainty to the relationship between economic growth and electricity use in these nations.

The Roundtable has identified a number of major uncertainties in long-range energy outlook for the United States. They include consumer choice shifts, technological innovations and substitutions, and institutional changes in energy industries, particularly electric utilities. Surprisingly, fuel prices are viewed by most participants as comparatively unimportant in the long run. These uncertainties reflect the impact of a new generation of consumers in an age of choice and a world of intense competition. Some of the views expressed are as follows:

* There is a wide variety of ways in which information technologies will dramatically change the efficiencies of energy use as well as supply.
* The price of oil is expected to rise again in the next decade as the current low prices stimulate demand and erode production.
* Coal will continue to be a mainstay in the energy scene because of its abundance, capital intensity, and production flexibility.
* There are strong correlations between electricity use and economic growth, but there is room for doubt about a causal linkage.
* There were differences of opinion regarding future natural gas abundance versus shortages. There was nevertheless general agreement that current gas use, mainly for space and industrial heating, is saturating and would not expand rapidly unless it could be widely adopted for power generation and for transportation.
* Technological improvements have resulted in continued decreases in energy and electricity intensities in chemical processes.
* Energy intensities in US industries are in continual decline, mainly due to efficiency improvements and sectoral shifts. At the same time, there is a continuing trend in the direction of electricity substitution for other fuels.
* A comparison of electrification trends in the steel, paper, cement and motor vehicle industries in the US and Japan showed that, except for steel, electricity intensities were growing in the US industries, while falling in the Japanese industries. The comparison showed that electrotechnologies improved productivity in Japan without significant increases in electricity use.
* The economic advantages of modular electric power capacity investments was demonstrated.
* Long-term changes in consumption and economic patterns, and technological developments, have changed energy use in the US economy. Consumer choices have expanded rapidly with income growth, with resulting diversity of expenditures, which in turn impacts on energy use directly in the domestic sector and indirectly in the production sectors, both for goods and services. Furthermore, income growth has also changed the economics of energy supply and end use technologies, resulting in intensity shifts for different energy forms.

IIASA will publish an executive summary of the Roundtable, and complete the proceedings by June 1987. In addition, a number of areas for potential collaborative research have been identified. These include:

1. Consumption pattern and lifestyle changes: impacts on technology and energy.
2. Information and transportation: interactions and tradeoffs.
3. Technology life cycle: assessment and management.
4. Changing trends and interrelations among international electric utilities.
5. Advanced power system planning methodologies.
6. Energy system robustness and sustainability.
7. Energy trends in less developed countries.

IIASA – a Catalyst for Ideas

IIASA must constantly act as a dynamic institution. By definition, a dynamic institution has a built-in mechanism for generating more ideas than can be acted upon at a certain time. That mechanism has been incorporated into the IIASA catalytic activities, which are a means of using IIASA's accumulated expertise and contacts from previous programs to think about critical open questions and how the Institute could contribute to their resolution. In addition to helping IIASA promote scientific cooperation among a worldwide network of institutions, these catalytic activities include a series of "time-to-think" meetings on research aspects that no longer fall within the purview of the existing program. Such topics include Energy/Environmental Management, Children in the Information Age, Long-Wave Activity, Innovation Management, Agriculture, and Biotechnology, among others.

The Art and Science of Systems Practice

The Institute is approaching the 15th anniversary of its foundation. During its lifetime much new knowledge on systems practice, the true reason for its existence, has accumulated. It is believed that, in spite of continuous developments in systems theory, methodology and the set of concepts used, the primary importance of practice has remained unchanged. Practice is the source of useful theory and a testing ground for it. The focus of the *Roundtable on the Art and Science of Systems Practice* was based on the belief that theory, methodology and concepts without practice are sterile – just as practice without theory can be sterile. Twenty-nine participants from twelve countries and IIASA met from 6 to 8 November to review the current state of the art of systems practice and to identify areas of interest for the future. The scientific sponsor of the meeting was Professor Russell L. Ackoff, from the University of Pennsylvania, USA.

The systems view of the world incorporates a set of concepts, a body of theory, including a theory of practice, and methodologies of research on, planning for and design of social systems. The theory of practice was considered first, and some of the concepts of practice which professionals might apply in their relationships with clients were presented.

The educational programs which have attempted to deliver the systemic message that the behavior of the system as a whole is irreducible to properties of its parts have chosen unsystemic means to deliver it. Most such programs aiming at the development of systems practitioners rely on conventional disciplinary and mechanistic approaches, which merely reinforces the paradigm they seek to replace. Some desired properties of an effective systems education were specified, as was a proposal for a graduate program in systems science, involving a structure of learning cells and research cells.

The practice of theory is something like so-called "management science", which is a body of scientific knowledge and principles relevant to the management process. But it is characterized, in Einstein's words, by a perfection of means together with a confusion of goals. A generation ago, modeling tools were elementary, but objectives were simple. Now the position is reversed; as manipulative skills have increased, the single objective function has been lost, and the resulting pitfalls have to be avoided.

Discussion of the practice of development focused on planning *as* development versus planning *for* development, the dilemma of development planning, the changing context for the planning process, some consequences for a new approach, some new directions and institutional implications, and a suggested evolving institutional network for development planning.

The discussion of the frequently neglected political dimension of practice used as its starting point a particular process of intervention based on systems thinking, namely the soft systems methodology approach. Active intervention in real problem situations is a difficult task, and an important aspect of this task, one which has been relatively neglected in the systems and management literature, is the political nature of all human situations. Politics is defined here as a process by which differing interests reach accommodation, therefore what is needed is a process for political analysis both of the situation and of the intervention which becomes part of it.

The question of who ought to be the clients of system design raises serious ethical issues. In a large majority of cases whom the system actually serves and whom it should serve are by no means identical. What, then, is the point of designing a system by an elaborate model and impeccably collected information in order to maximize a performance measure which serves the wrong people? The practice of systems design is the use of systems thinking in serving people. A system is primarily made up of three roles that people play – those who should be served, those who should be involved in decision making, and those who should plan the future of the system. The question is how we can so design the world that future generations are stakeholders.

Academician Wolfgang Schirmer, Berlin, GDR representative on the IIASA Council, visited IIASA to present a statue called "Meditation", by the sculptor Drake, on behalf of the Academy of Sciences of the German Democratic Republic. This was a contribution to Director Thomas H. Lee's idea of having every national member of IIASA represented in some kind of permanent exhibition by a work of fine art.

Management and the New Economic Environment

Among the many complex problems of change in the international economic environment, IIASA focuses on analysis of the opportunities for and obstacles to long-term development and stability in East-West economic relations in terms of management development. IIASA focuses its activity in this area on examining the changing environment, national and international management mechanisms, and other issues of inter-firm activity.

This was the motivation for the workshop on *Management Development and the New International Economic Environment,* held at Laxenburg on 10-12 November. The objective was to identify the role IIASA can and should play in this area, and to contribute to the managerial competence of participants along the following lines:

* mutual understanding of the prospects for East-West economic relations as well as comprehension of how management mechanisms in both systems operate.
* understanding the ways for the development of East-West inter-firm cooperation by organizing joint ventures, solving financial difficulties, holding trade promotions, etc.
* recognizing the role of management development in East-West economic relations.
* examining the existing management values, styles and techniques of the participants, and estimating their effectiveness in the context of international economic relations; exploring common experiences and problems; gaining new ideas and approaches to organization.

Taking into account the objectives and peculiarities of the IIASA approach to management development activity, three related sets of issues were considered:

1. The changes in the international economic environment, as well as commercial and technological foreign policies of Eastern and Western countries. These changes (opportunities and obstacles) were considered in a long-term context as determinants for drawing up export-oriented firm policy.
2. The basic features and changes in international and national management mechanisms, which in turn determine East-West interfirm relations.
3. The choices that could be made by firms under the changing environment and management mechanisms: choice of partners, forms of cooperation, commodity compositions, financing, etc.

Of these issues, the last is the most important, i.e. the consideration of inter-firm policy choices. The workshop, which was attended by senior managers, executives, researchers and educators, resulted in the preparation of a number of reviews and case studies. Some of the views expressed during the final discussion, including opinions on the role of IIASA, were as follows:

* It is important for the purposes of management development to understand the management process in both Western and Eastern countries, including China, in order to identify the needs of managers there. The changing situation in the Eastern countries means that new kinds of management will be in demand. To some extent there must be an effective study of the management development process, and a focussing on the needs of the managers, as a starting point to launch such an effort.
* IIASA could perhaps fulfil the role of catalyst in bringing together people interested in joint ventures, and to exchange experiences. There was a view that IIASA should concentrate on research, because a move into executive training would require a special setup, with special staff, housing, etc. Research directors capable of bringing people together on particular topics in different countries would make IIASA a place where one could wire into such a network, something that presents great difficulty in the United States.
* IIASA's role as a catalyst should not be confined to joint ventures and comparative studies for East-West trade. There should be a focussed study, based on a focussed presentation, on understanding the needs and differences in East and West.
* IIASA has a unique role to play in this field – a view that permeated the entire discussion. The research in the Institute is one of the few common undertakings between East and West in the world at present.
* One of the main objectives should be to bring managers from East and West together. The more they know and understand the other side's problems, the more they will drop their prejudices. One approach would be case studies in joint ventures.

The Workshop on Management Development and the New International Economic Environment.

Shanxi – A Good Example

The case study of Shanxi Province in the People's Republic of China is a good example of an externally-funded IIASA contract project. The aim of the study, carried out under IIASA's Advanced Computer Applications (ACA) Project, is to develop an integrated system of software tools to make the scientific basis for planning and management directly available to planners, policy and decision makers. Using concepts of artificial intelligence (AI) coupled with more traditional methods of applied systems analysis and operations research, these tools are designed to provide easy and direct access to scientific evidence, and allow the efficient use of formal methods of analysis and information management by non-technical users.

Within the context of the study, the project is developing an operational prototype level expert system (model-based interactive information and decision support system with an intelligent, graphics-oriented user interface and integrated AI technology) that will be used by the regional government of Shanxi Province for development planning. The two-year study is being carried out with intensive collaboration between IIASA and the Chinese academic, industrial and governmental institutions, especially the regional government of Shanxi Province, and is funded by the State Science and Technology Commission of China and the Science and Technology Commission of Shanxi Province.

The overall problem situation addressed by the case study could be described as follows: how to plan for integrated industrial development centered on a primary resource, namely coal, maximizing revenues from industrial production for a set of interdependent activities, subject to resource constraints and minimizing external (i.e. environmental) costs. The major activities which are to be introduced or intensified in Shanxi Province are coal mining and processing; metal mining; chemical industries; power generation (coal-fired); iron, steel, aluminium and copper production; heavy and light engineering; transportation (mainly coal); and agriculture. A balanced and sustainable development is the objective, despite a number of constraints as regards capital, water resources, the transportation network, environmental degradation and the industrial labor force.

The problem addressed is the gap between the ever-increasing complexity and volume of scientific and technological information relevant to large socio-technical and environmental systems, and the information requirements at a strategic planning and policy level.

Taking advantage of the rapid developments in computer technology, the objective of the project is to help bridge this gap with a new generation of intelligent information and decision support systems. These systems integrate methods and approaches of operations research and applied systems analysis with elements of AI and advanced information and computer technology. The easy-to-use software tools are designed to provide direct and interactive access to a large volume of information and the powerful methods of scientific analysis to planners and policy makers.

In addition to the sponsoring authorities, the project entails intensive collaboration with various institutions in the PRC, including the School of Economic Management of Tsinghua University; the Dalian Institute of Technology of the Institute of Systems Engineering, and the Institute of Energy Research of the Academy of Science of the PRC.

This particular study also involves collaboration with the Division of Mathematics Informatics of the Academy of Sciences of the German Democratic Republic; the Institute for Control and Systems Engineering (ICSE) of the Academy of Mining and Metallurgy in Cracow, Poland; the Center for Advanced Decision Support for Land and Water Management of the University of Colorado, Denver, USA; and the Section of Economic Studies, Division of Nuclear Power of the International Atomic Energy Agency, Vienna, Austria.

Sponsored Research

Private-sector involvement in IIASA has been steadily expanding, and is a development which can only be greeted with approval. A new Office of Planning and Sponsored Research was set up two years ago to handle the sponsored research work arising from this involvement. Some of this work is entirely externally-funded, while other projects are sponsored on a 50-50 basis in conjunction with the Institute.

Some of these activities fit into the regular program structure. One example is the environmental impact assessment of industrial development in the Doon Valley in Northern India. This was carried out under IIASA's Environment Program, the clients being UNIDO and the Indian Department of the Environment.

The Dutch Ministry of Housing, Physical Planning and the Environment is supporting a study on future environments for Europe, being carried out under the Biosphere Project, while the Ford Foundation is providing financial support for IIASA's Project on Decision Support Systems for Managing Large International Rivers.

Other typical examples are the externally-funded case studies on hazardous substances management (client: Commission of the European Communities Joint Research Centre, Ispra, Italy); and integrated development under environmental constraints (client: State Science and Technology Commission of China).

These projects are being implemented under IIASA's Advanced Computer Applications (ACA) Project, and involve model-based decision support and applied artificial intelligence. The results are software systems, implemented at client institutions, as well as methodological contributions.

Another multidisciplinary research project has as its subject the processes of international negotiations. Funded by the Carnegie Corporation, it seeks to develop approaches and insights that contribute to the knowledge, conduct and results of international negotiations. The project will develop and utilize techniques, tools and concepts that would enable policymakers and negotiators to better understand and deal with the complex tasks and problems of the negotiation process.

News from the Institute

Developments in Collaborative Research

IIASA carried out a contract with UNIDO/UNDP and the Government of India to undertake a preliminary *Environmental Assessment of the Doon Valley*, about 200 km north of New Delhi. The principal investigators were Professors R.E. Munn and V. Fedorov.

A collaborative agreement for conducting a European case study between IIASA's Biosphere Project and the Dutch Ministry for Housing, Physical Planning and the Environment has been approved. This three-year effort to study *Future Environments for the European Continent* will bring together scholars and policy makers from Eastern and Western Europe. They will explore how near-term initiatives in technology and institution-building could increase future freedom of action in European efforts to carry out ecologically sustainable development.

IIASA's Advanced Computer Applications Project has started a study on *Interactive Risk Assessment for Chlorine Transportation in the Netherlands*, under contract to the Dutch Ministry for Housing, Physical Planning and the Environment. The study, related to ACA's research for the Commission of the European Communities' Joint Research Center on Hazardous Substances and Risk Management, will integrate various data bases, a large fault-tree analysis package, consequence models and decision-support techniques into an interactive package featuring computer graphics and embedded artificial intelligence technology.

Since 1979, IIASA has conducted active research on *Applied General Equilibrium Modeling (AGEM)* that has gained a prominent reputation in this field. The Ford Foundation approved a grant to support a workshop on AGEM and an associated three-month international summer school in 1986 at IIASA, within the System and Decision Sciences Program. The main objectives of these meetings were to survey papers summarizing major areas of policy application, and to organize panel discussions involving modelers and policy makers in order to stimulate interaction between the two groups.

Work on *Information Systems and Road Traffic* was supported by a grant from the Swedish National Road Administration. The project is designed to serve as the background for information technology investments in the transport sector by road authorities and the automobile and electronic industries. The principal investigator is Dr. Ove Sviden. The results of this research will be presented as scenarios describing likely patterns of system evolution over a period of 10-50 years, based on different policy assumptions and technological options.

The Carnegie Corporation of New York is supporting a two-year IIASA project on *The Processes of International Negotiations (PIN)*, which is being carried out in close collaboration with other projects at IIASA, and with the developing network of researchers within IIASA's member organization countries. The research will emphasize retrospective case studies of actual negotiations that illustrate the varied institutional, scientific, cultural and psychological aspects of negotiation processes. These insights will lead researchers to develop theoretical and practical tools for educating negotiators and facilitating negotiations.

Academician Leonid Vitaljevich Kantorovich, a devoted friend and strong supporter of IIASA, who contributed actively and fruitfully to the International Institute's goals and ideals, died in Moscow on 7 April. An eminent Soviet mathematician and economist, Academician Kantorovich was co-winner of the Nobel Prize for Economics in 1975. A Member of the Academy of Sciences of the USSR, a Foreign Member of many academies of sciences, and an Honorary Doctor of many universities, he was known world-wide for his important contributions to the development of pure and applied mathematics as well as of mathematical economics. IIASA will always remember him as a distinguished scientist and a very close friend.

A protocol was signed between IIASA and the Computing Center of the USSR Academy of Sciences to pursue collaborative research in the field of *Modeling Responses of the Biosphere to Human Activities*. Signatories were Director Thomas H. Lee and Academician Nikita N. Moiseev, Deputy Director of the Computing Center. The collaboration will be carried out as part of IIASA's Project on Ecologically Sustainable Development of the Biosphere, headed by Dr. William Clark.

IIASA's Acid Rain Project and the Institute of Meteorology and Water Management (IMGW) in Warsaw, Poland, are continuing collaboration on *Quantitative Evaluation of Atmospheric Model Uncertainty*, which began in 1984. In 1986, the research focused on the evaluation of composite uncertainty, on uncertainty due to the structure of the atmospheric model used in IIASA's model RAINS (Regional Acidification Information and Simulation) and on uncertainties in linkages between atmospheric models and environmental impact models. Principal investigators are Mr. Joseph Alcamo from IIASA and Drs. Jerzy Pruchnicki and Jerzy Bartnicki from IMGW.

IIASA signed a contract with UNIDO to undertake a study on *Development Strategies and International Policy Alternatives*. The goal of the study is to analyze the structure of foreign trade and the patterns of comparative advantage and international location of industry. First, factor intensities (i.e. labor, capital, energy and some raw materials) on a detailed level are to be estimated. Direct as well as total factor contents in foreign trade of about 30 countries will provide comprehensive information on resource endowment of those countries. Finally, comparison of the factor content of net exports with those of domestic final demand will be analyzed in order to reveal the correct interpretation of the Heckscher-Ohlin-Vanek proportion hypothesis, according to the Edward Leomez approach. Work in progress on data collection and on the concordance development between different sources of data was submitted to UNIDO in an interim report in June 1986.

The continuation of the 1985 contracted study on *INFORUM Model* (Phase II) took place in 1986 in two interrelated activities. First, Polish specialists from the Institute of Econometrics and Statistics, Lodz University, adapted software for input-output modeling (SLIMFORP) on ES computers (RYAD). Then dissemination

Collaborative Research

shops, case studies and publications of meeting proceedings, as well as related research by scholars from Eastern and Western countries. Three meetings are planned. for the near future: the *Task Force Meeting on Forest Decline and Reproduction: Regional and Global Consequences* to be held in Cracow, Poland, in March 1987; the *Workshop on Sustainability of Regional Development* to be held in Vilnius, Lithuanian SSR, USSR, in June 1987; and the *Workshop on Application of Dendrochronology in Forestry and Ecological Forecasting* to be held in Irkutsk, USSR, in August 1987. This collaboration is to span the period August 1986 to December 1987. Coordinators are Academician Leonardas Kairiukstis from IIASA and Professor Andrzej Straszak from SRI.

IIASA's Acid Rain Project and the Institute of Environmental Engineering (IEE) of the Technical University of Warsaw signed an eight-month study agreement on *A Computationally Efficient Method to Compute Parameter Uncertainty of a Long-Range Transport Model of Air Pollutants Model.* The IEE will join the Acid Rain Project's uncertainty analysis effort by applying a Fourier method to the atmospheric uncertainty analysis. Coordinators are Dr. Leen Hordijk and Mr. Joseph Alcamo from IIASA, and Dr. Maria Ozga-Zielinska from IEE.

Implementation of IIASA's *Decision Support Systems for Managing Large International Rivers (LIR)* Project requires effective contribution from collaborating institutions. As a first step towards building a collaborative network, two agreements were signed recently with the Department of Water Resources at the Institute of Geophysics of the Polish Academy of Sciences, and the Hungarian Research Center for Water Resources Development (VITUKI). The agreement with the Academy of Sciences covers a period of two years, and some other Polish institutes are also involved in preparing methodologies for the characterization of water supply-demand problems, flood control, and thermal pollution in large river basins, as well as data management systems. The agreement with VITUKI delineates only those tasks that should be implemented during this year (preparation of a working paper on the Danube River Basin; preliminary research to select aggregated state variables and human impact to be simulated; preparation of a pilot data management system for processing water quality data). The program for subsequent years will be determined later. The general coordinator at the Polish Academy of Sciences is Academician Zdzislaw Kaczmarek, Head of the Department of Water Resources at the Institute of Geophysics, and at VITUKI Dr. Geza Jolankai, Head of the Surface Water Section of the Hydrological Institute. At IIASA, collaboration is being coordinated by the Project Leader, Professor György Kovacs.

Mr. Ed Schmidt, a great and devoted supporter of IIASA, and since September 1984 Research Planning Adviser to the Director, died on 1 December after a short illness. Mr. Schmidt, who began his career as a chemical engineer, had a knack for finding unexpected solutions to important problems. This talent drew the respect of numerous persons of influence in the US and elsewhere, some of whom he served in a personal capacity, such as his twenty years as special adviser to successive Chairmen of the Board and Chief Executive Officers of the General Electric Company. A fervent believer in IIASA, he devoted himself to building a base of support for the Institute with the help of his influential friends. Though he is gone, these efforts will continue on the foundations he laid. IIASA has lost a faithful friend.

A one-year collaboration agreement was signed between IIASA and the Digital Equipment Corporation (DEC) to pursue research on *New Technological Aspects for Selection Committee Oriented Decision Proposing Systems Based on Distributed Workstation Networks.* The research to be sponsored would focus on the impact of DEC's new Networked Office Workstations (NOW) architecture on the accuracy of IIASA's Selection Committee Decision Analysis and Support (SCDAS) state-of-the-art management software package, developed by the Methodology of Decision Analysis Project of the System and Decision Sciences Program; and on the definition of new technological possibilities offered to decision proposing systems. Coordinators are Professor Andrzej Lewandowski from IIASA and Mr. Christian Lehky from DEC.

An eighteen-month collaboration agreement was signed between IIASA and Fonds National de la Recherche Scientifique de Belgique. The topic of research on *Reduced Methods in Constraint Optimization and Identification* will be studied in conjunction with the research activities of IIASA's System and Decision Sciences Program Core and the Adaptation and Optimization Project. The principal investigator is Dr. Jean Charles Gilbert from the Catholic University of Louvain.

Participants in the Task Force Meeting on "Policy-Oriented Assessment of the Impact of Climatic Variations" enjoying the best of weather outside the main door of Schloss Laxenburg.

Other Meetings

The Second IIASA Task Force Meeting on *Acid Rain and Policy Analysis in Europe* was held at Laxenburg from 14 to 18 April. Forty-seven scientists and policy advisors reviewed IIASA's RAINS (Regional Acidification Information and Simulation) model, and decided to initiate coordination of ongoing developments in modeling acidification effects and control strategies in Europe. A demonstration of interactive model use was also given to the participants.

The Department of Economic Geography of the Sea at the University of Gdansk, Poland, hosted a meeting on *Ecosystem Redevelopment of the Great Lakes and Baltic Sea Basins*, from 20 to 23 April, which was sponsored by the Polish Academy of Sciences and IIASA. The purpose of the meeting was to plan one of the plenary sessions of a major symposium on Ecosystem Redevelopment and Redesign, which is to be held in Budapest, Hungary, in April 1987. As a result, a set of comparative ecological, economic and institutional analyses of past and future efforts to repair degraded ecosystems in the Great Lakes and the Baltic are being prepared. The symposium is being sponsored by the Royal Society of Canada, UNESCO's Man and Biosphere Program, the Hungarian Academy of Sciences, the Royal Swedish Academy of Sciences, and IIASA.

From 22 to 24 April, IIASA sponsored the inaugural meeting of a new scientific society devoted to air pollution research, the European Association for the Science of Air Pollution (EURASAP). In conjunction with the meeting, forty participants from 14 countries attended a symposium on *Interregional Air Pollutant Transport with Special Emphasis on the Linearity Question*. The meeting and symposium were cosponsored by the Hungarian Committee for Applied Systems Analysis, EURASAP, and the Hungarian Central Institute for Atmospheric Physics.

Under the auspices of the International Association of Agricultural Economists (IAAE), a conference on *The IIASA Global Agricultural Model System: Perspective and Prospects* took place at the Food and Agriculture Organization (FAO) headquarters in Rome, Italy, 5-7 May. Over 30 participants critically examined the system of linked national agricultural policy models constructed over the years by the Food and Agricultural Program of IIASA, with the help of a large network of collaborating institutions.

IIASA organized the *International Forum on Agricultural Policies in an Interdependent World: Hunger and Trade Liberalization*. Forty participants from eighteen countries met from 2 to 4 June to evaluate the results of the application of the Basic Linked System to policy makers, advisers and analysts. The validity of the results was generally accepted. However, some doubts were expressed concerning the practical viability of realizing the suggested policy changes. A number of participants suggested additional scenarios to explore more gradual changes, which may be politically more acceptable. It was also emphasized that closer cooperation between policy makers and researchers should be developed.

The Systems Research Institute of the Polish Academy of Sciences and IIASA jointly organized the Task Force Meeting on *Methodology of Dendrochronology: East/West Approaches*, held in Cracow, Poland, 2-6 June. Thirty-three participants from thirteen countries met to discuss the geographical, biological and ecological bases for field samplings; establishment of modern regional and transregional chronologies; data processing and intercalibration methods; application methods (particularly for early indications of forest dieback) based on changes in atmospheric chemistry; and approaches and methods for estimating future probable outcomes. Cosponsors of the meeting were the Laboratory of Tree Ring Research in Tucson, Arizona, USA, and the Commission for Dendroclimatology of the USSR Academy of Sciences in Moscow.

Mr. Shoichi Saba, Chairman of the Board of Toshiba Corporation and a member of IIASA's Advisory Board, visited the Institute on April 25.

The Vienna III Conference on New Horizons in East-West Trade and Cooperation, organized by the International Council for New Initiatives in East-West Cooperation, and held from 16 to 18 June, brought together some 300 high-level representatives from business, industry, banking and government from 23 countries in

The Hon. Robert S. McNamara, former US Secretary of Defense, and former President of the World Bank, gave the second Dr. Bruno Kreisky Lecture entitled "Blundering Into Disaster: The First Century of the Nuclear Age" at IIASA on November 17. Mr. McNamara (right) is accompanied by Dr. Kreisky. On the left is Director T.H. Lee, with Mr. Chester L. Cooper, External Support Executive for IIASA, in the background.

Other Meetings

East and West. Four working groups addressed the following subjects: Natural Resources and Energy; Economic Cooperation; Science and Technology; and Transport. IIASA was asked to prepare the main paper for the Working Group on Natural Resources and Energy. Compiled by T.H. Lee, E. Schmidt and J. Anderer, the paper, entitled "Natural Resources and Energy Systems: A Strategic Perspective", was presented by Director Lee. It served as the basis for very intensive and constructive deliberations by the group. In the Working Group on Transport, Dr. Sten Wandel, Leader of IIASA's New Logistics Technologies Project, presented the Institute's plans to study new transportation systems and information technology for road traffic.

IIASA, with the support of the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), the Canadian Climate Center, the US National Climate Program Office, and the Dutch Ministry of Housing, Physical Planning, and Environment, held a Task Force Meeting on *Policy-Oriented Assessment of the Impact of Climatic Variations* in Laxenburg, 30 June to 2 July. Twenty-four invited participants from fourteen countries joined with IIASA staff and other institutional observers to discuss recent progress in climate impacts research in the light of policy needs. Building upon a 1985 World Climate Programme Conference at Villach, Austria, the group developed specific recommendations regarding future policy-relevant research in the areas of climate scenario development, agriculture, water resources, fisheries, forestry, and tropical biomes.

IIASA and the Hungarian Bureau for Systems Analysis of the State Office for Technical Development organized a conference on *Modeling and Adaptive Control* in Sopron, Hungary, 8-15 July. Forty-three scientists from fourteen East and West countries discussed topics comprising a broad range of issues including theoretical and computational problems as well as applications. Special attention was paid to different approaches to the treatment of nonlinearity, uncertainty and adaptivity in control systems, and to the interaction of dynamics information and feedback control. The meeting served as a forum for presenting recent results as well as for discussing future research directions and cooperation. The proceedings of this meeting will be published by Springer-Verlag.

Multiple Criteria Decision Making (MCDM) has been a very important concept in many practical fields. After remarkable developments in theory and methodology, and the completion of several pilot case studies in recent years, MCDM is now at the stage of real applications and the development of more sophisticated methodologies, such as interactive intelligent decision support systems. The aim of the *7th International Conference on Multiple Criteria Decision Making* was to exchange ideas and to discuss theoretical and practical implications of MCDM. One hundred and sixty participants from twenty-two countries dealt with such topics as: multidimensional evaluation by multiattribute utility analysis; interactive programming methods; fuzzy analysis; utilization of model concepts like expert systems, artificial intelligence, and knowledge engineering; planning, design, control and management; and gaming, with computer demonstrations on the above topics. The meeting, which was held in Kyoto, Japan, from 18 to 22 August, was organized by the International Special Interest Group on MCDM and the Japan Institute of Systems Research. Cosponsors were the US National Science Foundation, the French National Institute of Informatic and Automatic Research (INRIA), IIASA, and a number of Japanese research institutions and industrial organizations. IIASA's delegation consisted of Deputy Director Vitali Kaftanov, Professor Alexander Kurzhanski, Professor Manfred Grauer, Professor Andrzej Lewandowski, and Dr. Istvan Valyi, of the System and Decision Sciences Program. The proceedings of this meeting will be published by Springer-Verlag.

Professor Harrison Brown, the first US representative to IIASA's Council, Chairman of the Finance Committee until November 1975, and the first holder of the IIASA Honorary Scholar title, died in Albuquerque, New Mexico, USA, on 8 December. A highly-respected chemist and political thinker, Professor Brown worked on plutonium chemistry for the Manhattan Project. From 1951 to 1977 he was on the faculty of the California Institute of Technology, first as a professor of geochemistry, and after 1967 with a joint appointment in science and government. But he also worked energetically outside academia: as a member of the US delegation to the first International Atoms for Peace Conference in 1955; as a member of the National Academy of Sciences from 1955 on, including three terms as its Foreign Secretary; as a member and then President of the International Council of Scientific Unions; and as science advisor to presidential candidate Adlai Stevenson. In 1977, Professor Brown took on the challenge of developing and directing the East-West Resource Systems Institute at the East-West Center in Hawaii. IIASA will always remember his dedication, creativity, and sheer intellectual force.

The Third Task Force Meeting on *Applied General Equilibrium Modeling* was held at IIASA on 25-29 August. It was sponsored by the Ford Foundation, and jointly organized by the American Academy of Arts and Sciences, the Department of Economics of Harvard University, the Stockholm School of Economics, the Karl Marx University of Economics, and IIASA. Eighty participants from twenty countries and IIASA met to discuss the application of computable general equilibrium models to international trade policy issues, to development planning, and to tax and sectoral policy analysis (energy, agriculture). More than fifty papers were presented, and it is planned to publish selected papers in a proceedings volume. This meeting was preceded by a *Summer School on Applied General Equilibrium Modeling*, held at IIASA from 4 to 24 August, and led by an international faculty.

The *International Conference on Stochastic Programming*, organized by the Faculty of Mathematics and Physics of Charles University and IIASA, was held in Prague, Czechoslovakia, from 15 to 19 September. This meeting was the latest in the series of IIASA meetings on stochastic optimization. Sixty participants from seventeen countries stressed IIASA's contribution in the field, and discussed the state-of-the-art of stochastic programming, including supporting mathematical theory, applications of stochastic programs, and experience with their numerical solution.

The George Washington University and IIASA's Large International Rivers Project organized a workshop on *The Management of International River Basin Conflicts* in Laxenburg from 22 to 25 September. The meeting, sponsored by the Ford Foundation, brought together thirty-one scientists and policymakers from sixteen countries and IIASA to examine cases of international conflicts hindering socio-economic developments in international river basins, and to formulate ways of facilitating future negotiations in river basins around the world. The publication of the proceedings of the workshop is forthcoming.

The John v. Neumann Society for Computing Sciences, and IIASA, organized the *International Conference on Remote Education and Informatics – Teleteaching '86*, held in Budapest, Hungary, from 20 to 25 October. It was cosponsored by the Hungarian Bureau for Systems Analysis of the State Office for Technical Development and IFIP (International Federation for Information Processing), and was held in cooperation with various European scientific institutions. One hundred and twenty educational and technical experts from seventeen countries discussed and exchanged their experience in the field of remote education on informatics, and demonstrated different teaching materials (books, videos and films, tapes, teaching courses using videotex and other terminals) in order to illustrate remote education systems in their countries.

On 17 November the Third Meeting of IIASA's *Advisory Board* took place under the chairmanship of Mr. Donald Kendall, Chairman of the Executive Committee of Pepsico, USA. The main issues under discussion were the Institute's past, present, and possible future work on technological risk, as well as a review of IIASA's long-term strategy. The next meeting will be held on 10 June 1987.

The 27th meeting of the *IIASA Council* was held on 18-19 November, under the chairmanship of Professor Ognyan Panov (Bulgaria), Vice Chairman of the Council.

Forthcoming Event

The International Life Sciences Institute (ILSI) and IIASA are organizing a conference on *Radionuclides in the Food Chain*, to be held in Laxenburg, Austria, from 2 to 5 November 1987. The meeting will bring together scientists, industrial managers and policy makers from East and West to discuss the various factors involved in the analysis and management of radionuclides in the food chain. It will contribute to the development of a common understanding of the scientific basis of the issue. The scientific and policy perspectives documented at this meeting should provide a sound basis for future reference and contribute significantly to the harmonization of exposure standards for radionuclides in food worldwide. The conference sessions will include: biological effects of ionizing radiation; sources of radioactive contamination; environmental pathways critical to man; risk assessment, identification and quantification of critical factors; comparative effects of radioactive and chemical toxicity; methodology of surveillance procedures; regulatory and control programs; impact of psychological, institutional and cultural factors on response to and management of radioactive contamination; and guidelines for safety evaluation of food and water. For further information please contact Dr. Gerhard Krömer, Conference Coordinator, IIASA.

High baroque and high technology. The first meeting of the Advisory Committee for IIASA's Technology, Economy and Society Program, held in one of the historic rooms of Schloss Laxenburg.

Following the recommendations of its Research Committee, which met on 17 November under the chairmanship of Academician Wolfgang Schirmer (GDR), the Council approved IIASA's Activity Plan and budget for 1987, as presented by Director Thomas H. Lee. The Council also approved guidelines for the financial contributions by National Member Organizations through the year 1990, and endorsed the report of the Task Force on Technological Risk, which was presented by Deputy Director Boris Segerstahl. Following the recommendations of the Council at its 26th meeting in June, IIASA will strengthen its relations with the International Atomic Energy Agency (IAEA), and in particular will organize a workshop on *Safety of Energy Systems*, to be held in March 1987, and a workshop on *Inherently Safe Technological Systems*, to be held in May 1987.

Economic growth is intimately related to structural change, as regards both the commodity composition and the size and direction of commodity and credit flows between countries and regions. The assumption retained in IIASA's Economic Growth and Structural Change Project is that the basic driving forces of economic growth and structural change emanate from within countries and may be measured by population growth, rate of technical progress, and rate of capital accumulation. In 1984, IIASA decided to examine these problems. A joint University of Bonn-IIASA research group was set up, with links to research groups in many countries and international organizations. During the *Conference on Economic Growth and Structural Change*, attended by forty-eight scientists from fifteen countries and held at IIASA from 24-25 November, the results of this research were presented and discussed. It is planned to publish a book in 1987 summarizing the outcome of this research.

The first meeting of IIASA's *Technology, Economy and Society (TES) Advisory Committee* took place in Laxenburg on 24-25 November. Eleven members from ten countries reviewed the achievements of the eight TES Projects to date, presented by the project leaders, and advised on the course of future research directions. The TES Program was received favorably, and it was recommended that there should be a stronger emphasis on the social/societal aspects of the different TES projects. Another viewpoint expressed was the necessity of including approaches other than the technological life cycle concept as the principal basis of the TES Program.

Solving world problems through international cooperation in research was the theme of a conference held in the USA, 5-6 December, in honor of Professor Harvey Brooks of Harvard University, and designed to highlight and present IIASA. The symposium, *New Directions in International Research, Education and Practice*, was initiated and organized by Professor Sven B. Lundstedt at the Ohio State University (OSU) in Columbus, in cooperation with IIASA. Financial support was provided by OSU and IIASA. Professors Thomas H. Lee (USA), Alexander Kurzhanski (USSR), Robert E. Munn (Canada), Howard Raiffa (USA), and James Vaupel (USA) were among presenters illustrating major IIASA programs on Technology, Economy and Society, System and Decision Sciences, the Environment, Population, and International Negotiations.

New Publications

RESEARCH REPORTS

RR-86-001. *Canonical Models and the Law of Requisite Variety.* J.L. Casti. 8 pp. Reprinted from Journal of Optimization Theory and Applications, vol. 46 (1985). Available for a handling charge of 5 US dollars.

RR-86-002. *Integrated Analysis of Acidification in Europe.* J. Alcamo, L. Hordijk, J. Kämäri, P. Kauppi, M. Posch, E. Runca. 18 pp. Reprinted from Journal of Environmental Management, vol. 21 (1985). US $5.

RR-86-003. *Heterogeneity's Ruses: Some Surprising Effects of Selection on Population Dynamics.* J.W. Vaupel, A.I. Yashin. 13 pp. Reprinted from The American Statistician, vol. 39 (1985). US $5.

RR-86-004. *Metaphors for Manufacturing: What Could it be Like to be a Manufacturing System?* J.L. Casti. 33 pp. Reprinted from Technological Forecasting and Social Change, 29, 241-270 (1986). US $5.

RR-86-005. *Atmospheric Computations to Assess Acidification in Europe: Work in Progress.* J. Alcamo, J. Bartnicki, editors. 93 pp. US $10.

RR-86-006. *Thousands of Data at a Glance: Shaded Contour Maps of Demographic Surfaces.* J.W. Vaupel, B. Gambill, A.I Yashin. (forthcoming)

RR-86-007. *From Farm Gate to Food Plate.* J.K. Parikh. 13 pp. Reprinted from Energy Policy, August 1986, 363-372. US $5.

RR-86-008. *Dynamics in Metropolitan Processes and Policies.* B. Johansson, editor. 251 pp. Reprinted from Scandinavian Housing and Planning Research, vol. 2 (1985), pp. 115-251. US $10.

RR-86-009. *Spatial Dynamics and Metropolitan Change.* B. Johansson, editor. 160 pp. Reprinted from Regional Science and Urban Economics, vol. 16 (1985). US $11.

These publications are available from the IIASA Publications Department.

BOOKS

BK-86-001. *Impacts of Artificial Intelligence.* R. Trappl, editor. Published by North-Holland Publishing Co., Amsterdam, New York, Oxford. ISBN: 0-444-87587-5.

BK-86-002. *Systems Analysis in Forestry and Forest Systems.* M.J. Kallio, A.E. Andersson, R. Seppala, A. Morgan, editors. Published by North-Holland Publishing Co., Amsterdam, New York, Oxford. ISBN: 0-444-87648-0.

BK-86-401. *Modeling and Managing Shallow Lake Eutrophication – With Application to Lake Balaton.* L. Somlyódy, G. van Straten, editors. Published by Springer-Verlag, Berlin, Heidelberg, New York, Tokyo. ISBN: 3-540-16227-5.

BK-86-402. *Stochastic Optimization. Proceedings of the International Conference, Kiev, 1984.* V.I. Arkin, A. Shiraev, R.J.-B. Wets, editors. Published by Springer-Verlag, Berlin, Heidelberg, New York, Tokyo. ISBN: 3-540-16659-9.

BK-86-403. *Large-Scale Modeling and Interactive Decision Analysis.* G. Fandel, M. Grauer, A.B. Kurzhanski, A.P. Wierzbicki. Published by Springer-Verlag, Berlin, Heidelberg, New York, Tokyo. ISBN: 3-540-16785-4.

BK-86-901. *Design of Management Systems in USSR Industry: A Systems Approach.* B.Z. Milner, V. Rapoport, L. Yevenko. Published by D. Reidel Publishing Co., Dordrecht, Boston, Lancaster, Tokyo. ISBN: 90-277-2208-0.

BK-86-902. *Adaptive Management of Renewable Resources.* C.J. Walters. Published by Macmillan Publishing Company, New York. ISBN: 0-02-947970-3.

BK-86-903. *Sustainable Development of the Biosphere.* W.C. Clark, R.E. Munn, editors. Published by Cambridge University Press, London, New York, New Rochelle, Melbourne, Sydney. ISBN: 0521-32369-X (hard cover), ISBN: 0521-31185-3 (paperback).

These books are available from your regular supplier and the publishers.

EXECUTIVE REPORTS

ER-86-009. *Migration and Settlement: A Multiregional Comparative Study.* A. Rogers, F. Willekens. 18 pp. US $5.

ER-86-010. *Modeling and Managing Shallow Lake Eutrophication.* L. Somlyódy, G. van Straten. 23 pp. US $5.

ER-86-011. *Insuring and Managing Hazardous Risks: From Seveso to Bhopal and Beyond.* P. Kleindorfer, H.C. Kunreuther, editors. 40 pp. US $5.

ER-86-012. *Adaptive Management of Renewable Resources.* C.J. Walters. 28 pp. US $5.

ER-86-013. *From Hunger Amidst Abundance to Abundance Without Hunger.* K.S. Parikh, W. Tims. 36 pp. US $5.

These publications are available from the IIASA Publications Department.

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- to promote international cooperation in addressing problems arising from social, economic, technological and environmental change;
- to develop and formalize systems analysis and the sciences contributing to it, and to promote the use of the analytical techniques needed to address complex problems;
- to create a network of institutions in the countries with National Member Organizations and elsewhere for joint scientific research;
- to inform policy advisors and decision makers about the application of IIASA's work to current problems.

National Member Organizations

Austria – The Austrian Academy of Sciences; **Bulgaria** – The National Committee for Applied Systems Analysis and Management; **Canada** – The Canadian Committee for IIASA; **Czechoslovakia** – The Committee for IIASA of the Czechoslovak Socialist Republic; **Finland** – The Finnish Committee for IIASA; **France** – The French Association for the Development of Systems Analysis; **German Democratic Republic** – The Academy of Sciences of the German Democratic Republic; **Federal Republic of Germany** – The Association for the Advancement of IIASA; **Hungary** – The Hungarian Committee for Applied Systems Analysis; **Italy** – The National Research Council; **Japan** – the Japan Committee for IIASA; **Netherlands** – The Foundation IIASA-Netherlands; **Poland** – The Polish Academy of Sciences; **Sweden** – The Swedish Council for Planning and Coordination of Research; **Union of Soviet Socialist Republics** – The Academy of Sciences of the Union of Soviet Socialist Republics; **United States of America** – The American Academy of Arts and Sciences.