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Analyzing the World Food Problem

H. de Haen

Hunger and malnutrition are among the greatest problems mankind is facing today. Although worldwide food production has increased during the last three years, a larger number of people are affected by food shortages. A little more than a year ago, IIASA started working on a program on "Food and Agriculture" to study the systems aspects of this truly global problem. Some basic issues involved and IIASA's approach to them is described in the following article.

During the early 1970s, the world went through a series of food crises more serious and widespread than most previous periods of food scarcity. In spite of the comparatively favorable situation that has prevailed more recently, the shock resulting from this experience should not be forgotten, but rather it should stimulate effective measures to prevent a repetition. Owing to crop failures in a great number of countries and rising energy and fertilizer prices, many countries suffered from insufficient food supplies for large parts of their populations and a servere widening of their foreign exchange gap. FAO estimates that even in average years close to 500 million people are underfed. A more exact measurement of the inequality in the distribution of food among different socioeconomic groups would probably reveal an even greater number of malnourished people.

The causes for the instability and the deficient levels of food supplies, and hence appropriate strategies to overcome the problems are manifold. Many different proposals have been made, but no single policy will guarantee a satisfactory solution. Most measures require a rather long time horizon to become effective at all.

Certainly, the heaviest burden for generating a change will lie on the developing economies themselves. Depending on their respective situation (income level, distribution, usable reserves of natural resources), they will need to sustain high rates of growth of agricultural and nonagricultural production and to reduce internal inequalities in the distribution of resources and income. The expected scale of the effective and latent demand for food in the developing countries, compared to realistic estimates of future foreign agricultural trade and of the economic and technical capacities of international food aid leave little doubt that these national measures will need high priority.

Three major problems

International activities and collaboration, however small their relative contribution to the solution of the overall problem may be, are nonetheless of great importance. This is especially evident as far as they are seen as additional and not alternative measures to alleviate hunger. Moreover, their relative importance is probably much higher in the short run than in the long run. The ex-

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perience during recent years and especially during the food crisis revealed clear deficiencies of international food policy in at least three areas: instability of world markets, insecurity of food aid, and deterioration of international trade.

The capacity of bufferstocks has obviously not been sufficient so far to stabilize price movements. International decisions concerning size, financing, localization, and operating rules for those stocks are still to be made. International stabilization policies might have to include also a revision of existing national protection measures in many industrial countries. Those policies, installed to protect domestic consumers and producers against price fluctuations in the world market (e.g., variable levies at the border of the European Community) not only do not help stabilize world markets, but even destabilize them by exporting domestic instability.

Food aid has, in spite of considerable efforts of some countries with undoubtedly humanitarian purposes, still played too much the role of being a useful way to dispose of fluctuating domestic surpluses. Even during years of worldwide scarcity, when food aid was most badly needed, it was reduced in favor of profitable commercial sales. Since then, much has been achieved through bilateral and multilateral cooperation. However, agreements with guaranteed quantities and sufficiently high growth rates and programs to integrate food aid appropriately in national development plans will have to be further developed.

The third problem area where international activities in agriculture need to be improved is international trade of agricultural products. Agreement is comparatively easy on recommendations to reduce protection measures on the side of industrial countries for so-called "noncompeting" tropical goods. The pressure on developed countries to open their markets further for imports of other agricultural products from developing countries (fruit, vegetables, sugar, beef) will, however, most likely become much stronger in the future. Agricultural exports are a main source of foreign exchange for most developing countries. For some of them, those exports also comprise so-called "competing" products, which so far (due to the industrial countries' protectionism) could not be economically mobilized.

In summary, there are more questions than answers in the area of international relations in agriculture. Many hypotheses are not yet empirically tested. Recommendations for certain strategies, however, depend very much on numerical estimates of the expected effects. A reduction of the rate of protection in the EC, for instance, which is frequently called for by economists to improve the allocation efficiency, would undoubtedly–within a medium time horizon--result in a reduction of domestic production and increased world market prices. However, at the current state of empirical knowledge it would be rather difficult to predict what the range of the price increase might be in the long run, what other countries would take over the EC's market share, to what extent, etc. The answer, which would have to be specific for a given product, determines to a great extent the evaluation of such a policy alternative from the standpoint of the EC's development policy goals.

For the future development and analysis of the world food economy the existence of this broad set of international linkages and national feedbacks has two consequences. First, any national policy related to food and agriculture will have to be aware--more so than in the past--of its repercussions on other countries and other policies. Second, analysis will have to be much more concentrated on the international interdepencence of national agricultural sectors than has been done so far. IIASA plans to analyze some of these problems.

Some international modeling efforts

The uncertain future development of the level and distribution of food in the world in connection with fears for an exhaustion of other resources has given rise to an increasing number of international models. The starting point for all of them is the notion of a worldwide interdependence of resource use and distribution as well as a plea for global responsibility bearing. The models differ, however, both in their basic problem interpretation and in their "global welfare" concept.

In spite of a variety of improvements that have been made in this--rather young--research area of international modeling, there are at least four directions in which further research is necessary:

- More emphasis has to be put on the country specific internal structures and the inclusion of information on the effects of various policies on agricultural growth and income distribution. An internationally identical model structure that only allows for differences in variable levels probably does not suffice to capture the differences.
- The national agricultural sector models should be product specific. Otherwise, such important aspects as the effects of a trade liberalization, which depend on product specific supply and demand elasticities and comparative advantages, can hardly be examined.
- The response of third countries to one country's aid and trade policy measures is the result of policy decisions also. Therefore, a complete international model requires that each national model includes a positive component describing the effect of price and income changes on the level of policy instruments (tariffs, subsidies, quotas). This may be done in reduced form models or under explicit consideration of a policy objective function--indeed one of the most difficult tasks where much work needs to be done.
- Finally, one major problem of international concern, closely related to agricultural trade, is the increasing indebtedness of developing countries to industrial countries. A realistic representation of a country's food import capacity

*Prof. Hartwig de Haen from the Institute for Agricultural Economics at the University of Goettingen is not a full-time staff member of IIASA, but is affiliated with the Institute on a cooperative basis to develop country specific agricultural sector models. This article is based on a paper presented last November at the "Agricultural Sector Analysis Seminar No. 2" in Cebu, Philippines. It describes international aspects of IIASA's Food and Agriculture Program. Another aspect of this Program–increase of food production–is dealt with in "SWIM for Silistra" in this issue of Options.

requires that balance of payments and foreign exchange effects of nonagricultural trade are included in the analysis, possibly at a rather high level of aggregation.

The IIASA approach

The IIASA Food and Agriculture Model is an attempt to contribute to some of these open questions. Generally speaking, the objective of IIASA's Food and Agriculture Program is to define and quantify alternative sets of international and national policies that could reduce world hunger within the next 5-15 years

- by exploiting the international interactions between developing and developed nations, as well as among developing nations; and
- by increasing local production in the developing countries.

The range of questions to which the model might contribute answers is broad:

a) What kind and level of investment is needed to achieve a desired level of nutrition?

b) What set of national and international policies would yield an acceptable distribution of food consumption between countries and population groups?

c) What would be the likely effects on production and income in industrial and developing countries of a reduction of frictions in international agricultural trade?

d) What policy measures should be used to stabilize the international markets? What would be the likely distribution of costs and benefits among the nations?

The end product is expected to be a policy analysis model, suitable to project consequences of alternative courses of action, not a model to generate one "optimal" policy set for all countries or even any one country. The model should thus help to indicate and quantify conflicts of interest between industrial and developing countries, importing and exporting countries, and also assess the effects of policies with shorter (food aid) and longer term (structural policies) impacts.

Typical international policies to be analyzed include

- stabilization policies (e.g. international buffer stocks);
- food aid policies (e.g. in kind, concessional loans, etc.).

National agricultural policies in developed countries will be restricted to those with direct international effects (e.g. quotas, tariffs, export subsidies). National policies in developing countries will comprise

- policies with international effects (e.g. export subsidies, fixing foreign exchange for food imports); and
- policies with internal effects (e.g. population policies, tax policies, asset or income redistribution, price subsidies).

Selecting and grouping countries

To make the model operational, a grouping is necessary for countries with relatively small shares in the relevant variables, while an individual representation will be maintained in the most important countries, either because of their high share in world production, trade or consumption, or because a significant nutrition problem exists in those countries. Thus the approach is an attempt to include--in spite of the global character--real world decision units. A stepwise procedure is envisaged:

1. Identify the most important countries covering altogether, say, 80 percent of the world's production, population, consumption, or trade. A rather stable group of 25 countries could be identified.
2. Define a limited number (10-12) of subgroups, representing countries at a similar stage of development, with similar resource bases, nutritional situation, foreign trade structure, and policy alternatives.
3. Choose one important country of each subgroup. Construct a detailed model for this country, estimate parameters for this country, and evaluate the quality of the model.
4. Consider the basic structure of this model to be representative for every country of the same subgroup within the group of 25, and estimate parameters for all these countries on the basis of the respective prototype model structure.
5. Infer from the tested models the structure and parameters of those countries belonging to the "rest of the world".
6. Link all national models to simulate the global system.

The grouping approach is given preference over modeling countries one by one, not only because the international linking would thereby be easier and the number of man years for the project is limited, but also because it seems more convenient to think in terms of some typical constellations of problems than in terms of a great number of single countries with only slightly different problems.

Basic model structure

Each national model will consist of a real world bloc and a policy bloc. In the real world bloc, the technical and behavioral relationships determining the reactions of the producing and consuming units are described. This bloc would comprise resource allocation, production and consumption functions. Among the variables exogenous to this bloc are the instruments of government policy. These instruments are determined endogenously in the policy bloc. The endogenous representation of policies is a necessary model property within an international link. Ohter than in individual national sector models, the level and composition of instruments cannot be determined exogenously. One of the potential benefits of an international linkage is just this: to simulate how the rest of the world would react to one country's trade or internal policies.

Seen from the international markets, the national models react to world market prices with a response of net excess demand, possibly also stock mutation. Within any given period an interactive procedure will be used to achieve consistency between imports and exports for all traded commodities.

Currently, national models are being developed for India, Hungary, Czechoslovakia, and Bulgaria, EC countries, Kenya, Brazil, and the USA. Some otheres are in the planning phase. Moreover, the theoretical and computational foundations for international linkage are being laid.

An important precondition for project success is certainly improved international cooperation between IIASA and research teams working on national agricultural sector models. The flexible approach used allows linkage to any other national model as long as it fulfills the common requirements (dynamic, common commodity list, descriptive, etc.). Hopefully, this joint effort for a global approach may lead to better quantitative proposals for the world food economy, thus helping to improve international cooperation in fighting hunger in the world.

"SWIM" for Silistra

As demand for water increases relative to its supply, the intensity and efficiency of water resources management must be further enhanced. This requires an increase in the degree of detail and sophistication of the analysis of water resources development alternatives to assist in planning, design, and operational decisions. SWIM, the "Silistra Water for Irrigation Model", developed by IIASA's Resources and Environment area in collaboration with the Bulgarian Ministry of Agriculture and Food Industry, is a step in this direction.

Silistra is a region in the North-Eastern part of Bulgaria, covering a territory of about 2,700 square kilometers, with a population of some 200,000. Although water resources in this area are limited, large-scale agricultural development has taken place in recent decades. These agricultural activities are integrated in the "Drustar" agro-industrial complex, which coordinates all individual enterprises dealing with crop production and its processing as well as livestock growing and processing. It is responsible for overall planning, development, and management of the complex.

Special attention is being given to determining the best way of directing future agricultural activities and investments. Water resource planning is of particular importance for at least two reasons:

- A vast irrigation development is to take place in the coming five to ten years to meet the feed requirements of meat and milk producing livestock; hence, to ensure stable agricultural production, a large reliable water supply has to be established in the region.
- Regional water resources are limited to those available from the bordering Danube river. No other rivers exist in Silistra. Ground water is available only in small quantitites at depths exceeding 400 meters, which makes it an insignificant resource.

In the quest for solutions to these difficulties, intensive investigations have been carried out in this region over the past few years. As a result, a number of alternatives for augmenting the available water supply have been proposed. They include construction of reservoirs in various parts of the region, the combined use of pumping stations and reservoirs, constructing long distance canals, and so on. The common characteristic of all alternatives is that firstly, they rely on Danube river water (which is reliable, but which is restricted in use by certain international agreements) and secondly, all of the alternatives are rather costly.

Reducing water demands and costs

Obviously, one way of decreasing the supply cost would be to reduce agricultural water demands for irrigation, which constitute a major part of the demand in the region, while at the same time holding the production targets at the desired level. However, reducing agricultural water demand necessitates an increase of the cost of other input factors to maintain the desired agricultural production level (e.g. more labor, machinery, or fertilizer will be required if less water is used). The problem is: are these costs greater than the water supply cost and where is the point at which the water resources system attains economic efficiency, i.e. the point at which the incremental cost of additional supply is equal to the incremental benefit from demanded water.

> The Silistra study is part of IIASA's research activities in the area of water demand, which strive to extend the methodologies already developed in water demand modeling and apply them to specific cases. SWIM is an effort to model the water demand of a large agricultural region and apply the model to water management planning.

It was this problem that Drs. Ilya Gouevsky and David Maidment* from IIASA's Resources and Environment area tried to tackle within the framework of a large-scale study on modeling and forecasting of water demands, in close collaboration with other research groups at IIASA and the Bulgarian Ministry of Agriculture and Food Industry, and with partial sponsorship by Stiftung Volkswagenwerk. They developed a model that would be able to answer at least some of the questions raised: the "Silistra Water for Irrigation Model", SWIM. The study that led to the construction of SWIM made a thorough analysis of factors that influence both agricultural water demands and associated agricultural production, taking into account the major goal of the Drustar complex, which is to maximize the total agricultural and livestock production within the limited regional resources. In the course of the study the main objectives were focused towards providing an adequate answer to the following questions:

- What is the amount of crops that can be produced by the complex, given various possible volumes of water supply, within the constraints of available resources of other types: labor, machinery, fertilizer, etc.?
- How much area should be developed for irrigation and which crops should be irrigated?
- What is the export-import balance in the complex under favorable or unfavorable weather conditions?
- What is the marginal productivity of water and irrigated land in the complex, i.e. how much would the benefit (or cost) change if one additional unit of water or irrigated land were provided?

A mathematical model

Thus, SWIM has been developed to estimate the amount of water needed for irrigation in the Drustar complex. In the conventional approach to evaluating these water demands, the following method is usually employed:

- the area to be developed is specified;
- the area of each type of crop to be grown with irrigation is decided, taking into account the crop production from nonirrigated land
- considering the weather conditions, the depth of irrigation water which must be supplied for each crop is determined;

*Dr. Ilya Gouevsky from the Institute for Engineering Cybernetics of the Bulgarian Academy of Sciences was at IIASA from August 1974 until December 1977. His research at IIASA concerned development of decision making methodology for planning and operating water resource systems and regional water demand and management. Dr. David Maidment of New Zealand joined IIASA in September 1977 supported by the Rockefeller Foundation to work on regional water demand and management. He completed his stay at the Institute in December 1977.

* the total volume of water needed for the irrigated area is found as the product of the depth required for each crop and the crop's area, summed over all the irrigated crops.

Clearly, this method should be applied a number of times to estimate the effect on water demands of different assumptions concerning the area of land to be developed for irrigation, weather conditions, crop production, etc.

With SWIM, the conventional approach is considerably extended. One can follow the conventional approach, in which case for a given area of irrigated land SWIM determines the optimal crop distribution for maximum production on both irrigated and nonirrigated land and the volume of water needed for irrigation under normal weather or drought conditions. However, SWIM can also operate in the opposite direction: for a given volume of water available, the model can determine the optimal crop distribution, which crops are irrigated, and hence the area of land which should be developed for irrigation. Moreover, since SWIM is computerized, with little extra cost it can be used many times to determine the optimal solution for different assumptions concerning irrigated land area, water availability, weather conditions, etc.

A tool for decision makers

Although the results of SWIM are still rather preliminary, it seems obvious that this method of using available information can be an important and useful tool in the decision-making process of the Drustar complex. As it can be easily used in the field by cooperating with the local authorities and farmers, SWIM is expected to be implemented soon, thus helping to improve the existing procedures in planning this agricultural production complex.

SWIM also might serve as the basis for similar studies to follow: other NMO-countries of IIASA have already indicated that they would like to carry out similar studies.

Looking into the Coal Option

M. Grenon*

Following the first two IIASA Energy Resources Conferences held at Laxenburg in May 1975 (on Models and Methods for Assessing Energy Resources) and in July 1976 (on the Future Supply of Nature-made Petroleum and Gas), IIASA together with the All-Union Institute for Systems Studies of the USSR Academy of Sciences organized the third conference in this series in Moscow in late 1977: some 80 scientists from 16 countries joined in five days of extensive discussions on the prospects of coal as a major energy option.

The conference was more or less evenly divided between technical and economic aspects, and national, international, and global coal policy problems.

Starting from current estimates of coal resources and reserves—more than 10,000 billion tons and 640 billion tons respectively, according to the last survey of the World Energy Conference, it is clear that large and still untouched coal deposits exist on the globe. Reserves and resources are, in fact, continuously being revised upwards as a result of increased world energy prices, as well as of new exploration programs. Although these programs will probably not dramatically change the world distribution of coal, dominated by the three giants, the USSR, the USA, and China, it seems that large coal deposits are progressively being found in various developing countries, thus enabling them to improve their energy situation appreciably.

New mining techniques

Two main types of coal extraction may be applied to mine these huge reserves: underground and surface. Underground mining has now reached its maturity, and has benefited largely from increased mechanization and automation. Hydraulic mining, pioneered in the Soviet Union, is now being experimented with in the USA, Canada, the FRG, and other countries. Over the long term, more radical changes are foreseen—and were reviewed in a provocative paper from the UK National Coal Board—from robots to hydraulic bore hole mining, from microbiological attack to in-situ liquefaction. By far the most advanced of these futuristic, but promising, technologies is in-situ coal gasification, also pioneered in the Soviet Union during the last 3 to 4 decades. There is a growing interest in many countries—Poland, the USA, the FRG, France, etc.—in underground gasification (mining without miners!), including the method of high pressure underground gasification proposed by Belgium, possibly easing the problem of interaction of the in-situ coal process with underground water reservoirs (a WELMM aspect of coal mining*). Should this method succeed, which is not presently known for sure, many coal deposits in the world that are today considered noneconomic or technically not exploitable because of too great a depth would become exploitable, and could dramatically increase world coal reserves.

As organizer of the Conference, the author wants to take this opportunity to express his gratitude to our Soviet hosts, who not only helped to make this Third IIASA Conference on Energy Resources a success in the scientific sense, but also whose hospitality was warm and unforgettable.

Surface mining: gigantism

Pending these long-term prospects, it is foreseen that most of the big increase in world coal production in coming decades will come from surface mining. Here, the trend is towards gigantism. Gigantism of the equipment, to begin with, such as the impressive German bucket wheel excavators able to "eat" 200,000 cubic meters of rock and/or coal per day. And gigantism also of the opencast mines themselves: 10 to 20 million tons per year in the Western USA, 30 to 50 million tons per year in Germany (in the existing Garsdorf mine—the planned Hambach mine in the Rhine area has a potential future production of 100 million tons per year!), and in Siberia: Ekibastusz (coal seam of 130 m thickness) and Kansk-Achinsk.

These giant mines in the Western USA and in Siberia will enable very low production costs—a few dollars per ton compared to the $100/ton price of oil—but raise the difficult problem of long-distance transportation by rail, by pipe-

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*Prof. Michel Grenon, France, has been an international consultant on energy problems and policies. In January 1974 he joined IIASA's Energy Systems Program, where he is in charge of resources assessment and management.

*WELMM is a method developed by the IIASA Energy Systems Program, to compare the overall impacts of alternative energy strategies in terms of the demand for Water, Energy, Land, Materials, and Manpower

Looking into the Coal Option

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line, or by wire after on-site conversion to electricity. It became clear during our Moscow conference that this problem was one of the major factors affecting development of a future potential world coal market: contrary to oil, coal does not seem supply- or resource-constrained, but faces a very difficult transportation problem, both technically and economically. The promising use of pipelines was actively discussed, including the—expensive—proposal to use as a transporting fluid methanol derived on site from the coal in regions lacking adequate water resources (like the Western USA).

Coal's future potential

The second part of the conference** was devoted to reviewing and analyzing the present role of coal and its future prospects in meeting a further increasing energy demand, in line with IIASA's Coal Task Force studies. 16 papers were presented, referring to the situation in the following ten countries: Austria, Czechoslovakia, the FRG, Hungary, India, Japan, Poland, the UK, the USA, and the USSR. The time horizon was short- to medium-term and the main questions thus addressed were those of increasing national reserves; improving present mining techniques; planning of coal production in view of the general energy supply situation of the various national economies; extending consumer markets for coal in order to substitute for larger fractions of the oil and natural gas markets; and protecting the environment from impacts of extended coal production and consumption.

A few common conclusions, in addition to the technical aspects reviewed above, evolved from the presentations and discussions. Among them, the fact that apart from metallurgical applications, coal will mainly expand through its increased use for electricity production. Also, there will be long lead times and very long-term technical choices inherent in the extension of the coal system. Of course, over and above these aspects, the evaluation of the prospects for coal clearly differed according to the general economic and resource situation in the various countries.

A rather consistent outlook on the more long-term and global prospects developed, somewhat in contrast to that for the medium-term and national prospects. Broad interest was shown in synthetic liquid and gaseous fuels, which could be produced for a very long time due to the very large coal resource base. Also, it was clear that the requirements to step up the present world coal trade exceed present national plans and projection. Such an extension is a prerequisite, however, if coal on a global scale is to maintain its present share of roughly 30% of the primary energy supply. Within this framework, liquefaction and gasification technologies depend on an ample and cheap supply of coal, which itself depends heavily on reasonably cheap transportation potential, as already mentioned above.

Finally, emissions of CO_2—the combustion product of coal—were discussed as an important global constraint on an expansion of the long-term coal supply. Worldwide efforts in modeling the climatic consequences of a significant further increase of atmospheric CO_2 point to climatic changes that might possibly occur in the early decades of the next century. Much more work still is needed before the CO_2 risk can reliably be quantified.

Altogether 45 excellent papers were presented and discussed at the Moscow Coal Conference. It is planned to publish these papers commercially with Pergamon Press, as was the case with the previous IIASA Energy Resources Conference on The Future Supply of Nature-made Petroleum and Gas.

**This part of the analysis was written together with Dr. W. Sassin, leader of IIASA's Coal Task Force.

On November 28, 1977, IIASA celebrated it's fifth "birthday" at an open meeting of the IIASA Council at the Vienna Hofburg. The meeting was attended by the Austrian President Dr. Kirchschlaeger, Austrian Ministers Dr. W. Pahr (Foreign Affairs) and Dr. H. Firnberg (Science and Research), official representatives of the Institute's NMO-countries, delegations from the NMOs, members of the international scientific community, and the staff of IIASA.

At this occasion, messages from many Heads of States and Governments reached IIASA, congratulating us for the achievements gained during the five years since the signing of the Charter of IIASA and expressing hope that the Institute's work shall continue as successfully during the coming years. OPTIONS publishes excerpts from these messages.

"The Austrian Government will continue to support the Institute to the best of its ability, and deems itself lucky that the Institute has developed so well, and that its staff clearly feel 'at home' and content."

Dr. Hertha Firnberg,
Minister of Science and Research,
Austria

The Open Council Meeting was followed by a cocktail reception at which we had the pleasure to welcome colleagues from all over the world. Our picture shows Dr. Philip Handler, President of the US Academy of Science (left), together with Dr. R. Levien, Director of IIASA (center), and Prof. J. Gvishiani, Chairman of the IIASA Council (right), toasting to the Institute's future.

News from IIASA

The Fifth Anniversary Open Council Meeting

"As IIASA enters the next exciting stage of its development and brings to the world the first results from this unique experiment in international scientific collaboration, I am happy to assure you of the continuing support and encouragement of the United States."

Jimmy Carter,
President, USA

"At the present time, international cooperation is an objectively necessary precondition for solving global problems; and the establishment of international teams of scientists and specialists and the development of mutually beneficial scientific and technological cooperation on a multilateral basis seem to be promising forms of such cooperation. This is confirmed by the very fact of the creation and successful work of the International Institute for Applied Systems Analysis."

The Council of Ministers of the USSR

"By the acceleration of scientific-technical progress and social development, mankind is confronted with a number of difficult tasks. The decision of the founders of the Institute to bring about an international scientific institute for studying these problems can only be approved."

The Council of Ministers of the
Hungarian People's Republic

"In the five years that have passed since the signing of the Charter of the IIASA, the world has begun to realize not only that East, West, and Third World are affected alike by the problems confronting the modern industrial society, but also—and this is in my view of still greater consequence—that no nation should any longer seek long-term solutions on its own."

Dr. Walter Scheel,
President, FRG

"At a time when we must face complex problems it is essential that the developed nations cooperate in the search for solutions. IIASA is in the forefront of this movement."

Pierre Elliott Trudeau,
Prime Minister, Canada

"...I want to congratulate IIASA for the important contributions which it already has been able to make, during the relatively short period of its existence..."

J.M. den Uyl,
Prime Minister, Netherlands

"Although five years is not a long time in the life of an international organization, we may already say that IIASA has earned the respect of the Czechoslovak scientific community and that it has become a well-known organization in our country."

The Government of the CSSR

"As far as I can see, the Helsinki spirit—if this expression may be used—has been reflected in the best possible way by the activities carried out within the framework of IIASA, which has displayed a firm belief in and a sincere effort towards meeting the problems facing mankind with combined forces."

Urho Kekkonen,
President, Finland

"IIASA has made great contributions so far in such fields as energy resources, ecology, and the environment, but there still remain major global problems to be solved. In congratulating you on your achievements, may I also encourage you to work even more intensely on the projects before you."

Tatsuo Tanaka,
Minister of International Trade
and Industry, Japan

"Although the achievements in science at IIASA already have been of great value: IIASA's greatest significance may prove to be the strengthening of international collaboration by enabling scientists from countries with different economic, social, and political systems to work together."

Jan-Erik Wikstroem,
Minister of Education and
Cultural Affairs, Sweden

Visit of Austrian Minister for Science and Research

On January 20, the Austrian Minister for Science and Research, Dr. Hertha Firnberg, visited the Institute. After a one-hour discussion on IIASA's Austrian Energy/Environment case study carried out last year, Mrs. Firnberg exchanged views with leading IIASA scholars on how to bridge the gap between science and the decision maker.

Our picture shows Minister Firnberg meeting two Austrian members of the IIASA research group that worked on the Energy/Environment case study, Erwin Poenitz and Alois Hoelzl. Also present were Prof. Wolf Haefele, head of IIASA's Energy Systems Program and Deputy Director (second from right) and Dr. Roger Levien, Director of IIASA (far right).

Recently Published

Collaborative Publications

CP-77-007, Optimization Applied to Transportation Systems, H. Strobel, R. Genser, M. Etschmaier, editors, December 1977, $9.20

CP-77-008, Modeling Health Care Systems, E.N. Shigan, R. Gibbs, editors, November 1977, $5.00

CP-77-009, Climate and Solar Energy Conversion: Proceedings of a IIASA Workshop, December 8-10, 1976, J. Williams, G. Kromer, J. Weingart, editors, December 1977, $6.40

CP-77-010, Computer Applications in the Steel Industry: Control of Basic Oxygen Furnaces and Integrated Management Systems in Large Plants, G.D. Surguchov, editor, $10.80

Research Reports

RR-77-020, Power from Glaciers: The Hydropower Potential of Greenland's Glacial Waters, R. Partl, November 1977, $3.50

RR-77-021, Software Package for Economic Modelling, M. Norman, November 1977, $5.40

RR-77-022, Macrodynamics of Technological Change: Market Penetration by New Technologies, V. Peterka, November 1977, $5.60

RR-77-023, Normative Modelling in Demo-Economics, F. Willekens, A. Rogers, December 1977, $3.50

RR-77-024, Food and Energy Choices for India: A Model for Energy Planning with Endogenous Demand, K.S. Parikh, T.N. Srinivasan, December 1977, $2.50

Research Memoranda

RM-77-046, The Japanese Urban System During a Period of Rapid Economic Development, N.J. Glickman, October 1977, $4.80

RM-77-047, The Management of the Japanese Urban System: Regional Development and Regional Planning in Postwar Japan, N.J. Glickman, October 1977, $3.50

RM-77-048, Financing the Japanese Urban System: Local Public Finance and Intergovernmental Relations, N.J. Glickman, October 1977, $3.50

RM-77-049, Health Care System Models: A Review, P. Fleissner, A.A. Klementiev, October 1977, $4.50

RM-77-050, How Systems Analysts Can Provide More Effective Assistance to the Policy Maker, K.R. Hammond, J.K. Klitz, R.I. Cook, October 1977, $3.50

RM-77-051, International Trade Policies in Models of Barter Exchange, M.A. Keyzer, October 1977, $1.50

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