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options

International Institute for Applied Systems Analysis December '90

"The solution lies in abandoning the search for halfway houses, in abandoning the dream of a regulated market economy."

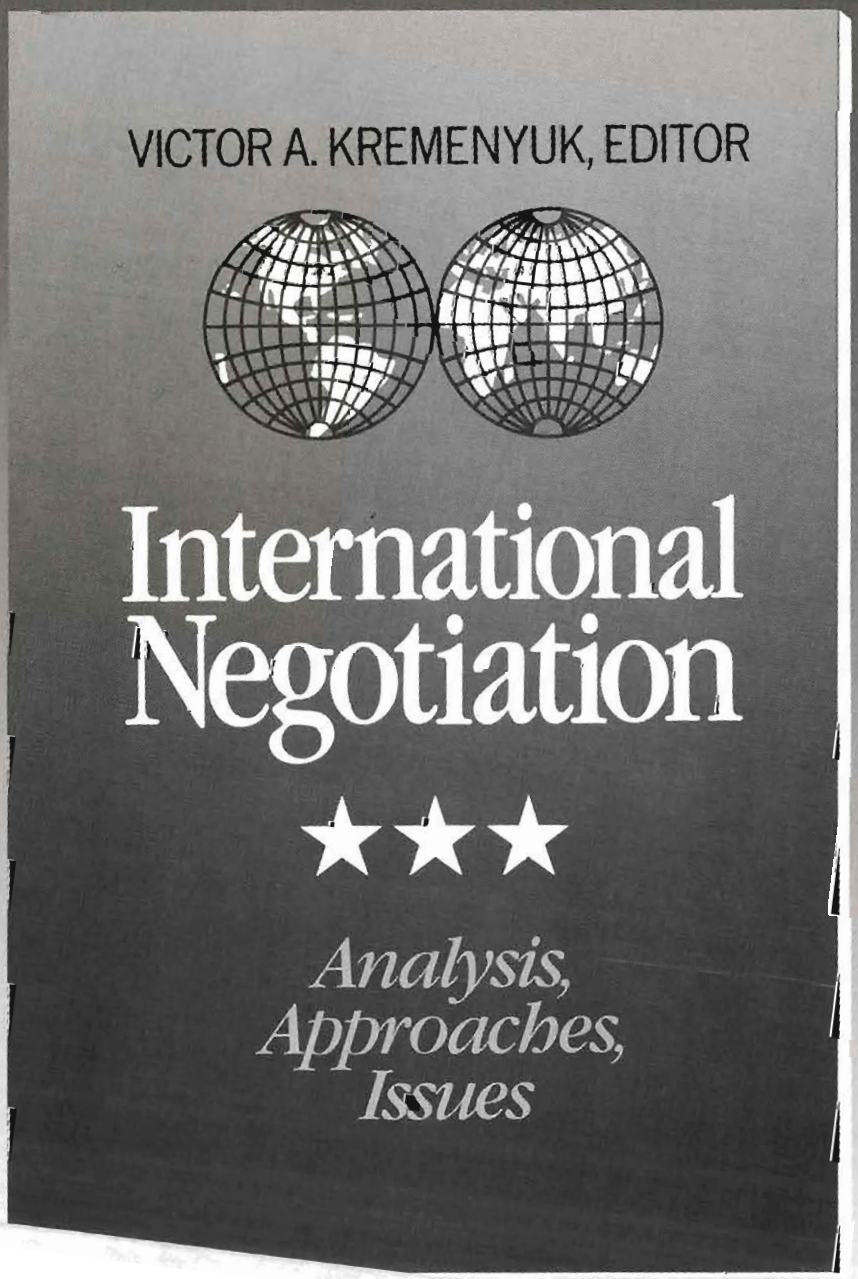
Some of the world's most respected economists give their prescription for the Soviet economy.

IIASA BOOKS

This monograph, born of a collaboration of negotiation experts and practitioners from 10 countries, offers a comprehensive overview and comparison of the latest conceptual frameworks, analytical approaches, and applications in the field of international negotiation.

International Negotiation
Analysis, Approaches, Issues

Victor A. Kremenyuk, editor
Jossey-Bass Publishers



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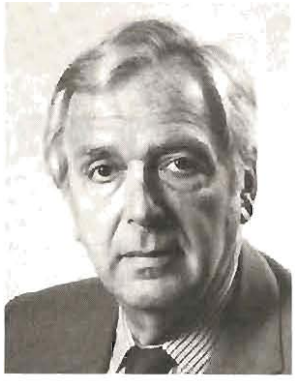
IIASA is an international research institution which draws on the scientific and financial resources of member organizations to address problems of global significance.

Used worldwide, IIASA's results and products have established IIASA as a frontrunner in applying systems analysis to the examination of international issues.

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; *Czech and Slovak Federal Republic* – The Committee for IIASA of the Czech and Slovak Federal Republic; *Finland* – The Finnish Committee for IIASA; *France* – The French Association for the Development of Systems Analysis; *Germany* – The Association for the Advancement of IIASA; *Hungary* – The Hungarian Committee for Applied Systems Analysis; *Italy* – The National Research Council and the National Commission for Nuclear and Alternative Energy Sources; *Japan* – The Japan Committee for IIASA; *Netherlands* – Netherlands Organization for Scientific Research (NWO); *Poland* – The Polish Academy of Sciences; *Sweden* – The Swedish Council for Planning and Coordination of Research (FRN); *Union of Soviet Socialists Republics* – The Academy of Sciences of the Union of Soviet Socialist Republics; *The United States of America* – The American Academy of Arts and Sciences.

EDITORIAL



This issue of Options offers glimpses of three projects that together reveal a lot about IIASA; its flexibility, its uniqueness, and its priorities.

IIASA's project on Economic Reform and Integration had an extraordinary origin. It began late in 1989, when Soviet economist Stanislav Shatalin asked IIASA to create a forum that would allow Soviet reformers to trade ideas with Western economists. Within months some of the West's best-known economists had agreed to work alongside leading Soviet reformers. This magazine gives an edited version of a remarkable memorandum that summarizes their thoughts on the Soviet economic crisis, and their recommendations on how to solve it.

The project demonstrates the value of IIASA's unique 18-year heritage of East-West collaboration; Academician Shatalin turned to IIASA in part because of its history of nonpartisan research. It also shows the institute's ability to respond rapidly and imaginatively to requests from member countries. Indeed, the project was conceived initially not as research in any traditional sense, but as an unbiased sounding board for Soviet reformers. With that mission accomplished, the project will now focus on sustained, comparative research on issues related to the transition from central planning to a market economy.

The magazine also touches on another issue of keen interest at IIASA, the prospect of global warming. It summarizes a study that asks some tough questions about responsibility for the rise of atmospheric CO_2, and about the difficulty of fairly allocating cuts in carbon emissions.

If the ERI Project underscores IIASA's capacity to call on world-renowned researchers, the carbon study shows its ability to attract new talent. The study's author is Yasumasa Fujii, 25, who participated in IIASA's 1990 Young Scientists Summer Program, which since 1977 has brought outstanding doctoral candidates and recent PhD recipients to Laxenburg each summer to work with IIASA scholars.

Lastly, this issue outlines the new direction of the Project on the Processes of International Negotation. This is a natural field of study for IIASA, given that many of the problems and issues that concern us can be resolved only through international co-operation.

Economic reform, carbon quotas, international negotiations we hope that the following pages give you an idea of IIASA's ability and willingness to tackle a variety of important subjects, in a variety of ways.

Peter E. de Jánosi
Director

CONTENTS

FEATURE

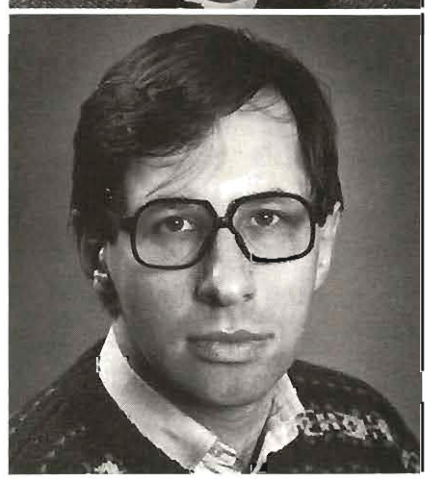
Steps on the Road to Economic Reform

On the following pages is an edited version of a remarkable document. The original is an 18-page memorandum developed by the chairmen of five study groups comprising some 50 eminent economists. They came together last summer in a small town in Hungary from the United States, Eastern and Western Europe, and Japan under the auspices of IIASA to discuss what must be done to solve the economic crisis in the Soviet Union. More generally, they were there to ponder one of the great economic issues of our time: the transition of formerly socialist countries from central planning to market economies.

The meeting traces its origin to a request from an official of the progenitor of all planned economies, the Soviet Union. During a visit to IIASA late in 1989, Soviet economist Stanislav Shatalin, a member of the USSR Presidential Council, asked Friedrich Schmidt-Bleek, Leader of IIASA's Technology, Economy and Society Program, if the institute could set up a mechanism that would allow Soviet reformers to trade ideas with leading Western economists. The resulting Project on Economic Reform and Integration (ERI) took shape quickly.

Following Shatalin's 1989 visit to IIASA, Soviet and Western economists met in December and March to plan the project. They agreed to structure it around five working groups on capital market and privatization; labor market and employment; opening of the economy; economic stabilization; and prices and competition. Yale University economist Merton Peck was asked to head the project and Soviet economist Petr Aven, an IIASA scholar, to act as co-ordinator.

On July 23, Peck and Aven were joined in Sopron, Hungary, by some 50 economists from the United States, Eastern and Western Europe, and Japan, plus about 15 Soviet experts headed by Eugeny Yasin, department chief of the USSR State Commission on Economic Reform. By all accounts, the meeting that followed was extraordinary. For two weeks some of the best economists in the world freely discussed economic reform in daytime sessions and later during informal meetings. Within days, most of the working group chairmen had sent draft reports to Moscow. Yasin and others said later that the Sopron discussions made important contributions to the drafting of the 500-Day Plan for economic reform.



Peck (above); Aven: a unique exercise

In November Peck, Aven, Yasin and the five working group chairmen were joined in New Haven, USA, by US economists Barry Bosworth and Thomas Richardson. The main outcome of the meeting was an 18-page memorandum stressing the need for immediate action to address the Soviet economic crisis. The memorandum reflected the discussions at the Sopron Conference, and also took into account subsequent developments in the Soviet Union.

A full text of the memorandum is available from IIASA. The institute also expects to publish a book later this year giving a comprehensive review of Soviet reform efforts. The book is to include chapters summarizing the discussions of the five ERI working groups, a section comparing the Sopron papers with other reform proposals, and a discussion of Soviet economic reforms since 1985.

From the beginning, ERI was intended to look not just at the Soviet situation, but more broadly at issues stemming from the transition to market systems in all Eastern European countries. Members of the ERI Project have twice held discussions with Czechoslovakian officials. And in October they held two international workshops on themes related to transition. The first, held in Varna, Bulgaria, attracted more than 50 people, including government and industry officials from all six Eastern Europe countries, to discuss convertibility of currency. A second workshop in Socchi, USSR, focused on statistical measures for economies in transition. Proceedings of both workshops will be published.

These workshops foreshadowed the course of the ERI Project. In future, it will focus less on short-term advice—although this will remain a part of the project—and more on sustained research regarding transitions from central planning to free markets. ■

The Soviet Economic Crisis: Steps to Avert Collapse

The Soviet Union faces a worsening economic crisis that makes it essential to complete market reforms, stabilize the budget and credit, and open the economy. This memorandum lays out reforms that must be taken in the next few months if the Soviet economy is to arrest and reverse the economic collapse that is underway.

INTRODUCTION

The symptoms of repressed inflation become more acute every day. State shops have empty shelves, citizens and enterprises hoard goods and materials, trade within the Soviet Union deteriorates toward barter, and the ruble buys little. The real gross national product has fallen sharply in 1990.

Reforms in the last five years have neither created a market system nor improved the planning system. Any economic system needs a mechanism to coordinate and discipline its enterprise; no effective system now exists. Enterprises have been partially freed, but the incentives and competition necessary for effective markets have not been introduced. The banking system allows ballooning credit and sets no constraints on enterprise spending.

Prices at the procurement and wholesale level have been raised, but retail prices are still frozen. Such partial liberalization has meant substantial increases in state subsidies, adding to a government deficit that is already over 10 percent of the gross national product.

The solution lies in abandoning the search for halfway houses, in abandoning the dream of a regulated market economy. All the reform plans considered in the last year recognize the need for a market system. What has not been recognized is that it takes a few bold but simple steps to make a market system effective.

The Soviet Union now has the large, unified market that has been so successful in America and has taken Western Europe decades to achieve. The forces of separatism, now so pervasive, threaten to destroy it. Trade barriers would be particularly costly for the Soviet Union because its plants and facilities have been built on the basis of geographic specialization and exchange across the unified market.

Proposals for Reform

The time for careful sequencing of reforms is past. The following five measures must be taken simultaneously and, in view of the present crisis, as soon as possible, that is, early in 1991:

- Liberalize prices
- Corporatize enterprises
- Stabilize government spending and restrict credit
- Moderate the social costs of unemployment
- Open the economy to competition, both internally and internationally

Each measure reinforces the others. If adopted together, the five can be successful; if adopted singly or over time, they are doomed to failure.

I. LIBERALIZE PRICES

To liberalize means allowing sellers to set prices. Sellers will set prices that cover their costs; they will no longer require state subsidies. Sellers will also set market-clearing prices—those that equate supply and demand—and in this way eliminate the long lines before shops and the frantic search by consumers for goods.

The Soviet Union has already freed many prices. On January 1, 1991, all wholesale prices are to be freed of central control, along with prices at which enterprises sell to one another. Retail prices, however, remain controlled for more than 80 percent of retail sales. The government subsidizes the difference between wholesale and retail prices, adding to the budget deficit.

Retail prices must increase. Experience shows that administrative price reforms do not help.

The Impact of Price Liberalization

Freeing prices will lead to immediate and serious price increases for most goods, threatening to trigger inflation, and lowering real incomes. It is important to recognize, however, that grey- or black-market prices are already at market-clearing levels, and are likely to fall with liberalization.

The serious threat to the Soviet economy is not the one-time price jump following liberalization, but the possibility that this jump would set off a wage-price spiral in which price increases lead to wage increases that in turn lead to further price increases. Only tough macroeconomic stabilization policies can prevent the one-time price jump from turning into hyperinflation.

Basic necessities can be guaranteed to low-income households and pensioners at prices they can afford, either by distributing coupons for minimum quantities or by controlling prices of a few items such as bread, milk and cheap meat. Such controls might be most effectively administered by the Republics or localities. ▷

The Benefits of Liberalization

First and foremost, liberalization means that rubles will be able to buy things. Currently that is not so. Goods are disappearing from store shelves, and Republics and localities are driven to ration basic goods like soap, meat, bread and cigarettes. The ruble is less and less convertible **internally** by Soviet residents into Soviet goods and services. Trade between localities has shifted to a complex and inefficient barter system.

Freeing prices makes the ruble convertible once again. It brings goods from the back of the shop, where they are sold illegally for high prices to a select few, to the front, available to all willing to pay the now higher higher prices.

Price liberalization also contributes to economic stabilization, which requires reducing the growth of money incomes. That requires reducing the budget deficit and price liberalization. Freeing prices eliminates many of the state subsidies that add to the deficit.

Finally, it sets the stage for greater economic efficiency by giving enterprises an incentive to serve consumers. In time, competition among enterprises will lead to improved productivity—the only possible basis for improving the standard of living.

II. CORPORATIZE STATE ENTERPRISES

To be effective, liberalization of prices requires that enterprises be converted to independent, self-financing, profit-maximizing organizations. We call the most important step **corporatization**. This is distinct from privatization, which will require more time.

The key elements of corporatization are independence and financial autonomy for enterprises. Independence means all enterprises must have authority to set prices, output, and wages, as well as determine inputs and financing. Financial autonomy means that they can obtain money to pay workers, build plants, buy equipment, and pay suppliers from only three sources: sale of products, borrowing from banks at realistic interest rates, or by selling their assets. Enterprises must know that unprofitability ultimately means bankruptcy for the firm and economic ruin for the managers.

The possibility of bankruptcy is the stick of the market system; the system's carrot is profit. Enterprises must retain a portion of their profits. Corporate tax rates must be uniform across enterprises, non-negotiable, and low enough to leave a significant reward for success.

There are three preconditions for corporatization. First, the government must enact and enforce laws of property. There must be clear rules for ownership transfer and a system of contract enforcement. Creditors must have the right to seize the assets of debtors. Second, banks must refuse to issue credit to enterprises that have poor economic prospects. Third, there must be rules of bankruptcy and liquidation.

Steps in Corporatization of Large State Enterprises

The joint stock company is the best organizational form for making large state enterprises independent and self-financing. As initial owners of the capital stock, governments should create Property Management Agencies (PMA) of the Union, Republics, and localities. The appropriate government level will depend in part on the type of company and in part on a political decision as to the distribution of ownership.

The PMA should behave as a traditional stockholder. It must select directors on the basis of competence; it must protect against abuses of managerial discretion while avoiding interference with day-to-day operations; it must resist political interference with the firm; it must not seek subsidies for failing corporations. This asks much of the property agencies, but fulfilling these responsibilities is essential to a market economy.

An enterprise transformed into a joint-stock company will have the power to decide on prices, production, and product mix; on inputs of labor, materials, and capital; and on the level and financing of investment. It will have the right to enter freely into contracts with government, other enterprises, and foreign entities. It will have the right to hire and fire workers. All these rights will, of course, be subject to the laws of the land, but those laws must not preclude the discretion generally provided businesses in market economies.

Corporatization can be done quickly—in a month if necessary—once the division of ownership among governments has been resolved. The existing management could serve as the initial directors. Privatization should be the ultimate goal, but it takes time. Corporatization is a necessary interim compromise.

The Monopoly Problem

Many state enterprises are monopolies, but reform should not be postponed until effective competition is established. Nor should most monopolies be subject to special price controls. The one exception would be natural monopolies such as the railroads, some communications services, or the local distribution of electricity, water, or gas.

In a market system, high profits attract rivals and thereby sow the seeds of destruction of the monopoly that made them possible. Enterprises must be free to enter any market they wish. Opening the economy to the competition of imports will further limit monopoly power.

Small Business and Agriculture

Corporatization applies to large enterprises. Small businesses such as retailing, services, and small-scale manufacturing, can be quickly privatized by sale or lease. The resulting competition would improve consumer welfare quickly at little cost. To encourage new entries, all requirements to enter new markets or activities should be abolished, except the minimum

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Participants in the Economic Reform and Integration Project conference held in Sopron, Hungary, from July 23 to August 8, 1990 (page 4). Also present at the conference were Friedrich Schmidt-Bleek, Leader of IIASA's Technology, Economy and Society Program; Merton Peck, ERI Project Leader; Petr Aven, ERI Project Coordinator; and Eugeny Yasin, Senior Soviet Adviser.

necessary to protect public health and safety (e.g., sanitary standards for restaurants and food stores).

Agriculture is a mixed case. Individuals should be allowed to own or lease land for small-scale farming for fruit, vegetables, meat and dairy production. Large agricultural organizations are likely to be most efficient in grain production, and such units should be converted to joint stock companies along the lines discussed above.

III. STABILIZE SPENDING AND RESTRICT CREDIT

In addition to the microeconomic issues of pricing, the Soviet Union today faces a huge and growing government budget deficit; money incomes that are rising much more rapidly than output; worsening open and repressed inflation; and a flight from the ruble.

In a free market, rising incomes and stagnant production would cause a rise in prices—inflation. With retail prices fixed, increased demand manifests itself as bare shelves. Once shortages appear, hoarding takes over as people begin to use goods as a store of value. Republics are driven to ration basic goods, and the ruble becomes less and less convertible internally.

These are the familiar symptoms of **severe repressed inflation**. The causes fall into three categories:

- The ruble overhang. Households have excess spending power in currency and savings accounts.

- The budget deficit. Budget deficits add continuously to the ruble overhang. The official deficit, currently 10 percent of GNP, will explode in 1991 if retail prices are not raised when wholesale prices are liberalized.

- Hoarding. As people come to expect price increases, the result is hoarding and attempts to flee the ruble.

Stabilization Policies in the Short Run

The immediate threat is that the deterioration of economic activity and disruption of the distribution system will get worse: fewer goods in state stores, greater divergence between official and black-market prices, and spiraling inflation. With the breakdown of the price system, Republics and localities will turn increasingly to rationing, coupons, substitute currencies, border controls, and restrictions on movement of goods.

It will be difficult to avoid a major increase in prices. If liberalization of prices is postponed, flight from the ruble will intensify, inflation will accelerate, and hyperinflation will be a real possibility. The best hope for avoiding total breakdown is free prices and tough budget and credit policies. Stabilization policies should focus on restraining the growth of money incomes.

We recommend the following:

- The first priority is to reduce the budget deficit. A balanced budget would effectively control the growth of incomes. The most important action in the short run would be to liberalize prices and remove subsidies; without such a measure the deficit will rise in 1991 by at least 100 billion rubles.

More generally, we recommend spending cuts rather than tax increases. There is room to reduce subsidies to unprofitable industries. Central investments can be cut. The allocation of hard currency might be immediately reformed, say by hard-currency auctions.

- A substantial tightening of credit is essential. Gosbank must extend credit only to firms that can repay it. In addition, the banking system must place overall credit limits on the enterprise sector, much as western central banks do. It is neither possible nor necessary in the short run to privatize the banking system in order to tighten credit, though privatization should be a long-run goal.

- The current tax structure is on the whole viable, except that all taxes set in rubles per unit must be replaced by *ad valorem* taxes set as percentages of product prices. This will prevent erosion of real taxes as prices rise. ▷

We recommend against compensating various groups for price increases through indexing. The more the system is indexed, the greater is the threat of hyperinflation. The only exception we recommend is for payments to low-income households, like pensioners.

IV. MODERATE SOCIAL COSTS

Perhaps the most serious adverse consequence of these essential reforms will be a sharp increase in open unemployment. Unemployment compensation is the only way of reconciling the need to reverse the disintegration of the Soviet economy with the prevention of severe hardships for workers in the transition.

Given the diversity within the Soviet Union, it would be desirable to have Republics and localities administer the compensation system. These governments must have tax revenues necessary to meet the cost.

V. OPEN THE ECONOMY INTERNATIONALLY

There are compelling reasons to do this as soon as possible. The principal reason is to expose Soviet firms to the world marketplace. Foreign competitors would set a price and quality standard that Soviet firms must match to sell at home or abroad.

Second, allowing convertibility of the ruble would ensure that Soviet prices move to market-clearing levels. Foreign firms are adept at finding the combination of prices, quantity, and quality appropriate to each country; they will force newly corporatized Soviet firms to align internal prices with world prices.

Third, opening the economy will provide a wide array of goods to workers, albeit at high prices.

Finally, foreign competition will effectively and immediately restrain the exercise of monopoly power.

We recommend the following:

- The ruble should become freely convertible into other currencies for all "current" transactions. Soviet and foreign enterprises would be allowed to buy and sell rubles and foreign currencies for the purposes of export and import of goods and services. Foreign firms would be free to sell in the Soviet market, to hold ruble accounts and to repatriate profits. We propose an initial limitation on "capital" transactions, however. Soviet residents would not be permitted to hold foreign securities or large quantities of foreign currencies.

- The ruble should be allowed to float, subject to government intervention to limit severe exchange-rate fluctuations. A fixed exchange rate for Western currencies is desirable, but infeasible in the near term because of the prospect of severe inflation.

Depreciation upon floating is both inevitable and desirable. An undervalued ruble ensures that doing business in the Soviet Union would become a bargain, attracting foreign firms and technology.

- A uniform tariff on all imports of about 10 percent should replace import quotas. It may be desirable to subsidize importation as well as domestic production of some key food products, such as bread and vegetable oils. Energy exports, particularly oil and gas, may also need to have a temporary export tax to cushion domestic consumers from large price increases, although domestic energy prices should rise eventually to world levels.

Economic Union

The centrifugal forces leading Republics and localities to seize control and demand autonomy arise from the breakdown of the current administrative system. It is futile to try to negotiate agreements between the Union and the Republics in a world where the terms of trade—prices—are so distorted, where trade is involuntary, and where everyone feels exploited.

There are powerful gains from maintaining a free-trade zone when the price mechanism is functioning effectively. However, only when prices are freed and reflect genuine scarcities and costs, and the ruble regains value and stability, will economic conditions be propitious for forging a political consensus about the shape of the new Soviet Union.

VI. CONCLUSION

To succeed, these measures must be explained to the parliament, to the media, and to the people. Successful adoption will require a firm, wholehearted, and consistent commitment by Soviet leaders and an accord with the leaders of the Republics.

We recognize that the solution will be painful and controversial. Moreover, it is not possible to provide an ironclad guarantee that these measures will cure the nation's ailments. But we can say with confidence that history shows again and again that allowing markets to direct an economy offers the best hope for resuscitating the sick economy and for raising living standards. ■

The original memorandum was written by:

- *Merton Peck (Chairman) Yale University, USA; former member of the US President's Council of Economic Advisers*
- *Wil Albeda, MERIT, Netherlands; former Minister of Labor, President of the National Council on Economic Policy*
- *Barry Bosworth, Brookings Institution, USA; former Director of the US Government's Council on Wage-Price Stability*
- *Richard Cooper, Harvard University, USA; former US Undersecretary of State for Economic Affairs*
- *Alfred Kahn, Cornell University, USA; former US Presidential Adviser on Inflation*
- *William Nordhaus, Yale University, USA; former member of the US President's Council of Economic Advisers*
- *Thomas Richardson, Yale University, USA*
- *Kimio Uno, Keio University, Japan*

FEATURE

Looking Anew at Negotiation

The rejuvenation of IIASA's Project on the Processes of International Negotiation (PIN) is starting to yield an ambitious series of new ventures. Since Bertram Spector took over the project last August, new activities have been launched ranging from a study of cultural factors in negotiations, to assessment of creativity techniques aimed at breaking stalemates, to an analysis of national objectives and positions leading up to the 1992 UN World Conference on Environment and Development.

At the same time, the project is witnessing completion of two books. The just published *International Negotiation: Analysis, Approaches, Issues* (Jossey-Bass Publishers, San Francisco), is a 486-page stock-taking of the state of the art. The book examines the process of negotiation from different levels and approaches, from structure and strategy to application of game theory and content analysis. It also addresses major negotiations, including arms control, trade talks, and negotiations with terrorists; and concludes with a section on the education and training of negotiators.

The second book will focus on the factors that distinguish international environmental negotiations: the insignificance of boundaries, scientific uncertainty, and high public interest, among other things. Experienced negotiators and researchers from industrialized and developing countries will describe and analyze recent and ongoing negotiations on ozone and global warming, nuclear accidents, acid rain, sea pollution, inland water, the Sahel, and biological diversity. The editor, Gunnar Sjöstedt, expects it to be published late in 1991.

Sjöstedt is a member of the PIN Project Steering Committee, as is Victor Kremenyuk, editor of *International Negotiation*. The other members are: Guy-Olivier Faure; Winfried Lang; Jeffrey Rubin; Wilfried Siebe; and I. William Zartman. This group of seven researchers from six countries has guided the PIN Project since 1988.

One important new project is designed to complement work underway by other IIASA researchers, who are preparing a report for the secretariat of the 1992 UN Conference on Environment and Development. Spector and his colleagues will attempt to identify for the secretariat likely opportunities and pitfalls in the upcoming conference. In addition, they will analyze national and regional interests to assess the likely impact of coalition dynamics on the upcoming negotiations. The UNCED Secretariat has pledged its support for the project.

Work has also begun on two conceptual studies, both of which are expected to produce books. The first will highlight the special characteristics of multilateral negotiations: coalition-building, the role of international organizations, and so on. The second will focus on the effect of cultural factors on negotiations. Cultural anthropologists who are experts on selected disputes involving water rights will assess the role of culture in the negotiations.

Spector and the PIN Steering Committee are also exploring ways to move the project beyond pure scholarly research into a down-to-earth dialogue with practitioners. A working group on negotiation training will consider ways to disseminate and exchange information on training materials for diplomats and universities, primarily in Eastern Europe. One project already approved is a quarterly newsletter, to be called PIN Points. A second working group will discuss applications of systems analysis tools and techniques, such as the MC-BARG bargaining support software developed by IIASA's System and Decision Sciences Program.

Lastly, Spector expects to set up a Negotiation Laboratory to serve as a venue for systematic testing of hypotheses and propositions concerning the behavioral processes of negotiations. Noted US researcher Daniel Druckman will join the PIN staff for three months in 1991 to initiate studies in the lab. ■

Sjöstedt (left), Spector

FEATURE

CO_2: A Balancing of Accounts

Who is responsible for the buildup of atmospheric CO_2 that has sparked fears of global warming? And if people can agree on the need to reduce carbon emissions, what would be a fair way to allocate emission quotas? Those two questions will loom large when negotiators gather in Washington this winter to begin historic talks on the issue of global climate change. They are also at the heart of a study completed recently by Yasumasa Fujii. The study recently won for him one of three coveted Peccei Scholarships awarded by IIASA for outstanding work in its Young Scientists Summer Program.

While participating in the 1990 YSSP, Fujii developed a novel approach to the problem of climate change and international burden-sharing. The result is a working paper that offers fresh insights into the question of historic contributions to the CO_2 buildup, and the problem of how to allocate future emissions fairly.

Patterns of energy use are deeply rooted in technology, geography, and culture.

Fujii's paper is based on a system of inter-generational carbon accounts. The scheme is founded on a principle of rigorous equity: all people born from the onset of the Industrial Revolution to the year 2100 would have an equal carbon emission quota, regardless of where or when they lived. Fujii adopted this principle in part to address the concerns of developing nations, which point out that they have enjoyed few of the fruits of industrialization—the main cause of the carbon buildup—yet they are now being asked to share the burden of carbon cutbacks. Their concerns are bound to be a key issue in the coming negotiations.

Under Fujii's scheme, present and future generations of Africans, Asians, and Latin Americans would inherit the unspent carbon quotas of their 19th- and 20th-century forerunners. But his calculations indicate that this inheritance may be of little benefit to poorer nations, given trends in population growth. Fujii concluded that continued high population growth in the developing world would quickly overwhelm any emission credits from past generations, leaving developing regions in the 21st century with per capita quotas not significantly greater than for most of the developed world.

His study, like other energy-related work underway at IIASA, reflects mounting concern about the consequences of changes in the atmosphere. Devastation of forests and crops, flooding of islands and sea coasts, great storms and great droughts—these are some of the predicted upshots of climate change brought on by manmade

changes in the atmosphere. Skeptics point out that all projections of climate change, let alone its consequences, will remain suspect until science better understands the complex systems that regulate climate.

Some scientists contend that waiting for that understanding entails a colossal gamble. In 1986 the World Meteorological Organization concluded: "We are conducting one giant experiment on a global scale by increasing the concentration of trace gases in the atmosphere without knowing the consequences." The opening of negotiations this winter in Washington is evidence of fears that the "giant experiment" is too risky, and should be stopped.

If those negotiations are to succeed, they must address the question of energy use. The main greenhouse gases put in the atmosphere by human activity are carbon dioxide (CO_2), methane, chlorofluorocarbons, nitrous oxide, and ozone. CO_2 is the biggest problem, accounting for about half the addition to natural global warming potential. And the biggest source of increased CO_2, as well as nitrous oxide, is the burning of fossil fuels for energy. The 1990 report of the Intergovernmental Panel on Climate Change estimates that energy use accounts for 46 percent of mankind's yearly greenhouse-gas emissions, and predicts that the figure will rise to 65 percent.

Clearly, control of global warming will depend on control of energy use. The most obvious form of control—burning fewer fossil fuels—would yield great benefits in areas unrelated to global warming, notably in the control of pollution.

Part of the the solution lies in greater energy efficiency. Another part lies in a shift to energy sources that emit fewer greenhouse gases. But projections at IIASA and elsewhere indicate that even if these measures and others are vigorously pursued, the buildup of greenhouse gases will continue.

The driving factor will be population. Various projections indicate that high growth rates in the developing world, especially Africa, will cause the world's population to double or even triple within 50 years. Leaders of many poor countries insist that economic and social development take priority over other issues, which in practice may mean a growing consumption of energy.

The question, then, is not whether atmospheric greenhouse gases will increase, but how quickly and by how much. In light of this, international agreements to limit carbon emissions could be vitally important.

Fujii's working paper is one contribution to the debate on how to share the burden of restraint. It offers no predictions, but rather "hypothetical calculations designed to illustrate equity issues inherent in any emissions reduction strategy." As noted above, it is framed around a simple principle: "Everyone has an equal emission quota irrespective of the country he or she lives in and the generation he or she belongs to."

Fujii began by dividing the world into nine regions—Western Europe, Eastern Europe, North America, Latin America, the USSR, Japan, Oceania, Asia, and Africa. Data on population and fossil fuel consumption from 1800 to the present were culled from a variety of sources. Data on carbon emissions from forests and soils were derived from R.A. Houghton *et al* (1983).

The next step was to determine what fraction of past emissions of carbon remain in the atmosphere—in other words, what regions and peoples bear historic responsibility for today's CO_2 problem. Current atmospheric CO_2 levels

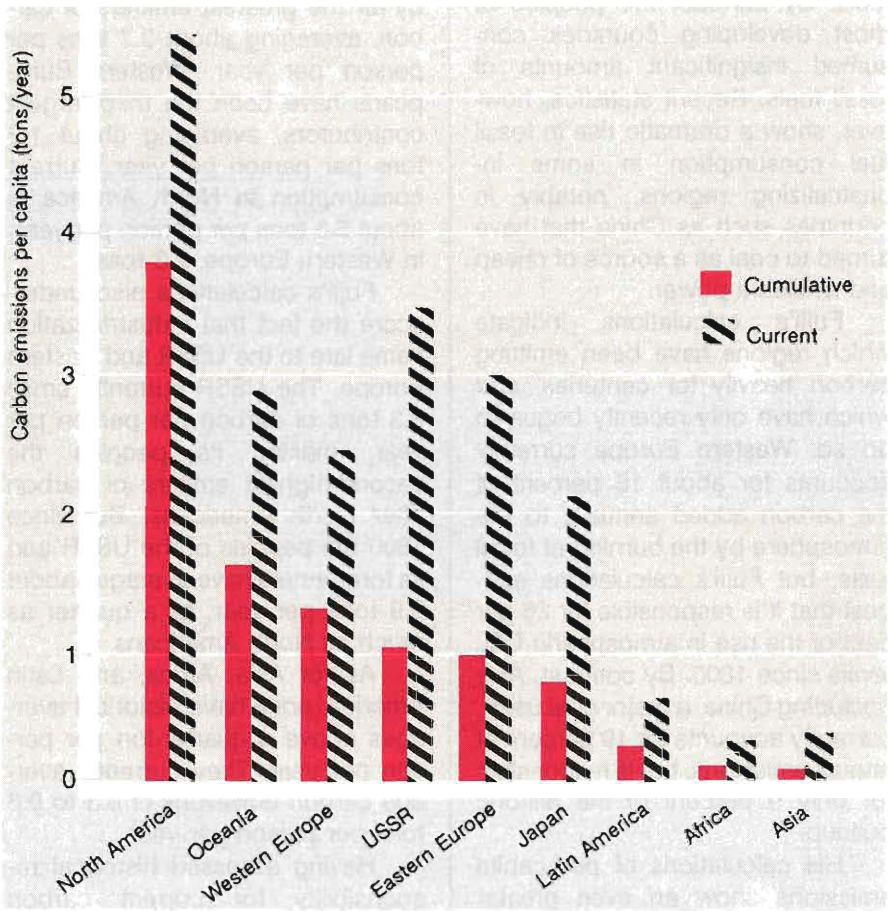

Figure 1. Carbon emissions per capita by region from the burning of fossil fuels, Cumulative (1800-1987) and Current (1987).

FEATURE

are about 350 parts per million. In 1800, at the dawn of the Industrial Revolution, CO_2 levels were more or less stable at 280 ppm. Then industrialization and rapid expansion of population led to unprecedented rates of deforestation and burning of fossil fuels, releasing vast amounts of carbon. Natural systems, primarily oceans, gradually absorb atmospheric carbon, but the process is slow; some of the CO_2 now in the atmosphere may have issued from the boiler of James Watt's first steam engine.

Fujii developed a simplified mathematical model of atmospheric concentration. The resulting calculations lend support to the complaints of developing nations that current levels of carbon emissions do not reflect historic responsibility for the CO_2 problem. For most of the past two centuries Europeans and North Americans consumed vast quantities of fossil fuels. By contrast the peoples of most developing countries consumed insignificant amounts of fossil fuels. Recent statistics, however, show a dramatic rise in fossil fuel consumption in some industrializing regions, notably in countries such as China that have turned to coal as a source of cheap and available power.

Fujii's calculations indicate which regions have been emitting carbon heavily for centuries, and which have only recently begun to do so. Western Europe currently accounts for about 16 percent of the carbon added annually to the atmosphere by the burning of fossil fuels; but Fujii's calculations suggest that it is responsible for 26 per cent of the rise in atmospheric CO_2 levels since 1800. By contrast, Asia (including China, a major coal user), currently accounts for 19 percent of annual emissions, but is responsible for only 9 percent of the historic buildup.

His calculations of per capita emissions show an even greater regional imbalance (Figure 1). Since 1800 North Americans have been

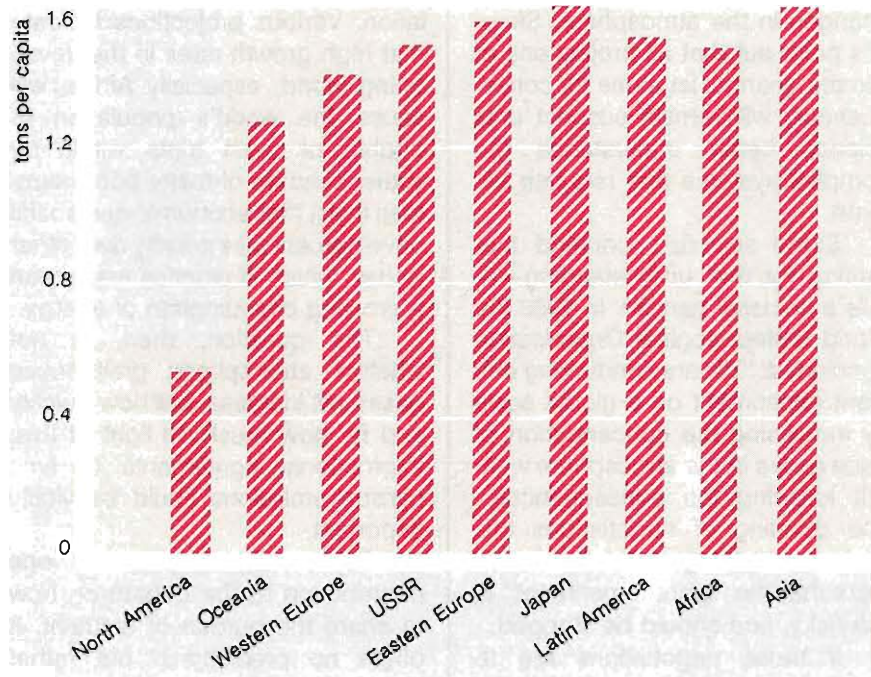

Figure 2. Average annual carbon emission allowances in tons per capita by region from 1988 to 2100, assuming inter-regional and inter-generational equity, and a doubling of atmospheric CO_2 levels from pre-industrial levels.

by far the greatest emitters of carbon, averaging about 3.7 tons per person per year. Western Europeans have been the third largest contributors, averaging about 1.2 tons per person per year. Current consumption in North America is about 5.3 tons per person per year; in Western Europe, 2.3 tons.

Fujii's calculations also underscore the fact that industrialization came late to the USSR and Eastern Europe. The USSR currently emits 3.3 tons of carbon per person per year, making its peoples the second-highest emiters of carbon after North Americans. But since 1800 the peoples of the USSR and its forerunners have averaged about 0.9 tons per year, or a quarter as much as North Americans.

As for Asia, Africa, and Latin America, none have historical averages above a quarter-ton per person per year. They currently average carbon emissions of 0.3 to 0.6 tons per person per year.

Having assessed historical responsibility for current carbon levels, Fujii turned to the future. His calculations of future carbon emission quotas are designed to demonstrate what emission levels each region would need to adopt if the goal was to balance all emissions among all peoples over the three centuries from 1800 to 2100. Fujii's quota calculations did not take account of biotic emissions from farming or deforestation; the quota calculations are based solely on emissions from fossil fuels. Biotic emissions are estimated to account for 10 to 33 percent of current carbon emissions.

Central to his calculation of quotas were assumptions of future population and target levels of atmospheric CO_2. Fujii derived population data from 1990 to 2100 from the World Bank's 1988 projections, settling on a "comparatively optimistic" assumption that world population will stabilize at 10.4 billion. As for CO_2 emissions, he developed three scenarios based on gradual increases in atmospheric CO_2 concentrations by the year 2100 to levels 140, 280, and 420 parts per million above the pre-industrial level.

The intermediate scenario—a

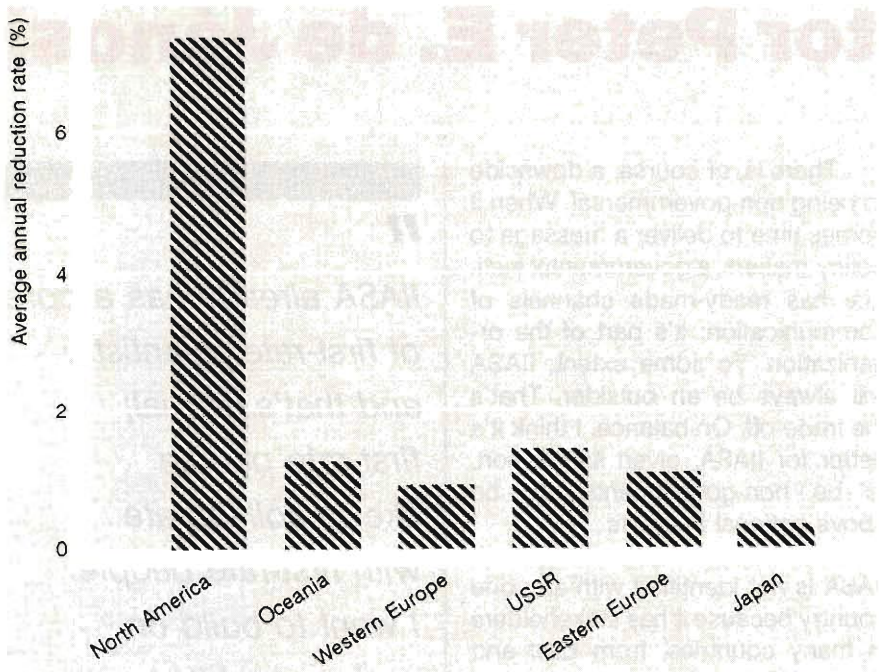

Figure 3. Average annual rate of reduction in per capita carbon emissions from 1988 to 2100 assuming scenario outlined in Figure 2. Under this scenario no reductions from current levels would be required in Asia, Africa, or Latin America.

CO_2 increase of 280 ppm, or a doubling of pre-industrial levels—yielded an average emission quota of 1.37 tons of carbon per person per year over the three centuries from 1800 to 2100. Given that historical data showed which regional carbon accounts were in the black and which were overdrawn, Fujii could calculate the average per capita emissions needed to even accounts by 2100.

Fujii's calculations of future quotas yielded some surprises (Figure 2). Developing countries would be able to increase per capita emissions substantially, but not as much as might be expected. Soaring populations—even with Fujii's conservative growth assumptions—would overwhelm their inherited balances, leaving them with per capita quotas comparable to most developed regions.

Fujii calculated that Asia, Africa, and Latin America would have average quotas through the next century of 1.5 to 1.7 tons per person per year, a negligible difference from the quotas of 1.4 to 1.7 tons calculated for Western and Eastern Europe, the Soviet Union, and Japan. The exception was North America, where the quota calculations reflect generations of high energy use. Future North Americans could redress the region's carbon account balance only by cutting average emissions to 0.5 tons per person per year, about a tenth of the current rate in the region.

The comparison is equally stark when calculated as a yearly rate of change from current emission levels (Figure 3). North Americans would have to cut per capita emissions between now and 2100 by 7.4 percent *each year*. By comparison, the annual cuts required for other industrialized regions would be significantly smaller: for the Soviet Union, 1.5 percent per year; Eastern and Western Europe, 1.0 percent; Japan, less than 0.5 percent. As noted above, Africa, Asia, and Latin America would be able to triple and quadruple their current per capita emissions to levels comparable to averages in the industrialized world, outside North America.

Data for the two other scenarios showed similar trends.

Fujii readily acknowledges some weaknesses in his methodology. His carbon cycle model is based on relatively simple mathematics, but as his study notes, "the real carbon cycle must have nonlinear characteristics and be desperately complicated." His calculations of quotas are based only on emissions from fossil fuel consumption, neglecting emissions from biotic sources. They also neglect potential efforts to mitigate carbon buildup, including reforestation or CO_2 abatement technologies. And his rigid criteria of equity overlooks complex and deep-rooted linkages among energy use, geography, and social history.

Still, questions of historic responsibility for the present problem and fair allocation of future emissions are bound to figure in the coming negotiations. In this regard, Fujii's study underscores some important points. First, North Americans bear the largest historical reponsibility for the present carbon problem. Second, some regions currently emitting high amounts of carbon per capita, notably the USSR, Eastern Europe, and Asia have contributed relatively little historically to the problem. Third, historic rebalancing of carbon emissions would require only modest annual per capita cuts in emissions by most industrialized regions, but radical cuts by North America. Fourth, expected high rates of population growth in developing regions would quickly overwhelm any emission credits inherited from past generations, leaving them with CO_2 allocations no greater than in most developed regions.

Fujii is currently at the Kaya Laboratory of the University of Tokyo, where he is researching integrated energy systems with the aim of improving efficiency of energy use. He is also developing long-term energy models for evaluating the potential of non-fossil fuels. He expects to return to IIASA in 1991 to conduct additional work on energy issues. ■

INTERVIEW

IIASA Director Peter E. de Jánosi

Q: IIASA was founded primarily as a bridge between East and West. Those barriers are coming down, so why should IIASA continue?

A: Naturally, we wouldn't create an IIASA today for the same reasons. But we should remember that even in its earliest days IIASA had strong scientific objectives. Those objectives will now come to the fore.

There is still a need for a multinational, non-governmental institute that addresses scientific and policy issues in a sound and sensible way. As for purely East-West matters, it's true that contacts are growing—there are more collaborative agreements, more joint ventures, and so on. But many of the links are commercial, or bilateral, and frequently sporadic. There are very few multinational organizations like IIASA that can claim 18 years of experience in East-West collaboration.

Q: More and more organizations are researching environmental issues. What separates IIASA from the crowd?

A: First, let me say that IIASA welcomes good competitors. They make us work harder and force us to define our special advantages. Competition is good for everyone. There is no shortage of problems to solve.

That being said, I believe that IIASA has a number of advantages. First, it is non-governmental. It does not have to reflect any specific government position. Take our work on heavy metals in the Rhine River Basin, or on transboundary air pollution: those are sensitive issues involving a number of countries, so it helps to be able to approach it from an entirely nonpolitical perspective.

There is, of course, a downside to being non-governmental. When it comes time to deliver a message to policy-makers, a governmental institute has ready-made channels of communication; it's part of the organization. To some extent, IIASA will always be an outsider. That's the trade-off. On balance, I think it's better for IIASA, given its mission, to be non-governmental, to be above national interests.

And it helps to be multinational. IIASA is not identified with any one country because it has stakeholders in many countries, from East and West. When Soviet economists wanted to compare notes with Western economists about reforms, it was natural for them to turn to IIASA, because it is *their* institute as much as it is anybody's. If another institute or a university in the West had brought together the same economists to provide the same service, I don't think it would have worked as smoothly.

Another example: look at the success of RAINS [IIASA's Regional Acidification INformation and Simulation model; signatories to the Geneva Convention on Transboundary Air Pollution in Europe have agreed to use RAINS as the main scientific basis for renegotiation of the convention in 1991]. If RAINS had been developed by researchers in any one European country, if it were identified with any one country, others might not have accepted it. IIASA is non-governmental and multinational, which is to say, neutral. It is above questions of national bias and national interest.

Let me mention one more advantage. Because of the staunch support of IIASA's National Member Organizations, IIASA can carry out sustained, interdisciplinary research on a wide range of topics. We can do so by having a team of people in residence, and we can amplify our internal resources by tapping into an extensive network. There are very few organizations that can call on both in-house and external scholars to tackle the sort of transnational problems we do.

> *"IIASA already has a core of first-rate scientists, and that's crucial; first-rate people like to collaborate with first-rate people. I want to build on and expand that core, and I want to encourage more networking."*

Q: What will IIASA focus on in future?

A: The November Council meeting spent a lot of time discussing an appropriate framework for IIASA in the 1990s; a final statement will be adopted at next June's Council meeting. There is general agreement that IIASA must change in the '90s, that it should focus on environmental change, global and regional; on global economic transformation; and on methodological issues related to systems analysis. And there is a consensus that IIASA must find specific niches and avoid duplicating work done elsewhere.

De Jánosi addressing IIASA staff members shortly after assuming the role of Director on August 16, 1990

> *"There is a consensus that IIASA must change in the 1990s, that it should focus on environmental change, global and regional; on global economic transformation; and on methodological issues related to systems analysis."*

The Council will define the framework, the broad characteristics of our work, as clearly as possible, but it cannot define research projects tightly. That's the institute's job. We must remember that outstanding researchers will come only if they can formulate their own projects, within the framework set by Council. And we need outstanding people; we must always stress quality, if we are to compete.

Q: How can IIASA attract those people, given its lack of resources? What does it have to offer a top-notch scientist?

A: A lot. IIASA will never have the money or the facilities of some national institutions, but it has other things. It is multinational and interdisciplinary. It tries to bridge the gap between purely scientific and purely policy-oriented institutes. That appeals to many people. And fortunately some of us still are motivated by this idea that we can make a useful difference by working together in the sort of intellectual setting IIASA provides.

IIASA already has a core of first-rate scientists, and that's crucial; first-rate people like to collaborate with first-rate people. I want to build on and expand that core, and I want to encourage more networking, more collaboration with people outside Laxenburg. I don't think the founders of IIASA ever intended that it be limited to the area within the walls of the Schloss. The technology to move ahead already exists, and with East-West barriers falling, there is no reason not to. In the end, IIASA will be judged not only by the work done in Laxenburg, but also by the number and quality of lasting collaborative links it creates among researchers and institutions. ■

RESEARCH

Carbon Balance Model

The Biosphere Project has received a contract from the German Ministry for Research and Technology, through the University of Osnabrück, to develop a dynamic model of the carbon balance of the terrestrial biosphere. The focus will be on global deforestation and land-use changes. Scenarios will be developed for the period 1860-1980 and 1980-2050. (Contact: *Gerd Esser*, IIASA)

RAINS, Climate Change, and Chemical Bombs

The Transboundary Air Pollution Project received a three-part, three-year contract from the Dutch Ministry of Public Housing, Physical Planning and the Environment for work on climate change, chemical time bombs, and the RAINS (Regional Acidification INformation and Simulation) model. Among other things, the contract will support use of RAINS in renegotiation of the UN-ECE Convention on Long-Range Transboundary Air Pollution in Europe. (Contact: *Roderick Shaw* or *Markus Amann*, IIASA)

CIM and Developing Countries

Supported by United Nations Industrial Development Organization, and in cooperation with the Finnish Industries Development Agency, the institute's Computer Integrated Manufacturing Project is conducting a nine-month research project on CIM and developing countries. The study will focus on six African nations, using Brazil as a comparitor. Subjects include national policy instruments, organization and training, automation costs, and product design. (Contact: *Bill Haywood*, IIASA)

Mining and Metallurgy

IIASA and the Institute of Automatic Control and Systems Engineering of the Polish Academy of Mining and Metallurgy signed a one-year scientific cooperation agreement covering various aspects of programming and industrial development, with special emphasis on economic reforms and adaptation to markets, and on the development and application of decision support systems. (*Arkadii Maltsev*, IIASA)

Culture and Negotiations

This study, which is partially funded by UNESCO, will examine whether enduring national/ethnic cultures significantly affect the way negotiation processes are perceived, conducted, and concluded. The study will focus on disputes over rivers and water rights in Europe, North and South America, Africa, Asia, and the Middle East. (page nine) (Contact: *Bertram Spector*, IIASA)



*Peccei Scholarships for outstanding achievements in the 1990 Young Scientists Summer Program have been awarded to (left to right): **Yasumasa Fujii** of the Department of Electrical Engineering at the University of Tokyo (page 10); **Deanna Haunsperger** of the Department of Mathematics at the University of Delaware in Newark, USA; and **David Rios-Insoua** of the Department of Artificial Intelligence at the Polytechnical University of Madrid, Spain. The YSS Program brings PhD students and recent PhD recipients to IIASA each summer to work with IIASA scholars.*

CONFERENCES

Recent Conferences

Population and Sustainable Development in Mauritius, Laxenburg, Austria, 3-5 September.
This meeting ended the first phase of a project organized by the institute's Population Program in collaboration with the University of Mauritius and the United Nations Population Fund. Thirty scientists discussed the development of Mauritius from a variety of perspectives, as well as the possible structure of a computer information system to model population and development in Mauritius. (Contact: *Wolfgang Lutz*, IIASA)

Modeling and Control of Uncertain Systems, Sopron, Hungary, 3-7 September.
Fifty people from 12 countries attended this workshop, organized jointly by the IIASA System and Decision Sciences Program, the Research Institute of Systems Dynamics and Bioengineering (LADSEB) of the Italian National Research Council (CNR) in Padova, and the Department of Mathematics at Washington University in Seattle, USA. Participants compared the use of differential inclusions or funnel equations for modelling of uncertain systems with the use of stochastic disturbances. The proceedings will be published by Birkhauser in 1991. (Contact: *Dr. Andrea Gombani*, LADSEB-CNR, Corso Stati Uniti 4, I-35020 Padova, Italy)

Operational and Systems Research of the Transition to the Advanced Market Economies, Bratislava, CSFR, 3-7 September.
Organized by the Polish Operational and Systems Research Society, the Austrian Operational Research Society, and the Management Institute of Bratislava, in cooperation with several scientific organizations and IIASA, this meeting of economists and operational-systems researchers discussed the use of operations and systems research in transport, economics, finance, public service and related issues. (Contact: *Friedrich Schmidt-Bleek*, IIASA)

Methodology, Implementation, and Applications of Decision Support Systems, Udine, Italy, 17-21 September.
Over 50 practitioners and researchers attended this summer school, organized

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by the IIASA Methodology of Decision Analysis Project, the International Center for Mechanical Sciences, UNESCO, and the University of Udine. The goal was to disseminate information on design, implementation, and application of decision support systems in the areas of business, engineering, environmental control, transportation, industrial planning, and scheduling. (Contact: *Marek Makowski*, IIASA)

New Uncertainty Concepts in Hydrology and Water Resources, Madralin, Poland, 24-26 September.
Forty-four scientists from 15 countries discussed water resources management, methodology of water projections, and tools for decision-making in an uncertain environment. The workshop was convened by the Polish Academy of Sciences in cooperation with the International Association of Hydrological Sciences and the IIASA Water Resources Project. The proceedings will be published by UNESCO. (Contact: *Zdzislaw Kaczmarek*, IIASA)

SCAN '90: Computer Arithmetic, Scientific Computation, and Mathematical Modeling, Albena, Bulgaria, 24-28 September.
The International Association for Mathematics and Computers in Simulation, the German Society for Applied Mathematics and Mechanics, and the System and Decision Sciences Program organized this symposium, hosted by the Coordinating Center for Informatics and Computer Technology of the Bulgarian Academy of Sciences. Some 70 people from nine countries discussed modeling with uncertain data; numerical approaches to uncertain data; extended arithmetic facilities; and software for scientific computations. The proceedings will be published. (Contact: *Vladimir Veliov*, IIASA)

Currency Convertibility in Central and Eastern Europe, Varna, Bulgaria, 30 September-3 October.
More than 50 people from government, business, and research organizations attended this symposium organized by the Economic Reform and Integration Project. Presentations and discussions covered: stages in the transition to convertibility; reorganization of credit and monetary systems and capital management; payment balance, currency reserves, and external debt; and new financial institutions and opportunities for economic transition. (page four) (Contact: *Nikola Totzev*, IIASA)

Demographic Processes in the USSR in the 20th Century in the Context of the European Experience, Tbilisi, Georgia, USSR, 8-12 October.
This seminar brought together some 40 Soviet demographers and 16 foreign experts from eight countries. In collaboration with the European Association for Population Studies, the meeting was organized by the IIASA Population Program, the Soviet Institute for Socio-Economic Studies of Population, the Soviet Branch of the World Laboratory, and the University of Tbilisi. Topics included changes in fertility

The IIASA Council at its 36th meeting, November 15 and 16. Council agreed to hold the Fourth IIASA Conference in May, 1992.

CONFERENCES

analysis and projections; new demographic features in marriages, families, and households; decreases in mortality; migration and migrant behavior in the second half of this century; changes in number and age structure of population. (Contact: *Sergei Scherbov*, IIASA)

Economies in Transition: Statistical Measures, Sochi, USSR, 15-17 October.
The Economic Reform and Integration Project and the Academy of Sciences of the USSR jointly organized this event, which attracted more than 40 experts on statistical measures and analytical methodology. Users and statisticians discussed ways to monitor economies in transition from one system to another, particularly from central planning to a market system. Special attention was devoted to difficulties in measuring and analyzing developments in the USSR. (page four) (Contact: *Petr Aven*, IIASA)

Regional and Urban Restructuring in Europe, Laxenburg, Austria, 28 October.
The Population Program hosted the Steering Committee Meeting of the European Science Foundation's RURE scientific program. Participants agreed that the first general conference, to be held in Lisbon, Portugal, 17-20 February 1991, would focus on Southern Europe and its integration with the rest of Europe; and that the second, to be held either in Budapest or Dresden, would deal with East-West Relations in Europe. (Contact: *Sture Öberg*, IIASA).

Environment in Eastern Europe, Laxenburg, Austria, 19-23 November.
This conference marked the first attempt to put the environmental problems of Eastern and Central Europe into a region-wide perspective. Thirty-five scientific experts identified problems common to most or all countries in the region and discussed priorities for near-term action. The meeting was organized by the IIASA Environment Program and cosponsored by the French Ministries of Environment, and Research and Technology. (Contact: *Joseph Alcamo*, IIASA)

Economic Reform Plan of the CSFR: Adjustment, Reform, and Progress, Lnáře, CSFR, 30 November-2 December.
Jointly organized by the CSFR Ministries for Strategic Planning and for Economic Policy and Development, this meeting allowed Western and Eastern experts from six countries, including members of the Economic Reform and Integration Project, to review and comment on reform plans in the CSFR. (page four) (Contact: *Friedrich Schmidt-Bleek*, IIASA)

Global Optimization, Sopron, Hungary, 9-14 December.
This meeting brought together people working in different areas of global optimization to determine if there is a significant common core of theory and practice. The workshop attracted 36 participants from 10 countries. It was organized by the University of Trier (Germany), the Kalmár Laboratory of Cybernetics at the Jozsef Attila University (Hungary), the Hungarian Committee for Applied Systems Analysis, and the IIASA Adaptation and Optimization (ADO) Project. Papers presented will be published in a special issue of the Journal of Global Optimization. (Contact: ADO Project Secretariat, IIASA)

NEWS

Awards and Appointments

At its 36th meeting, 15-16 November 1990, the IIASA Council welcomed the appointment of two new representatives: Ivan Jurceka, of the Committee for IIASA of the Czech and Slovak Federated Republic; and Robert White, President of the US Academy of Engineering and Chairman of the US Committee for IIASA.

The Council passed resolutions conferring the title of IIASA Honorary Scholar on:

□Harvey Brooks, former Chairman of the US Committee for IIASA.

□Ladislav Kubiček, CSFR Representative on the IIASA Council and its Vice Chairman.

□Wolfgang Schirmer, former Council member and Chairman of the former GDR Committee for IIASA.

Forthcoming IIASA Conferences

February 3-5, 1991: Eco-Restructuring: Managing the Transition to an Ecologically Sustainable Economy, Laxenburg, Austria (Contact: *Robert Ayres or Friedrich Schmidt-Bleek*, IIASA).

February 4-6, 1991: Ammonia Emissions in Europe: Emission Factors and Abatement Costs, Laxenburg, Austria (Contact: *Ger Klaassen or Markus Amann*, IIASA).

February 13-15, 1991: Economically Efficient and Environmentally Sound Energy Strategies for Sustainable Food Production, Berlin, Germany (Contact: *Tibor Vaško*, IIASA).

March 18-20, 1991: The Influence of Organization and Management on the Safety of NPPs and Other Complex Industrial Systems, Vienna, Austria (Contact: *Björn Wahlström*, IIASA).

March 18-22, 1991: CO_2 Reduction and Removal: Measures for the Next Century, Laxenburg, Austria (Contact: *Nebojša Nakićenović*, IIASA).

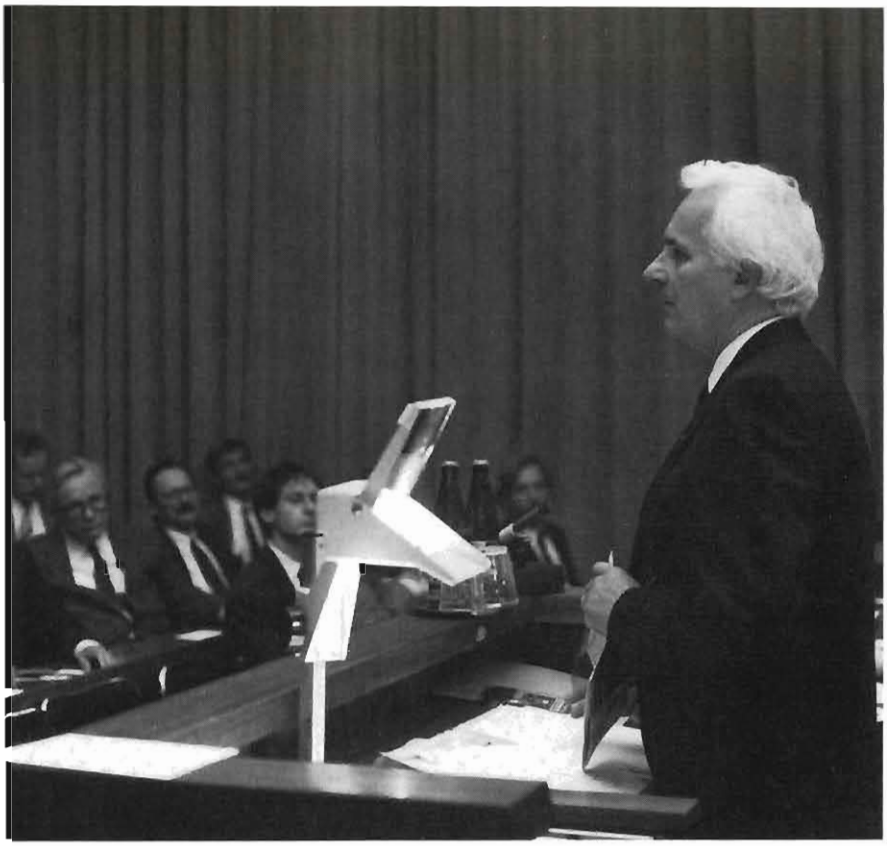
April 21-24, 1991: Regional Development: Problems of Countries in Transition to a Market Economy, Štrbské Pleso, CSFR (Contact: *Tibor Vaško*, IIASA).

May 6-10, 1991: Optimization and Control Theory, Bronislawow, Poland (Contact: *Alexander Kurzhanski*, IIASA).

May 13-16, 1991: Global Environment/Development Policy: Pragmatism and Effective Policymaking, Abisko, Sweden (Contact: *Paul Weaver*, IIASA).

May 13-17, 1991: Electricity and the Environment, Helsinki, Finland (Contact: Joint Secretariat, c/o IAEA, P.O. Box 100, A-1400 Vienna, Austria).

June 18-20, 1991: International Energy Workshop, Laxenburg, Austria (Contact: *Leo Schrattenholzer*, IIASA)



Jacques-Louis Lions, President of the French National Center for Space Studies in Paris and a former member of the Advisory Committee of IIASA's System and Decision Sciences Program, delivering the fourth annual Dr. Bruno Kreisky Lecture on 15 November 1990. The lecture was titled ***Global Change and Systems Science.***

The Council also welcomed the appointment of Arkadii Maltsev of the USSR as the new IIASA Secretary.

Two IIASA researchers have been elevated to Academician status:

□ Alexander Kurzhanski, Leader of the System and Decision Sciences Program and IIASA Deputy Director, by the Academy of Sciences of the USSR.

□ Sten Nilsson, Leader of the Forestry Project, by the Royal Swedish Academy of Agriculture and Forestry.

Jaroslav Jirásek was awarded the 1990 Masaryk-Hoover Medal for outstanding achievements in scientific management.

Jacques Lesourne, IIASA Honorary Scholar and former French Representative on the IIASA Council, has been elected Director of the newspaper "Le Monde."

Visitors to IIASA

Among recent visitors were:
Jostein Mykletun, Director of the Norwegian Research Council for Sciences and the Humanities in Oslo; *Yuichi Moriya*, Board Director and General Manager of the Hitachi Research Institute in Tokyo; *John Perry*, Staff Director of the Committee on Global Change at the US National Research Council in Washington; *Mario Nuti*, Economic Advisor of East European Affairs to the Directorate General for Economic and Financial Affairs of the Commission of the European Communities in Brussels; *Gury Marchuk*, President, and *Igor Makarov*, Chief Learned Secretary of the Academy of Sciences of the USSR in Moscow; *Markku Kanninen*, Project Manager at the Finnish Research Program on Climate Change at the Academy of Finland in Helsinki; *Natalia Rimashevskaya*, Director of the Institute for Socio-economic Population Studies of the Soviet Academy of Sciences.

PUBLICATIONS

IIASA Books

The following IIASA books are now available from your regular book supplier or direct from the publisher.

International Negotiation: Analysis, Approaches, Issues. V. Kremenyuk, editor. Jossey-Bass: San Francisco, Oxford. ISBN 1-55542-297-7.

Climate Change and World Agriculture. M. Parry. Earthscan Publications: London. ISBN 1-85383-065-8.

Future Demographic Trends in Europe and North America: What Can We Assume? W. Lutz, editor. Academic Press: London, New York, San Diego, Boston, Sydney, Tokyo. ISBN 0-12460-445-5.

IIASA Reports

In addition, the following IIASA reports are now available from the Publications Department at the prices indicated:

Decision Support and Geographical Information Systems. K. Fedra and R.F. Reitsma. December 1990. Reprinted from *Geographical Information Systems for Urban Planning*. RR-90-009. US $5.

Interactive Environmental Software: Integration, Simulation, and Visualization. K. Fedra. December 1990. Reprinted from *Informatik fuer den Umweltschutz*, Vienna September 1990, Proceedings. RR-90-010. US $5.

Interactive Energy Demand Analysis: The MAED-BI Model Application in the Shanxi Province, PRC. December 1990. B. Vallance and E. Weigkricht. US $7.

For further details contact Robert McInnes, IIASA Publications Department.

◆ Capital Cities of NMO Countries

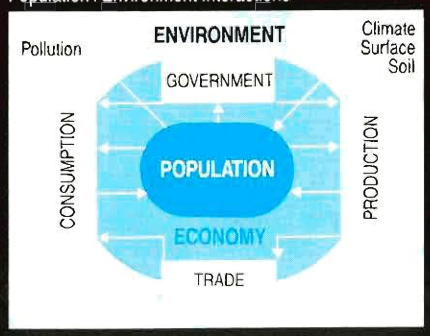
IIASA

International Institute
for Applied Systems Analysis

IIASA's ROLE

The International Institute for Applied Systems Analysis is an international, nongovernmental research institution sponsored by scientific organizations from 15 countries. IIASA's objective is to bring together scientists from various countries and disciplines to conduct research in a setting that is non-political and scientifically rigorous. It aims to provide policy-oriented research results that deal with issues transcending national boundaries. Resident scientists at IIASA coordinate research projects, working in collaboration with worldwide networks of researchers, policymakers, and research organizations.

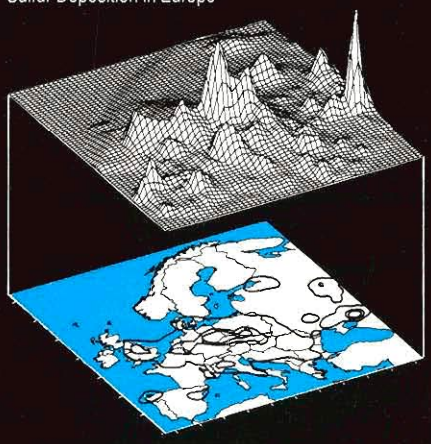
Population /Environment Interactions



RESEARCH

Recent projects include studies on global climate change, computer modelling of global vegetation, heavy metal pollution, acid rain, forest decline, economic transitions from central planning to open markets, the social and economic implications of population change,

Sulfur Deposition in Europe



processes of international negotiations, and the theory and methods of systems analysis. IIASA applies the tools and techniques of systems analysis to these and other issues of global importance.

Global Mean Temperature

MEMBERSHIP

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FURTHER INFORMATION

Further information about IIASA and its work is available from: The Office of Communications, International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria, Telephone (02236) 71521-0.