RMA/CSFR-PR-03

COMPONENT #4 : ENERGY PRICING
FINAL REPORT - CZECHOSLOVAKIA

May 1992

U.S. EMERGENCY ENERGY PROGRAM
FOR EASTERN AND CENTRAL EUROPE

(USAID Project #: 180-0015)
(USAID Contract #: EUR-0015-C-00-1006-00)

RESOURCE MANAGEMENT ASSOCIATES
of Madison, Inc.

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APPENDICES

I. Executive Summary

This report describes the activities, accomplishments and recommendations of the USAID Energy Price Reform Project in Czechoslovakia, conducted by Resource Management Associates of Madison, Inc. (RMA). The main activities of the project consisted of institution building through workshops and energy modelling activities, and providing assistance to the government of Czechoslovakia on energy policy and program issues. Five documents were produced by RMA as part of the work in the project. A major workshop was held which brought policy makers together to discuss energy pricing issues and formulate fuel pricing policies. In addition, three pricing models were prepared and delivered to counterpart organizations in the Czech and Slovak Republics.

The Energy Price Reform Project took place at a critical juncture in the transformation of the CSFR economy and of the energy sector in particular. The USAID program provided one of several bilateral and international efforts to assist the CSFR to make the transition to a market economy. At the beginning of the project in early 1991, significant changes in energy pricing policy were underway, and specific tariff changes had already been implemented. Within this environment of rapid change, debates and discussions on the specific form of the institutional changes in the energy sector formed a key element of the project's workshops and working forums. The project has provided assistance in understanding the U.S. experiences in energy pricing and in developing the tools and institutions appropriate for building upon that experience. This report summarizes that process, the specific products and documentation arising from it, and the recommendations for future directions.

A brief summary of each of the major deliverables is included below:

1. Progress (trip) report: Component #4: Energy Pricing Reconnaissance Trip Report - Czechoslovakia, RMA/CSFR-PR-01, March, 1991. Report describes the energy situation both physically and institutionally. Specific areas of technical assistance were identified for subsequent phases of the project.

2. Progress (trip) report: Component #4: Energy Pricing Workshop Report, RMA/CSFR-PR-02, May, 1991. Report summarizes the workshop presentations and discussions. Preliminary energy pricing scenarios are presented using the pricing models developed in the project.

3. Workshop proceedings: Proceedings of the Workshop on Energy Pricing Reform in Czechoslovakia. U.S. and Czech papers presented at the workshop are included. The eight Czech papers, translated to English, offer an important view from within on the energy sector.

4. Models and documentation: Users guides were provided for the RMA industrial and transportation energy use models, and the LEAP end use energy

model.

5. Final report: Component #4: Energy Pricing Final Report - Czechoslovakia, RMA/CSFR-PR-03. Summarizes the key findings and recommendations of the pricing reform project.

The energy pricing models and documentation which were provided in the project are in use by the National Academy of Sciences in Prague and the Slovak Ministry of Economy in Bratislava. Other institutions which received copies of the models include the Institute of Economics of the Czech Academy of Sciences, the Czech Technical University and the Slovak Power Enterprise.

II. Introduction

This is the final report for the Czechoslovakia Pricing Reform Program. The tasks were carried out by a team which consisted of Mr. Harvey Salgo (Team Leader: Tellus Institute), Dr. Jack Huddleston (RMA), Mr. Bruce Biewald (Tellus), and Mr. Bronek Dutkiewicz (Intratech). The project included three trips to the CSFR. Mr. Salgo and Dr. Huddleston participated in all three, while Mr. Biewald and Mr. Dutkiewicz participated in the second trip, the Bratislava workshop and planned followup meetings. Wesley Foell of RMA attended numerous meetings on the first two trips and participated in the Bratislava workshop in May.

The activities which took place on the first and second trips have been described in earlier trip reports. An important observation, which was reinforced with each set of encounters, is that CSFR policy makers generally possess (or have available to them) great sophistication and expertise in technical matters relating to both energy and the environment. On the other hand, as one might expect, there was often confusion concerning the nature of market systems and the differences between command- and market-based planning.[1] The confusion was exacerbated by the fact that the transition from one to the other is taking place during a period of significant uncertainty concerning both the availability and price of energy resources. The transition is also at a time during which important environmental issues have come to the fore.

One source of confusion concerned what one might call the 'boundaries of market relationships. For instance, it was unclear to some individuals how a free market system could co-exist with price regulation, which prompted further discussions concerning markets, natural monopoly and regulation. Similarly, there were numerous discussions concerning the nature and role of government generally in a market based economic system.

In our judgment, one might characterize the initial post-1989 period as one in which there was a significant struggle to come to grips with a plethora of new ideas and concepts. The issues were basic: "What is a market?"; How are prices 'set'?"; "How are free market contracts negotiated?"; "Can any regulation be consistent with the concept of free markets?"; and so on.

To a great extent, as measured by the meetings the team has had over the duration of the project, many of those questions have been answered satisfactorily on the conceptual level. It is clear to policy makers that, for example, market imperfections may require regulation and that there is no inherent conflict between the two. Thus, while during the early stages

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[1] This report uses the term 'market based' planning to indicate that planning does take place within market systems but is different from the 'command based' planning in centrally directed economies.

of this project the team addressed a variety of issues on the conceptual level, more recently the exchanges have had a different emphasis. In a word, there is a need now to shift toward assistance in the implementation of the concepts. We illustrate this point with a few examples.

One example concerns scenario development. During the past several months, a number of agencies (see the project trip reports) have begun the process of adopting models for their scenario development work. The present needs are for assistance in the development of the scenarios. A critical problem is the paucity of sufficiently disaggregated data. As discussed below, this will require the implementation of periodic data collection exercises which should include, but not be limited to, statistically based sa[illegible] designs. It is apparent to the team that the data constraints will have an impact on policy-making; that is, to the extent that policy evolves from the modelling activities, it will be adversely affected by the limits to the available information.

Another important example concerns household and, to a lesser degree, industrial conservation.[2] There is a significant need at this stage for the development of workable plans for the implementation of broad-based conservation programs. The concepts appear to be well understood, but the methods for moving forward need to be clarified and implemented. The need, in a word, is comparable to what utilities in the US faced several years ago: that is, the need to move from concepts to field delivery. Implementation requires planning skills, methods to overcome market barriers, financing availability, contracting skills, skills in vendor solicitation and proposal evaluation, and the ability to accomplish post-implementation estimation and measurement of conservation impacts.[3]

The utilization of private sector energy resources such as power project developers and energy services companies is another example (and, of course, is related to the discussion in the preceding paragraph). The utilization of both domestic and foreign private sector energy providers requires the development of important skills: contracting, soliciting, and financial/economic evaluation. These matters are addressed in our recommendations of this report; they are stressed here, however, to reinforce the central point concerning the need for implementation assistance. Specifically, it would be most valuable if, in the near term,

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2 The RMA Industrial Energy Efficiency program demonstrated both technologies and concepts to a wide audience. The gist of the comments in the text, however, is that in both industrial and household sectors, policy, institutional, or technical assistance is necessary to develop methods to move from demonstration projects to full-fledged programs.

3 One should not ignore the interplay between, say, the implementation of a conservation program and limits in the availability of pertinent data. In the absence of key data, it is not possible to be precise about the technical and economic potential of conservation (that is, to know the conservation 'supply curve'). And if the technical and economic potential is not reasonably known, it is difficult to assess the potential impact upon supply planning of a broad-based conservation program. In other words, as noted earlier, scenario development is affected as is the making of appropriate planning and policy decisions.

there was a movement from the idea that the CSFR might obtain certain benefits from, for example, private power, to a systematic way of assessing whether or not that is correct and, if it is, to methods for tapping those benefits.

A final example concerns regulation generally, and power sector regulation in particular. As noted above, earlier discussions concerning regulation often focused on matter such as the relationship between regulation and private markets -- and in what circumstances regulation was required. The questions now concern the nature of the regulatory structures that one might advocate. It is clear, for instance, that the power sector (particularly at the transmission and distribution levels) are 'natural monopolies'.[4] What transactions should be regulated? How should the regulatory bodies be structured? What precisely should be the scope of their regulatory authority? In other words, how might a Western-type regulatory body be established and its regulatory authority be implemented?

The preceding examples are intended to illustrate an important point. During the recent past, there have been major changes in the CSFR and the introduction of numerous new ideas. Many of these ideas, however, are better understood at the conceptual, rather than the practical, level.

These observations led us to conclude that it was essential that we be clear about both the nature of the recent experience in the United States and why that experience is pertinent to the present circumstances in the CSFR. As is discussed below (Section II), we believe that the short- and long-term responses in the U.S. to the post-embargo oil shocks of the 1970s provide valuable insights. Those responses included both new ways of thinking and, correspondingly, new tools to assist in the thought process.

This report describes the context for the team's work and states the team's overall conclusions and recommendations in the areas of energy pricing reform. The remainder of the report is organized as follows:

- Project Context and General Approach to Energy Pricing Problems
- Conclusions and Recommendations
- Summary

A summary of the team's third trip to the CSFR: September 9-13, 1991, is included as Appendix A.

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[4] The precise delineation of what is or is not a natural monopoly has changed over the years. This discussion is not meant to engage that debate. Rather it is to note that where there is natural monopoly, regulation is required.

III. Project Context and General Approach to Energy Pricing Problems

The energy situation - planning, pricing, supply, use - in the CSFR is in a state of flux; conditions and responses change rapidly. At the same time, the country is moving, in energy and other spheres, from central planning to a system of market relations. The CSFR is particularly affected by external events as it is extraordinarily dependent upon other countries (principally the Soviet Union[5]) for energy resources. The CSFR is virtually devoid of oil and natural gas reserves and, as a practical matter, of the fossil fuels has only coal (which is, for the most part, of quite poor quality).[6] The ability to switch between (or substitute for) fuels is limited in both the short- and long-term by a number of factors such as technological and financial constraints. It is also constrained by its dependence upon external supplies; this constraint has been exacerbated by recent events in the Soviet Union.

The CSFR situation is analogous in some important ways to the post-embargo years (after 1973) in the United States. Prior to the embargo, energy planning, particularly in the electric utility sector, was relatively straightforward. Growth rates were very nearly constant; economies of scale were evident in the facility sizes of that time; and prices were relatively low with only modest changes (up or down) from year-to-year. After 1973, the situation was dramatically different. And, as in the CSFR, the price impacts and the actual and potential shortages of certain fuels affected some portions of the country more substantially than others.

The long-term responses in the U.S. to the new circumstances were several. Described broadly, new ways of thinking about and dealing with risk and uncertainty emerged. The value of diversity was analyzed and, ultimately, better understood; and new planning tools were developed to accommodate the more volatile circumstances. Such tools included end-use forecasting models (since reliance upon historic data was, at the time, not sensible) and scenario analysis (which would allow for the assessment of a variety of alternative 'futures').[7] In a word, energy planning (which in the U.S. is market-, rather than command-based) moved from a search for deterministic solutions to the evaluation of the risks inherent in a variety of options.

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5 The term 'Soviet Union' is used in this report even though it is no longer precisely correct.

6 Other resources are important as well. In 1990, for example, 28.4% of the energy (gigawatt hours or Gwh) in the power sector was provided from nuclear facilities; and 4.5% was provided by hydro power plants.

7 End-use forecasting takes on greater importance the more significant the change in conditions. That is, tools -- such as econometric models -- which rely on historical data yield problematic results during such times. The change to a market system in the CSFR is an added complication for forecasting and planning generally. Recent years have seen an influx of new types of energy-using commodities into the marketplace. Certain types of information will become both more important and more difficult to obtain with the shift from a command to a market system.

Least-cost planning began to include a wider variety of factors than had been considered previously. Resource plans which at one time stressed large facilities and the ostensible advantages of scale now stress diversity - of fuel, facility size and type -- and conservation (or the 'management' of demand). An essential ingredient to this type of planning was more detailed data - particularly concerning the consumption of energy at its end-use -- for both forecasting and scenario development.[8]

Recent years have also witnessed a growing concern with the environmental implications of energy use. The trend in least-cost planning is to consider environmental costs directly in the selection and use of resources. To some extent the plans which evolved out of a concern about fuel shortages and costs were consistent with the emphasis on the environment. Conservation, for example, can be a benefit to both.

The passage of The Public Utility Regulatory Policy Act of 1978 (PURPA) also reflects both concerns. PURPA expresses a preference for energy efficiency (cogeneration) and an increase in the utilization of renewable resources, which will have measurable environmental benefits. In addition, it was also an expression of the desirability of resource diversity. The search for diversity led to smaller, shorter lead-time investments in power plants which is often preferable in times of planning uncertainty, even if such investments sometimes result in the loss of potential scale economies.

PURPA, of course, also delineated a role for the non-utility private sector[9] in the provision of power resources. Its passage was in part the result of a willingness to reconsider the nature and extent of the natural monopoly concept.

The oil price and supply shocks of the 1970s affected legislation and planning in other spheres - such as transportation - as well. The point here, however, is not to be fully inclusive and exhaustive. It is, rather, to say that price and supply shocks of the 1970s, triggered by uncontrollable external events, led to a sea change in modes of thinking and planning.

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8 The issues concerning data availability and the development of comprehensive data bases are significant and will be discussed in more detail later. Lack of data imposes significant constraints on planning.

9 It is important to avoid confusion concerning terms such as "private sector" and "privatization". For example, it is possible for a government-owned utility to turn to the private sector for the development of a power facility; or it may undertake the construction and operation itself. It is also possible for an investor owned utility (IOU) -- that is, one which is privatized -- to either build and operate on its own or turn to the non-utility private sector in the same manner as did the government-owned utility in the previous example. In other words, a purchaser may rely on the private sector whether or not it is itself a privatized entity. Similarly, privatized purchasers may or may not turn to the non-utility private sector for such facilities. PURPA brought the non-utility private sector to both government-owned utilities and IOUs.

In our judgment, this is the appropriate context for the lessons to be learned by the Czechoslovakians from recent U.S. experience. It is fair to say, of course, that the situation in the CSFR now is considerably more complex and difficult than that in the post-embargo U.S. The CSFR is in the midst of a comprehensive change in its overall mode of economic relations and, in addition, has fewer options than did the U.S. The CSFR has a much more limited resource base and is, after all, a much poorer country. These factors temper the extent to which the U.S. experience in dealing with a major exogenous perturbation to the system can be directly relied upon by the Czechoslovakians as a guide to policy. One might summarize the categories of major differences as follows:

- extent of capital availability
- availability of economically obtainable indigenous resources
- price responses of the various decision-makers (households, industry, commercial sector)[10]
- maturity of the institutional and regulatory structures.

Nonetheless, despite the differences in these matters, the experience in the U.S. informed our general approach in the CSFR. That approach may be outlined as follows:

1. We sought to describe in what ways the recent U.S. experience contains important lessons for the present CSFR circumstances. That is, we discussed our approaches to the various problems which arose in the post-embargo years, the successes and the mistakes. It was important, in these exchanges, that the significant differences between the U.S. and the CSFR -- concerning, for example, resources, wealth, and the economic infrastructure -- be acknowledged so that one might understand the extent to which U.S. experience is transferable.

2. As in the U.S., there is a need to incorporate risk and uncertainty into resource planning exercises, and we assisted in both identifying and prioritizing the issues to be dealt with.[11] By 'priority' we do not necessarily refer to the most important problem but, rather, to the most important problem concerning which we could provide assistance in this project.

3. We then sought to target our assistance to those priority areas. As part of our overall approach to the problems, computer models (such as Tellus' LEAP and the

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[10] The price responses (elasticities) in Czechoslovakia are a major research topic. It is our judgment that the range of energy elasticities from the US and Western Europe may be useful starting points for analysis, but should not be relied upon without caution. Similarly, the consumer demand elasticities estimated in the CSFR prior to 1989 (See Appendix B of the May 7, 1991 Trip report) should also be used only cautiously.

[11] We recognize that all planning exercises consider risk and uncertainty to some degree. Therefore, the change in the U.S. in the 1970s was in the manner and degree that such factors were analyzed.

RMA industrial and transportation models) were introduced and, as noted elsewhere, are in the process of being adopted for use by a number of organizations.

The team's overall approach to the project was to utilize the initial trips and other communication to inform ourselves of the issues and problems and, as important, to identify the strengths and weaknesses of those with whom we would work. A major objective was to progressively narrow the range of issues concerning which we would provide assistance.

This was not always easy to do, for two broad reasons. First, the CSFR situation is highly dynamic. Each change in policy or circumstances, such as recent events in the Soviet Union, changes the list of priorities for at least the short term. Second, policy makers in the CSFR are regularly offered advice and opinions by numerous others; thus, there is the perceived need to understand the differences and, where possible, to reconcile the conflicting points of view. Of necessity, much time was spent on discussions of this sort. One cannot easily discuss policy problems where there is still confusion about basic principles and the manner in which actual market-based systems function and make decisions.

IV. Conclusions and Recommendations

Our conclusions and recommendations are based upon our discussions with our CSFR counterparts, a review of a significant amount of information, and some analysis. We have attempted to put our conclusions and recommendations into a useful context, using the following categories: power sector, coal sector, natural gas, petroleum sector, industrial sector, and financial sector.

A. Power Sector

The conclusions and recommendations concerning the power sector have previously been placed in context (as described in Section II). The CSFR situation is one of great flux. Prices have changed dramatically in a relatively short period of time, with substantial impacts which cannot be estimated with precision; long-term resource supplies are subject to new commercial standards; the private sector, domestic and foreign, will play a role in energy supply (and demand management) in a variety of ways; and environmental issues, and their relationship to energy supply and prices, have risen to the forefront of policy concerns. Planning is always difficult during rapid transitions.

Despite the rapid changes underway, it is apparent to us that there has been significant progress in the CSFR in the transition from past practices to a market oriented pricing and planning structure. The conclusions and recommendations below are intended to supplement what is already taking place; in addition, in some instances, comments are made simply to indicate that we agree that the steps being taken are appropriate.

1. The movement toward the establishment of tariffs (prices) which reflect the cost of providing service to each class of customers (residential and industrial) should be continued. This is necessary regardless of whether the power sector is privatized or if there are either the same or different prices for power in each republic. Current electricity prices are included in Appendix B.

2. A market-based least-cost planning structure must be established which can accommodate the continuing changes in prices, demand, resources, and so on. It is evident that important pieces of the structure are in place; but it is not clear that the pieces have been integrated into a comprehensive overall structure. A solid least-cost planning structure should include thorough data collection, an end-use forecast, a systematic evaluation of the technical and economic potential for supply and demand-side resources, dispatch modelling capability, and a thorough approach to the solicitation and evaluation of new resource options (including private sector options). At this juncture, it is evident that the dispatch modelling capability is in place but that other components need to be enhanced. Because a least-cost planning structure requires regulatory oversight, it should be established at the utilities and in any other sector with comparable regulation.

An important need is to develop a comprehensive set of forecasts (base case and plausible scenarios) of power supply needs. Because of the absence of relevant historical data (on price and consumption relationships), an end-use forecast is to be preferred over a statistical (or econometric) forecast. There are a number of end-use forecasting tools available, including one developed by Tellus (distinct from LEAP) and used widely in the U.S. An end-use forecasting approach will be particularly useful to track and account for progress made concerning energy conservation.

Strategies for data collection (particularly end-use data) should be developed as quickly as possible. With the present availability of a wider variety of energy using appliances and machinery than had prevailed prior to 1989, systematic data collection will be increasingly important. It is reasonable to expect, given the rapid movement to a free market, that there will be a correspondingly rapid change in the mix of household and industrial appliances and equipment. Thus, periodic surveys should be conducted. In the household sector, the surveys should be statistically based; that is, random surveys, pursuant to an appropriate sample designs (which will have to be developed for each data collection exercise) should be carried out. Given the heterogeneity of the industrial sector, another protocol will be necessary; there is no single approach that is preferable in all circumstances. It may be that a survey of all large users (above a certain MW or Mwh level) will be sensible, with a random protocol for the others. The point here is that data collection is essential and that with the rapid change to a market economy, **periodic** collection is also important.

3. To the extent possible, a major focus of planning should be on conservation and relatively small (short lead time) supply projects. As for the latter, this may result in the loss of some scale economies; however, it is appropriate at this time to weigh flexibility heavily. System planning should be done with one of the more advanced electric system dispatch (production costing) models available for such purposes. We have not had the opportunity to fully examine their production costing model but, as it was described to us, believe that it is quite advanced. In addition, however, a model, such as Tellus' ECO model, is required to integrate the conservation and supply options into a comprehensive, consistent structure.[12]

   As for conservation, we are impressed by the scope of the Decree of the Government of the Czech and Slovak Federal Republics, March 1, 1991, No. 132, on "Principles of State Participation Aimed at Reducing The Consumption of Fuels and Energies in Houses and Apartments". The Decree recognizes the need for conservation and

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[12] The ECO model has been used by US and Canadian utilities for the development conservation programs and least-cost plans (sometimes called integrated resource plans). ECO is also being evaluated for use by the Electric Generating Authority of Thailand and by several utilities in Central and South America.

that there are market barriers that are likely to inhibit its implementation. The Decree has an educational component and a component which provides for the leveraging of conservation investments through the use of government loans and grants. It is a good beginning.

4. Because of the large increases in prices, the short- and long- term impact on industry should be evaluated carefully. Many firms will not be able to respond quickly to the changes in energy prices and will have serious financial problems as a result. These are likely to be the energy intensive industries which are using inefficient technologies. It is important to identify those industrial concerns which, if they had more efficient technologies, would be economically viable. It is sensible to develop strategies to assist such firms during a transition period. Such strategies could consist of temporarily lower rates coupled with financing (loans) of the more efficient technologies. Firms which would require continuing assistance, even if they possessed energy efficient technologies, are a more serious problem.

   There are a number of U.S. states which have permitted "economic development" rates for a variety of very similar reasons. Some other states have rejected such rates. The key issues appear to be how to (1) capture and identify the benefits from such rates, and (2) how to avoid 'free riders' -- those who benefit from such rates but who would have absorbed the normal rate without severe consequences, and (3) how to avoid substantial impacts on 'non participants'. Note that, as a contrast to notions of 'subsidy', there is the notion that price discrimination may be a useful long term tool, even if it requires what appear to be subsidies in the short term. The key is to identify the beneficiaries of lower rates carefully.

   If there is transitional assistance, it is essential to make it as limited as possible and to be certain that the magnitude is such that it can be afforded.

5. It is possible that cost-effective conservation measures may, in some instances, allow an industrial firm to reduce its energy consumption sufficiently to gain economic viability. All cost-effective conservation measures should be explored. It is important to adopt a wide range of strategies and mechanisms for the delivery of conservation services.[13] This should include energy service companies, engineering firms and others.

6. A coherent strategy concerning the environment and energy planning and pricing should be developed as quickly as possible. As part of this process, various pollution

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[13] A good conservation program will attempt to obtain all cost-effective measures. The costs include not only the measure costs (such as insulation or controls) but also site visits and administration costs. If all cost-effective opportunities are not obtained at the same time, it is possible that the costs of additional visits and administration, for example, will result in some measures becoming too expensive (not cost-effective).

reduction scenarios should be developed using a model such as LEAP and its accompanying Environmental Data Base (EDB). The use of LEAP for these scenarios should be coordinated with the RMA models for industrial and transport sectors.

The nature and type of environmental regulation will have a substantial effect on major investment decisions. For example, any decisions concerning pollution control retrofit investments, or the potential phaseout of one or more coal plants, should be made within the context of a least-cost plan with clearly defined environmental objectives and associated costs.

Various options for internalizing environmental costs should be carefully considered as part of an overall policy which will directly affect energy prices. As policy makers are aware, the possible options include:

- market-type mechanisms such as the 1990 U.S. Clean Air Act Amendments;[14]

- legislated constraints or requirements, including those imposed by regulatory bodies;[15]

- taxes (both to reduce consumption and favorable tax treatment to induce certain types of investments).

Because of the limited experience with market-type mechanisms, such as the U.S. Clean Air Act Amendments (which deal primarily with sulphur dioxide), we do not recommend such approaches at present in Czechoslovakia.

It is evident that there is a deep level of understanding of the possible options for internalizing environmental costs. The comment and recommendation here is made so as to stress an important point. That is, as we have learned in the United States, frequent changes in environmental regulation can have major impacts on technical requirements, the types of resources (fuel type, power plant type, pollution control equipment necessary, and so on) to be utilized, and investment decisions. Therefore,

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14 The Clean Air Act Amendment of 1991 sets a nationwide cap for the emission of sulfur oxides and will distribute "allowances" which will permit the holder to emit one ton. The holders of allowances will be able to sell them in the open market. Presumably, the holders of allowances will undertake those pollution reduction strategies which will cost less than the revenues which would be obtained from the then unnecessary allowances. The most recent Clean Air Act amendment is in the process of being implemented; there is no experience with it as yet.

15 By this we mean those requirements -- such as scrubbers and other pollution abatement technologies -- which are required by statute or regulation.

the environmental costs to be internalized should be determined as soon as possible.

It is also important to consider whether or not environmental externalities -- the cost to society of environmental problems caused by the energy sector -- will be a factor in resource selection and operation (dispatch). If externalities are to be a factor in power planning and operation, it is important to evaluate the various approaches for valuing them -- such as the monetization of externalities.

It is our recommendation that, at this time, that decisions concerning the required pollution control equipment should be made. These investments for pollution control which are **internalized** costs and should be passed through to the consumers of electricity. Any environmental **externalities** remaining, such as some residual emissions, should not now be valued in monetary terms and included in the resource selection and utilization processes. We recommend that, at present, issues pertaining to environmental externalities be studied carefully, with the objective of including them at a later date.

7. Power sector operations should be commercialized as soon as possible. By "commercialized" we mean that all transactions should be transparent (easily seen and understood) to outsiders. This will require that standard books (operations, accounting, finance) are kept in ways which have become the norm in Western market economies.[16] This will be necessary whether or not the sector is privatized. That is, if prices and planning are to be regulated by independent commissions (in the manner of U.S. regulation, for instance) this information will be required.

There have been discussions concerning the privatization of CEZ and SEP; but, to our knowledge, no firm plans are yet in place. In any event, any firm steps toward that end should be preceded by commercialization of each utility as well an understanding of the relationship between the two. For example, it will be essential to investors to know how transactions between the two will be priced, and whether prices will be different in each republic.

Similarly, investors will need to know what sort of regulation will be in place and how tariff rates and structures will be established. The sector is, and almost certainly will remain, a natural monopoly for many of its important functions (such as transmission and distribution). Thus, a regulatory structure which protects both investors and consumers is essential.

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16 There is, in general, a very solid foundation in the CSFR for the collection and organization of retrospective information. Thus, data concerning, for example, the prior year's costs, energy production, or fuel use is collected and organized quite well. As one moves to a market system, however, financial projections and capital budgeting become quite different and the financial and accounting procedures require new techniques. It is here where an understanding of Western procedures and standards will be most important.

Regulatory bodies should be independent and free from political pressure. It is important that the returns on investment which are established by regulation are not guaranteed to the utility, but can be earned only if operations are undertaken prudently. In other words, prices cannot simply be costs plus a return, with no consideration of whether or not the costs were incurred in a prudent manner. The precise makeup of the regulatory structure will depend upon decisions concerning the overall structure of the power sector.

8. Because power generation is not a natural monopoly, and because private sector ownership and operation of power plants can provide benefits in many circumstances, steps should be taken to facilitate the utilization of private power in the system.

Private power should be examined during the least-cost planning process. It should be determined during the planning process whether or not it can be mutually beneficial and, if so, under what terms and conditions. Because private sector energy providers undertake investments at their own risk, relying upon such resources reduces the pressure upon capital budgets. Thus, there are likely to be some possibilities for mutual benefit. These possibilities should be examined in a structured fashion. One possibility is a workshop in which private sector firms (CSFR and foreign) participate along with the prospective utility purchasers. The workshop should be designed to allow the developers to identify, as precisely as possible, what their requirements are for investment in the CSFR. It would also be valuable to explore at that time the possibilities for joint ventures with Western companies.[17]

To effectively utilize private sector resources, it will be necessary to establish an adequate infrastructure for soliciting, evaluating, and contracting with private power developers, it is necessary to:

- provide an appropriate regulatory framework which guarantees that if the private developers perform as agreed to, they will receive compensation

- consider and develop policies dealing with a wide variety of issues, such as whether or not to provide protection against currency devaluation

- develop appropriate, mutually satisfactory, contractual terms and

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[17] The type of issues that should be addressed concern such matters as: what are the best opportunities for joint ventures; who will have operating control of, say, a power plant; whether or not the private sector will provide investment funds if it has less than majority ownership or does not have operating control; and so on.

conditions

- work with domestic and foreign sources of project financing to apprise them of the 'ground rules' for private power projects in the CSFR.

9. The development of an infrastructure for dealing with private sector energy resources should also consider energy services companies (ESCOs) which are able to provide conservation services. ESCOs can provide services in a variety of ways, including the shared savings approaches which have been under consideration in the CSFR.

The benefits of shared savings approaches are that, typically, the investment is undertaken by the ESCO in return for a share of the savings. There is generally no investment required by either the consumer or the utility. However, with shared savings arrangements only certain conservation investments are likely to be undertaken. The result may be so-called 'cream-skimming', in that only the most cost-effective conservation measures are invested in. This can lead to many lost conservation opportunities. Thus, the benefits of arrangements such as shared savings must be weighed against their opportunity costs. It should be noted that we only mention "cream-skimming" so that companies are aware that it can in occur in the long term.

For planning purposes the benefits and costs of all approaches to the delivery of conservation services should be considered within the least-cost planning process. See the discussion in paragraph 2 above for the necessary components of a least-cost planning process and the steps which should be taken by CEZ and SEP to implement such processes.

In order to evaluate and to compare resources to one another, and to determine the maximum price to be paid for private sector resources, it is necessary to adopt a methodology for the calculation of system marginal or 'avoided' costs. This calculation should be done within the context of the planning process, since the level of avoided costs depends upon such information as demand and resource requirements.

B. Coal Sector

The mining of coal and lignite has traditionally been an important economic activity in Czechoslovakia. Large deposits exist in both the Czech and Slovak Republics, although the quality of these deposits and mining practices and costs of production vary considerably between the two republics.

Rapid changes have been occurring in the ways coal and related resources are priced for market purposes. Most notably prices have been freed from (at least partial) "cost of production" accounting to "comparable international alternative" pricing. During the

transition period considerable attention is being given to "criterion prices," which is a way of establishing upper limits for what individual producers might charge.

Price setting is also being decentralized to individual production regions, if not sites. This will allow more accurate capture of quality differences in the price of coal and the relative cost of transport.

Efforts have also been undertaken to remove subsidies for household consumption of coal, but political pressures have momentarily halted full implementation of these measures.

As with the power sector, there has been significant progress in the transition to market oriented pricing and planning. Our conclusions and recommendations acknowledge the appropriateness of many of these actions and suggest possible future steps.

The conclusions and recommendations follow:

1. No further major changes in the mechanisms for determining the price of coal and related resources are necessary or appropriate. Proposed pricing changes that are either being implemented or are scheduled for implementation are appropriate. Further changes, other than minor technical changes, would prove unproductive and would create unnecessary uncertainty in domestic markets.

2. It is important that a clearly articulated national resource taxation policy be developed. Such policy serves two purposes. First, taxation schedules and allowances can be used to provide public incentives for resource development and exploitation. An examples of this includes selected capital asset depreciation allowances. A second use of such policy is generation of mining-related sources of revenue. This aspect of natural resource taxation policy is discussed further below.

   As domestic coal resources approach world prices it is quite apparent that significant "down-sizing" will occur in the country's coal sector. Output and employment in this sector may decrease by as much as 40 percent from its 1989 levels. Although the full regional dimensions of such down-sizing is not currently understood, it is probable that the impacts will be disproportionately shared between the two republics.

   Mines left open after the down-sizing should be profitable enterprises. The elimination of existing cross-subsidies (mine-to-mine) should allow the introduction of appropriate levels of resource taxation without significant start-up dislocation. Tax revenues generated by operating mines could be either (1) dedicated to public sector costs of the mining sector, or (2) used as general revenues for either national or republic governments. If resource tax revenues are dedicated to the mining sector, proceeds could be used as production efficiency grants or loans, economic readjustment assistance to displaced workers, or as a source of revenues for reclamation efforts.

Implementation of this recommendation would require specific examination of resource taxation situations in comparable countries. This analysis should include features such as taxation devices and schedules; linkages between resource taxation and other fiscal policies; elasticities of demand with respect to tax rates and income; and alternative mechanisms for distributing tax revenues that are collected.

3. Significant economic dislocation by the work-force currently in the mining sector will clearly occur. Relocation and retraining assistance would help workers in this sector move to other sectors in the economy. Such assistance would not only provide transitional assistance to individual workers but would provide an economic "buffer" to local and national economies--mitigating the negative multiplier effects of large down-sizing in the economy.

   The assistance could be modelled after the Emergency Economic Assistance Program (used during the late 1970s) of the U.S. Economic Development Administration or other comparable programs. Under these programs, funds are often dedicated for worker retraining and industrial retrofitting. It is common to allow local (or regional) governments to apply for such funding. Funding for such assistance would most appropriately come from some form of resource taxation.

4. The subsidized use of coal by household consumers has met certain social goals but has also led to the over- consumption of the coal resource--to the detriment of obvious environmental goals. It is important that remaining price distortions be removed so that an incentive is created for household consumers to shift to more environmentally sensitive fuel sources.

   Economic hardship for low-income families can be mitigated through income-transfer programs (for example, energy purchase assistance) while removing the price distortions among various fuels.

C. Natural Gas

Natural gas supplies are purchased almost entirely from sources external to the country. METALIMEX purchases bulk gas supplies from the USSR. Natural gas distribution is operated by the Czech Gas Enterprise in the Czech Republic and by the Slovak Gas Enterprise in the Slovak Republic. The transit gas line is operated by Transgas in the Czech Republic and the Brotherhood line by the Slovak Gas Enterprise in the Slovak Republic.

Major changes have occurred in the pricing of natural gas in recent years. Prior to 1991 natural gas prices to consumers were determined using a cost-based system. This system, although capable of establishing efficient prices for consumers in "theory," was weakened by numerous distortions (largely due to cross-subsidies among consumers). For example, residential consumers were subsidized by industrial users and current users were subsidized by future users (long-run facility maintenance was not included in price).

Beginning in 1991 the USSR began pricing their natural gas exports at international levels. This prompted a revision of price determination within Czechoslovakia. Today prices to consumers reflect the cost of natural gas procurement and the average cost of distribution over all regions of the country. The effective price to large consumers is currently approximately 2,900 Kcs/MCM and to smaller (retail) consumers approximately 2,200 Kcs/MCM. Thus, cross-subsidization continues.

As a general statement, much emphasis is being placed on increasing the role of natural gas in the overall energy sector. Considerable effort is being placed in finding alternative suppliers of natural gas and in developing increased storage capacity within the country.

The conclusions and recommendations follow:

1. Present mechanisms for natural gas pricing, principally continued development of cost based tariffs, should be continued.

2. Efforts to procure alternative supplies of natural gas should be continued. This recommendation is based on the continued uncertainty of USSR supply and the price advantages of having alternative supplies for domestic consumption.

3. Expanded natural gas storage facilities appear to be important. Detailed economic studies should be undertaken, however, before significant investments are made in this area.

D. Petroleum Sector

In recent years Czechoslovakia has been insulated from fluctuations in crude oil prices because of its heavy reliance on long-term, fixed price contracts with the USSR, its primary crude oil supplier. The USSR remains the primary source of petroleum for Czechoslovakia, but prices now are determined using international crude oil prices as the basis.

In turn, Czechoslovakia is rapidly moving towards bringing related prices in line with international (EEC) price levels. Prices were increased to border prices recently, even during a period of rapidly escalating oil prices resulting from the Gulf War. Pricing levels were consistent with a crude oil price of approximately $30 per barrel, thus leaving some margin for future decreases in price.

Ex-refinery prices appear to be quasi-decontrolled with the expectation that all prices will be decontrolled in the foreseeable future. The refining sector appears to be especially positive on the expectation of price decontrols and feels that they can compete on a level footing internationally and with the alternative sources of energy (oil, natural gas and coal) domestically. Evidence of fuel substitution in the cement industry on the basis of price is viewed as positive competition, for example.

The conclusions and recommendations follow:

1. There appears to be some confusion and lack of understanding between the refiners and the government on how and what prices are controlled at present, under what conditions, and what costs can be passed through. The lack of a clear pricing policy will make planning for the sector extremely difficult during the transition period.

   Articulation of a clear national (and republic) pricing policy for the petroleum sector is of immediate importance.

2. The reliance on preconceived ideas, rather than the pricing mechanism, for the allocation of crude oil to different consumer sectors could have some detrimental impact on certain consumers, especially the petrochemical industry. Petrochemical exports have decreased dramatically this year due to crude oil allocation resulting from problems with USSR crude supply.

   The impact of petroleum price increases on the energy intensive users and their impact on the economy as a whole deserves careful consideration. This could be undertaken as part of a broader analysis of potential economic restructuring within the Czechoslovakian economy. This study should examine the use of petroleum (or energy resources more broadly) throughout the industrial sectors of the Czechoslovakian economy. The existing national input-output model could be useful as a benchmark for this analysis. The analysis needs to be extended further, however, to include the impacts of higher petroleum prices on industrial output (output elasticities) and on foreign trade relationships. The inflow and outflow of hard currency associated with the use of petroleum in the industrial sector should also be examined.

3. Decontrol of ex-refinery prices is expected to provide the impetus for the efficient restructuring of the refining sector. This may not be fully effective as long as the refiners do not have direct access and control of their crude oil supplies due to the existence of government purchasing monopolies and lack of hard currency. Increased competition in the purchasing component of the petroleum sector is essential.

E. Industrial Sector

While much of our work dealt with pricing issues within individual energy sectors it became quite clear that many issues transcend such boundaries and are best understood using a more broad perspective. The following discussions on the industrial and financial sectors reflect this perspective.

It is clear that Czechoslovakia (and other Eastern European countries) will be going through rapid economic restructuring. Industrial and non-industrial outputs will be changing in response to domestic and international market shifts. In the case of the Eastern European economies, these shifts will be accelerated by rapidly changing energy prices.

Three forces are currently playing crucial roles in reshaping the Czechoslovakian economy: (1) rapidly rising energy prices, (2) hard currency constraints, and (3) massive capital requirements.

Rising energy prices are increasing the relative prices of Czechoslovakian produced energy intensive goods and services. Rising energy prices are, thus, selectively affecting demands for both domestic and export consumption. As the prices of Czechoslovakian goods and services increase it is likely that considerable reductions in national output will be necessary. Some are concerned that entire industries that are extremely energy intensive (such as aluminum) will be eliminated due to rising energy prices.

Economic adjustment requiring externally secured products (imports) are also causing concerns. Realities of the modern international market are such that hard currency is often required to complete market transactions. A natural response to these conditions is to reduce or minimize any economic activity requiring large amounts of hard currency. The chemical sector is subject to these pressures, for example, since the inputs for this sector are all externally purchased (requiring hard currency).

It is also clear that a large amount of re-tooling will be required as the Czechoslovakian economy adjusts over time. New capital will be required as industries adjust to new production technologies and as firms change the goods they produce.

The conclusions and recommendations are meant to augment those of the AID Industrial Energy Efficiency Program carried out by RMA and are as follows:

1. Energy prices faced by industrial firms have increased significantly since 1989. In response, firms can either raise the price of their goods and services (and face reduced demand) or seek ways to reduce the use of energy in their production processes.

   Industrial firms are beginning to treat seriously the need to adjust their production processes in ways that minimize energy use. Plant energy audits are being conducted; multiple use energy options are being explored; and co-generation is being considered where it is not already in use, to reference a few examples. Development of a formal national (or republic) program that expedites and rationalizes the industrial transition to new energy conditions is crucial. This program could consist of three main thrusts:

   A. Industrial Energy Efficiency Management. Training programs should be

utilized focusing on helping firms identify ways to conserve or replace energy in their production processes.

B. Development of Energy Efficiency Materials/Equipment. Many of the technical means for conserving or replacing energy can be developed using domestic private firms and expertise. These services can be supported by national (republic) promotional programs, informational techniques, and incentive programs.

These options could include the use of Energy Service Companies (ESCOs) as the vehicle. These companies could provide energy conservation services or equipment, for example, in exchange for a share of energy savings (so-called shared savings programs). One benefit of this approach is that, in general, no investment (and thus hard currency) is required by the energy consumer.[18]

C. Energy Efficiency Loan Programs. Once energy efficiency measures have been identified for firms, a major barrier to implementation may be availability of sufficient finance capital for purchase of goods and services. A loan program, administered through the banking system (or through a government ministry), can promote the implementation of energy conservation equipment.

This program could provide loans for the purchase of energy conservation equipment. Loans would be repaid by firms from the savings realized from energy conservation (and other sources). Interest rates for loans could be "at market" or "below market" depending on the degree of incentive desired by the government. Funds for the loan program could be secured through either direct government appropriation or through the sale of energy efficiency bonds.

A second option would be establishment of governmental loan guarantees for commercial bank energy efficiency loans. Expected rates of return on a variety of energy efficiency measures are sufficient to attract commercial bank activity. Removal of economic uncertainty pertaining to these loans would encourage private sector financing of appropriate conservation measures and would allow interest rates to be sufficiently low to encourage industrial energy conservation programs to be undertaken by most sectors throughout the

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18 As a practical matter, there are a variety of ways to structure a shared savings program. If the savings are great enough (compared to the investment required to obtain them), customer contributions are generally not required. as the ratio changes, and the investments are less cost-effective, many will not go forward without a financial contribution from either the customer or energy provider (such as the electric utility).

economy.

All of the options above should be considered as illustrations of alternative methods for capitalization, especially options that might be considered as quick, start-up initiatives. Other options that should be considered include promotion in development of private A & E operations and development of private energy vendors and contractors.

2. Rapid price increases, uncertainties about future industrial output levels, demands for hard currency, and movement away from centralized planning are all factors causing extreme uncertainty in the industrial sector of Czechoslovakia. Although central planning is being replaced by market mechanisms, this does not imply that there is no need for market-oriented industrial policies.

   Such policies would take into account the uncertainties of international markets, hard currency requirements, macroeconomic linkages, and strategic requirements for example. The role of the national industrial policy would be to anticipate and estimate the impacts of rising energy prices and corresponding impacts on national industrial output, employment, income, government expenditures and revenues, and the environment. In whatever form, development of a national industrial policy might provide the framework in which important industrial and governmental decisions could be made.

F. Financial Sector

The existing financial sector in Czechoslovakia is based on a strong central bank with local branches responsible for currency control and savings functions. A small commercial banking sector is beginning to emerge. There appears to be little in the way of secondary money markets for debt instruments or in the way of security markets (selling of stocks and bonds).

The financial capital requirements of the emerging Czechoslovakian economy are large. No reliable estimates exist as to the amount of investment and savings that would be required to re-tool the Czechoslovakian economy, although there is little doubt that it would be several times larger than current levels of domestic savings.

The conclusions and recommendations follow:

1. Although this effort was primarily oriented towards energy pricing reform, it has become extremely clear that reforms must take place in the financial sector of the Czechoslovakian economy if the more broad-based economic reforms are to take place.

2. It is not clear, for example, if sufficient investment resources would be available if firms decided to make only ten percent of estimated potential energy efficiency investments. Loanable funds for household energy conservation measures are equally uncertain.

3. A detailed study of the Czechoslovakian financial sector should be conducted to ensure that necessary prerequisites for broader economic reform are in place. This study should examine the existing and emerging relationships among national income, investment and savings. It should also explore the possibilities for creation of secondary debt markets and tradable securities markets. By necessity this study would also need to explore legal dimensions for creation of all of the above prerequisites.

APPENDIX A

Summary of Final Trip to CSFR

APPENDIX A

Summary of Trip to the CSFR: September 9 - 13, 1991

The team members on this trip were Messrs. Salgo and Huddleston. It will be recalled that the two previous trips -- as well as the intervening communication and work -- identified a number of important matters concerning which our assistance was requested. These matters were discussed in some detail at the Bratislava workshop but are the subject of continuing interest. The following summary of these discussions is divided into two parts: modelling and data issues and all other matters. Modelling issues were a particularly important concern on this trip because the modelling efforts are moving along rapidly and there were many questions of the sort described below.

It should be noted here, although it is not discussed further below, that Mr. Salgo met with Ms. Lee Roussell of USAID in Prague. The meeting was a broad ranging discussion of various matters relating to the project and was in the nature of a debriefing session.

Modelling

During the May Bratislava workshop, models from RMA (industrial and transportation) and Tellus (LEAP and its associated Environmental Data Base (EDB)) were discussed and demonstrated. These models have been placed with several CSFR (and republic) organizations[19] which are in the process of adopting them for various modelling exercises. During this trip it was necessary to work with these organizations concerning their modelling efforts. Assistance was requested concerning technical problems with the models themselves and with various matters related to the modelling itself. For example, advice was requested concerning what one might assume, at this stage, for both consumer and industrial responses to energy price increases.[20] That is, what responses are most appropriate for the scenarios presently under development?

The discussions concerning modelling issues took place in both Prague (at the National Academy of Sciences) and in Bratislava (at the Slovak Ministry of Economy). The balance of this section begins with a description of some of the general modelling concerns and then turns to a recapitulation of the Prague and Bratislava discussions. There is obviously some overlap between the general concerns and the meeting topics.

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19 These include the Institute of Economics of the Czechoslovak Academy of Sciences; The Slovak Ministry of Economics, and the Czech Technical University. In addition, a request for LEAP from the Slovak Power Enterprise is currently being processed.

20 As part of understanding industrial energy price elasticities in the short- and long-term, one would have to assess, for instance, the alternatives available to current industrial production techniques.

General Concerns about Modelling

The assessment of price elasticities is a particularly difficult problem in the CSFR (as well as other economies in Eastern Europe). The elasticity estimates for western (including U.S.) economies is of limited value for several reasons. The price increases are generally much greater than seen in the western economies; thus, on the household side, price elasticity estimates are likely to be confounded with significant income effects, particularly since the CSFR is a relatively poor country. In addition, because of the significant amount of central heating (equivalent to master-metering in the U.S.), the ability of customers to respond -- particularly in the short run -- will be constrained (in comparison to other countries with a greater degree of customer flexibility at the end-use).

In the industrial sector, the short term responses to price increases will be limited in the CSFR, as elsewhere; instituting significant changes in production techniques in the short term is always difficult.[21] The long-term is, by definition, a time period after which changes in capital (equipment, machinery, etc) is possible. Thus, the long-term energy price elasticity depends critically on such matters as the ability to withstand any short-term profit erosion, the availability of long-term financing -- which is both a structural matter (concerning the viability of the financial sector) and an individual matter (if available, will that firm qualify?).

Thus, another major problem, for which continuing assistance was requested, concerns the estimation of the financial dimensions of energy-related economic restructuring. This is a priority issue at present. In a word: In what direction is the economy, and the energy sector, moving and what type of financial structure (and how much currency) will be required to 'get there'? The financial requirements and implications of various scenarios must be evaluated carefully if the scenario development exercises are to be an adequate guide to high level policy.

The organizations which have the Tellus and RMA models have been commissioned by either the federal or republic ministries to prepare scenarios for planning purposes. It is apparent that assistance to those efforts, on a continuing basis, would be both useful and welcome. Attached to this report as Appendix B is a letter from Maria Vlckova of the Slovak Ministry of Economy which describes, from that ministry's perspective, the type of assistance which they would seek in a future collaboration. Similar requests have been made verbally from the other organizations which are utilizing the RMA and Tellus models.

A persistent theme in our discussions with the planners and modelers concerns the paucity

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[21] The ability to respond to the price increases is not separate from the ability to either pass the costs to domestic or international consumers or -- if some or all the costs cannot be passed on -- absorb them and remain profitable. This matter is of great interest and importance for a number of industries, particularly those which are relatively energy intensive. This issue has been raised on numerous occasions during the course of the project.

of disaggregated data.[22] Naturally, this lack will affect the level of detail attainable in the scenario and other modelling exercises. It is useful to note that LEAP is designed to accommodate highly disaggregated data, but does not require it. In fact, LEAP is often used as a guide to data collection activities. Thus, LEAP can be used at this time, but the resulting scenarios will improve as the data itself improves.

Some guidance concerning data collection, management, and analysis would be useful. For example, the availability of goods in the free market means that estimates of the penetration and saturation of energy using equipment will be required. Sampling and statistical analysis techniques will become more important in the collection and analysis of data.

Another data problem arises because of the growth of a free market and because many state enterprise firms will be privatized. That is, what data are or are not proprietary? There is a great deal of confusion, particularly as regards environmental data (such as emissions of pollutants) concerning what information can and should be collected from firms which have been privatized. A separate question concerns the definition of what data might then be in the public domain.

We turn now to a recapitulation of the meetings concerning modelling.

Meetings Concerning Modelling

1. At the National Academy of Sciences (Academy) in Prague

There were two meetings at the Academy during this trip (September 9 and 12). Each was attended by individuals from the Czech Technical University (CTU), who will work with the Academy concerning scenario development, and who themselves have been given LEAP and EDB. The Academy is working with LEAP/EDB and with the RMA industrial and transport models.[23]

At the meeting on Monday, September 9, an overview of the Academy's work and plans was provided by Ing. Petr Kacvinsky. The principal purpose of this meeting was to discuss

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[22] These questions arose in discussions at the Academy of Science in Prague and at the Ministry of Economy in Slovakia.

[23] Materials prepared for the trip and delivered to the Academy and CTU attenders were:

a. "Output Responses to U.S. Price Increases"
b. "Selected Writings on Price Elasticities"
c. "Role of Energy Price Changes in Restructuring the Czech Economy"
d. "Overview of Industrial Energy Conservation Programs"
e. "User Guide to the [RMA] Industrial and Transportation Models"
f. "Revised/updated Programs for the Industrial and Transportation Models"

current scenario development by the Academy and the current use of LEAP/EDB from Tellus and the RMA industrial and transport models. The Academy has been commissioned by the Federal Ministry of Economy to provide an alternative set of energy, environmental, and overall economic scenarios to those prepared by VUPEK.

The Academy has completed an analysis of each fuel sector, specifically analyzing questions concerning the impacts of price liberalization and the need for regulation.[24] We should treat this analysis as a first step in the development of a fully articulated national energy policy which is being drafted by the Federal Ministry of Economy (in conjunction with other ministries and the Academy) and will be released shortly.

Ing. Kacvinsky also described the upcoming phase of the Academy's energy policy analysis. The focus of this phase will be estimating prospective demand and supply conditions at the federal level. Several steps are involved:

a. The development of estimates of the country's economic structure over the next ten years is their starting point for demand projections. Changes in consumption, by sector, are being developed; the primary focus is on the energy intensity of each sector (household, industrial, commercial).[25]

b. An inventory of energy supply resources in the CSFR has been developed, using primarily energy accounting techniques.

c. The preliminary conclusion from their analyses thus far is that less primary energy will be required in the year 2000 than in the year 1989. According to Ing. Kacvinsky, this will allow for at least a modest reduction in the number of coal-fired electricity plants.[26]

d. The Academy's preliminary study projects a 33 - 55 percent reduction in coal demand by 2005. Some of the reduction is the result of national economic decline; another portion is due to the projected replacement of some coal by nuclear energy. There are numerous discussions under way concerning other modes of fuel or energy substitution, such as the possible use of heating oil rather than nuclear energy for the replacement of coal. Naturally, these types

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24 The impacts of price liberalization on price itself and on the responses of the various sectors was assessed by the Academy. Whether or not there was a need for regulation in any fuel sector depends upon the degree of competition that sector. This, too, was addressed by the Academy.

25 The Academy expressed an interest in using the RMA industrial model to verify industrial growth and energy consumption forecasts. They have concentrated primarily on the direct effects on consumption of rising energy prices; they were intrigued by the notion of output price elasticities and how these might affect the national economic structure over the long-term.

26 We emphasize that we have not had the opportunity to review their **preliminary** analysis and, thus, cannot comment upon the quality of the effort or whether the conclusions are likely to be borne out by the more complete study.

of proposals will be evaluated as the various scenarios are developed.

Ing. Kacvinsky and the others at the September 9 meeting made it clear that there was great concern about the lack of detailed disaggregated data and that LEAP modelling and other scenario development and policy would suffer until such data were available. This issue has been discussed earlier in this report. Mr. Kacvinsky noted that two related areas ('a' and 'b', below) remain crucial to the development of energy policy and that much work and assistance is needed in these areas.

a. Little is known about the investment requirements of industrial firms and households as they respond to rising energy prices. It is possible to estimate how much investment will be required in the energy production sphere, but the induced effect in the industrial and household sectors has not been well estimated.

b. While energy conservation as a concept enjoys increasing acceptance in the CSFR, specific tools for planning and implementation are weak. Especially lacking are analyses of the overall financial requirements for various energy conservation programs in both the industrial and household sectors. Because of its heterogeneity, the industrial sector presents different, and more difficult, analytical problems.

It was agreed during this meeting that a second meeting, scheduled for Thursday, September 12, would be most useful. Although a number of issues were discussed, the primary purpose of the second meeting was to allow Ing. Soukop to ask questions concerning LEAP, since it will be central to their scenario development work. Dr. Paul Raskin, President of Tellus, and one of the principal developers of LEAP (who was coincidentally in Prague on other business) was able to attend the meeting.

Mr. Soukop, who has a sophisticated understanding of LEAP (and, in general, has excellent modelling skills), suggested some changes and improvements to LEAP. He was informed by Dr. Raskin that many of his suggestions will be incorporated in a revised version of LEAP which will be distributed shortly.[27] Other changes to LEAP were suggested which, according to Dr. Raskin, may not be possible in the short term. As is explained to all users of LEAP, the model is worked on continually, to improve upon and enhance its features. Thus, some of the suggestions made by the Academy may be available at a later date.

On another matter, Ing. Kacvinsky again discussed possible uses of the RMA industrial

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[27] According to the license agreement between Tellus/SEI and the users of LEAP, as LEAP is revised, users receive updated versions without charge. Mr. Soukop was of the opinion, for example, that it would be useful to LEAP users if the data entry screens displayed the values for data entry years when the macro drivers were employed. This would allow the user to get feedback concerning the impact of his or her assumptions. This modification to LEAP was made and will be a feature of the upgrade which will be shipped shortly to licensees. Some modifications to the transformation module suggested by Mr. Soukop have also been made.

model in current Academy work. However, because they do not currently have the Quattro Pro software, they have not been able to formally evaluate the model. (Dr. Huddleston promised that Quattro Pro would be provided, as it was subsequently.) The Academy would like assistance concerning the possible use of the model and for the evaluation of several scenarios currently under development at the Academy.

Ing. Kacvinsky stated that he would like to work toward an arrangement for ongoing collaborative research on the following: energy pricing; industrial and household responses; investment requirements; the characteristics of a more developed financial infrastructure; and general scenario development techniques. The research group would include the Academy, the Institute of General Energy (Ustav Obecne Energetiky) under Ing. Vrba, and experts from the U.S. Ing. Kacvinsky will pursue this with officials from both the U.S. and Federal Ministry of Economy.

2. At the Slovak Ministry of Economy in Bratislava

The meeting concerning modeling and scenario development issues took place on Wednesday, September 11. The general purpose of the meeting was to conduct a technical review and discussion of the LEAP/EDB and RMA industrial models. This was the second day of meetings in Bratislava. The meeting was attended by approximately a dozen individuals representing the Slovak Ministry of Economy (SME), the Power Research Institute, the Slovak Power Enterprise (SEP), and INCO (Inzinierska Konsultacna a Projektova Organizacia). The latter is a private firm which will assist the Ministry of Economy in its scenario development efforts.[28]

Messrs. Salgo and Huddleston provided overviews of LEAP and the industrial model, respectively. Ing. Horniak (INCO) discussed how he saw and understood the models and offered his opinions of their potential use in Slovakia.

a. Both models will be valuable for planning in Slovakia.

b. The RMA industrial model will be of most immediate use to Slovak planners. It is a straightforward, flexible model which addresses key issues currently under consideration in the republic. Dr. Huddleston turned over the latest versions of both the industrial and transportation models to Ing. Vlckova, along with final documentation.

c. LEAP is more complex than the industrial model and will take somewhat longer to put into full operation.[29]

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[28] The particular requirements for the use of LEAP were explained to INCO and, once again, to the members of the Slovak Ministry of Economy which has a LEAP user license.

[29] Ing. Stach (Slovak Power Research Institute) indicated that his institute had been doing scenario research for over 20 years and that LEAP appeared to be a refreshing, new way to think about the questions. Although the institute learned of LEAP only recently, he is interested in understanding it

d. Both models, in Ing. Horniak's view, represent a movement away from the use of large models in remote, centralized planning offices to the use of smaller models in decentralized locations.

e. There was a brief discussion of Tellus' Energy Conservation Model (ECO) and its possible use for some analyses. Some expressed an interest in it and Tellus has received an inquiry from SEP for ECO and is in the process of making an arrangement to provide it to them.

As for (d), this movement is indicative of the shift in analytical capability to the republic level. This movement is essential, given the recent shift in administrative responsibilities to the republics.

As at the Academy in Prague, there were concerns expressed about the availability of detailed data for many of the important variables.[30] The lack of adequate data was coupled with two other concerns that have also been expressed by others:

- Data collection -- as well as other planning requisites -- is presently constrained by the lack of clarity concerning the organizational structure for federal and republic planning. There is no single entity which is either entirely responsible for planning or for coordinating the efforts of the various entities which are carrying out planning tasks;

- Certain types of data will not be available after privatization occurs; for instance, the rules concerning proprietary information may allow firms to keep private some of what would otherwise be public.[31]

In our view, each of the above is a serious problem. As for the latter, it is evident that some guidance should be provided concerning the nature of proprietary information in a free market economy. There is likely to be substantial pressure placed upon government by private investors to adopt relatively restrictive rules concerning the release of important energy and environmental information. The rules which are adopted should reflect a

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in greater detail to see how it might be used in the institute work.

30 Ing. Simka (SEO) stated that he believes that SEP has adequately detailed data for its modeling and planning purposes. This issue could not be pursued at great length during the meeting. Suffice it to say that we are not convinced that adequate data exists for the newer types of planning that SEP will undertake in the future. For example, end-use forecasting in a market environment is a more difficult task than under a centrally planned economy in which the end use appliances and equipment are known with greater certainty; similarly, detailed assessments of the potential costs and savings from a broad-based conservation effort will also require detailed data.

31 The concern here is with the development of an understanding of the type of information which can be obtained from firms in the private sector. That is, once a firm is privatized, what will be the constraints on the information flow?

appropriate balancing of societal and investor requirements.[32]

This meeting concluded with general agreement that the RMA and Tellus models will be useful for their planning exercises. In addition, since this was the second and last day of meetings in Slovakia (with the same ministry attenders many others from the day before), we concluded with a discussion concerning the past connections with our project and possible future connections. Ing. Vlckova agreed to send a letter summarizing the possible topics on which the Federal Ministry of Economy and others would cooperate. This letter has been alluded to earlier and is attached here as Appendix A.[33] As may be seen from the letter, the proposal is for a collaboration in a wide variety of modelling and substantive areas.

Other Matters and Meetings

There were several other meetings in both Prague (September 9 and 12) and Bratislava (September 10) to discuss matters other than modelling. Friday the 13th of September was

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[32] We anticipate that there will be some tension between the desire for information and information which, if released, would be considered damaging to a private sector firm. In the US, for example, specific electric and gas use, by customer, is generally considered to be proprietary. There was concern that the rules which are promulgated do not inhibit private investment by requiring the release of such types of information.

[33] The collaboration proposal from Maria Vlckova includes several components, as referenced below. We agree with her assessment that these would be useful areas of collaboration.

1. Some specific changes to the LEAP and Industrial model software may be useful and targeted for their specific problems.

2. Training of Ministry staff concerning:

   - methodologies for the inclusion of environmental costs in energy prices;
   - institutional changes within the industrial sector which would improve energy management;
   - data collection, storage, and analysis methodologies;
   - the development of methodologies for examining the cost-effectiveness of new development programs.

3. Other matters which she believes are presently important include:

   - the development of appropriate contracts for the utilization of private sector resources (power projects and conservation) in the energy sector;
   - the development of new energy tariffs;
   - analysis of the potential for (including the cost-effectiveness of) demand side management investments.

spent with Mr. Vladislav Hauptvogel on a trip to North Bohemia to visit a coal-fired power plant and to see the effects of acid rain on the environment of the area. Although it is out of chronological order, the discussion here begins with the meeting in Bratislava on September 10. We start with this meeting so as to provide some continuity with the immediately preceding comments.

1. Slovak Ministry of Economy: September 10

This meeting was for the entire day and was coordinated by Ing. Maria Vlckova of SME and attended by approximately 15 individuals from various organizations including SEP and the Slovak Commission on the Environment (SCE). The participants were welcomed by Ing. Jaroslav Kubecka, First Vice Minister of SME. The stated purpose of the meeting was to follow-up on many of the issues that had been discussed during the May workshop and other May meetings with our project team.

Ing. Kubecka expressed his opinion concerning several important points at the beginning of the meeting.

a. Energy production in Slovakia is not likely to expand in the near future. It will be necessary to deal with issues concerning energy efficiency and with what he called the effective reorganization of the republic's economy.

b. Perhaps the largest problem for the Slovak republic arises from the financial constraints. The ability to implement plans will be constrained by the inadequate financing.

c. The republic has specific problems in the area of mining and in financing the completion of some electric generation capacity. (There was some discussion later on concerning a nuclear facility in Slovakia which is only partially constructed.)

d. As a general matter, "solutions" should not be "compartmentalized", but need to take into account "the realities of Slovak economic resources and constraints". We took this to be a reiteration of points made often in both republics and which we stress here. That is, the weakness of the economy and the limitations of the financial sector must be considered during the planning process. If not, the plans will be idealized rather than practical.

As noted above, the purpose of this meeting was to allow for the continued discussion of issues raised in May -- or indeed other critical issues of the moment -- and, thus, there was no central theme to the meeting. And because the participants were from a variety of organizations, the questions and issues raised were quite disparate. We only list and describe them here.

There was a lengthy discussion concerning the types of issues that one must consider in planning during periods of significant uncertainty. Much of this discussion focused on the

ways in which the U.S. responded to the exogenous shocks, and their consequences, in the 1970s. The points, which have been more fully addressed in Section II above will not be recapitulated here. It is important to note, however, that this topic led to discussions of a variety of related topics: ways to consider and evaluate resource diversity; the possible planning benefits of somewhat smaller, shorter lead time, production units (such as power plants); the potential benefits of conservation from a planning perspective (cost, lead time, reliability, time of availability, environmental); the types of models which would best accommodate the planning requirements.

Stemming from a discussion of the role of PURPA in the U.S. response to the problems of the 1970s, questions were raised concerning private sector matters. In particular, we discussed whether or not there would be any opportunity for joint ownership (which would include at least one private sector 'partner') of transmission lines. We thought that there might be, but that if the transmission line was in effect a natural monopoly, it should be regulated. Thus, in principle, there could be joint ownership, but how likely it would be depends in large part on whether profits would be allowed to exceed the regulated rates of return to equity.

Another set of discussions focused upon nuclear power issues, such as: the relative cost of nuclear versus other options in the U.S.; average life of nuclear plants and nuclear fuel. This conversation was quite detailed and dealt with specifics such as the various types of reactors, their vintages, the regional differences in relative power costs in the U.S., and so on. We recommended clearly that planning judgments in Slovakia concerning such matters must be made on the basis of the specific data in the republic. U.S. costs (at various times, with different reactor types, different regulation, and so on) should not be the primary basis for decisions concerning power system options.

Another discussion focused on whether or not in the U.S. there are tariff differentials for small versus large customers or for one type of industry or another. This discussion focused on two separate matters: the cost-based differentials in tariffs, on the one hand, and special 'breaks' for some customers who might pay less than the cost to serve them. It was explained that, in general, rates and tariffs are based upon costs and that, because costs differ among customer classes, tariffs differ as well.[34] Some of the discussion, therefore, focused upon whether some states -- which regulate retail rates -- have allowed utilities to charge industrial customers less than the full cost of service. It was explained that some states have, while others have not. We also discussed the categories of reasons given by the states for their decisions on this matter. As one might surmise, this issue is a particularly thorny one for each republic and the country as a whole, particularly in regard to those industrial enterprises which are particularly energy intensive.

The general level of these discussions was quite high reflecting the expertise of the participants and the greater precision with which questions are framed than at the beginning

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[34] Industrial rates and tariffs differ from those for households because, for example, industry takes power at higher voltages generally. And within the industrial class there are differences in voltages, load factor, power factor, instantaneous demand, and so on.

of our project. Whether the information conveyed is from us or others, it is apparent that much has been learned since the beginning of our project. This is a major reason why, as we recommend, it is necessary, over time, to sharpen the issues, narrow the focus onto a relatively few of them, and dig into each more deeply.

2. Czech Power Works (CEZ): September 9

This meeting was with Erik Schmidt, Chief Engineer for CEZ. The team has met with Ing. Schmidt on many occasions, and he was an attender of the Bratislava workshop in May. The discussions with Ing. Schmidt have always been wide-ranging and detailed. He has studied several matters -- such as U.S. rate and tariff policy, regulatory structures, and others -- at some depth. This meeting was another opportunity to address some questions concerning U.S. regulatory policy. He was also provided information concerning relative fuel prices in different regions in the U.S., as he had requested that we bring that information with us.

There are a number of matters which we could pursue in depth with Ing. Schmidt in a future collaboration. He has, on a number of occasions, expressed an interest in U.S. regulation and would like to explore it in detail. We discussed several issues related to regulation at this meeting, building on discussions we have had with him in the past.

The question of how to structure the regulatory system generally, and how to solve certain particular regulatory problems, remains an important matter to be addressed in both republics and at the federal level. We have had many deep discussions concerning these matters, but the issues are complex and require a good deal of thought. Thus, despite the progress made, there is more which could be usefully done.

3. Czech Ministry for Economic Policy and Development of the Czech Republic: September 12

This meeting was attended by Mr. Salgo and Ing. Petr Knizek, Csc., Director of the Department of Fuel and Energy Policy. The meeting was relatively brief. The team had not met before with Ing. Knizek and, therefore, the discussion was principally in the nature of a debriefing. The nature of the project was discussed: its goals, how we sought to carry them out, where it goes from here. Ing. Knizek expressed a keen interest in some continued collaboration with our team and indicated that he would talk with others about the possibility. Ing. Knizek's principal interest in collaboration concerned scenario development and work in structuring and analyzing different scenarios.

4. Federal Committee for the Environment (FCE): September 12

The meeting was attended by Dr. Petr Horacek and Mr. Salgo. It was the first meeting between our team and Dr. Horacek, who is Advisor to the Minister of Environment. The discussion focused on methods for including environmental costs into energy prices. We also talked at some length about conservation implementation, which he sees as crucial to the mitigation of environmental problems in the CSFR.

As for the issue of environmental costs and energy prices, we discussed various approaches to dealing with both internalized costs (such as abatement equipment required by regulation) and externalities (the costs to society of the remaining emissions). The discussion was quite broad ranging. We agreed on certain general principles concerning externalities, such as the theoretical, if not practical, importance getting comprehensive damage assessments in order to value environmental externalities. We also discussed a compromise approach that Tellus has utilized and which has received a measure of acceptance by U.S. regulators. We have provided him with information concerning that approach.

As for the discussion of conservation, Dr. Horacek was most interested in how to structure implementation plans. Some approaches utilized in the U.S. were discussed. We also mentioned the USAID Energy Efficiency Program which is being managed by RMA as an example of approaches to implementation in the industrial sector.

5. Trip to North Bohemia: September 13

Prior to our departure from the CSFR, Mr. Vladislav Hauptvogel suggested a day trip to North Bohemia. There were several reasons to make this trip and spend the time with Mr. Hauptvogel. First, Mr. Hauptvogel has been a key person for the team and has been most gracious with his time and expertise. Second, it was necessary to spend time with him to review the project generally and to explore avenues for further collaboration. Third, it was important in our judgment to get a first hand view of coal operations, as well as the environmental impacts which were evident in the region.

The focus of the recapitulation here is on the prospects for future collaboration. Mr. Hauptvogel is of the view that the project went well and that much useful information was exchanged, a view which we obviously share. We suggested that a future collaboration should focus on a few issues which we would deal with in depth. This would not completely preclude the exchange of ideas on a broad range of issues; rather, the allocation and time and effort would be directed principally to those few issues. We explored some of the possible issues -- such as regulatory structures, conservation implementation, macroeconomic analysis, environmental costing and energy prices, certain financial analyses, private sector resources, and so on -- and agreed that there were numerous possible options from which to choose.

Mr. Hauptvogel recommended that we work toward a continuing collaboration.

APPENDIX B

Energy Prices for Romania, Czechoslovakia and Lithuania

ENERGY PRICES IN OWN CURRENCY INCLUDING TAX

AUTOMOTIVE FUELS RETAIL	UNITS	1988	1989	1990 1st Q	1990 2nd Q	1990 3rd Q	1990 4th Q	1991 1st Q	1991 2nd Q	1991 3rd Q	1991 4th Q	1992 1st Q
Leaded Premium												
Czechoslovakia	C/litre	8	8	12.4	-	13.5	18	18				
Lithuania	R/litre											4
Romania	L/litre											
Unleaded Premium												
Czechoslovakia	C/litre		9	12.4	-	13.5	18	18				
Lithuania	R/litre											
Romania	L/litre											
Leaded Regular												
Czechoslovakia	C/litre											
Lithuania	R/litre											3.5
Romania	L/litre							15			45	
Unleaded Regular												
Czechoslovakia	C/litre											
Lithuania	R/litre											
Romania	L/litre											
Diesel												
Czechoslovakia	C/litre	5.5	6.5	9.8	-	9	15	15				
Lithuania	R/litre											3
Romania	L/Litre											
LPG for Vehicles												
Czechoslovakia	C/GJ											
Lithuania	R/GJ											1.85
Romania	L/GJ											

AUTOMOTIVE FUELS WHOLESALE	UNITS	1988	1989	1990 1st Q	1990 2nd Q	1990 3rd Q	1990 4th Q	1991 1st Q	1991 2nd Q	1991 3rd Q	1991 4th Q	1992 1st Q
Leaded Premium												
Czechoslovakia	C/tonne	3550	2474	2476	2476	2476	2476					
Lithuania	R/tonne											2637.5
Romania	L/tonne											
Unleaded Premium												
Czechoslovakia	C/tonne	3550	2474	2476	2476	2476	2476					
Lithuania	R/tonne											
Romania	L/tonne											
Leaded Regular												
Czechoslovakia	C/tonne	3550	2474	2476	2476	2476	2476					
Lithuania	R/tonne											1857
Romania	L/tonne											
Unleaded Regular												
Czechoslovakia	C/tonne	3550	2474	2476	2476	2476	2476					
Lithuania	R/tonne											
Romania	L/tonne											
Diesel												
Czechoslovakia	C/tonne	2834	2080	2080	2080	2080	2080					
Lithuania	R/tonne											1800
Romania	L/tonne											
LPG for Vehicles												
Czechoslovakia	C/GJ											
Lithuania	R/tonne											1785
Romania	L/GJ											

3/5/92

FUEL OIL				1990				1991				1992
RETAIL/RESIDENTIAL		1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Light Fuel Oil	UNITS											
Czechoslovakia	C/litre	820	820	820	820	820	820					
Lithuania	R/tonne											1877
Romania	L/tonne			1875								
WHOLESALE/INDUSTRY												
Light Fuel Oil												
Czechoslovakia	C/litre	24.51	24.76	35.69	-	31.3	59.34	54.58				
Lithuania	R/tonne											1785
Romania	L/litre											
Heavy Fuel Oil												
Czechoslovakia	C/tonne	2290	1700	2718	-	2760	4710	4272				
Lithuania	R/tonne											1171.5
Romania	L/tonne		1875					1500				

PROPANE/BUTANE/KEROSINE				1990				1991				1992
RETAIL	UNITS	1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Propane Butane Mix												
Czechoslovakia	C/GJ											
Lithuania	R/GJ											31.28
Romania	L/GJ											
LPG												
Czechoslovakia	C/tonne	4203	4249									
Lithuania	R/tonne											
Romania	L/tonne											
Kerosine												
Czechoslovakia	C/litre	5	5	6								
Lithuania	R/litre											
Romania	L/litre											
WHOLESALE												
Propane Butane Mix												
Czechoslovakia	C/tonne											
Lithuania	R/tonne											1775
Romania	L/tonne											
LPG												
Czechoslovakia	C/tonne	4981	3166									
Lithuania	R/tonne											
Romania	L/tonne											
Kerosine												
Czechoslovakia	C/tonne	3325	2160	2160								
Lithuania	R/tonne											
Romania	L/tonne											

CRUDE OIL				1990				1991				1992
WHOLESALE	UNITS	1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Czechoslovakia	C/tonne	2250	1550	1550	1550	1550	5280					
Lithuania	R/tonne										70	
Romania	L/tonne							6000				25476

TURAL GAS				1990				1991				1992
INDUSTRIAL USE	UNITS	1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Czechoslovakia	C/10^7 kcal	2414	1746	1777	-	1530	2520	3350				
Lithuania	R/m^3										42	
Romania	L/tonne		1000				2800				6000	
ELECTRIC GENERATION												
Czechoslovakia	C/10^7 kcal	2414	1746	2355	-	2027	3338	4439				
Lithuania	R/t m^3										42	
Romania	L/tonne		1000				2800				6000	
RESIDENTIAL USE												
Czechoslovakia	C/10^7 kcal	1080	1058	1058	-	1058	1058	1058				
Lithuania	R/t m^3											3.02
Romania	L/tonne											

COAL	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
INDUSTRIAL USE												
Steam Coal												
Czechoslovakia	C/tonne	182	195	235	-	215	311	311	471			
Lithuania	R/tonne											
Romania	L/tonne		179					350			810	
Coking Coal												
Czechoslovakia	C/tonne	705	917	944	-	917	1320	1467	1661.1			
Lithuania	R/tonne											
Romania	L/tonne											
Coke												
Czechoslovakia	C/tonne	965.32	1314.91	1349.81	1349.81	1349.81	1349.81	1934.2				
Lithuania	R/tonne											
Romania	L/tonne											
ELECTRIC GENERATION												
Steam Coal												
Czechoslovakia	C/tonne	102	109	134	-	120	179	179				
Lithuania	R/tonne											
Romania	L/tonne							350			810	
RESIDENTIAL USE												
Steam Coal												
Czechoslovakia	C/tonne	180	180	180	-	180	180	180				
Lithuania	R/tonne											
Romania	L/tonne											

ELECTRICITY	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
LIGHT INDUSTRIAL***												
Consumption Charge												
Czechoslovakia	C/kwh	0.466	0.477	0.525	-	0.499	0.597	0.597				
Lithuania	R/kwh											0.30
Romania	L/kwh							2.2			12.7	
Demand Charge#												
Czechoslovakia	C/KW											
Lithuania	R/KW											750
Romania	L/KW										2407	
HEAVY INDUSTRIAL												
Consumption Charge												
Czechoslovakia	C/kwh											
Lithuania	R/kwh											0.3
Romania	L/kwh		0.57					0.8			5.7	
Demand Charge#												
Czechoslovakia	C/KW											
Lithuania	R/KW											750
Romania	L/KW							706			6364	
RESIDENTIAL												
Czechoslovakia	C/kwh	0.506	0.506	0.497	-	0.497	0.497	0.497				
Lithuania	R/kwh											0.35
Romania	L/kwh							0.65			0.65	

*** for industries < 1KV (Romani) or <750KVa Lithuania
# demand changes are paid annually

HEAT	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
INDUSTRIAL												
Consumption Charge												
Czechoslovakia	C/GJ	57	57	56	56	56	59.2		102.96			
Lithuania	R/GJ											85.67
Romania	L/GJ							462			1100	
RESIDENTIAL												
Czechoslovakia	C/GJ	22	22	22	22	22	22					
Lithuania	R/GJ											11.46
Romania	L/GJ							88				

KEY

blank data not aviable
- assumed same price as pervious period

EASTERN AND CENTRAL EUROPEAN ENERGY PRICING

EXCHANGE RATES*

NATION	Units	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
Czechoslovakia	Crowns/US$	9.4	10	23.6	23.6	23.6	23.6	27.3	30.2	30.9	29.77	27.7
Lithuania*	Roubles/US$	0.629	0.629	1.6	1.6	1.6	1.6	1.6	1.79	1.6	1.6	120
Romania	Lei/US$	14.37	14.44	34.71	34.71	34.71	34.71	36.97	60.35	61.38	183	183

*1988–1991 official exchange rates for the USSR.
**The exchange rates are accurate through 4th quarter 1990, afterwhich multiple devaluations could occur per quarter. This is especially a problem in Lithuania and Romania late in 1991 and early in 1992.

ENERGY PRICES IN DOLLARS ($US) INCLUDING TAX

AUTOMOTIVE FUELS
RETAIL

	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
Leaded Premium												
Czechoslovakia	$/litre	0.55	0.60	0.53		0.57	0.76	0.66				
Lithuania	$/litre											0.03
Romania	$/litre											
Unleaded Premium												
Czechoslovakia	$/litre		0.90	0.53		0.57	0.76	0.66				
Lithuania	$/litre											
Romania	$/litre											
Leaded Regular												
Czechoslovakia	$/litre											
Lithuania	$/litre											0.03
Romania	$/litre							0.41			0.25	
Unleaded Regular												
Czechoslovakia	$/litre											
Lithuania	$/litre											
Romania	$/litre											
Diesel												
Czechoslovakia	$/litre	0.59	0.65	0.42		0.38	0.64	0.55				
Lithuania	$/litre											0.03
Romania	$/litre											
LPG for Vehicles												
Czechoslovakia	$/GJ											
Lithuania	$/GJ											0.02
Romania	$/GJ											

AUTOMOTIVE FUELS
WHOLESALE

	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
Leaded Premium												
Czechoslovakia	$/tonne	377.66	247.40	104.92	104.92	104.92	104.92					
Lithuania	$/tonne											21.98
Romania	$/tonne											
Unleaded Premium												
Czechoslovakia	$/tonne	377.66	247.40	104.92	104.92	104.92	104.92					
Lithuania	$/tonne											
Romania	$/tonne											
Leaded Regular												
Czechoslovakia	$/tonne	377.66	247.40	104.92	104.92	104.92	104.92					
Lithuania	$/tonne											15.48
Romania	$/tonne											
Unleaded Regular												
Czechoslovakia	$/tonne	377.66	247.40	104.92	104.92	104.92	104.92					
Lithuania	$/tonne											
Romania	$/tonne											
Diesel												
Czechoslovakia	$/tonne	301.49	208.00	88.14	88.14	88.14	88.14					
Lithuania	$/tonne											15.00
Romania	$/tonne											
LPG for Vehicles												
Czechoslovakia	$/GJ											
Lithuania	$/tonne											14.88
Romania	$/GJ											

42

FUEL OIL				1990				1991				1992
RETAIL/RESIDENTIAL		1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Light Fuel Oil	UNITS											
Czechoslovakia	$/litre	87.23	82.00	34.75	34.75	34.75	34.75					
Lithuania	$/tonne											15.64
Romania	$/litre			54.02								
WHOLESALE/INDUSTRY												
Light Fuel Oil												
Czechoslovakia	$/litre	2.61	2.48	1.51		1.33	2.51	2.00				
Lithuania	$/tonne											14.88
Romania	$/litre											
Heavy Fuel Oil												
Czechoslovakia	$/tonne	243.62	17.00	115.17		116.95	199.58	156.48				
Lithuania	$/tonne											9.76
Romania	$/tonne		129.85					40.57				

LIQUID GAS				1990				1991				1992
RETAIL	UNITS	1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Propane Butane Mix												
Czechoslovakia	$/GJ											
Lithuania	$/GJ											0.26
Romania	$/GJ											
LPG												
Czechoslovakia	$/tonne	447.13	424.90									
Lithuania	$/tonne											
Romania	$/tonne											
Kerosine												
Czechoslovakia	$/litre	0.53	0.50	0.25								
Lithuania	$/tonne											
Romania	$/litre											
WHOLESALE												
Propane Butane Mix												
Czechoslovakia	$/tonne											
Lithuania	$/tonne											14.79
Romania	$/tonne											
LPG												
Czechoslovakia	$/tonne	529.89	316.60									
Lithuania	$/tonne											
Romania	$/tonne											
Kerosine												
Czechoslovakia	$/tonne	353.72	216.00	91.53								
Lithuania	$/tonne											
Romania	$/tonne											

CRUDE OIL				1990				1991				1992
WHOLESALE	UNITS	1988	1989	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q
Czechoslovakia	$/tonne	239.36	155.00	65.68	65.68	65.68	223.73					
Lithuania	$/tonne										7.00	
Romania	$/tonne							216.39				139.21

NATURAL GAS	UNITS	1988	1989	1990 1st Q	2nd Q	3rd Q	4th Q	1991 1st Q	2nd Q	3rd Q	4th Q	1992 1st Q
INDUSTRIAL USE												
Czechoslovakia	$/10^7 kcal	256.81	174.60			64.83	106.78	122.71				
Lithuania	$/ m^3										23.33	
Romania	$/tonne		69.25				80.67				32.79	
ELECTRIC GENERATION												
Czechoslovakia	$/10^7 kcal	256.81	174.60	99.79		85.89	141.44	162.60				
Lithuania	$/ m^3										23.33	
Romania	$/tonne		69.25				80.67				32.79	
RESIDENTIAL USE												
Czechoslovakia	$/10^7 kcal	114.89	105.80	44.83		44.83	44.83	38.75				
Lithuania	$/ m^3											0.03
Romania	$/tonne											

COAL	UNITS	1988	1989	1990 1st Q	1990 2nd Q	1990 3rd Q	1990 4th Q	1991 1st Q	1991 2nd Q	1991 3rd Q	1991 4th Q	1992 1st Q
INDUSTRIAL USE												
Steam Coal												
Czechoslovakia	$/tonne	19.36	19.50	9.96		9.11	13.18	11.39	15.60			
Lithuania	$/tonne											
Romania	$/tonne		12.40					9.47			4.43	
Coking Coal												
Czechoslovakia	$/tonne	75.00	91.70	4.00		38.86	55.93	53.74	55.00			
Lithuania	$/tonne											
Romania	$/tonne											
Coal												
Czechoslovakia	$/tonne	102.69	131.49	57.20	57.20	57.20	57.20	70.85				
Lithuania	$/tonne											
Romania	$/tonne											
ELECTRIC GENERATION												
Steam Coal												
Czechoslovakia	$/tonne	10.85	11.60	14.26		12.77	19.04	19.04				
Lithuania	$/tonne											
Romania	$/tonne							37.23			86.17	
RESIDENTIAL USE												
Steam Coal												
Czechoslovakia	$/tonne	19.15	19.15	19.15		19.15	19.15	19.15				
Lithuania	$/tonne											
Romania	$/tonne											

ELECTRICITY	UNITS	1988	1989	1990 1st Q	1990 2nd Q	1990 3rd Q	1990 4th Q	1991 1st Q	1991 2nd Q	1991 3rd Q	1991 4th Q	1992 1st Q
LIGHT INDUSTRIAL***												
Consumption Charge												
Czechoslovakia	$/kwh	0.05	0.05	0.06		0.05	0.06	0.06				
Lithuania	$/kwh											
Romania	$/kwh							0.23			1.35	
Demand Charge/												
Czechoslovakia	$/KW											
Lithuania	$/KW											79.79
Romania	$/KW										256.06	
HEAVY INDUSTRIAL												
Consumption Charge												
Czechoslovakia	$/kwh											
Lithuania	$/kwh											0.03
Romania	$/kwh		0.06					0.09			0.61	
Demand Charge/												
Czechoslovakia	$/KW											
Lithuania	$/KW											79.79
Romania	$/KW							75.32			679.15	
RESIDENTIAL												
Czechoslovakia	$/kwh	0.05	0.05	0.05		0.05	0.05	0.05				
Lithuania	$/kwh											0.04
Romania	$/kwh							0.07			0.07	

*** for industries < 1KV (Romania) or < 750KVa (Lithuania)
/ the demand charge is levied annually

HEAT	UNITS	1988	1989	1990 1st Q	1990 2nd Q	1990 3rd Q	1990 4th Q	1991 1st Q	1991 2nd Q	1991 3rd Q	1991 4th Q	1992 1st Q
INDUSTRIAL												
Consumption Charge												
Czechoslovakia	$/GJ	6.06	6.06	5.96	5.96	5.96	6.30		10.95			
Lithuania	$/GJ											9.11
Romania	$/GJ							49.15			117.02	
RESIDENTIAL												
Czechoslovakia	$/GJ	2.34	2.34	2.34	2.34	2.34	2.34					
Lithuania	$/GJ											1.22
Romania	$/GJ							9.36				

Note. these tables are a prototype.