REGIONAL ENERGY EFFICIENCY PROJECT (180-0030) CONTRACT # DHR-C-00-95-00064-00

Final Report

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The United States Agency for International Development (USAID), Bureau for Europe and the New Independent States issued RFP M/OP/ENI/EE-94-P-008 in September 1994 for a program to improve energy efficiency in Central and Eastern Europe and the Baltics (CEE). A team[1] formed by Electrotek Concepts, Inc. was competitively awarded the contract and began work in March 1995. This contract (DHR-C-00-95-00064-00), that formed an important park of USAID's Regional Energy Efficiency Project (Component #180-0030), ended on September 30, 2001. Regional activities were completed in the Baltics, the CENTREL, and the Southeastern European Cooperative Initiative (SECI) countries. Specific country activities were completed in Bosnia, Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, and Slovakia.

1.2 SITUATION

The political and economic transition that was the basis for the initiation of this effort continues in Central and Eastern Europe and the Baltic States. Fundamental changes are being made in political institutions, economic and financial structures and processes, privatization of state entities, and development of the private sector and social systems. Through the period March 1995-September 2001, the CEE and Baltic countries had specific traits that were addressed in the activities completed under this project, e.g. the:

- pace of political reform,
- profile of industrial capacity,
- size and profile of the labor force,
- existing political infrastructure and its adaptability to democratic traditions,
- existing economic infrastructure,
- energy supply and consumption characteristics,
- level of subsidies for energy purchases, and
- level of arrears and non-payment for consumption of natural gas and electricity.

The activities completed under this project supported the very significant concerns of the United States in efforts to promote a smooth and successful transition to democratic governance and market-based economies.

1.3 PROJECT OBJECTIVES

The objective of this component of the Regional Energy Efficiency Project was to provide a mechanism for technical and advisory services, training and research for an energy efficiency initiative and related activities in the CEE and the Baltic countries. The

[1] Electrotek Concepts, Inc. from Arlington, VA was the Prime Contractor. Major subcontractors were Resource Management Associates (RMA) from Madison, WI; International Resources Group (IRG) from Washington, D.C.; and Central Maine Power International (CMP) from Augusta, ME.

contract Statement of Work specified that Electrotek provide services in four related areas:

- Demand side management (DSM) and integrated resource planning (IRP);
- Energy service companies (ESCOs) and industrial buildings energy efficiency;
- Energy efficiency policy, strategy and finance; and
- Energy systems efficiency.

As part of certain technical assistance activities, Electrotek procured, shipped and helped install instrumentation and equipment to demonstrate sustainable energy efficiency improvements.

1.4 OVERVIEW OF PROJECT ACTIVITIES AND COUNTRIES

Baltic Regional Energy Development Program (BREDP)

The objective of the BREDP was to introduce modern planning methods for Baltic power systems, develop a least-cost energy planning capability in the Baltic region, and enable the Baltic States to develop, and periodically update, a common least-cost plan. Implementation of the activity was a joint effort between Eesti Energia of Estonia, Latvenergo of Latvia, AB Lietuvos Energija of Lithuania, the regional dispatch center DC Baltija in Riga, and Electrotek Concepts, Inc. (USA) under the guidance of a Steering Committee[2]. This activity also supported the application of planning tools to evaluate regional power system operation, and the identification and evaluation of transmission issues and organization and management structures required for regional cooperation. These tasks built upon the emerging capabilities of the newly developed planning departments at each of the Baltic organizations to advance their understanding of planning methods and tools, and their value in system planning and operations.

Electrotek worked with each of the utilities to accurately model their electric systems, and with the group as a whole, to conduct regional planning exercises. Major elements of assistance were:

- System simulation software, training and technical assistance was provided for load forecasting, expansion planning, optimal power flow models, and transaction scheduling
- Load flow, short circuit and transient/steady state analysis were performed on the transmission system to determine the impact of regional operation on system stability and integrity
- Transmission pricing and ancillary service cost studies were performed to demonstrate cost allocation techniques
- Extensive on-the-job training and advanced formal training programs in the U.S. in regional planning and operations techniques were completed.

[2] The Steering Committee consisted of top management personnel from Eesti Energia of Estonia, Latvenergo of Latvia, AB Lietuvos Energija of Lithuania, and DC Baltija in Riga. Oversight was provided by representatives of the United States Agency for International Development (USAID) and the European Bank for Reconstruction and Development (EBRD).

Latvia

Two activities were completed in Latvia. The *Natural Gas Energy Efficiency Program* at Latvijas Gaze supported improved efficiency of customer gas use through the development of a Customer Service/Energy Efficiency Center and demonstrations of customer efficiency improvements. The *Electricity Demand Side Management (DSM) Program* at Latvenergo supported improvement of the efficiency of electricity use by its customers. It included support for the implementation of a time-of-use rate program, a DSM demonstration program designed to achieve the desired load shape objectives and reduce customer arrears, and a DSM program plan.

Lithuania

This activity supported Lietuvos Energia's efforts to improve the efficiency of electricity use by its customers as well as by the company. It included support for a customer service department and a DSM demonstration project designed to achieve appropriate company and customer load shape objectives.

CENTREL

CENTREL is a regional group of four electric power companies from the Czech Republic (CEZ), Hungary (Magyar Villamos Muvek Rt.), Poland (Polskei Sieci Elektroenergetyczne SA) and the Slovak Republic (Slovensky Energeticky Podnik, now called Slovenske Elektranrne). This activity supported the evolution of CENTREL to a power pool and a participant in the power and energy markets of the European Union. Techniques, methods and structures to improve economy of operation and help in the transition to a free market for power and energy were addressed. Activities were:

- energy market development
- selection and procurement of software tools
- evaluation of costs and benefits of alternative CENTREL power pool structures

Poland

Two activities were completed in Poland. Under the first activity, *Support for External Financing/Investment in Electric Distribution Utilities*, Electrotek worked with electric distribution utilities to 1) improve strategic planning by developing an integrated resource plan; 2) attract capital for needed infrastructure and operations improvements; 3) and incorporate DSM and other market-based strategies to retain/attract customers and support the region's economic development. The specific objectives were:

- development of an Integrated Resources Plan (IRP) and capacity to carry out investment planning with IRP models and methodologies
- provide assistance, training and equipment to distribution utilities to develop and implement demand side programs, and develop mechanisms for International Financial Insitutiton (IFI) loan funds to flow to energy efficiency investments.

Under the second activity, *Promote Development of the Energy Services/Energy Efficiency* Sector, Electrotek focused on training and developing private Polish energy service companies (ESCos) to provide a range of energy efficiency services, including energy performance contracting (EPC) arrangements for energy efficiency investments. The objective was to assist small and medium size private enterprises to develop profitable, sustainable energy efficiency businesses. The specific objectives were:

- ESCo Training and Project Development, including training for customers and lenders
- Implementation of Energy Efficiency Projects.

Hungary

Electrotek provided technical assistance to the Hungarian government to (1) develop energy planning capabilities; (2) institute a regulatory and pricing system that promotes investment and efficiency; and (3) provide consumers with the technical and financial tools to respond to market signals. Specific activities were:

- assist the Hungarian Energy Office to support DSM and IRP;
- support and training for Energy Services Sector;
- implementation of Energy Efficiency projects.

Czech Republic

Efforts focused on tariff reform, energy efficiency demonstrations that showed the need for tariff reform to encourage innovative financing, and demonstration of appropriate, affordable energy efficiency measures. The specific objectives were:

- promote the implementation of Energy Efficiency Projects
- financial planning and tariff reform
- technical training and municipal/NGO/University networking for Energy Efficiency.

Slovakia

Efforts in Slovakia (1) identified cost-effective mechanisms that allowed condominium associations to reduce and control their energy costs, (2) developed policy options to promote energy efficiency in condominiums that can minimize the financial impacts on residents of eliminating subsidies for district heat, and (3) evaluated macroeconomic impacts on the housing sector of these policy options, using a computer model developed by the Urban Institute. The activity also included assistance to update the Slovak National Energy Strategy.

Balkan Regional Program

The overall goal of the Balkan Regional Program was to identify financially viable telecommunication projects within the Southeastern Europe electrical utility system that can be (1) financed by International Financial Institutions (IFI), (2) encourage regional cooperation, and (3) lead to significant cost benefits. The study addressed three major segments of communication systems: Applications, Capacity, and Technology/Architecture.

Romania

The *ESCo/Performance Contracting Development Program* focused on overcoming the obstacles to ESCo operation in Romania, particularly the capital constraints and lack of performance contracting expertise. Efforts included (1) development of an ESCo corporate structure/business plan, (2) assistance in obtaining financing, and (3) extensive training of ESCo staff in all aspects of project development, management and implementation using on-the-job training with real projects. ESCo project development began concurrently with efforts to establish and capitalize an ESCo. The activity consisted of:

- Identification of ESCo Partners, Staff and Potential Investors
- Preparation of ESCo Corporate Business Plan
- Securing Financing and Incorporation of the ESCo
- ESCo Project Development
- Training and Management Assistance

Bulgaria

This activity (1) expanded the role of the private sector in the delivery of energy efficiency services, equipment and financing, (2) educated energy consumers about the benefits of energy efficiency, and (3) developed innovative financing mechanisms applicable in Bulgaria that stimulated implementation of additional projects. Activities were:

- Development of energy efficiency demonstration projects, focusing on municipally owned facilities such as hospitals
- Development and implementation of a municipal energy efficiency network
- Development of Association of Energy Engineers (AEE) capabilities

Macedonia

The activity in Macedonia provided technical assistance to the Ministry of Economy, to (1) define the most advantageous long-term energy sector development strategy for Macedonia, with particular focus on measures which reduce air pollution and lessen dependence on energy imports, and (2) develop the capability within the Ministry for implementation of, and future updates to, the Macedonian National Energy Strategy Plan.

Bosnia

Between December 9-10, 1995, USAID and the US Trade and Development Agency (TDA) sent a project definition mission to Bosnia. Electrotek was a part of that mission specifically to assess the Kakanj power plant rehabilitation.

Southeast European Cooperative Initiative (SECI) Support

This activity assisted the development of commercial energy efficiency projects in SECI countries by completing feasibility studies for municipal facilities designated by USAID, with any further project implementation activities being the responsibility of the municipality. Five activities were completed:

- Business Plan – Energy Efficiency Project in Pecs, Hungary
- Pre-feasibility Study – District Heating System and Building Energy Efficiency in Constanta, Romania
- District Heating Substation Analysis – Constanta, Romania
- Pre-feasibility Study – District Heating System Analysis and Upgrade in Oradea, Romania
- Pre-feasibility Study – District Heating System Analysis and Upgrade in Medgidia, Romania

1.5 MAJOR RESULTS AND LESSONS LEARNED

Baltic Regional Energy Development Program (BREDP)

- The three power companies (Eesti Energia of Estonia, Latvenergo of Latvia, AB Lietuvos Energija of Lithuania) and the regional dispatch center (DC Baltija in Riga) have:
  - established and staffed permanent planning departments which have developed demonstrable planning capabilities
  - produced the "Baltic Regional Energy Development Program 2000-2015" (June 1999) that identifies cumulative investments for that period of the order of $1.0-1.4 billion (depending on the date of closure of the two units of the Ignalina nuclear power plant) in power plant rehabilitation and new power plants that meet European Union environmental emissions standards
  - created a capability for regional power system operations using state of the art capacity scheduling software, vital for the future operation of an open, competitive regional market for electricity

- In October of 1998 an "Agreement on Co-operation in the Energy Sector" was signed between the Baltic Ministers of Economy

- In April 1999 a Baltic Energy Strategy was approved by the Baltic Council of Ministers (BCOM) CoE and a Memorandum of Joint Intentions to establish a Common Baltic Electricity Market was signed.

Latvia

- A Customer Service/Energy Efficiency Center (Center) was initiated at Latvijas Gaze and customer efficiency improvements were demonstrated.
- A Business Plan was written for the Latvijas Gaze Energy Center and demand-side management (DSM) demonstrations were completed. In development of the Business Plan, a training needs assessment was completed as was an assessment of Latvian markets for new gas equipment and related services.
- The evaluation of the Riga Dairy energy efficiency project was completed that indicated project payback of less than one year.
- Discussions were held with Riga Gaze concerning the design of a new boiler tune-up service, which uses the combustion analyzers provided to Rigas Gaze through this project. An implementation plan for a new boiler maintenance service was completed for Riga Gaze.
- A draft Business and Marketing Plan was completed for the Rigas Gaze Energy Exhibition Center.
- The Electricity Demand Side Management (DSM) Program supported the implementation of Latvenergo's time-of-use (TOU) rate program, a DSM demonstration program designed to reduce peak demands and reduce customer arrears, and a DSM program plan for Latvenergo.
- A work plan for the DSM Demonstration activity was completed. The demonstration was for weatherization of homes and retrofitting of electric water heaters with insulation materials and timers.
- A residential building insulation project was initiated as the central activity in a broader residential energy efficiency demonstration project. A Project Demonstration Program Conference was held at Latvenergo to disseminate information about the project.
- A three-day Energy Efficiency Policy Workshop was conducted at the Latvian Energy Agency to identify policy recommendations to address barriers to energy efficiency that currently exist in Latvia.

Lithuania

- Training and technical support provided to the newly established Customer Service Department. included:
    - The preparation of an implementation plan, including organization, staffing and resource requirements, and activities;
    - The preparation of a program plan, identifying specific DSM program options (e.g. lighting programs, weather-stripping, information programs)
    - The development of procedures and channels for necessary and effective information exchange to support customer outreach;
    - Computer hardware and software.
- Lietuvos Energija required a solid foundation upon which to start building its customer service capabilities. Technical assistance included:

- Market research to help identify specific customer requirements that could be served by the Customer Service Department;
- Training seminars to develop the technical skills necessary for the design and implementation of effective customer service programs;
- Seminar for municipal officials;
- Support for customer communications and outreach programs; and\
- Program evaluation training.

- Lietuvos Energija has established a customer telephone center to provide customers with information on energy efficiency, tariffs, and to assist in scheduling any other service requests.
- A customer-information program has been established to develop an information resource base about their customers and about energy efficiency technologies and opportunities.
- Energy efficiency booklets have been printed targeting residential and commercial customers and handbooks available to all residential and new customers.
- The Customer Service Department has instituted public training and education efforts and conducted five separate training seminars to inform customers about energy efficiency.
- A high efficiency heat recovery and ventilation system was installed at the cardiac surgery unit of the Santariskiu Hospital in Vilnius.

CENTREL

- The "Regional Coordination, Power Pooling and Energy and Power Markets" activity supported the evolution of CENTREL to a power pool and a participant in power and energy markets of the European Union. Technical assistance included:
  - Energy market development
  - Software tools - selection and procurement
  - Evaluation of costs and benefits of alternative CENTREL power and energy markets scenarios
- CENTREL has met the UCPT requirements for synchronous interconnection.
- A "Round Table Forum" titled *Transmission Services and Pricing in Electricity Markets* was attended by technical experts and regulators from PSE (Poland), MVM Rt. (Hungary), CEZ (Czech Republic) and SE (Slovakia).
- A Technical Exchange Visit was conducted from June 8-16, 1998 to the California ISO/PX.
- A second and third Round Table Forum was held in Prague, Czech Republic and in Bratislava, Slovakia. Topics discussed included EU harmonization, and contract and licensing requirements.
- A workshop on "Ancillary Services for CENTREL Utilities" was held in Warsaw, Poland. Topics included Definition and Scope of Ancillary Services (AS), presentations on AS by four CENTREL utilities, Planning and Scheduling of AS, Technical Requirements of AS and Their Verification, Costs Incurred in Providing AS, Long- and Short-Term Policy for AS Development, Exchange and Trade of AS

Among Independent Systems, Setting Up a Competitive Market for AS, Paying for AS and Cost Recovery, and Infrastructure for AS Management.

Poland

- Two Polish electric distribution companies (ZET and GZE) have implemented a load forecasting program, *Energy 2020* and developed base-case forecasts.
- GZE implemented a corporate financial model.
- GZE implemented a distribution system load flow and investment planning model, *Distco Suite*^{tm}, developed by Electrotek.
- GZE and ZET were in the first group of Polish power distribution utilities to be privatized. The management of both utilities credit USAID technical assistance with significantly helping to modernize their utilities and position them for privatization.
- GZE has made promotion of customer energy efficiency an integral part of its corporate policy. ZET has reversed its previous stand on DSM and is investigating energy efficiency initiatives as a way to attract or retain customers.
- Five energy efficiency projects were implemented by small enterprise ESCos;, i.e., PilBut, Enertech, BfiG, and ProEsco. The projects involved thermal renovation (schools and residences) and installation of efficient street lighting. All of these ESCos are continuing to implement additional projects.
- All targets for the activities in Poland were achieved or exceeded by the end of the project. Specific results were that at least:
    - Five utilities adopted modern planning methods (including integrated resource planning) to set prices and design tariffs which cover costs, required investments and profits,
    - Eight business support organizations (BSOs) provided assistance to small and medium enterprises (SMEs) on energy efficiency opportunities,
    - Ten SMEs implemented modern commercially-oriented business management concepts, practices and systems, and
    - Ten municipalities improved their capacity to plan, finance and manage infrastructure projects.

Hungary

- The Hungarian Energy Office became a member of NARUC
- Energy service companies and financial institutions were educated and trained and the legal/contractual and financial analysis groundwork was developed to stimulate implementation of energy efficiency projects in Hungary.

Czech Republic

- Five demonstraion projects were developed and implemented:

- *Frydlant Hospital* – the old back-up diesel was replaced with a gas-driven generator equipped with a co-generation system. Annual savings were $37,165 with a payback of 0.54 years.
- *Litomerice Hospital* – the new building energy management system allowed the hospital to save $20,000 annually with a payback of 1 year.
- *Ivancice Hospital* – A high efficiency surgical steam generator was installed. The hospital saved $13,333 (with a payback of 1.6 years) and plans to add 3 similar generators.
- *Mimon School* – Weatherization and the installation of zoned heating controls allowed the school to realize annual savings of $29,125 with a payback of 0.58 years.
- *Uherske Hradiste Schools* – High efficiency drying units were provided for the city of Uherske Hradiste to recover from the flooding in the summer of 1997. This allowed the city schools to open on time.

Slovakia

- An energy efficiency demonstration project was designed and implemented at a privately owned apartment building (condominium association) in Kosice. The project
  - identified cost-effective measures that allow building residents to reduce and control their energy costs in the face of rising heat prices.
  - involved a panel type apartment building (Kuzmanyho 45-51), highly replicable energy savings measures, and financially stable and motivated building owners.
  - Installed four energy saving measures – a new heat distribution system in the basement, heating controls and balancing of the heating system, thermostatic radiator valves, and weatherstripping.
- Assistance was provided to update the Slovak national energy strategy. The objective was to assess the Slovak Republic's energy sector development concept and policy to 2010 with regard to compliance with European Union guidelines.

Balkan Regional – Southeast European Cooperative Initiative (SECI)

- A modern teleinformation system among national dispatch centers is required to enhance efficiency, security and reliability, promote electricity exchanges and trade, and develop the basis for a future regional electricity market and the integration of Southeast Europe systems into UCTE. Technical assistance was provided to:
  - develop bankable projects for consideration by international lenders;
  - facilitate compliance with UCTE communication and EU Directive 96/92 requirements;
  - harmonize current and planned national teleinformation system improvements;
  - define considerations and requirements related to possible future development of a regional communications/accounting center.

Romania

- USAID required that the *ESCo/Performance Contracting Development Program* focus on developing a Romanian-based ESCo. However, all potential investors required that some level of foreign participation be taken in the ESCo. Therefore, a well-capitalized Romanian ESCo could not be established. Foreign expertise and access to capital could have made the process of setting up a Romanian ESCo significantly easier. Efforts to acquire venture capital failed. Traditional venture capital does not yet exist in Romania. Future effort to set up an ESCo or other energy services in Romania should not rely on a start-up approach.
- Financial research and analysis indicated that the largest impediment to energy efficiency in Romania is access to financing. An important lesson learned in a similar program in Hungary is that a comprehensive approach to addressing all the impediments to energy efficiency financing provides the best chances for success. In particular:
    - Technical assistance to project developers and banks in understanding how to package energy efficiency projects for financing;
    - Loan guarantees for energy efficiency projects, to reduce the risk taken by banks and other financial institutions and to provide the motivation to enter the energy efficiency market;
    - Financial incentives in the form of matching grants and soft loans to give customers an added incentive to implement energy efficiency projects.
- Romanian banks do not currently have access to the same types of guarantees that are now available in Hungary, Poland, and Bulgaria. While such guarantees are not a pre-requisite for energy efficiency financing, they certainly facilitate the development of the market and help give the financial institutions a lower-risk method of entering a new lending area.
- Romania has the opportunity to establish a vibrant energy efficiency market. Since Romania is flanked by Hungary and Bulgaria, there may be opportunities to pair Romanian banks with Hungarian and/or Bulgarian banks to cooperate in energy efficiency financing.

Bulgaria

- This project served as the focal point for the development of a municipal network to promote "grass roots" energy efficiency activities throughout Bulgaria, expand the role of the private sector in the delivery of energy efficiency services, equipment and financing, and educate energy consumers about the benefits of energy efficiency. The following activities were completed:
    - development of an NGO (EnEffect) and implementation of a municipal network (EcoEnergy)
    - development of local chapter Association of Energy Engineers (AEE) capabilities (an energy efficiency project was completed at the Regional Hospital in Gabrovo)
    - development and implementation of 3 demonstration projects in the municipalities of Plovdiv, Stara Zagora and Varna.

Macedonia

- Development of the most advantageous long-term energy sector development strategy for Macedonia (with particular focus on measures which reduce air pollution and lessen dependence on energy imports) has the following requirements and attributes:
    - Load demand must be quantified, e.g., an immediate decision is necessary on the future of the metallurgical factory, the largest single power consumer in the country
    - Existing thermal power plants can continue to operate
    - No additional import of electricity is needed
    - No new power plants are necessary that require domestic or imported lignite, coal, or liquid fuel through 2020.
    - No new natural gas pipeline is required through 2020
    - The Negotino power plant is needed at its full capacity through 2020
    - A minimum of 1300 MW of additional capacity is needed after 2020
- Key options for energy sector development must be analyzed and a decision must be made within the next few years to provide direction for development through 2020:
    - Rehabilitation of existing thermal power plants
    - Use of natural gas-fired, combined cycle thermal power plants
    - The use of natural gas is critical to energy sector development – possible options should be researched and assessed
    - Environmental implications of energy sector development should be identified and assessed
    - Critical issues and trade-offs of nuclear power for Macedonia should be identified and assessed

Bosnia

Recommendations from a US Trade and Development Agency Definitional Mission to assess the potential for rehabilitation of the Kakanj power plant are:

- Given the age of most of the equipment at the Kakanj plant (except for the 230 MW unit), it would be difficult to justify investment on other than humanitarian grounds.
- The World Bank recommends that coal production be restored to minimum acceptable levels at the lowest cost mines, one of which is the Vrtliste mine. Most of the remaining 28 mines are uneconomical and should be shut down. Technical assistance and training will be required for any program of assistance to the coal mine or power plant.

Regional Support for the Southeast European Cooperative Initiative (SECI)

Business Plan – Energy Efficiency Project in Pecs, Hungary: The Pécs Education Center was selected for an energy efficiency demonstration project. An energy audit of the entire 11 building Education Center was completed and the Municipality selected a set of about 10 energy conservation measures for the complex. The energy audit showed that

the project should save $US 42,000 annually through reduced energy consumption and facility operations and maintenance (O&M) costs. The project economics are very strong - an IRR of 46.65%, and a payback period of 2.56 years. The project maintains a positive net present value and an acceptable IRR even in the worst case scenario.

District Heating System and Building Energy Efficiency in Constanta, Romania: Energy audits were completed on 4 prototypical school buildings, and the district heating facilities, and energy conservation opportunities were analyzed using a building energy simulation model. Results and recommendations include:

- *Heat Substations*: a complete retrofit is needed – replacing all heat exchangers, piping, and valves between the primary and secondary connections, and installing heat metering and controls.
- *Schools:* Eleven energy conservation opportunities (ECOs) were evaluated. The most viable ECO package combines weatherstripping; building level controls; thermostatic radiator valves (TRVs) and system balancing; showerheads and aerators; heat meters; and replacement of local boilers.

There are two key barriers that will inhibit the development of this project, namely highly subsidized residential heat tariffs and problems with late payment of heating bills. Also, there is clearly a need for substantial overhaul of the system of subsidies and cross subsidies, which may involve institutions that are not principal project beneficiaries. Six types of risks that could threaten the viability of the project (Sponsor Risk, Completion Risk, Technology Risk, Operating Risk, Insufficient Payment Risk, and Contract Enforceability Risk) were evaluated. Electrotek found conditions to be favorable in most cases for managing this risk.

District Heating Substation Analysis – Constanta, Romania: This study considered technical measures and feasible packages taking into account improvements completed since June 1999 by RADET (the district heating company) in Constanta. Recommendations are:

- There is sufficient hot water transport capacity, and with a small investment in circulating pumps and system balancing, all substations will be supplied with heating water at sufficient pressure, temperature and flow quantity.
- Substations should continue to be upgraded with re-piping and installation of needed controls.
- Secondary pipes in critically poor condition should be replaced as a "necessary cost" for efficient system operation.
- The most cost-effective energy conservation package for municipal buildings combines weatherstripping, building level controls, thermostatic radiator valves and system balancing, low-flow showerheads and aerators, and heat meters.
- Continued upgrading of substations with individual gas-fired boilers is not recommended.

District Heating System Analysis and Upgrade in Oradea, Romania:

The objective was to determine the least-cost alternative to upgrade the heat supply system. The assessment also considered the effect and cost-benefit of energy savings from implementation of energy conservation measures in municipally-owned buildings.

Recommendations are:

Demand Side

- *Electrotek recommends a three-year project to improve substations and replace a selected length of the secondary distribution pipes.* The energy efficiency investment will (1) have a positive impact on the price of heat delivered, (2) reduce the total annual cost of heat for the average consumer, and (3) improve the profit/loss statement of APATERM, the local heat distribution company.
- *APATERM should continue to purchase hot water for area heating and domestic hot water from Termoelectrica, the heat supply company in Romania,* rather than installing individual natural gas boilers at substations.
- *A combination of energy conservation measures is the most cost-effective solution for energy savings in buildings.* The municipality should invest in energy conservation measures in schools, i.e., window weatherization, building level heat control, thermostatic radiator valves, hydraulic balancing of the system, and shower heads and flow restrictors.
- *Energy saving projects in schools should be a part of an overall demand-side energy efficiency improvement program in the municipality.* Carefully designed projects yield a simple payback of 2.1 years for high schools ($242,000 USD investment), 2.1 years for technical schools ($134,000 USD investment) and 3.4 years for kindergartens ($89,500 USD investment).
- *Street lighting improvements should be considered as part of any demand-side energy efficiency project.* While replacement of street lighting fixtures and lamps was not assessed in this effort, experience in Bulgaria and elsewhere in Eastern Europe demonstrates the cost-effectiveness of such projects.

Supply Side

- *The most cost-effective investment for Termoelectrica is to upgrade* one of the central heating plants (CHP1) to burn low sulfur black coal.
- *While the hot water would be supplied more economically if Termoelectrica pursues the black coal alternative, there is no urgent physical need to do so.* Failure to make these improvements on the supply side does not jeopardize the viability of APATERM'S energy savings under the recommended energy efficiency improvements at the substations and in the secondary distribution network.

District Heating System (EDILMED) Analysis and Upgrade in Medgidia, Romania:
An energy audit and analysis of the district heating system in Medgidia, Romania identified a number of attractive projects suitable for commercial financing. The goal of this specific project is to improve the overall operational efficiency and the heat supply capacity of the Medgidia district heating system (generation and primary and secondary

distribution networks) so that acceptable heat comfort levels and sufficient domestic hot water supply are realized and affordable to all consumers. Technical measures include rehabilitation of four boilers with district heating networks and fuel switching to natural gas. The pre-feasibility analysis has showed that the proposed project, which costs US$ 1 million, has very strong economics including a payback period of 1.8 years. The project is robust and very attractive for commercial financing. Project benefits are significant and will lead to more cost-effective heat supply, greater comfort in residential buildings, a more modern municipal infrastructure and the opportunity to fund expansion of social programs without an increase in the municipal budget.

2.0 BALTIC REGIONAL ENERGY DEVELOPMENT PROGRAM

The Baltic Regional Energy Development Program (BREDP) was established in 1995 with the help of USAID in response to a request from the three Baltic States (Estonia, Latvia and Lithuania) to help their power utilities develop a least-cost energy investment planning capability. USAID recognized from the outset the importance of coordinated energy planning in the Baltics to advance a number of development and US foreign policy objectives. These objectives include:

- Promoting economic independence from Russia by helping the Baltic countries to operate a regional energy system no longer administered from Moscow;
- Integrating the Baltic states more closely into Western Europe through interconnection with the European power grid (UCPT);
- Helping the Baltic states find a coordinated approach to retiring the Ignalina nuclear power plant;
- Facilitating reductions in environmental emissions from Baltic power plants such as the Estonian oil shale plants through coordinated investment planning.

A coordinated approach is critical for these countries in order to help defray the costs of power investments and to operate their systems in a more efficient manner. USAID took the lead in establishing the BREDP Steering Committee to include not only representatives from the three Baltic power companies and their dispatch center (DCBaltija), but also representatives from the World Bank and EBRD – two possible financing sources for Baltic power investments.

Detailed activities are described in two approved workplans, i.e., BREDP WG1 Workplan and BREDP WG2 Workplan. Phase I of the BREDP effort, implemented under a previous contract with USAID (Contract Number EUR-0030-C-00-2060-00), has been recognized by international financial institutions (IFI's) and the Baltic parties as a significant accomplishment. In particular, the development of the planning departments in each of the Baltic organizations, the development of the preliminary draft regional plan, and the acquisition of and training for advanced planning models have been cited by representatives of the World Bank and EBRD, as well as the BREDP Steering Committee, as significant milestones in the development of indigenous planning capabilities of the Baltic companies. These results have laid the foundation for the continued development of Baltic regional planning activities and for the evaluation of Baltic alternatives to Ignalina - Phase II of the BREDP effort.

In addition to the regional planning activities in BREDP Phase II, coordinated power system operations were evaluated. The four Baltic parties were provided with the Optimal Power Flow with Security Constrained Dispatch (OPF/SCD) software and training to evaluate system loss minimization, provide reactive power planning, determine nodal pricing, minimize production cost, and perform generation scheduling to relieve constraint violations. The three Baltic countries are attempting to deregulate (and privatize) the electric utilities and, where possible, follow the EU directives on

establishing competitive electricity markets, including providing access to the transmission system to third parties (TPA). The power systems operation component of BREDP Phase II addressed the following issues:

- establish the transmission related services to be offered, including a pricing paradigm that is consistent with basic economic principles but also is financially sound and transparent regarding cost recovery and future expansion;
- establish a market based regional approach to obtaining and providing generation related services such as capacity, energy, reactive power, etc.; and
- develop suitable organizational structures that will ensure system reliability while recognizing that the three countries are independent with differing languages, legal systems, and economic and social expectations.

2.1 GENERATION EXPANSION PLANNING (WORKING GROUP I) AND POWER SYSTEMS OPERATIONS (WORKING GROUP II)

The BREDP had two working groups. Working Group (WG) 1 addressed the topic of Regional Least Cost (Generation) Development Plan and was completed in 1999. Working Group (WG) 2 addressed the operational aspects of power system operations. Initially only regional coordinated operation was considered, but this was altered and expanded to address issues related to the development of a Common Baltic Electricity Market (CBEM). The major focus of the WG2 was to provide the Baltic entities the training, technology and some of the tools needed to operate a CBEM.

Details of specific activities are given in a Final Report for WG2 and a "Baltic Project Closeout Report – March 2000." A summary of major results includes:

- The three power companies and the regional dispatch center have:
  - established and staffed permanent planning departments which have developed demonstrable planning capabilities
  - produced the "Baltic Regional Energy Development Program 2000-2015" (June 1999) that identifies cumulative investments in power plant rehabilitation and new power plants for that period of the order of $1.0-1.4 billion, depending on the date of closure of the two units of the Ignalina power plant, for a power system that meets with European environmental emissions standards
  - created a capability for regional power system operations using state of the art capacity scheduling software, vital for the future operation of an open, competitive regional market for electricity
- An Agreement on Co-operation in the Energy Sector was signed between the Baltic Ministers of Economy in October of 1998
- A Baltic Energy Strategy was approved by the Baltic Council of Ministers (BCoM) with the objective of creation of the Common Baltic Electricity market in April 1999.
- The BCoM signed a Memorandum of Joint Intentions on a Common Baltic Electricity Market in the Spring of 1999.
- Seminar on Transmission System Pricing in a Competitive Market was held in Riga in 1999. Presenters included experts from California, Spain, and Nordpool.

- An Optimal Power Flow (OPF) Program was provided for use in Marginal Pricing and Optimal Dispatching (regional and by country)
- The PSS/E Power Flow, Transient Stability and Short Circuit programs were upgraded to the latest version. This is the most widely used set of transmission analysis programs in the world.
- Training was given in the use of the OPF including modeling the Baltic and interconnected power system. The Baltic parties are now fully able to run the studies.
- Seminars on ancillary services and new communication infrastructure technologies
- A feasibility study was completed and a procurement specification prepared for four dispatching systems (one system for each country and one for DC Baltija). Helped with vendor selection and contract negotiation.
- A feasibility study was completed for a backbone communication system for Lietuvos Energija.
- Provided a 2 week US training visit for personnel from the Dispatch Centers to enable them to better understand the state of the art before procuring new systems.

3.0 LATVIA

3.1 NATURAL GAS ENERGY EFFICIENCY PROGRAM AT LATVIJAS GAZE

The Natural Gas Energy Efficiency Program supported improved efficiency of customer gas use through the development of a Customer Service/Energy Efficiency Center (Center) at Latvijas Gaze and demonstrations of customer efficiency improvements (details are in the Latvia Workplan). The Center: (1) promotes end-use energy efficiency, (2) provides customer support for new high-efficiency gas technologies, (3) supports basic customer service functions, and, (4) serves as a model for similar centers at Latvijas Gaze distribution companies. To the greatest extent possible, local private ESCOs were included, particularly in the demonstrations, to develop their capability to perform under contract to Latvijas Gaze and Latvenergo.

Natural Gas Energy Efficiency Program at Latvijas Gaze: This activity included development of a Business Plan for the Latvijas Gaze Energy Center and demand-side management (DSM) demonstrations. Electrotek's subcontractor for this activity, Resource Management Associates (RMA), assessed the market for energy efficient gas equipment and completed an evaluation of the institutional capabilities at Latvijas Gaze. In development of the Business Plan during the early stages of the project, RMA completed a series of activities:

- A Training Needs Assessment and Curriculum was completed during April 1996.
- Assessment of Latvian Markets for New Gas Equipment and Related Services was completed in May 1996.
- A set of monitoring and diagnostic equipment was delivered to the utility and a small number of Latvijas Gaze staff were trained on the use of this equipment.

RMA completed an analysis of eight candidates for customer-based energy efficiency demonstration projects (four industrial sites and four municipal sites). Riga Dairy was selected for an energy efficiency demonstration project. The evaluation of the Riga Dairy demonstration project was completed during the first quarter of 1997 that indicated a project payback of less than one year.

Discussions were held with Rigas Gaze concerning the design of a new boiler tune-up service, which uses the combustion analyzers provided to Rigas Gaze through this project. The implementation plan for the new boiler maintenance service was completed and submitted to USAID.

A draft Business and Marketing Plan was completed for the Rigas Gaze Energy Exhibition Center. Staff of the Rigas Gaze Marketing department were given a week of training and technical assistance related to marketing. The business and Marketing Plan contains recommendations developed during the training sessions that address market research and marketing strategies for Rigas Gaze.

In March 1997, fourteen managers from several Latvijas Gaze subsidiaries attended a training course on marketing techniques and technical services. Course topics were based on the recommendations in the Training Needs Assessment performed by RMA in April 1996.

A Final Report was submitted in May/June 1997 documenting all RMA/Latvijas Gaze activity.

3.2 ELECTRICITY DEMAND-SIDE MANAGEMENT PROGRAM FOR LATVENERGO

The Electricity Demand Side Management (DSM) Program supported Latvenergo's efforts to improve the efficiency of electricity use by its customers. Specific activities are detailed in the work plan. It included support for the implementation of Latvenergo's time-of-use (TOU) rate program, a DSM demonstration program designed to achieve the desired load shape objectives and reduce customer arrears, and a DSM program plan for Latvenergo. The DSM plan detailed staffing requirements at both headquarters and distribution branch levels, program offerings and budget requirements, evaluation procedures for documenting program effectiveness/impact, marketing strategies for targeting customers, and program administration requirements.

Electricity Demand Side Management (DSM) Program for Latvenergo focused on the new Customer Service/Energy Efficiency Center and a new time-of-use (TOU) tariff structure. A Time-Of-Use Rate Implementation Strategy was completed and distributed to USAID and Latvenergo.

A work plan for the DSM Demonstration activity was completed. The plan specified that the demonstration be focused primarily on private homes in the residential sector located on portions of Latvenergo's service area where the distribution transformers are overloaded. The demonstration was to involve weatherization of homes (to reduce electric space heating loads) and retrofitting of electric water heaters with insulation materials and timers (to reduce electric water heating loads during peak periods).

A DSM Planning workshop was conducted in early June 1996 to familiarize participants with the DSM planning process, and to obtain their input regarding DSM planning-related issues in Latvia and, specifically, at Latvenergo. In late June, Latvenergo was provided with copies of end-use survey forms for residential, commercial and industrial customers. Copies of brochures and videos obtained from US utilities, addressing DSM programs, marketing strategies and energy education centers, were provided to Latvenergo.

RMA prepared a detailed proposal and schedule for the assessment of Latvian markets for 8 natural gas efficiency demonstration projects (natural gas demonstration activity).

Thirteen of Latvenergo's employees participated in a two-week long energy auditing course in November 1997. Participants included all staff from the newly-created DSM section and representatives from each of the 6 districts served by Latvenergo.

A residential building insulation project was initiated as the central activity in a broader residential energy efficiency demonstration project. Attic insulation was installed in 15 two- and three-story residential buildings during November/December 1997. Training was provided to representatives of Latvenergo's service department on the proper use of an insulation blowing machine (purchased specifically for this activity), as well as on insulation techniques and job cost estimating. RMA and Latvenergo completed a customer survey of building residents to evaluate the project. An evaluation report for the Residential Buildings Insulation Demonstration Project was written documenting all results. A Project Demonstration Program Conference was held at Latvenergo to disseminate information about the project.

A three-day Energy Efficiency Policy Workshop was conducted by RMA at the Latvian Energy Agency to identify policy recommendations to address barriers to energy efficiency that currently exist in Latvia. About 26 participants from a wide range of organizations concerned with energy use and efficiency attended.

The Final Report documenting these activities for Latvenergo was submitted to USAID in April/May 1997.

4.0 LITHUANIA

There were two major activities in Lithuania under this project component that were designed to promote the fiscal health of the energy industry in Lithuania through institutionalizing energy conservation in support of energy policy and tariff reform. One activity assisted Lietuvos Energia with the design and implementation of their Energy Efficiency & Customer Service Department (EE&CS Department). Focus was on steps required to make the department effective in promoting customer energy efficiency projects through-out all Lietuvos Energia's service territory. The other activity was a DSM demonstration program implemented at the Santariskiu Hospital to demonstrate the impact of energy efficiency measures on capacity requirements, capital investments, peak demand, customers' bills and collection of revenues. Details of these activities are in a final work plan.

4.1 CUSTOMER SERVICE DEPARTMENT PROGRAM DEVELOPMENT AND DEMONSTRATION PROJECT AT LIETUVOS ENERGIA (LE)

Electrotek/CNEX (Central Maine Power) worked with LE to define their customer service requirements, and to help meet these requirements with tools, training and technical support provided to the newly established Customer Service Department. Assistance provided in mid-1996 as LE established a new Customer Service Department included:

- The preparation of an implementation plan, including organization, staffing and resource requirements, and activities;
- The preparation of a program plan, identifying specific DSM program options (e.g. lighting programs, weather-stripping, information programs)
- The development of procedures and channels for necessary and effective information exchange to support customer outreach;
- Computer hardware and software.

LE required a solid foundation upon which to start building its customer service capabilities. While there were many corporate functions within LE that could support customer services, no attempts had been made at collecting, compiling and consolidating corporate data, let alone customer and other information. Technical assistance was defined in a Customer Service Implementation Plan that included:

- Market research to help identify specific customer requirements that could be served by the Customer Service Department;
- Training seminars to develop the technical skills necessary for the design and implementation of effective customer service programs;
- Seminar for municipal officials;
- Support for customer communications and outreach programs; and
- Program evaluation training.

Since the establishment of the Customer Service Department at LE there has been a more systematic approach to energy efficiency activities. Lietuvos Energija has established a customer telephone center to provide customers with information on energy efficiency, tariffs, and to assist in scheduling any other service requests. A customer-information program has been established to develop an information resource base about their customers and about energy efficiency technologies and opportunities. Energy efficiency booklets were printed targeting residential and commercial customers and handbooks were available to all residential and new customers. The Customer Service Department has instituted public training and education efforts and conducted five separate training seminars to inform customers about energy efficiency. These activities are defined in a Customer Energy Efficiency Program Plan, a Final Report for the Customer Service Department and an overall Final Report for the Lithuania program.

4.2 ENERGY EFFICIENCY DEMONSTRATION PROJECT AT SANTARISKIU HOSPITAL

Using information and methods developed earlier, LE profiled a wide range of customers to assess their viability for participation in a DSM demonstration project. The selection process was extensive, with a review of the customer's billing history, payment history, end-use processes and technologies, location (to target overloaded distribution feeders), and needs. After a series of audits and site visits at the Vilnius University Hospital, a high efficiency heat recovery and ventilation system was recommended, approved by USAID, procured and installed at the cardiac surgery unit of the Santariskiu Hospital in Vilnius. As a public health facility, there was the social benefit of improving the financial health of an important public institution. Additionally, the system was expected to significantly improve the air quality in the operating rooms through better air management and sophisticated air filtration. A Memorandum of Understanding was prepared and signed, which detailed the commitments of the parties (LE, Santariškių Hospital, and Electrotek), project financing, design, and schedule. In the MOU, the hospital agreed to cost-share assuming the installation and overland transportation costs, and by reducing arrears with LE.

Because of the sequencing of the DSM project with a major rehabilitation of the hospital's surgical wing, significant delays were encountered. First, it took the hospital time to secure the financing for the rehabilitation, as well as get the plans developed, procure the materials and services, and progress to the point where the heat recovery system could be installed. The hospital was not prepared to have the system installed until September 1999. This installation schedule did not allow for the calibration of the system for the heating cycle until December 1999. Second, the rehabilitation plan resulted in some structural changes in the facility that significantly increased the capacity requirement of the heat-recovery and ventilation system. USAID committed to supporting the larger system with additional support from the hospital.

Among the major milestones achieved through the energy efficiency demonstration project are (1) the demonstration of the LE Customer Service Department's skills in helping to realize a project of this scale and scope and (2) the successful installation of a

high efficiency DSM Demonstration Project at the Santariškių Hospital as part of a larger rehabilitation program at the hospital. This expanded rehabilitation included new windows, plumbing, electrical, HVAC, and structural improvements (walls, insulation, roof). Because of this, it is all but impossible to verify the estimated savings due specifically to the heat recovery system. An indication however is that within 18 months of their commitment, Santariškių Hospital substantially reduced their arrears with LE.

5.0 CENTREL

CENTREL, established in October 1992, is a regional group of four electric power companies from the Czech Republic (CEZ), Hungary (Magyar Villamos Muvek Rt.), Poland (Polskei Sieci Elektroenergetyczne SA) and the Slovak Republic (Slovensky Energeticky Podnik, now called Slovenske Elektranrne). In addition to the four members, the following organizations have observer status:

- VEAG, Germany,
- Verbund, Austria,
- Ministry of Energy and Electronics, Ukraine,
- RENEL, Romania, and
- NEK, Bulgaria.

Any electric power company, previously with observer status, whose system is or shall be interconnected to the CENTREL network, can apply for membership, provided that all technical, economic, and organizational requirements set by the Council of CENTREL have been met. The main objectives of CENTREL are:

- The promotion of cooperation of CENTREL with UCPT and other associations of interconnected power systems;
- The improvement of Czech, Hungarian, Polish and Slovak power systems performance;
- The most efficient use of CENTREL generating and transmission systems; and,
- The facilitation of international exchange of electric power.

CENTREL currently has five principal working groups: Interconnections, System Operation, Power Plant and Network Development, Economic Policy Foreign Trade and Pricing, and Organization (including restructuring, privatization and energy laws)

5.1 REGIONAL COORDINATION, POWER POOLING AND ENERGY AND POWER MARKETS IN THE CENTREL COUNTRIES

This activity supported the evolution of CENTREL to a power pool and a participant in power and energy markets of the European Union (EU). CENTREL has met the UCPT requirements for synchronous interconnection to join the EU energy and power markets. Therefore, Electrotek looked at techniques, methods and structures that both improve economy of operation and help in the transition to a free market for power and energy. Technical assistance included support for:

- Energy market development
- Software tools - selection and procurement
- Evaluation of costs and benefits of alternative CENTREL power and energy markets scenarios.

A CENTREL regional work plan was developed and approved on May 28, 1997 that explicitly defined the work to be done under the technical assistance categories above. On September 16-18, 1997, Electrotek completed the first activity, a "Round Table Forum" titled *Transmission Services and Pricing in Electricity Markets*. Technical experts and regulators from PSE (Poland), MVM Rt. (Hungary), CEZ (Czech Republic) and SE (Slovakia) attended the meeting in Warsaw, Poland.

A Technical Exchange Visit was conducted from June 8-16, 1998 to the California ISO/PX. Three representatives from each utility (CEZ, MVM, PSE, and SE – only two) attended the technology transfer event. The ISO/PX systems visited were operational and helped to solidify the software needs of the CENTREL countries based on observation of operational systems.

Bechtel organized the second Round Table Forum held in Prague, Czech Republic on January 20-23, 1998 and the third Forum held in Bratislava, Slovakia on May 26-28, 1998. Topics discussed included EU harmonization, and contract and licensing requirements.

Electrotek summarized data needed to price transmission services under open access. A report was prepared that deals with costs that must be included for pricing transmission tariffs. Electrotek prepared a report on the effect of the EU 96/92 Directive.

A workshop on "Ancillary Services for CENTREL Utilities" was held in Warsaw, Poland on February 22-24, 2000. An Electrotek / USAID team of four utility experts were joined by two participants from Endesa in Spain. The workshop was attended by 3 or 4 representatives from each of the four utilities (CEZ, MVM, PSE, and SE), and one representative of the CENTREL Secretariat. Topics included Definition and Scope of Ancillary Services (AS), presentations on AS by four CENTREL utilities, Planning and Scheduling of AS, Technical Requirements of AS and Their Verification, Costs Incurred in Providing AS, Long- and Short-Term Policy for AS Development, Exchange and Trade of AS Among Independent Systems, Setting Up a Competitive Market for AS, Paying for AS and Cost Recovery, and Infrastructure for AS Management.

6.0 POLAND

Activities in Poland were grouped under two main activities:
Support for External Financing/Investment in Electric Distribution Utilities
Electrotek worked with electric distribution utilities to 1) improve strategic planning by developing an integrated resource plan; 2) attract capital for needed infrastructure and operations improvements (World Bank loan and/or attracting a strategic investor); and 3) incorporate demand side management (DSM) and other market-based strategies to retain/attract customers and support the region's economic development. Specific activity is detailed in the Poland Work Plan - Activity 1.

Promote Development of the Energy Services/Energy Efficiency Sector
Electrotek focused on training and developing private Polish energy service companies (ESCos) to provide a range of energy efficiency services, including energy performance contracting (EPC) arrangements for energy efficiency investments. Assistance was given to small and medium size private enterprises to develop profitable, sustainable energy efficiency businesses. This included customer education, lender education, customer and energy service company training, and help to develop the legal/contractual groundwork needed to stimulate implementation of energy efficiency projects in Poland. Specific activity is detailed in the Poland Work Plan - Activity 2.

6.1 SUPPORT FOR EXTERNAL FINANCING/INVESTMENT IN ELECTRIC DISTRIBUTION UTILITIES

Specific activities and results in support of external financing and investment in electric distribution utilities were the following:

Modern Planning Methods for Power Distribution Utilities: The objective of this activity was to improve the planning and management methods of Poland's electricity distribution utilities, resulting in:

- least-cost investment strategies for the utilities, and lower operating costs,
- increased value of the utilities when privatized, and earlier privatization,
- consideration of demand-side strategies and customer service benefits in utility planning procedures, and
- development of rational, cost-based tariffs for electricity.

Beginning in 1997, a series of workshops were held to describe the principles and process of integrated resource planning (IRP) and least-cost planning (LCP). Zaklad Energetyczny Torun S.A. (ZET) and Gornoslaski Zaklad Elektroenergetyczny S.A.(GZE), prioritized areas where Electrotek's technical assistance would help. ZET decided to undertake a comprehensive data and information system integration, using a proprietary German software system. However, the German system did not include load forecasting and ZET requested assistance in that area. GZE asked for assistance with distribution system planning and in obtaining a modern load forecasting program. Final

reports were written to document the load forecasting activity with ZET and the distribution system planning activity with GZE.

The results for each utility (ZET and GZE) were:

- Implementation of an end-use-based load forecasting program, *Energy 2020*, developed by Systematic Solutions, and modified for each utility. A base-case forecast was developed for each utility.
- Implementation of a corporate financial model for GZE, developed by CNEX (Central Maine Power Company).
- Implementation of a distribution system load flow and investment planning model for GZE, *Distco Suite*™, developed by Electrotek.

The results of the IRP and least cost planning (LCP) and demand side management (DSM) work were summarized in a seminar held in Zabrze in November 1999. Representatives from 5 other Polish utilities attended the seminar.

Energy Efficiency and Customer Energy Services Activities for Power Distributors: The goal was to have GZE initiate customer energy activities in an environment where:

- As a power re-seller, GZE earns revenues and makes profit on the kWh sold,
- The Ministry of Economy has instructed GZE to increase its electricity sales to stimulate demand for coal,
- Current wholesale power tariffs (paid to GZE and PSE) offer no financial incentive for GZE to change the magnitude of timing of customer's energy use, and
- GZE could find no overloaded areas in its distribution system that could benefit from load management.

Under a previous USAID contract, Electrotek had helped GZE implement energy efficiency projects at a wire manufacturer (FdG) and a carbon electrode manufacturer (ZEW). The FdG project won the Association of Energy Engineers' 2000 Environmental Project of the Year Award. These DSM projects demonstrated real benefits for GZE and its customers. GZE established a "power trade" subsidiary company, OBROT, which is working with customers and individual GZE power regions to identify, promote and implement energy efficiency projects.

The purpose of this project was to expand on these past efforts by having GZE develop additional industrial energy efficiency projects. To achieve project targets by November 1999 and to make sure that GZE had established a viable mechanism and organization to support DSM, alternative DSM projects that could be implemented quickly were selected in late spring 1999:

- *City of Zabrze – city lighting modernization*
- *Town of Gieraltowice – street lighting modernization and thermorenovation*

- *Town of Rudziniec – street lighting modernization*

GZE and ZET were in the first group of Polish power distribution utilities to be privatized. The management of both utilities credit USAID technical assistance with significantly helping to modernize their utilities and position them for privatization. ZET is using the Energy 2020 load forecasting model as the basis for their planning and GZE is using Distco Suite[tm] for IRP evaluation.

GZE has made promotion of customer energy efficiency an integral part of its corporate policy. The GZE subsidiary power trading company (OBROT) is actively designing and implementing customer energy service projects and is establishing an ESCo for this purpose. ZET has reversed its previous stand on DSM and is investigating energy efficiency initiatives as a way to attract or retain customers.

In November 1999, GZE and ZET hosted an information dissemination seminar where they, together with representatives from Nashville Electric, CNEX, and Electrotek, presented results of the USAID work. Staff from 5 power distribution companies attended and the seminar was reported in the Polish press and radio.

Assistance to Heat Companies for Tariff Design and Submissions to URE: In January 1999, the Energy Regulatory Agency (URE) was given authority to approve tariffs of heat companies. USAID provided technical assistance to Poland's heat utilities to enable them to prepare tariff submissions that were acceptable to URE. Electrotek worked with 3 heat companies – Malbork, Koscierzyna, and Bytow – and actively disseminated the results to other polish heat companies. The heat tariff technical assistance in Poland was coordinated and led by Narodowa Agencja Poszanowania Energii S.A.(NAPE) with the help of polish and foreign experts (Trigen Energy Corporation and CNEX). The format was a series of workshops and a seminar. The project was also described to a country-wide district heating conference attended by 400 participants.

6.2 PROMOTE DEVELOPMENT OF THE ENERGY SERVICES/ENERGY EFFICIENCY SECTOR

This activity focused on the "non-utility" aspects of the energy sector. This includes training and capacity building, demonstration projects, and support to companies interested in providing energy efficiency services. The activity covered: (1) Enhancing energy-related courses in technical universities, (2) Providing assistance to businesses, local governments, and companies (especially small and medium size enterprises – SMEs) wishing to reduce energy costs, and (3) Facilitating negotiations between energy service companies (e.g., ESCos), their customers and financial institutions.

Energy Audit Training and Business Support – NAPE: NAPE is a business support organization (BSO) providing assistance and training to all sectors of the Polish economy. NAPE certification is required for an audit to qualify for various Polish government financing options. NAPE developed and sells a software program (Energy Auditor) that provides the methodology and format for presenting and evaluating energy

audits and energy efficiency alternatives. USAID technical assistance was designed to upgrade and update NAPE's energy audit courses and publications to cover new technologies, performance contracting and ESCos, new project structures responsive to changes in Poland's economy and energy sector (especially Poland's Thermomodernization Law), and new financing sources. In 1999, a series of audit courses was prepared to train auditors and to re-certify people who had previously taken NAPE auditor courses.

Other business support activities by NAPE include:

- Publications about energy efficiency, directed to businesses providing energy services or organizations looking for ways to reduce their energy costs.
- Establishing a web site and Internet Secretariat for businesses to ask questions and obtain information about energy efficiency technologies, procedures, financing, audits, consultants, etc.
- Assisting the State Energy Conservation Office (KAPE) to establish an energy efficiency project information data base.
- Providing assistance to KAPE and the Ministry of Economy in developing secondary legislation for the Thermomodernization Law.
- Helping Warsaw University of Technology to enhance its energy-related courses and pedagogic methods.

Seminars on "Financing Energy Efficiency Projects": Fundacja Efektywnego Wykorzystania Energii cnetrum w Krakowie (FEWE-Krakow) and the Polish Network Energie Cities (PNEC) conducted a series of training seminars for representatives from small and medium enterprises (SMEs), local governments, heat distribution companies, ESCos, housing estates, environmental agencies, banks, and other financial institutions. The seminars were typically 2 days in length and were held in various cities around Poland. Over 400 people attended these seminars.

Assistance to Universities: Electrotek and the University of Tennessee, the Alliance of Universities for Democracy, and Czech Technical University worked with four Polish technical universities (Warsaw University of Technology, Silesian University of Technology, Krakow Academy of Mining and Metallurgy, and Krakow Polytechnic University) to introduce improved pedagogical techniques. This activity consisted of four phases:

- Introductory meetings with Polish universities at the AUDEM annual meeting in 1997.
- A workshop in Krakow in February 1998 attended by 7 to 8 faculty from each university.
- Three faculty from each university visited the University of Tennessee (UT) in July 1998 and also met with local governments, various businesses, NGOs and environmental centers.

- Assistance by UT to each university in September 1998 to conduct Energy and Environmental Assessments at 3 Polish businesses.

Demonstration Projects: Five energy efficiency projects were implemented by small enterprise ESCos;, i.e., PilBut, Enertech, BfiG, and ProEsco. The projects involved thermal renovation (schools and residences) and installation of efficient street lighting. All of these ESCos are continuing to implement additional projects.

Information Dissemination and Technology Transfer Seminars: Two seminars were held to disseminate the results of the USAID activities; one in Warsaw in June 1999 attended by 90 people ("How to Increase Energy Efficiency in Polish Gminas") and one in Krakow/Lopuszna in December 1999 attended by 75 people (Municipal Energy Projects and Environmental Protection).

All targets for the activities in Poland were achieved or exceeded by the end of the project in December 1999. A final report was written to document all results. Specific accomplishments include:

- Five utilities adopted modern planning methods (including integrated resource planning) to set prices and design tariffs which cover costs, required investments and profits,
- Eight business support organizations (BSOs) provided assistance to small and medium enterprises (SMEs) on energy efficiency opportunities,
- Ten SMEs implemented modern commercially-oriented business management concepts, practices and systems, and
- Ten municipalities improved their capacity to plan, finance and manage infrastructure projects.

7.0 HUNGARY

Rational cost-based energy tariffs are essential to finance energy efficiency projects and to stimulate necessary investment in the energy sector. The inability of the poorer citizens to afford higher energy prices has been a significant political impediment to adoption of cost-based tariffs that can support necessary investments both on the supply side and on the demand side. The Hungarian Energy Office (HEO) requested assistance in designing tariff approaches that provide a necessary societal "safety net" as well as encourage efficient use of energy (and reduced energy imports). The HEO also asked for help to develop a "perspective" on IRP and DSM that will assist them to review and oversee the DSM and IRP programs of the electric utilities. Finally, the HEO asked for help to stimulate the market for energy services and to resolve current legal, financial or contract questions which were barriers to implementation of energy efficiency and environmental improvement initiatives. To address these issues, Electrotek wrote a work plan that provided technical assistance in 6 major areas:

- *National regulatory and tariff assistance*: Support the USAID Restructuring Project contractor (Bechtel) with assistance to the HEO in areas related to energy efficiency.
- *Municipal energy planning*: Assist a municipality to develop an energy plan, consistent with sound fiscal practices for implementing and financing energy efficiency measures.
- *Energy efficiency financing*: Demonstrate the applicability of innovative financing methods (e.g., performance contracting) to implement energy efficiency projects.
- *Support to NGO's*: Assist established Hungarian NGO's on energy efficiency initiatives.
- *Support for private sector energy service providers*: Provide training and facilitate project implementation (i.e., market development) to stimulate the energy services market.
- *Implementation of energy efficiency opportunities in sectors related to other USAID/Hungary programs*: Implement energy efficiency demonstration projects in municipal housing, schools, and hospitals, and provide direct links to other USAID programs in Hungary.

7.1 ECONOMICALLY SUSTAINABLE RESTRUCTURED ENERGY SECTOR

Specific activities and results in support of a sustainable restructured energy sector were the following:

Assist Hungarian Energy Office to Support Demand Side Management (DSM) and Integrated Resource Planning (IRP): Bechtel and Arthur Andersen, under USAID's energy sector restructuring project, worked extensively with the HEO to establish techniques for designing tariffs and procedures for implementation. Electrotek worked closely with Bechtel to augment the tariff work to include energy efficiency-incentive tariffs. Planned workshops and travel to the US by the HEO under the Bechtel contract

were expanded to include specific sessions on energy efficiency issues and support for low income customers. The HEO became an associate member of NARUC and attended appropriate NARUC meetings and committees.

Support and Training for Energy Services Sector: This task focused on education and training for energy service companies and financial institutions; and developing the legal/contractual and financial analysis framework needed to stimulate implementation of energy efficiency projects in Hungary. Major activities were:

- Developing model energy performance contracting contracts and customer agreements,
- Developing standard financial analysis procedures, which described an energy efficiency project in financial terms in a format and level of detail acceptable for a bank or other financial institution to evaluate a proposed loan.
- Developing training course outlines and schedule and provided training through a series of seminars and workshops to private engineering/energy services firms, municipalities, financial institutions, utilities, industrial customers, and other energy users, including:
  - how to identify efficiency opportunities and define specific projects,
  - how to identify and team with, and contract with energy service companies,
  - how to financially evaluate a proposed energy efficiency opportunity,
  - discuss the structure of contracts for energy performance contracting projects,
  - identification of financing options, sources of financing (domestic and international), and preparation of requests for funding (i.e., proposals),
  - monitoring/verification of savings resulting from project implementation, and
  - case studies of energy efficiency projects implemented on a performance contracting/shared savings basis.

Implementation of Energy Efficiency Projects: This initiative used the contacts (customers), tools (model contracts and project financial evaluation procedures), and financing mechanisms identified or developed in previous activity to implement 2 to 3 energy efficiency projects addressing public sector customers. Candidate sites were evaluated and chosen where the measures implemented were cost-effective, without any outside funding or subsidies to finance implementation costs. Impediments to public sector entities encouraging and/or contracting with energy services providers to implement energy efficiency programs were identified and remedial actions were recommended. Limited USAID funds were used to purchase monitoring equipment and/or partially fund energy efficient equipment or materials. However, funds used for this purpose were repaid on a performance contracting basis, with the repayments being used to finance additional energy efficiency measures. Evaluation reports were written to document all activity:

- Berzseryi Daniel Evaluation Report
- Fejar Meguei Szent Gyorgy Korhaz Hospital Evaluation Report
- Nemetvolgyi School Evaluation Report
- Jávorszky Ödön Hospital Evaluation Report
- Csolnoky Ferenc Kórház és Rendelõintézet County Hospital Evaluation Report

8.0 CZECH REPUBLIC

At the time of this project, the Czech Republic government was encouraging (i.e. subsidizing) widespread conversions of heating systems from coal to natural gas. This was done without full consideration of the operating costs to the consumer. Rational evaluation of costs was made more difficult because of the large cross-subsidies in electric and gas prices (i.e., industrial customers are subsidizing residential tariffs). The Czech government was paying significant subsidies to district heat customers. The government wished to eliminate these subsidies, but was under considerable political/social pressure to maintain them. At the time, the district heat tariffs/subsidies provided no incentive to invest in building energy efficiency measures. The work plan describes activities implemented under this project. They focused on tariff reform; energy efficiency demonstrations that showed the need for tariff reform to encourage innovative financing; and demonstration of appropriate, affordable energy efficiency measures. The specific objectives included promotion of energy efficiency projects; financial planning; tariff reform; and technical training and networking with municipalities, non-governmental organizations, and universities.

8.1 PROMOTE DEVELOPMENT OF CZECH ENERGY EFFICIENCY

Electrotek was responsible for designing and implementing demonstration projects in five Czech municipalities. Activities included selection and comprehensive audit of sites, recommendation of energy efficiency tariff systems, and technology transfer seminars. The USAID assistance was successfully used to leverage additional contributions from the Czech Energy Agency, municipalities, hospitals, banks, and vendors. Electrotek and its subcontractors developed and implemented five demonstration projects.

- *Frydlant Hospital* – the old back-up diesel was replaced with a gas-driven generator equipped with a co-generation system. Annual savings were $37,165 with a payback of 0.54 years.
- *Litomerice Hospital* – the new building energy management system allowed the hospital to save $20,000 annually with a payback of 1 year.
- *Ivancice Hospital* – A high efficiency surgical steam generator was installed. The hospital saved $13,333 (with a payback of 1.6 years) and plans to add 3 similar generators.
- *Mimon School* – Weatherization and the installation of zoned heating controls allowed the school to realize annual savings of $29,125 with a payback of 0.58 years.
- *Uherske Hradiste Schools* – High efficiency drying units were provided for the city of Uherske Hradiste to recover from flooding in the summer of 1997. This allowed the city schools to open on time.

The Ministry of Industry and Trade (MOIT) was provided with a regulatory model that incorporated financial models of all eight electric distribution companies and CEZ. A two-day tariff seminar was presented to representatives of CEZ, the distribution companies, MOIT, and the Ministry of Finance.

Training was provided at three universities in the Czech Republic in technical and financial analysis of energy efficiency/environment programs through collaboration among the faculties of engineering and management of the Technical University of Liberec, Technical University Ostrava, Czech Technical University in Prague and the University of Tennessee. The program enabled and supported the development of pre- and post-graduate courses in environment and energy efficiency at the three Czech universities.

Energy Efficiency Demonstration Projects for District Heat and Gas Heat Conversions: Czech municipalities had aging, subsidized district heating (DH) systems that were difficult to maintain and represented a large and growing drain on municipal budgets. Tariff structures did not permit cost recovery of efficiency investments to DH buildings, or encourage efficiency investments to gas heated buildings. Demonstration projects were identified that demonstrated the need for tariff reform, prepared a structure that allowed cost recovery of energy efficiency investments, demonstrated a means for implementation using performance contracting financing, and demonstrated cost-effective building energy efficiency measures. Electrotek worked with SEVEn, USAID-Prague, the Ministry of Industry and Trade, and the gas utilities to identify candidate municipalities for the demonstration sites. Specific details of these activities are in the following documents:

- Evaluation of Energy Efficiency Projects
- Hospital Energy Audit Methodology
- Energy Audit – Mimon Elementary School
- Energy Audit – Frydlant Hospital
- Energy Audit – Ivancice Hospital and Polyclinic
- Energy Audit – Litomerice City Hospital
- Energy Audit – Ostrava Fifejdy Hospital

Financial Planning and Tariff Reform: The purpose of Central Maine Power's (CMP) distribution company financial planning model is to analyze utility financial behavior under alternative load growth and rate design scenarios, and parametric rates of general inflation and individual escalation rates. The model generates income statements, balance sheets, and cash flow projections for a 5-year business-planning horizon. This task continued previous work by CMP, in cooperation with USAID's Energy Sector Restructuring Project. Specific activities completed were:

- Financial planning model expansion
  - include revenue requirement analysis and alternative tariff structures for the eight Czech electric distribution companies.
  - implement other model requirements
  - exercise and customize the model for the 8 distribution companies.
  - help prepare a tariff/rate design seminar for the electric distribution companies and appropriate government ministries.

Technical Training and Municipal/NGO/University Networking for Energy Efficiency: This task provided training in financial analysis of energy efficiency/environment programs, development of model ESCo agreements, establishment of a self-sustaining

network of NGOs and energy training/university programs, and support for technology transfer and cooperative assistance with Czech municipalities. Electrotek and its subcontractors completed the following activities:

- Energy Service Company and Lender Support and Training
  - Develop model agreements and contracts
  - Develop appropriate savings verification methods
  - Work with local banks to develop financial analysis templates for small to medium size projects
- Information Dissemination and Education Initiative
  - Develop energy efficiency course for Czech University, in cooperation with the Alliance of Universities for Democracy (AUDEM).

9.0 SLOVAKIA

The Slovakia energy efficiency activity was designed (work plan) to identify cost-effective mechanisms that would allow condominium associations to reduce and control their energy costs. The project's focus was on policies and measures that mitigate the effects of elimination of heating price subsidies on households and particularly, the poor. At the national level, Electrotek advised the Ministry of Economy on appropriate pricing and energy efficiency policies, and provided information on the impacts on consumers of eliminating heat subsidies. Policy guidance was also provided to the Ministry of Labor and Social Affairs regarding suitable energy-efficiency based low-income energy assistance programs. The original work plan was expanded to include assistance to update the Slovak national energy strategy and provide recommendations for compliance with European Union accession requirements.

At the local level, Electrotek worked with a condominium association to design, implement and disseminate the results of an energy efficiency demonstration project. Four energy efficiency newsletters were published, a seminar for municipal officials and condominium association representatives was held, two energy audit courses were given, and peer exchange was supported through attendance by key energy engineering faculty members at two international conferences and a USA study tour. This project is an excellent model for implementation of residential energy efficiency demonstration projects in other countries. A Final Report summarizes all project activities.

9.1 DEVELOPMENT AND IMPLEMENTATION OF A PILOT PROJECT

An energy efficiency demonstration project was designed and implemented at a privately owned apartment building (condominium association) in Kosice. The project identified cost-effective measures that allow building residents to reduce and control their energy costs in the face of rising heat prices (i.e., reduced subsidies). The project involved a panel type apartment building (Kuzmanyho 45-51), highly replicable energy savings measures, and financially stable and motivated building owners. Four energy saving measures were installed – a new heat distribution system in the basement, heating controls and balancing of the heating system, thermostatic radiator valves, and weatherstripping.

The Kuzmanyho 45-51 building was selected since it is typical of many apartment buildings in Slovakia and therefore project results would be replicable to many other buildings. Four energy efficiency measures were implemented and described in an evaluation report:

- Replacement of heating distribution system in basement
- Heating controls and balancing of heating system
- Thermostatic radiator valves (TRVs)
- Weatherstripping

An institutional assessment of district heating price subsidies that assesses the institutional, social and economic aspects of heat price subsidies was completed in August of 1999. However, available data were all prior to 1996. Key findings are:

- From 1993 to 1997, between 2.6 billion and 4.3 billion SK annually was spent on heating price subsidies for households. This subsidy averaged between 36% and 42% of the cost of delivered heat.
- All households are adversely affected by the elimination of heating subsidies. The government should develop energy saving programs for all households regardless of income level.
- Non-fuel costs differentiate the low-to-medium cost producers from the high-cost producers. The highest cost producers are those that have recently invested in new equipment and are using accelerated depreciation to recover their capital costs.
- The Slovak government is taking steps to correct heating price distortions by phasing-out price subsidies and establishing a special program to provide relief for the poor. Impacts of these actions must be considered and safety net programs established.
- The government should establish a partially subsidized building weatherization program that will pay for itself quickly as heating prices inevitably increase.
- The government should consider other complementary programs such as a ban on disconnections during the heating season, lifeline rates, budget billing, large-scale energy efficiency funds, and energy education programs.

9.2 ENERGY EFFICIENCY AND MARKET REFORM

Capacity Building – An **information dissemination plan** was written and executed. A total of four energy efficiency newsletters were published for the 4,500 members of the condominium associations which addressed energy supply choices, the USAID-sponsored energy efficiency demonstration project in Kosice, upcoming heating price changes, and pending energy related legislation. A **seminar** was held in Bratislava on May 27,1999 to disseminate information about the demonstration project and to inform participants about other heat supply-related issues and projects

Two energy audit courses were given to train participants on the energy audit process for residential buildings. The two-day seminar was attended by 21 participants - mostly presidents or other "officials" of the apartment owner's associations from several Slovak cities. Seminar topics were energy audit procedure, energy efficiency improvements, methods for evaluating the economics of energy efficiency opportunities, and analysis using the ASEAM3[3] computer model. The local TV channel aired a 5-minute videotape as part of a TV series dedicated to problems related to privatization of apartments. The interview praised the USAID's assistance to the region. An "Advanced Energy Audit Training Course" was provided using a more advanced computer model (ASEAM5). Each of the eight participants were given a copy of the software.

[3] ASEAM is a public domain computer model (A Simplified Energy Analysis Method) that is used to calculate the energy consumption of proposed and existing buildings.

Support for Publication of Textbook - Financial support was provided for publication in September 1999 of a new energy and energy engineering textbook titled "Energy Sources: Transformation and Utilization of Energy". The content was developed primarily from the energy efficiency curricula and lectures from the energy-related courses taught by a group of energy engineering professors from Bratislava Technical University.

Networking of Czech and Slovak Universities through AUDEM – Two Slovak faculty members' participated in the 1997 and 1998 AUDEM (Alliance of Universities for Democracy) conferences in Warsaw, Poland and Nitra, Slovakia, one Slovak university professor participated in a January 1998 meeting in Krakow, and a U.S. study tour was held in September 1998.

9.3 NATIONAL ENERGY STRATEGY SUPPORT

National Energy Strategy Support - In response to a request by the Ministry of Economy, assistance was provided to update the Slovak national energy strategy. The objective was to assess the Slovak Republic energy sector development concept and policy to 2010 with regard to compliance with European Union guidelines. The energy balance in Slovakia is described, the country's resources and demand are quantified, and the energy sector infrastructure is described. Information, findings and recommendations from *The Updated Energy Concept of the Slovak Republic by 2005* with regard to the current state of the energy industry, conceptual aims of the government, and energy sector development strategies are summarized. *Energy Policies of the Slovak Republic*, a 1997 survey by the International Energy Agency (IEA), is reviewed. Key elements of the energy sector are described, energy policy objectives are stated, and conclusions and recommendations on legal framework, energy security, pricing, resources, and energy consumption are made. The European Commission's (EC's) energy policy and implementation guidelines for market integration, energy security and sustainable development are described. Suggestions are made on energy prices and subsidies, influence of natural gas and oil transit pipelines, power sector restructuring, electricity generation and continued development of nuclear power, lignite mining, and demand-side management. Compliance of the Slovak energy sector policy with the EC guidelines is discussed. Some insight is provided into the security and quantity of Slovakia's energy supply. Estimates of energy demand growth through 2010 are reviewed and matched with expected supply. Slovak government energy legislation is briefly reviewed and compared with EC policy.

10.0 BALKAN REGIONAL PROGRAM

At the present time, the electric power sector in Southeast Europe consists mostly of vertically integrated utilities where each country has conducted central planning independently and power exchanges have taken place on an ad-hoc basis to meet reliability requirements and/or to avoid the cost of higher priced energy. There are also indications that electricity markets in the region, and even a regional energy market, may soon emerge. This will require development of an energy trading and contracting infrastructure, as well as the need for further strengthening of the transmission networks. Interconnection between power systems is an effective means of improving the overall level of system reliability and economy. Specifically, regional cooperation will provide immediate and long-term benefits to countries in the region in the following areas:

- *interconnecting the power systems of the Balkan countries* in order to take advantage of load diversity, generating reserves, and optimal usage of resources on a regional level
- *upgrading and/or adding power system facilities* needed to accommodate demand growth and energy transactions within the region
- *establishing reliability criteria and measures* aimed at improving and maintaining the quality and continuity of the electric service
- *developing consistent methodologies for pricing* transmission and ancillary services
- *modernizing the existing, and implementing new information and communications facilities* needed to enhance and maintain the operating security of the interconnected power system and to support the new type of energy transactions with the advent of the open energy market in the region
- *encouraging private sector investment* in the electricity sector
- *reducing environmental emissions* through better system coordination

Realizing the economic benefits will depend on the capability of the communications infrastructure to support the current and known requirements and provide for future applications and users within each utility, and with future dispatching centers. Thus the overall objective is to design a modern teleinformation system among national dispatch centers in SECI countries to enhance efficiency, security and reliability, promote electricity exchanges and trade, and develop the basis for a future regional electricity market and the integration of Southeast Europe systems into UCTE. Specific objectives are to:

- develop bankable projects for consideration by international lenders;
- facilitate compliance with UCTE communication and EU Directive 96/92 requirements;
- harmonize current and planned national teleinformation system improvements;
- define considerations and requirements related to possible future development of a regional communications/accounting center.

10.1 BALKAN REGIONAL ELECTRICITY SYSTEM COORDINATION - INSTITUTION BUILDING PROGRAM

Electrotek developed a framework for regional cooperation among the utility companies and systems operating throughout Southeast Europe, with the direct participation of the member countries of SECI. Specific accomplishments of this task were:

- a regional task-force was created to:
  - identify needs and propose steps for action towards regional cooperation as perceived by each individual country,
  - designate a liaison with SECI, the Business Advisory Council (BAC) to SECI, Black Sea Regional Energy Center, Black Sea Economic Cooperation (BSEC), World Bank, EBRD, IFC, EIB, EU Phare, and regulators and government officials in SECI countries,
  - define priorities for implementation, and
  - propose the agenda for a round table for regional cooperation in the electric energy sector.
- power system technical characteristics of each country and the potential for regional cooperation were evaluated
- options for phased introduction of regional coordination were defined
- a roundtable was held to identify regional coordination issues

Electrotek participated in SECI meetings to ensure coordination among SECI activities and those of the USAID project to develop a "Framework for Cooperation in the Electric Energy Sector in Southeast Europe." SECI was also informed about some of the major goals of the project, including establishing reliability criteria, developing consistent pricing methodologies, and assessing the current implementation of privatization in the region. A "white paper" was written that summarized the key characteristics of the power systems of the Balkan region, identified the current problems and needs, described the infrastructure needs in the electrical power industry in Southeast Europe, and characterized the evolution of an efficient Balkan Regional Electricity Market. This document led to the signing of a "Memorandum of Understanding" – unsigned copy" among the SECI member countries for participation in continuing efforts to address the three major segments of a "teleinformation" system for the region as identified in the work plan:

- *Applications* - the services that must be provided over the communication system. These include operational information such as voice and data required to initially support regional cooperation and eventually lead to the establishment of a power exchange.
- *Capacity* - the determination of the capacity and connectivity required to support the applications and services defined previously
- *Technology/architecture* - necessary to support the applications and connectivity requirements. This includes support to the backbone network as well as the

connectivity between the required locations and the backbone network (access network).

10.2 TELEINFORMATION SYSTEM AMONG THE NATIONAL DISPATCH CENTERS IN SECI COUNTRIES

Input for this study was provided by Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, FYR Macedonia, Moldova, Romania, Turkey, Slovenia, and Yugoslavia. All of these countries except for Yugoslavia, Slovenia and Moldova signed the Project Memorandum of Understanding – unsigned copy in February 2000 and were active participants in this Teleinformation project. Slovenia participated as an observer and attended some of project meetings. Moldova did not actively participate in the project. Yugoslavia started participating in November 2000. This project was one of several critical, urgently needed projects identified by SECI members. The Terms of Reference (TOR) were jointly developed by SECI members.

Electrotek Concepts Inc. was the prime contractor with the electric utility ESM of FYR Macedonia, as the SECI project coordinator. The Chairman of the SECI Electricity Interconnections Group headed a Steering Committee that was responsible for the overall direction of the project. The Steering Committee included:

- Each signatory SECI participant and supporting states
- United States Agency for International Development (USAID)
- Economic Commission for Europe of the United Nations
- The World Bank
- The European Bank for Reconstruction and Development (EBRD)
- The European Commission
- The European Investment Bank

The project reviewed existing dispatching and communications infrastructure and defined requirements, evaluated alternative solutions and selected optimal alternatives, and defined telecommunication system management requirements. A three volume report was published: Volume 1 - *Introduction and Summary*, Volume 2 – *The Current Situation*, and Volume 3 – *Project Definitions*. A concluding workshop was held in Ohrid, Macedonia in May 2000. Visits were made to the UCTE center in Laufenburg, Switzerland and the CENTREL accounting center in Warsaw, Poland in July 2000.

Nine countries have National Dispatch Centers (NDCs). They are:

- KESH in Tirana, Albania,
- ZEKC in Sarajevo, Bosnia and Herzegovina,
- NEK in Sofia, Bulgaria,
- HEP in Ljubljana, Croatia,
- ESM in Skopje, Macedonia,
- PPC in Athens, Greece,
- MVM in Budapest, Hungary,
- Transelectrica in Bucharest, Romania,
- TEAS in Ankara, Turkey,

- EPS in Belgrade, Serbia, Yugoslavia, and
- EPCC in Podgorica, Montenegro, Yugoslavia.

Several regional dispatch centers communicate with the National Centers using internal telecommunication systems (Fiber Optic, Power Line Carrier, Microwave, Satellite). Thus, for the purpose of this project, it is sufficient to provide communication capability among the NDCs only since all data are then accessible. In Yugoslavia there are two centers one for each Republic and both are treated as NDCs. A number of issues were identified and recommendations were made as follows.

UCTE Second Synchronous Zone Accounting Center: Currently, many of the project countries are operating in the Second UCTE Synchronous zone. Others, for example Hungary and Slovenia, are connected to the UCTE main grid. There is an Accounting Center for the Second Synchronous Zone in Belgrade, Yugoslavia referred to as the EKC, which collects and transmits certain energy accounting data to the UCTE Southern Region Accounting Center in Laufenburg, Switzerland.

Internal Telecommunication Facilities: There are substantial efforts under way in all of the electric utilities to upgrade and modernize their internal telecommunication network. All of them have decided to implement a fiber optic based network for the "backbone" communication facilities supplemented by a variety of communication media for the tributaries and spurs.

Traffic Analysis: An initial estimate of the volume of data to be exchanged was prepared. Results indicate that a 128 Kbps channel would suffice. Adding an allowance for voice traffic and recognizing that some links will carry traffic for third parties, and consistent with the minimum SDH channel, a channel capacity of 2 Mbits per second (designated E1) between the each NDC pair in each direction was assumed adequate.

Development of an Electricity Market in the Project Countries: All of the countries participating in this project have stated that they intend to comply with the EU Directive 96/92 on the Internal Electricity Market. Therefore, a competitive electricity market in the SECI countries must develop consistent with the EU Directive. With regard to the development of a centralized Balkan power exchange, the situation is less clear. The EU Directive does not require that such a system be put in place by any of the utilities.

Telecommunication System Monitoring: The regional management function will be one of monitoring and coordination rather than controlling.

Power System Security Monitoring Functions: The transmission security functions will provide for monitoring and coordinating the demand and energy transactions over the region's transmission lines. Since the generation of electricity must continuously be matched to customer demand, day-to-day, minute-by-minute, monitoring by the security center and member utilities is necessary to keep the transmission system functioning reliably. The transmission security activities will encompass conventional functions and

new ones, including security monitoring, voltage and reactive control, congestion management, and transfer capability assessment.

Energy Accounting: This regional function will focus on inter-country flows with the internal energy accounting being the responsibility of the local System Operator(SO)/Market Operator(MO). This function could be performed for the SECI NDC project members only or could be incorporated into an existing UCTE center such as the one at Laufenburg, Switzerland.

Interfacing to External Entities: There are a number of external entities that the SECI NDC's could potentially interface with. These include one or more MOs, perhaps ancillary services providers, distribution companies and other market agents. In addition, interfaces will be required to UCTE centers, either existing or new, that are responsible for UCTE-wide reliability and transmission network management.

SECI NDC's Communication Infrastructure: The equivalent of four E1 (4*2 Mbps) links among the dispatch centers was planned. The capacity of the existing system was used and augmented as needed to provide a more cost effective and faster alternative than a completely new system. All parties agreed that each country would be responsible for the portion of the network up to its boundary with the neighboring country.

In-country and Regional Projects: Based on the connectivity defined above to interconnect the NDCs, at least 54 projects were identified as necessary by the 12 countries to complete the telecommunications network. In addition, three projects were regional in nature, (1) Security Functions, (2) Energy Accounting Functions, and (3) Teleinformation System Management.

11.0 ROMANIA

A project work plan was written that identified activities to support the development of at least one, well capitalized Energy Service Company (ESCo) in Romania capable of carrying out performance contracting. The following were completed:

- development of a complete ESCo business plan together with financial projections;
- elaboration of a staffing plan and training program for the ESCo;
- provision of training to the ESCo staff in project financial analysis, contract development and ESCo management;
- development of Chauffage and Guaranteed Savings performance contracts, tailored to the Romanian market and reviewed by local attorneys;
- assistance in the technical and financial preparation of several ESCo projects, specifically at Cimus, Stratusmob and Petromidia.

Approximately 20 venture capital and investment firms were presented with the business plan together with a proposal for first-round investment in a local ESCo, Energy Serv. A number of firms entered negotiations with Energy Serv, backed by the Electrotek team. One consortium in particular -- consisting of the Romanian Post-Privatization Fund, the Romanian-American Enterprise Fund and the Oresa Fund -- made a concrete investment offer. Unfortunately, the latter offer collapsed due to a dispute over the inclusion of a foreign, strategic investor. After 18 months of effort with Energy Serv, USAID concluded that further assistance to the company was not likely to enhance its prospects significantly. Energy Serv has therefore been applying the training it received under the program to build a thriving, albeit smaller than planned, energy-efficiency business. The remaining budget for the program was redirected to provide training to a broader portion of the energy-efficiency community, both developers and customers. The Electrotek team organized three workshops (in Cluj and Bucharest) which were attended by a total of 106 participants. The workshop topics were as follows:

Workshop 1: Project Financial Analysis for Energy Efficiency Professionals
Workshop 2: Writing and Negotiating Performance Contracts
Workshop 3: Making Money From Energy Efficiency: Preparing Tenders and Negotiating with ESCOs

11.1 ROMANIAN ESCO DEVELOPMENT PROGRAM

Project Pipeline: A pipeline of projects was developed prior to finalizing the work plan. Electrotek met with a number of venture capital firms to assess their interest. Meetings were held with commercial banks, the local chapter of the Association of Energy Engineers, and other engineering firms to identify impediments to project development. In general, there was a strong interest in performance contracting in Romania.

Evaluation of ESCo Environment/Project Design: Romania had a well-trained cadre of energy professionals, many of whom had benefited from previous USAID training. The country also had increasing access to commercial bank financing for energy efficiency projects and a plethora of industrial projects. The missing link was the lack of training in packaging projects for financing and an unwillingness of most industrial firms to put

significant equity into efficiency projects. The program focused on developing one (possibly two) domestic ESCos to minimize impact on a locally developing performance contracting sector. The plan to develop a domestic ESCo was predicated on the availability of venture capital in Romania.

Identification of ESCo Partners, Staff and Potential Investors: Nearly 30 different Romanian engineering and energy firms were approached by the Electrotek team. An assessment was made to evaluate the suitability of each candidate as a potential ESCo and to determine the level of interest and commitment of each firm. Energy Serv was finally selected principally because of their energy efficiency expertise and their commitment to the formation of an ESCo. Electrotek approached 12 financial institutions as potential equity participants in the ESCo or providers of project financing. These firms ranged from multi-lateral institutions (e.g., EBRD, IFC) to local branches of venture capital firms (e.g., RPPF, RAEF, Oresa, CA IB, etc.).

Preparation of ESCo Corporate Business Plan: The Electrotek team and Energy Serv developed a complete corporate business plan and presented it to investors, including extensive financial projections, risk analysis, a proposed capital structure, business organization and training plan, and a detailed write-up of the corporate strategy. Electrotek assisted with the following activities:

Securing Financing and Incorporation of the ESCo

Energy Serv was incorporated as an ESCo prior to completion of the business plan. Cash flow supported a staff of 7 professionals and avoided the impression that the company was a strictly start-up venture. An initial team of investors was assembled with considerable interest in the venture including the Romanian Post-Privatization Fund (RPPF) and the Romanian-American Enterprise Fund (RAEF). Discussions with these investors progressed well into early 1998 and culminated in offers for an investment. Discussions were also held with Creditanstalt's venture group in Romania (CA IB), with the EBRD, and with several other foreign-based funds, but ultimately all of these attempts failed.

ESCo Project Development

Electrotek provided technical assistance to Energy Serv to develop three projects through the feasibility stage and provided limited assistance on a number of other projects. In particular, Electrotek helped to develop projects at Cimus (a cement producer), Stratusmob (a furniture manufacturer) and Petromidia (an oil refinery). These companies were selected from a short-list of approximately twelve companies that were visited to select the most promising ESCo project opportunities. These projects were also used as the input for the business plan financial projections and served as a real anchor for the interest of investors. Ultimately Energy Serv carried out some energy services for all three of these companies, but the full projects were never implemented due to the lack of equity capital. Energy Serv has continued to develop literally dozens of smaller contracts which it has implemented on a straight consulting basis or using a modified form of performance contracting. Energy Serv is currently realizing approximately $3 million of

energy savings per year for its customers and is taking in nearly $1 million of revenues in consulting and other service fees.

Training and Management Assistance

Energy Serv staff was trained in the development of performance contracts, forecasting, company financial statements, and carrying out project financial analysis. These training areas served as the framework for developing three workshops, each of which was presented twice (once in Cluj and once in Bucharest).

Project Financial Analysis for Energy Efficiency Professionals. This two-day workshop reviewed concepts such as basic cash flow analysis, internal rates of return and net present value calculations and then examined more complex applications of these tools including the application of sensitivity analysis and basic risk analysis.

Writing and Negotiating Performance Contracts. Using model contracts developed specifically for Romania under the Energy Serv work (including Chauffage and guaranteed-savings contracts), participants learned the steps to tailor contracts to meet their specific project requirements and then to negotiate these contracts with the customer. The workshop concluded with a simulated contract negotiation process using real computer simulations and dividing the participants into teams of customers and ESCos.

Making Money From Energy Efficiency: Preparing Tenders and Negotiating with ESCOs. This one-day workshop was for managers of industrial customers to assist them in understanding different approaches to energy efficiency financing, and, in particular, to introduce them to performance contracting.

Details of these activities are given in the final report for the overall project.

12.0 BULGARIA

This project served as the focal point for the development of a municipal network to promote "grass roots" energy efficiency activities throughout Bulgaria, expand the role of the private sector in the delivery of energy efficiency services, equipment and financing, and educate energy consumers about the benefits of energy efficiency. The following activities were completed:

- development and implementation of a municipal network
- development of local chapter Association of Energy Engineers (AEE) capabilities (an energy efficiency project was completed at the Regional Hospital in Gabrovo)
- development and implementation of 3 demonstration projects in the municipalities of Plovdiv, Stara Zagora and Varna.

The work plan for these activities initially included a task to develop financing mechanisms for energy efficiency projects. The financial crisis in Bulgaria during the project caused the cancellation of this task. It was replaced with the 3 demonstration projects – in Plovdiv, Stara Zagora and Varna.

12.1 DEVELOPMENT AND IMPLEMENTATION OF THE MUNICIPAL ENERGY EFFICIENCY NETWORK

The Municipal Energy Efficiency Network, EcoEnergy, was founded in 1997 with the support of 10 founding-member municipalities as a voluntary non-profit association of Bulgarian municipalities that wished to contribute to the sustainable development of municipalities through energy efficiency. The Centre for Energy Efficiency (EnEffect) is the Secretariat of the association (for current information on EcoEnergy access **www.eneffect.bg**). Development and implementation of the EcoEnergy network involved a number of steps:

- Evaluate existing networking infrastructures in Bulgaria
- Evaluate US networking approaches.
- Assess relative cost/benefit of various approaches and recommend mechanism
- Develop rules/procedures for municipal energy networking
- Establish formal linkages with municipalities in Bulgaria, national government organizations, and foreign NGOs
- Advertise network through existing Associations of Municipalities / Mayors
- Implement formal municipal energy efficiency network at ten municipalities
- Registration of the municipalities wishing to become members of the Network and nomination of the municipal energy efficiency officers
- Organization of a Network Secretariat to co-ordinate its activities
- Development of Rules of Procedure for the organization and activities of the Municipal Network and a Program of Work of the Network
- Conduct 5 workshops in different Bulgarian cities:
  - First Workshop, Sofia, March 12, 1997
    - Organizational meeting

- Second Workshop, Stara Zagora, November 19, 1997
  - Review/approval of procedural rules and work program for 1997-1998
  - Review of energy efficiency projects in Gabrovo, Radomir and the hospital in Stara Zagora
- Third Workshop, Sofia, February 12, 1998
  - "Municipal Energy Planning and Management" workshop that addressed fundamentals, practical approaches to local energy policy, planning of building projects and energy audits, energy consumption data bases, and funding opportunities for energy efficiency projects.
- Fourth Workshop, April 7, 1998
  - "Financing of Energy Efficiency Projects" workshop that addressed the Draft Law on Energy Efficiency, EU organization to promote energy technologies (OPET and FEMOPET), energy efficiency and environmental protection, and funding of municipal energy efficiency projects.
- Fifth Workshop, 10 December 1998
  - Round-table discussion on "Efficiency in Bulgarian Hospital in the Light of the Reform in the Health Care System"

A business plan was developed for network activities. The plan addresses the mission, objectives and tasks; status and property; activities and market; strategy for attainment of objectives; and management of EcoEnergy. An information database on energy efficiency was also developed. Initial efforts were made to create an information system about energy consumption in member-municipalities. The system quantifies actual fuel and energy consumption by functions and groups of municipal activities. Five pilot municipalities were selected (Belene, Gabrovo, Gorna Oryahovitsa, Karlovo and Stara Zagora) for the initial data collection effort. A second database was developed for publications in the field of energy efficiency. A total of 3,000 documents have been processed and about 2,000 inputs have been made. The information is structured in five subject groups: energy policy, capacity building, demonstration projects, technological problems of energy efficiency and environmental aspects of energy efficiency. A system user guide has been developed. Finally, a formal peer exchange program for members has been established.

12.2 DEVELOPMENT OF ASSOCIATION OF ENERGY ENGINEERS CAPABILITY

Electrotek provided a two-week training course in building energy simulation to Association of Energy Engineers members in the Sofia and Plovdiv Chapters. In addition, two laptop computers and building energy simulation software (ASEAM) was procured. Extensive training in building modeling of Bulgarian building construction characteristics was given as a part of experience with computer simulation of the hospital in Gabrovo.

Association for Energy Engineers' workshops were held on the topics of power quality, motors and adjustable speed drives, hospital energy management, heat recovery and

packaged cogeneration systems. In addition, Electrotek funded AEE members to attend a number of international conferences in the U.S. Finally, Electrotek provided financial support to the Plovdiv AEE chapter to develop a series of university-level energy management courses.

12.3 DEMONSTRATION PROJECTS – GABROVO, VARNA, PLOVDIV AND STARA ZAGORA HOSPITALS

The original scope of work required the implementation of one demonstration project (Gabrovo Hospital), and dissemination of the results through EcoEnergy. The Gabrovo project received the 1998 International Energy Project of the Year Award from the Association of Energy Engineers, and was featured on a CNN news clip on energy efficiency in Eastern Europe. When work to identify financial mechanisms in Bulgaria to fund energy efficiency projects was cancelled, business plans were developed for three additional hospital projects – Varna, Plovdiv and Stara Zagora. As a result of the demonstration project in Stara Zagora, the director of the regional hospital traveled to the U.S. two times (funded equally by USAID and the hospital) to meet hospital managers in the U.S. and learn about energy and hospital management practices, which could be applied in Bulgaria.

12.4 REPORTING

A final report was written documenting all activities under the Bulgarian Municipal Energy Efficiency Program. The report included five appendices as listed below. Appendix B is accessed as a hyperlink in this report. All other appendices were delivered to USAID in hard copy.

Appendix A. Final Report from The Center for Energy Efficiency – EnEffect
Appendix B. Business Plan for the Municipal Energy Efficiency Network
Appendix C. Training materials for Association of Energy Engineers Workshops
Appendix D. Course material for AEE Plovdiv Energy Efficiency Courses
Appendix E. Gabrovo Hospital Demonstration Projects – Results and Energy Audit
Appendix F. Business Plans for Varna, Plovdiv and Stara Zagora Hospital Energy Efficiency Projects

13.0 MACEDONIA

USAID funded Task 2 of the original work plan for technical assistance to:

- support the Ministry of Economy in defining the most advantageous long-term energy sector development strategy for Macedonia, with particular focus on measures which reduce air pollution and lessen dependence on energy imports, and
- develop the capability within the Ministry for implementation of, and future updates to, the Macedonian National Energy Strategy Plan.

In March 1998, the Government of Macedonia (GOM) and the United States Agency for International Development (USAID) agreed to jointly support development of an energy sector strategy through 2020 for the Republic of Macedonia. The effort focused on identification and assessment of a plan for development of a power sector strategy. A final report was written that presents the results of this collaborative effort by energy professionals from GOM institutions, and the technical support of US contractors and private sector Macedonian consultants working through the Macedonian Academy of Sciences and Arts. The study identified and analyzed:

- Characteristics of the Existing Infrastructure in Macedonia: The type, level of technology, age and condition, and operation and maintenance experience of major system hardware are identified and assessed for existing Macedonian energy sector systems.
- Analysis of Energy Consumption From 1975-1991 and 1991-1997: quantified by form, sector and end-use.
- 5-year Energy Consumption Growth Scenarios Periods Between 1998-2020: growth in energy consumption strategies, e.g., low, medium and high growth; minimum environmental impact; maximum supply security; lowest-cost power generation.
- Quantification of Energy Supply Between 1998 and 2020: estimate of the quantity, availability, and method of supply (local, centralized, distributed) for both indigenous and imported energy required to adequately meet the energy demand.
- Energy Sector Strategy Development: computer modeling of sector strategies for resource supply and energy consumption to 2020 (selected strategies go to 2030).

13.1 MACEDONIA ENERGY SECTOR DEVELOPMENT STRATEGY

The specific direction that the energy sector development takes will be determined by decisions within the next few years on the level of government support for sub-sector demand growth (transport, agricultural, industrial, residential/commercial, etc.), selection of fuel types and rate of use, and the type and development schedule of new power plants. A phased approach is the most reasonable, i.e., in the near-term to return to the industrial capacity and production level of the pre-independence time period, in the mid-term to attain the level of growth of the more developed Eastern European countries, and in the longer-term to achieve a level of development equal to that of fully developed countries.

The overall objective of energy sector development is to identify an approach that will enable Macedonia to be integrated into the European Union (EU) as soon as possible. Decisions that must be made and actions that must be taken include:

- definition of the future of the government-owned metallurgy facilities which are inefficient, costly, and the largest single consumers of electricity,
- a decision on how to address the unpredictability of oil supply and price, since the oil refinery (OKTA) has been sold to a Greek company,
- determination of the actual extent of the lignite resource in Macedonia and planning for continual lignite supply for TPP Bitola and TPP Oslomej and/or their conversion to dual-fuel systems (the situation with TPP Oslomej is very critical - the lignite deficit in 1999 reduced its electricity generation to 50%),
- a decision on how to use the current supply of natural gas (industrial, residential, commercial, or power generation) and whether or not to build an additional pipeline,
- the trade-off of rehabilitation and modernization of equipment in TPP Bitola and TPP Oslomej versus construction of new combined cycle gas-fired power plants (this is especially critical for TPP Oslomej where the maximum 100,000 operating hours has been reached),
- assessment of the impact of the possible sale of TPP Negotino and/or its conversion to natural gas,
- research and assessment of nuclear power as an option for Macedonia.

The decisions identified above provide a basic configuration for the power sector through 2010, with development options thereafter depending on the availability of energy resources and how they are used between now and then. The lowest-cost power generation scenarios assume no retirement for the existing thermal power plants. The basic configuration uses hydropower expansion currently planned by ESM (HPP Matka 1 in 2001, HPP Koziak in 2002, HPP Matka 2 in 2005). Two new power plants are required with their commissioning year dependent on the assumed annual electricity consumption. A 270 MW natural gas combined cycle power plant is required between 2003 (for the high demand case) and 2006 (for the low demand case). The 45 MW HPP Boskov Most is required between 2004 and 2008.

A minimum of 1220 MW of additional capacity is required by 2020 beyond the development of HPP Koziak, HPP Matka 1, and HPP Matka 2. This capacity comes from a combination of natural gas combined cycle power plants and nuclear power plants. Once again, the specific mix of fuel types depends on how the energy resource is used in Macedonia to meet the assumed growth in electricity consumption. For example, about 600 MW of additional capacity are needed between 2013 and 2015. This can be provided by one 600 MW nuclear plant or two 270 MW combined cycle natural gas power plants. A decision must be made within the next few years since the nuclear power plant must be on-line between 2013 (high demand) and 2015 (low demand). However, if natural gas plants are chosen, a second gas pipeline must be built and in operation by 2014 (high demand) or 2019 (low demand).

14.0 BOSNIA

The Special Envoy to Bosnia for President Clinton inquired about the possibility of providing assistance to rehabilitate the Kakanj power plant in Central Bosnia. Between December 9-10, 1995, USAID and the US Trade and Development Agency (TDA) sent a project definition mission to Bosnia. Electrotek was a part of that mission specifically to assess the Kakanj power plant rehabilitation. Electrotek visited the power plant and a nearby coal mine and wrote a trip report summarizing findings.

14.1 REHABILITATION OF THE KAKANJ POWER PLANT

The Situation

The Kakanj plant has four units of 32 MW each, 2 each placed in service in 1956 and 1960; 2 units of 110 MW each, placed in service in 1969 and 1977; and one unit of 230 MW, placed in service in 1988. Two of the 32 MW units are in operating condition and 2 are being repaired. One of the 110 MW units is operating, and the other is disassembled and in need of technical assistance to complete the overhaul and reassembly. The 230 MW unit was partially mothballed early in the war, but is in need of technical assistance for recommissioning. One of the 32 MW units or 110 MW units must be in operation to supply the Kakanj district heating requirement of 30 MW of steam. The lack of fuel delivered to the plant is currently the limiting factor in the plant output.

The two major power plants supplying the Muslim territory of Bosnia are Kakanj and Tuzla. In order for the system to be operated in a stable fashion, the power plants must be connected by lines of sufficient capacity to maintain system stability during transient events. The transmission network must also be adequate to get the energy from the power plants to the load centers. The same is true for the distribution system, which must provide service from the substations to the customers. Transmission system limitations are the next most limiting factor in constraining plant output, after fuel supply.

Zenica and Tuzla were said to be the two dirtiest cities (suffering from air pollution) in pre-war Bosnia. At the Kakanj plant, only the 230 MW unit has any environmental control - an electrostatic precipitator. The ash content of the fuel is 40%, and sometimes reaches 50%. Apparently, there has been no serious erosion problem with ash storage yet. Typical ranges for sulfur content for brown coal deposits in Bosnia are .6-3.1%. Given the age of all but the 230 MW unit, it is difficult to justify the expense of retrofitting any sulfur removal equipment. The coal washing plant is inoperable.

Requirements for Rehabilitation

Given the age of most of the equipment at the Kakanj plant (excepting the 230 MW unit), it would be difficult to justify investment on other than humanitarian grounds. No donor country or program has taken an interest in the critical link in the restoration of a reliable level of electric service in Bosnia, as well as the only source of heat and hot water for the city of Kakanj, i.e., the Kakanj thermal power plant. It was undamaged by the war, and

has suffered mainly from a lack of maintenance and spare parts. The WB estimated the emergency rehabilitation requirements of the Kakanj power plant at $23 million for the four 32 MW units and the two 110 MW units. It also estimated that the adjacent Vrtliste surface brown coal mine required $10 million of emergency assistance in the first year to restore production to about 0.5 million tons/yr.

The WB recommends that coal production be restored to minimum acceptable levels at the lowest cost mines, one of which is the Vrtliste mine. The others specifically mentioned are the Banovici surface brown coal mine and the Dubrave surface lignite mine, both part of the Tuzla Coal Mines company, which fuels the Tuzla power plant. Most of the remaining 28 mines are uneconomical and should be shut down. Technical assistance and training will be required for any program of assistance to the coal mine or power plant.

15.0 SOUTHEAST EUROPE COOPERATION INITIATIVE (SECI) SUPPORT

The SECI program was initiated on December 6, 1996 by the U.S. Department of State and the European Union to encourage cooperative programs among the participating states, i.e., Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, the Former Yugoslav Republic of Macedonia, Moldova, Romania, Slovenia, and Turkey. Under USAID funding, four energy efficiency pilot projects were selected and designed in Hungary and Romania based on their ability to be replicated throughout the SECI region. The projects can be financed through loans on commercial terms. The projects are designed so that the annual debt service is equal to or less than the annual value of energy cost savings that flows from the project.

15.1 BUSINESS PLAN – ENERGY EFFICIENCY PROJECT IN PECS, HUNGARY

The Project Team selected the Pécs Education Center for the first project site from 10 sites proposed by the Municipality of Pecs. The Pécs Education Center is comprised of 11 buildings: three schools, the main building, a sports center, a restaurant, a hostel, and three kindergartens (two of which have been semi-converted to schools). EXERG, Electrotek Concepts' Hungarian subcontractor, conducted an energy audit of the entire Education Center and worked with the Municipality to determine the proposed energy conservation measures. The table below summarizes the measures chosen for each of the buildings of the Education Center.

Results of the Energy Audit: Proposed Energy Conservation Measures

Building	Proposed Energy Conservation Measures
Heat Center (Substation in Central Building)	Complete Retrofit of the Center
Schools including Kindergartens	Fan Coil Control, Thermostatic Radiator Valves (TRVs), Weatherstripping, Reduction in Number of Windows Tariff Adjustment, Installation of Heating Controls, Weatherstripping
Central Building	Heating & Ventilation System Controls, TRVs, Weatherstripping
Hostel	Heating Controls, TRVs, Weatherstripping, Insulation
Restaurant	Insulation, Switching Off of Heat Exchanger, Heat Reflectors
Sport Center	HVAC Control

The proposed project will result in lower energy usage and costs and improved comfort levels in the facilities. The energy audit showed that the project should save 848,504

MWh/year, 5,837,069 GJ/year, and reduce operations and maintenance (O&M) costs. The total value of savings is approximately 9,026,000 HUF, or $US 42,000.

Summary of Financial Analysis: The project financial economics are very strong. The base scenario, with bank financing at market interest rates and without VAT, has NPV of 54,333 million HUF, an IRR of 46.65%, and a payback period of 2.56 years. The table below shows the results of five different financing schemes.

Responsibilities and Benefits During First Six Years of Project Life

Scenario	Responsibility for Project Implementation	Responsibility and Risk for Project Financing	Recipient of Savings	Interest Rate	Municipality's Net Cummulative Cash Flow (HUF in Thousands)	ESCO's Cummulative Cost & Profit (HUF in Thousands)
1	Municipality	Municipality	Municipality	20.5%	31,151	0
2	Municipality	Municipality	Municipality	8.1%	39,412	0
3	ESCO	Municipality with ESCO guarantee	Municipality, ESCO	20.5%	11,820	19,466
4	ESCO	ESCO, Municipality	Municipality, ESCO	20.5%	7,031	22,205
5	ESCO	ESCO	ESCO	20.5%	0	29,236

Note: Municipal net commutative earnings = Commutative Municipal earnings - Municipal cash (equity) at the beginning of the project

Sensitivity and Risk Analysis: The sensitivity analysis examined four different scenarios: (1) capital cost overruns, (2) operating failure or mismanagement leading to a decrease in realized savings, (3) a delay in the adjustment of energy tariffs, and (4) a worst case scenario, in which all three of the above problems occur at once. The analysis found that the project financials are very robust – the project maintains a positive net present value and an acceptable IRR even in the worst case scenario. The most serious risks are the operating risk and completion risk. If the Municipality implements the project without an ESCO, it has to be able to both install the new equipment and control its operation. The other significant risk is the risk that the project is not completed on-time. This is particularly of concern given the time needed to comply with Hungarian procurement procedures. To mitigate this risk, the Municipality must plan well in advance of the heating season and allow extra time for security.

15.2 DISTRICT HEATING SYSTEM AND BUILDING ENERGY EFFICIENCY IN CONSTANTA, ROMANIA

The objectives of the work plan for this activity were to:

- identify cost-effective, bankable energy saving measures for municipally-owned facilities in Constanta, and
- prepare engineering and financial pre-feasibility studies for the project.

Electrotek completed audits of 4 prototypical schools and the RADET district heating facilities, and analyzed these data using building simulation models and other types of software. The information for the financial analysis was obtained from several potential financing sources, including: EBRD, IFC, and Honeywell. Electrotek examined energy savings opportunities in the city of Constanta at district heating substations and schools controlled by the Constanta municipal government that are representative of the 134 substations and 123 schools in Constanta. Other facilities, such as hospitals, were excluded from consideration due to ownership and institutional constraints.

Heat Substations: In order to provide the greatest impact on energy efficiency at the most reasonable cost, Electrotek recommends a complete substation retrofit – replacing all heat exchangers, piping, and valves between the primary and secondary connections, and installing heat metering and controls. A complete retrofit of all substations would require an investment of US $12.6 million and save US $2.4 million per year in efficiency gains.

Schools: Schools were segregated into four representative groups - high schools (with and without dormitories), general schools, and kindergartens. Eleven energy conservation opportunities (ECOs) were evaluated: roof insulation, floor insulation, external wall insulation, window replacement, replacement of boilers in schools not connected to the RADET system, weatherstripping, insulation of heating pipes, building level controls, thermostatic radiator valves (TRVs) and system balancing, low flow showerheads and aerators, and heat meters. The proposed school improvements in aggregate have a cost of US $1.8 million with annual savings of US $274,000. The most viable ECO package combines weatherstripping; building level controls; TRVs and system balancing; showerheads and aerators; heat meters; and replacement of local boilers. The first four of the eleven ECOs have poor paybacks and are considered viable only as 'social investments' to improve comfort in the schools.

Project Sponsor: Electrotek evaluated three potential project sponsors: the municipality of Constanta, the Constanta district heating company (RADET), and a newly defined private entity. Based on this evaluation, Electrotek recommends that either the municipality or a third-party entity be considered as the project sponsor rather than the district heating company, which has financial and institutional constraints.

Institutional Issues and Implications for Project Design: There are two key barriers that will inhibit the development of this project, namely highly subsidized residential heat tariffs and problems with late payment of heating bills. While these barriers will need to be overcome, they will be significantly easier to address due to recent institutional changes that have given the municipality control over heating subsidies and responsibility for setting prices.

Heating Costs, Prices and Subsidies: The average cost of heat supply (to the distribution system) was estimated by CONEL at US$ 18.00 per Gcal. Tariffs for heat substations and schools were expected to be US$ 11.85 to US$ 20.56 per Gcal. respectively from July 1, 1999. While the project is viable at these tariffs, there is clearly a need for substantial overhaul of the system of subsidies and cross subsidies, which may involve institutions (e.g., CONEL) that are not principal project beneficiaries.

Possible Financing Approaches: Electrotek developed four financing schemes with the intention of providing adequate security for commercial lenders. Under the first two schemes, the municipality of Constanta is assumed to be the borrower. Both schemes employ a special escrow account to capture the payments needed for the loan. In one scheme, heat payments from RADET's best-paying customers are deposited into the escrow account (up to the amount of the loan payment). In the other scheme, the municipality relies entirely on revenues formerly earmarked toward subsidies to meet the loan payment. The second two schemes assume an escrow account is established by RADET to collect the loan payments and a new business entity owns and/or manages the project. Under the first, payments from RADET's best paying customers are deposited into the escrow account for debt service. The second scheme is slightly different in that RADET does not establish an escrow account. Instead, RADET and the municipality provide money directly to the new entity to pay the loan.

Sensitivity and Risk Analysis: Sensitivity scenarios analyzed increased capital cost overruns (5% technical and 5% price contingencies), decreased energy savings (10% reduction), delays in adjusting tariffs to exchange rate and inflation movements, and combinations of all these scenarios. In all cases, Electrotek found that project financials were not substantially affected by the risks that were modeled. Electrotek evaluated six types of risks that could threaten the viability of the project (Sponsor Risk, Completion Risk, Technology Risk, Operating Risk, Insufficient Payment Risk, and Contract Enforceability Risk). Electrotek found conditions to be favorable in most cases for managing this risk.

15.3 DISTRICT HEATING SUBSTATION ANALYSIS – CONSTANTA, ROMANIA

As a follow-on to the previous project ("District Heating System and Building Energy Efficiency in Constanta"), Electrotek was requested by USAID to further develop the pre-feasibility study into a bankable project, focusing only on the district heating system (work plan). This study considered technical measures and feasible packages taking into account improvements completed by RADET Constantza since June 1999. Specifically the objectives of this activity, detailed in a final report, were:

- Review and assess the efforts to date by RADET to increase energy efficiency of heating substations in Constanza and formulate new options,
- Assess the district heating distribution network in Constanza; make recommendations regarding re-habilitation of specific zones throughout the city,

- Review RADET plans to use natural gas-fired boilers in selected substations and develop cost estimates for installation at the substations.

CONEL's Facilities: CHP PALAS and The Primary Network: The CHP PALAS, owned and operated by CONEL, was assessed for (1) its thermal capacity and capability to deliver sufficient heating capacity to the substations and the end users, (2) the condition of equipment, and (3) its hydraulic performance and efficiency. The analysis shows that there is sufficient transporting capacity, and after a relatively small investment in circulating pumps and system balancing by CONEL, all substations will be supplied with heating water at sufficient pressure, temperature and flow quantity to meet end-user demands. Primary metering installed by CONEL needs to be calibrated and properly maintained.

Substations: RADET operates 134 substations in Constantza. During 1998-1999, RADET made a substantial investment in the substations by installing new plate type heat exchangers and replacing some internal piping. Electrotek recommends continuing the upgrade with re-piping and installation of needed equipment and controls. Proposed measures cost US$ 10.4 million and provide annual savings of US$ 3,0 million, which is a 3.5-year simple payback.

Secondary Pipes: The condition of secondary piping is not satisfactory. However the high cost of installation of underground piping and the length of the network (233 km of channels with four pipes) is a substantial investment for total replacement or upgrading. While replacement of secondary pipes has a very poor payback, it is crucial for operation of the district heating system and should be considered as a 'necessary cost'. The investment for gradual replacement of pipes in critical locations is estimated at US$ $7.19 million.

School Buildings: The municipality of Constantza owns and operates 123 schools. The most cost effective energy conservation package combines weatherstripping; building level controls; thermostatic radiator valves (TRVs) and system balancing; showerheads and aerators; and heat meters. The proposed school improvements in aggregate have a cost of US$ 1.8 million with annual savings of US$ 242 thousand, which is a 7.3 year payback. However, it is important to note that investments in the schools also include improvements of comfort and quality of indoor environment in the schools and should be considered.

RADET's Gas Boilers: In 1999 two substations (No. 37 and 47) were upgraded by installing independent natural gas-fired boilers. Installation of gas boilers at other substations is not warranted. The difference between the cost of heat purchased by RADET (the heat distribution company) from the primary system and the cost of heat produced in small gas boiler houses is marginal and cannot be used as a basis for an investment decision. Finally, the operational efficiency of recently installed gas-fired boilers in substations PT 37 and PT 47 would be enhanced by installation of a proper control and regulation system. The table below summarizes the results for the proposed project. Based on the size of the project and on the seasonal nature of the work, a three-year project implementation period is proposed.

Project Summary

	Total Investment				Annual Savings				Simple
	Material (US$)	Labor (US$)	Design (US$)	Total (US$)	Heat (Gcal)	Electricity (kWh)	Water (m^3)	(US$)	Payback (Years)
Substations	$8,127,550	$1,991,250	$319,469	$10,438,269	257,582	3,835,866		$3,000,077	3.5
Secondary pipes	$2,732,561	$4,242,661	$215,729	$7,190,950	13,466		96,732	$168,005	42.8
Municipal Buildings	$1,265,420	$497,003	$0	$1,762,423	14,477			$242,534	7.3
Completion of GB 37&47	$45,100	$10,100	$0	$55,200	2,897			$31,789	1.7
Total	**$9,585,776**	**$2,727,686**	**$535,197**	**$19,446,842**	**288,422**	**3,835,866**	**96,732**	**3,442,405**	**5.6**

15.4 DISTRICT HEATING SYSTEM (CONEL) ANALYSIS AND UPGRADE IN ORADEA, ROMANIA

The scope of the assessment of the Oradea central heating system is detailed in the work plan and results are summarized in the final report. The system is divided into four principal sections along ownership lines:

1. *Central heating plants (CHP1 and CHP2), and the primary distribution network* - owned and operated by Termoelectrica, S.A.;
2. *143 substations, the secondary piping network, and municipal buildings* - owned and operated by APATERM, the heat distribution company. [An alternative system using small distributed boilers at substations was assessed as a "primary side" alternative with respect to the technical division of equipment, but if implemented, it would be owned by APATERM];
3. *54 substations and secondary network* - owned and operated by "others". [For those substations, the required investment was assessed without addressing the economic impact on the owners. Reduction of the capacity demand on the primary side was included in the analysis]; and
4. *Geothermal resource* – use was assumed in all supply side alternatives.

The objective was to determine the least cost alternative to upgrade the heat supply system. The assessment also considered the effect and cost-benefit of energy savings from implementation of energy conservation measures in municipally-owned buildings.

Substations and the Secondary Distribution Network: The original substation equipment and design is obsolete, at the end of its useful life and not capable of much longer system operation. During 1998 and 1999, about 60% of the substations were equipped with modern, compact plate heat exchangers, but other parts are in very poor condition. It is most economical to replace the substation equipment, including the recently installed compact heat exchangers in all substations by factory pre-assembled, modular substations. APATERM needs to upgrade substations and the secondary network pipes, and perform hydraulic balancing of the secondary network loops at the user side. It is not cost-effective to replace the entire network. Therefore, replacement of only the oldest pipes (installed between 1965-1970) was considered in this assessment. The table below summarizes the total savings and investment.

Table 1: Total Investment and Savings – APATERM Project

Item	Material Cost (US$)	Domestic labor Cost (US$)	Foreign Labor Cost (US$)	Design Cost (US$)	Total Investment (US$)	Total Savinga (US$)	Simple** Payback (years)
Substations	$12,424,500	$606,300	$107,200	$124,200	$13,262,200	$4,512,312	3.3
Hydraulic Balancing*	$919,100	$620,400		$93,100	$1,632,600		
Secondary network	$5,377,124	$733,807		$110,071	$6,221,002	$138,354	45.0
Total	$18,720,724	$1,960,507	$107,200	$327,371	$21,115,802	$4,650,666	4.5

* savings included in substations

** assumes that investment and savings are realized by one entity

Municipal Buildings: Combinations of ECMs were evaluated by computer simulation of heat supply and losses in municipally-owned schools in Oradea. Two combinations proved to be the most cost-effective for acceptable simple payback in a combined project with other demand side upgrades for substations and the secondary distribution network:

- *Window weatherization, building level heat control, thermostatic radiator valves, and hydraulic balancing of the system* yield a project simple payback of 2.7 years for high schools ($239,000 USD investment), 2.7 years for technical schools ($132,000 USD investment) and 3.4 years for kindergartens ($88,000 USD investment).
- *Window weatherization, building level heat control, thermostatic radiator valves, hydraulic balancing of the system, and shower heads and flow restrictors* yield a project simple payback of 2.1 years for high schools ($242,000 USD investment), 2.1 years for technical schools ($134,000 USD investment) and 3.4 years for kindergartens ($89,500 USD investment).

Supply Side Assessment

The current heat supply and distribution system suffers from age, years of insufficient maintenance caused by a lack of funds, substantially oversized installed capacity, and insufficient operational control equipment. Four supply side alternatives were selected (1) Decentralized Natural Gas, (2) Retrofit to Burn Black Coal in CHP 1, (3) Centralized MultiFuel Systém in CHP 1, and (4) DeSulfurization of CHP2. Required investment for each alternative is given below.

Required Investment for Supply Side Alternatives

Value of Investments/Year	Unit	2001	2002	2003	2004	TOTAL
Alternative (1)	Mill. USD	6.0	37.0	17.1	14.1	**74.2**
Alternative (2)	Mill. USD	6.6	28.2	5.2	11.7	**51.7**
Alternative (3)	Mill. USD	4.7	21.0	12.9	42.4	**81.0**
Alternative (4)	Mill. USD	10.6	23.5	25.3	25.4	**84.8**

Recommendations

Demand Side

- *Electrotek recommends a three-year project to improve substations and replace a selected length of the secondary distribution pipes.* The energy efficiency investment will (1) have a positive impact on the price of heat delivered, (2) reduce the total annual cost of heat for the average consumer, and (3) improve the profit/loss statement of APATERM.
- *APATERM should continue to purchase hot water for area heating and domestic hot water from Termoelectrica* rather than installing individual natural gas boilers at substations.
- *A combination of energy conservation measures is the most cost-effective solution for energy savings in buildings.* The municipality should invest in energy conservation measures in schools, i.e., window weatherization, building level heat control, thermostatic radiator valves, hydraulic balancing of the system, and shower heads and flow restrictors.

- *Energy saving projects in schools should be a part of an overall demand-side energy efficiency improvement program in the municipality.* Carefully designed projects yield a simple payback of 2.1 years for high schools ($242,000 USD investment), 2.1 years for technical schools ($134,000 USD investment) and 3.4 years for kindergartens ($89,500 USD investment).
- *Street lighting improvements should be considered as part of any demand-side energy efficiency project.* While replacement of street lighting fixtures and lamps was not assessed in this effort, experience in Bulgaria and elsewhere in Eastern Europe demonstrates the cost-effectiveness of such projects.

Supply Side

- *The most cost-effective investment for Termoelectrica is to upgrade to burn black coal*, i.e., reconstruction of CHP1 to burn low sulfur black coal.
- *While the hot water would be supplied more economically if Termoelectrica pursues the black coal alternative, there is no urgent physical need to do so.* Failure to make these improvements on the supply side does not jeopardize the viability of APATERM'S energy savings under the recommended energy efficiency improvements at the substations and in the secondary distribution network.

15.5 DISTRICT HEATING SYSTEM (EDILMED) ANALYSIS AND UPGRADE IN MEDGIDIA, ROMANIA

Electrotek's activities for this project are outlined in the approved work plan. Electrotek met with municipal governments and management of district heating companies (DHC) in 17 Romanian cities to identify projects which would 1) generate sufficient cash flow to return investment in commercial terms, and 2) be secured and affordable within the annual budgets of the municipalities and the DHC.

The city of Medgidia was chosen as the first project for implementation. The goal was to improve the overall operational efficiency and the heat supply capacity of the Medgidia district heating system (generation and primary and secondary distribution networks) so that acceptable heat comfort levels and sufficient domestic hot water supply are realized and affordable to all consumers. Technical measures include rehabilitation of four boilers with district heating networks and fuel switching to natural gas. The analysis, summarized in the final report, showed that the proposed project, which costs US$ 1 million, has very strong economics including a payback period of 1.8 years. The project is robust and very attractive for commercial financing. Project benefits are significant and will lead to more cost-effective heat supply, greater comfort in residential buildings, a more modern municipal infrastructure and the opportunity to fund expansion of social programs without an increase in the municipal budget.

The Medgidia municipality approved a two-phased approach for project implementation:
Phase 1 – establish conditions for full cost recovery in heat generation and distribution throughout the entire district heating system without overcharging customers.
Phase 2 – provide all consumers with sufficient, affordable heat and DHW at near Western standards.

The Medgidia municipal government and EDILMED selected 4 boiler houses and their distribution networks for initial upgrade. Energy efficient measures include:

Generation side (in each boiler house):

- Replacement of the least efficient boilers with one or two smaller, high efficiency gas-fired boilers;
- Connection of the four boiler houses to the natural gas pipeline;
- Installation of chemical water treatment in each boiler house;
- Installation of a plate heat exchanger separating the primary loop in the boiler house with the primary space-heating distribution loop.

Distribution network:

- Replacement of the oversized 3-pipe networks with two-pipe systems using smaller, pre-insulated pipes for space heating only;
- Removal of the domestic hot water pipes.

Demand side:

- Flushing of each buildings' heat extraction systems (the municipal government suggested that EDILMED would complete this upgrade under a contract with individual building owners associations)[4];
- Installation of a simple metering and control system in each building (a more comprehensive system will be installed after achievement of full cost recovery of heat generation and distribution at a level that matches the required demand);
- Implementation of simple energy conservation measures (basic weatherization) for two kindergartens connected to distribution network #4[5].

The implementation of the initial 4 networks should be completed during the 2002 and 2003 non-heating seasons since a) it is more affordable for the municipal budget, and b) with the networks and internal building systems upgraded first, boiler capacity can be sized to meet the real demand. The accrued savings from the initial upgrade of the four networks should be sufficient to service the loan and allow for upgrading the entire municipal heating system in a few years. With the increase in overall system efficiency, it might be possible to finance Phase 2 without additional external financing.

Under the base case, the total project cost is US$ 1,030,977 without value added taxes (VAT). The estimated debt-to-equity ratio is 78:22. Considering the possible interest of the World Bank/GEF Fund and the potential for vender capital investment, a number of financial schemes with five-year maturity are possible. The most significant benefit is that revenue that will be generated by the project after the loan repayment. The municipality can use this revenue to fund a number of social needs.

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[4] Building owners associations should also be encouraged to complete basic weatherization and energy efficiency measures for their buildings, e.g. caulk windows and doors, insulate ceilings and walls where possible, install low flow water fixtures, etc.

[5] As additional heat distribution networks are upgraded, simple energy conservation measures should be implemented in all municipal buildings connected to them.

16.0 CONCLUSIONS

The reform of energy systems throughout Central and Eastern Europe, including the Baltic countries and those in southeast Europe, is critical to the economic restructuring and environmental improvement underway throughout the region. The economies of these countries are characterized by high-energy intensities and inefficiencies that are two to three times higher per unit output than west European countries. Despite the decline in energy use since the beginning of the reform process, significant inefficiencies remain and are even greater in many cases with industrial operations operating below capacity. Introduction of new institutional arrangements to attack energy inefficiency are at an early stage. Private energy service companies are a new concept; the active promotion of energy efficiency by utilities is novel; and the role of non-governmental and private voluntary organizations in energy is limited.

Economic and energy sector reform has had a profound impact on households throughout the region. While economically sound and fostering energy efficiency, energy price reform impacts households directly, particularly those of lower and moderate incomes. Electricity and heating costs are significant; electricity prices are generally increasing and heat tariffs need to increase to achieve sustainable systems and rehabilitation to improve efficiency and environmental performance. Programs designed to improve the efficiency of energy use by households can be an important element of the social safety net needed for the transition to democracy and a market economy.

The work completed in this project from March 1995 through September 2001 contributed to the improvements in energy systems efficiency in many areas, but most importantly in three key areas:

1. Economic restructuring and privatization that introduced competition, improved management and technology;
2. Continued progress on policy reform, particularly energy pricing; and
3. Aggressive market-oriented energy efficiency initiatives

Economic restructuring and privatization that introduced competition, improved management and technology - for example:

- in Poland, very real results in energy efficiency and industrial process improvement were realized for projects at the FdG wire manufacturing plant (Association of Energy Engineer's 2000 Environmental Project of the Year Award) and the ZEW carbon electrode manufacturing plant.
- in Latvia, improvements were made at the Riga Dairy and the Riga Gaze Company that reduced energy cost and thereby improved competitiveness of the companies
- in Poland, Czech Republic, Slovakia and Hungary, the CENTREL utilities adopted transmission pricing procedures and policies to promote the development of a regional power and energy market, and integration into the European Union.
- in the Balkan region, a modern teleinformation system among national dispatch centers was designed and bankable projects were developed to facilitate

compliance with UCTE and EU directives and to support the future growth of a regional electricity market.

- in Poland, two utility companies implemented load forecasting programs, distribution system load flow models, and investment planning models.
- in Romania, three district heating supply and distribution systems were evaluated to identify ways to reduce the cost of delivered heat and improve the profit/loss statements of the utility companies.
- in Lithuania, technical assistance helped the Lietuvos Energija utility to establish and operate a customer service center, implement DSM programs, and establish a customer telephone center to provide information on energy efficiency and tariffs.
- in Slovakia, an energy efficiency demonstration project at a privately owned apartment building helped residents reduce consumption and control their energy costs in the face of rising heat prices.

Continued progress on policy reform, particularly energy pricing - for example:

- in Slovakia and Macedonia, energy sector analyses were completed that identified development concepts and policies to strengthen the economic sector while supporting compliance with European Union accession guidelines.
- in the Baltic region, the capability for regional power system operations was established and initiatives were coordinated through the Baltic Council of Ministers to establish a Common Baltic Electricity Market.
- in Bulgaria, four municipal energy efficiency projects were completed at schools and hospitals, that demonstrated the importance of energy planning at the local level.
- In Romania, the district heating systems of Constanta and Oradea were studied to identify technical measures for least-cost heat delivery and to structure financial packages that overcame barriers such as subsidized heat tariffs and late payment of heating bills.

Aggressive market-oriented energy efficiency initiatives - for example:

- in Poland, business support organizations (BSOs) were established to support small and medium enterprises in implementing modern, commercially-oriented business management concepts.
- in Hungary, energy service companies and financial institutions were educated and trained to support legal/contractual and financial analysis needed to stimulate implementation of energy efficiency projects.
- in Poland, five energy efficiency projects were implemented by working through small energy service companies (ESCos) for thermal renovation of schools and residences and for improved street lighting.
- in Latvia, a Customer Service/Energy Efficiency Center was started at Latvijas Gaze and demand side management (DSM) projects showed end-users how to make their energy costs more affordable.
- in Latvia, a Customer Service/Energy Efficiency Center was started, a demand side management (DSM) plan and demonstrations were completed, and a time-of-use rate program was implemented at Latvenergo.

In the final analysis, the activities completed under this project supported the very significant concerns of the United States in efforts to promote a smooth and successful transition to democratic governance and market-based economies in Central and Eastern Europe and the Baltic States.