

Energy Efficiency Centers in Six Countries: A Review

November 1999



**Advanced
International
Studies
Unit**

Pacific Northwest National Laboratory

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November 1999

Prepared for the
U.S. Environmental Protection Agency
and the U.S. Department of Energy under
Contract DE-AC06-76RLO 1830

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FOREWORD

The Advanced International Studies Unit continues to receive many requests for information about energy efficiency centers we helped to create in transition economies. These institutions are rare among foreign assistance programs because they are staffed fully by local experts and have remained operational after initial program funding expired. The centers support policy reform and business projects to introduce energy-efficient technologies that can help reduce greenhouse gas emissions.

This paper updates and expands upon *Energy Efficiency Centers: Experiences in the Transition Economies*. It covers recent activities by centers in the Czech Republic, China, Poland, and Russia, as well as activities in two newer ones located in Bulgaria and Ukraine. In addition, this paper concludes with a new section outlining the major types of activity each organization plans during the next three to five years.

Like its predecessor, this paper offers broad guidelines for the creation of new institutions and a menu of example activities that can be undertaken by existing non-governmental organizations (NGOs) who are considering options for promoting energy efficiency. We hope this paper meets these needs and provides a resource for countries working to introduce new energy technologies and build institutional capacity to help implement the Kyoto Protocol.

The authors would like to thank Paul Schwengels of the Environmental Protection Agency for funding the original research on which this paper is based, and Ron Bowes, Thom Sacco, John Millhone, and Brian Castelli of the U.S. Department of Energy for supporting this update. Schwengels and Bowes, along with Robert Ichord of the Agency for International Development, William Eichbaum of the World Wildlife Fund, and Rick Bradley of the Department of Energy were early and constant supporters of the institutions themselves. Without these five persons, the six centers described here would never have existed.

Thanks to Olga Chumachenko, Zoya Giurova, Alexander Kolesov, Vladimir Sochor, Mykola Raptun, and Shi Yingyi for providing valuable information to help update the original paper. And thanks to Elizabeth Arner, Lydia Popova, Meredydd Evans, Susan Legro, Jeff Logan, and Tom Secrest for their insightful comments to this paper.

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EXECUTIVE SUMMARY

The formerly planned economies still rank among the least energy-efficient in the world. Energy efficiency technologies offer transition economies a way to increase economic well-being while reducing environmental burdens caused by energy use, including greenhouse gas emissions. Technology transfer to these countries could thus help reduce the risk of global climatic change. This paper describes lessons drawn from one approach to technology transfer—the creation of centers staffed with local experts to promote the use of energy efficiency products, techniques, and services.

Each author has been involved in the creation and development of energy efficiency centers in the formerly planned economies. These centers have a solid track record of success. They have helped stimulate private-sector business volume in energy efficiency technology transfer valued up to 20 times the total start-up cost of the centers themselves.

More importantly, the centers engage in making energy efficiency business possible. Every firm with which we have discussed doing business in the formerly planned economies expresses concern about the lack of an energy efficiency business infrastructure. Western energy efficiency markets have evolved over decades, creating along the way the legal, regulatory, and financial infrastructure necessary to do business. This business, being decentralized and distributed in nature, requires much preparation to make it work. Energy efficiency technology transfer must include a significant element of market creation and market conditioning. Therefore, the formerly planned economies must reform prices, eliminate supply-side subsidies, privatize ownership of means of production, make customer finance available to large and small firms and households, reform utilities and give incentives to invest in demand-side management, and develop codes and standards for construction and energy-consuming equipment.

The centers have been key players in drafting basic energy efficiency laws in their nations. For example, the staff of the Russian Center for Energy Efficiency helped develop the first regional-level code for energy-efficient building construction. That standard was adopted by the Moscow government in August 1994. A stronger version was adopted in 1995, with a similar version adopted by a half-dozen other oblasts, with new ones added each year. The Czech Republic Center for Energy Efficiency helped guide the development of the Czech National Energy Policy and drafted the energy labeling and standards provisions of the Czech Energy Law. The Polish Foundation for Energy Efficiency drafted the region's first utility policy to allow utilities to profit from investing in energy efficiency equipment in their customers' facilities. This policy entered into force as part of the Polish Energy Law of 1997.

EnEffect, the Bulgarian Energy Efficiency Center, helped develop the first energy efficiency standards for household appliances in Bulgaria and participated in shaping the Bulgarian National Program for Energy Efficiency. The Beijing Energy Efficiency Center provided expertise in integrated resource planning (IRP) to the Shenzhen Utility Corporation and persuaded the city to divert investment slated for 600 MW of power plant capacity to demand-side management (DSM) instead. In addition, the Chinese Electric Power Law enacted in 1997 required that IRP and DSM must be considered in plans for new electric power

development. Likewise, the Ukrainian Agency for Energy Efficiency and Rational Energy Use helped develop Ukraine's Comprehensive Energy Conservation Program, and assisted in preparing the First National Communication to the Framework Convention on Climate Change.

These examples show that policy development and institutional capacity-building are key to technology transfer. And because policy development occurs within the context of national and local governments, it can proceed legitimately only under the leadership of in-country experts. The experts working at the energy efficiency centers described in this paper have demonstrated that they are well-positioned to provide the leadership necessary to condition markets to make technology transfer happen.

THE ENERGY EFFICIENCY CENTER CONCEPT

This paper reviews selected experiences by six institutions (listed below) created between 1990 and 1994 to help Poland, the Czech Republic, Russia, Bulgaria, China, and Ukraine save energy and improve economic development.

- C **The Polish Foundation for Energy Efficiency (FEWE)** - opened its doors in December 1990 and has offices in Warsaw, Katowice, and Krakow.
- C **The Czech Republic Center for Energy Efficiency (SEVEN)** - was also created in December 1990 and is headquartered in Prague with a branch office in Ceske Budejovice.
- C **The Russian Center for Energy Efficiency (CENEf)** - began operation in June 1992 from its base in Moscow.
- C **The Bulgarian Center for Energy Efficiency (EnEffect)** - opened in Sofia in November 1992.
- C **The Beijing Energy Efficiency Center (BECon)** - was established in Beijing in December 1993, in cooperation with the Energy Research Institute of the State Planning Commission of China.
- C **The Ukrainian Agency for Rational Energy Use and Ecology (ARENA-ECO)** - was created in Kyiv in July 1994.

The energy efficiency centers were designed to help introduce energy-efficient technologies in countries shifting from centrally-planned economies to more market-based approaches. In 1990, when the first center was created, the process of market reform had barely begun in any of these countries. The industry standard of energy-using technologies in these countries continues to lag behind that of the United States and western Europe.

Each center is a not-for-profit, non-governmental independent entity. The center creators planned to help forge partnerships between suppliers of modern energy-efficient equipment and services and in-country

partners. For these business efforts to succeed, the centers also had to encourage legal reform to develop incentives for energy conservation.

The center concept from the outset relied heavily on the value of local experts in partner countries. In many U.S. foreign assistance efforts, American personnel attend conferences abroad and return home with little follow-up. By contrast, the energy efficiency centers have anchored long-term substantive engagement between American experts and local energy specialists in the transition economies. This approach acknowledges and invests in existing human resources, engaging both public and private sectors in each country.

Today, nine years after the first center opened, the effort has yielded a massive body of collaborative research. In addition, new domestic laws and international agreements have been enacted to support energy efficiency. The six countries included in this report now face exciting possibilities for future energy efficiency progress that would not exist without the centers' past accomplishments.

The centers are responsible for managing their own projects to promote energy efficiency and international cooperation under the guidance of a board of directors, consisting of international experts and representatives of local government and non-governmental organizations. This paper explores four types of activities conducted by the centers to promote energy efficiency:

- C Market conditioning (policy reform):** to provide policy recommendations and model legislation for policy-makers to create incentives for energy conservation
- C Private-sector assistance:** to identify investment opportunities and possible partners for joint ventures in key energy technology and service areas, and to provide coordination and other support to western companies, including feasibility studies, market analyses, and information on doing business in these countries
- C Demonstration projects and training:** to build an infrastructure for energy conservation services by training experts in IRP and energy auditing and to demonstrate energy efficiency technologies
- C Public education and information:** to create and implement information programs on energy efficiency to help consumers and enterprises develop energy-efficient practices, and to promote broad societal awareness of the benefits of energy conservation.

Table 1 shows the centers' objectives and corresponding mechanisms for providing assistance to Eastern Europe, the Newly Independent States, and China.

Before reviewing the substantive work done by the centers, this paper explains how the centers have grown from new institutions fueled by foundation support and U.S. government start-up funds to fully self-sufficient organizations.

Table 1. Energy Efficiency Center Objectives and Corresponding Mechanisms for Providing Assistance

Energy Efficiency Assistance Objective	Program Assistance Mechanism
Support the transition of post-planned economies to democracy and market systems	Provide assistance in policy reform and market mechanisms, joint venture development, demonstration projects, and public information
Assist industry in expanding business opportunities for energy efficiency and renewable-energy technologies and services	Help companies develop ventures with local firms by conducting market assessments for given technologies and offering assistance in doing business in the region
Enhance economic recovery in the region by cutting energy-related capital and operating costs	Assist local governments in meeting energy and social needs through policy reform and technical project development
Promote East-West cooperation in science and technology, sharing experiences and gaining insight to the wealth of scientific expertise in these countries	Create information networks and databases on energy efficiency technologies, services, and potential projects and partners
Reduce the regional and global human and environmental health risks from energy-related air and water emissions	Implement practical energy technology and planning measures that reduce the negative environmental effects of energy production and use and simultaneously promote economic growth

THE SHIFT TO SELF-SUFFICIENCY

The centers are among the only U.S. foreign assistance programs to continue operating years after project funding ended. In other words, the centers' "core funding" from U.S. organizations has expired and they have reached their goal of becoming self-funding institutions.

The centers received start-up funding from the U.S. Environmental Protection Agency (EPA), the U.S. Department of Energy (DOE), the U.S. Agency for International Development (USAID), the World Wildlife Fund, the Charles Stewart Mott Foundation, and the John D. and Catherine T. MacArthur Foundation. Assistance in establishing the centers was provided by the Advanced International Studies Unit (AISU) of Pacific Northwest National Laboratory (PNNL). Independent evaluations of the centers' success have been positive from the beginning (see Box 1).

**BOX 1: INDEPENDENT EVALUATIONS OF THE
ENERGY EFFICIENCY CENTERS**

“A strong assistance program can be a major element in helping Central and Eastern Europe through their present difficulties. Energy efficiency assistance will be beneficial for both the United States and the recipients regardless of political developments. If Congress is willing to increase assistance, substantial increases in several elements of the current program would be effective. In particular, information programs such as the energy efficiency centers, technical demonstrations, and training could be expanded.”

- from *Energy Efficiency Technologies for Central and Eastern Europe*, U.S. Congress Office of Technology Assessment, 1993

“American demonstration projects and information programs (especially the efficiency centers) are a vital component of technology transfer in the energy sector.”

-from *Fueling Reform*, U.S. Congress Office of Technology Assessment, 1994

“[t]hese centers...have been instrumental in influencing energy and environment policies favorable to clean energy technologies, preparation and financing of major projects, and market-transformation activities.”

-from *Powerful Partnerships: The Federal Role in International Cooperation on Energy Innovation*, President’s Committee of Advisors on Science and Technology, September 1999

The centers have continued to thrive by undertaking projects for multilateral lending institutions, energy and environmental agencies from several countries, national and local government units in their home countries, and local businesses. FEWE, for example, receives approximately one-third of its funding from multilateral climate change institutions; one-third from a USAID project to improve energy efficiency in cities; and one-third from private industry, local governments, and utilities.

SEVEN receives about three-quarters of its funding from clients in the Czech Republic. This funding includes one-quarter from state institutions and environmental foundations, one-quarter from municipalities, and one-quarter from private companies, including electrical and gas utilities. SEVEN earns the rest of its funding through contracts with the European Union. SEVEN receives only a small percentage of its funding from projects sponsored by the U.S. government.

CENef earns one-half of its revenues from contracts with oblast and city governments. Remarkably, CENef receives regular payment under these contracts despite the Russian “nonpayment” crisis frequently cited in the Western media. CENef receives about one-sixth of its funding from DOE for projects related to the Russian-American Memorandum of Cooperation on Energy Efficiency. CENef receives another one-sixth from USAID to support a loan project for Russian district heating companies, and one-sixth directly from the World Bank for similar work.

EnEffect currently receives most of its funding from the Global Environmental Facility (GEF) for a major energy efficiency project in Bulgaria. EnEffect was the first Bulgarian non-governmental organization (NGO) selected by GEF as a project implementation unit. EnEffect also works on several projects financed by the European Union and USAID.

BECon receives one-half of its funding through projects for the Chinese government. About one-fourth of BECon’s funding comes under contract with the World Bank to implement a project to develop energy service companies (ESCOs) in China. The remaining one-fourth is earned through contracts with private companies, multilateral agencies, and private foundations, including W. Alton Jones and the Pew Charitable Trusts.

ARENA-ECO, the most recently created energy efficiency center, receives most of its funding from the U.S. government to support initiatives related to the Gore-Kuchma Commission. The United States has found ARENA-ECO a reliable and effective partner in efforts to identify energy-saving alternatives to help close the remaining Chornobyl reactors.

This experience shows that each center has successfully emerged as a self-sufficient institution. The authors attribute this success to the fact that in each country, the local experts defined their own energy efficiency priorities and designed the projects to address them. Local leadership has been the most significant element, allowing the centers to become viable enough to attract their own funding.

During the past nine years, the energy efficiency centers have achieved results beyond anything their creators and sponsors had expected—and expectations were high at the outset. This paper provides reviews the centers’ substantive efforts in four major areas—private-sector assistance, demonstration projects and training, and public information and training.

MARKET CONDITIONING

The centers have helped draft legislation, regulations, and related documents to assist local and national governments in creating the policy framework for energy efficiency. The Central and Eastern European countries began the transition to market economies heavily burdened by the inefficient use of all factors of production, including energy. The main challenges surrounding the introduction of energy-efficient technologies are to remove existing barriers and create market forces for competition related to cost-effectiveness. This effort requires that energy efficiency policy be integrated with a wide range of issues

regarding the restructuring of each country's national economy, including price reform and liberalization, and privatization. The centers have found that economic, energy, and environmental policies must be linked to foster the introduction of energy-efficient technologies.¹

Each center has supported proposals to integrate these policy areas, many of which have become law at both the local and national levels (see Box 2). FEWE helped draft Poland's Energy Law, which entered into force in 1997. This law provides for utility investments in energy efficiency. FEWE specialists also served on the steering committee that developed regulations for implementing this law. FEWE facilitated Poland's signing of the Framework Convention on Climate Change by providing the region's first greenhouse gas emissions inventory and the first comprehensive analysis of the cost-of-mitigation options. FEWE regularly participates in working groups organized by the Polish Ministry of Industry and Trade.

At the local level, FEWE has been active in developing financing mechanisms for energy efficiency. FEWE worked with representatives of Tychy municipality to develop a revolving-loan fund for energy efficiency projects in that city. FEWE is supporting similar efforts in Bielsko-Biała and Radom.

SEVEN has also supported government initiatives to improve energy efficiency. The Czech government named SEVEN the lead organization in developing the National Action Plan to Reduce Greenhouse Gas Emissions and Climate Change in the Czech Republic. This plan included an estimate of the impact of technologies in reducing climate change. SEVEN also provided comments to the proposed National Energy Policy of the Czech Government and a draft of the Czech Energy Law. SEVEN drafted the labeling and standards provisions of the Czech energy law at the request of the Czech Ministry of Industry and Trade, and prepared air quality regulations and a review of efforts for implementing energy conservation for the Czech Ministry of Environment. SEVEN improved prospects for financing efficiency projects by aiding the establishment of the PHARE Energy Saving Fund for Energy Efficiency Investments.

SEVEN has bolstered local efforts to improve efficiency by drafting energy plans for the cities of Prague, Plzen, Tabor, Bechyne, Mimon, Nymburk, Cesky Krumlov, and the Sumava area. Each plan was tailored to the needs of the specific locality and included methods for cutting costs by implementing energy efficiency projects. SEVEN also prepared a book entitled, *How to Develop Municipal Energy Projects*, to further assist cities on this front.

SEVEN drafted a proposal entitled, "Deregulation Model Proposal for the Czech Power Sector," and a companion action plan for implementation on behalf of the Czech Association of Power Distribution Companies.

CENEf staff have influenced legislation at both the national and local levels in Russia. The center prepared the first draft of the Russian Federal Law on Energy Conservation, which became law in 1996. In 1993 CENEf's draft became the first Russian energy legislation draft ever published publicly before it was considered by the government.

CENef staff helped draft several local bills that became law in recent years, including energy conservation laws in Chelyabinsk, Tula, Nizhnii Novgorod, and Sakhalin Oblasts. Efforts to pass similar laws are underway in the Kostroma, Ryazan, and Yaroslavl Oblasts--also with support from CENef. In addition, CENef regularly participates in working groups within the Russian Ministry of Fuel and Energy, the Security Council of the Russian Federation, the Ministry of Economy, and the Ministry of Finance.

Several years ago, EnEffect undertook the SACHA project, aimed at harmonizing Bulgarian energy standards for appliances to those in Europe and introducing energy efficiency labels. This first part of this project, which was completed, addressed household refrigerators and freezers. The second phase, which is now underway, concerns washing machines and lighting fixtures.

In 1998 EnEffect won a Global Environmental Facility (GEF) grant to begin a major energy efficiency effort funded at a level of US\$6.5 million, including US\$2.575 million in GEF funding. The Energy Efficiency Strategy to Mitigate Greenhouse Gas Emissions: Energy Efficiency Demonstration Zone in the City of Gabrovo program is broad in scope and will be addressed again in other sections of this paper. Regarding policy development, EnEffect has worked under the GEF project to support municipalities in developing their own energy efficiency offices as part of the Municipal Energy Efficiency Network. This network was established through the USAID-funded Municipal Energy Efficiency Initiative project and was further developed as one of the primary capacity-building efforts of the GEF project. Additional aspects of the GEF project are discussed below.

BECon helped develop China's Energy Conservation Law, approved by the Chinese National People's Congress in 1997. BECon also assisted provincial-level ministries in developing the regulations, standards, and monitoring and enforcement measures needed to implement the law.

BECon has also published a report on Cogeneration Policy and Market Conditions in China. This research discussed the current situation, including policy and market barriers to energy efficiency, and provided recommendations for future actions. This paper serves as a guide for making decisions on cogeneration projects in China.

ARENA-ECO began spearheading a major national policy effort soon after the center opened its doors. The Ministry of Environmental Protection and Nuclear Safety of Ukraine appointed ARENA-ECO to lead Ukraine's Country Study Team in 1994 under an agreement between the Government of Ukraine and the U.S. Country Studies Program. Recently, ARENA-ECO completed work on a draft national action plan for climate mitigation in Ukraine. The plan, which is being reviewed by Ukrainian government agencies, identifies priorities among climate change problems and methods for addressing them. The Country Study Team has completed four other projects—a greenhouse gas emissions inventory, an assessment of ecosystem vulnerability and adaptation analysis of mitigation measures, and public education efforts. The information gathered under the project is intended to aid international efforts to address climate change issues and to help Ukraine meet its commitments under the United Nations Framework Convention on Climate Change for preparing the First National Communication on Climate Change.

BOX 2: POLICY SUPPORT FOR MARKET CONDITIONING

Each of the energy efficiency centers has shaped the development of laws, regulations, and other policy instruments aimed at creating a legal and institutional context in which energy efficiency business can thrive.

FEWE

- C Drafted Eastern Europe's first utility demand-side management legislation in Poland
- C Facilitated Poland's signing of the Global Climate Convention
- C Helped develop a revolving-loan fund for efficiency projects in the city of Tychy

SEVEEn

- C Drafted the labeling and standards provisions of the Czech Energy Law
- C Led the development of the Czech Republic's climate change national action plan
- C Completed a Strategic Environmental Assessment of the proposed Czech Energy Policy
- C Developed provisions for the Czech National Program to Improve Air Quality

CENEf

- C Drafted the first version of the Russian Federal Law on Energy Conservation
- C Helped develop energy conservation laws in Chelyabinsk, Tula, Nizhnii Novgorod, and Sakhalin Oblasts
- C Participated in developing energy efficiency codes for buildings in Moscow, Yaroslavl, and Sakhalin Oblasts

EnEffect

- C Helped develop the first energy efficiency standards for household appliances in Bulgaria
- C Participated in developing the Bulgarian National Program for Energy Efficiency and assisted the governmental institutions responsible for developing and promoting the draft Energy and Energy Efficiency Act
- C Assisted municipalities in developing local energy efficiency policy plans

BECon

- C Helped develop and implement China's Energy Conservation Law and related regulations
- C Assisted Chinese government in developing and implementing China's Green Lights Program
- C Assisted the Chinese government in introducing and establishing energy management companies (EMCs) using GEF funds and World Bank loan proceeds
- C Worked with China's State Development Planning Commission to develop the "Tenth Five-Year Plan on Energy Conservation," the first plan to be based on market economic mechanisms

ARENA-ECO

- C Supported the development of Ukraine's "Comprehensive State Energy Conservation Program to 2010"

ARENA-ECO also helped formulate the Complex State Program for Energy Conservation in Ukraine, the legal document defining Ukraine's energy efficiency policy. This document was approved by decree of the Cabinet of Ministers in February 1997. The program established energy efficiency standards and state monitoring of energy conservation procedures, and created a state fund for energy conservation to invest in projects and programs, including loans to business entities.

ARENA-ECO participated in the preparation of a proposal and supporting documents required to create and operate UkrESCO, a Ukrainian energy service company, in the Ukrainian legal environment. The Ukrainian Parliament approved UkrESCO in May 1999.

Market Research

Before assisting legislative reform, the centers each conducted rigorous assessments of their national economies to pinpoint barriers to improving energy efficiency. This research has developed domestic capacities to monitor and assess the effectiveness of energy efficiency projects—and to better design such projects in the future. In the transition economies, the lack of these capacities has been a major barrier to the introduction of energy-efficient technologies. This section reviews some recent studies published by the centers and notes some major works from the early 1990s. In total, the centers have published over 200 reports and documents. More complete listings are offered on each center's Internet website (see Box 7).

In 1996 FEWE published a policy study entitled, *Poland's Alternative Energy Policy Until the Year 2020*. This policy study analyzes challenges in Poland's energy sector and recommends possible solutions, including privatization, the organization of a competitive energy market, third-party access to grid transmission, and proposals for establishing revolving-loan funds for energy efficiency projects. FEWE also released a report in 1998 evaluating investment opportunities involving coalbed methane. FEWE's earlier report entitled, *Energy Efficiency Investment Opportunities in Poland*, provides market research for 12 investment opportunities with internal rates of return as high as 300 percent (see Box 3). FEWE has also published English versions of its reports entitled, *Review of Energy & Environmental Policies in Poland*, *Performing Energy Audits*, *Case Study of Greenhouse Gas Emissions in Poland*, and a wide array of other articles and documents. FEWE staff wrote significant portions of Poland's climate change country study as well.

In 1998 SEVEN completed a proposal entitled, *Strategic Environmental Assessment of the Czech Energy Policy Proposal*. The energy policy proposal prepared by the Czech Ministry of Industry and Trade in 1997 was the first in the history of the Czech Republic to be assessed according to its future environmental impact. In accordance with Czech legislation requiring such analysis, the Ministry chose SEVEN to conduct an environmental assessment of the draft document. Three options were evaluated through the year 2010. Two options were based on the proposal as prepared by the Ministry, while the third option was based on input from the public. SEVEN also completed a document entitled, *A Strategy and Instruments to Reduce the Energy Intensity of the Czech Republic*, under contract to the Czech

Ministry of Environment. The report entitled, *Catalogue of Measures to Reduce the Continuing High Energy Demand of the Czech Republic's National Economy*, involved a detailed analysis of energy consumption and savings in buildings ranging from offices, health care facilities, schools, and protected cultural sites to residential buildings.

BOX 3: THE ENERGY EFFICIENCY MARKET IN POLAND

FEWE estimated the profitable, achievable potential for efficiency in Poland to be about 10 percent of 1991 demand, or over 0.4 exajoules. This estimate assumes 1992 energy prices and includes certain efficiency investments that were estimated to have greater than an 18 percent internal rate of return.

The most profitable technologies identified by FEWE include

- C Steam traps: IRR=> 335 percent**
- C Polish gas residential boilers: IRR=> 210 percent**
- C Low-pressure sodium street lighting: IRR=> 155 percent**
- C Industrial electric motors: IRR=> 55 percent**
- C Heat meters and controls: IRR=> 40 percent**
- C Compact fluorescent lights: IRR=> 18 percent**
- C Gas turbines for coalbed methane and biogas: IRR=> 18 percent**

Source: Polish Foundation for Energy Efficiency. 1993. *Evaluation of the Feasibility and Profitability of Implementing New Energy Conservation Technologies in Poland.*

SEVEN has also worked to promote energy efficiency improvements to household appliances. In 1997 SEVEN published a report entitled, *Energy Labels and Standards*, for the Czech Power Utility (CEZ). This report included a model concept for regulations guiding labeling for refrigerators, washers and dryers, and household hot water heaters. The Italian government sponsored a SEVEN report due out later in 1999 describing the Czech market for several household appliances. This report will include results of a survey of 1000 Czech households. Finally, the European Union's SAVE program sponsored an analysis of the present state of legislation and standardization for electrical appliances in European Union countries. This project, to be completed in 2000, will include draft legislation and implementation instruments for the Czech Republic and Poland.

A CENEf book entitled, *Regional Energy Efficiency Policies: From Problems to Solutions*, formed the basis for the oblast-level legislative efforts noted above. In 1997 CENEf developed two new reports under contract to the Russian Ministry of Fuel Energy to support federal energy efficiency initiatives. These

reports addressed energy efficiency management at the federal level and the Energy Efficiency in the Housing Sector project taking place as part of the Energy Efficiency in Russia: 1998-2005 program. These recent reports build from CENEF's earlier studies, including reports entitled, *Introduction and Promotion of Energy Efficiency in Russia* (1994) and *Russia: Investment Priorities in Energy Efficiency*.

To assist investors and other potential partners in understanding Bulgarian conditions, EnEffect published a report entitled, *Bulgaria in Words, Charts and Figures*. This report describes state institutions, the administrative structure and local self-government, Bulgaria's banking system, the legal framework for foreign investments, and statistical data about industry, the energy sector, and the environment. EnEffect has also produced studies on *The Investment Process in Bulgaria*, *Sources of Funding for Energy Efficiency Projects in Bulgaria*, and *Energy Reform in the Building Sector in Bulgaria* in conjunction with Electrotek Concepts, Inc.

In 1998 BECon and AISU completed a major study published in a paper entitled, "China's Electric Power Options: An Analysis of Economic and Environmental Costs." This paper assessed the current and future states of power generation technologies in China, forecasted regional electricity demand through 2020 and evaluated least-cost technologies for meeting this demand, and recommended policies for minimizing both economic and environmental costs. Some of BECon's other works are entitled, *Climate Change Mitigation: Case Studies from China*, *Energy Efficiency Opportunities in China: Industrial Equipment and Small Cogeneration*, *Market Survey on Energy Efficient Lights*, *Potential for Developing Energy Management Companies to Promote Energy Conservation under Market Economy in China*, and a market study analyzing ten key technologies used in Chinese industry.

ARENA-ECO's major publication analyzing Ukrainian energy and environmental issues is entitled, *Ukraine on the Way to Energy Efficiency*. ARENA-ECO further analyzed these issues in its publication entitled, *The Country Study on Climate Change in Ukraine*. The agency also published *Greenhouse Gas Emissions Inventory in Ukraine* and *Ukraine and the Global Greenhouse Effect*. ARENA-ECO staff have collaborated with AISU and DOE on a series of projects designed to help close the remaining Chernobyl reactors by reducing regional energy demands. The reports from this project are entitled, *Energy Efficiency Business Opportunities in Ukraine*, *Kiev Institutional Building Sector Energy Efficiency Program*, *Cogeneration and Energy Efficiency at Avdeevka*, *Pre-Feasibility Study on Energy Efficiency Upgrades to Compressor Stations of the Ukrainian Gas Transmission System*, *Pre-Feasibility Study on Energy Efficiency Upgrades to the Kharkiv District Heating System*, and *Energy Efficiency at Gostomel: Recommendations and Energy Audit Report for Gostomel Glass Plant*.

Several centers have researched the role renewable energy can play in preventing climate change. In 1999 SEVEN completed a study published in a report entitled, *Wind Power Utilization in the Czech Republic*, under contract to CEZ. This report reviews the economics of operating wind power plants in the Czech Republic under current conditions, barriers to developing wind power in the Czech Republic and how to remove them, and changes related to European Union (EU) accession.

FEWE analyzed wind energy's potential in Poland in the 1994 report entitled, *Poland: Analysis of Wind as an Energy Resource for Eastern Europe*. This report, published jointly by PNNL and FEWE, used both existing data and new research to evaluate the feasibility of using wind as an energy source. Promising wind locations in Poland were assessed using remote-sensing data and available records. FEWE staff gathered wind resource data, assessed the quality of the data, and developed policy recommendations.

Five of the centers have published bulletins providing reliable energy and economic data to potential investors, policy makers, and others involved in the energy efficiency arena. These bulletins gather hard-to-find information virtually unavailable under a single cover. They also help remedy the imbalance toward production-oriented data. CENEf developed the first bulletin entitled, *Russian Energy Picture*, in 1994. FEWE produced the bulletin entitled, *Energy Information Bulletin*, during the last quarter of 1994 and the first two quarters of 1995. BECon has since published *China Energy Bulletin*; SEVEn initiated the bulletin entitled, *Energy and Economic Bulletin for the Czech Republic*; and ARENA-ECO developed the bulletin entitled, *Economy and Energy Sector of Ukraine: Main Indicators*.

PRIVATE-SECTOR ASSISTANCE

The energy efficiency centers have worked with over 250 companies from their home countries and abroad. Through this cooperation, the private sector has overcome barriers to doing business and enjoyed successful ventures. The public has benefitted because technologies that benefit the environment and improve residential comfort have been more rapidly introduced.

As their initial core funding expired, the centers have relied increasingly on contracts with private businesses to fund operations. The success of these ongoing partnerships evinces the quality of and demand for the centers' activities. The centers have assisted a broad range of manufacturers or suppliers of controls, cement, electronic equipment, lighting, and insulation (see Table 2). Requests for assistance have grown steadily over the years, with multiple inquiries being received each week.

Table 2. Number of Technology Companies Assisted by Centers by Product Type

Type of Energy-Efficient Product	FEWE	SEVEn	CENEf	EnEffect	BECon	ARENA-ECO
General energy efficiency technologies	15	24	20	25	15	22
Insulation and energy-efficient construction materials	4	8	5	3	2	6
Cogeneration equipment	8	7	6	0	3	5
Renewable-energy technologies	8	16	2	0	3	4
Energy conservation services: DSM, IRP, and others	26	15	0	3	4	20

Coalbed methane technologies	28	5	3	0	0	2
Cement technologies	2	3	0	0	2	2

The technical level of industrial equipment in the former centrally planned economies lags behind the western world by decades. U.S. and other western firms offer many technologies and services needed there. However, barriers such as the lack of information and reliable contacts impede firms' ability to sell modern equipment or undertake joint ventures in the region. Recognizing these barriers, clients asked the centers to design projects to stimulate sales and joint ventures.

Through the centers, companies can analyze existing and potential new markets for their products, identify potential barriers and ways to overcome them, and access information on privatization, tax, property, and other laws that affect the company. Programs include the following:

- C Identifying informational needs for industry through interaction with firms and regional industrial experts.
- C Gathering information on financial and technical resources available to industry in the area of energy efficiency and conducting market surveys of the company's product.
- C Compiling and distributing information on energy efficiency prospects in the region to industry and preparing business plans and feasibility studies.
- C Working with energy efficiency experts and in-country authorities to develop innovative ways to finance energy efficiency investments.

Box 4 describes the typical five-step approach for handling a request from an energy technology or service company.

BOX 4: STEPS TO PROVIDING ASSISTANCE FOR PRIVATE FIRMS

- 1. A company contacts the energy efficiency center for information.**
- 2. A center representative responds with country background information and brochures.**
- 3. A company can contract directly with a center to initiate projects and conduct feasibility studies.**
- 4. The center conducts market analyses for company products and identifies options for projects and partners.**

Business Partnering

The energy efficiency centers work to facilitate business opportunities for domestic and foreign companies, which produce energy-efficient equipment, such as basic controls, thermostats, energy-efficient windows, insulation, adjustable-speed drive motors, steam traps, energy-efficient lighting, and a broad range of other technologies. Energy-efficient technologies not only offer the potential to reduce carbon emissions that can lead to global warming, but they also represent lucrative business opportunities (see Box 5). According to a report by FEWE, the profitable energy-savings potential in Poland is over US\$2 billion per year. Introducing these technologies thus offers an added potential benefit of economic growth. The estimated reduction in carbon dioxide emissions associated with implementing these technologies is 11 million tons, or about 10 percent annually at 1990 levels.²

BOX 5: ENERGY EFFICIENCY BUSINESS SUCCESS STORIES

ARENA-ECO assisted Honeywell Inc. in identifying and developing projects for Kharkiv Municipal District Heating Company and Zhidachiv Pulp and Paper Plant for implementing advanced control and optimization technologies.

BECon worked with the U.S. firm Armstrong to help establish the U.S.-Chinese joint venture Kangsen-Armstrong Company, Ltd. This joint venture was established by Armstrong and the Chinese Electronic and Machinery Ministry to produce high-efficiency steam traps in China. The plant, located in Beijing's Daxing High-Tech Industry District, began production in 1995. The plant's annual production capacity is 100,000 steam traps per year, and will likely be expanded.

CENef located a Russian partner, the enterprise "Kupol," for Vencon Management, Inc., a U.S. firm that distributes another U.S. company's "sorbent" technology used with coal-burning electricity plants or district heating hot water and steam facilities. The technology also helps mitigate sulfur dioxide emissions from industrial factories. Kupol and Vencon developed a joint venture.

EnEffect completed demonstration projects in the regional hospitals in Gabrovo and Stara Zagora. The Gabrovo project won the Association of Energy Engineers' 1998 International Energy Project of the Year Award for design and implementation.

FEWE located a Polish partner for LSR Technologies, a U.S. firm seeking to produce core separators in Poland. The value of contracts signed to establish this joint venture approached US\$2 million and the venture has already installed many units in Poland.

SEVEN helped establish the first ESCO in the Czech Republic, which signed contracts and installed energy-saving technology worth more than US\$12.5 million to date. This company's success has generated U.S. tax revenues worth twice the initial U.S. government investment in all six centers.

To make available information about the Polish market for energy-efficient technologies, FEWE has provided consultations to nearly 100 firms and institutions. These consultations include data collection, research, and business information. FEWE has also developed concepts for energy efficiency and fuel-switching for Joint Implementation projects under the Framework Convention on Climate Change. FEWE has supplemented its consulting activities by creating a for-profit energy services company that has insulated eight major apartment houses in Krakow. In addition, a FEWE feasibility study is facilitating financing for a geothermal power project.

SEVEN held its sixth Energy Efficiency Business Week in October 1998. The event attracted over 420 participants, including 38 exhibitors and 5,000 visitors to the exhibitions. The first Business Week workshop took place in 1992. SEVEN held subsequent workshops annually through 1996, when Business Week became a biennial event. The event provides U.S. and other companies an opportunity to display product information and meet with potential partners. In addition, SEVEN worked to promote the energy-efficient equipment market by developing energy efficiency labels for 10 refrigerator models. These labels are applied on models sold through Prague's largest department store, *Kotva*. SEVEN also helped one American firm obtain tens of millions of dollars worth of contracts for energy efficiency services.

CENef has also hosted six workshops on "Business Opportunities in Energy Efficiency." The first workshop had 87 participants. The second workshop had 120 participants, including representatives from 15 private firms. CENef has provided consulting services for 25 companies, four of which penetrated the Russian market due to their initial support from CENef.

Since May 1994, CENef organized 10 regional seminars and exhibitions in which 150 companies made presentations and exhibited their products to over 1,000 potential Russian clients in 10 Russian Oblasts. This approach has proven successful. At the seminar in Yaroslavl, two firms (Honeywell and Carrier) signed contracts for hundreds of thousands of dollars.

A current BECon project is helping several state-owned enterprises in China develop a market-based orientation. Three state-owned energy companies in Beijing Municipality, Liaoning Province, and Shandong Province are being transformed into private EMCs, through the cooperative efforts of the World Bank, the GEF, and the Chinese government. These new EMCs will operate similarly to Western ESCOs, providing up-front financing for energy efficiency measures in return for a percentage of the revenue earned from the resulting energy savings. With introductory financing provided by the World Bank, the GEF, and the European Union, BECon is now working with the EMCs on 30 ongoing energy efficiency projects.

ARENA-ECO has assisted U.S. firms, including Honeywell and Controlotron, in distributing their products in Ukraine. The center has also been a key player in a major industrial energy efficiency effort (discussed in the next section). This project could benefit several Ukrainian and foreign businesses participating in the project who will have an opportunity to demonstrate their products and continue attracting possible customers.

DEMONSTRATION PROJECTS AND TRAINING

Numerous studies published in the United States, Europe, and the transition countries have indicated that the cost-effective potential for introducing energy-efficient technologies in the transition economies is huge. The energy efficiency centers have participated in demonstration projects intended to prove this potential empirically in a controlled setting (see Box 6). Demonstrations of this kind are necessary to raise awareness of energy-efficient technologies in these markets, and to instill consumers with confidence that they really work. Unfortunately, demonstrations are usually the most expensive assistance projects sponsored by governments.

Demonstration Projects

FEWE managed a Global Environment Facility/International Finance Corporation project to promote sales of compact fluorescent lamps (CFLs) in Poland by recommending incentives for CFL producers, distributors, electric utilities, and residential consumers, and by leveraging grants. This effort included a media campaign using newspapers, radio, and television. Since this project began, sales of CFLs in Poland have increased by 1,700 percent. CFL prices have dropped dramatically in Poland as well. In 1996 CFLs were priced between US\$14 and \$21; today, they range between US\$5 and \$7. FEWE also developed a software program designed to help select the best electric motors for industrial plants.

In earlier years, FEWE participated in a demonstration of district heating energy efficiency potential in the historic city of Krakow. The project was designed by a government committee composed of Polish and American officials. FEWE collected baseline heating data for four identical multifamily residential buildings. A different scope of work was planned and executed for each building, ranging from controls only at the building level to thermostatic valve control and weatherization within each apartment. This project showed that the introduction of measures such as building-level or apartment-level controls and retrofits can yield cost-effective energy savings of 20 to 30 percent.³

The Krakow Demonstration Project has generated several follow-on activities. In the Pradnik Biały housing complex in Krakow, 15 blocks of apartment buildings were insulated on a commercial basis, using the same technology used in the demonstration project. Insulation was also installed in several individual buildings in the center of Krakow, around the hot-water pipes in the insulation factory in Bielsko-Biala, in a hospital complex in Pilka in central Poland, and in other buildings across Poland. FEWE is sharing the experience of the Krakow Project with other Polish cities, such as Katowice, Wadowice, Lublin, and Warsaw, to improve the heating master plans of cities by including demand-side improvement options in the residential sector. FEWE has also initiated and supported the establishment of the Polish Energy Cities program, which provides a network of energy efficiency and environmental information to Polish municipalities.

SEVEN participated in a smaller but similar demonstration project in the city of Plzen. This project also revealed a large potential for residential-sector energy efficiency: 27 percent of total building-sector space

and water heating energy consumption could be saved cost-effectively at mid-1994 fuel prices.⁴ Because the Czech government decided to raise prices for hot water and natural gas by an average of 10 percent in 1995, the cost-effective potential became even higher.⁵ In 1991 SEVEN worked with Resource Management Associates of Madison, Wisconsin, on the U.S. Emergency Energy Program, a USAID project in which they demonstrated low-cost and no-cost energy efficiency measures in five Czech and three Slovak industrial enterprises. SEVEN has also led the effort to install energy efficiency upgrades in several schools, hospitals, and other facilities, including the hospitals in the cities of Ivancice, Litomerice, Frydlant v Cechach, and Vinohrady (which is part of Prague). SEVEN also led upgrade efforts in schools in Trutnov, Jihlava, Tabor, and Mimon, and in residential buildings in Nymburk, Prague, Kamenice, and other cities.

CENef was selected by the World Bank and funded by DOE to help develop technical and financial plans for district heating system retrofits worth more than US\$220 million in more than 10 Russian cities. The World Bank Municipal Heating Loan project team is currently working with four Russian cities. Three of these cities--Kostroma, Lytkarino, and Zhukovsky--used feasibility studies and business plans developed by CENef. Two other cities that are candidates for loans under the bank's project--Tambov and Maloyaroslavets--have asked CENef to assist them in revising their feasibility studies for the same purpose. In addition, the energy efficiency program that CENef developed for Murmansk is in the final stages of consideration by the city administration. CENef is also working with Murmansk to present its business plan to the World Bank and the European Bank for Reconstruction and Development.

Since late 1994, CENef has been supporting the World Bank Enterprise Housing Divestiture Project (EHDP). CENef conducted energy audits and monitored existing housing stock for demonstration phases in Zhukovsky and Ryazan; prepared studies on taxes and customs duties, regulations, codes, and standards; and developed a database on energy efficiency measures. In 1998 and 1999, CENef conducted a study on monitoring and accumulating budgetary savings resulting from the EHDP in three cities: Volkhov, Cherepovets, and Petrozavodsk. Total project investments are valued at US\$300 million.

EnEffect helped create the Municipal Energy Efficiency Network in Bulgaria. The network will disseminate the results of the Gabrovo demonstration project noted earlier, and will assist member municipalities in developing city-level energy plans. By the end of the GEF project, the network will have 30 member cities with their own energy efficiency offices and municipal officers as part of local administrations.

BECon has played a leading role in helping organize China's Green Lights Program. This program aims to reduce electricity demand for lighting by 22 billion kWh (enough to light over 23 million U.S. households annually) by the year 2000 through improvements in Chinese-made CFLs and consumer education. China currently produces about 80 million CFLs annually, but 75 percent of this production is exported. The CFLs that are sold domestically are generally of poor quality, with less than one-third of the life span of

BOX 6: A RECORD OF IMPLEMENTING EFFICIENT TECHNOLOGY AND PRACTICES

Since 1990, the centers have guided the selection and installation of energy-efficient technology in hundreds of schools, hospitals, industrial plants, and apartment buildings.

FEWE

- C FEWE managed the insulation of 15 blocks of apartment buildings in the Pradnik Biały housing complex in Krakow.

SEVEEn

- C SEVEEn led energy efficiency upgrade efforts in the Czech Republic in 6 hospitals and health facilities, 23 schools, and 27 other facilities, including industrial plants, city-owned buildings, swimming pool, and residential houses.

CENEf

- C Entire apartment buildings in Russia have been built in compliance with city-level energy efficiency standards CENEf helped create.
- C CENEf is involved in the World Bank's "Enterprise Housing Divestiture Project," which is providing residential energy efficiency upgrades valued at US\$300 million.

EnEffect

- C EnEffect was awarded US\$6.5 million from GEF to begin a large-scale demonstration effort. During the next five years, the center will implement five demonstration projects focusing on street lighting, district heat, and buildings in the city of Gabrovo.
- C The rehabilitation of the regional hospital in Stara Zagora was a successful example of co-financing by several national and international sources.

BECon

- C BECon helped create three EMCs that are currently implementing 30 energy efficiency projects. BECon also implemented six demonstrations of energy-efficient lighting in hotels, shopping centers, and farms.

ARENA-ECO

- C Gostomel Glass Plant, Avdeevka Coke Chemical Plant, and Rosich Food Processing Plant have invested a total of US\$1 million in energy efficiency improvements recommended by ARENA-ECO and AISU.

high-quality bulbs. As a result, CFLs have gained a poor reputation in China. To improve production lines, the State Economic and Trade Commission of China is providing loans to Chinese manufacturers to upgrade their facilities. The Beijing Green Lights Exhibition Center was established in 1996 to showcase high-efficiency lighting products and teach consumers about the economic and environmental benefits of energy-efficient lighting. The United Nations Development Programme provided approximately US\$1 million in technical assistance for this project.

ARENA-ECO has played a major role in a Ukrainian industrial energy efficiency effort sponsored by DOE. In February and March 1997, ARENA-ECO organized a visit by PNNL and DOE personnel to seven industrial plants in Ukraine to assess their suitability for energy efficiency retrofits. From an original group of 17 sites, four plants were selected for technical assistance. Selection criteria included each plant's financial status, product market potential, management, energy efficiency opportunities, and equipment status. Business plans for these plants were completed in the summer of 1997, and ARENA-ECO and PNNL staff are now working to conduct feasibility studies and structure financing arrangements for projects at two plants. Informational support has been provided to the remaining plants.

ARENA-ECO also worked with AISU to undertake a demonstration effort in four school buildings in the city of Kyiv, known as the Kyiv Institutional Buildings Energy Efficiency Program (KIBA). This project was supported by DOE in conjunction with the Ukraine State Committee for Energy Conservation.

Energy Management Training

Energy efficiency technology transfer to the transition economies is more complex than simply introducing new technologies; it involves a significant and sustained training process to reverse decades of inefficient energy management practices. This training must reach a wide range of actors: utility representatives; industrial enterprise managers; and federal, regional, and local officials. The centers have helped fill a vast information gap by educating these participants about energy efficiency and have worked to bring these participants together. Over time, these activities can help cultivate a new culture of energy conservation management in the transition economies.

FEWE has provided a series of training seminars for municipal-level energy managers in Poland, focusing on planning for energy efficiency, financing, and the new obligations for municipalities resulting from the 1997 Energy Law. FEWE has also conducted more than 60 energy audits of schools, hospitals, and other public buildings to demonstrate the investment potential of energy efficiency projects. During 1995 and 1996, FEWE staff members met with officials from over 30 city administrations, including Wadowice, Namysłów, Katowice, and Zabrze, to explain the principles of IRP. As a result of these meetings, FEWE worked with these administrations to develop integrated resource energy and environmental plans for their cities. FEWE has organized three energy management courses for industrial managers, as well as conducted post-graduate courses on the energy efficiency aspects of restructuring Polish industry.

Within the framework of the USAID Housing Guarantee Program, SEVEN provided training to municipal officials on how to develop city district heating systems. Topics included implementing risk management, reducing emissions of air pollutants, modernizing the system as a whole, and obtaining financing for energy efficiency projects. In 1998 SEVEN developed a project that paired Czech and foreign energy consultants for an exchange of expertise.

Between 1993 and 1996, CENEf conducted the Promotion of Energy Efficiency in Russia's Regions program. The ambitious project began with a series of seminars on the following:

- C developing regional energy efficiency legislation and regulation
- C designing pricing policy and energy efficiency policy
- C implementing IRP
- C conducting an on-site demonstration energy audit
- C monitoring environmental conditions at energy facilities
- C reducing the environmental impacts related to energy use
- C designing energy codes for buildings
- C establishing business contacts with foreign energy-efficient equipment manufacturers
- C developing and evaluating the economic aspects of project proposals
- C educating the public about energy efficiency
- C defining energy consumption data collection requirements and methods for developing and monitoring energy efficiency programs.

During this effort, CENEf held seminars in Khabarovsk, Kostroma, Samara, Chelyabinsk, Yaroslavl, Omsk, Chita, and Kaliningrad. Following the seminars, CENEf assisted three regions in developing energy efficiency programs, helped draft regional energy efficiency laws or regulations in nine locations, and helped establish three regionally-based partner energy efficiency centers. Several regions also formed their own revolving-loan funds for energy efficiency projects. CENEf staff have also conducted lectures on energy economics at the Moscow Institute for Physics and Technology. Several years ago, CENEf conducted two-week training courses on energy audits for 30 Russian experts. CENEf also developed a Russian-language energy audit training video.

As part of the Energy Efficiency Strategy to Mitigate Greenhouse Gas Emissions: Energy Efficiency Demonstration Zone in the City of Gabrovo project, EnEffect will train experts who in turn will train local energy managers on energy-efficient management practices. This training will cover municipal energy planning and management, business plan preparation, and auditing. Under the European Union project INNOBUILD, EnEffect adapted a Bulgarian version of the manual for architects entitled, *How to Save Energy in Residential Buildings: Rehabilitation of Existing Multi-Story Buildings*.

BECon has provided training to China's energy efficiency service centers to introduce the concept of ESCOs and to share experiences about doing energy efficiency business in market economic conditions. BECon also held a training course for financial and industrial entities to describe the new method of energy

performance contracting used by the EMCs. BECon assisted in creating the National Energy Efficiency Information Center. This center will educate enterprise managers throughout China on ways to increase profits through energy efficiency measures and assist them in meeting stricter energy consumption targets under China's current five-year plan.

BECon held training courses in energy standards implementation in September 1994 and June 1995. Two hundred experts from local energy standards bureaus, energy conservation departments of industrial ministries, and large companies received training on monitoring compliance with national standards for the manufacture and operation of pumps, fans, and industrial boilers. The course was co-sponsored by the State Standardization Bureau and the Chinese Society of Standardization. Since its inception, BECon has coordinated and organized more than 10 study tours to North America and Western Europe to learn about the energy efficiency experience developed in these countries.

BECon organized another training session to introduce concepts and principles of IRP, which was attended by 50 officials from provincial electricity bureaus. In February 1995 BECon assisted the United Nations Economic and Social Commission for Asia and the Pacific in holding a training session on Energy Efficiency Service under Market Economic Mechanisms, with approximately 25 participants from the government and key companies.

ARENA-ECO has conducted several training workshops for Ukrainian specialists on how to develop feasibility studies and business plans for energy efficiency projects. The center also created an "Energy Bus" equipped with energy audit equipment. As plant managers work with ARENA-ECO to conduct audits, they begin learning how to identify areas where energy is being wasted.

PUBLIC INFORMATION AND EDUCATION

In addition to demonstration and training efforts, the centers have raised the public's awareness through media outreach and by developing educational materials for school children. Activities in this sphere include publishing energy efficiency newsletters, conducting television and radio campaigns, and developing educational programs for school children. In 1997 all six centers created Internet home pages with support from DOE's Office of Technical Assistance. These home pages enable the centers to reach larger audiences in their own countries and around the world (see Box 7).

FEWE recently developed an educational brochure entitled, *Energy and Its Impact on the Environment*. Fifty-thousand copies were distributed to Polish schools at no cost. Earlier, FEWE created a ten-part weekly series of five-minute television spots on simple ways to save energy. The series was broadcast nationally on Poland's most popular daytime program.

FEWE established the not-for-profit Coalbed Methane Clearinghouse in Katowice, Poland, in December 1991. The clearinghouse, sponsored by EPA, disseminates information about coalbed methane

technologies, energy needs, and the environment. The clearinghouse also supports EPA's efforts to encourage expanded recovery of methane from coal mining in Poland.

BOX 7: INTERNET RESOURCES

The energy efficiency centers moved quickly to develop Internet web sites to allow interested parties instant access to contact information and many reports, studies, and periodic bulletins. All six center web sites can be accessed through the AISU website at <http://www.pnl.gov/aisu/centers.htm>

FEWE in Poland: <http://www.silesia.top.pl/fewe>

SEVEN in the Czech Republic: <http://www.svn.cz>

CENef in Russia: <http://www.glasnet.ru/~cenef>

EnEffect in Bulgaria: <http://www.eneffect.bg>

BECon in China: <http://www.gcinfo.com/becon>

ARENA-ECO in Ukraine: <http://www-tech.viaduk.net/~arena>

SEVEN helps cultivate energy efficiency scholarships in the Czech Republic by presenting an award to the best graduate student dissertation on efficiency each year. In 1996 SEVEN completed the Energy Conservation Instructional Program for Secondary Schools project. During this project, SEVEN staff developed an instructional computer program for secondary schools in cooperation with a computer firm. SEVEN also designed a video presenting basic information on the threat of climate change and energy efficiency measures that can help prevent it. Czech TV co-financed the production of this video, which was aired nationally. SEVEN also publishes the quarterly bulletin entitled, *News at SEVEN*, which is circulated to over 4,000 subscribers. CENef doubled the print run of its quarterly bulletin entitled, *Energy Efficiency*, since publication began in 1993. Currently, 1,100 Russian-language copies and 350 English-language copies reach readers around the world four times each year. The bulletin analyzes new federal laws and regulations and highlights regional energy efficiency programs, new technologies, and entities interested in forming partnerships.

The first conference on Joint Implementation in Bulgaria was organized by EnEffect in 1995, followed by a second conference in 1998 co-sponsored by Novem in the Netherlands and EnEffect. EnEffect has also encouraged residential energy consumers to begin conserving energy by publishing and distributing a reference guide entitled, *How to Save Energy at Home*. EnEffect publishes a quarterly energy efficiency bulletin entitled, *EcoEnergy*.

Since 1994, BECon has sponsored the Chinese newsletter entitled, *World Energy Newsletter*, to run a special column providing information about advanced energy efficiency technologies. BECon also publishes a biannual information bulletin on energy efficiency in China entitled, *BECon News*. ARENA-ECO publishes the quarterly bulletin entitled, *Energy Efficiency and Ecology* (see Box 8).

BOX 8: EFFICIENCY CENTERS INFORM AND EDUCATE THE PUBLIC

FEWE

- C Created energy and environmental brochure for 50,000 Polish schoolchildren.
- C Designed 10 television announcements on how to save energy.

SEVEn

- C Developed instructional computer program for Czech schoolchildren.
- C Publishes quarterly informational bulletin entitled, *News at SEVEn*.

CENEf

- C Conducted television and radio campaigns in 10 regions of Russia.
- C Publishes quarterly informational bulletin entitled, *Energy Efficiency*.

EnEffect

- C Publishes quarterly informational bulletin entitled, *EcoEnergy*.
- C Developed a reference guide for residential energy consumers entitled, *How to Save Energy at Home*.

BECon

- C Sponsors energy efficiency articles in Chinese newsletter entitled, *World Energy Newsletter*.
- C Publishes a biannual information bulletin on energy efficiency in China entitled, *BECon News*.

ARENA-ECO

- C Publishes quarterly informational bulletin entitled, *Energy Efficiency and Ecology*.
- C Prepared a television documentary on energy savings in buildings as part of the Kiev Institutional Buildings project.

CHALLENGES: PAST AND PRESENT

This paper intends to assist those working to create new institutions and centers in the field of energy efficiency and environmental protection. Therefore, a review of some challenges faced by the centers during the past nine years are provided below to help prevent others from experiencing similar challenges and to speed their progress.

Past Challenges

Multilateral Financing

In 1996 World Bank lending to Central and Eastern Europe, the Newly Independent States, and China in the energy sector focused predominately on energy supply projects. These projects included power supply rehabilitation or privatization, fuel-switching, and oil and gas development.⁶ Similarly, the largest share of energy sector loans from the European Bank for Reconstruction and Development and the International Finance Corporation went to power-sector and oil and gas development projects.⁷

Fortunately, however, multilateral bank funding for efficiency projects and demand-side measures has increased dramatically. Examples include the World Bank's Enterprise Housing Divestiture Project in Russia, valued at US\$300 million, and the Global Environment Facility's Energy Efficiency Demonstration Zone in Gabrovo, Bulgaria, valued at US\$6.5 million with US\$2.5 million in GEF financing. In 1998 the World Bank approved a US\$63 million loan for energy conservation work in China. Clearly, lending of this magnitude represents a major achievement in the effort to promote energy efficiency.

Informational Barriers

The combined problems of inaccurate and scarce energy data have existed. In CENef's early years, a project to compile statistics for the city of Moscow was canceled because no reliable and consistent time series data developed from a uniform methodological basis were available. Additionally, city officials did not regard the development of an accurate energy consumption picture as a high priority.

Several centers have helped resolve this challenge by compiling and publishing energy and economic data (discussed above). This information provides both government officials and company representatives a more solid basis for decision-making.

Unequal Partnerships

Not all approaches to energy and environmental research involving the centers have met with equal success. Probably the least successful approach has been when Western agencies and consulting firms have tried to use center staff as "gophers" who collect data and statistics but do not provide data analysis. One assessment of the potential for IRP in Poland, done to support the Polish government and the Polish Power

Grid Company in restructuring the Polish electric utility sector, exemplifies the pitfalls. A report was produced by a consulting firm using FEWE's data but not its analyses, producing results inconsistent with most studies of the Polish electric power sector. The potential for energy efficiency by the year 2000 was estimated at only 1 to 2 percent of current capacity. Some observers felt that certain arbitrary assumptions made in this report led to an incorrect, low estimate of the potential for efficiency.⁸ This estimate could have discouraged Polish authorities from pursuing energy efficiency, rather than promoting it. The centers' reports have been more methodologically sound, and therefore better resources for policy development, when they have performed their own analyses.

The centers became attractive to their many contracting partners by charting their own courses. Nonetheless, some collaborators of the centers tend to view center staff as number-crunching assistants rather than equal players in large scope analyses.

Continuing Challenges

U.S. Energy Policy in the Transition Economies

Despite the potential and proven effectiveness of energy efficiency measures, U.S. foreign assistance policy in the energy sector still overwhelmingly favors supply-side measures. For example, nuclear energy projects in recent years accounted for half of U.S.- and European-sponsored energy cooperation efforts in the transition economies.⁹

Total U.S. foreign assistance monies are not expected to grow substantially during the coming decade. Nonetheless, this paper has helped demonstrate the remarkable results that can be achieved with modest and well-targeted U.S. government support for energy efficiency. If efficiency commanded a larger share of the current pie, even more could be done to implement efficient technologies, improve occupant comfort, promote regional stability, and ultimately reduce global climate emissions.

Resistance to International Cooperation

The center founders worked carefully and deliberately to create completely independent institutions. One center, BECon, has quasi-official ties to the government of China for reasons specific to that country. All other centers are completely non-governmental in both law and fact.

Nonetheless, some organizations, including the European Union, view the centers as "American" institutions. To be sure, the centers were founded with funding and guidance from a host of U.S. agencies and non-profit entities. However, this view does not undermine each centers' legal and operational independence.

Cooperative relationships have been forged by the centers with energy and environmental agencies outside their home countries, including ISIS in Italy and Novem in the Netherlands. The European Union sponsors ongoing work with SEVEN in the Czech Republic, EnEffect in Bulgaria, and FEWE in Poland.

Global Economic Crisis

In 1998 the global economic crisis that began in Asia spread to many other countries around the world. In Russia, currencies devalued almost overnight and the much-noted problem of non-payment grew even larger. This crisis could have ruined CENEf had the center not wisely amassed reserves before the crisis set in. CENEf had to pay staff out of the reserve funds for over two months. Since the crisis eased, CENEf has endured and prospered.

For years before this event occurred, some individuals in the U.S. government questioned the propriety of centers stockpiling a certain amount of financial reserves. CENEf's experience illustrates the prudence of using a strategy of building reserves.

CENEf's success in weathering the global financial crisis illustrates three points of value to any NGO operating in the transition economies. First, NGOs cannot operate in a vacuum. Like the U.S.-China tensions example noted above, the global financial crisis was a far-reaching, macro-level influence that directly impacted a center's operation. Center staff and their international allies need to observe, anticipate and prepare for these types of "big picture" economic and cultural trends.

Second, centers must be prepared for unexpected shocks—both financially and psychologically. In addition to building financial reserves, directors and staff may need to stretch project time lines by a year or more in response to such shocks. Fortunately, however, the centers have endured difficult times and thrived.

CONCLUSION

Observations

The founders of the energy efficiency centers sought to create institutions of human talent that would remain effective long after initial U.S. government funds expired. That goal has matured into reality. During the creation and development of the centers, we have developed some shared observations that hopefully can benefit other NGOs working on energy and environmental issues. These observations include the following:

1. A wide range of promotional and educational activities are necessary to foster the introduction of energy-efficient technologies. The center directors agree that initiating a dialogue among governmental officials, energy-system managers, industrial enterprises, and the academic community should be the first step for a new NGO seeking to promote energy efficiency. An important effort at this phase of activity is to raise public awareness through the media and public seminars at the local level.

2. U.S. investors need information and expertise when considering business opportunities abroad. The centers have met this need by providing market analyses, energy data, overviews of business conditions, and a wide range of other reports.
3. In-country experts can help provide a bridge for U.S. investors by facilitating partnerships with foreign counterparts, research institutes, and the appropriate government agencies. The centers have shared their knowledge of local business conditions, contacts, and their command of the English language to help U.S. investors overcome cultural and institutional hurdles.
4. NGOs can have the biggest impact when they cooperate with Western government agencies and institutions as equal partners, not as merely data-gatherers or interpreters. It must be re-emphasized that local experts have a homegrown knowledge of local conditions.
5. Technology transfer of energy efficiency (perhaps the most difficult challenge) requires a financial and regulatory incentive structure that must be developed over time. Like each of the observations above, this effort can be most effectively supported by local citizens with expertise in engineering and economics who enjoy strong working relationships with a range of domestic and foreign investors, utility managers, public officials, and international energy experts. The centers have shown a remarkable ability to incorporate the concerns of all these players into sound, innovative policy recommendations to promote energy efficiency.
6. NGOs in the transition economies need to cultivate innovative programs and funding strategies if they hope to survive. Unlike American NGOs, transition economy NGOs cannot rely completely on in-country donors at the present time. The centers have thrived by developing services that provide value to a wide range of government and business-sector clients in many countries. Over time, the centers may develop for-profit spin-off institutions to begin to directly pursue energy efficiency businesses. This effort may raise conflict of interest issues that will need to be considered carefully by the boards of directors for each center.

Note that each of these observations underscores the importance of in-country expertise. We believe that because policies must be concluded at the national level and business must be developed at the local level, it is appropriate to concentrate on national rather than multi-national centers.

Future Directions

This paper has documented the centers' policy work, research, involvement in business projects to implement technology, and public education efforts. It has also chronicled their evolution into self-funding entities. Having reviewed their substantive work and institutional evolution, we now briefly anticipate future directions for the energy efficiency centers during the next three-to-five years. FEWE is implementing a USAID project aimed at developing small- and medium-size firms to conduct DSM measures in buildings. FEWE will continue to provide consultations on municipal energy planning to cities such as Lodz, Radom,

and Tychy. Municipal energy plans are required by the Polish Energy Law of 1997. FEWE will also build from its success with CFLs to develop a project aimed at market penetration of energy-efficient motors. FEWE will undertake this project with support from the GEF.

SEVEn envisions three major areas of work. First, SEVEn plans to work with municipalities to help develop energy plans that will encompass regional and local needs. Second, SEVEn will develop policy recommendations relating to liberalization of the energy sector and environmental protection. Third, SEVEn will promote energy efficiency by providing consultations for Czech-based and foreign companies that implement energy-efficient technologies and management practices.

CENef's upcoming initiatives include work on USAID's Regional Investment Initiative in the Russian Far East and Samara Oblast to mobilize financial sources for implementing energy efficiency programs. CENef will also work on verification and monitoring methods to evaluate the effectiveness of energy efficiency improvement projects and continue to assist in the development of energy efficiency programs for Russian municipalities.

EnEffect plans to continue working on the creation and development of a market for energy efficiency activities. The center aims to expand its activities in the industrial sector, as well as participating actively in regional energy efficiency efforts in the Balkans. EnEffect will continue supporting initiatives on climate change and emissions trading, and begin developing financial mechanisms for energy efficiency projects to assist Bulgarian cities develop sustainably.

BECon will continue its efforts to promote energy efficiency and environmental protection in China through its policy research, public education, technology introduction, capacity-building, and demonstration activities. BECon will also increase efforts to strengthen relations between China and the other countries of the world.

ARENA-ECO will continue in-depth efforts in the industrial and buildings sectors, district heating, and natural gas deployment. ARENA-ECO will also promote energy efficiency business development through the recently-created ARENA-ECO business center. Finally, the center plans to begin new initiatives targeting renewable energy and the transportation sector.

NOTES AND REFERENCES

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