

**DRAFT FINAL**

**EVALUATION REPORT OF  
A.I.D. DISTRICT HEATING PROJECT  
IN THE NEWLY INDEPENDENT STATES (NIS)**

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## Executive Summary

The District Heating project is a component of A.I.D.'s Energy Efficiency and Market Reform Program for the NIS. Begun in January 1992, this project was the first economic development effort undertaken by the U.S. in the NIS. With funding of approximately \$4.0 million, the project provided technical assistance, training, equipment and advisory services to improve district heating systems in six countries: Armenia, Byelarus, Kazakhstan, Kyrgyzstan, Russia, and Ukraine.

Because of the fuel crises that resulted from the political and economic collapse of the USSR, the NIS countries are facing serious problems in securing adequate heat supplies for their citizens. The A.I.D. project assisted in several ways. First, by conducting energy audits of district heating systems in nine cities (Yerevan, Minsk, Kiev, Moscow, St. Petersburg, Kostroma, Ekaterinburg, Almaty, and Bishkek). Secondly, by providing low-cost energy efficiency instruments manufactured by U.S. companies that demonstrated improvements in the production, distribution and consumption of heat supplies. Thirdly, by studying and making recommendations about policy, regulatory, institutional and pricing reforms needed to improve the management of district heating systems, and the energy sector in general.

Following the completion of work under the project, a series of wrap-up seminars was held in each location during June 1993. These seminars, which lasted for two days, were attended by NIS representatives from local government, industry, business and academia. From the U.S. side, participants included representatives from business, as well as A.I.D. and the contractors who worked on the project. The seminars provided a venue to discuss the project's findings, promote the benefits of "low-cost and no-cost" energy saving techniques, and promote U.S. products for the energy industry. A few U.S. businesses also initiated joint ventures negotiations for the local manufacturing or distribution of their products in the NIS markets. TV and radio media coverage at each seminar helped promote the U.S.-NIS cooperation to a wider audience.

The project resulted in significant benefits to the district heating systems. The total equipment costs amounted to \$1,113,153, and will produce an estimated annual savings of \$14,127,147, based on world market prices for fuel oil and natural gas. Taking the total project cost of approximately \$4.0 million compared to the total benefits, the payback period on A.I.D.'s investment is  $\$4.0/\$14.1$ , or .28 years. By using improved combustion equipment, boiler plants have reduced carbon dioxide, sulfur and other emissions into the atmosphere, thereby providing an environmental benefit as well.

A.I.D. has learned through this project that the potential is great for transferring new energy technologies to the NIS. The technical and industrial know-how are advanced. NIS counterparts, in government and the private sector, are eager to cooperate with U.S. experts. Because NIS countries are being forced into paying higher and higher prices for fuel, the demand for energy saving technologies is assured. The challenge, however, is in the area of financing, both to cover the cost of system upgrades, and the cost of start-up ventures to manufacture and distribute the range of energy efficiency products needed in the NIS.

A.I.D. has already begun to broaden its work in policy reform and privatization of utilities and fuel suppliers through other project initiatives. The successes of the District Heating Project, however, also suggest that A.I.D. should expand its demonstration programs to include other district heating sites and major industrial complexes which are large energy consumers. A.I.D. also should disseminate its findings about the potential market for energy saving technologies in the NIS to the U.S. business community, perhaps by involving the Department of Commerce and U.S. Chambers of Commerce in the NIS. Finally, A.I.D. should investigate how it might provide financing to expand the availability of energy efficiency products, and to finance the upgrading of existing energy-inefficient plants.

## **I. PROJECT OVERVIEW**

### **Background and Purpose**

The District Heating Project is a component of A.I.D.'s program in Energy Efficiency and Market Reform for the Newly Independent States (NIS). The project was started in January 1992 by the A.I.D. Eastern Europe Office, and was transferred to the NIS Task Force when it was formed in February of that year. This project was, in fact, A.I.D.'s first economic development effort in the former Soviet Union.

The purpose of the District Heating Project has been to introduce energy efficiency technologies and practices into major district heating systems of selected countries in the NIS.<sup>1</sup> The work has been carried out in six countries, Armenia, Byelarus, Kazakhstan, Kyrgystan, Russia and the Ukraine, with a total project cost of about \$4.0 million. The work included technical assistance, training and procurement of energy saving instrumentation from U.S. companies.

The project design is based on a similar effort that was undertaken by A.I.D. in Eastern Europe. Although the focus in Eastern Europe was on industrial energy efficiency, district heating was chosen in the NIS for two reasons.

First, A.I.D. was concerned that sensitivities in the former Soviet Union about its industrial complex would inhibit the spirit of cooperation which A.I.D. hoped to foster in its relations with the NIS. District heating, which is more clearly a matter of civilian interest, therefore provided a safer ground upon which to begin work in the energy sector. This issue was even more important in light of the fact that this was A.I.D.'s first development project in the NIS.

Second, as a result of the collapse of the Soviet Union in December 1991, fuel scarcities and economic failures were disrupting existing fuel supply arrangements among the NIS countries. It was therefore widely recognized that any assistance the U.S. provided to improve the supply of heat to NIS citizens could help prevent political and social upheaval. Because of the general economic decline, and because of the crises in fuel supply, during the winter of 1991-1992 several energy enterprises failed, and thousand of residents were left without heat or electricity for long periods of time. Therefore, a focus on district heating presented an opportunity for A.I.D. to do something quickly and effectively without presenting too many bureaucratic obstacles to implementation.

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<sup>1</sup> District heating, which is not common in the U.S., is a large, centrally operated network of hot water boilers and pipes, which provides radiant heat, hot water, and steam to a municipality. In the U.S., university campuses and government buildings sometimes employ this type of system.

## Contractor Scopes of Work

Three contractors are responsible for implementing the District Heating Project: International Resources Group (IRG); RCG/Hagler, Bailly, Inc. (RCG); and Resource Management Associates (RMA). Each contractor worked in different locations, with slightly different scopes of work. A summary is provided in Table 1.

**Table 1: Overview of Contractor Scopes of Work**

Contractor/\$\$	Countries (Cities)	Basic Elements of SOW
IRG (\$1,273,760)	Kazakhstan (Aimaty) Kyrgyzstan (Bishkek)	<ul style="list-style-type: none"> <li>■ Energy audit and equipment procurement for district heating systems.</li> <li>■ Policy and Institutional Analysis reports.</li> <li>■ Coal, Gas and Petroleum Energy Pricing and Taxation Reform studies - hydroelectric sector later added to Kyrgyzstan study.</li> </ul>
RMA (\$1,345,436) <sup>2</sup>	Byelarus (Minsk) Ukraine (Kiev) Armenia (Yerevan)	<ul style="list-style-type: none"> <li>■ Energy audit and equipment procurement for district heating systems.</li> <li>■ Policy and Institutional Analysis report (Ukraine only).</li> <li>■ Energy Pricing Study (Byelarus).</li> </ul>
RCG (\$1,300,000)	Russia (Moscow, St. Petersburg, Kostroma, Ekaterinburg)	<ul style="list-style-type: none"> <li>■ Energy audit and equipment procurement for district heating systems.</li> <li>■ Natural Gas Pricing Reform study.</li> <li>■ Trade promotion of US energy efficiency manufactured goods.</li> </ul>

## Description of Activities

### District Heating Energy Efficiency Improvements

As can be seen from Table 1, the three contractors had common scopes of work in terms of improving the energy efficiency of district heating systems. The tasks were to:

- Conduct a reconnaissance mission to identify district heating plants to work with, prepare an implementation plan, and finalize arrangements for

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<sup>2</sup> An additional \$1,381,600 was put into RMA's contract in June 1993 to provide emergency response services, in light of an energy crises situation in Armenia.

subcontracts for local technical and logistical support;

- Conduct energy audits in the selected sites, including training of local counterparts, in audit methods;
- Procure energy efficiency equipment for installing at the sites, arrange customs clearance, etc;
- Assist in installation of equipment as necessary (in most cases, the equipment was installed by local engineers, with some assistance from the suppliers); and
- Sponsor a wrap-up seminar for management and technical staff.

The installation of energy efficiency equipment was intended to provide a concrete demonstration of the savings that could be gained by utilizing "no-cost" or "low-cost" technologies. These demonstrations served another purpose of showcasing American-made products and services. The types of installations included:

- Oxygen analyzers at boiler plants to improve fuel-burning efficiency (heat production improvements);
- Flow meters, heat sensors, and leak detection equipment along heat distribution lines to determine optimum pumping rates and temperature settings (heat distribution improvements);
- Heat measuring equipment, flow meters and thermostatic control valves to control flows and temperatures at end-user sites (heat consumption improvements).

The oxygen analyzers, flow meters and heat sensors were installed in major boiling houses and distribution networks located in each of the cities targeted under the project. In some cases, permanent equipment was installed, and in other cases portable units were provided to allow several boiler houses within a district to benefit from the equipment. Although the reliability and longevity of permanently-installed equipment is greater, it is also more costly. The contractors therefore had to balance their budgets with demand for equipment from the NIS side.

Metering and temperature control equipment for end-users was installed with an eye towards publicizing the benefits of controlling heat consumption. At present, few controls exist so that during the winter residents must open their windows to regulate temperatures within their apartments, offices, etc. Among the sites selected were: apartment complexes in Ekaterinburg and Kostroma; the Veterans of the Great War Hospital in Ekaterinburg; the Borovay School in Kostroma; a manufacturer (Rabochiy Metalist) in Kostroma; the Opera

House (a popular cultural facility which is used daily) and the book publishing center in Kiev.

### Policy and Institutional Analysis Reports

Scopes of work for IRG and RMA called for them to complete policy and institutional analysis reports in Kazakhstan, Kyrgyzstan and Ukraine. The studies described the factors that influence energy efficiency decision making in those countries, and made recommendations for improving policies, regulations and institutions to promote energy efficiency.

The results of these studies were presented and discussed with participants at the wrap-up seminars held in June 1993.

### Pricing Studies

Each contractor was also tasked to complete pricing studies as part of a joint A.I.D.-World Bank effort to identify pricing constraints and reforms needed in the energy sector. In Kazakhstan and Kyrgyzstan, IRG completed studies of pricing and taxation of petroleum, gas and coal supplies; hydro-electric was later added to the SOW for Kyrgyzstan because of its important potential for offsetting some of the reliance on energy imports. In Russia, RCG completed a study of natural gas pricing. In Byelarus, RMA completed a study of energy market reforms and pricing issues.

### Promotion of U.S. Energy Efficiency Products

After identifying needed improvements in the district heating systems, the contractors procured the specified equipment from U.S. companies. These manufacturers were also invited to the wrap-up seminars to present their equipment, and to answer any questions from local counterparts about equipment costs, servicing, etc. The manufacturers were encouraged to use this opportunity to talk with local enterprises about distributorship for their products, and joint-venturing to assemble or manufacture their goods in-country for local markets.

In the case of RCG, the promotion effort was much expanded. Their contract included a specific purpose to: "Implement an Energy Efficiency Industry Development Effort to support emergence of a Russian private sector energy efficiency industry." <sup>3</sup> Tasks were to:

- Identify potential private sector business opportunities for in-Russia manufacture of district heating energy efficiency equipment (including instrumentation and controls) and materials. Select NIS private sector energy efficiency business opportunities for use in subsequent work.

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<sup>3</sup> RCG/Hagler & Bailly, Amended Statement of Work, page 2.

- For the selected private sector business opportunities, identify Russian firms (or other entities), including military components manufacturers, that are interested in undertaking joint ventures, and/or licensing agreements with established foreign district heating energy efficiency equipment and materials developers/manufacturers.
- For the selected private sector energy efficiency opportunities identified, and the Russian firms (or other entities) identified, propose potential business venture financing approaches and sources.
- Disseminate information to relevant U.S. equipment and materials developers/manufacturers on potential private sector business opportunities, with prior approval from the A.I.D. Project Officer.
- Organize and conduct, with prior approval of the Project Officer, cost-shared technology cooperation missions and reverse missions to facilitate communications between interested foreign energy efficiency equipment and materials developers/manufacturers and potential Russian firms (or other entities) for establishing equipment and materials production facilities located in Russia.
- Based on the above, prepare an Energy Efficiency Industry Development Lessons Learned document for use in planning and conducting similar future efforts.

To implement this component, RCG carried out preparatory missions to Russia, contacted 250 - 300 relevant U.S. manufacturers to explore their interests in doing business in Russia, and arranged a trade mission to participate in the wrap-up seminars held in four cities in Russia in June 1993. Twelve companies participated in this mission, at their own expense, and were given the opportunity to make presentations on their products and services, meet with potential partners, and become acquainted with doing business in Russia. Representatives also made presentations at the other country seminars. The companies are listed in Table 2. (The Armenia seminar has been delayed because local officials are busy dealing with the extreme energy crises facing that country.)

**Table 2: U.S. Companies Participating in Wrap-up Seminars**

Seminar Series	Company
Byelarus, Ukraine	Armstrong; Digital Equipment Corporation; Foster Wheeler; Honeywell;
Russia	Ahlstrom Pyropower; Allison Gas Turbine Division of General Motors; Armstrong; Association of Energy Engineers; Bacharach; Circle Group; Cleaver Brooks; Honeywell; Inframetrics; NRG; Tampella-Keller; UE Systems
Kazakhstan, Kyrgyzstan	Armstrong; Honeywell

**II. EVALUATION PURPOSE AND TASKS PERFORMED**

**Purpose**

This evaluation was carried out by Russell Webster of Management Systems International (MSI), funded through MSI's PRISM contract with CDIE. The evaluation was requested by the NIS Task Force, Office of Energy, Environment & Technology, who saw the wrap-up seminars as a good opportunity to (a) see and assess what had been accomplished under the project, (b) document the opinions of the various stakeholders in the district heating program (contractors, counterparts, U.S. manufacturers, etc.), and (c) form an opinion about the successfulness of the project's strategy, which was to demonstrate the benefits of energy saving technology while, at the same time, promote the policy, regulatory, and pricing reforms necessary to generate the incentives to use this technology.

There were four stated objectives for the evaluation exercise. These were to:

- Summarize work done under the District Heating component to date;
- Verify outputs produced to date, and likely additional outputs that might occur;
- Identify progress toward achieving project and component objectives, including the impact of the component on the problems it was designed to address; and
- Recommend follow-up efforts that will improve the likelihood that A.I.D.'s objectives in energy efficiency will be attained, both under the project as currently planned, as well as through the implementation of other activities.

## Schedule

The evaluator was able to attend a total of four seminars over a two week period, each seminar lasting about two working days. A.I.D. had requested the three contractors to schedule their seminars at about the same time, to try and minimize the number of trips that had to be made by U.S. businesses, and also to facilitate participation by A.I.D. at each of the sites. Given the various constraints each had to operate under, they did a good job of this activity. The seminar schedule in each location is presented in Table 3. Seminars which the evaluator attended are indicated with an asterisk.

**Table 3: District Heating Project Wrap-up Seminars Schedule <sup>a</sup>**

Contractor	Location	Dates
RMA	Minsk, Byelarus	June 10 - 11
	Kiev, Ukraine	June 14 <sup>b</sup> * including 15th
RCG	Moscow, Russia	June 14 - 16
	St. Petersburg, Russia	June 18 - 19 *
	Ekaterinburg, Russia	June 21 - 22
	Kostroma, Russia	June 24 - 25
IRG	Almaty, Kazakhstan	June 21 - 22 *
	Bishkek, Kyrgyzstan	June 24 - 25 *

<sup>a</sup> Seminars which were attended by the evaluation specialist are indicated with an asterisk (\*).

<sup>b</sup> RMA remained in Kiev and made presentations as part of the World Bank Energy Conference June 15 - 18)

The evaluator stopped in Moscow on the return trip home to meet with USAID/Moscow to get more background information on the Russia energy program.

## Approach

Given the compressed nature of the trip, the evaluator had to take the best advantage of time available to talk with the various stakeholders, without disrupting their participation in the seminars. Fortunately, the contractors, counterpart officials and engineers, and the U.S. manufacturers all played a role in making presentations during the seminars. This in itself provided a good opportunity to learn about issues relating to project design, implementation, results and impacts.

The following approach to collecting information was taken:

- Note-taking during seminar presentations;
- Discussions with U.S. manufacturers about how they benefited from participating in the project, what business contacts they had been able to establish, what they saw as future market/local manufacturing potential, etc.;
- Discussions, through translators, with local entrepreneurs trying to expand their business in manufacturing and selling energy efficiency products;
- Discussions with local counterparts -- both administrative officials and engineers -- involved in the project (assisting in energy audits, installation of equipment, energy savings analysis, etc.);
- Interviews with the contractor teams to discuss project implementation, impacts, and follow-up; and
- Visits to equipment installation sites in Kiev, Almaty and Bishkek.

### **III. FINDINGS**

#### **General**

Overall, the project has produced marked benefits, not just in terms of measurable improvements in the energy efficiency of district heating systems, but also in terms of creating a solid basis for future cooperation. This cooperation is already starting to emerge in the form of joint venture negotiations between U.S. and NIS companies. It is also starting to emerge in the form of discussions between A.I.D. and NIS organizations about how the momentum begun through this project can be continued and expanded.

The wrap-up seminars, which served as the main venue for the evaluation, were well attended from the NIS side. Approximately 100 to 150 individuals from industry, government, private business, and academia came to hear presentations from both U.S. and local experts. Questions and comments were entertained from the floor for discussion, and the availability of several translators helped break the language barrier. The Kazakhstan seminar was attended also by representatives from other Central Asian countries, Turkmenistan, Uzbekistan, and Tajikistan, and from central Russia. Local media coverage at each event (TV and radio) also served to publicize the joint U.S.-NIS effort to a wider audience. In a couple of cases, high-ranking officials from the municipal government welcomed the U.S. delegates.

The NIS counterparts, from both the public and private sectors, are very well equipped to sustain the benefits that can result from adapting the technologies utilized in this project. NIS countries for the most part have the manufacturing capacity and know-how to make energy efficiency products. Engineers and technicians are highly skilled, and they understand the principles and concepts promoted through this project. What they lack, however, is the capital to implement energy efficiency programs on a significant scale.

## **Project Implementation**

### Success of Demonstration Projects for Energy Efficiency in District Heating Systems

As described earlier, implementation of the district heating component involved a couple of phases: conducting energy audits and training local counterparts in the methodology; procuring and installing equipment at various points in the district heating system; analyzing savings, and; disseminating the findings in a wrap-up seminar.

Work at each phase was carried out by joint contractor-counterpart teams. The counterparts expressed a great deal of appreciation, both in their formal statements as well as in informal conversations, for the work done by the contractors. They were genuinely enthusiastic about the technology, and also about the opportunity to work with experts from the U.S. Close relationships, professional and inter-personal, were forged during the process of carrying out this project.

Statements made by local officials included such comments as: "A.I.D. and its contractors have undertaken a pioneering role in the energy efficiency field in the NIS." One chief engineer observed that "at first, the shop engineers had to struggle a bit to figure out the equipment, now they are using the devices all the time." One local official referred to the project as a "turning point" in the operation of their district heating enterprise. Another official made the following statement during his presentation:

"We have been open to the suggestions and to the expert advice of our friends from the West. We need and welcome this support. There is a clear need for us in Russia to improve management of energy systems. The devices that have been provided by the project have been very successful."

Other statements were also supportive:

"We had primitive facilities prior to receiving equipment provided by the project. Once we started using the new devices, our productivity increased two to three times. Not only have we improved the process of heat generation, but we've also introduced automation that enhances efficiency of production, distribution, and consumption."

Several heating plants took follow-up steps to ensure that the benefits would continue and the systems further developed. In Almaty, a district heating plant that previously didn't measure heat production and consumption (a fact that was common in most locations) now has introduced computers to help assist management in tracking system performance, and has formed a management working group of ten people to oversee development of the new technologies.

The contractor teams, in turn, spoke very favorably about the skill, knowledge and level of commitment demonstrated by the people they worked with. One expert who led the teams in Kazakhstan and Kyrgyzstan said it plainly: "The teamwork, from both sides, has been tremendous!" Only in one case, Ekaterinburg, did the contractor (RCG) express frustration that there was a low level of local interest in the project.

There were a couple of problems that the teams faced during implementation.

One had to do with the equipment line item in the budgets. When the contracts were first approved, the budgets for equipment were quite small, somewhere around \$40,000 for each location. The contractors had been told by A.I.D. that these budgets could go up, but it wasn't until the teams were actually in the field and in the midst of completing the energy audits that they learned about the budgets being increased to around \$120 to 150,000. As a consequence, they had to rethink their strategy, and rework their original equipment specifications. The additional funding, however, didn't come until late in the summer of 1992, thereby delaying the purchase of equipment.

A second issue had to do with the logistics of getting equipment cleared in-country. The equipment for Kazakhstan and Kyrgyzstan, for example, was waylaid in Moscow for a couple of months, lost in red-tape, awaiting clearances, being moved overland between airport terminals, etc.

A third problem was the difficulty in communications, fax and telephone, between the contractor head offices in the U.S., and NIS counterparts. This problem didn't just have to do with the logistics of communicating, which was much worse for the two Central Asian countries, but also with the fact that messages had to be translated, and that people in-country sometimes had to follow procedures to make decisions and take action, etc. At times, the contractors were at the "arms length" mercy of government bureaucracy. Still, through hard work and perseverance, these problems were surmounted.

Sometimes the unexpected happened. It was agreed, for example, with officials in Kiev that a central railway station would be one of the sites to install thermostatic control valves and metering equipment. However, after the specifications had been drawn up and the equipment ordered, the city began a major renovation effort on the railway station, the plans for which were not brought to the team's attention during the audit phase. In spite of this minor setback, RMA and its local counterparts were able to find a second suitable location to install and demonstrate the equipment.

Once the energy audits were completed, and the equipment procured and transported, the teams relied on their local counterparts to receive and install the devices. In some cases, company representatives (for example from Honeywell and Armstrong) went on-site to supervise installation, and orient the engineers in how to use the equipment. This added effort served the project very well, and was covered at the expense of the manufacturers, not the project.

By April 1993, all of the equipment was installed and operating. Savings were also calculated for presentation during the seminars. At a district heating plant in Almaty, for example, the chief engineer explained that during the three months of using an oxygen analyzer provided by the project, they had been able to (a) reduce oxygen emissions of the burner by 2%, which had (b) increased efficiency by 0.8%, thereby resulting in (c) a reduced amount of fuel use. Asking us to keep in mind that the testing period was March through May (not the main heating season), he explained that the amount of fuel saved during that initial period was equal to about \$5,400 at world market prices. Increased efficiency of the system also lessened demands on fans and pumps, producing a reduction in electricity costs of about \$400. Total savings, during a three month, non-peak period, were therefore \$5,800 from a piece of equipment that cost \$24,000. Payback will be in less than a year -- an important criteria for success in the energy efficiency industry.

Other demonstration efforts also showed promising preliminary results. In Kostroma, Honeywell installed metering equipment in identical apartment buildings, and equipped one of them with thermostatic control valves, leaving the other without. Through a central computer system, the project was able to show the actual savings as they occur to the upgraded building. This demonstration was also set up in Ekaterinburg.

Table 4 presents an estimate of savings produced by the equipment provided to each locality served by the project. These calculations were provided by the contractors, and use world fuel prices to estimate the value of savings.

**Table 4: Calculation of Equipment Costs and Energy Savings**

Location	Equipment Cost	Est. Annual Savings	Pay-Back (Years)
Armenia	\$126,400	\$4,567,405	0.03
Byelarus	\$127,950	\$2,518,354	0.05
Kazakhstan <sup>a</sup>	\$159,613	\$434,368	0.37
Kyrgyzstan <sup>b</sup>	\$154,999	\$636,168	0.24
Russia (four cities)	\$417,941	\$1,400,000	0.30
Ukraine	\$126,250	\$4,570,852	0.03
<b>TOTAL</b>	<b>\$1,113,153</b>	<b>\$14,127,147</b>	<b>0.08</b>

<sup>a</sup> Estimate is conservative, for two reasons: (a) savings from use of oxygen analyzers at New Western boiler plant (cost of \$22,165) is based on annualizing calculated savings of \$6,417 during the three month period March - May, which is not peak heating season, and (b) estimate does not include a calculation of savings as a result of using annubar flow meters and temperature and pressure transducers, which represents \$121,910 of the total equipment cost.

<sup>b</sup> Estimates conservative, for same reasons stated in (a). In this case, the oxygen analyzers represent \$119,467 of the total equipment cost (more provided) and the flow meters represent \$16,400 of the total (fewer provided).

By taking the total project cost of approximately \$4.0 million, which includes all of the training, technical assistance and studies, and comparing it with the total estimated annual savings, the payback period on A.I.D.'s investment is \$4.0/14.1, or .28 years.

#### Benefits Gained by U.S. Manufacturers

The evaluator had an opportunity to talk with most of the U.S. manufacturers who attended the seminars. He had a particularly good chance to discuss the project and its benefits with representatives from Honeywell and Armstrong, who attended all of the seminars.

All of the manufacturers were excited and optimistic about new market opportunities in the NIS. They also felt that the work done by A.I.D. and its contractors would benefit them in better understanding and realizing those opportunities.

The representatives from Honeywell commented that, although they were already working on business development in the NIS, "the A.I.D. program helped give us lots of exposure that we wouldn't have gotten otherwise." The Armstrong participant had a similar comment: "We've been able to get some valuable contacts; now we are in a good position to follow-up on our own." Both companies also reported having concrete conversations during the seminars that

opened preliminary negotiations about joint venturing. Yet another participant, Cleaver Brooks, was able to identify a joint venture partner in Moscow, and a distributor in St. Petersburg for its packaged boiler systems.

There are other examples of progress being made by U.S. businesses. However, whereas the needs and the opportunities are great, the main constraint is financing. This problem has forced the manufacturers to come up with some alternative schemes. Honeywell recently signed a \$3.0 million contract with the city of Moscow to automate controls in the Tushino District Heating Plant. Honeywell put \$1.0 million of its own money into the project, and expects to get payback in 1 ½ years. To try and help address the financing problem on the Russian side, they are seeking to get approval from the Russian Government to have payment come from the state gas company, GAZPRO, in the form of gas, which, in turn, would be marketed by Gaz de France on behalf of Honeywell; Gaz de France has already agreed, but there are still some problems to be worked out on the Russian side of the table.

Honeywell also was successful in getting the City of St. Petersburg to support its proposal to conduct a feasibility study for a district heating sub-station improvement project. The project should go forward once a funding source is found, and hopefully lead to eventual project implementation.

#### Contribution of the Various Studies on Policy, Institutional and Pricing Reforms

The policy and institutional studies conducted by RMA and IRG formed a central part of the wrap-up seminars. The contractors wanted to get the message across that technology can be an effective solution only if the structures are in place to encourage energy conservation. As it turns out, although many of the NIS participants were unfamiliar with how such incentives would operate in a free-market system, they were keenly aware that real savings could not be realized without policy and institutional reform, including pricing.

One participant commented that "economic factors have inhibited any incentive to be more efficient." During a conversation in Kiev, the evaluator asked a chief engineer of the district heating plant whether awareness about the need for energy efficiency had been raised as a result of the project. He responded by saying "yes, but without economic and political incentives, real progress can't be made."

During a presentation in St. Petersburg, a representative from the Moscow Energy Efficiency Center stated that "without good legislation, our efforts to improve the efficient use of energy will have little impact." The Center has drafted new policies and regulations governing the use of power and energy supplies, and submitted these to the government. However, they have not yet been seriously considered in the Russian Parliament. The center has also carried out an energy audit of twenty industries in Russia which it is using to support its campaign for reform.

Beyond district heating, overall interest in energy efficiency is on the rise. Most municipalities where the project was active had either recently established, or were in the process of establishing, an organization to help promote national energy efficiency legislation, and energy efficiency practices among producers and consumers alike. Other donors are also focusing on energy efficiency and conservation techniques: the World Bank (who sponsored a major workshop in Kiev in June), the Japanese (although they may be targeting energy production, rather than conservation, technologies), the EEC and EBRD. The evaluator was told by a seminar participant that the EEC is actively promoting European manufacturers of energy saving technologies.

The pricing studies, in most cases, have already been completed. Only Kyrgyzstan is pending, because a fourth sub-sector, hydro-electric, was recently added to the terms of reference. In each case, the contractors worked with the World Bank teams to complete their portion of the study. The only exception was Russia, where the World Bank team apparently didn't make a serious effort to involve the RCG consultant in its work. Still, RCG did complete a study of natural gas pricing for A.I.D.

#### **IV. CONCLUSIONS**

##### **Achievement of Project Purpose**

There are three components of overall project purpose which can be addressed. One has to do with what might be called the "main purpose" of the project, that is, to demonstrate gains that can be made by using energy efficiency technologies in district heating systems. A second purpose has to do with creating opportunities for U.S. businesses to enter new markets for their products in the NIS. A third has to do with promoting reforms needed in policies, regulations, and institutions that will contribute to the goals of energy efficiency and world market pricing of energy resources.

In all three cases, the project activities have been completed as specified in the scopes of work, and project purpose has been realized. In addition, the work has been carried out in a "high visibility" environment, publicly demonstrating the U.S. commitment to assisting in the critical areas of heating and energy efficiency.

In the case of the upgrades made to the district heating systems, the scope of work identified three purposes, each of which were accomplished. They were to:

- Foster improved management of energy use in the heating plants by identifying and implementing immediately cost-effective "low cost-no cost" energy efficiency improvements;
- Transfer energy auditing and management techniques including financial and economic analysis techniques; and

- Provide equipment support to implement lo-cost options, improve monitoring and energy management, and identify additional energy efficiency opportunities.

The second purpose, to promote U.S. business opportunities, although it was explicit only in the RCG scope of work, is worth mentioning for all three contractors. The U.S. delegates who attended the seminars in Russia were clearly pleased with the opportunity, and had also made progress in developing business ventures.

In Byelarus, Kiev, Almaty and Bishkek, it was in many ways a "bonus" that the project was able to help leverage agreements between U.S. manufacturers and local enterprises that will be important for realizing the sustainability of benefits. In all instances, this has been a good example of how U.S. government and U.S. business can cooperate for mutual gain.

The reasons for doing the various studies (third purpose) were pretty straightforward, although the ultimate objective -- actual reforms -- will depend heavily on numerous other factors not within the project's manageable interest. Nonetheless, the documents did achieve their objective of identifying policy, institutional and pricing issues and constraints, and making recommendations about what should be done to address them.

Overall, this project has provided a good entry point for the U.S. to assist the NIS in its problems relating to energy supply and demand. The work was well-managed; the results were definitive; and, the experience of working together was positive for both the U.S. and the NIS participants. This has created a solid basis upon which to build future cooperation in the energy sector.

### **Contributions to Higher-Order Objectives in A.I.D.'s Program**

When put together, the various activities undertaken in the District Heating project constitute a basis upon which higher order program objectives for the energy and environmental sector in the NIS can be achieved. The strategy of the project has been to address two sets of issues, one technical and the other policy and regulatory in nature. Both are areas that need to be developed in order for the technology to be adopted, and the resultant benefits to be sustained. Working on both issues creates a better likelihood -- which can be thought of in LogFrame terms -- that the project outputs will contribute to program level objectives.

The project, therefore, has combined (a) the demonstration of techniques, methods, and technologies to produce energy savings, with (b) a parallel effort to reform the economic and regulatory environment, so that the proper incentives are in place to promote adoption of these techniques. This approach has made a significant positive contribution to two of the four strategic objectives of the Energy Efficiency and Market Reform program by:

- Cutting energy waste and reducing environmental pollution through improved energy efficiency; this also contributes to reducing dependency on energy

imports through lower consumption (energy efficiency and performance improvement); and

- Introducing market-driven approaches to energy supply-demand balance and to incentives for efficient use and new investments (energy pricing policy and institutional reform).<sup>4</sup>

In addition, the project has produced immediate results that will provide needed momentum to support achievement of longer-term impacts. These include: efficiency gains from the equipment provided by the project; promotion of U.S. products; promotion of U.S.-NIS business relations and joint ventures; public awareness; and, guidelines for necessary policy, regulatory and institutional reforms to get broader benefits in the energy sector.

Although the project has demonstrated its success in creating the basis for program-level impacts, the effects would be minimal if A.I.D.'s efforts were to stop here. At relatively little cost to date under this project, A.I.D. has been able to produce benefits, while at the same time developing the networks with local institutions for future cooperation. Additional demonstration projects -- which have shown themselves to be cost effective through a straightforward analysis of the "payback" period for the equipment provided -- would broaden and strengthen these results. Additional work on the policy and regulatory issues -- which is already being planned by A.I.D. -- will also make an important contribution to keeping the momentum going. But, based on the experience of the District Heating project, it can be said that both tracks working together will achieve better results than if one proceeds without the other.

### **Lessons Learned that are Useful for Planning Future Development Assistance**

The work to date under the District Heating project has shown that while on the one hand there is tremendous potential for developing and disseminating energy saving technologies in the NIS, there exists, on the other hand, certain obstacles which must be overcome. These opportunities and obstacles are probably not unique to the energy sector. In fact, A.I.D. and its contractors working on this project have learned some lessons that might be useful experience for planning future development assistance activities in this and other sectors:

- The knowledge, education and skill of local counterparts is advanced. The ability to understand, adapt, modify and produce energy saving technologies is readily available. Some of the equipment is in fact already being produced locally in some form.

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<sup>4</sup> "Energy Efficiency and Market Reform," A.I.D. program description, February 1993. The other two strategic objectives are: to improve energy production and delivery from existing facilities and promote most efficient alternatives for new capacity; and, to reduce the risk of accidents in unsafe civilian nuclear power stations.

- Professional working relationships and a spirit of cooperation and teamwork can be readily developed between U.S. and NIS specialists. The commitment among NIS technicians and professionals is high when it comes to improving their field of expertise. They are proud of their own abilities, and seek to work in a spirit of collegium with their U.S. counterparts.
- Although many people in the NIS are in favor of economic reforms, not very many have a good understanding of the workings of a free-enterprise economy, a fact which is not surprising given the history of central planning under the former Soviet Union. Many aspiring entrepreneurs are looking for quick profits. The contractors and U.S. business representatives both commented that their NIS counterparts had unrealistic expectations about how to develop a business. There is a need for potential joint-venture partners and local manufacturers to be better educated about how to create a successful business, about risk, market penetration, cost control, pricing and the like.
- Financing is the biggest obstacle to getting production underway. Also, the incentives and regulations are not yet in place -- although some progress is being made -- to encourage energy consumers to save. Consumer demand is of course vital to create a viable market for energy efficiency technology.

## **V. RECOMMENDATIONS**

### **Follow-up Project Activities**

Three types of follow-up activities should be considered by the NIS Task Force. These are recommended for the contribution they can make in more broadly promoting the introduction of energy efficiency technologies and practices in the NIS.

One recommendation is to combine forces of the energy and private sector offices in the Task Force to develop a scheme which will help finance local small and medium-sized enterprises that have the capacity to manufacture energy efficiency goods for NIS markets. Some enterprises already exist in the private sector, although they are struggling to find foreign partners that will invest in their business and increase their chances of survival. This effort could help promote U.S.-NIS joint ventures, improve the availability of high-quality equipment in the NIS, and further the goal of opening new markets for U.S. companies. As a first step, A.I.D. could fund independent feasibility studies of the market potential, financing requirements, industrial and manufacturing capacity, and so forth.

A.I.D. might even consider project financing, of the nature being implemented at the Tushino district heating plant in Moscow, which would upgrade the facilities of major energy consumers. Honeywell indicated that individual projects costing in the range of \$500,000 to

\$1,000,000 would bring significant savings to many facilities in the NIS, with a payback in one to one and a half years.

A second recommendation is to do more demonstration projects of this nature, targeting industry as well as district heating. The equipment costs are relatively modest in comparison to the gains to be made, not only at the facility which receives the equipment, but also in terms of the general public awareness these projects create, and in terms of the demand it helps to create for new conservation technologies among other energy producers and consumers.

A.I.D. should continue, wherever possible, to promote greater awareness in the NIS of the need for conservation. This can be done by strengthening associations and partnerships, for example of the type being promoted by the U.S. Energy Association under its grant from A.I.D. This objective will also be furthered by sponsoring training workshops, seminars and conferences, like the ones discussed in this report, that bring together technicians, researchers, businesses and government officials to talk about and promote energy efficiency. Other workshops could also be more straightforward, and provide training to local counterparts in energy efficiency concepts and techniques. A final component of this effort would be to help in the development of energy efficiency legislation, new building codes, etc.

Finally, the business opportunities that have been identified under this project should be disseminated more widely to interested U.S. companies working in the energy field. A.I.D. should share its findings with the Department of Commerce, U.S. Chambers in the NIS, commercial attachés, etc., who might pass this information along to companies who are seeking partnerships, joint ventures, or local distributors for their products.

### **Recommended Monitoring Efforts**

From this point forward, A.I.D. should continue to monitor and report on developments in the energy efficiency field in the NIS. Although savings have already been demonstrated through the installed equipment under the project, ongoing monitoring will help the NIS Task Force in planning other energy related activities, as well as in knowing whether the assistance A.I.D. is providing is in fact having the desired impact. The initial results are promising. A formalized monitoring and evaluation plan will help A.I.D. in managing future efforts to achieve sustainable benefits.

The first area to be monitored has to do with the success of U.S. businesses to enter new markets in the NIS. This would include basic information about joint ventures and sales over time. The evaluator asked some of the representatives of U.S. businesses whether they would be willing to provide this type of information, and they said in fact that they would. It would be fairly easy for someone to develop an informal network of contacts within selected U.S. companies who could be called upon on a regular basis to provide updates on how they are progressing in the NIS.

Another area to monitor is whether policy and regulatory reforms are written into law, and, where necessary, enforced. Because A.I.D. is beginning a new project in the energy policy area, the data could be made available through the contractor selected to carry out the project.

A third area would be the rate of adoption of new technologies in a cross-sampling of energy producers and consumers. This could be done through a random sample survey, establishing a baseline, with regular follow-up to measure changes. With the proper local support, this effort could be low-cost, and somewhat informal, by using telephone conversations to collect data from key informants at selected facilities, etc.

**ANNEX A  
CONTACT LIST**

<b>Name</b>	<b>Company/Organization</b>
<b><u>NIS Participants:</u></b>	
Mukhtar K. Kembraev	"Alma-Ataenergo" Heating Systems Enterprise
Muravev Igor Nikilaevich	Russianergo, Moscow
Konstansi G.Terpogosov	Firm "Praktika", Kazakhstan
Alexi Invanovich Tregupov	Deputy Chairman, Committee of Buildings and Energy Supply, City of St. Petersburg
Victor Lysyh	Ukranian Commission for Nuclear and Radiational Safety
Anitoly Apkalikov	Alma-Ata Enegro Heating Systems Enterprise
Miribeck Bataknoy	Chief, Biskek Heating Systems Enterprise
Bolot Botbaev	Executive Director, Kyrgyz State Energy Company
Alexei Chunkchenovitch Lee	Bishkek Heating Systems Enterprise
Alexey Kniazev	Private Entrepreneur
Victoria Kuznetsova	Asea Brown Boveri, Ukraine
Leonid V. Rodichev	"The Thermal Nets"/AC Lenenergo
Andrew V. Marinov	Ukraine Department of Energy
Victor Dmitrievich Levin	Almatynskaja Heat Power Station
Vladimir N. Chernyshev	LenEnergo/Electrical Power Administration
Zaituna K. Sarybayeva	Kazakh State Research Institute of Scientific-Technical Information/ Republican Information-Translation Centre
<b><u>Contractors:</u></b>	
Gerry Decker	International Resources Group, Ltd.
Frank Wang	International Resources Group, Ltd.
John P. Banks	International Resources Group Ltd.
Lisa Hindman	International Resources Group Ltd.
Charles Ebinger	International Resources Group Ltd.
Mary Worzala	Resource Management Associates
Wesley K. Foell	Resource Management Associates

<b>Name</b>	<b>Company/Organization</b>
Charles H. Fafard, P.E.	Resource Management Associates
John L. Nicol, P.E.	Resource Management Associates
David A. Keith, P.E.	RCG/Hagler, Bailly, Inc.
Suzanne Goldstein-Smith	RCG/Hagler, Bailly, Inc.
El Oliker	Joseph Technology Corporation, Inc.(RCG Subcontractor)
Greg Savoy	Rising Earth Productions (producing documentary film of Russian seminars under subcontract to RCG)
Albert H. Skeath	U.S. Energy Association/Energy Industry Partnership Program
Evgueny (Gene) Fominykh, Program Specialist	U.S. Energy Association/Energy Industry Partnership Program

U.S. Manufacturers:

Helmut W. Mayer	Honeywell, Austria
Joseph A. Vilardo	Honeywell/Home and Building Control
Dane D. McSpedon	Honeywell/Home and Building Control
Alexander Zygmuntowicz	Armstrong International, S.A.
Ron Schneider	Armstrong International, S.A.
Leslie K. Fradken, President	The Circle Group
Charles L. Wills	Caterpillar/Power Systems Department
Brook S. Horowitz	General Electric Lighting
Rod Scriban	SNC-Shawinigan, Inc.
Graham P. Norton-Standen	Digital Equipment Co. Ltd.
John W. Brace	Northland Power/Business Development
A.F. (Tony) Anderson	Northland Power/Finance & Administration
Raj Bery	Foster, Wheeler International Corporation
Csaba Csomos	Foster Wheeler International Corporation
J. Tuit	General Motors Nederland B.V./Allison Gas Turbine Division

A.I.D.

<b>Name</b>	<b>Company/Organization</b>
Edvard Markeset, P.E.	USAID/NIS Task Force/Office of Energy, Environment & Technology
Charles Mosley, Director	USAID/Moscow/Office of Energy, Environment & Technology Activities
Galina Krivova	USAID/Moscow/Office of Energy, Environment & Technology Activities

**Other Donor/Int'l Organizations:**

Barbara J. Evans	World Bank/Europe and Central Asia, Dept. IV/Infrastructure Operations
Thomas M. Kearney	World Bank/Energy and Environment
Istvan Dobozi	World Bank/Europe & Central Asia, Middle East and North Africa Regions/ Technical Department/Industry & Energy Division
Emily Landis Walker	European Bank for Reconstruction and Development
William Walker	London Business School/CIS-Middle Europe Centre

**ANNEX B**

**EVALUATION SCOPE OF WORK**

## Scope of Work for Russell Webster

### Evaluation of the District Heating Component of the Energy Efficiency and Market Reform Project (110-0002)

The contractor will review the objectives of the Energy Efficiency and Market Reform Project, the objectives of the District Heating component of this project, and the indicators that will show progress toward achieving these objectives and prepare a report for AID that will:

1. Summarize work done under the component to date;
2. Indicate and verify outputs under the component to date and likely additional outputs which may occur;
3. Identify progress toward achieving project and component objectives, including the impact of the component on the problems it was designed to address; and
4. Contain recommendations for actions to improve the likelihood objectives will be attained both under the project as currently planned as well as through further efforts that might be made in the future with or without AID, or other donor support.

Included in the report should be an indication of host country public and private sector interest in and acceptability of the project component.

To carry out this work, the contractor should attend at least three energy efficiency seminars being held in Kiev, St. Petersburg, Almaty, and Bishkek, including at least one being hosted by each of the three component contractors; and if possible, visit one or more pilot sites where project work was performed. In conjunction with these seminars and any possible site visits, the contractor should interview project contractors, host country public and private sector individuals, and U.S. public and private sector individuals to verify progress, determine problems/possible solutions, determine impact and likely impact of the component including the likelihood of changes in energy use resulting from project activities, and the likelihood of expanded use of US equipment and technology.

The contractor's report should be provided to AID in draft in five copies within 3 weeks of the completion of field travel. The report should contain the information called for above as well as annexes indicating who was contacted and containing any statistical material relevant to the report. Three copies of these reports should be provided to Carlos Pascual, AID/NIS/PAC, and two copies should be provided to Scott Smith, AID/POL/CDIE. A final report in the same number of copies to the same recipients should be provided within two weeks of the contractor's receipt of comments by AID on the draft report.

Background information on this project and this component has

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already been provided to the contractor in conjunction with work the contractor is already doing regarding development of an evaluation plan for the project, including the refinement of objectives and indicators.