PD-ABW-632

EcoLinks Partnership Grants Program
Quarterly Progress Report
October – December 2001

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EcoLinks Partnership Grants
Quarterly Progress Report
October 1, 2001 – December 31, 2001

Part I. Narrative Discussion

1. Brief overview of activity status and major accomplishments this quarter.

Status:

Challenge Grants: The first three cycles of grants have been closed. The fourth cycle is in progress. The fifth cycle was awarded in November – 31 grants for $1.4 million. A fast-track cycle was launched in November. To date 165 Challenge Grants have been awarded for a total of $7.7 million.

Quick Response Awards: QRAs continue to be offered on a rolling basis. During the quarter, 9 Quick Response Awards were awarded for $37,300. To date, 304 QRAs have been awarded for about $1.3 million.

Financial: Estimated total program expenses at the end of the quarter are $13.9 million. Total IIE cost share is $3 million.

Major Achievements:

Grants Administration:

- On November 5 the selection panel awarded 31 Challenge Grants for the fifth cycle. Project summaries are provided in Annex A. The breakdown of grants by country is below:

Bosnia & Herzegovina	2	Macedonia	1
Bulgaria	2	Romania	11
Croatia	2	Russia Far East	3
Kazakhstan	3	Ukraine	7

- The breakdown of these fifth-cycle grants by topic is below:

Global Climate Change	39%
Cleaner Production	35%
Water Quality Management	26%

- The breakdown by Project-Leader organization is below:

Local Govts/Utilities	45%
Businesses	55%

- In the fifth cycle, 25 of the 31 Project Leaders selected U.S. Partners. For all five cycles, 75% of the Project Leaders selected U.S. Partners, representing 33 different states and the District of Columbia. A breakdown of EcoLinks partnerships with U.S. companies by state is provided in Annex B.

- On November 6 a fast-track Challenge Grants cycle was launched. Concept papers are due on January 14, full applications are due on April 8 and the selection panel meets on May 30.

- To publicize this fast-track cycle, the country program officers conducted 22 information workshops attended by 773 people.

- Ralph Braccio, a consultant with ERM, was invited to join the selection panel. His prior experience at The World Bank packaging environmental projects for financing will be particularly useful.

- In the last quarterly report initial responses were reported from a survey conducted in September among grantees that participated in Challenge Grants Cycles 1 and 2. The survey's aim is to obtain information on follow-up activities and feedback on staff support. Questionnaires were sent to 74 grantees (both Project Leaders and American partners), and as of December 31 completed questionnaires were received from 27 of them. Six additional responses were received since the last quarterly report, making a 36% response rate. The main results were that 78% of the respondents stated that their partnership was continuing, all the respondents said that the capacity of the Project Leader was strengthened as a result of the grant, and 90% rated staff support as either excellent or good.

- During the quarter, 9 Quick Response Awards were awarded for $37,300. A listing is provided in Annex C. Of this total, two facilitated Challenge Grant applications and seven pursued environmental trade and investment relationships.

- One notable QRA success was reported during the quarter. During December 2001, the Vice President of the Khabarovsk-based SKIF Company traveled on a Quick Response Award to visit Florida Heat Pump Manufacturing Company in Fort Lauderdale, FL (FHP) and discuss a possible trade deal. SKIF sells and installs air conditioning and heating systems in Russia Far East and became interested in Florida Heat Pump's environmentally friendly, energy efficient products. As a result of this EcoLinks QRA, SKIF signed a $1 million five-year distribution agreement with the Florida Heat Pump Company to sell and install FHP's geothermal heat pumps in the Russia Far East. Geothermal heat pumps use solar energy accumulated in the earth's surface to provide clean heat and hot water. FHP's geothermal heat pumps have a short payback period and are rated by customers as more reliable than traditional fossil-fuel systems.

- To date 304 QRAs have been awarded for $1,292,000. The country breakdown is provided below:

Bulgaria	47	Lithuania	5
Bosnia Herzegovina	4	Macedonia	19
Croatia	17	Moldova	1
Czech Republic	21	Poland	27
Estonia	1	Russia	32
Georgia	3	Romania	48
Hungary	21	Slovakia	5
Kazakhstan	26	Ukraine	24
Latvia	2	Turkmenistan	1

- During the quarter, seven Best Practices were prepared from closed Challenge Grants:

  - Improving Waste Management at Singegorskaya Mine in Sakhalin Island, Russia
  - Improving the Environmental Performance of Odessa CHPP-2 Heat Boilers in Teplodar, Ukraine
  - Reducing Wastewater Contamination at Celhart Donaris in Braila, Romania
  - Developing an Environmental Management System at Concern Stirol in Ukraine
  - Environmentally Friendly Leather Production in Croatia
  - Regional Water Management in Bulgaria
  - Promoting Environmental Protection and Energy Efficiency at Elprom-Elin in Bulgaria

  These Best Practices are provided in Annex D. In addition, a new Best Practice format was prepared that is more user friendly and a new Best Practices webpage was developed that provides search options and is easier to read.

- At the end of the quarter grantees reported that they had raised $40.9 million in additional funds for EcoLinks-related financing, trade or investment. A list of these post-grant successes is provided in Annex E.

  An exceptional success was reported in Macedonia. A Challenge Grant was awarded to the Electric Power Company of Macedonia to assess the feasibility of rehabilitating seven small hydro power plants. As a result of this EcoLinks grant, the power company has signed a $19.6 million concession contract with a consortium of British and Czech investors to establish a new joint venture that will rehabilitate, operate and transfer the seven hydro plants over eleven years.

Program Outreach and Coordination:

- During the quarter senior managers updated all the Missions with recent program developments. In Kazakhstan the CoP presented the program not only to Ambassador Larry Napper and the USAID Mission but also to the new Senior Commercial Officer, James Fluker.

- In October the CoP presented the Grants Program at Ex-Im Bank's Regional Financing Conference in Dubrovnik.

- In December the Deputy Director presented the Grants Program at an EcoLinks seminar in Washington. Attendees included U.S. companies as well as a Bulgarian MEEP's Program delegation and a Romanian water delegation.

Staffing Office and Network:

- In October the annual staff training program was organized in Kiev. During this three-day program, sessions were held on environmental project financing, greenhouse gas financing mechanisms, integrated solutions to environmental problems, grantees' best practices and various grant administration issues.

- The program officer in Kazakhstan resigned effective January 18 to accept a position with the USAID Mission. Her replacement is being recruited.

Cost Share and Financial Information:

- By the end of the quarter, IIE's total cost-share contribution to the program amounted to $3 million.

- Estimated total program expenditures to date are $13.9 million. The ratio of administrative expenses to grants continues to be well within the USAID guidelines. A preliminary financial report is attached as Appendix F. As soon as final expense reports are available from REC, a final financial report will be submitted.

2. Implementation issues identified last period and status of resolution.

- At USAID's request, a fast-track cycle of Challenge Grants was launched on November 6.

- The extension of the program is still pending.

3. Implementation issues and/or procurement issues anticipated in the next reporting period.

- The Missions need to be approached by USAID/W in the Jan-Mar 02 period about possible buy-in, including Missions in Yugoslavia and Bosnia that are not now fully participating in the program.

- A program extension is needed in order to plan for additional grant cycles and possibly include new countries.

January 28, 2002

IIE's Fourteenth Quarterly Report

For the Period: October 1, 2001 – December 31, 2001

Prepared by: Winston Bowman, IIE
Date Prepared: January 28, 2002

Part II. Basic Activity Information

Activity Name: Eurasian-American Partnerships for Environmentally Sustainable Economies – EcoLinks	Life of Activity Value:	$23,297,897
Purpose of Activity: Promote market-based solutions to Environmental problems in CEE/NIS, with emphasis on the urban and industrial sectors.	Amount to be obligated:	$ 5,794,194
Implementing Partner: Institute of International Education (IIE)	Amount obligated:	$17,503,703
Award/Amendment No., Type (CA): EE-A-00-98-00020	IPSES Funds 180-0039 (CEE) EPT Funds 110-0003 (NIS)	$ 8,665,908 $ 5,288,538
Period of Award: 07/01/98 to 06/30/03	Funds Expended to Date (Total):	$13,954,446
CO/CTO/COP: Sherrill Fachet (AO), Carl F. Maxwell (CTO), /Winston Bowman (COP).	Obligated Funds Remaining:	$ 3,549,257
Linked to S.O. No.: 1.6 Increased Environmental Management Capacity to Promote Sustainable Economic Growth	Next Obligation Due By:	
Intermediate Results Nos.: IR 1.6.2 (Trade), IR 1.6.3a (Best Practices), and IR 1.6.4 (Inst.)		

Part III. Results Performance

Result Description	Result Indicator Performance
Result No. 1.6.3a: "Best Practices" Adopted by Industrial and Public Sectors. **Results:** Successfully operating environmental partnerships will be established to promote solutions to environmental problems appropriate to market-oriented economies and democratic societies. **Indicators:** (1) Number of projects that result in a best practice to solve an environmental problem; (2) Number of projects that result in a market-based solution to an environmental problem ; (3) Number of Quick Response Awards (QRAs) that result in a collaborative Challenge Grant Proposals.	
Result Indicator (1): Number of projects that result in a best practice to solve an environmental problem Unit of Measurement: same	**Life of Strategy Target:** 70 **Cumulative Achievement to Date:** 37 **Current Year Target (6/02):** 20 **Current Quarter Achievement:** 5 **Current Year Achievement** 12
Result Indicator (2): Number of projects that result in a market-based solution to an environmental problem Unit of Measurement: same	**Life of Strategy Target:.** 225 **Cumulative Achievement to Date:** 87 **Current Year Target (6/02):** 45 **Current Quarter Achievement:** 18 **Current Year Achievement** 41
Result No. 1.6.4: Increased Institutional Ability to Identify and Remedy Environmental Problems. **Results:** Successfully operating environmental partnerships will be established to promote solutions to environmental problems appropriate to market-oriented economies and democratic societies. **Indicators:** (1) Number of Challenge Grant proposals that met prescreening criteria. (2) Number of partner searches that result in an on-going relationship (e.g. challenge grant proposal); (3) Number of projects that result in institutional changes that enhance the project participant's ability to identify and remedy environmental problems.	
Result Indicator (1): Number of Challenge Grant proposals that met prescreening criteria. Unit of Measurement: same	**Life of Strategy Target:** 525 **Cumulative Achievement to Date:** 277 **Current Year Target (6/02):** 50 **Current Year Achievement:** 50

Result Indicator (2): Number of partner searches that result in an on-going relationship (e.g. challenge grant proposal) Unit of Measurement: same	**Life of Strategy Target:** 150 **Cumulative Achievement to Date:** 56 **Current Program Year (6/02) Target:** 15 **Current Quarter Achievement:** 0 **Current Year Achievement:** 6
Result Indicator (3): Number of projects that result in institutional changes that enhance the project participant's ability to identify and remedy environmental problems Unit of Measurement: same	**Life of Strategy Target:** 150 ***Cumulative Achievement to Date:*** **56** **Current Program Year (6/02) Target:** 30 **Current Quarter Achievement:** **12** **Current Year Achievement:** **26**

Result No. 1.6.2: Increased environmental trade, finance, and investment

Results: Successfully operating environmental partnerships will be established to promote solutions to environmental problems appropriate to market-oriented economies and democratic societies.

Indicators: (1)Number of QRAs that result in an agreement to pursue environmental trade, finance, or investment; will also track the number of QRAs that result in a Challenge Grant Proposal (2) Number of projects that result in an agreement to further pursue environmental trade, finance, or investment.

Result Indicator (1): Number of QRAs that result in an agreement to pursue environmental trade, finance, or investment; also track the number that result in a Challenge Grant Proposal Unit of Measurement: same	**Life of Strategy Target:** 350 **Cumulative Achievement to Date:** Total QRAs = 304, Trade –114, Grants – 190 **Current Year Target (6/02):** Total QRAs = 120, Trade – 40, Grants – 80 **Current Quarter Achievement:** Total QRAs = 9; Trade - 7; Grants - 2 **Current Year Achievement:** Total QRAs = 85; Trade – 30; Grants – 55
Result Indicator (2): Number of Challenge Grant projects that result in an agreement to further pursue environmental trade, finance, or investment. Unit of Measurement: same	**Life of Strategy Target:**. 70 **Cumulative Achievement to Date:** 27 **Current Year Target (6/02):** 15 **Current Quarter Achievement:** 3 ***Current Year Achievement:*** 12

Annex A
Summaries of Awarded Challenge Grants
Fifth Cycle – 2001-2002

In November, 2001 the EcoLinks Grants Selection Panel met in Budapest, Hungary and awarded 31 Challenge Grants in cycle 5 for a total of about $1,400,000. The grant topics were Cleaner Production, Water Quality Management and Global Climate Change. By country breakdown, 2 grants were awarded in Bosnia and Herzegovina, 2 in Bulgaria, 2 in Croatia, 3 in Kazakhstan, 1 in FYR Macedonia, 11 in Romania, 3 in Russia, and 7 in Ukraine. Brief descriptions of the awarded grants are provided below.

BOSNIA and HERZEGOVINA

1) Title: *Unaccounted for Water Reduction Plan*
Leader: Vodovod I Kanalizacija, Konjic, Bosnia and Herzegovina
Partner: Valu Add Management Services, North Andover, MA, USA
Partner: Hydro-Engineering Institute, Sarajevo, Bosnia and Herzegovina
Grant Total: $49,339
Summary: The water supply utility in Konjic is faced with a high percentage of unaccounted-for-water (UFW) that is usually at 60 – 70% of their total water production. The causes of UFW will be assessed and an unaccounted-for-water reduction plan consisting of precise measures to correct each cause will be developed. This will be completed with the goal of reducing UFW, decreasing the burden on local water resources, and improving the management of the water supply system.
Results: An unaccounted-for-water reduction plan that will reduce UFW to 25%. The plan will include: guidelines for mapping, metering improvements, activities needed for full network monitoring, activities needed to reduce losses, and a long-term policy for the reduction of unauthorized and un-metered water use.

2) Title: Substitution of Drinking with Technological Water and Introduction of a Recycling System in the Production Process
Leader: UNIS UNISGAL d.o.o., Konjic, Bosnia and Herzegovina
Partner: Recovery Engineering and Sales, Inc. (REASCO), Arvada, CO, USA
Partner: PLAN d.o.o., Konjic, Bosnia and Herzegovina
Grant Total: $47,390
Summary: The UNISGAL Company, a coating and galvanization plant, uses drinking water from the City of Konjic's water supply system as technological process water. A high percentage of this water is discharged as wastewater rather than recycled. This project will examine options for alternative sources of technological water such as replacing the drinking water with water from the Neretva River or by using underground water through a system of wells. It will also consider decreasing process water input demand by recycling the cooling water and plating process rinse water. Recycling will decrease the volume of wastewater discharged from the company and reduce the potential for toxic metal ion discharges.
Results: A feasibility study based on production processes data that provides cost estimates and comparisons for different solutions as well as a recommended system for implementation.

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BULGARIA

3) Title: Development of Constructed Wetlands Wastewater Management System
Leader: Municipality of Sewliewo, Bulgaria
Partner: ECOKAN LLC, Cary, North Carolina, USA
Grant Total: $50,000
Summary: The Municipality of Sewliewo's existing sewage system is incomplete and discharges untreated wastewater directly into the nearby creek. The municipality is looking for a reliable, cost effective and low maintenance system to address this problem. Under this project, they will examine the use of constructed wetlands for treatment of their municipal wastewater. Options for a constructed wetlands wastewater management system will be proposed and evaluated based on local conditions.
Results: A feasibility study, environmental impact assessment, technical designs and cost models will be developed to examine the local use of constructed wetland systems as a wastewater treatment technology.

4) **Title:** Plovdiv Municipal Water System Leak Detection and Abatement
Leader: Plovdiv Municipality, Bulgaria
Partner: EWA Environmental Technologies Inc., Herndon, VA, USA
Partner: Stalker-KM LTD, Sofia, Bulgaria
Grant Total: $49,963
Summary: The municipal government of Plovdiv has started a long-term development initiative to modernize and expand its water distribution system. An important initial step in this multi-year, multi-phased program is the assessment of the current state of Plovdiv's drinking water distribution system and the implementation of a leak detection and abatement project. This project will demonstrate on a pilot scale a leading-edge technology for water system leak detection using web and wireless monitoring and reporting systems. Based on the outcome of the demonstration, a feasibility study will be developed for the system-wide deployment of the system.
Results: A pilot demonstration project of the leak detection system in a selected zone and a feasibility study for system-wide deployment.

CROATIA

5) Title: Cleaner Production and Economical Management of Utilities
Leader: Jarran Galenski Laboratorij d.d.(JGL), Rijeka, Croatia
Partner: PMC Technologies, Exton, PA, USA
Grant Total: $50,000
Summary: This cleaner production project will reduce the environmental impacts from JGL's pharmaceutical manufacturing process. An environmental audit will be performed which will develop a process flow diagram for the facility to quantify wastes, emissions and energy consumption. A prioritized list of waste minimization, pollution prevention alternatives and energy saving will be developed. Some initial improvements by reducing water and energy consumption will be performed during the project.
Results: An environmental audit will be completed that includes a process flow diagram, waste and emissions inventories, and a prioritized list of facility improvements.

6) Title: Topusko Greenhouse Project, Reuse of Energy and Cleaner Production
Leader: Municipality of Topusko, Topusko,Croatia
Partner: LEMTECH Konsulting, Krakow, Poland
Grant Total: $49,830
Summary: The project will evaluate the feasibility of establishing a public-private partnership to operate energy efficient and environmentally sound greenhouse facilities in the city of Topusko. The use of hot geothermal water will be considered as an efficient, cost effective energy source for the facilities and a business plan will be developed for organic food and flower production.
Results: A feasibility study and business plan will be prepared to attract international investors.

KAZAKHSTAN

7) **Title:** Introduction of Cleaner Production Practices at FoodMaster's Dairies
Leader: FoodMaster Company, Almaty, Kazakhstan
Partner: Environmental Control Opportunities, LLC, Waynesboro, VA, USA
Grant Total: $50,000
Summary: This project will help FoodMaster Co. identify alternative solutions to their environmental problems related to product waste generation, water use, and energy use at its five plants in Kazakhstan. Specifically, they will design a plan for implementing EMS and ISO 14000 standards, develop a cost-effective and ecologically sound plan for dealing with whey wastes, and decrease water consumption through conservation and recycling.
Results: An Environmental Management Manual for the dairy facilities will be produced based on the needs assessment and identified solutions.

8) **Title:** Quality Management of the Drinking Water in Leninogorsk
Leader: Leninogorsk Vodokanal, Leninogorsk, Kazakhstan
Partner: Envirosmith Engineering, Inc., Suwanee, GA, USA
Grant Total: $50,000
Summary: The goal of this project is to improve the reliability and efficiency of the Leninogorsk Vodokanal water treatment plant. The partners will assess the condition of the plant, develop a near-term and long-term plan to renovate it and then prepare a feasibility study for long-term improvements. This study along with tender documents will be presented to financial institutions to fund the priority long-term improvements.
Results: A prioritized improvement plan, tender documents and a feasibility study will be developed as a first step towards improving the operating efficiency of the treatment plant.

9) Title: Development of Integrated Solid Waste Management System at the Ferroalloys Plant
Leader: JSC Ferrochrome, Aktubiusk Ferroalloys Plant, TNC Kazchrome, Aktobe, Kazakhstan
Partner: EnSafe Inc., Memphis, Tennessee, USA
Grant Total: $48,579
Summary: This project will work towards developing an integrated industrial solid waste management system for the Aktubinsk ferroalloys plant. The project will focus on low-carbon slag waste that is a major problem because of its high concentration of soluble, toxic hexavalent chromium. The current slag generation and management practices as well as the potential impacts on environmental receptors and human health will be reviewed. Following this review, a feasibility study will be performed to identify alternative waste management practices and an economic, beneficial use for the slag. The slag is comprised mostly of calcium oxide (or quick lime), a valuable and widely used industrial compound. Results of the study will be presented to Ferrochrome's top management for integration into the plant's operations.

Results: A feasibility study for alternatives for low-carbon slag production, utilization, and disposal as well as a management plan.

MACEDONIA

10) Title: Improvement of Municipal Solid Waste Management in Veles
Leader: *Municipality of Veles, Republic of Macedonia*
Partner: Burge & Associates, Inc., Tempi, Arizona, USA
Grant Total: $50,000
Summary: The primary goals of this project are to collect information and data about the present situation with solid waste management in the Municipality of Veles; to analyze and determine options for solid waste management improvements; and to prepare a strategy for implementing the most feasible options. This strategy will focus on ways to reduce the amount of waste that is deposited at the landfill.
Results: A feasibility study that includes a report on the current state of the municipal waste management system, a strategy for improvements, and a public education program.

ROMANIA

11) Title: Energy from Sawmill Waste in Bistrita Nasaud County
Leader: Ilva Mica City Hall
Partner: Project Performance Corporation, Richland, WA, USA
Partner: GIE FOLOS SRL, Bucharest, Romania
Grant Total: 49,618
Summary: The City Hall of Ilva Mica is working with other villages in Bistrita Nasaud County to address the environmental problems caused by the wood processing operations in the region, mainly their waste production. The partners will look at various options for improving the efficiency and quality of wood production and will examine the possibility of installing a biomass energy system. This biomass-fueled heat and power facility would generate electricity for the regional mill operations and produce heat for drying the lumber.
Results: A final report and feasibility study will be prepared with the proposed solutions and a process for implementing them. Also, a Local Stakeholders Advisory Board will be established, and a workshop will be organized at the end of the project to discuss the findings and next steps.

12) Title: Implementing Energy Audits in School Buildings
Leader: Giurgiu Town Hall
Partner: Sandhill Associates, Bunswick, ME, USA
Partner: Global Energy Services Ltd., Bucharest, Romania
Grant Total: $49,984
Summary: This project will focus on increasing the energy efficiency of six schools in Giurgiu by conducting energy audits to analyze consumption patterns and changing some operations and equipment. A preliminary analysis estimates the energy savings potential at 32%. The project team will visit the US to observe energy efficiency measures in schools and municipalities as well as to discuss performance issues with municipal and state officials. The Municipality of Giurgiu will share their information and results regionally through the Black Sea Energy Cities Network.
Results: An energy audit for each of the 6 schools identifying energy conservation measures, a list of low-cost and no cost measures to improve energy efficiency, and the implementation of retrofit measures along with other improvements in one pilot school.

13) Title: Integrated Solid Waste Management Program for Slatina
Leader: Local Council of the City of Slatina
Partner: Aquatest a.s., Prague, Czech Republic
Partner: Quantum Leap S.A., Bucharest, Romania
Grant Total: $50,000
Summary: The project's objective is to eliminate pollution sources resulting from the current methods of solid waste collection, transport and disposal in the city by developing an integrated solid waste program to include collection, recycling, and ecological disposal. The partners will analyze the current solid waste management system and improvement measures and then develop an optimization plan for the system including local policies, training and public education.
Results: The implementation of a functional integrated waste management program in the city that complies with EU quality standards, local policies and regulations concerning waste management and that includes a system of local fines and penalties for non-compliance, a public education program and a pilot recycling program at three points in the city.

14) **Title:** Energy Audit for Energy Efficiency Improvements at UPSOM SA
Leader: UPSOM SA, Ocna Mures, Romania
Partner: Sustainable Energy Partnerships, Tarrytown, NY, USA
Partner: Energobit SRL, Cluj Napoca, Romania
Grant Total: $48,978
Summary: Through an energy audit, the project will identify the most promising solutions for energy and emissions reduction for UPSOM, a soda manufacturing company. The study will look at ways to reduce electric power consumption at their heat generation site as well as inefficiencies in their electricity generation. Energy management practices and practices of energy consumers at the facility will also be examined.
Results: A detailed energy audit that includes proposed solutions and next steps for continuing the activity. UPSOM plans to implement the suggested measures from the audit and will work to secure financing for the most promising investments.

15) Title: The Improvement of the Solid Waste Management System for Suceava
Leader: The Local Council of Suceava Municipality, Romania
Partner: Gannett Fleming, Inc., Camp Hill, PA, USA
Partner: ASA Holding SA, Bucharest, Romania
Grant Total: $47,895
Summary: The goal of the project is to minimize the environmental impact of the current solid waste system by improving its management and by minimizing the amount of residential waste deposited in the municipal landfill. The objective is to conduct a study of the existing system and make an inventory of both the short-term solutions for the rehabilitation of the current system without major investments and of the long-term solutions for the design of a new management system including a new landfill.
Results: A feasibility study analyzing the different options for the solid waste management system including waste reduction, transportation, recycling, separation, and composting. Also, the major conclusions of the study will be presented in a seminar for the local council, other local authorities, the media and civil society representatives.

16) Title: Feasibility Study for Modernization of Baneasa Heating Plants
Leader: Bucharest District Heating Company (RADET), Bucharest, Romania
Partner: AEAI, Watertown, MA, USA
Partner: Institute of Power Studies and Design (ISPE), Bucharest, Romania
Grant Total: $50,000
Summary: The project's goal is to prepare a feasibility study for the rehabilitation and modernization of two district heating plants in order to improve their energy efficiency. Included in the study will be an assessment for adding cogeneration units, a heat metering system pilot project and a financial plan for implementing the modernization measures.
Results: A feasibility study providing technical solutions/options and a financial plan that will provide information on the project's bankability for investors. Finally, a workshop will be organized in Bucharest to disseminate the results of the project.

17) Title: Cleaner Production in the Ceramic Tiles and Sanitaryware Industry
Leader: SC Cesarom SA, Bucharest, Romania
Partner: Pojasek & Associates, East Arlington, MA, USA
Grant Total: $49,970
Summary: The production of ceramic tiles and sanitaryware uses large quantities of bulk raw materials, and current production techniques result in significant losses of raw materials into the environment through dust, wastewater and solid waste. The goal of this project is to reduce the loss of these materials by increasing the yield of finished product from input materials. This will be accomplished by evaluating the entire ceramic-production process from raw material purchasing practices to handling, storage, processing and finally waste treatment and disposal. Additionally, recycling and reusing materials will be assessed.
Results: A process flow diagram for the plant that will include mass balance analyses, an action plan for implementing those production process changes that are economically feasible, and a Quality Control/Quality Assurance Plan for monitoring production processes and waste discharges with a provision for continuous assessment of the situation.

18) Title: Creating a Solid Waste Reduction and Paper Recycling Service Program
Leader: RER Ecologic Service Galati, Romania
Partner: Swanson Environmental Management System, Inc., Highlands Ranch, CO, USA
Grant Total: $50,000
Summary: The project will help address the city of Galati's solid waste problems by initiating a solid waste reduction and recycling program. Activities will include a market study, a public education campaign, and a pilot recycling program with two businesses. RER, with its partners, hopes to develop and implement a recycling collection-to-market system that will responsibly manage the entire waste stream.
Results: A feasibility study that assesses the market opportunities for solid waste reduction and recycling services and that includes a market-entry approach. Also, a pilot recycling program will be conducted, and a report will be prepared that measures its results and lists next steps for introducing the program throughout Galati.

19) Title: Study for Reduction of Pollutants from Packaging and Toilet Paper Production
Leader: SC Vrancart SA, Vrancea, Romania
Partner: Sandwell Engineering Inc., Atlanta, GA, USA
Grant Total: $45,000
Summary: This project will look at the alternatives for complying with all wastewater pollution limits related to the mill processes established under current Romanian legislation with a view to move towards EU standards. The study will include methods for modernizing the wastepaper processing plants to treat the rejects and wastewater resulting from mill processes, as well as modernizing the existing wastewater treatment plant and landfill area for sludge.
Results: A study that includes block flow diagrams, material balances, operating and capital costs as well as environmental impact and economic benefits for the proposed modernization. At the end of the project, a workshop will be held for the Romanian pulp and paper industry to disseminate the results of the project.

20) Title: *Reducing Harmful Emissions by Energy Efficiency Measures*
Leader: SC Carbochim SA, Cluj Napoca, Romania
Partner: Good Consulting, Washington Grove, MD, USA
Partner: SC Proenerg SRL, Oradea, Romania
Grant Total: $39,837
Summary: This energy efficiency program for this abrasive product manufacturer will consist of a detailed examination of the facility's energy uses, the main sources for energy waste and pollution, and recommendations for changes in operating practices to reduce energy consumption and emissions. It will also examine replacing versus rehabilitating equipment. Because the sandpaper section of the facility is the largest energy consumer, the audit will start in this section and then extend to the entire company.
Results: An energy audit to identify the energy-saving measures with the highest potential and a business plan to attract prospective investors.

21) Title: Environmental Improvements by Modernization of Otopeni Thermal Plant
Leader: Ana Aslan National Institute of Gerontology and Geriatrics, Bucharest, Romania
Partner: Artemel International, Inc., Alexandria, VA, USA
Partner: Eninvest SA, Bucharest, Romania
Grant Total: $49,974
Summary: This project will identify solutions for improving the environmental conditions at the Otopeni Clinic area. The overall goal is to reduce fuel consumption by maximizing heat and power production efficiency and to increase the energy efficiency of the incinerator and wastewater treatment plant. The energy consumption will be examined for the complex and the potential for modernizing the existing thermal plant, the wastewater treatment plant and the waste incinerator will be determined.
Results: An environmental and financial assessment that will recommend options and technologies in order to determine the most suitable and cost-effective system.

RUSSIA FAR EAST

22) Title: Celina Water Conservation & Pollution Prevention Project
Leader: Celina Ltd., Yuzhno-Sakhalinsk, Russia
Partner: Loomis Austin, Inc., Austin, TX, USA
Grant Total: $49,700
Summary: The goal of this project is to reduce or eliminate the water quality and wastewater problems at Celina's food processing facilities, while simultaneously decreasing production costs and improving operating efficiency. The specific objectives are to eliminate the frequent overflows at the facility as well as the high monthly costs of waste hauling, to become independent from the contaminated public water supply, to reduce potable water costs, and to reduce potable water consumption through wastewater recycling for non-potable water uses.
Results: Technical reports and evaluations regarding wastewater treatment, recycling and sewer technology options; specifications and procurement information for necessary equipment; and a well report that evaluates the results of the test data and recommends next steps.

23) Title: Feasibility Study for the Production of Wood Pellets Using Harvest and Saw Mill Waste
Leader: OOO Kristal Ltd., Sakhalin, Russia
Partner: New England Wood Pellet, Inc., Jaffrey, New Hampshire, USA
Grant Total: $50,000
Summary: Through this project, a feasibility study will be developed for the construction of a wood pellet plant to reduce waste from timber harvesting, improve environmental conditions and provide an alternative energy source. Wood pellets are made of 100% waste sawdust that would otherwise be left in the forest or sent to landfills. They can replace traditional fuels, such as coal and diesel fuel oil, for both households and industrial purposes.
Results: A feasibility study will be developed and if the plant is feasible, a design plan will be prepared for the pellet plant.

24) Title: Alternative for Water Quality Improvement at Pavlovskoe Mine
Leader: JSC Primorskugol Mining Company, Vladivostok, Russia
Partner: EarthFax Engineering, Inc., Midvale, Utah, USA
Grant Total: $50,000
Summary: This project will evaluate alternatives for improving the mine water management at a surface coal mine with a focus on improving the mine drainage system and the quality of water discharged from the mine. The partner will concentrate on alternatives that rely on technology applications with minimal consumption of power, water, and technical labor for implementation.
Results: A technical and economic assessment with recommendations will be conducted for improving the groundwater and surface water controls at the mine.

UKRAINE

25) Title: Reduction of Greenhouse Effect through Methane Utilization at Lugansk Landfill
Leader: JSC Protos, Lugansk, Ukraine
Partner: SCS Engineering, Inc., Reston, VA, USA
Partner: Scientific Engineering Center "Biomass", Kiev, Ukraine
Grant Total: $49,930
Summary: The Lugansk Landfill managed by Protos emits almost 4 million cubic meters of methane into the atmosphere each year. The following activities are planned to address this issue. First a feasibility study will be developed to assess different solutions for a LFG extraction, collection and utilization system and then, based on the study results, a demonstration project of the system will be set up and monitored. Finally, a business plan and marketing strategy will be developed for the implementation of a LFG extraction, collection and utilization system for the entire Lugansk landfill.
Results: A report on the present state of the Lugansk landfill and potential for a LFG extraction and utilization system, a monitoring report on the demonstration system and a business plan to implement the system throughout the entire landfill.

26) Title: Integrated System for Managing Solid Waste for Donetsk Iron and Steel Works
Leader: OJSC Donetsk Iron and Steel Works (DMZ), Donetsk, Ukraine
Partner: ICF/EKO Ltd., Moscow, Russia
Partner: Ukrainian Center for Ecological Auditing and Insurance Ltd., Donetsk, Ukraine
Grant Total: $48,091
Summary: The goal of this project is to develop a strategy for waste management and to minimize the industrial solid waste generated at DMZ. For the waste management plan, the partners will look at the current situation at the plant, conduct a risk and environmental analysis, and then develop an environmental policy and waste management program for DMZ.
Results: An environmental audit report including findings and conclusions and an Environmental Policy and Waste Management program.

27) Title: Environmentally Safe Water Consumption in Belgorod-Dnestrovksy City
Leader: Belgorod-Dnestrovsky Enterprise for Water Supply and Sewerage, Ukraine
Partner: SRC International CS, sro, Prague, Czech Republic
Partner: Century XXI, Ltd., Kiev, Ukraine
Grant Total: $49,492
Summary: This project will develop a comprehensive strategy for water quality management in the Belgorod-Knestrovsky city with the aim of improving the water supply and sewage water treatment efficiency, quality and reliability. After the major problems are identified, a range of potential measures will be suggested that would lead to substantial improvements in the city's water supply and sewage water treatment systems.
Results: An environmental audit of the drinking water and sewage water networks followed by a feasibility study and action plan for rehabilitating them.

28) Title: The Industrial Organic Wastes Utilization Program Involving Waste Combustion for Heat Energy Production
Leader: The Stryi District State Administration, Lviv Region, Stryi, Ukraine
Partner: District Heating Research and Development Center,
Warsaw District Heating Enterprise, Warsaw, Poland
Partner: Energy Service Company Univers Ltd., Lviv, Ukraine
Grant Total: $46,839
Summary: This project will assess the feasibility of using wood wastes produced by Stryi district enterprises for fuel for boiler stations and the impact of this activity on the environment. As part of the study, reconstructing the existing boiler stations and installing modern wood-burning heat boilers will be examined, as well as the possibility of introducing heat energy saving measures in buildings. Finally, an Action Plan will be developed for implementing the system in practice.
Results: An energy audit report on the coal-burning boilers and communal buildings, an action plan for utilizing wood wastes and a business plan for reconstructing the boilers to gradually burn wood waste and implement energy efficiency measures in buildings serviced by the boilers.

29) **Title:** Utilization of Biogas Extracted from Sewage at Ecotekhprom
Leader: Ekotekhprom, Ivano-Frankivsk, Ukraine
Partner: Energopol S.A., Lublin, Poland
Grant Total: $49,673
Summary: The goal of this project is to determine the feasibility of using biogas produced from processing sewage at the sewage treatment plant to meet the plant's energy needs. Also, the project will modernize sludge handling at the plant. Modern sludge handling technology will help remove fermentation gas emissions, remove the need for grounding fields for sludge storage, and provide for both heat self-sufficiency and energy savings at the plant.
Results: A report that examines the feasibility of the project and evaluates the options for implementation.

30) Title: Program of Saving Fuel and Energy Resources
Leader: Cherkasytransgas, Cherkasy, Ukraine
Partner: Indaco Air Quality Services, Inc., Fayetteville, NC, USA
Grant Total: $49,988
Summary: The objective of the project is to develop a program at these natural gas facilities to reduce methane emissions at the compressor stations and pipelines. Activities will include instrumental measurements of all natural gas (methane) leakages and the development of technical and organizational measures to repair and reduce the methane emissions within the system. In addition, staff at the compressor stations will be trained on how to implement the new methods of leak measurement and reduction.
Results: A report that evaluates the gas leakage detection and measurement results followed by a repair plan including other measures needed to reduce the methane emissions.

31) **Title:** Utilization of Wood Wastes for Energy Production at Belichi Woodworking Plant
Leader: Belichskiy DOK, Kotsiubinske, Kyiev, Ukraine
Partner: McNeil Technologies, Inc., Springfield, VA, USA
Grant Total: $49,975
Summary: The goal of this project is to utilize the wood residues created at the Belichi woodworking plant by combusting it in a modern, clean-burning boiler for heat production. Wood biomass is an environmentally friendly fuel. It is CO2 neutral and does not contain sulfur, chorine and other elements hazardous to the atmosphere. All the heat produced would be used at the plant for drying lumber in the wood kilns and for heating the buildings in the winter.
Results: A technical report that analyzes the quantity, composition and condition of the wood wastes generated at the facility, a heat energy audit and a final report that analyzes possible combustion technologies for using wood waste for energy production and that recommends the most suitable technology.

Annex B
EcoLinks Challenge Grants
Partnerships with US Companies by State

Cycle 1 Challenge Grants (June, 1999) – 20 Grants Awarded in Total, 13 with US Partners
Cycle 2 Challenge Grants (November, 1999) – 43 Grants Awarded in Total, 31 with US Partners
Cycle 3 Challenge Grants (June, 2000) – 41 Grants Awarded in Total, 29 with US Partners
Cycle 4 Challenge Grants (January, 2001) – 30 Grants Awarded in Total, 25 with US Partners
Cycle 5 Challenge Grants (November, 2001) – 31 Grants Awarded in Total, 25 with US Partners

From all five cycles (165 grants) there is a total of 123 grants with US partners representing 33 different states and the District of Columbia. The grants are listed below by the US partner's State.

	City/State	US Company	Title of Activity	Grant Cycle/ Country	Grant Amount
AZ (2)	Flagstaff, Arizona	Southwest Windpower	Renewable Energy – Electric Power Systems	Cycle 3 – Romania	$34,700
	Tempi, Arizona	Burge & Associates	Improvement of Municipal Solid Waste Management	Cycle 5 – Macedonia	$50,000
				AZ TOTAL	**$84,700**
CA (9)	Hercules, California	Cal Recovery Inc.	Danube River Municipal Solid Waste Management Systems	Cycle 1 – Bulgaria	$37,492
	Roseville, California	Brown, Vence & Associates	Landfill Biogas Extraction and Energy Utilization	Cycle 2 – Bulgaria	$50,000
	Sonoma, California	Moore Recycling Associates	Improving the Waste Management Services	Cycle 2 – Bulgaria	$49,705
	Torrence, California	Universal Aqua Technologies	Reduction of Water /Wastewater Consumption	Cycle 2 – Croatia	$50,000
	San Leandro, California	Waste Management Inc	Municipal Waste Minimization and Recycling	Cycle 2 – Romania	$50,000
	Mission Viejo, California	Energy and Environmental Consulting Engrs	Emissions Control and Ash Utilitzation Technologies for Waste-to-Energy Facility	Cycle 2 – Russia	$50,000
	San Francisco, California	Smyser Associates	Co-generation and Energy Efficiency	Cycle 3 – Bulgaria	$49,523
	Santa Rosa, California	EBA Waste-technologies	Treatment System for Recycleable Waste	Cycle 4 – Bulgaria	$38,800
	Irvine, California	Sierra Engineering	Ecologically Cleaner Solvent Production	Cycle 4 – Kazakhstan	$43,777
				CA TOTAL	**$419,297**
CO (5)	Denver, Colorado	Knight Piesold	Treatment of Effluent Water from Smolnik Mine	Cycle 1 – Slovakia	$50,000
	Highland Ranch, Colorado	SEMSI	Municipal Solid Waste Minimization and Recycling	Cycle 2 – Romania	$50,000
	Denver, Colorado	McLaughlin Water Engineers	Minimize Toxic Raw Materials in Galvinization	Cycle 3 – Macedonia	$44,075
	Arvada, Colorado	Recovery Engineering and Sales, Inc.	Substitution of Drinking with Technological Water and Introduction of Recycling	Cycle 5 – Bosnia & Hi	$47,390
	Highlands Ranch, Colorado	SEMSI	Solid Waste Reduction and Paper Recycling Program	Cycle 5 – Romania	$50,000
				CO TOTAL	**$241,465**

DC (2)	Washington, DC	Ecoenergy International	Preparation of Climate Change Mitigation Initiative	Cycle 2 – Ukraine	$48,744
	Washington, DC	Ross and Parks	Cleaner Production at a Rock Quarry	Cycle 3 – Bulgaria	$50,000
				DC TOTAL	**$98,744**
FL (1)	Casselberry, Florida	TeKontrol, Inc	EMS for a Machine Building Company	Cycle 2 – Bulgaria	$41,360
GA (3)	Atlanta, Georgia	Aponowich, Driscoll & Associates	Upgrading the Water Pretreatment Plant and Management System	Cycle 4 – Romania	$47,950
	Suwanee, Georgia	Envirosmith Engineering	Quality Management of Drinking Water	Cycle 5 – Kazakhstan	$50,000
	Atlanta, Georgia	Sandwell Engineering	Reducing Pollutants from Packaging and Toilet Paper Production	Cycle 5 – Romania	$45,000
				GA TOTAL	**$142,950**
ID (1)	Idaho Falls, Idaho	Environmental Management	Cleaner Production for a Ceramic Factory	Cycle 4 – Romania	$44,915
IL (2)	Elk Grove Village, Illinois	K.R. Komarek	Conversion of Solid Waste into a Viable Product	Cycle 4 – Kazakhstan	$49,973
	Chicago, Illinois	Hazra Engineering	Alternatives for Improving the Water Management System in Petromidia	Cycle 4 – Romania	$49,352
				IL TOTAL	**$99,325**
IN (1)	Valparaiso, Indiana	Amtech	Improving the Effluent Quality from Galvanization	Cycle 2 – Macedonia	$50,000
LA (1)	Hammond, Louisiana	Lamp Recyclers of Louisiana	Recycling Fluorescent and High Discharge Lamps	Cycle 4 – Bulgaria	$49,980
ME (1)	Bunswick, Maine	Sandhill Associates	Energy Audits in School Buildings	Cycle 5 – Romania	$49,984
MD (9)	Washington Grove, Maryland	Good Consulting	Energy Efficiency Plan for Sofia Building Stock	Cycle 1 – Bulgaria	$45,300
	Potomac, Maryland	GT Strategies + Solutions	Environmental Cost Accounting	Cycle 2 – Budapest	$50,000
	Annapolis, Maryland	Robert Watts Consulting Engineers	Energy Audit for Petrochemical Plant	Cycle 2 – Romania	$50,000
	Laurel, Maryland	Holzer Energy Management	Energy Efficiency Measures for a Municipality	Cycle 3 – Bulgaria	$42,750
	Baltimore, Maryland	Tetrahedron, Inc	Pollution Abatement Plan for a Textile Plant	Cycle 3 – Bulgaria	$50,000
	Baltimore, Maryland	BP Solarex	Photovoltaics Feasibility Study	Cycle 3 – Poland	$50,000
	Bethesda, Maryland	Sentech	Wood Biomass as an Alternative Fuel	Cycle 3 – Ukraine	$46,033
	Rockville, Maryland	Princeton Energy Resources	A Model for a Geothermal Plant in Sapareva Banja	Cycle 4- Bulgaria	$48,000

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	Washington Grove, Maryland	Good Consulting	Reducing Emissions by Energy Efficiency Measures	Cycle 5 - Romania	$39,837
				MD TOTAL	**$421,920**
MA (7)	Cambridge, Massachusetts	Camp, Dresser & McKee	Effective Environmental Management Implementation	Cycle 1 – Bulgaria	$50,000
	Marshfield, Massachusetts	William Finn Associates	Recycling Solid Waste in District 5	Cycle 2 – Romania	$50,000
	Haverville, Massachusetts	Energy Resource Solutions	Energy Efficient Heating	Cycle 3 – Romania	$48,238
	Wellesley, Massachusetts	Environmental Science Services	Environmentally Friendly Recycling Wastes	Cycle 4 – Ukraine	$49,998
	North Andover, Massachusetts	Valu Add Management Services	Unaccounted for Water Reduction Plan	Cycle 5 – Bosnia & Hi	$49,339
	Watertown, Massachusetts	AEAI	Modernization of Baneasa Heating Plants	Cycle 5 – Romania	$50,000
	East Arlington, Massachusetts	Pojasek & Associates	Cleaner Production for Tiles and Sanitaryware Industry	Cycle 5 – Romania	$49,970
				MA TOTAL	**$347,545**
MI (1)	Ann Arbor, Michigan	Resource Recycling Systems	Project for Recycling Municipal Waste in Bistrita	Cycle 4 – Romania	$50,000
MN (3)	Duluth, Minnesota	City of Duluth	Regional Environmental Management System	Cycle 2 – Bulgaria	$49,000
	Minneapolis, Minnesota	Barr Engineering	Implementing EMS in Municipalities	Cycle 2 – Slovakia	$49,999
	Minneapolis, Minnesota	Lemna International	Feasibility Study on Drinking Water Improvements	Cycle 3 – Romania	$50,000
				MN TOTAL	**$148,999**
MO (1)	Columbia, Missouri	Shell Engineering	Reducing Polllution from Car Wash Centers	Cycle 3 – Kazakhstan	$49,657
MS (2)	Ridgeland, Mississippi	Kuykendall & Associates	Environmental Management of Rendering Activity	Cycle 2 – Bulgaria	$49,557
	Starkville, Mississippi	Clearwater Consultants	Public/Private Partnership for Water Treatment & Delivery	Cycle 3 – Bulgaria	$50,000
				MS TOTAL	**$99,557**
NE (2)	Fremont, Nebraska	New Horizon Consulting	Improved Environmental Performance at Paper Mill	Cycle 1 – Bulgaria	$36,875
	Lincoln, Nebraska	American Int'l University Network	Creating Effective Environmental Policies and Procedures	Cycle 2 – Russia	$49,804
				NE TOTAL	**$86,679**
NH (1)	Jaffrey, New Hampshire	New England Wood Pellet	Producing Wood Pellets from Harvest and Saw Mill Waste	Cycle 5 - Russia	$50,000

NJ (11)	East Hanover, New Jersey	BET Engineering	Using Renewable Hydro Energy Resources	Cycle 1 – Bulgaria	$50,000
	Edison, New Jersey	World Power Technologies	Bankable Documents for the District Heating System	Cycle 2 – Romania	$46,400
	Blawenburg, New Jersey	Chavond-Barry Engineering	Combustion Optimization for Cement Production	Cycle 2 – Romania	$50,000
	Somerville, New Jersey	CEVA International	Recycling/Reuse Program for Used Oils	Cycle 2 – Romania	$50,000
	Cherry Hill, New Jersey	Universal Technology Resource Service	Recycling Oil Filters and Containers	Cycle 3 – Hungary	$47,981
	Paramus, New Jersey	Power Technology Associates	Minimizing Waste at Heat/ Electric Power Station	Cycle 3 – Russia	$49,997
	Montvale, New Jersey	Joseph Technology Corporation	Modernization of Hot Water Supply System in Municipal Buildings	Cycle 3 – Russia	$50,000
	Camden, New Jersey	Biothane Corporation	Anaerobic Wastewater Treatment	Cycle 3 – Ukraine	$49,765
	Chatham, New Jersey	BEM Systems	Cleaner Shoe Production	Cycle 4 - Bulgaria	$50,000
	Mahwah, New Jersey	Hydro Qual	BioPrespa Feasibility Study	Cycle 4 – Macedonia	$50,000
	Bridgewater, New Jersey	Cantox	A Sustainable Waste Management System	Cycle 4 – Ukraine	$50,000
				NJ TOTAL	**$544,143**
NV (1)	Reno, Nevada	Geo Hills Associates	Geothermal Project	Cycle 3 – Macedonia	$50,000
NY (5)	White Plains, New York	Leggette, Brashers,Graham	Cleaner Technology at Astra Refinery	Cycle 1 – Romania	$50,000
	Albany, New York	AWS Scientific	Wind Energy Project	Cycle 2 – Poland	$50,000
	Little Falls, New York	The Energy Group	Energy Efficiency System	Cycle 3 – Romania	$50,000
	Centerport, New York	Environmental Tech. Group	Waste Management Planning	Cycle 4 – Croatia	$50,000
	Tarrytown, New York	Sustainable Energy Partnerships	Audit for Energy Efficiency Improvements	Cycle 5 – Romania	$48,978
				NY TOTAL	**$248,978**
NC (5)	Winston-Salem, North Carolina	Cavanaugh & Associates	Leak Detection and Abatement Technologies	Cycle 1 – Romania	$50,000
	Winston-Salem, North Carolina	GeoScience & Technology	Recycling and Reuse of PET Wastes	Cycle 1 – Romania	$35,000
	Winston-Salem, North Carolina	Cavanaugh & Associates	Reducing Losses in the Thermal Energy Network	Cycle 4 – Romania	$50,000
	Cary, North Carolina	ECOKAN LLC	Constructed Wetlands Wastewater System	Cycle 5 – Bulgaria	$50,000
	Fayetteville, North Carolina	Indaco Air Quality Services	Program of Saving Fuel and Energy Resources	Cycle 5 - Ukraine	$49,988
				NC TOTAL	**$234,988**

OH (1)	Cincinnati, Ohio	Katzen International	Feasibility of Production of Livestock Feed from Stillage	Cycle 4 – Russia	$49,985
OR (2)	Portland, Oregon	Ogden Beeman & Associates	EMS for the Black Sea Coast	Cycle 2 – Bulgaria	$50,000
	Portland, Oregon	Association of OR Recyclers	Solid Waste Sorting and Recycling Project	Cycle 4- Russia	$48,009
				OR TOTAL	**$98,009**
PA (6)	Pittsburgh, Pennsylvania	Pittsburgh Technology Council	Model for Environmenal Management Systems for Municipalities	Cycle 1 – Bulgaria	$49,600
	Monroeville, Pennsylvania	Paul C. Rizzo Associates	Hydropower from Bogovinjska River	Cycle 2 – Macedonia	$50,000
	McMurray, Pennsylvania	PA-American Water Company	Action Plan for Integrated Water Quality Management	Cycle 4 – Bulgaria	$50,000
	Reading, Pennsylvania	Parsons Energy and Chemicals	Cogeneration Plant in Clinical Hospital Osijek	Cycle 4 – Croatia	$49,500
	Exton, Pennsylvania	PMC Technologies	Cleaner Production and Management of Utilities	Cycle 5- Croatia	$50,000
	Camp Hill, Pennsylvania	Gannett Fleming	Improvement of the Solid Waste Management System	Cycle 5 – Romania	$47,895
				PA TOTAL	**$296,995**
SC (1)	Columbia, South Carolina	Wilbur Smith Associates	Alternative Fuels and Transportation	Cycle 3 – Bulgaria	$50,000
TN (3)	Greenville, Tennessee	Vaughn and Melton	Solid Waste Recycling Plant	Cycle 2 – Russia	$50,000
	Knoxville, Tennessee	IT Corporation	Reducing Emissions from Resin & Paint Manufacturing	Cycle 3 – Romania	$49,971
	Memphis, Tennessee	EnSafe	Integrated Solid Waste Management System	Cycle 5 – Kazakhstan	$48,579
				TN TOTAL	**$148,550**
TX (4)	Conroe, Texas	Hoffland Environmental	Reducing Cyanide/Heavy Metals in the Water	Cycle 3 – Romania	$50,000
	Midland, Texas	BCCK Engineering	Utilization of Coal Mine Methane	Cycle 3 – Ukraine	$50,000
	Houston, Texas	PRSG Consultants	Reduction of Ammonia Emmissions at Dairy	Cycle 4 – Kazakhstan	$49,929
	Austin, Texas	Loomis Austin	Water Conservation & Pollution Prevention Project	Cycle 5 - Russia	$49,700
				TX TOTAL	**$199,629**
UT (3)	Midvale, Utah	EarthFax Engineering	Program for Minimizing Waste at a Mine	Cycle 3 – Russia	$49,950
	Salt Lake City, Utah	Resource Enterprises	Degasification of Underground Coal Mine	Cycle 4 – Ukraine	$49,608
	Midvale, Utah	EarthFax Engineering	Water Quality Improvement at Pavlovskoe Mine	Cycle 5 - Russia	$50,000
				UT TOTAL	**$149,558**

VT (2)	Ascutney, Vermont	DSM Compost	Demonstration for Small-Scale Waste Management	Cycle 1 – Bulgaria	$39,780
	Burlington, Vermont	Living Technologies	Living Machine Barge for Danube River	Cycle 1 – Hungary	$28,810
				VT TOTAL	**$68,590**
VA (17)	Arlington, Virginia	Electrotek Concepts	Energy Efficient Retrofit for Municipal Hospital	Cycle 1 – Bulgaria	$46,200
	Alexandria, Virginia	Artemel International	Energy Efficiency in Hotels and Restaurants	Cycle 2 – Bulgaria	$46,000
	Richmond, Virginia	Environmental Control Opportunities	Cleaner Production for Snack Food Factory	Cycle 2 – Kazakhstan	$49,550
	Reston, Virginia	Eurasia Environmental Associates	Development and Implementation of EMS	Cycle 2 – Kazakhstan	$49,971
	Arlington, Virginia	The Cadmus Group	Reducing Energy Consumption at Water Pumping Station	Cycle 2 – Romania	$48,154
	Arlington, Virginia	Futurepast Inc	Development of EMS and preparation for certification	Cycle 2 – Ukraine	$48,784
	Arlington, Virginia	Hagler Bailly Services	Energy Audit and Conservation Measures	Cycle 3 – Bulgaria	$49,441
	Arlington, Virginia	National Rural Electric Cooperative	Energy Efficiency and Renewable Energy	Cycle 3 – Croatia	$50,000
	Reston, Virginia	SCS Engineers	Energy Production from Waste and Biomass	Cycle 3 – Estonia	$50,000
	Arlington, Virginia	EnviroNet Management Systems	Cyanide Recycling at a Gold Mine	Cycle 3 – Kazakhstan	$50,000
	Chester, Virginia	Oshman Group	Waste Water Management at ICERP	Cycle 4 – Romania	$50,000
	McLean, Virginia	Twenty First Strategies	Developing Climate Change Mitigation Strategy	Cycle 4 – Ukraine	$49,996
	Herndon, Virginia	EWA Environmental Technologies	Water System Leak Detection and Abatement	Cycle 5 – Bulgaria	$49,963
	Waynesboro, Virginia	Environmental Control Opportunities	Cleaner Production Practices at FoodMaster's Dairies	Cycle 5- Kazakhstan	$50,000
	Alexandria, Virginia	Artemel International	Environmental Improvements for Thermal Plant	Cycle 5 - Romania	$49,974
	Reston, Virginia	SCS Engineering	Collection and Utilization of Methane at Lugansk Landfill	Cycle 5 - Ukraine	$49,930
	Springfield, Virginia	McNeil Technologies	Wood Wastes for Energy Production	Cycle 5 – Ukraine	$49,975
				VA TOTAL	**$837,938**
WA (5)	Bellvue, Washington	Montgomery Watson	EMS Development and Implementation Support	Cycle 2 – Bulgaria	$50,000
	Bellvue, Washington	Ekono Inc	Reduce Wastewater Contaminated with Organics	Cycle 3 – Romania	$50,000
	Seattle, Washington	Utility Service Associates	Drinking Water Management Project for Vladivostok	Cycle 4 – Russia	$43,282

	Kirkland, Washington	TLK Consulting	Solving Environmental Problems of Chemical Enterprises	Cycle 4 – Ukraine	$48,500
	Richland, Washington	Project Performance Corporation	Energy from Sawmill Waste	Cycle 5 - Romania	$49,618
				WA TOTAL	**$241,400**
WI (2)	Appleton, Wisconsin	OMNI Associates	EMS for water treatment plant	Cycle 2 – Romania	$50,000
	Madison, Wisconsin	Mead & Hunt International	Cleaner Production for Sausage Factory	Cycle 2 – Ukraine	$43,440
				WI TOTAL	**$93,440**

Annex C

01/30/02

ECOLINKS QUICK RESPONSE AWARDS
October - December 2001

#	GRANT NUMBER	DATE OF AWARD	GRANTEE	PROJECT TITLE	COUNTRY	PROJECT PARTNER	GRANT AMOUNT	ACTIVITY DATE	INITIATOR/ STAFF
296	HU-316	10/01/01	UNIQ-GLOBE Kft.	Wastewater treat. Products Training	HU to US	Chemtech International, Inc.	$3,633	Oct-01	Ap/IH
297	CZ-317	10/03/01	Aqua Smart, Inc	Water quality technology	US to CZ (PL, HU)	WatEco	$3,397	Oct-01	AP/AK
298	UK-318	10/08/01	Provisen	Geothermal technology transfer	UK to US	HVAC & Geotech Systems, In	$3,300	Oct-01	AP/AK
299	RFE-319	10/05/01	SKIF-MX Ltd.	Geothermal Heat pumps training	RFE to US	Peerless Pacific portland	$4,620	Oct-01	Ap/IH
300	BH-320	10/25/01	FLW Enterprises, Inc.	EMS for BIH	US to BH	BIH Chamber of economy	$4,813	Nov-01	TR/PT
301	PL-321	11/21/01	Mo-Bruk	contract negotiation, seeing technology	PL to US	Unistar/Meridian	$4,313	Dec-01	TR/AK
302	BG-322	12/06/01	EA - Georgi Kirov	signing distributor contract	BG to US	Winda Technologies, LLC	$5,000	Jan-02	AP/AK
303	BG-323	12/06/01	Greiner Environmental, Inc.	Promoting cleaner technology in Bulgaria	US to BG	Niksun, Betta level	$3,235	Dec-01	Ap/PT
303	BG-324	12/11/01	Team Co., Ltd.	Manufacturing of energy-efficient products	BG to US	Sterling International, Ltd.	$5,000	Jan-02	Ap/PT
						TOTAL	$37,311		

Initiator: Tech Rep - TR; Applicant - AP; other-O

QRAs promoting trade in bold

Annex D
EcoLinks Best Practices
October – December 2001

Title	Page
Improving Waste Management at Sinegorskaya Mine in Sakhalin Island, Russia	2
Improving the Environmental Performance of Odessa CHPP-2 Heat Boilers in Teplodar Ukraine	9
Reducing Wastewater Contamination at Celhart Donaris in Romania	16
Developing an Environmental Management System At Concern Stirol in Ukraine	23
Environmentally Friendly Leather Production In Croatia	29
Regional Water Management in Bulgaria	36
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Improving Waste Management at Sinegorskaya Mine

Project Title: Model Program of Waste Disposal Control at Sinegorskaya Mine
Project Leader: Shakhta Sinegorskaya, Sakhalin Region, Russia
Project Partner: EarthFax Engineering, Inc., Midvale, Utah
Location of Project: Sinegorsk, Sakhalin Island, Russia Far East
Project Duration: September 2000 - June 2001
EcoLinks Project Contribution: EcoLinks Grant Support: $47,754; Project Team Contribution: $28,319.

Best Practice: Transferable Solutions

This project "Improving Waste Management at Sinegorskaya Mine" is an EcoLinks Best Practice. The project developed low tech, low cost measures to improve waste disposal and management at underground coal mines, minimizing the environmental impacts of mining. At the same time, the project assessed the potential to reuse the coal in rock waste piles, which will reduce the size and impact of the piles, while bringing additional revenue to the mine. The recommendations and Model Plan developed through this EcoLinks funded project are highly transferable to other underground coal mines in the NIS (with the exception of recommendations concerning the Sinegorsk town boiler).

Project Summary

Underground coal mining has been conducted at the Sinegorskaya Mine since 1913. Beginning in 1945, waste rock generated from the mine has been deposited into waste rock piles at the site, the total volume of which is currently estimated at 4,000,000 m^3. Because coal processing at the Sinegorskaya Mine is not highly efficient, these waste piles contain not only waste rock (shale and sandstone) but also a significant amount of coal.

This waste, now piled into four dumps at the edge of the town of Sinegorsk, presents a serious environmental hazard. In its current form, the waste piles have destroyed 19 hectares of landscape. Heavy metals from the piles leach into the groundwater and sediment from the piles runs off to adjacent areas, including into the Susuya River. Fine particle dust blows from the piles into the atmosphere and particulate matter content in the air near the mine exceeds permissible limits approximately 50% of the time. Finally, because of the high coal content in the waste piles and the way the waste piles have been formed, the piles are subject to spontaneous combustion, with regular, frequent burns occurring in the summer months.

The goal of this project was to develop a Model Program to improve waste disposal and treatment at the Sinegorskaya Mine. The Project Team assessed the potential for initiating low and no cost measures at the mine to minimize the environmental impacts of coal mining and processing. Recommendations focused on four areas: (1) reducing and capturing the sediment/leaching from the piles; (2) recovering the coal in the waste piles; (3) improving waste disposal/treatment; and (4) improving efficiency of the coal-fired district heating boiler in the town of Sinegorsk. Results of the Project Team's analysis show that the coal in waste

piles can be recovered with little processing, and that this coal represents a potential $450,000 in additional annual revenue to the mine.

Project Activities

The main goal of this project was to develop recommendations to improve waste disposal and treatment at the Sinegorskaya Mine. Project activities included the following:

1. Assessment of Conditions at the Mine

Action: The Project Team surveyed, reviewed, and assessed current conditions at the mine, including current coal processing methods and geological conditions at the mine. The formation of the coal seams in the mine create very difficult mining conditions and result in the generation of a large amount of waste rock during the mining process. Coal is mined using longwall methods and brought to the service by underground rail cars. Waste rock is separated out by inefficient hand procedures after the coal is brought to the surface. This is accomplished as the mined material passes along a conveyor, and workers visually evaluate the material. If the material is judged to contain more than 45% coal, it is diverted to the coal pile. If the material is judged to contain less than 45% coal, it is diverted to the rock waste pile.

Approximately 100,000 tons of coal is produced from the mine annually. The coal is of high quality, with the following typical properties:

Ash	Moisture	Sulfur	Heat Content
17%	8.3%	0.28%	6,600 kcal/kg

Due to the dip of coal seams at the mine, the Project Team determined that there were no realistic options for improving efficiency of the mining process itself, and therefore focused their recommendations on treatment and storage of waste in the following project activities.

Product(s): 1) Analysis of pre-project mining processes and conditions at Sinegorskaya Mine.

2. Analysis of Waste Rock

Action: Waste rock from the dumps of each of the four piles was collected for laboratory analyses carried out in the United States. Laboratory analysis showed that the Sinegorsk waste rock contains approximately 50% coal. Furthermore, the coal in the waste rock piles proved to be of high quality.

Properties of waste rock from Sinegorskaya

Ash	Moisture	Sulfur	Heat Content (corrected for moisture and ash)
54.5%	13.7%	0.15%	6,590 kcal/kg

Product(s): 1) Analysis of content of waste rock piles at Sinegorskaya Mine.

3. Environmental Assessment of Waste Piles

Action: The four waste rock piles have been created over the past 50+ years. Piles 1,2 & 3, the older piles, are similar in formation and content. Pile 4, the pile into which waste rock is currently deposited, differs from the other piles in that it is flattened regularly with a bulldozer, which keeps the surface of the pile flat, thereby allowing water to accumulate on the pile and decreasing slope stability. Although Piles 1, 2 & 3 have naturally revegetated, the active working of Pile 4 precludes the establishment of a good vegetative cover.

An environmental impact assessment of the waste rock including assessment runoff impacts, slope instability risk, partical dust impacts, and spontaneous combustion was conducted. A topographic map of the waste dumps was developed. Legislative norms and regulations concerning disposal of mine waste and utilization were reviewed.

Product(s): 1) Environmental impact assessment of the waste piles.

4. Site Visit to Coal Mines and Processing Facilities in the USA

Action: Sinegorskaya Mine's head engineer traveled to the USA to learn about structures, designs, processes and equipment used at mines in the United States to minimize the environmental impact of mining and coal processing. The Sinegorskaya Mine representative was given an underground tour of the SUFCO Mine in Salina, Utah, and a surface tour of the Star Point Mine, Willow Creek Mine, and Hardscrabble Canyon Mine. The Project Team toured the underground operations of the SUFCO Mine, where longwall mining techniques are used to create one of the most productive underground coal mines in the USA. At the Star Point Mine, the Sinegorskaya Mine representative was shown run-off and sediment control facilities similar to those recommended by the Project Team. At the Willow Creek Mine, mine management gave a presentation on their coal preparation and washing facility, which is used to separate coal from waste rock; sediment control and run off facilities were also visited. The Sinegorskaya Mine representative also visited the Sunnyside Cogeneration Power Plant, which uses coal waste rock as fuel, without significant processing, in a circulating fluidized bed combustor (such a combustor may be appropriate for the town boiler in Sinegorsk). At Hardscrabble, The Sinegorskaya Mine representative was given a presentation on land that has been reclaimed at the mine site after 120 years of mining. The US study tour was arranged by the US project Partner, EarthFax Engineering, Inc.

Product(s): 1) Improved understanding of waste management methods used in coal mines in the USA.

5. Site Visit to Sakhalin

Action: The US Partner traveled to Sakhalin and Sinegorsk to visit mine and governmental officials and to work with the Project Leader in finalizing the recommendations for the ModelProgram. While in Yuzhno Sakhalinsk, the US Partner representative met with the Vice Governor of the Sakhalin Region, with the Chairman of the Committee on Economics and Industrial Policy, with the Vice Mayor, with the Chairman of the Department of the Committee on Natural Resources, with the Director of the Department of Fuel, Energy and Mineral Resources and with the Head of the Department of Mining Inspection to discuss project findings. Through these meetings, potential sources of follow up funding for implementation of project recommendations were identified in the Governor's Office and in the City Administration of Yuzhno-Salhalinsk. Officials from the Department of Mining Inspection and the Department of Fuel, Energy and Mineral Resources and the Department of

Natural Resources provided their endorsement for applying this program at other appropriate mines on Sakhalin Island. The Project Leader arranged the US Partner's visit and meetings.

Product(s): 1) Information on project results disseminated to Sakhalin Island government officials. 2) Potential sources of follow-up finding identified.

6. Development of Project Recommendations and Model Program

Action: The Project Team developed a Model Program for waste processing and disposal at the mine. The main recommendations included in this Program are:

- **Sedimentation Control**
  Two methods of run-off and sedimentation discharge control are presented in the Model Program. The first involves constructing a run-off basin at the downstream end of the pile access road. An abandoned wastewater pond constructed with concrete walls exists at a nearby, down slope location. This wastewater pond can be modified using existing mine equipment to make a sediment basin to capture runoff from the piles. Once the sediment has settled to the bottom of the pond, the treated water can be released to the Susuya River. Second, the Model Program recommends that loose-rock check dams be installed at intermittent locations within the ditches that run along the waste-rock pile access roads. Run-off water will collect behind these dams, allowing the sediment to settle out. These dams will help to limit the amount of sediment discharge that currently runs freely through the down-slope ditches into the Susuya River. Sediment from both the sediment basin and the loose rock check dams will have to be removed to one of the waste piles periodically.

  Since the materials, equipment and manpower required to implement these recommendations are available at the mine, the recommendations can be implemented at no capital cost to the mine.

- **Waste Coal Recovery**
  The Model Program developed by the Project Team recommends that coal be recovered from the waste piles by cyclone separation. This process involves first screening and then crushing the waste rock. Water is then added to the crushed waste rock, and this slurry is pumped through a cyclone separation system, which will separate the slurry into fine and coarse refuse and clean coal. At this point, the coal may be used without any further processing.

  New screens, a crusher, cyclones, and pumps will have to be purchased and installed to implement the coal recovery recommendations. It is estimated that the cost of coal recovery will be approximately $11.15 per metric ton. The cost of mining new coal from Sinegorskaya Mine is between $22-$25 per metric ton. Thus, coal can be recovered from the waste piles at about half the cost of mining new coal.

- **Improved Treatment of Waste Piles**
  Pre-project waste rock disposal at the mine encouraged slope failure, spontaneous combustion, infiltration of precipitation which in turn leaches contaminants into nearby surface and ground water, and high wind blown particulate matter. In order to minimize these risks and environmental impacts, the Model Program recommends several measures, including: (1) removing vegetation and topsoil from areas where waste rock will be

disposed of; (2) separation of organic waste (used mine timbers) from the rock pile prior to disposal; (3) compacting the dumped waste rock to promote stability; and (4) ceasing disposal of town garbage in the waste rock piles. All of these measures are designed to limit the amount of oxygen in the piles (which can lead to spontaneous combustion) and the amount of precipitation that seeps into the piles (which reduces pile stability and leads to leaching into the ground and surface water).

The equipment and manpower to implement these recommendations already exists at Sinegorskaya mine. Thus, no additional capital costs will be required to implement these measures.

- **Boiler Conversion/Replacement**
  The Sinegorsk town district heat boiler runs on coal mined from the Sinegorskaya Mine. The boiler was built in 1913 and has had only several upgrades and modifications since. The boiler is extremely inefficient, and removes only about 28% of the heat value from the coal. Although the boiler is not the property of Sinegorskaya Mine, and an assessment of the boiler was not originally planned in this project, coal waste from the boiler is disposed of in Sinegorskaya's waste rock piles. Since the boiler's inefficiency contributes to Sinegorskaya Mine's waste disposal problems, the Project Team decided to do a preliminary assessment of the town boiler. This initial assessment showed that retrofitting the boiler would not significantly improve the boiler's efficiency. Instead, the Model Program recommends that the town of Sinegorsk replace the boiler with either a conventional fixed or a circulating fluidized bed boiler.

  The Project Team was not able to develop cost estimates for boiler purchase and installation (due to the fact that the Sinegorsk heating system is a district heating system, and the boiler types will have to be developed to specifically fit Sinegorsk) during project implementation. Cost estimates are being developed in cooperation with the Russian Center for Energy Efficiency.

Product(s): 1) Model Program for improving waste management at the mine.

Project Benefits

This project draws on waste management practices which have been implemented successfully for years at mines in the USA. The project built the Project Leader's capacity to improve waste management and disposal at Singorskaya Mine. The Model Plan developed through this project outlines a systematic approach to improving waste management at the mine, which will result in both economic and environmental benefits.

Capacity Building Benefits
This project resulted in several capacity building benefits. First, project activities built the Sinegorskaya Mine management's capacity to approach waste treatment and disposal systematically, addressing the wide spectrum of environmental problems stemming from the mine waste piles. Second, through this project, Sinegorskaya Mine management was introduced to waste management and control practices which have been successfully implemented at mines in the USA for years. Finally, the Project Team shared project recommendations with government officials on Sakhalin Island, introducing them to low-cost solutions to improve waste management in Sakhalin Island mines.

Environmental Benefits

Recommendations in the Model Waste Disposal Program focus on four areas: (1) sediment/leaching control and capture; (2) coal recovery from waste piles; (3) improved waste treatment; (4) increasing the efficiency of the town boiler. Implementation of each of these measures will result in significant reductions in the environmental impact of mining operations at Sinegorskaya.

- *Installation of Sediment Control Measures.* Project findings estimate that implementation of sediment control measures as recommended in the Model Plan will significantly reduce the amount of sediment flowing into near-by bodies of water. Based on results achieved at US mining operations, it is estimated that implementation of the Model Program will result in reducing the sediment yield to the Susuya River by approximately 90%.

- *Coal Recovery* will reduce the risk and frequency of spontaneous combustion and reduce wind blown dust, leaching contaminants into the ground water and the discharge of sediment to local surface water. Furthermore, recovery of coal in the waste piles would reduce their volume by approximately 1/3, thereby reducing the area of impacted land by about 1/3.

- *Improved Waste-Rock Disposal* will reduce the risk of slope failure of the piles, of spontaneous combustion, and of wind blown dust.

- *The Town Boiler* is currently removing only about 28% of the heat content from the coal. Replacing this boiler with a new system with 75% efficiency will significantly reduce the quantity of coal required to operate the boiler. This will result in an accompanying reduction in emissions of carbon monoxide, carbon dioxide, and particulates. Although a precise estimate of this improvement is a function of the air treatment system and was beyond the scope of this project, it is likely that a reduction in air pollution of 90 to 95% could be achieved with a more efficient boiler.

Economic Benefits

Implementation of two of the above-mentioned recommendations in the Model Waste Disposal Plan will also bring significant financial benefits to the mine and the town of Sinegorsk. Specifically:

- *Coal Recovery* Project findings demonstrate that coal from the existing waste piles can be recovered at about $11.15 per metric ton, or at about one half the cost of mining coal from underground. Coal is currently sold for about $25 per metric ton. Based on processing 100,000 tons of waste rock annually and recovering 32,500 tons of coal from this waste rock, coal recovery from waste piles will result in approximately $450,000 additional income to the mine annually. Depending on the availability of crushing and screening equipment at the mine, the Project Team estimates that purchase and installation of equipment needed to recover coal from the waste piles will cost $680,000 and have a payback period less than 3 years, assuming an interest rate of 12.5%.

- *Boiler Replacement* Results of project findings show that replacing the Singorskaya town boiler with a more efficient system will result in about $260,000 to $340,000 in avoided fuel (coal) purchase costs each year.

Lessons Learned

Lessons learned from this project include the following:

- A significant portion of sediment resulting from mining operations in Russian Far East can be retained on site, without major capital expenditures, using methods that have been successfully implemented in the US for many years.

- Economical methods are available for recovery of coal from waste-rock piles in Russian Far East. Capital costs required for equipment purchases to accomplish this have a payback period of no more than 3 years. Nonetheless, capital money is scarce in Russian Far East, and coal-recovery projects must compete with other priorities for funding.

- Waste-rock disposal practices in Russian Far East create unstable conditions in the waste-rock piles. Practices can be economically implemented to improve the stability of waste-rock piles in the future.

- Replacement of inefficient town boilers in Russian Far East can significantly reduce the quantity of coal required, and the related cost, to produce a given amount of heat.

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Improving the Environmental Performance of Odessa CHPP 2 Heat Boilers in Teplodar, Ukraine

Project Title: Development of the Comprehensive Program for Reduction of Harmful Emissions into the Atmosphere by the Odessa Central Heating and Power Plant 2
Leader: Regional Community Utility Odessa CHPP 2, Odessa Ukraine
Partner: SRC International, Prague, Czech Republic
Partner: CENTURY XXI Ltd. Kiev, Ukraine
Associates: Real, Ltd., Kiev, Ukraine
Location of Project: Teplodar, Odessa Region, Ukraine
Project Duration: September 2000 - May 2001
EcoLinks Project Support: EcoLinks grant support: $43,898; Project Team cost-share contribution 19,530.

Best Practice: Transferable Solutions

The project "Improving the Environmental Performance of Odessa CHPP Heat Boilers" is an EcoLinks Best Practice. It illustrates the environmental and financial benefits that can be achieved through relatively low-cost efficiency improvements at heat utility plants in the NIS. In this case, the heat utility plant dramatically improved its environmental performance while reducing heat production costs by more than 50%. The project shows the value of taking a systematic approach to improving energy efficiency, and in identifying both high and low cost measures which can be implemented as funding allows. The methodology for conducting energy and environmental audits and for development of a feasibility study comparing various scenarios can be used by other heat utilities in the NIS. The methodology will be particularly transferable for heat utilities with boilers which generate super-saturated steam and for heat utilities considering the introduction of co-generation.

Project Summary:

The heat-only boiler plant (HOBP) in Teplodar was originally constructed for the commissioning of a planned 2-reactor nuclear heat and power plant at Teplodar. Plans to build the nuclear plant in Teplodar were abandoned after the Chernobyl accident in 1986, and the HOBP remains the only heat source for more than 10,000 inhabitants, commercial consumers and public services in the area. Since the HOBP was originally planned to be used only during the commissioning of the nuclear power plant, even the environmental requirements that were in place at the time of the HOBP's construction were not observed (for example, the HOBP has a very short-stack chimney, only 40 meters high).

Prior to project implementation, the HOBP ran on bunker fuel oil and the boiler and heat distribution systems of HOBP did not run efficiently. Consequently, HOBP was a very heavy polluter, and emissions greatly exceeded permissible limits. Prior to project implementation, annual emissions from the HOBP were estimated at 38 tons of CO, 89 tons of NO_x, 7 tons of ash, 371 tons of SO_2 and 4 tons V_2O_5.

The goal of this project was to develop a comprehensive strategy to reduce these emissions by improving energy efficiency at the HOBP. An audit of the current energy flows at the HOBP and in the heat distribution network was conducted, including an audit of selected end-users and an estimation of energy savings potential. Training for plant managers in monitoring heat production and in conducting energy audits was also carried out. Based on the results of the energy audit, project experts developed a feasibility study for suggested efficiency improvements at the HOBP. A final product of this project was a fully developed Action Plan for energy efficiency improvements at HOBP.

Using the findings and recommendations developed in this project, HOBP management was able to demonstrate to the Odessa regional government administration the significant environmental improvements and cost savings that could be achieved through a fuel switch from bunker fuel to natural gas. The Odessa regional government administration contributed $460,000 to carry out this fuel switch on two of the four boiler units and HOBP management has contributed Plant resources to carry out several smaller efficiency measures. The economic and environmental impact of these energy efficiency measures has been significant: SO_2 ash and V_2O_5 have dropped to virtually zero, CO and CO_2 emissions have been reduced by 70 % and 20% respectively compared with pre project levels, while HOBP's cost for producing a unit of heat at has dropped by about 50%.

Project Activities

The goal of this project was to develop a comprehensive strategy to reduce emissions at HOBP by improving energy efficiency. The project activities included the following:

1. Energy and Environmental Audits of Teplodar HOBP

Action: The project team calculated the energy balance at the HOBP and in the district transmission network, the central heat exchangers, and the heat distribution network. Energy losses in selected end user apartment buildings and commercial enterprises were also estimated. During the energy audit process, auditors also calculated or estimated pollutants resulting from the HOBP and district heat network.

Findings of the energy audit showed that: (1) Over 11% of energy is lost in the two-step process of heat production (production of steam in the boilers which is then converted to hot water). (2) About 7% of energy input to the plant is lost through inefficiencies in the heat supply needed for various processes in the boiler room (including preparation of bunker fuel for burning). An additional 5% of the total energy input to the plant is lost through inefficiencies in heat supply at the plant site (losses from heating plant buildings, etc). (3) There are significant power losses in the transformation process (from high voltage to low voltage) of electricity, which the plant purchases for its own energy consumption needs. (4) Energy losses in the heat transmission pipe line and hot water and heat distribution network equal almost 25%. This is partly due to the over-sized capacity of the district network (for its current use of supplying heat and hot water to 10,000 residential users) and partly due to poor thermal insulation of district heat pipes and heat exchangers. Total energy losses from the Teplodar HOBP heat production, transportation and distribution equal more than 47%.

Findings of the environmental audit showed that the type of fuel used at the Teplodar HOBP, bunker fuel (which is a heavy fuel oil high in sulfur content), resulted in annual emissions of

371 tons of sulfur oxides and 89 tons of nitrogen oxide, as well as V_2O_5 emissions and other heavy metals.

As a result of these findings, the Project Team developed no, low, medium and high-cost measures to reduce energy losses in the district heating system and to improve environmental performance.

> No-and Low-Cost Measures: The project team recommended conducting an awareness and information campaign to explain to end users no-cost measures to reduce energy losses in their homes, such as the optimal level of humidity in apartments, etc. The project team identified basic insulation measures in apartment buildings, such as sealing windows and installing aluminum foil behind radiators installed in external walls as the low-cost measures with the highest potential energy savings. Estimated simple pay back period for all no-and low-cost measures is less than two years.
>
> Medium-Cost Measures: Medium-cost measures identified by the Project Team focused on the plant boilers, the district-heating network and on end-users buildings. Recommendations included installing metering devices in end-user buildings where possible; regularly monitoring the efficiency in the boilers and consumption and losses throughout the system; and closing off hot water pipes in the HOBP and district heating network which are no longer used. Estimated pay back period for these medium-cost measures is less than two years. The Project Team also recommended a series of more expensive insulation and sealing measures (such as insulating buildings) on end-user buildings, which could be financed by the municipal authorities.
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> High-Cost Measures: High-cost measures focus mostly on rehabilitation/modernization measures. Recommended high-cost rehabilitation measures include: modernizing boilers at the Teplodar plant; repairing and replacing the heat main pipe from the Teplodar plant to the city and distribution pipe within the city; rehabilitating of the heating system in end-user buildings; carrying out a fuel switch at HOBP from bunker fuel to natural gas; installing steam turbines at the plant; and replacing district tap water heating system with local tap water heating, through heat exchanges located in individual buildings. Estimated simple pay back period for all of these measures is less than five years, with the exception of replacement of the district tap water system, which has a pay back period of 12 years.

Product(s): 1) Energy and environmental audit of the HOBP and district heat network produced completed. 2) No, low, medium and high-cost measures to reduce energy losses and to improve environmental performance were developed.

2. Training of HOBP Staff in Metering Equipment, Estimating Energy Use/losses and Conducting an Energy Audit

Action: The Project Team trained Teplodar HOBP staff to use the methodology applied within project implementation to measure or estimate energy use and loss throughout the system. This training included use of special equipment, such as the infrared thermometer as well as appropriate computer programs, such as TERMIFLOW. Selected staff were also

trained in conducting an environmental audit, and in the methodology of cost benefit analysis, including the benefits of using FINPLAN software.

Product(s): 1) Increased capacity of HOBP staff to monitor energy efficiency/losses. 2) Selected HOBP staff trained to conduct an environment audit and cost/benefit analysis.

3. Development of a Feasibility Study Comparing 5 Possible Scenarios at HOBP

Action: The project team developed five scenarios for reducing energy losses at the HOBP. These included (1) Decommissioning of the HOBP and replacing it with a large, co-generation plant; (2) Optimization of existing HOBP operation, combined with installation of steam turbines (which would allow for co-generation); (3) Decommissioning of the HOBP, replacing it with small co-generation plants located closer to end users; (4) Replacement of the district heating system with local heating systems in Teplodar city; (5) Replacement of the district heating network with local heating systems.

Economic and environmental analysis was done for each scenario. The Project Team, together with the HOBP management decided that Option #2 "Optimization of existing HOBP operation combined with installation of steam turbines (which would allow for co-generation)" was the most attractive in the near-term future. The Project Team recommended that this option be implemented in tandem with energy efficiency improvements in the heat transmission and distribution networks and in end user buildings for maximum effect.

Product(s) 1) Feasibility study on reducing energy losses at the HOBP produced.

4. Fuel Switch from Bunker Fuel to Natural Gas at the Teplodar HOBP

Action: A critical step in realizing Option #2 at the HOBP was making a fuel switch from bunker fuel to natural gas, which would result in significant cost savings and greatly improve the environmental performance of the HOBP. Further, this fuel switch is a critical precursor for the installation of steam turbines and thus for co-generation at the HOBP. With data and findings developed through this EcoLinks funded project, the Project Team was able to demonstrate and quantify these benefits, and the regional government of Odessa contributed $460,000 to carry out this fuel switch on two of Teplodar's four boilers. The switch was completed in December 2000 and involved reconstruction of fuel and burning systems in two boilers, laying 1600 meters of pipe, installing three gas compressor stations and building a new distribution system inside the HOBP.

Product(s): 1) Fuel switch from bunker fuel oil to natural gas at two on the HOBP's four boliers.

5. Installation of New Heat Transport Piping System to Administration Buildings on HOBP Territory

Action: New heat transport pipes between the boilers and the administration buildings at the HOBP site were installed. The pipes are more direct than the previous heat transport system and better insulated. The approximate cost of this work was $5,000 and it was paid for by Teplodar HOBP.

Product(s): 1) New heat transport pipes installed to HOBP administrative buildings.

6. Development of an Action Plant for Implementing Efficiency Measures

Action: The Project Team developed an Action Plan outlining major recommended energy saving measures, their costs, benefits, potential funding sources and estimated timetable for implementation. Measures focused on five potential areas of energy conservation: decreasing consumption and losses in the Plant; reducing thermal losses in the heat main network; reducing thermal losses in the heat distribution network; reducing thermal losses in the hot tap water heating and distribution network; reducing thermal losses in end-user buildings. Total cost for rehabilitating the HOB district heating network and implementing recommended energy saving measures is approximately $1.4 million. All but one of the recommended measures have simple payback period of between several months to five years.

This Action Plan was presented to the Odessa Regional Council in March 2001. The Odessa Regional Council showed much interest in supporting the public awareness raising measures in the near-term future and also interest in financing the purchase of one gas turbine to allow for co-generation in 2003.

Product(s): 1) An Action Plan outlining major recommended energy saving measures, their costs, benefits, potential funding sources and estimated timetable for implementation was developed.

Follow-up Activities

Near-term follow up activities include the preparation of a business plan for selected measures, which will be presented to the Odessa Regional Council by the end of 2001. Measures highlighted in the business plan will include the purchase and installation of a steam turbine and connection of the boilers to the 120m chimney. The Plant also plans to undertake some of the recommendations on reconstruction/repair of boiler units to optimize steam production and in the piping system on Plant territory to reduce heat losses, using the Plant's own resources.

In the longer-term, the management of Teplodar's HOBP will develop a strategic plan of measures to be implemented, including rehabilitation and insulation of the main heat pipe from the HOBP to Teplodar city pipes, rehabilitation of the hot tap water heating and distribution network, and consistent monitoring of energy loss and use throughout the system. The management of the Teplodar HOBP will also assist Teplodar government authorities in preparing a public awareness campaign on household energy savings measures.

Project Benefits

This project resulted in environmental, economic and capacity building benefits. Capacity building benefits were realized through training for HOBP staff in how to monitor energy use/losses and how to conduct an energy audit. Environmental benefits include significantly reduced emissions and reduced water use, achieved through the fuel switch to natural gas and other energy efficiency measures. Finally, this project also brought significant monetary benefits, through cost savings resulting from more the efficient use of natural resources.

Capacity Building Benefits

Within the implementation of this project, HOBP staff gained experience in conducting energy and environmental audits and in analysis of audit results. This experience included both methodology and data collection, as well as the use of measurement instruments, including an infrared thermometer and metering equipment. Selected HOBP staff were also trained to develop a feasibility study/cost benefit analysis and computer soft ware tools.

Environmental Benefits

Environmental Benefits of Completed Measures
Measures completed within this project include the fuel switch from bunker fuel to natural gas and subsequent decommissioning of the old fuel oil handling system.

Fuel switch to natural gas on two boiler units: total cost $460,000 (Completed)

Pollutant	Pre-project emission	Post-project emission
CO	38 tons per year	12.9 tons per year
SO_2	371 tons per year	0 tons per year
V_2O_5	3.6 tons per year	0 tons per year
Nox	89.3 tons per year	91.5 tons per year
Ash	6.6 tons per year	0 tons per year

Furthermore, the fuel switch to natural gas has also resulted in an annual water savings of about 2,500 m^3, mostly as a result of the decommissioning of the old oil handling system.

Environmental Benefits of Planned Measures
Additional priority measures identified in the feasibility study include repair of the boiler units to optimize steam production, repair (and in some cases decommissioning or replacement) of the piping system on Plant territory to reduce heat losses, installation of metering equipment to measure fuel and steam consumption and heat supply throughout the system. Implementation of these measures will result in increased efficiency and additional reductions in CO, CO_2, NOx and water consumption.

Economic Benefits

The economic benefit of the switch from bunker fuel to natural gas includes cost savings in fuel purchase, transport, handling/storage and preparation. One unit of heat produced from natural gas at Teplodar costs less than half of a unit of heat produced from bunker fuel, and this equals an annual costs savings of almost $200,000. This fuel switch also allows for the possibility for Teplodar to produce its own electricity (after the installation of a steam turbine), which it will be able to produce at about half the cost of buying electricity from the power distribution company. Expected payback time of the fuel switch on two boilers is 2-2.5 years.

The cost of additional priority measures (focusing on repair/reconstruction of boiler units, of the piping network on Plant territory and installation of metering equipment) recommended in the feasibility study is estimated at $175,000. These measures have a payback period of less than 5 years.

Lessons Learned

This project demonstrates that, while municipalities in NIS do have modest funds to support project implementation, in many cases they lack reliable data or well developed feasibility studies which project the costs and benefits of environmental investment projects. The Odessa CHPP-2 Project Team was able to attract significant funding from the Odessa regional government administration because they were able to clearly demonstrate both the environmental and financial benefits of project implementation.

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Reducing Wastewater Contamination at Celhart Donaris S.A. in Romania

Project Title: Reducing wastewater contaminated with fibers and dissolved organic substances
Leader: Celhart Donaris S.A., Braila, Romania
Partners: Ekono Inc., Bellevue, WA USA and Ceprohart S.A. Braila, Romania
Location: Braila, Romania
Project Duration: September 2000-September 2001
EcoLinks Project Investment: Total EcoLinks Project Investment: $69,986; EcoLinks Grant Support: $49,582; Project Partner Cost Share Contribution: $20,404.

Best Practice: Transferable Solution

This Best Practice, Reducing Wastewater Contamination at Celhart Donaris in Romania, provides a concrete set of actions for identifying critical pollution sources and reducing wastewater pollution associated with manufacturing pulp and paper. Celhart Donaris, a pulp and paper mill in Romania, upgrades its environmental disposition to meet new environmental standards established by Romanian authorities and ultimately to strive toward achieving EU requirements. This Best Practice guides the way for similar companies throughout Romania to work towards achieving national and EU environmental goals. With implementation of these measures, the discharge of dissolved organic substances is significantly reduced decreasing the environmental impacts on water quality in the Danube Basin. By reducing operating costs, the Company builds its capacity to financially support practical measures to meet national standards.

Project Summary

Celhart Donaris Mill, a pulp and paper processing facility in Braila, Romania, consumes large amounts of water (200 m^3/ton of pulp) and bleaching chemicals (95-100 kg chlorine per ton of pulp). This consumption leads to excessive wastewater discharge consisting of dissolved organic substances (measured by Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), and phenols, resin and fatty acids (RFA)). Celhart Donaris exceeds wastewater discharge requirements according to the new standards under a "Water Management Permit" issued annually by the National Authority on Romanian Waters in Bucharest. The company's wastewater discharge also exceeds EU environmental standards in organic substances (COD and BOD) and chlorinated organics (AOX). The wastewater effluent is discharged in the Danube Basin and negatively impacts the flora and fauna of the Danube River and Danube Delta.

While there are many plants at the Celhart Donaris Mill, processing wood pulp is an especially chemical intensive process. Bleaching pulp is the most polluting technological phase in pulp processing. Celhart Donaris uses chlorine and chlorine based chemicals (e.g., chlorine dioxide and sodium hypochlorite) in its bleaching plant. The bleaching plant effluent from Celhart Donaris contains high levels of dissolved organic substances and chlorinated organic substances. About 50% of fiber loss and dissolved organic substances in the company's wastewater is discharged from the bleach plant. Chlorinated organics that are very toxic and generate dioxins and furans, are also found in the wastewater and discharged from the plant.

Celhart Donaris is challenged to meet the environmental requirements set by Romanian Authorities for wastewater effluent discharged into the Danube River. In this project, Celhart-Donaris collaborates with an American firm, Ekono and a Romanian partner, Ceprohart to develop and implement a feasible scheme for reducing wastewater pollution. Several environmental measures are developed and financing options are explored.

This project is especially useful in exploring multiple measures for reducing wastewater pollution while also considering important economic factors associated with their implementation. With implementation of the environmental measures outlined and initiated in this project, reductions in organic dissolved substances (indicated by COD and BOD) are achieved. Chemical Oxygen Demand (COD) of wastewater effluent, for example, is ultimately reduced from 175 kg/ton to 99.4 kg/t. The Biological Oxygen Demand (BOD) is reduced from 55 kg/t to 29.5 kg/t. By applying the financial options outlined in this project to reduce operating costs, increase revenues and implement an AOX Reduction Program, Celhart Donaris can achieve national standards. Detailed descriptions of the project activities, benefits, lessons learned, and contact information are provided in the following sections.

Project Activities

To reduce fiber and dissolved organic substances in wastewater, an assessment of several plants at the Celhart Donaris Mill was conducted: pollution sources were identified; and pollutants were measured and analyzed. A feasibility study for applying oxygen delignification technology was then conducted. A program was developed to reduce wastewater pollutants and a monitoring system was put into place. These actions are described in detail below along with a list of items produced with each action step (i.e., reports, data, etc.).

1. Conducted complete assessment, emphasizing the identification of pollution sources

Action: Assessed operating capacity; production levels; consumption of raw materials, energy, water, and chemicals; process flows; and major technical and economic parameters. Flow sheets for all operations were reviewed. Data on the production levels, and the consumption of raw materials, water and chemicals for the year 1999 were reviewed. The data were used to develop material and energy balances and to prepare an "Oxygen Delignification Feasibility Study." Pollution sources (i.e., flow and composition) were identified.

Product(s): 1) Flow sheets on pollution sources (36 polluting sources were identified and mapped) 2) Block diagrams 3) Basis for design of Oxygen Delignification Feasibility Study

2. Measured and analyzed pollution levels

Action: Measurements of pollution levels were taken at each identified critical pollution source. An analysis based on these measurements was conducted in light of Romanian environmental legislation and the permitting requirements of the National Authority of Romanian Waters. A measurement program was set up consisting of:

sampling points, indicators to be measured, sampling frequency, and period of measurements for the different pulp mill and chemical recovery system, the fine paper machine, the duplex board machine, and the freshwater treatment plant.

Product(s): 1) Table comparing Ceprohart production of Total Suspended Solids (TSS), Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) and legislative and permitting requirements 2) Measurement program 3) Measurement results regarding TSS content and dissolved organic substances content

3. Conducted Oxygen Delignification Feasibility Study

Action: The possibilities for introducing an oxygen delignificaiton plant were explored in terms of site, benefits, and costs. The pulp mill site where an oxygen delignification plant might be built was visited. The facility is needed to address effluent problems associated with the operations of the bleaching plant and to comply with Romanian and European environmental legislation that puts limitations on effluent levels of BOD, COD, chlorinated organic substances, etc.

Product(s): Arrangement drawings and cost estimates for the installation of an oxygen delignification facility

4. Developed a program to reduce wastewater discharges from pulp, paper, and board mill operations

Action: Alternatives for reducing pollutants at different facilities were identified. They are listed below.

1) Screening Plant: The screening plant was replaced. The new plant operates under a closed system based on pressure. New pollution levels based on this installation were measured and recorded.
2) Cooking Plant: A pre-impregnation stage was added at the cooking plant.
3) Oxygen Delignification Plant: The feasibility study indicated that a new plant would be too costly. The low-cost alternatives for oxygen delignification included: 1) two-stage oxygen delignification using a single reactor; 2) mini-oxygen delignification process; and 3) hexenuronic acid removal (HEX-A Process).
4) Bleaching Plant: To reduce pollution associated with bleaching activities, possibilities to eliminate chorine and sodium hypochlorite (i.e., chlorinated organics (AOX)) [THIS NEEDS TO BE CONFIRMED] were identified. The possibilities included: 1) altering the chlorine/chlorine dioxide bleaching stage to chlorine dioxide at medium to low consistency; 2) altering the oxidative extraction stage to oxidative extraction with hydrogen peroxide addition; and 3) replacing the sodium hypochlorite bleaching stage with other bleaching sequences.

Financing options were explored to implement several measures. Options for increasing revenues were explored. They included: increasing production rate, operating an evaporator train to promote steam savings, and lowering soda losses from the recovery and recausticizing areas. Alternative measures were developed in cases where improvements proved to be too costly.

Product(s): 1) Alternatives and inexpensive solutions for reducing pollutants at the cooking plant, washing and screening Plant, bleach plant, and wastewater treatment plant 2)

Comparative table of discharges from old screening plant and new screening plant 3) Environmental Management Plan including a program to prevent plant malfunctions, possibilities to collect and store spills and uncontrolled contaminated discharges 4) An investment program to meet new environmental targets

5. Developed monitoring system

Action: A monitoring program for wastewater discharges was developed. The monitoring program assessed normal operating conditions and allowable limits.

Product(s): Monitoring program

6. Disseminated project activities and results

Action: The results of the project were shared at seminars and through publications.

Product(s): 1) A paper titled, "Reducing wastewater contaminated with fibers and dissolved organic substances – EcoLinks project for S.C. Celhart Donaris S.A. Braila" was presented at two seminars: "Novelties in pulp and paper fabrication" and "Economical and social re-launching –Braila 2001" 2) Presentation of project activities and results at the Second Romanian-Italian Seminar in the Field of Pulp and Paper, "Additives, Machinery, and Automation Systems" 3) Final Report published in the "Technical and Informative Bulletin" at Ceprohart 4) Article on project to be published Balkan Pulp and Paper magazine

With the application of the methods and materials listed in this section, specific benefits are accrued that allow Celhart Donaris to achieve compliance with Romania environmental regulations regarding wastewater management.

Project Benefits

This EcoLinks project promotes several benefits. The project establishes a context of collaboration and technology transfer that promotes several tangible environmental and economic benefits. Through the project partnership and information sharing, the content of fiber and dissolved organic substances in wastewater effluent generated by Celhart Donaris was reduced and savings generated. These benefits are described in more detail in the following subsections: capacity building benefits, environmental benefits, and economic benefits.

<u>Capacity Building Benefits</u>

This project promoted several capacity building benefits through the cooperative approach to problemsolving. Cooperation on this project allowed for the development of an exhaustive measurement program to assess pollution levels at Celhart Donaris. The technical expertise of the partners and the on-site knowledge of the project leader provided a basis for developing creative alternatives for addressing the environmental problems associated with pulp and paper production.

Several publications and presentations on the project were developed and shared (See Product(s) in Project Activities #6). This transfer of knowledge and opportunity to engage

other interested parties in constructive dialogue enhanced the capacity to improve environmental practices for ecological and economic benefits in the pulp and paper industry. The environmental and economic benefits are listed in the next two subsections.

Environmental Benefits

This project reduces the amount of pollution from wastewater effluent. Measured most notably by chemical oxygen demand (COD) and biological oxygen demand (BOD), dissolved organic substances in the wastewater generated by Celhart-Donaris are reduced significantly through the application of the techniques and tools identified in this project. The reductions are accounted for in the following ways.

- Installation of a new screening plant reduces fiber and dissolved organics. Dissolved organics are reduced by 36%. See Table 1. *Project Implications for Reducing Dissolved organic Substances.*

Table 1. Project Implications for Reducing Dissolved organic Substances

Indicator	Before project	After new screening plant	After implementation of proposed measures
COD_{Cr} kg/t	175	149.0	99.4
BOD_5 kg/t	55	44.0	29.5

- Introduction of a pre-impregnation stage at the cooking plant reduces bleaching chemical consumption as well as BOD and COD each by 10%.

- Installation of an oxygen delignification plant decreases COD from the bleaching plant by 60% (from 81 to 33 kg/t) and BOD by 50% (from 30.5 to 15.2 kg/t). Total chlorine consumption for bleaching purposes is decreased from 80-100 kg/t to 50 kg/t. However, a feasibility study revealed that the plant would be too costly, so alternatives were generated to produce similar results [THIS NEEDS TO BE CONFIRMED].

- Implementation of an AOX Reduction Program will lower the AOX discharges to a level comparable (less than 0.5 kg/BDT) to the mills operating in the US or EU.

- Recirculation of black liquor into the recovery loop and thickening of the rejects and sending them back to the bark boiler further reduce organic substances discharge.

- Closure of water circuits by recirculating filtrate from the decker to the fourth washer leads to a reduction of fresh water consumption by 150 m^3/h which also improves the washing efficiency.

In the next section, the economic benefits of this project are discussed.

Economic Benefits

The need to meet the new Romanian environmental standards is a pressing concern for Celhart Donaris. Also pressing, however, is the need to make this process economically

feasible. To address this challenge, measures to provide revenues to finance proposed measures and several operating cost changes were identified. The additional revenues provide an internal rate of return (IRR) in excess of 20% for investments in the range of $21,744,245 to $27,956,887. This capital would cover the investments to increase Celhart Donaris' production rate by 23,000 BDt/yr and to satisfy the required environmental improvements to meet the new Romanian regulations.

Financing options, for implementing several of the proposed measures, are enhanced by generating savings from applying different techniques. For example, a savings of $155,279 per year can be generated from operating the evaporator train as a six-effect unit. An additional savings of $310,559 per year can be generated by lowering soda losses from the recovery and recausticizing areas. These savings can be used to implement wastewater management measures identified in the project.

Operating cost changes to meet the new Romanian regulations also generate further savings. The changes and savings include:

1) Lowering sodium losses by 10 kg NaOH/BDt by reactivating the idled number four washer, closing the screen room, treating screen room rejects, and applying best management practices as outlined by the project provides a cost savings of $46,584 per year.
2) Installing an impregnation vessel reduces the consumption of chemicals in the bleach plant (e.g., chlorine, chlorine dioxide, sodium hydroxide, and hypoclorite) and provides a savings of $83,998.
3) Implementing an AOX Reduction Program would provide an annual savings of $102,499 in bleaching and recovery chemical costs.
4) By reducing pollutant discharges, a total savings of $65,217 is generated from reduced charges for water pumped from the Danube River as well as polluted effluent that is discharged back into the river.

Many of the solutions generated through this project provide additional economic as well as environmental benefits. For example, recirculating black liquor into the recovery loop and thickening the rejects reduces dissolved organic substances at a low cost. A pre-impregnation vessel can be acquired inexpensively (approx. $300,000) and also promotes notable environmental benefits as discussed in the preceding subsection.

Several lessons were learned during the implementation of this challenging task to meet new Romanian regulations. They are provided in this next section.

Lessons Learned

During the implementation of this project, several lessons were learned. Other pulp and paper mills in Romania adjusting to the new Romanian environmental regulations can benefit from these lessons as they apply the methodology developed in this project.

- Qualified, knowledgeable partners secure the success of a given project. The collaboration between the project leader and project partners improved the scientific interpretation of measurement results. Ekono's knowledge on updated methods and

technologies for addressing environmental problems was especially useful for generating solutions.

- Purchasing software VISIO 2000-Technical Edition increased the productivity of project participants through the development of flow sheets, block diagrams, and balance sheets.
- The Oxygen Delignification Feasibility Study revealed that a plant for this purpose would be a huge investment with a return of investment of 17 years. Less expensive alternatives were generated which would provide similar environmental benefits at a lower cost. The alternatives are listed in the Project Activities section.
- Working together in the same office or at the mill site allowed all the project participants to clarify and concentrate on the same issues and to share knowledge and experiences immediately.
- Implementation of the work plan was facilitated by good cooperation and coordination between the project leader and partners. Duties and responsibilities were clear through ongoing dialogue and interaction.

Contact Information

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Developing an Environmental Management System at Concern Stirol in Ukraine

Project Title: The Development of an Environmental Management System and Preparation for Certification and Compliance with ISO 14001 Requirements at Concern Stirol
Leader: Concern Stirol, Donetsk Oblast, Ukraine
Partners: 1) Futurepast, Inc., Arlington, VA, USA; 2) Ukrainian Environmental Technology Center (UkrNTEC), Donetsk, Ukraine
Location: Donetsk Oblast, Ukraine
Project Duration: January 2001-January 2002
EcoLinks Project Investment: Total EcoLinks Project Investment: $106,221; EcoLinks Grant Support: $48,785; Project Partners Cost Share Contribution: $57,436

Best Practice: Transferable Solution

This project is a Best Practice because Concern Stirol, a chemical manufacturing company in Ukraine, established itself as a model and an experienced guide and mentor in Environmental Management Systems (EMSs) and ISO 14000 series standards. The ISO 14000 series emphasizes an internationally established protocol and standard for controlling and monitoring harmful emissions and waste materials. With the support of an EcoLinks Challenge Grant, Concern Stirol used the EMS/ISO 14000 series to generate the framework and impetus for other companies throughout Ukraine to reduce the environmental impacts of industrial activity and increase their competitive stance in national and international markets.

Through this project, Concern Stirol becomes the first company to be certified in ISO 14001 procedures by a third party organization. Concern Stirol employees received expert training in environmental auditing to identify and control energy use, emissions, and waste. With the implementation of the EMS established in this project, Concern Stirol reduced ammonium emissions by 233 metric tons per year and ammonium nitrate emissions by 96 metric tons per year. Companies incorporating the system outlined in this project gain economic benefits including improving their access to loans, increasing their competitiveness, and reducing operation costs through energy savings.

Project Summary

Ukraine is highly industrialized. The Donetsk region in eastern Ukraine has a disproportionately high share of industrial activity compared to the rest of the country. Companies are still in the early stages of preparing to meet national environmental policy objectives and internationally recognized environmental standards. In 1997 Ukraine adopted ISO 14001 as a national standard. The ISO 14000 series standardizes the field of environmental management systems and tools promoting consistent and effective organization and product evaluation (e.g., environmental auditing, environmental labeling, environmental performance evaluation, etc.). Prior to project implementation, Ukrainian companies had no experience preparing for third party ISO 14001 certification.

Concern Stirol, an open stockholding company founded in the 1930s, is one of the biggest manufacturers of ammonia, fertilizers, polystyrene, pharmaceutical products and building materials in Ukraine. It captures 80% of the external market for agricultural chemicals. While Concern Stirol has experience with environmental management programs, due to the scale of its operations (4,500 full-time employees and multiple large-scale production lines), it sought additional expertise on EMSs and ISO 14000 series standards.

With the support of an EcoLinks Challenge Grant, Concern Stirol teamed up with Futurepast, Inc. a US firm and UkrNTEC of Ukraine to establish an EMS that meets ISO 14001 standards. This project established the process by which Concern Stirol was able to design and implement an EMS qualifying it for ISO 14001 third party certification. Concern Stirol's final ISO 14001 third party certification was subsequently achieved.

To prepare for ISO 14001 certification, an initial assessment of environmental management practices at Concern Stirol was conducted and recommendations were provided. Additionally, employee trainings in EMS/ISO 14000 series standards with an emphasis on environmental auditing, on-site visits of model companies in the US, and a pre-registration audit were conducted. The notable outcomes of this project include initiation of the ISO 14001 third party certification process for companies in Ukraine, a reduction in harmful emissions with each new registrant, and improved competition and financial opportunities for companies in Ukraine. In the next sections, detailed descriptions of project activities, benefits, lessons learned, and project participant contact information are provided.

Project Activities

The following methods and materials were applied at Concern Stirol to develop an EMS in accordance with ISO 14001 standards and to prepare to achieve ISO 14001 third party certification. Other companies in Ukraine seeking to achieve similar results can replicate these methods.

1. Established Steering Committee for the EMS/ISO 14001 Implementation Project

Action: The EcoLinks project team met with the senior management at Concern Stirol to organize a steering committee to establish and implement an EMS according to ISO 14001 standards.

Product(s): 1) Organizational structure to implement ISO 14001

2. Conducted review of existing environmental protection system and developed recommendations for incorporating EMS ISO 14000 elements

Action: Stirol environmental specialists and UkrNTEC project team members conducted a review of the currently operating environmental protection system at Stirol. An analysis of existing documentation procedures was conducted. Existing environmental data bases created in accordance with existing national legislation were reviewed. Recommendations based on ISO 14001 standards were developed. Futurepast Inc. provided an introductory seminar on ISO 14001 standards for Stirol staff.

Product(s): 1) Audit Report (confidential) 2) Environmental parameters and ranking procedure 3) Methodology for data collection, storage, and treatment 4) Documentation templates (e.g., audit check-list) 5) Authorization procedure for documentation 6) Seminar on ISO 14001 for Concern Stirol staff

3. Developed an ISO 14000 EMS data base concept

Action: A concept for an EMS data base system including reference terms for software development was developed. Waste treatment documentation was of special concern. The data base is to include a list of emissions associated with hazardous chemicals, an inventory of release points, control equipment, and monitoring and test points, and a summary of economic information related to plant emissions. The target audience is to include specialists and managers in the industrial sector, parties interested in statistics compilation, and environmental inspectors.

Product(s): 1) Scheme of ISO 14000 EMS Data Base Concept and draft terms of reference for software development 2) Target audience identification

4. Identified corrective actions and developed corrective actions working design

Action: Upon review of existing environmental protection activities at Concern Stirol, corrective actions were identified. A process for assessing corrective actions was established. The working design emphasized 1) new technology for the compression of gaseous ammonia; 2) new membrane technology for air separation to decrease NH_3 emissions; and 3) new membrane technology for sewage water purification to decrease fresh river water intake and polluted water discharge.

Product(s): 1) Criteria for corrective actions assessment 2) Corrective actions working design

5. Conducted internal auditor training course

Action: A three-day internal auditor Training Course, "Documenting an Environmental Management System," was conducted. Twenty-five participants attended and included the Concern Stirol EMS implementation team, staff members from UkrNTEC (project partner), top management staff from Stirol, and representatives from the Ecology Office. Participants learned how to create flowcharts, establish a structure for a documented management system, and write procedures and work instructions. The training also provided an overview of the EMS ISO 14001 requirements.

Product(s): Twenty-five trained internal auditors at Concern Stirol to ensure ISO 14001 compliance

6. Toured US facilities to observe ISO 14001 implementation procedures

Action: A study tour of five facilities in the US to observe and experience the application of ISO 14001 standards was completed. The following facilities were visited: Nissan Motor Manufacturing Corporation in Smyrna, TN; Bridgestone/Firestone Inc. in Nashville, TN; Reichhold, Inc. in Bridgeville, PA; ChemFirst Fine Chemicals, Inc. in Tyrone, PA; and P.H. Glatfelter Company in Spring Grove, PA. A meeting was also convened with the Deputy Assistant Secretary for Pollution Prevention and Compliance Assistance from the Pennsylvania Department of Environmental Protection. ISO 14001 implementation procedures were observed and documentation procedures were shared.

Product(s): Comparative case examples of ISO 14001 implementation and documentation procedures

7. Prepared for registration audit

Action: An internal audit team conducted a pre-registration audit of Concern Stirol's EMS to assess its conformity with ISO 14001 standards. Debriefing sessions were held.

Product(s): A complete audit report including nonconformance reports, an audit plan, and auditor working papers

8. Finalized contract for registration and completed public information materials for distribution

Action: A registration audit was scheduled. Team members shared their experiences implementing the EMS.

Product(s): 1) Contract for registration audit appointment 2) 2000 copies of booklet, "Concern Stirol ISO 14001/EMS" for distribution at Concern facilities 3) 150 copies of booklet "Partnership program. ISO 14000: from problem to solution" for broad distribution 4) Paper presentation at American Society for Quality's ISO 14000 Conference to be held March 19-22 in Reno, Nevada

This methodology provides a step-by-step account of the methods and materials used to complete this project. The next section, "Project Benefits," outlines the measurable outcomes of applying this methodology.

Project Benefits

In addition to the environmental and economic benefits derived from applying an EMS/ISO 14001 standard, a most notable benefit from this project is capacity building. This project strengthens the capacity for Ukraine's industrial sector to design and implement effective EMSs by making Concern Stirol a model company in the third party ISO 14001 certification procedure. The application of this standard reduces harmful emissions, makes certified companies more competitive on the open market, and increases financial opportunities. A detailed outline of the capacity building benefits, environmental benefits, and economic benefits is provided below.

<u>Capacity Building Benefits</u>

Organizational capacity building is key in terms of designing and implementing an effective EMS program in accordance with ISO 14001. Given that Concern Stirol has 4,500 full-time employees, designing and implementing an effective EMS is a large task. This project provided capacity building elements necessary for EMS implementation at Concern Stirol and throughout Ukraine. Those elements are:

1) A training seminar in EMS/ISO 14000 series standards with an emphasis on environmental auditing. Twenty-five people, mostly Concern Stirol staff, were trained in environmental auditing.

2) In 1997 Ukraine adopted ISO 14001 as a national standard and Concern Stirol is expected to be the first organization in Ukraine to become registered by a third party organization as meeting the standard's requirements.

3) A registered EMS raises employee morale and demonstrates management commitment. Confident employees positively affect company operations and production.

4) Concern Stirol and Futurepast Inc. have established a relationship that is fostering future engagements and networks. For example, John Shideler of Futurepast Inc. has been invited by a Concern Stirol staff member to participate in a seminar in Kiev on ISO 14001.

Environmental Benefits

Implementing an EMS in accordance with ISO 14001 standards provides direct environmental benefits. Vital natural resources, especially non-renewable energy sources such as fossil fuels, are used more efficiently. Harmful emissions from the combustion of fossil fuels, ammonia, and ammonium nitrate are reduced.

With an EMS/ISO 14000 series program in place, both operations and mechanical aspects of production at Concern Stirol are more efficient. With improved efficiency, fewer raw, non-renewable resources (e.g., fossil fuels) are consumed. With more efficient use of combustibles, there are fewer greenhouse gases emissions that pollute ambient air and contribute to global warming.

The EMS/ISO 14000 series program at Concern Stirol controls harmful emissions by monitoring, documenting, and planning for further reductions. With the implementation of this program, ammonia emissions were reduced by 233 metric tons per year starting March 2001. Ammonium nitrate emissions were lowered by 96 metric tons per year. Ammonia concentration within the company area is the lowest in twenty years.

Economic Benefits

The primary economic benefit from ISO 14001 certification is increased competitiveness on the international market. As most of Concern Stirol's goods are sold to the European market, ISO 14001 certification helps it to maintain its competitive position with European buyers. ISO 14001 certification helps companies to build a positive public image both at home and abroad.

In addition to market competitiveness, there are multiple savings from implementing an EMS that promotes energy efficiency and sound waste management practices and meets national and international environmental standards. These include savings from reduced energy consumption and waste management. Concern Stirol can also expect reduced environmental fees resulting from significant reductions in ammonia emissions.

Lessons Learned

Several lessons were learned during the implementation of this project. These lessons provide other companies with practical knowledge on EMS/ISO 14001 third party certification in Ukraine.

- ISO 14001 is a useful EMS standard for companies in the former Soviet Union. Only a few companies in Ukraine and neighboring Russia, however, have embraced ISO 14001 to date, but interest in ISO 14001 in the region is growing.

- Support and interest in ISO 14000 series standards by company top managers is critical to the successful implementation of an EMS that meets these standards.

- Concern Stirol is a large-scale operation. The time and effort to initiate and implement an EMS and work towards ISO 14001 certification exceeded the EcoLinks Grant parameters. Additional support would have facilitated these efforts given the scale of the project.

- Intensive EMS training accompanied by visits to US companies applying ISO 14001 standards provided a sound theoretical and practical understanding of applying EMS ISO 14001 standards. On-site visits to US companies currently applying ISO 14001 standards provided practical knowledge that could be used to implement ISO 14001 in Ukraine.

- To develop an EMS documentation system, company specialists should be relieved of other duties and assigned only to the initiation and implementation of the EMS. The number of specialists should furthermore correspond to the scope of the EMS.

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Environmentally Friendly Leather Production

Project Title: Introduction of Low-Pollution Processes in Leather Production and Their Consequences on End-of-Pipe Effluent Treatment and on Solid Waste Disposal
Leader: HDKO, "Croation Association of Leather and Footwear Manufacturers", Zagreb, Croatia
Partner: Ingstav Ostrava, Marianske Hory, Czech Republic
Location: Zagreb, Croatia
Project Duration: September 2000 – May 2001
EcoLinks Project Investment: Total EcoLinks Project Investment: $71,093; EcoLinks Grant Support: $49,073; Project Partner Cost Share Contribution: $22,020.

Best Practice: Transferable Solution

This project, "Environmentally Friendly Leather Production," is a Best Practice. It demonstrates a workable methodology for reducing the environmental problems associated with leather production that can be applied throughout Croatia. Through low-pollution techniques and waste management systems, water and chemical consumption and wastewater pollutants are reduced. Using the Psunj Tannery as a test site, for example, this project demonstrates that by applying a technique called salt trashing, the amount of chloride pollution is reduced by 25%. This framework ultimately allows an important sector in the Croatian economy to persist and grow in a way that respects the ecological vitality of the Danube Basin.

Project Summary

While leather treatment technology has improved significantly in Croatia, insufficient attention has been paid to the environmental consequences of processing and manufacturing leather. Leather processing and manufacturing involves a variety of aggressive chemicals and produces organic wastes that frequently end up in the environment despite control efforts. Chemicals such as sulfides, acids, alkalis, and chromium are used to process and manufacture leather and have deleterious effects on the environment if not handled appropriately. Decomposing organic matter from raw leather materials such as skin or hide, hair and dissolved proteins and keratin from hair take oxygen away from riparian flora and fauna if it is not treated before disposal.

One of the most detrimental environmental consequences of leathermaking in Croatia is water pollution. All of the tanneries in Croatia are located in the Danube Basin adding to the already high levels of tributary pollution. Croatia produces approximately 20,000 tons of leather each year consuming 800,000 – 1,000,000 m^3 of water per year. Leather production contributes four to five percent of all water pollution in Croatia. Few tanneries in Croatia have fully functioning effluent treatment plants. Only six percent industrial effluents are adequately treated or treated at all before being discharged into water bodies. The hazardous chemicals and raw organic material that are a part of leather production frequently end up in wastewater effluent.

While leather production is half what it used to be pre-war time, the Croatian leather industry is still a vital and significant part of the Croatian economy. There are six large leather

factories, four medium sized factories, and a number of small manufacturers. The Croatian leather industry directly employs approximately 20,000 people and produces 18 million pairs of shoes a year, 1.7 million square meters of finished leather, 0.5 million square meters of wet-blue, and 0.5 million m^2 of splits. Environmental and economic improvements in the leather industry are critical to its development.

Supported by an EcoLinks Challenge Grant, the Croatian Association of Leather and Footwear Manufacturers collaborated with a firm from the Czech Republic, Ingstav Ostrava to develop and test a strategy for reducing the environmental impacts of leather production. They sought to 1) determine the exact volume and pollution parameters of tannery effluent; 2) select optimal methods to reduce water consumption and pollution; 3) develop optimal effluent and sludge treatment alternatives; 4) determine operation and maintenance costs and develop a financing program for implementing an environmentally sensitive water management program; and 5) initiate a legislative framework that promotes appropriate discharge standards, regulations, and pricing guidelines for effluent and sludge disposal.

As a result of this project, several benefits were achieved. The project established a model for reducing the environmental pollution associated with leather production that can be applied by tanneries throughout Croatia. Through certain low-pollution applications such as salt trashing and hair saving, the project demonstrates notable reductions in environmental impacts and production costs. Through hair saving alone, for example, the biological oxygen demand (BOD) that impacts water ecology is reduced by 25% and savings from reduced chemical supply costs and lowered sludge production can amount to almost $80,000 per year.

Project Activities

The methods and materials used to make this project a Best Practice are described in detail here. The purpose of sharing this methodology is to designate a successful framework for reducing the environmental impacts of leather production.

1. Defined the parameters and actions for reducing environmental hazards associated with leather production

Action: Key elements in the effort to reduce water and chemical consumption and pollutants in the production process and in wastewater management were identified. They are:

Production Process

- Salt trashing: reduces chlorides in tannery effluent;
- Green-fleshing: provides option to reuse fleshings by avoiding lime and sulfide contamination; reduces organic pollution and sludge volume;
- Hair saving: hair is removed before dissolved and discharged in sewage system reducing organic pollution and sludge volume; and
- Cr-reduction: considers method for maximum Cr saving within tanning process; reduces Cr effluent and sludge.

Effluent Pre-Treatment

- Removal of sulfides;
- Identification of effective coagulants and flocculants;
- Sludge treatment, disposal, and/or reuse; and

- Laboratory analysis of effluent and sludge composition.

A solid waste assessment was conducted to determine the types and quantities of generated solid waste as well as the characteristics of leachates.

Product(s): 1) List of parameters 2) Solid waste assessment

2. Collected data on the environmental parameters and proposed alternative applications

Action: The following strategy was applied to gather data, clarify pollution issues, and assess the feasibility of the different applications. The proposed strategy was tested at two tanneries: Psunj –Nova Gradiska and Kik –Karlovac (note, however, that Kik Tannery has ceased operation, so only the results from Psunj are emphasized in the following sections).

1) Interviewed tanners and representatives of government institutions about the problems and required standards for proper waste management.
2) Analyzed present production processes involving waste generation.
3) Tested the proposed measures for pollution reduction.
4) Tested the proposed technologies for addressing effluent and sludge/solid waste management concerns.
5) Determined the types and quantities of generated solid waste.
6) Collected data on the space requirements for incorporating waste management system.
7) Determined the costs of water, chemicals, electricity, waste disposal, etc. with respect to the low-pollution applications and waste management approaches.
8) Collected data on additional equipment requirements.

Product(s): Data on environmental parameters and context for implementation of pollution reduction measures and a waste management system

3. Compiled study results including the environmental and economic implications of the proposed applications

Action: An inventory of the test results was conducted. Final recommendations were made regarding the introduction of low-pollution processes (e.g., salt trashing, green fleshing, hair saving, etc.), effluent pre-treatment plant systems and solid waste management. Implementation requirements were identified including supplies, suppliers, and investment and operation costs. The costs, savings, and environmental effects of implementing the recommendations were determined.

Product(s): 1) Inventory of test results 2) Recommendations for improvements using low-pollution processes, effluent treatment systems, and solid waste management strategies in the leather industry 3) Cost/Benefit analysis

4. Identified Further Actions

Action: Further actions to be taken to address pollution issues associated with tannery operations were identified. They are as follows:

1) The Croatian Association of Leather and Footwear Manufacturers (hereafter referred to as the "Association") should open dialogue with government representatives (Ministries of Industry, Economy, and Environment; and the Water Authority).
2) The Association should analyze the feasibility of solid waste reuse.
3) The Association should engage in planning the development of the leather industry with an emphasis on expanding opportunities for implementing optimal pollution control measures. Space requirements, for example, are an important consideration.
4) The Association should examine the possibility to group "wet" leather production processes in one location reducing pollution control costs while enhancing production capacity.
5) The Association should make contact with tannery pollution control consultants and equipment producers to collaborate on the promotion of low-waste production processes and treatment systems.
6) The Association should encourage product pricing that includes at least the minimum costs of applying pollution control measures.

Product(s): List of further actions

Project Benefits

Several benefits resulted from the application of the methods and materials outlined in the previous section. This project builds expertise in approaches to addressing environmental problems associated with leather production as well as in public policy considerations. The project environmental benefits include reductions in water and chemical consumption and wastewater pollution. There are several economic benefits from applying multiple, low-pollution measures. It is important to note, however, that wastewater treatment facilities can prove to be more costly than disposal charges.

Capacity Building Benefits

This project stimulates the necessary organizational capacity and expertise to reduce pollution and improve waste management at tanneries throughout Croatia. By researching and demonstrating the possibilities for reducing pollution associated with leather production, the implementation capacity for applying environmentally sound practices in the leather industry in Croatia is strengthened. Tanneries in Croatia now have the expertise and a model for reducing environmental impacts on water ecology.

Through this project, the capacity to influence environmental policies is enhanced. Due to the insights and experiences gained through this project, the Croation Association of Leather and Footwear Manufacturers is in the position to articulate feasible environmental policy recommendations regarding the standards and regulations on effluent discharge and solid waste disposal.

Environmental Benefits

There are multiple environmental benefits accrued from the applications outlined and applied in this project. They include notable reductions in water and chemical consumption and harmful effluents. A detailed description of the project environmental benefits demonstrated

at the Psunj Tannery in Nova Gradiska is provided below (Table 1.). Note that significant reductions are made from the low-pollution applications.

Table 1. Environmental Benefits of Alternative Applications

Procedure	Water consumption reduction (%)	Chemicals consumption reduction		Pollution factors reduction (%)		Solid waste reduction
Salt Trashing	5%	5%		Suspended Solids	-.6%	5% raw hide weight
				Biological Oxygen Demand (BOD)	4%	
				Chemical Oxygen Demand (COD)	3%	
				Chlorides	25%	
Green Fleshing	9-10%	9-10%		Sulfide: 9-10%		9-10% pelt hide weight; 16% solid waste converted to useful product
Hair Saving	N/A	Lime	9-10%	TS	6.7%	N/A
				SS	41%	
		NaHS (72% Na_2S)	105 kg/d	COD	25%	
				BOD	25%	
		Na_2S (62-67%)	15 kg/d	S^{-2}	18%	
				N-total	35%	
				$N\text{-}NH_4$	2%	
Sludge Reduction	N/A	N/A		52%		N/A
Chrome Recovery	N/A	N/A		98-99% Cr		N/A

While implementing a solid waste management program can be more costly than discharge and disposal fees in Croatia, the environmental benefits of such a program are especially positive. The environmental benefits of implementing the solid waste management strategy outlined in this project, for example, reduces uncontrolled disposal by 14,567 kg/year.

Economic Benefits

Applying low-pollution production processes reduces the costs of raw hide production from \$100/ton to \$13-\$15/ton which would result in an annual savings of more than \$1,700,000. Savings are generated from reducing pollution loads (hence, reduced Pollution Compensation Fees) and costs associated with sludge disposal.

Several options were explored for handling raw hide waste, limed fleshings, and chrome-contaminated waste. At Psunj Tannery, it was determined that with the application of low-waste production processes (e.g., hair saving, chrome recovery), the overall investment is low and the total costs of waste management would be decreased by more than 40% in comparison with other more commonly used approaches. With an activated hair saving system, there are reduced costs in chemical supplies (at processing 15 t/d of raw hides; 240 d/yr) amounting to a savings of $20,952 per year, and sludge effluent disposal generating a savings of $50,400 per year. Hair saving requires a total investment of $46,000 in equipment and civil works. Running costs are estimated at $13,675 per year. The payback period for a hair saving system installation is one year. This amounts to an annual savings of more than $80,000 minus an investment of $46,000 and an estimated $13,675 in annual running costs.

Through chrome recovery additional savings are generated. The maximum quantity of recoverable chrome is about 26,400 kg of Cr_2O_3 per year. The commercial value of the recoverable chrome amounts to approximately $105,000. The operation costs for recovery amounts to $66,150-$75,400, leaving a difference or profit of $30,000-$38,850 each year. Furthermore, the reduction of chromium content (below 1000 mg/l) in certain types of sludge would enable a simple sludge processing method that can be handled at farms instead of more expensive hazardous waste disposal sites. A Chrome Recovery System requires an investment of approximately $169,000. Total operation costs are $42,830-48,920. The investment return period is three to four years.

The benefits outlined here point out the concrete, positive results of this project. In working towards these benefits, several lessons were learned that point out or address additional methodological concerns as well as unanticipated benefits and challenges. The lessons learned during this project are outlined in the next section.

Lessons Learned

The lessons learned during this project allow others applying this same methodology with a more detailed understanding of the challenges and economic considerations of implementing similar projects. The lessons learned during the implementation of this project include the following.

- Through the studies and cost/benefit analyses conducted as part of this project, the Croation Association of Leather and Footwear Manufacturers can promote tools and techniques for achieving environmental and economic benefits while providing a scientific basis for making effective public policy recommendations. The science produced in this project can be used further to establish a productive network between interest groups, policymakers, and industry as it considers both environmental and economic concerns.

- While the technology to promote environmentally friendly processes in the industrial sector is especially promising, it may not yet be profitable to implement all the available technologies. Low-cost technologies can be implemented to produce savings, however, while other financial possibilities can be explored to compensate for more costly applications.

- Introduction of low-waste production processes significantly improves effluent results, reduces sludge volume, and decreases overall effluent and sludge treatment and disposal costs. The cost of effluent treatment ($2.60-$2.90/m^3 of raw effluent), however, is significantly higher than the cost of discharging untreated effluent ($1.22/m^3 of raw effluent). This makes a notable difference in the costs of raw hide production: $70.00-$100.00 per ton of processed raw hide with effluent treatment and $43.00 per ton of processed raw hide with limited to no effluent treatment.

- The leather industry should include pollution control costs in the price of their products in order to stimulate investment in environmental protection and to balance the profit level amongst tanneries.

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Regional Water Management in Bulgaria

Project Title: Public/Private Project for Water Treatment and Delivery to the Haskovo Municipality and Surrounding Municipalities
Leader: The Municipality of Haskovo, Haskovo, Bulgaria
Partners: 1) Clearwater Consultants, Inc., Starkville, MS and 2) Povvik-Ep Ltd., Sofia, Bulgaria
Location: Haskovo Municipality, Bulgaria
Project Duration: October 2000 – May 2001
EcoLinks Project Investment: Total EcoLinks Project Investment: $107, 531; EcoLinks Grant Support: $50,000; Project Partner Cost Share Contribution: $57,531.

Best Practice: Transferable Solution

This project was chosen as a Best Practice because it generates a strong framework for addressing regional water supply and wastewater treatment problems throughout Bulgaria. This EcoLinks funded project builds regional capacity to understand and address water management problems and provides notable environmental benefits. A knowledge base is created including results from a community Willingness-To-Pay Study, a review of existing water management practices, facilities, and applicable laws and regulations across ten municipalities, water consumption projections, and an economic analysis. Collaboration across municipalities and between municipalities, private enterprises, state governmental representatives, and local communities provides a participatory context that significantly improves implementation capacity. The environmental benefits of this project include water resource conservation and a reduction in air and surface water pollution.

Project Summary

Insufficient water supplies are a fact of life for most towns and villages in Bulgaria. Approximately 33% of all villages in Bulgaria have no water supply networks. Wastewater treatment is also lacking. Only 12% of Bulgarian towns have sewage systems. In the municipality of Haskovo and the eight other municipalities included in this project, water quality is poor; water pipelines are deteriorating or obsolete; the water supply is insufficiently managed; and water service charges are inappropriately high given local income averages and service quality. Chlorination is the primary means of treating water. There are no wastewater treatment facilities in the region. Wastewater is frequently discharged directly into the Maritsa River or its tributaries.

Thirty-five percent of the settlements in the region included in this study experience annual or seasonal water shortages. Several municipalities have poor water quality due to elevated levels of manganese in addition to a lack of treatment facilities. Poorly functioning pipes contribute to a total water loss of 45%. Old pumping units contribute to high energy costs. Several initiatives to build municipal sewage systems have not been carried out to completion.

To address the water problems of the region, a Willingness-To-Pay Study and focus groups were conducted among the communities of the region. Most people in the region are unhappy with their water supply and would support efforts to improve water supply and treatment facilities. A survey of the water, sewage, and wastewater facilities of ten counties including

Haskovo, Harmanli, Svilengrad, Simeonovgrad, Ljubimets, Ivailovgrad, Madjarovo, Mineralni Bani, and Stambolovo was conducted.

Using the Haskovo region in Bulgaria as a demonstration site, this project 1) encourages private/public partnerships and regional collaboration to address municipal and state water problems; and 2) establishes a sound scientific, community-based approach (Willingness-To-Pay Study and a review of the current facilities, the operating institutional framework, available technologies, and future financing mechanisms) to empirically assess and improve water supply and wastewater treatment. The Willingness-To-Pay Study revealed that people are unhappy with the current state of water quality, water supply and management, and water prices. It further revealed that people are willing to pay more for water if water and wastewater treatment facilities are constructed and/or maintained. The project promotes environmental benefits including water resource conservation, reductions in air pollution, and decreases in surface water pollution.

This next section provides a detailed outline of the methods and materials applied in this project. This methodology can be used throughout Bulgaria to achieve the similar benefits (see Project Benefits section). The Willingness-To-Pay Study and the Tariff Study, for example, can be easily replicated in the water sector in other regions in Bulgaria.

Project Activities

The main activities of this project include a Willingness-To-Pay Study; an assessment of water, sewage, and wastewater treatment; a review of the legislative framework regarding water supplies, sewage, and wastewater management; and an assessment of financial opportunities. The municipalities studied were Haskovo, Harmanli, Svilengrad, Simeonovgrad, Ljubimets, Ivailovgrad, Madjarovo, Mineralni Bani, and Stambolovo.

1. Conducted a Willingness-To-Pay Study

Action: Questionnaires and survey materials were developed to identify main water supply problems from a community perspective, parameters and conditions for improving water supply, perspectives on water charges, and the communities' willingness to pay higher charges. A survey method involving face-to-face structured interviews was used. A group of 60 interviewers from Haskovo, Svilengrad, and Harmanli were trained to conduct interviews and record responses. A total of 1,847 people were interviewed. Additionally, three focus group discussions were held in Haskovo, Harmanli, and Svilengrad. The results were presented in two reports as listed below.

Product(s): 1) Study questionnaires and surveys 2) Willingness-to-Pay Final Report 3) Focus Groups Report

2. Assessed the current management system for water, sewage, and wastewater

Action: The status of water, sewage, and wastewater management was assessed for ten municipalities: Haskovo, Harmanli, Svilengrad, Simeonovgrad, Ljubimets, Ivailovgrad, Madjarovo, Mineralni Bani, and Stambolovo. The following features were described for each municipality: 1) water sources and water supply, 2) water treatment, 3) water supply system, 4) non-revenue water, and 5) wastewater treatment works. Based on the review, technical,

institutional, and financial remedies were explored. An economic analysis involving calculations of the IRR and NPV for proposed system alternatives was conducted along with tariff projections for seven years involving two different scenarios. The present and expected (to year 2020) demand for water and wastewater treatment services by municipal and industrial users was determined using data from the Water Company and industry on consumption patterns and future needs.

Product(s): 1) Technical Investigation Report 2) Water demand projections 3) Economic Analysis and Tariff Study Report

3. Identified the legal and formal institutional framework for managing water, sewage, and wastewater

Action: Laws affecting permitting and operation of water systems were summarized. The permits and authorization needed to build and operate water management systems were clarified. In the final report, issues of privatization are reviewed; specific Acts are summarized; legal options/alternatives for privatization of water supply and sewage and for private sector participation without stock or share transfers are discussed.

Product(s): 1) Preliminary Report on Relevant Laws, Regulations and Authorities 2) Final Report on Relevant Laws, Regulations and Authorities

4. Organized meetings with relevant industries, municipalities, and other governmental bodies on possibilities for a combined water and wastewater treatment system for the region

Action: Meetings were organized with relevant water industries and municipalities to consider participation in a combined water and wastewater treatment system. Preliminary conclusions of the project were presented to the Mayor of Haskovo Municipality, the Head of the Department of Water Quality, and the Head of the Department of the Water Sector of the Ministry of Regional Development and Public Works.

Product(s): 1) Meeting notes

The next section outlines the particular benefits derived through this project. The benefits generated from this project in capacity building and the environmental arena are especially noteworthy.

Project Benefits

The benefits for this project include 1) a collaborative institutional framework for resolving water supply and treatment and wastewater treatment issues, 2) fortification of the ties between municipalities and the surrounding communities in efforts to address water supply problems, 3) improved knowledge base on the legal, technical, and economic factors regarding water management improvements, and 4) improved water resource conservation, and reduced air and surface water pollution. These benefits are outlined in more detail in the following subsections.

Capacity Building Benefits

This project built social capital in a number of ways:

- Most notably, it encouraged collaboration amongst counties to work on water supply and treatment problems from a regional rather than local perspective.

- Through the "Willingness-to-Pay" study, the project built ties with the surrounding communities and established an empirical knowledge base about water problems allowing the municipalities to better address community-based water problems. The community had the opportunity to articulate their concerns regarding regional water supply and management issues. Further, municipalities discovered that people are willing to pay more for better quality water services.

- Relationships between municipalities, the industrial sector, and other water resource and management governing bodies such as the Water Company and The Department of Water Quality were strengthened. This network lays the groundwork for promoting an integrative approach to addressing and solving water supply and treatment problems.

With the legislative framework guiding water issues in the region, the municipalities have built their capacity to proceed with improvements using the laws, regulations, and authorities to guide and structure them.

Environmental Benefits

The environmental benefits of this project include water resources conservation, reduced air pollution, and reduced surface water pollution. They can be quantified in the following manner:

- Water Resources Conservation: approximately 100,000 m^3 per year of water is conserved by the proposed regional management system. This is sufficient to supply an additional 2000 people with water at a supply standard of 150 l/c/d.

- Reduced Air Pollution: due to energy efficiency, reductions in CO_2 are estimated at 1,100 tons per year (assuming 700 tons of CO_2 are produced per one megawatt of electricity).

- Reduced Surface Water Pollution: six hundred tons of BOD (biological oxygen demand) per year is avoided.

Economic Benefits

The implementation of a regional water management system as supported by this project improves water supply and water quality for ten municipalities. It secures the necessary economic framework and public/private partnerships. While the project emphasizes the feasibility of a public/private water treatment and delivery system, the economic benefits are derived from the regional versus local approach to water management and modernization and activation of treatment facilities. There are additional economic benefits from avoiding

potential pollution mitigation costs and from promoting ecological values by reducing the environmental impacts on water resources.

With implementation of the water management system outlined in this project, infrastructure costs are reduced, and energy and water consumption is more efficient. For example, building one large-capacity water treatment plant (300 l/s) for the entire region versus seven small-capacity plants (50 l/s) produces noteworthy savings. Infrastructure costs of a regional water management approach are reduced by $520,000. With an efficiently operating system, 1) energy savings can add up to $511,752 per year, and 2) there is a 50% reduction in water consumption and a 50% reduction in leakages achieving a savings of $39,772.

The next section, "Lessons Learned" provides a summary of the lessons learned during implementation of this project. They are key empirical insights that can be used by others seeking to improve water management in their region.

Lessons Learned

These are the lessons learned during implementation of this project. They especially emphasize the importance and benefits of a community-based, integrative approach to addressing water management problems.

- Conducting a Willingness-To-Pay Study provided important information about the surrounding communities' perspectives on water supply issues. People are willing to pay for access to quality water.

- Consulting multiple municipalities and the community, engaging the private sector, and meeting with state officials created a network that will facilitate the implementation of an effective water management system.

- The research conducted as part of this project including the Willingness-To-Pay Study, the Technical Investigation Study, the Tariff Study, the Summary of Relevant Laws, Regulations and Authorities, and the Water Use Projections all provided a sound base from which to consider a regional, integrative approach to water management.

- Certain project activities were delayed pending authorization from the Ministry of Regional Development and Public Works (MRDPW) for the Water Company of Haskovo to provide technical information. The Municipality of Haskovo resubmitted a request letter once the Water Company was authorized to provide the requested information and the information was obtained.

The next section provides contact information on the people who designed and implemented this project.

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Promoting Environmental Protection and Energy Efficiency at Elprom-Elin in Bulgaria

Project Title: Conducting an Eco/Energy Audit of Elprom-Elin Plc to identify and assess possible environmental protection and energy conservation measures
Leader: Elprom-Elin, Kubrat, Bulgaria
Partners: 1) Hagler Bailly Services, Inc., Arlington, VA USA and 2) Energy Efficient Systems Ltd., Sofia, Bulgaria
Location: Kubrat, Bulgaria
Project Duration: September 2000-September 2001
EcoLinks Project Investment: Total EcoLinks Project Investment: $115,895; EcoLinks Grant Support: $47,991; Project Partner Cost Share Contribution: $67,904

Best Practice: Transferable Solution

In this Best Practice, Elprom-Elin, an electrical accessories manufacturer, demonstrates a successful methodology for reducing energy and water consumption and wastewater pollution in Bulgaria. Using a Cleaner Production methodology, Elprom-Elin conducts an eco/energy audit and implements thermal, electricity, and water saving measures including equipment improvements and water recycling. With implementation of the energy and water saving and pollution reduction program, several environmental and economic benefits are accrued: 1) water consumption is reduced by over 50%; 2) electricity consumption is reduced by just over 20%; 3) heavy metals and soluble substances found in wastewater are reduced by 72.5%; 4) and economic savings from these reductions are estimated at $123,867 per year.

Project Summary

Elprom-Elin is a medium sized firm employing 296 people in Kubrat, Bulgaria. It produces electrical accessories including switches, lamp holders, plugs, and fuses. Elprom-Elin captures both domestic and international markets (more than 15 countries in Europe and Asia). To expand its competitiveness and improve its environmental practices, it must reduce its energy and water consumption and pollution associated with wastewater production.

Energy and water consumption and wastewater production at Elprom-Elin are high. Energy costs comprise 15.6% of total operating costs at Elprom-Elin. The costs of natural gas per unit of production are higher than the average costs for similar enterprises in Europe. The company's operating equipment is inefficient. The lighting and air compression systems are out-of-date and consume large amounts of electricity. The production and distribution of steam could be improved to promote energy savings. The tunnel furnace does not work according to the technology requirements and needs retrofitting. The existing galvanizing line generates a lot of pollution associated with wastewater. Concise and consistent information about energy consumption throughout the plant is not available.

With the support of an EcoLinks Challenge Grant, Elprom-Elin teamed up with an US firm, Hagler Bailly Services, Inc., and Energy Efficient Systems, Ltd. of Bulgaria to implement an energy savings program and apply the principles of Cleaner Production. The specific goals of the project were:

- To train a minimum of 10 people in Cleaner Production and energy efficiency auditing;
- Reduce energy consumption and CO_2 emissions through energy efficiency;

- Reduce waste generation through Cleaner Production measures; and
- Implement no-cost/low cost measures and seek funding for more costly measures.

By implementing the project program, Elprom-Elin generates a savings of $123,867 per year by reducing energy and water consumption and wastewater pollution. Additionally, wastewater pollutants are reduced by 72.5%.

Project Activities

To improve energy efficiency and reduce water consumption and wastewater production at Elprom-Elin, a complete audit of energy and water consumption throughout the plant was conducted. The results were then used to establish and implement appropriate conservation measures. The following is an itemized list of the methods and materials used to achieve these goals.

1. Conducted workshop on the concept of Cleaner Production

Action: A workshop on Cleaner Production involving ten people was conducted at Elprom-Elin.

Product(s): Trained individuals in Cleaner Production

2. Conducted eco/energy audit

Action: Collected and analyzed data on energy and water consumption. Developed feasibility and implementation recommendations. General data on the production of metal, porcelain, and plastics was collected. The scope of the audit included a review of the following:

- Energy management system;
- Electricity distribution and consumption;
- Thermal energy distribution and consumption;
- Water distribution and consumption;
- All production lines, technological equipment and administration facilities;
- Installed energy and production equipment; and
- Ecological impact of the production processes.

Areas of the largest consumption of energy and water were identified. As a result of the findings, recommendations for improving energy and water efficiency (e.g., Energy Conservation Opportunities) were developed. Additionally, preliminary market research of potential suppliers of equipment and materials was conducted. Suppliers and installation experts were selected.

Product(s): 1) Data on the consumption of natural gas, electricity and water and the production of wastewater 2) Pre-evaluation assessment report 3) Preliminary list of Energy Conservation Opportunities (ECO) 4) List of suppliers and installation experts for implementation of second-phase measures

3. Presented results of eco/energy audit and first-phase activity recommendations to plant management

Action: The principle conclusions and recommendations from the eco/energy audit were presented to plant managers. The presentation included information on:

- Objectives and tasks of the project
- Auditing tasks
- Annual energy costs at Elprom-Elin for the year 2000
- Energy savings at Elprom-Elin
- Data on investments and savings
- Greenhouse gas emission reductions
- Natural gas consumption
- High-temperature tunnel furnace
- Thermal losses in steam production and distribution
- Electric energy consumption
- Water consumption and production output
- Energy conservation and environmental opportunities

Based on this presentation, it was decided that low-cost measures or measures not requiring investments should be implemented in the short-term. Modernization and automation of the tunnel furnace would be initiated using internal financial resources.

Possible sources for financing further energy saving measures were identified. Documents would be prepared and used to apply for funding through the Municipal Energy Efficiency Program (MEEP). This funding was to be used to support the completion of the measures that were categorized as more costly.

Product(s): 1) Final plan to implement energy conservation measures 2) Financing options 3) Application and contract for loan through MEEP

4. Implemented first phase activities

Action: The following first-phase activities were implemented and evaluated.

Thermal and Electricity Saving Measures:

- Automation of tunnel furnace
- Avoidance of peak tariff zone during furnace operation
- Reparation of air leaks
- Reduction of energy consumption of heated baths

Water Saving Measures:

- Recycling of water used by light bulb socket presses
- Operation improvement of water cooling tower in the air compressor station
- Reparation of water leaks
- Implementation of improved activities related to plating bath monitoring, maintenance, work flow sequences, plating scheduling, chemical storage and chemical purchase records
- Improvement of plating bath chemistry and operation

- Application of multiple rinse static baths and agitation

Product(s): 1) Data on energy and water consumption 2) Results based on activation of applied measures from first-phase activities

5. Conducted seminar on project activities

Action: A seminar involving 48 experts and specialists from various industrial enterprises, energy service companies, power equipment suppliers, and representatives from municipal and state agencies was conducted. The agenda of the seminar was as follows:

- Opening and presentation of the project
- Summary of results of eco/energy audit
- Energy conservation and environmental measures
- Project to retrofit and automate tunnel furnace
- Elprom-Elin participation in Municipal Energy Efficiency Program (MEEP)
- Discussion and closure

Product(s): Seminar on project deliverables

6. Continued monitoring and evaluating first-phase energy and water conservation measures; Initiated second-phase activities

Action: Responsible Coordinators were designated by the Executive Director of Elprom-Elin to coordinate energy saving activities including ongoing data collection and the implementation of energy saving measures. Representative data was collected on 1) the results of the application of previously identified energy conservation measures, and 2) related environmental benefits. Monitoring and evaluation procedures were conducted according to the standards designated in the International Performance Measurement and Verification Protocol. It was determined that data would be collected using this protocol for a period of one year to achieve more representative data.

Several second phase activities were initiated. The second-phase measures included:

- Installation of automatic burner and gas-supply line
- Improvement of steam traps and regulators
- Insulation of steam and condensation pipe-lines
- Installation of control system for substations
- Installation of new air compressor

While several of the second phase activities would require additional financial resources, low cost activities were started. For example, the insulation of steam and condensation pipelines was initiated while installation of a new air compressor was postponed.

Product(s): 1) Designated Responsible Coordinators 2) Additional data on energy and water consumption based on first-phase conservation measures and initiation of second-phase activities 3) Findings and conclusions based on data from implemented activities.

7. Developed guidebook and case study

Action: The project team prepared a guidebook on energy efficiency and Cleaner Production. A case study was produced based on the results of the implemented measures. A visit was made to the headquarters of PA Government Services, Inc. in Arlington, VA. The visit also involved efforts to gather information about equipment suppliers and to exchange information with organizations and experts working on Cleaner Production and energy efficiency.

Product(s): 1) Guidebook 2) Case study 3) Report on the visit to US companies 4) Follow-up plan

Several benefits are generated when applying the methods and tools described here. Those benefits are discussed in detail in the next section.

These are the methods, tools, and products that make up this project. The next section, "Project Benefits," is an outline of the multiple benefits generated through implementing this methodology.

Project Benefits

The benefits of this project are detailed below. In addition to creating the organizational capacity to implement a Cleaner Production approach to management and production operations, serious reductions in water and energy consumption and harmful emissions provide several environmental benefits and economic benefits from reduced operation costs.

Capacity Building Benefits

With the development and implementation of energy efficient and Cleaner Production measures at Elprom-Elin several capacity building benefits have been generated. Elprom-Elin has built and demonstrated the organizational capacity to implement significant energy and water savings measures and reduce pollution associated with greenhouse gas emissions and wastewater production. Elprom-Elin's experiences have been shared with other interested parties. Through this information-sharing process, Elprom-Elin contributes to strengthening the capacity for other companies to implement similar programs. The following points specify the project's capacity building accomplishments.

1) Ten employees and project participants at Elrpom-Elin are now trained in the Cleaner Production approach.
2) Forty-eight experts and specialists from various industrial enterprises, energy service companies, power equipment suppliers, and representatives from municipal and state agencies participated in a seminar on the project and applied methodologies, and can utilize the methodology to promote energy efficiency and Cleaner Production in other contexts.
3) Responsible Coordinators have been designated and trained at Elrpom-Elin to carry out data collection and monitoring to continue to promote energy and water savings and wastewater reduction.
4) Elprom-Elin created a guidebook and case study that demonstrates to interested parties workable methods and materials for promoting energy efficiency and Cleaner Production in Bulgaria.

5) The project collaboration between Elprom-Elin, Hagler Bailly Services, Inc. and Energy Efficient Systems Ltd. established the possibility for future partnerships and technology exchange involving similar efforts.

Environmental Benefits

With the implementation of the full program of measures outlined in this project, the following environmental benefits are gained. Table 1. *Summary of Environmental Benefits* outlines the environmental benefits promoted by this Best Practice. The initial projection of water savings was lower than the savings that were actually achieved in practice. For example, the reduction in water consumption was initially projected to be 4,066 m^3/yr, but implementation of the water saving measures revealed an ultimate reduction of 21, 022 m^3/yr.

Table 1. Summary of Environmental Benefits

	Actual Situation	*Environmental Benefits*	*Reduction (%)*
Reduction of water consumption (and waste water generation)	37,818 m^3/yr	Reduction of 21,022 m^3/yr	55.5%
Reduction of electricity consumption	1,246,880 kWh/yr	Reduction of 256,225 kWh/yr	20.5%
Reduction of natural gas consumption	1,299,000 nm^3/yr	Reduction of 88,000 nm^3/yr	6.8%
Reduction of porcelain mass rejects	318 kg/yr	Reduction of 73,335 kg/yr	22.8%
Reduction of heavy metals and soluble substances in wastewater	0.3 mg/l Cu; 9.0 mg/l Zn; 3.1 mg/l Ni; Cr^{6+} and 1,552.5 mg/l soluble substances	Reduction of 0.2 mg/l Cu; 8.5 mg/l Zn; 2.9 mg/l Ni, Cr^{3+}; and 552.5 mg/l soluble substances	72.5%
Reduction of rejects from final production	54,3000 kg/yr	Reduction of 543 kg of rejects	1.0%

The expected electricity energy savings lead to a 20.6% reduction in polluting emissions. Table 2. *Total Reduction of Emissions* compares emissions reductions before and after program implementation.

Table 2. Total Reduction of Emissions

Results of Implemented Measures	Base Production (tons/year)		Reductions with Program Implementation (tons/year)		Total Reduction of Emissions (%)
Emissions reductions	SO_2	81.4	SO_2	17	20.6 %
	NO_x	11.6	NO_x	2	
	CO_2	1,300	CO_2	269	
	Ash	3.8	Ash	1	

With these reductions in consumption and emissions, certain economic benefits are derived. For example, costs associated with resource consumption are reduced. The economic benefits of this project are presented in the next subsection.

Economic Benefits

With the implementation of energy and water saving measures based on the eco/energy audit conducted as part of this project, several economic benefits are gained. For example, energy and water costs at Elprom-Elin are reduced by 15% due to lower consumption from improved efficiency. Table 3. *Savings Generated from Reduced Energy and Water Consumption* outlines the savings generated from implementing energy and water saving measures.

Table 3. Savings Generated from Reduced Energy and Water Consumption

Item	*Consumption in 2000 -- Before Energy and Water Saving Measures*	*Consumption -- After Energy and Water Saving Measures (units)*	*Energy/Water Consumption Reduction (%)*	*Annual Cost --Before Energy and Water Saving Measures ($/yr)*	*Annual Cost --After Energy Saving Measures ($/yr)*	*Savings ($/yr)*	*Savings (%)*
Water (m^3)	38,000	17,000	55.5	19,000	8,500	10,500	55.5
Electric Energy (kWh)	1,250,000	990,700	20.5	50,000	39,750	10,250	20.5
Natural Gas (nm^3)	1,300,000	1,212,000	6.8	130,000	121,160	8,840	6.8
Total	--	--	--	199,000	169,910	29,090	15

Full implementation of the activities outlined in this project requires a degree of investment. The investment requirements are outlined below in Table 4. *Summary of Investments and Savings.* The savings generated from implementing each reduction effort are also listed.

Table 4. Summary of Investments and Savings

	Investment ($)	Savings ($/yr)	Payback Period (years)
Reduction of water consumption & implementation of additional environmental improvements	$157,905	$36,177	4.4
Reduction of electric energy consumption	$38,974	$12,880	2.8
Reduction of thermal energy consumption	$79,905	$29,061	2.7
Product recuperation	$22,510	$59,214	Immediately
Total	$299,294	$138,235	2.2

The benefits accrued from this project support its designation as a Best Practice. This next section provides insights and experiences gathered from the practical application of the project methodology.

Lessons Learned

There are both opportunities and challenges in implementing this project. They are listed below to benefit those interested in implementing similar efforts in their regions.

- Presenting the eco/energy audit to company managers allowed for important brainstorming in terms of generating financial resources for implementing program recommendations.
- It is useful to establish a coordinating body that oversees ongoing energy and water data collection and analysis. This body assures the availability of constant feedback on the effectiveness of energy and water saving measures.

- Having the local project leader head the project with the partners acting as guides was especially beneficial as the project leader who is generally on-site has better knowledge about the context ("lay of the land") and how to avoid pitfalls and communicate more effectively with contacts. Also, as they lead the project, they learn more implementing the new program.
- The trip to the United States to make additional contact with the private sector was especially useful as it provided concrete examples of the project methodology.
- Project efforts can take longer than planned.
- Small projects such as this one tend to take less importance but more time. The bookkeeping and recording activities can be especially time-consuming and should be reduced to the extent possible.

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Annex E
Ecolinks Partnership Grants
Post-Grant Successes

Quick Response Awards

U.S. Partner:	**ENSAT (Culpepper, VA)**
Local Partner:	Design Academy Kazgor (Kazakhstan)
Activity Description:	Upgrade municipal water supply and sewage collection system for a portion of Aytrau city
Results:	$560,000 contract was awarded by World Bank

U.S. Partner:	**Ticon Trading, Inc. (San Rafael, California)**
Local Partner :	Olymp Plus Company, Ltd. (Russia)
Activity Description:	Minimization and reuse of wood waste
Results:	$5 million joint venture established in Primorsky Krai to manufacture and sell timber products to China, Japan and the United States.

U.S. Partner:	**Wynn Oil Company (Azusa, California)**
Local Partner:	AYR ImEx (Vladivostok, Russia)
Activity Description:	Pollution reduction of automotive fuel-system cleaning services
Results:	$240,000 in purchase of environmentally friendly automotive products and equipment

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U.S. Partners:	**Genesis Technologies International (Atlanta, Georgia)** **Pacific Environmental Management, Inc. (San Francisco, California)** **MicroBac International, Inc. (Round Rock, Texas)**
Local Partner :	PROTE Bioremediacja (Poland)
Activity Description:	Application of bioremediation technology for soil and groundwater remediation in Eastern Europe.
Results:	$100,000 purchase of equipment from the US Partners.

U.S. Partner:	**Udell Technologies (Berkeley, California)**
Local Partner :	Envi-Aqua (Czech Republic)
Activity Description:	Application of steam enhanced extraction technology to clean up land contaminated by oil products.
Results:	estimated $300,000 purchase of equipment from the US Partner over a two-year period.

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U.S. Partner:	**APPLIED POWER Corporation (Lacey, Washington)**
Local Partner :	Lesoproduct Export Co. (Vladivostok, Russia)
Activity Description:	Search for alternative source of power to reduce pollution and operating costs
Results:	$60,000 purchase of equipment from US partner

U.S. Partner:	**Koetter Dry Kiln, Inc.(Borden, Indiana)**
Local Partner :	Inkom Co, Ltd (Vladivostok, Russia)
Activity Description:	Reduction of sawdust accumulation at this wood finishing company and search for woodwaste recycling and finger gluing technologies.
Results:	$60,000 purchase of energy-efficient dry kiln from US partner and agreement to be its official distributor in Russia Far East

U.S. Partner:	**Environmental Systems Research Institute (Redlands, California)**
Local Partner:	Ecomedservice (Ukraine)
Activity Description:	Training of Kiev city authorities for use of GIS technologies as part of environmental management system in the city
Results:	$10,000 purchase of environmental GIS software

U.S. Partners:	**Florida Heat Pump Manufacturing Company (Fort Lauderdale, FL)** **Peerless Pacific (Portland,OR)**
Local Partner:	SKIF MX, Ltd. (Khabarovsk, Russia)
Activity Description:	training on geothermal heat pumps installation and maintenance, development of business contacts
Results:	$1 million agreement with Florida Heat Pump Manufacturing to purchase and distribute equipment over five years

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Challenge Grants

Project Leader:	**Municipality of Kisielice, Poland**
U.S. Partner:	AWS Scientific, Inc. (Albany, NY)
Project Description:	Installation of electricity generation wind turbine in Kisielice Municipality.
Follow-up financing:	$1.9 million in financing to cover the total investment outlay for installation of the wind turbine, as follows: - $600,000 grant from Polish Ecofund - $200,000 grant from the Polish National Fund for Environmental Protection - $1.1 preferential loan at 5.4% from the Polish National Fund for Environmental Protection - $20,000 investment from municipality's own funds

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Project Leader:	**Sofia Municipality (Bulgaria)**
US Partner:	Good Consulting, USA
Project Description:	Prepare energy efficiency action plan for Sofia building stock
Follow-up Financing:	$105,000 from European Union to set up a Municipal Agency for Energy Management. $3 million loan under negotiation from Black Sea Investment Bank to set up a Municipal Energy Efficiency Fund or an ESCO company to carry out the energy action plan for the next 2-3 years.

Project Leader:	**RAJAC (Iasi, Romania)**
U.S. Partner:	Cavanaugh & Associates (Winston-Salem, North Carolina)
Project Description:	Water leakage detection
Follow-up financing:	$6.8 million investment from ISPA program

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Project Leader:	**Organica Ecotechnologies Ltd (Budapest, Hungary)**
U.S. Partner:	Living Technologies (Burlington, Vermont)
Project Description:	Biological treatment of wastewater
Follow-up financing:	$1.2 million in equity investment from Environmental Investment Partners, a venture capital fund

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Project Leader:	**Special Plant #1 (Vladivostok, Russia)** Waste-to-energy facility
U.S. Partner:	Energy & Environment Consulting Engineers (Mission Viejo, California)
Project Description:	Install air emission-control system and improve process efficiency
Follow-up Financing:	$70,000 was contributed by Vladivostok Municipality to install a fly ash capture system on one incinerator

Project Leader:	**Ravisz, 96 Kft (Budapest, Hungary)**
U.S. Partner:	Universal Technical Resource Services, Inc. (Cherry Hill, NJ)
Project Description:	Development of a system to convert hazardous waste from the local transportation industry to non-hazardous recyclable materials.
Follow-up financing:	$55,000 purchase of environmental technology/equipment by Ravisz
Project Leader:	**Association of Danube Municipalities**
US Partner:	CalRecovery (Hercules, CA)
BG Partner:	Institute for Environmental Strategies
Project Description:	Modernize municipal solid waste management through regional collaboration and private sector participation
Follow-up financing:	$86,500 interest-free loan given to Nikopol Municipality by the National Fund for Environmental Protection.
Project Leader:	**Arbanassi PLC. (Bulgaria)**
Project Partner:	Tetrahedron, Inc., USA
Project Description:	Pollution Abatement Strategy for Arbanassi PLC.
Follow-up financing:	Negotiations are underway to establish a joint venture company with Arbannassi, Tetrahedron Europe. U.S. Partner's share will amount to 60% of the total investment.
Project Leader:	**Odessa CHPP -2 (Ukraine)**
Project Partner:	SRC International, Czech Republic
Project Description:	Feasibility study on energy saving measures at the heat-only boiler plant in Teplodar, Ukraine.
Follow-up financing:	$450,000 from the Odessa Regional government to implement a fuel switch (heavy oil to natural gas) on two of the four boilers at Teplodar.
Project Leader:	**Khabarovsk Krai Administration (Russia)**
Project Partner:	American International University Network, Nebraska
Project Description:	Develop an environmental audit training and certification program in Russia Far East.
Follow-up financing:	$30,000 in contracts with local businesses to conduct environmental audits in the Khabarovsk area.

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Project Leader:	**Elprom Elin (Bulgaria)**
Project Partner:	PA Government Services, Inc., USA
Project Description:	Conduct an Energy Audit of Elprom Elin
Follow-up financing:	- $100 000 loan from the United Bulgarian Bank through the USAID- DCA guarantee program based on the energy conservation opportunities proposed in the energy audit - $30 000 self-financed by Elprom Elin to optimize the automation process in the furnace and save energy.
Project Leader:	**Chervonograd Municipality (Ukraine)**
Project Partner:	EKOFOL-II S.A, Poland
Project Description:	Develop a systematic program of municipal waste management for the City of Chervonograd
Follow-up financing:	$60,000 was contributed by Lviv oblast and Chervonograd city administrations to build municipal solid waste processing plant
Project Leader:	**Elektrostopanstvo na Macedonia (Macedonia)**
Project Partner:	Elektroprojekt, Zagreb, Croatia
Project Description:	Rehabilitate seven small hydro power plants
Follow-up financing:	$19.6 million joint venture established, Machydro Project Co. A.D., to rehabilitate, operate and transfer the seven small hydro power plants over eleven years. This public-private partnership is financed by British V.R.O. Energy A.G. and Czech Hydropol Project & Management A.S..
Project Leader:	**Compa (Sibiu, Romania)**
U.S. Partner:	The Energy Group (Little Falls, NY)
Project Description:	Identify measures to reduce energy consumption at this automotive equipment manufacturing plant
Follow-up financing:	$15,000 invested from own funds to install new equipment in galvanization manufacturing section (condensate traps, temperature and pressure regulators)
Project Leader:	**Elmet (Cluj, Romania)**
U.S. Partner:	Hoffland Environmental, Inc (Silver Springs Road, Conroe, Texas)
Project Description:	Identify the best practice to reduce the quantity of water contaminated with cyanide and heavy metals resulting from the production process
Follow-up financing:	$25,000 invested from Relansin, a national program, to apply a less polluting metal plating technology from cyanide to alkaline salted

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Project Leader:	**Bulgarian Branch Chamber of General Machine Building, Bulgaria**
US Partner:	TeControl, USA
Project Description:	Training for twelve auditors to introduce EMS to Bulgarian machine-building companies and implement it as a follow-up activity in 3-5 pilot companies with the assistance of the U.S. Partner.
Follow-up activities:	$30,000 contributed for ISO 14001 certification by three Bulgarian machine building companies (Chugunoleene-Ihtiman, Belasitsa-Petrich and Brist-Breznik) that passed the EMS certification audit conducted by the US company American Systems Registrars.

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