PD-ABW-631

EcoLinks Partnership Grants
Third Annual Report
July 1, 2000 – June 30, 2001

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I. Narrative Discussion

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

The EcoLinks Grants Program continued to operate successfully in its third year. Demand for the program was strong, and the grant topics were responsive to the needs in the region. The members of the selection panel have commented that the quality of applications have improved with each cycle, partly as a result of the staff's efforts to strengthen the capacity of applicants to prepare better proposals and adopt an integrated, cleaner production approach to solving environmental problems. At the same time the implementation of the projects have led to higher quality results, due to the staff's efforts to closely monitor the projects and account for grant funds.

During the year twenty-one Best Practices were prepared from closed grants, exceeding the target for the year. These Best Practices demonstrate how both environmental performance and financial performance can be improved at the same time. They show how the experiences and technologies of U.S. and other partners can be applied under local conditions. By transferring these Best Practices to other organizations in the region, the impact of the program is further increased.

Another indication of the program's impact is the value of investment and trade that is generated through the partnerships that are established. To date over $15 million in trade and investment has resulted from about $575,000 awarded in Challenge Grants and Quick Response Awards. By this account, total USAID-funded grants have already been leveraged by over 200%. This figure will increase as more projects mature.

The status of the Grants Program at the end of the year is described below:

Challenge Grants: During the year 30 Challenge Grants were awarded in the fourth cycle for $1,400,000. To date 134 grants have been awarded for $6.2 million. The fifth cycle was announced on March 12, and the selection panel will meet on November 5 to select the winners. Approximately 70 grants are currently active and are being monitored by EcoLinks staff.

Quick Response Awards: During the year 73 QRAs were awarded for $314,755. To date 219 QRAs have been awarded for $941,450. Of this total number, 87% involved U.S. partners. QRAs continue to be offered on a rolling basis.

Twinning Grants: The pilot cycle for Twinning Grants was launched on November 1, 2000. The selection panel met on May 21, 2001 and declined all three applications that were submitted. The applicants failed to comply with all the selection criteria, specifically the criterion for sustainable partnerships.

Financial: Total cumulative program expenses at year-end are $11,530,841.

Major Achievements:

Post-Grant Successes

As noted above, over $15 million in trade and investment has resulted to date from both Challenge Grants and Quick Response Awards. For example, the municipality of Kisielice in Poland was awarded a Challenge Grant to team with AWS Scientific, Inc, a consulting company in Albany, New York, to assess the feasibility of generating electricity from wind power. As a result of their feasibility study, the Polish Ecofund awarded a $600,000 grant to Kisielice to cover 30% of the investment outlays for the installation of a wind turbine. This success in Kisielice and others are listed in Annex A.

Challenge Grants

- On January 22, 2001 the Challenge Grants selection panel met in Szentendre and awarded 30 grants for the fourth cycle (out of 65 applications). Project summaries are provided in Annex B. The breakdown of grants by country is as follows:

Bulgaria	6	Romania	7
Croatia	3	Russia Far East	3
Kazakhstan	3	Ukraine	6
Macedonia	2		

- By grant topic, 47% of the grants were awarded in Cleaner Production, 30% in Global Climate Change and 23% in Water Quality Management.

- By type of organization, 57% of the project leaders were businesses, 27% local governments and 16% utilities.

- Since program inception 134 Challenge Grants have been awarded for $6.2 million. The breakdown by country is as follows:

Bulgaria	34	Poland	2
Croatia	9	Romania	33
Estonia	2	Russia	9
Hungary	3	Slovakia	7
Kazakhstan	7	Ukraine	16
Macedonia	12		

- A total of 98 U.S. partners, representing 31 different states and the District of Columbia, have participated in the Challenge Grants program. These U.S. partners and their grants are listed by state in Annex C.

- All grants from the first and second cycles have been closed, according to Ecolinks policies and procedures.

- During the year the program officers organized 60 information workshops to publicize the Request for Applications and explain the application guidelines. These workshops were attended by 2370 people in seven countries.

- During the year the program officers organized 17 proposal-writing workshops to assist applicants in preparing their applications. These workshops were attended by 307 people, mostly applicants with approved concept papers. Of the total attendees, 93% rated the workshops as good to excellent.

Quick Response Awards

- A survey was conducted among past awardees of Quick Response Awards to determine the success of the program in initiating on-going partnerships and to evaluate the service of the EcoLinks staff. 164 organizations that were awarded QRAs from December 1999 to October 2000 were sent surveys, and 60% of them responded. Of these respondents, 80% had applied for a QRA to prepare a Challenge Grant application and 20% to facilitate an investment/trade relationship. The main conclusion was that 78% of the respondents reported that their partnership was still continuing and some of them described completed trade agreements. In addition, 75% rated staff support as excellent and 23% as good.

- During the year 73 Quick Response Awards were awarded for $314,755. A listing is provided in Annex D. Of this total, 34 facilitated Challenge Grant applications and 39 pursued environmental trade and investment relationships. The country breakdown is as follows:

Bulgaria	6	Macedonia	2
Croatia	5	Moldova	1
Czech Republic	7	Poland	12
Georgia	1	Russia	6
Hungary	3	Romania	14
Kazakhstan	7	Slovakia	1
Latvia	1	Ukraine	6
Lithuania	1		

- Of the above QRAs, 18 were initiated by Tech Reps in the Northern Tier countries. The total value of QRAs initiated by Northern-Tier Tech Reps for the year was $77,647. An allocation of $150,000 had been set aside for them for this one-year period.

- Since program inception 219 QRAs have been awarded for $941,450. Of this total, 135 QRAs facilitated Challenge Grant applications and 84 facilitated environmental trade and investment. A country breakdown is as follows:

Bulgaria	33	Lithuania	5
Croatia	12	Macedonia	16
Czech Republic	13	Moldova	1
Estonia	1	Poland	23
Georgia	2	Russia	26
Hungary	15	Romania	35
Kazakhstan	18	Slovakia	5
Latvia	2	Ukraine	12

Twinning Grants

- On November 1, 2000 the pilot cycle of Twinning Grants was launched. The Request for Applications was prepared and distributed to a short list of twelve U.S.-based multiplier organizations.

- The selection panel for the Twinning Grants pilot cycle was organized. The three panelists were Barbara Felitti from Institute of Sustainable Communities, Robert Cronin from IREX, and Aleg Cherp from Central European University.

- On January 16 five concept papers were received and screened against the screening criteria. Three concept papers were approved to proceed to the full application stage. On May 21 the selection panel evaluated the three applications which were received from the following organizations:

  - The Environmental Business Council of New England and the Association of Environmental Firms, Romania
  - The Pittsburgh Technology Council and Accredited Laboratories Association, Romania
  - The Solid Waste Association of North America and The Chamber of Commerce and Industry of Bucharest, Romania

  The panel declined all three applications because they did not fully comply with the selection criteria, including the requirement for a vision and strategy to sustain the partnerships.

Best Practices

During the year, twenty-one Best Practices were prepared from closed Challenge Grants. This number exceeds the performance target for the program year. These Best Practices include a wide range of projects, from recycling plastics in Iasi, Romania to reducing fly

ash emissions in Vladivostok, Russia. They are presented in Annex E, and they will be posted to the EcoLinks website for dissemination.

Program Outreach and Coordination:

Outreach

- A 16-page marketing brochure was produced in March, listing all the grants awarded in 2000, presenting program developments during the year and describing four best practices from Challenge Grants and one success story resulting from a Quick Response Award.

- The program officers organized nine press conferences during the year to announce the next competition for grants and to highlight current projects in their countries. For example, in September the Program Officer in Kazakhstan arranged a press conference in Almaty, together with FCS, to publicize the EcoLinks program and to highlight a grantee, Almaty City Municipality. U.S. Ambassador to Kazakhstan Richard Jones and the Director of the USAID Regional CAR Mission Office of Energy and Environment John Starnes gave presentations. The press conference was attended by 60 people and covered by Kazakhstani press, TV and radio.

- In April the CoP presented EcoLinks Best Practices in climate change and water management to the Business Forum in Bucharest, sponsored by USAID and WWF.

- In March the CoP and the Program Officer in Bulgaria attended a closeout workshop for an EcoLinks Challenge Grant to Bourgas Municipality, Landfill Biogas Extraction and Energy Utilization System at the Bratovo Landfill. It was attended by 54 representatives of nearby municipalities and businesses as well as the Ministry of Environment and Waters, the State Agency for Energy Efficiency and several NGOs. The U.S. partner, Brown Vence, and Associates,Inc., discussed the merits of the technology proposed in the feasibility study. The event was chaired by the mayor and widely covered by the press.

- In February the Program Officer in Croatia presented the EcoLinks program to the American Chamber of Business in Croatia.

- In December the NIS Regional Manager presented the EcoLinks program at the EPA LEAP kick-off meeting in Mariupol, Ukraine.

- In December the CoP presented the EcoLinks program to the Central European University in Budapest, in a joint presentation with the U.S. Environmental Attaché.

- In November the Program Officer in Russia Far East presented the EcoLinks program at the Conference for Women Entrepreneurs in Khabarovsk.

- In November the NIS Regional Manager presented the grants program to the Meeting

on Cleaner Production and Environmental Management in Enterprises organized by OECD in Baku.

- In October the EcoLinks staff in Russia Far East joined the U.S. Commercial Service in participating in the workshop, "Small Business Partnership, Security and Consulting", organized by the Administration of Primorski Krai.

Coordination with USAID Missions and other EcoLinks Partners

- In November the Chief of Party, the CEE Regional Manager and the Program Officer in Croatia visited the USAID Mission in Sarajevo to present the grants program and discuss expanding it to Bosnia on a limited basis. It was agreed to start Challenge Grants in Konjic and Mostar in the next cycle. Twelve concept papers were received for that cycle, and six of them were approved. This represents not only a solid demand for the program in Bosnia but also a reasonable capacity level in the country to participate in the program.

  Until the Mission prepares next year's budget and approves funding an EcoLinks program office in Bosnia, EcoLinks will cover these two municipalities from its office in Croatia. A budget was prepared by EcoLinks for this activity and approved by Merritt Broady.

- During the year the CoP met with all the Missions and updated them on the status and latest developments of the program, with the exception of the Mission in Kazakshstan. In this instance, the NIS Regional Manager met with the Mission in February.

- The program staff continued to coordinate grant activities with the Tech Reps and FCS representatives, as agreed. Concept papers for Challenge Grants were forwarded to them for review. Award letters for Quick Response Awards were sent to the Tech Reps.

- In June two representative of PriceWaterhouseCoopers conducted a mid-term evaluation of the Grants Program on behalf of USAID. They interviewed staff in Washington, Bucharest, Kiev, Szentendre and Budapest. Their report is due to USAID in July.

- In April the CoP, Deputy Director, CEE Program Manager and NIS Program Manager attended the annual EcoLinks Partners Meeting in Roslyn, Virginia. They presented the status of the program to date and best practices from grants.

- In March the Program Officer in Ukraine worked with USAID/Kiev and the Academy for Educational Development to organize the workshop, Environmental Management at State and Private Enterprises. Two EcoLinks grantees made presentations.

- In January the Program Officer in Ukraine arranged for two grantees to present their projects on EMS to an EMS/Cleaner Production seminar sponsored by USAID.

- In December the Program Officer in Bulgaria met with the USAID Mission to discuss how to include EcoLinks in its DCA program. A subsequent appointment was arranged with the DCA coordinator, and it was agreed to refer promising projects to the program. As a result of this initiative, the United Bulgarian Bank extended a $100,000 loan to Elprom Elin, an EcoLinks grantee, under a DCA loan guarantee to carry out the recommendations of an energy audit.

- In November the Program Officer in Croatia met with the assessment group from USAID's Small Business and Agriculture Division of the Office of Market Transition to discuss the needs of SME businesses in the country.

- In October the Program Officer in Kazakhstan worked with FCS in organizing a press conference/reception for John Butler, Chris Godlove and Walter Weaver at FCS offices. The NIS Regional Program Manager gave a presentation on a Kazak grantee, Altynalmas.

Staffing and Office Network:

- During the year there were a number of staff changes designed to improve the efficiency of the program. A list of staff assignments is provided in Annex F. Due to the heavy workload in monitoring grants, particularly in Bulgaria and Romania, it was decided to streamline procedures and to make some organizational changes within the existing budget. The major organizational changes were the following:

  - Olga Schetinina was promoted to Grants Manager and transferred to the NIS Regional Office in Kiev.
  - Marina Petrova replaced Olga as RFE Program Officer.
  - Two local hires were added in Bulgaria and Romania to monitor grants in those countries. These new positions were funded by the elimination of positions in Northern Tier.

  In addition, a new Grants/Financial Administrator was hired in November and the Chief of Party relocated to IIE's office in Budapest in August.

- The annual staff-training program was organized and conducted in September in Washington. It was attended by 26 staff members from 9 countries. The highlights of the weeklong training were a teambuilding retreat facilitated by Training Resources Group, site visits to a resource recovery facility and a wastewater treatment plant, and presentations on project financing and Global Climate Change. There was extensive discussion on how to improve and streamline the project monitoring process. Eleven participants scored the workshop as excellent, eleven as good, and one as fair.

- Two training programs were organized to train new staff on policies and procedures, especially with respect to monitoring grants. One training program was held in November for Program Assistants and another one in May for Grants Officers.

Financial Results

At year-end total program expenses amounted to $11,530,841. Total grants awarded were $7,106,406, and total administrative expenses were 4,424,435. The financial report is provided in Annex G.

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

USAID is considering a two-year extension of the program. Several USAID Missions have indicated an interest in contributing funds to the program. A strategy and plan needs to be prepared to work with the Missions.

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

The recommendations from the mid-term evaluation will need to be discussed and adopted, as appropriate. In addition, both the annual report and the annual workplan will need to be approved by USAID.

IIE's Third Program Year Report

For the Period: July 1, 2000 – June 30, 2001

Prepared by: Winston Bowman, IIE
Date Prepared: July 27, 2001

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:	$ 7,539,735
Implementing Partner: Institute of International Education (IIE)	Amount obligated:	$15,758,162
Award/Amendment No., Type (CA): EE-A-00-98-00020	IPSES Funds 180-0039 (CEE)	$ 7,423,965
	EPT Funds 110-0003 (NIS)	$ 4,106,876
Period of Award: 07/01/98 to 06/30/03	Funds Expended to Date (Total):	$11,530,841
CO/CTO/COP: Sherrill Fachet (AO), Carl F. Maxwell (CTO), /Winston Bowman (COP).	Obligated Funds Remaining:	$ 4,227,321
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:** 25 **Current Year Target (6/01):** 20 **Current Quarter Achievement:** 6 **Current Year Achievement** 25
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:** 46 **Current Year Target (6/01):** 50 **Current Quarter Achievement:** 20 **Current Year Achievement** 46
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:** 227 **Current Year Target (6/01):** 60 **Current Year Achievement:** 44

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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:** 50 **Current Program Year (6/01) Target:** 20 **Current Quarter Achievement:** 0 **Current Year Achievement:** 15 Note: Next report for partner searches will be in November when full applications are received for Cycle 5
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:** 30 **Current Program Year (6/01) Target:** 30 **Current Quarter Achievement:** 7 **Current Year Achievement:** 30

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 = 219, Trade – 84, Grants – 135 **Current Year Target (6/01):** Total QRAs = 120, Trade – 40, Grants – 80 **Current Quarter Achievement:** Total QRAs = 13; Trade - 9; Grants - 4 **Current Year Achievement:** Total QRAs = 73; Trade – 39; Grants – 34
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:** 15 **Current Year Target (6/01):** 15 **Current Quarter Achievement:** 6 **Current Year Achievement:** 15

Annex A
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 auto 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.

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

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:	$600,000 grant from Polish Ecofund to cover 30% of the total investment outlays for installation of the wind turbine.

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

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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:	**Municipality of Kriva Palanka (Macedonia)**
Project Partner:	OVERGAS Engineering Ltd., Bulgaria
Project description:	Preparation of pre-feasibility study for natural gas utilization for district heating.
Follow-up financing:	$28,000 was contributed by OVERGAS Engineering Ltd. for preparation of detailed design project. Municipality of Kriva Palanka invested $5000 for project revision.

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 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.

Project Leader:	**Elprom Elin (Bulgaria)**
Project Partner:	PA Government Services, Inc., USA
Project Description:	Conducting 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.

June 25, 2001

Annex B
Awarded Challenge Grants
Fourth cycle – 2000-2001

In January, 2001 the EcoLinks Grants Selection Panel met in Budapest, Hungary and awarded 30 Challenge Grants in Cycle 4 for a total of about $1,400,000. The grant topics were Cleaner Production, Water Quality Management and Global Climate Change. By country breakdown, 6 grants were awarded in Bulgaria, 3 in Croatia, 3 in Kazakhstan, 2 in FYR Macedonia, 7 in Romania, 3 in Russia, 6 in Ukraine. Brief descriptions of the awarded grants are provided below.

BULGARIA

1) Title: A Techno-Economic Model for a Geothermal Plant in Sapareva Banja
Leader: Municipality of Sapareva Banja, Bulgaria
Partner: Princeton Energy Resources International, LLC, Rockville, MD,USA
Partner: Elisa Consult, Sofia, Bulgaria
Grant Total: $48,000
Summary: The team will assess the potential of extending the geothermal energy use for all district heating needs of the Sapareva Banja community. Currently, the municipality is using geothermal on a small scale as an alternative to fossil fuel. First, the US partner will analyze the current system and identify opportunities to improve it. Then it will estimate the geothermal potential of the local field as well as determine the heat and energy consumption in the city. Based on the findings, a technical and economic study will be prepared to evaluate the district-heating scheme, including a general system configuration, environmental impact, and cost estimates. The study will be the basis for obtaining future funding for the project. The partnership was facilitated by an EcoLinks QRA awarded to the municipality.
Results: A description of the existing geothermal system and a report on the geothermal resource potential, including estimated costs to increase the fluid production. Also a district heating model, including an assessment of economic and environmental impacts of the proposed system.

2) Title: Cleaner Shoe Production: Environmental Friendly Products
Leader: Valeo Company, Plovdiv, Bulgaria
Partner: BEM Systems, Inc., Chatham, NJ,USA
Associates: CSM Worldwide, Inc., NJ,USA
Grant Total: $50,000
Summary: The goal of the project is to significantly reduce the VOC emissions through several cleaner production methods, including raw material substitution and waste minimization practices at the plant. The following tasks are planned: a preliminary assessment, including a process flow diagram that identifies each manufacturing step, raw materials, packaging methods, intermediate and end products, and waste stream. Based on the initial data, the team will develop a waste and emissions inventory and evaluate the substitution of currently used hazardous materials with less polluting materials, including low VOC content or water-based adhesives. The US Partner will develop a cost-benefit analysis of these options, including environmental benefits and a set of recommendations. Guidelines for Cleaner Shoe Production will be developed and distributed during a final workshop to disseminate project results.
Results: A preliminary assessment of shoe manufacturing and waste handling practices at the plant, an environmental inventory, and a cost-benefit analysis of identified options. The main result is a final report including recommendations for the best, feasible options as well as a brochure entitled "Guidelines for Cleaner Shoe Production" to be distributed to similar facilities.

3) Title: Action Plan for Integrated Water Quality Management
Leader: Municipality of Kavarna, Bulgaria
Partner: Pennsylvania-American Water Company, McMurray, PA, USA
Partner: Stoarch, Sofia, Bulgaria
Associates: Center for Environmental Research and Education, Duquesne University, Pittsburgh, PA, USA; Allegheny County Sanitary Authority, Pittsburgh, PA, USA
Grant Total: $50,000
Summary: The goal of this project is to develop a long-term action plan for developing an integrated water quality management system for the Kavarna region. The partners will identify and rank the causes of water quality problems and the potential for water conservation. Based on this information, the partners will identify the best ways to improve water quality and reduce water consumption.
Results: The partners will produce an analytical study of the state of water quality management in the Municipality, a draft action plan for integrated water quality management, and an investment promotion brochure for priority projects.

4) Title: Energy Audit
Leader: Kitka 1 Joint Stock Company, Novi Pazar, Bulgaria
Partner: EETEK Kft, Budapest, Hungary
Associate: Tetiva Ltd., Sofia, Bulgaria
Grant Total: $50,000
Summary: The goal of this project is to develop, design and implement a comprehensive energy efficiency strategy for Kitka 1. The partners will conduct an energy audit of the plant, including a financial analysis of potential energy efficiency investments. As part of the audit, the partners will analyze current energy consumption, calculate the amount of energy required for operation, estimate potential energy and cost savings from efficiency improvements, and make a cost/benefit analysis of the proposed efficiency measures.
Results: The partners will produce an energy audit report.

5) Title: Treatment System for Recyclable Waste at a Landfill
Leader: Chistota Iskar Ltd., Sofia, Bulgaria
Partner: EBA Wastechnologies, Santa Rosa, California, USA
Grant Total: $38,800
Summary: The primary goal of the project is to minimize the amount of residential waste deposited in the Sofia municipal landfill. In order to accomplish this goal, the partners will examine methods of waste separation that allow recyclable materials to be treated separately from non-recyclable waste. The partners will examine two possible strategies: separate collection of recyclable and non-recyclable wastes and separation of wastes at a central location. The partnership is a result of a partner match conducted by EcoLinks.
Results: The partners will produce an analysis of the composition and quantities of recyclable waste at the landfill, a proposal for waste separation, and a report that details strategies for modern landfill management and the recovery of recyclable waste.

6) Title: Recycling Fluorescent and High Intensive Discharge Lamps
Leader: Svetlina, Sofia, Bulgaria
Partner: Lamp Recyclers of Louisiana, Inc., Hammond, Louisiana, USA
Grant Total: $49,980
Summary: The goal of the project is to develop a plan for tracking, collecting, storing and transporting fluorescent lamps containing mercury. In addition, the partners will work towards identifying technologies for recycling lamps that can be integrated with the leader's current manufacturing technology. The partnership was facilitated by a QRA awarded to the leader.
Results: The partners will develop models for the effective management of a recycling facility for mercury-bearing lamps, the collection, storage and transportation activities associates with such a facility, and the effective reutilization of all by-products of the recycling process.

CROATIA

7) Title: Cogeneration Plant in Clinical Hospital Osijek
Leader: Klinicka Bolnica Osijek (KBO), Croatia
Partner: Parsons Energy & Chemicals Group, Reading, PA, USA
Grant Total: $49,500
Summary: This project will assess the feasibility of reducing Osijek Clinical Hospital's energy supply expenses and consequently the costs of medical treatment. The project leader and partner will develop an Energy Management Plan. The Plan will include data on total heat and power consumption during a calendar year, analysis of results and possible internal savings. Also, the selection of the most favorable technical and process options for combined heat and power supply of the hospital will be provided. Finally, they will determine parameters for the cogeneration plant and prepare documentation for the future plant. The partnership was facilitated by a QRA awarded to the leader.
Results: The final results of this project are process and tender documents for selecting the most favorable bidder for contract award.

8) Title: Waste Management Planning
Leader: Municipality of Biskupija, Croatia
Partner: Environmental Technology Group, Inc., Centerport, NY, USA
Partner: Urbing, Zagreb, Croatia
Grant Total: $50,000
Summary: The goal of the project is to completely reorganize and reform the leader's solid waste management system. Solid waste management in the municipality will be improved through waste reduction, reuse, separation, and the composting of organic materials. The partnership was facilitated by a QRA awarded to the American partner.
Results: The partners will produce an inventory of the waste disposed of at the municipal landfill, a model for a solid waste disposal facility, a marketing plan for recovered waste material, and a report that analyzes the information gathered during the project and details the plan for reorganizing the solid waste management system.

9) Title: Improvement of Water Quality and Reduction of Leaks
Leader: Darkom Ltd. Public Utility Company, Daruvar, Croatia
Partner: DHI HydroInform, Prague, Czech Republic
Partner: IMGD Ltd., Zagreb, Croatia
Grant Total: $49,939
Summary: The purpose of the project is to improve water quality and reduce the loss of water due to leaks in the system. The partners will develop a model to identify areas of severe leakage. Using that information, they will test and monitor the leak detection equipment on a pilot basis. The partnership was facilitated by a QRA awarded to the leader.
Results: The partners will prepare a leak detection study to be used for implementing the plan throughout the system.

KAZAKHSTAN

10) Title: Reduction of Ammonia Emissions at Atyrau Dairy Refrigeration Facility
Leader: Atyrau Sutcombinat Open Joint-Stock Company, Atyrau, Kazakhstan
Partner: PSRG Consultants, Houston, TX, USA
Grant Total: $49,929
Summary: The purpose of the project is to develop economically viable options to reduce ammonia emissions by implementing cleaner production and energy efficiency measures at the diary plant. The US partner will assist the leader in assessing the conditions at the plant and develop a maintenance plan, including leak detection and abatement. Activities include: an energy audit to determine opportunities for energy conservation and the development of a plan to identify options for new refrigeration equipment. The partnership is a result of partner search conducted by EcoLinks and was facilitated by a QRA awarded to the Kazak organization.
Results: An energy audit report, ammonia emissions testing report as well as a feasibility study that includes a project assessment, financing, and implementation cost estimates.

11) Title: Making Production of Solvents Ecologically Cleaner
Leader: Demeu Ltd. Almaty, Kazakhstan
Partner: Sierra Engineering Services, Irvine, CA,USA
Grant Total: $43,777
Summary: The main goal of the project is to make production of solvents ecologically cleaner at Demeu plant. The partners will develop a feasibility study on waste reduction and control of water and air pollution in the solvents production area. Cooperation with the partner company will enable the leader to establish environmentally friendly production of solvents.
Results: A feasibility study on waste reduction and control of water and air pollution, a list of recommendation, and a plan for adopting the best technology options will be developed.

12) Title: Conversion of Solid Waste into an Economically Viable Product
Leader: CJSC Alash, Almaty, Kazakhstan
Partner: K.R. Komarek, Inc., Elk Grove Village, Illinois, USA
Associates: Institute of Metallurgy and Ore Benefication of the National Academy of Science, Almaty, Kazakhstan; OJSC Ispat-Karmet, Temirtau, Kazakhstan
Grant Total: $49,973
Summary: The goal of the project is to study the feasibility of using briquetting technology to convert the waste from the production of calcium carbide into an economically viable product. The partners will study and analyze the current production operations, the feasibility of using briquetting technology on the waste and the different methods of doing so, and a technical and

financial evaluation of the different methods. By doing this, the partners will identify the best market-based solution to the waste problem. The partnership was facilitated by a QRA awarded to the American partner.
Results: The partners will produce a feasibility study that evaluates three methods of using briquetting technology, as well as a feasibility study that addresses the possibility of using the briquettes as a metallurgical additive.

MACEDONIA

13) Title: "BioPrespa" Feasibility Study
Leader: Municipality of Resen, Macedonia
Partner: HydroQual, Inc., Mahwah, NJ, USA
Partner: Fluid Project, Skopje, Macedonia
Grant Total: $50,000
Summary: The overall goal of this project is to improve Lake Prespa's environmental conditions by designing an efficient wastewater treatment system in the Municipality of Resen. The team will conduct a feasibility study to assess and recommend viable options for collection and treatment of sewage water. This study will include the evaluation of technology alternatives and will be the basis for cost estimates in order to pursue investment opportunities.
Results: A feasibility study that includes best practice models to solve the environmental problem of wastewater flowing into the lake.

14) Title: Modernizing the Landfill and Solving the Problem with Solid Waste Management in Resen
Leader: JKP " Proleter", Macedonia
Partner: Hydroprojekt CZ, a.s., Czech Republic
Partner: GEING, Krebs und Kiefer International, Macedonia
Grant Total: $47,155
Summary: The major goal of this project is to present options for the waste disposal system, waste collection and waste transport in Resen, Macedonia. The Czech partner will provide options for reconstructing the existing landfill. The final study will show if recycling and composting are suitable and an analysis of the quality and types of waste will also be included.
Results: A proposal for a waste management system and preliminary designs for the system.

ROMANIA

15) Title: Cleaner Production Options for a Ceramic Sanitaryware Factory
Leader: Bianca Romana SRL, Ploiesti, Romania
Partner: Environmental Management, Idaho Falls, ID, USA
Partner: SC "Petrom" INCERP Cercetare, Ploiesti, Romania
Grant Total: $44,915
Summary: The objective of the project is to improve the production process of ceramic sanitaryware by reducing waste and emissions while increasing energy and other resource efficiency. First, the partners will investigate the sources of waste, emissions and inefficiency by conducting an analysis of critical material and flow at the plant. Based on the results, they will develop several good housekeeping procedures to increase resource efficiency and reduce emissions. Several cleaner production options will be presented for process/equipment modification, such as water/waste reuse, dust-emissions reduction through improved filtration or containment, and increased energy efficiency through heat recovery or energy conservation. Finally, a workshop will be organized to disseminate project results.

Results: Project results include an air-quality, self-monitoring scheme, a manual on good housekeeping measures for ceramic sanitaryware manufacturers, a technical report on cleaner production options, and workshop materials.

16) Title: Pilot Project for Recycling the Municipal Waste in Bistrita City
Leader: Bistrita City Mayoralty, Romania
Partner: Resource Recycling Systems. Inc., Ann Arbor, MI, USA
Associate: Urbana SA Bistrita, Romania; SC Hicart SA Prundu-Bargaului, Bistrita, Romania; SC Codrisor SRL, Bistrita, Romania; SC Remat, Bistrita, Romania
Grant Total: $50,000
Summary: The US Partner and the Associates will develop a pilot collection, processing and marketing scheme for paper products collected from schools, businesses, residential areas, and institutions. Assisted by the partner, the City will prepare the procurement bid documents, and will upgrade the waste collection and disposal services by implementing a long-term service contract with local providers. A long-term recycling/solid waste service contracting strategy will be developed by the US company. The partnership is a result of a partner match conducted by EcoLinks and it was facilitated by a QRA awarded to the US company.
Results: The main results of the project will be an assessment and pilot recycling program as well as model procurement documents for Bistrita city.

17) Title: Efficient Energy Consumption, Minimum Climatic Changes
Leader: SC Tufon SA, Craiova, Romania
Partner: Thermal Desorption Technology Group LLC, Budapest, Hungary
Partner: MARCH CONSULTING spol. s.r.o., Prague, Czech Republic
Grant Total: $45,000
Summary: The main purpose of this project is to increase the energy efficiency of the technological process and to reduce the energy consumption at SC Tufon SA. The result from the energy audit will be a major reduction of greenhouse gas emissions. At the end of the project, technical solutions will be provided for reducing energy consumption and improving energy efficiency.
Results: The partners will present an energy audit and the leader will be able to calculate the cost of the expected investment. A report will provide technical solutions for reducing energy consumption during the production process and improving working conditions in the production hall.

18) Title: Waste Water Management at ICERP S.A. for Complying with the Legal Norms
Leader: S.C. ICERP S.A. Ploiesti, Romania
Partner: Oshman Group, LLC, Chester, VA, USA
Grant Total: $50,000
Summary: ICERP S.A. discharges wastewater that contains petroleum products and organic and inorganic compounds into the city sewer system. With the help of Oshman Group LLC, they will install efficient monitoring systems to monitor the quality of treated water at the outlet to the city sewer system. This new system will measure the level of hazardous products in the water.
Results: The major result of this project is to identify a cost-effective compliance program for S.C. ICERP S.A. Also another result is the development of options for managing the wastewater and for providing control/pre-treatment models.

19) Title: Alternatives for Upgrading the Water Pre-Treatment Plant and for Improving the Water Management System of S.C. Dorobantul S.A.
Leader: S.C. Dorobantul S.A., Ploiesti, Romania
Partner: Aponowich, Driscoll & Associates, Inc., Atlanta, GA, USA
Grant Total: $47,950
Summary: Dorobantul's production will be evaluated in order to reduce waste generation as much as possible. Then, wastewater treatment and the sludge management alternatives will be evaluated, to determine the most cost effective and environmentally acceptable alternatives. Each alternative will be evaluated using life-cycle costs and an appropriate discount rate. A final recommendation will be made on the most viable alternate for further implementation.
Results: The major result of this project is the evaluation report of in-plant process flows and pollution prevention techniques. The final report will summarize and develop the Cost of Implementation and Investment Plan for SC Dorobantul.

20) Title: Technical Alternatives for Improving the Water Management System of Petromidia
Leader: S.C. Petromidia S.A., Romania
Partner: Harza Engineering Co., Chicago, IL, USA
Grant Total: $49,352
Summary: The goal of this project is to improve the efficiency of Petromidia's operating and wastewater treatment systems in order to significantly reduce the raw water intake and concentrations of pollutants in the wastewater that is discharged into the Black Sea. Another aspect of the project is increasing the percentage of reused water in the technological process and reducing water consumption.
Results: A technical report that assesses the treatment efficiencies of the water and wastewater facilities at the plant, evaluates alternatives that should be considered, and recommends modifications/improvements.

21) Title: Reducing Losses in the Thermal Energy Distribution Network
Leader: Iasi District Heating Company, Iasi, Romania
Partner: Cavanaugh & Associates, P. A., Winston Salem, NC, USA
Associate: Regia Autonoma Judeteana Apa Canal Iasi, Iasi, Romania; S. C. Expert Grup, Iasi, Romania; Citadin, Iasi, Romania
Grant Total: $50,000
Summary: The goal of the project is to reduce the loss of heat in the district heating system due to leakages. The partners will test the feasibility of using leak detection equipment. In order to test the feasibility of the technology, the partners will establish a pilot project to test the technology at two substations in the heating network. In addition, the partners will study the problem from a financial point of view in order to determine the costs, benefits, and the potential rate of return of any future investment in leak detection equipment for the system. The partnership was facilitated by a QRA awarded to the leader.
Results: The partners will determine if the detection equipment can function as intended and will decide, based on economic factors, if the project should continue to the implementation stage.

RUSSIA FAR EAST

22) Title: Feasibility Study on the Production of High-Quality Livestock Feed from Stillage.
Leader: "OAO Likerovodochnyi Zavod" (Open Joint Stock Company), Yuzhno-Sakhalinsk
Partner: Katzen International, Inc., Cincinnati, OH,USA
Grant Total: $49,985
Summary: The project aims at minimizing the discharge of thin stillage (more than 4,000 tones annually) resulting from the production process that is ultimately deposited into the city landfill. An initial assessment will analyze the waste volume, raw materials and water use, and test the stillage characteristics. The project will also study the market and demand for livestock feed as well as waste transportation issues. A feasibility study and a business plan will be developed at the end to evaluate the most effective technologies and solutions that provide for the extraction of animal feed components from the waste while minimizing the water consumption reduction. The partnership was facilitated by a QRA awarded to the Russian plant.
Results: A feasibility study, including a cost estimate of proposed options and a business plan.

23) Title: Vladivostok Drinking Water Management Project
Leader: Vladivostok Municipality, Russia
Partner: Utility Service Associates, Seattle, WA, USA
Grant Total: $43,282
Summary: The project will develop a water system management plan for the city to conserve water and energy resources by eliminating leaks and reducing water losses. The municipality's employees will be trained in water management methods used in the US. The US Partner will develop programs for management of high, water-flow control in the distribution network, in-house leak detection and conservation, and improvement of the water loss accountability in Vladivostok. The partnership resulted from a partner matching conducted by EcoLinks and was facilitated by a QRA awarded to the leader.
Results: The main result of the project will be a water management and conservation program that will focus on high, water-flow control improvement, in-house leak detection, and better methodology for accounting for water losses in the city.

24) Title: Community Solid Waste Sorting and Recycling Project in Khabarovsk
Leader: Community Service Enterprise # 1, Khabarovsk, Russia
Partner: Association of Oregon Recyclers (AOR), Portland, OR, USA
Grant Total: $48,009
Summary: Based on the experience of the US partner, Community Service Enterprise # 1 intends to create a model system for collecting, sorting, transporting and recycling solid waste materials in a housing district of Khabarovsk City. The project involves several stages: designing of pilot recycling depots, selecting equipment, training depot managers and educating the public on recycling. The Association of Oregon Recyclers will provide experience, training, consultation and evaluation of the project. The partnership was facilitated by a QRA awarded to the leader.
Results: The operation of pilot recycling depots in the project area. Also lists of potential markets for different recyclable materials and a small manual for operating and maintaining the collection depots will be given.

UKRAINE

25) Title: Solving Environmental Problems of Chemical and Pharmaceutical Enterprises
Leader: Farmak Chemical and Pharmaceutical Plant, Kiev, Ukraine
Partner: TLK Consulting, Kirkland, WA,USA
Associates: Pivdenteploenergomontazh, Kiev, Ukraine; Technomer Energiya, Kiev, Ukraine; Ecomedservice, Kiev, Ukraine
Grant Total: $48,500
Summary: The goal of the project is to identify areas of energy loss and to evaluate the feasibility of implementing energy efficiency measures. The partners will perform an energy audit of the leader's manufacturing facility. In the course of performing the audit, the partners will develop qualitative and quantitative estimates of the potential for energy savings, and develop an energy management plan. The partnership is a result of a partner match conducted by EcoLinks and was facilitated by a QRA awarded to the US partner.
Results: The partners will prepare an energy audit of the leader's facility, and a method for an integrated solution to energy and environmental problems. In addition, they will conduct a workshop for representatives of chemical and pharmaceutical companies, local governments, and environmental organizations to disseminate the results of the project.

26) Title: A Sustainable Waste Management System for Zaporizhzhya.
Leader: Office on Ecology of Zaporizhzhya Municipal Council, Ukraine
Partner: Cantox, Inc., Bridgewater, New Jersey, USA
Partner: Scientific-Technical Industrial Corporation "EcoShield", Ukraine
Grant Total: $ 50,000
Summary: The city of Zaporizhzhya has two landfills that are quickly reaching their capacity. Both are technically inadequate and pose a serious environmental threat due to poor standard of service and the discharge of contaminants into the rivers. Moreover, the city is not taking advantage of the potential revenue that could be earned on the recyclable materials currently disposed of at the city dump. This project will look at alternatives for developing a waste management system and plan.
Results: The project report will include a short list of potential waste systems and the rationale for their selection, a cash-flow model that forecasts costs and revenues generated from various system alternatives, and a business plan for implementing the preferred waste management system.

27) Title: Developing Climate Change Mitigation Strategy for Donetsk, Ukraine.
Leader: Ecology and Environment Department of Donetsk City Council, Ukraine.
Partner: Twenty First Strategies, LLC, McLean,Virginia,USA
Associate: Center for Clean Ai Policy, USA; Ukrainian Environmental Technology Center (UkrNTEC), Ukraine; Advertising Agency "Styler", Ukraine
Grant Total: $ 49,996
Summary: Donetsk is an industrial city that contributes about one third of the pollution in Ukraine. The region is known for its concentration of heavy industry that results in extremely high energy consumption and elevated levels of GHG emissions. The City of Donetsk will carry out a project to evaluate the options for reducing GHG emissions and will develop a local climate mitigation strategy.
Results: The project deliverables include a GHG emissions inventory, a strategy for reducing GHG emissions and a shortlist of promising GHG reduction projects.

28) Title: Minimization and Management of Waste Products in Marganets, Ukraine
Leader: State Communal Enterprise "Blagoustriy", Ukraine
Partner: The Environmental Research and Monitoring Center PP, Poland
Partner: Closed Joint Stock "Dnieprocommunproject", Ukraine
Grant Total: $ 41,748
Summary: The city of Marganets is experiencing a problem with disposing of its household waste. The waste field does not meet the sanitary requirements established in Ukraine - it is not equipped with systems for removing dust and the effects on subsoil waters are not monitored. The city would like to develop a waste management system that would include ecologically safe and economically effective methods of gathering, transporting and processing of the waste products. The partnership is a result of a partner match conducted by EcoLinks
Results: The results of this project will include an audit of the content and the sources of waste in the region as well as a report on both legal and illegal waste dumps and their effect on the environment. Furthermore, a waste management program will be created for Marganets that will include ecological, technological, legal and training aspects.

29) Title: Degasification of Underground Coal Mine and Utilization of Coal Bed Methane
Leader: Stakhanov Mine, Donetsk Region, Ukraine
Partner: Resource Enterprises Inc., Salt Lake City, UT, USA
Grant Total: $ 49,608
Summary: The project team will conduct a methane drainage and use study for the underground, long-wall, coal-mining operations at Stakhanov mine. The overall goal of the project is to determine the feasibility of introducing methane drainage and use technology to Stakhanov Mine through the establishment of an independent drilling and gas utilization service organization, based in the Donetsk Coal Basin.
Results: A feasibility study that examines drilling technologies and evaluates the efficiency of degasification wells as well as the development of an independent service organization.

30) Title: Environmentally Friendly Recycling Wastes at "VtorMet"
Leader: Joint Stock Company Konstantinovka plant "VtorMet", Donetsk Region,Ukraine
Partner: Environmental Science Services (ESS), Inc., Wellesley, MA, USA
Grant Total: $ 49,998
Summary: The plant recycles discarded Ni-Fe industrial accumulators and produces nearly 5000 tones of ferronickel annually using this technology. This recycling leads to significant gaseous emissions that contain fumes, dust and gas hazardous to the environment. The plant wants to find a way to reduce the amount of emissions by technology improvements as well as by setting up a gas purification system. The overall goal of the project is to identify and assess the environmental problems resulting from recycling discarded Ni-Fe industrial batteries and to identify environmentally friendly and efficient measures to clean up pollution and to improve the processes. The partnership was facilitated by a QRA awarded to the Ukrainian company.
Results: The project deliverables include: a study to identify and evaluate the environmental and technological problems occurring during the process in order to create a cleaner production process, and a final report which lays out the concrete measures for implementing the recycling options including the technology alternatives for the plant.

ANNEX C
EcoLinks Challenge Grants
Partnerships with U.S. 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

From all four cycles (134 grants) there is a total of 98 US partners representing 31 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 (1)	Flagstaff, Arizona	Southwest Windpower	Renewable Energy – Electric Power Systems	Cycle 3 – Romania	$34,700
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 Engineers	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 (3)	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
				CO TOTAL	**$144,075**
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 (1)	Atlanta, Georgia	Aponowich, Driscoll & Associates	Upgrading the Water Pretreatment Plant and Management System	Cycle 4 – Romania	$47,950
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
MD (8)	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
				MD TOTAL	**$382,083**
MA (4)	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
				MA TOTAL	**$198,236**
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**
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 (4)	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
				NY TOTAL	**$200,000**
NC (3)	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
				NC TOTAL	**$135,000**
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 (4)	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
				PA TOTAL	**$199,100**
SC (1)	Columbia, South Carolina	Wilbur Smith Associates	Alternative Fuels and Transportation	Cycle 3 – Bulgaria	$50,000
TN (2)	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
				TN TOTAL	**$99,971**
TX (3)	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
				TX TOTAL	**$149,929**

UT (2)	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
				UT TOTAL	**$99,558**
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 (12)	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
				VA TOTAL	**$588,096**
WA (4)	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**
				WA TOTAL	**$191,782**

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 D
EcoLinks Quick Response Awards
Program Year Three

#	GRANT NUMBER	DATE OF AWARD	GRANTEE	PROJECT TITLE	COUNTRY	PROJECT PARTNER	GRANT AMOUNT
Bulgaria							
6	BG-201	10/10/00	Hydroisomat	Cleaner production at the bitumen plant	BG to Germany	Ogden Corporation	$1,752
	BG-189	10/02/00	Municipality of Elin Pelin	Meet with partner/CG application prep./Convers	BG to US	Power Management Corporatic	$3,600
	BG-179	09/20/00	Samokov Municipality	Management of water resources	BG to US	ABBA SUSA	$5,000
	BG-177	09/20/00	Valeo Co.	Environmental friendly shoe production	BG to US	BEM, NJ	$5,000
	BG-175	09/20/00	Sapareva Banja mun.	Geothermal plant model	BG to US	PERI-Princeton Energy Res. In	$2,089
	BG-169	09/13/00	Svetlina AD	Lamp recycling, travel to meet partner, CG prep	BG to US	Lamp Recyclers of Louisiana	$4,962
						Sub-total:	$22,403
Croatia							
5	CR-227	04/18/01	Hidroprojekt-ING	Biological wastewater treatment	CR to US	Parsons Engineering Science	$4,649
	CR-226	04/06/01	Iyer Environmental Group	Site visit to Herbos facility	US to CR	Herbos	$4,246
	CR-210	11/15/00	Herbos	Wastewater treatment	CR to Amsterdam	Iyer Environmental Group	$2,600
	CR-185	09/20/00	Clinical Hospital Osijek	Cogeneration Plant	CR to US	Parsons	$3,802
	CR-174	09/19/00	Darkom Ltd.	Water leakage reduction project	CR to CZ	DHI Hydroinform	$2,760
						Sub-total:	$18,257
Czech Republic							
7	CZ-237	06/25/01	BOCR CZ, a. s.	Updating sewerage systems	CZ to US	HVG International	$5,000
	CZ-233	05/23/01	SUDOP Praha	Innovative microturbine technology	CZ to US	SC Edison	$5,000
	CZ-229	05/07/01	Silnicni Technika, a.s.	Rosco Spray Patcher	CZ to US	Rosco, Manufacturing Comp	$5,000
	CZ-212	12/27/00	Zlin Municipality	Low energy housing	US to CZ	Davis Caves Construction In	$2,550
	CZ-198	10/05/00	PVK (Prague water Co.)	Real time control of sewer system	CZ to US	Accusonic techn., Inc., MA	$4,100
	CZ-195	10/03/00	VUC Praka	Wastewater treatment of Maraska factory	CZ to CR	Maraska factory	$3,061
	CZ-196	10/03/00	CVH Environmental, Inc	Remediation of Waste oil sludges	US to CZ	Diamo sp	$5,000
						Sub-total:	$29,711
Georgia							
1	GE-213	01/04/01	Design Fuels Corporation	Waste Coal recovery at Tkibuli mine	US to GE	Tkibuli mine, Rustavi mun.	$5,000
Hungary							
3	HU-231	05/18/01	PAE Environmental Co.	Municipal waste recycle/reuse- Lundell Proc	US to HU/RU	K&W kft, Mun. of Krasnodar,	$4,925
	HU-202	10/11/00	Consact	Wastewater, attend WEFTEC, represent clier	HU to US	KSA Eng., Aqua Environmen	$5,000
	HU-178	09/20/00	Pritech, Ltd.	Solving sedimantation sewer problem	HU to US	Airvac Co. Rochester	$2,482
						Sub-total:	$12,407
Khazakstan							
7	KZ-235	06/01/01	OJSC Ferrochrome	Industrial waste management system	KZ to US	Ensafe Inc.	$4,955
	KZ-199	10/06/00	Vinegar Connoisseurs Int'l	Garbage to gold (apple waste to vinegar)	US to KZ	Alma-Ata Ltd.	$5,000
	KZ-170	09/14/00	Almaty Energopool	Travel to meet partner, develop full app. wind p	KZ to RU	Vetroen	$3,210
	KZ-172	09/18/00	Atyrau plant	Reduction of ammonia ammision at the plant	KZ to US	PSRG, Inc., TX	$4,421
	KZ-164	08/17/00	K. R. Komarek, Inc.	Conversion of waste into economically viable pr	US to KZ	Alash JSC	$5,000
	KZ-162	08/04/00	Akvaconsult	Wastewater treatment plant	US to KZ	Municipality of Aktau	$4,997
	KZ-161	08/02/00	MTF LLP	Cleaner production of milk	KZ to US	Global Ecotech (IN)	$5,000
						Sub-total:	$32,583

#	GRANT NUMBER	DATE OF AWARD	GRANTEE	PROJECT TITLE	COUNTRY	PROJECT PARTNER	GRANT AMOUNT
Latvia							
1	LA-232	05/23/01	Aqua-Flo, Inc., MD	Ind. Waste reduction for Gulf of Riga	US to LA	EKO technologijas	$5,000
Lithuania							
1	LT-207	11/06/00	Greentechtexas International	ET3M Event and meeting LT partners	US to Latvia	Greentechtexas International	$5,000
Macedonia							
2	MK-188	10/02/00	Medical Center of Veles	Management of medical wastes	MK to US	Pennoni International	$5,000
	MK-181	09/20/00	J.K.P. Proleter	Modernization of existing landfill	MC to CZ	Hydroprojekt a.s.	$4,008
						Sub-total:	$9,008
Moldova							
1	MO-205	11/01/00	Cavanaugh & associates	leak detection in Moldova and Poland	US to MO,PL	Water Supply Companies	$4,100
Poland							
12	PL-230	05/17/01	Prote Bioremedacja	Soil/groundwater remediation equipement	PL to US	Enviro Products, Geotech, CI	$5,000
	PL-222	03/28/01	Parris International, LLC	Production of insulated windows in Poland	US to PL	OKNO Systems	$5,000
	PL-221	03/23/01	EKOLOG Systems Sp.	Waste Management System in Warsaw	PL to US	CP Manufacturing, Inc.	$5,000
	PL-220	03/21/01	STOEN SA	Photovoltaics at Warsaw utility	PL to US	Tucson, LI power co.	$5,000
	PL-214	02/13/01	Harmony Enterprises, Inc.	Harmony-Ekomech partnership	US to PL	Ekomech Sp. z o.o.	$4,200
	PL-211	11/20/00	Bytom Group	Rubber waste to energy	PL to US	Emery Recycling Group	$5,000
	PL-209	11/10/00	EarthFax Development Corp.	Deployment of furol-based remediation techi	US to PL	Prote Bioremelacja Ropopoc	$2,394
	PL-208	11/06/00	Municipality of Bytom	Deployment of plasma systems for toxic was	PL to US	MSE Technology Application	$4,912
	PL-206	11/03/00	HydroFlo, Inc.	meet with Polish company, attend EcoLinks	US to Amsterdam	Exico, Ltd.	$3,002
	PL-191	10/02/00	NAPE (Energy Conservation Agency)	Energy Eng. Certification	PL-US	AEE, GA	$5,000
	PL-171	09/15/00	Zeclips USA	Refinery Nafty Jedlicze waste project	US to PL	Refinery Nafty Jedlieze	$5,000
	PL-158	07/10/00	Euro-Time Group	Establishment of business relationship/tradi	PL to US	Filtration Engineering Co., In	$4,990
						Sub-total:	$54,498
Russia Far East							
6	RFE-193	10/02/00	Housing trust Y-S	Conservation of water resources	RFE to US	GOF Water Audits, CT	$4,761
	RFE-192	10/02/00	Izvestkovy Zavod	Meet partner/ See NESCO technology/ construc	RFE to US	Environmental Opportunities	$4,286
	RFE-184	09/20/00	Khabarovsk Community Services	District without wastes	RFE to US	AOOR	$4,554
	RFE-166	08/29/00	C. W. E., Inc.	South Primorsky water resources management	US to RU	State Kral Unitary Enterprise	$5,000
	RFE-163	08/11/00	Inkom Co., Ltd.	Wood waste- minimizing and recycling	RU to US	Koetter Dry Kiln, Inc.	$4,298
	RFE-160	08/02/00	V-Laser Company	Wood waste minimization and reuse	RU to US	Wood Man. Systems Inc. (NC	$5,000
						Sub-total:	$27,899
Romania							
14	RO-234	05/24/01	SC Tractorul UTB SA	Compliance for thermal engines	RO to US	StanadyneAuto, CT	$5,000
	RO-225	04/04/01	Allied Environmental Techn.,CA	Renewable power generation at GRIRO	US to RO	GRIRO SA	$3,881
	RO-224	04/04/01	Armstrong Geological & Engineering Serv	Recycling medical wastes plastics	US to RO	Health Insurance House of Iasi	$3,860
	RO-219	03/19/01	Celsius 2000	High efficiency boilers for pollution reduct.	RO to US	Enercorp, CA	$5,000
	RO-218	03/19/01	Accredited Lab Association	Pollution prevention and CP partnership	RO tu US	Pittsburgh Technology Council	$4,094
	RO-217	03/09/01	Chamber of Commerce Romania	p3 in solid waste management in Romania	RO to US	SWANA	$4,983
	RO-216	02/23/01	Self Reliance, Inc.	Products from distarded materials	US to RO	Metalsid trading, Inc.	$5,000
	RO-215	02/16/01	Env. Business Counc. of NE	develop. Of voluntary standards	US to RO	Asoc. Of Env. Firms	$5,000
	RO-200	10/06/00	Viseul de Sus city	Wood waste reuse and energy gen.	RO to US	KEH Engineering, MD	$4,592
	RO-186	09/22/00	District Heating Company of Iasi (RAT)	Monitoring losses in thermal energy distribution	RO to US	Cavanaugh & Associates	$4,161
	RO-183	09/20/00	ICPAO	Reduction pollutant emissions	RO to CZ	MEGA a.s.	$2,331
	RO-173	09/19/00	Urban SA slobozia	Water treatment optimisation at the plant	RO to US	Watek, MD; KSA Eng., TX	$3,380
	RO-168	09/13/00	RRSI, recycling	Bistrita City recycl. Pilot project	US to RO	Bistrita City	$4,665
	RO-165	08/29/00	North East Env. Products	Water supply contamination assess. In piole	US to RO	Aqua Pura	$4,065
						Sub-total:	$50,012

#	GRANT NUMBER	DATE OF AWARD	GRANTEE	PROJECT TITLE	COUNTRY	PROJECT PARTNER	GRANT AMOUNT
Slovakia							
1	**SK-223**	**03/30/01**	**Puchov - Mestsky Urad**	**Sustainability Partnership Initiative**	**SK to US**	**The City of Meadville**	**$5,000**
Ukraine							
6	UK-236	06/12/01	MSE Technology Applications, Inc.	Minimize and handle solid waste plating	US to UK	Ltava	$3,612
	UK-203	10/13/00	Postmol Ltd.	Use of drinking water in dairy production	UK to Russia	Sochimilk	$1,800
	UK-197	10/05/00	Brovaryteplomerega	Reducing energy consumption	UK to US	Kattner/FVB	$3,624
	UK-176	09/20/00	Vtormet	Recycling nikel batteries	UK to US	Environmental Science Service	$5,000
	UK-167	09/08/00	TLK Consulting	Development of approach to energy audit at Far	US to UK	Farmak	$5,000
	UK-159	*07/17/00*	*Gorlovka municip.*	*Energy efficiency in Gorlovka build.*	*UK to US*	*City of Berkeley*	*$4,840*
						Sub-total:	**$23,876**
Total: 73 Grants						**Total:**	**$314,755**

7/22/2001

Initiator: Tech Rep - TR; Applicant - AP; other-O
QRAs promoting trade in bold - 7/01/00-6/30/01

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Annex E
EcoLinks Grants Program
Best Practices

Number	Title	Project Leader	Partner
1	Energy and Water Conservation Program at a Textile Processing Plant in Bulgaria	Galatex AD Varna, Bulgaria	Energy Efficiency Technologies Ltd Budapest, Hungary
2	Leak Detection and Abatement in Romania	RAJAC Iasi, Romania	Cavanaugh & Associates Winston-Salem, NC
3	Energy Efficiency Action Plan for Buildings in Bulgaria	Sofia Municipality Sofia, Bulgaria	Good Consulting Washington Grove, MD
4	Modernizing Boiler Houses in Slovakia	Terming, s.r.o. Bratislava, Slovakia	Honeywell, s.r.o. Prague, Czech Republic
5	Training Environmental Auditors in Russia Far East	Khabarovsk Krai Khabarovsk, Russia	American International University Network Lincoln, Nebraska
6	Treatment of Wastewater from Abandoned Pyrite Mine in Slovakia	Aquipur Bratislava, Slovakia	Knight Piesold and Co. Denver, CO
7	Underground Pollution by Petroleum at Romanian Refinery	Astra Refinery Ploiesti, Romania	Leggette, Brashears & Graham, Inc. White Plains, NY
8	Environmental Management System for Dredging on the Bulgarian Black Sea Coast	Black Sea Coast Association Varna, Bulgaria	Ogden Beeman & Associates, Inc. Portland, OR
9	Energy Audit at Romanian Petrochemical Plant	Oltchim SA Ramnicu Valcea, Romania	Robert A. Watts Consulting Engineering Annapolis, MD
10	Modernization of Municipal Solid Waste Management in Bulgaria	Association of Danube River Municipalities	CalRecovery Inc. Hercules, CA
11	Rehabilitation of Small Hydro Power Plants in Macedonia	Electric Power Company of Macedonia Skopje, Macedonia	Elekroprojekt Zagreb, Croatia
12	Improving Environmental Performance at a Potato Chip Plant in Kazakhstan	Almaty Snack Food Company Talgar, Kazakhstan	Savory Snacks, LLC Madison, WI
13	Reducing Fly-Ash Emissions at the Vladivostok Municipal Waste-to-Energy Facility	Speczavod #1 Vladivostok, Russia	Energy & Environmental Consulting Engineers Mission Viejo, CA

14	Energy Efficient Refrigeration with Zero Ozone Depletion Potential	Institute of Refrigeration & Air-Conditioning J.S. Co. Sofia, Bulgaria	FEMTECHNIKA Hodmezovasarhely, Hungary
15	Increasing Energy Efficiency at a Beauty Products Manufacturer in Slovakia	DeMiclen, a.s. Levice, Slovakia	Aton Centrum, s.r.o. Zelenec, Czech Republic
16	Reducing Emissions of Volatile Organic Compounds at a Paint Manufacturer in Slovakia	CHEMOLAK, a.s. Smolenice, Slovakia	SYNPO, a.s. Pardubice, Czech Republic
17	Biogas Extraction and Utilization System in Bulgaria	Municipality of Bourgas Bourgas, Bulgaria	Brown, Vence & Associates, Inc. Roseville, CA
18	Wind Power Production in Poland	Municipality of Kisielice Kisielice, Poland	AWS Scientific, Inc. Albany, NY
19	Improving Water and Energy Efficiency at a Meat Processing Plant in Croatia	Gavrilovic Petrinja, Croatia	Universal Aqua Technologies, Inc. Torrance, CA
20	Environmental Management System at an Iron and Steel Works in Romania	SIDEX S.A. Galati, Romania	Aquatest Prague, Czech Republic
21	Plastics Recycling in Romania	S.C. Carmis S.R.L. Iasi, Romania	GeoScience & Technology, P.A. Winston-Salem, NC

Energy and Water Conservation Program at a Textile Processing Plant in Bulgaria

Project Area: Global Climate Change, Energy Efficiency

Project Partners:
Project Leader: Galatex AD, Cotton and Textile Processing Plant (Varna, Bulgaria)
Project Partner: EETEK Hungary - Energy Efficiency Technologies (Budapest)

Location of Project: Varna, Bulgaria

Project Duration: July 1999 – March 2000

Abstract: Galatex AD, a cotton and textile processing plant located in Varna, Bulgaria, faces numerous challenges in adjusting to a market economy. Both the energy and water it consumes per unit of production is exceptionally high, resulting in an annual energy bill of $1.5 million. In addition, CO_2 emissions are estimated at 12,000 – 15,000 tons per year. Galatex recognized that improving its energy efficiency was essential for the success of its operations. With an EcoLinks Challenge Grant, Galatex partnered with a Hungarian environmental consulting company, EETEK Energy Efficiency Technologies, to plan an energy and water conservation program at the plant. Their project is presented as an EcoLinks Best Practice because it demonstrates a successful methodology to identify and assess energy efficiency measures, and it shows the benefits of working with an Energy Services Company (ESCo).

The project partners conducted both preliminary and detailed energy audits to measure current consumption, and they proposed specific measures to improve energy efficiency. These measures were supported by technical and financial evaluations and ranged from improvements in the plant's boiler and heating systems to the water distribution system for cooling. They also prepared an Energy Performance Contract that included terms and conditions for further cooperation between the organizations in implementing and financing the conservation program.

The results of their analyses show that implementation of the program will yield significant environmental benefits, such as reduced air emissions through decreased heavy fuel oil and electricity consumption, a decline in water losses and reduced discharge of wastewater. If the energy and water conservation program is implemented, Galatex will also realize annual cost savings of $800,000.

The project team's methodology to identify and assess energy efficiency measures can be easily transferred to other plants in the region that face similar problems. Some of the lessons learned during the project were the importance of selecting an independent and experienced consulting company and of establishing an energy council that ensured shared ownership of the project.

Problem Statement

Established in 1905, Galatex AD Cotton and Textile Processing Plant is a large integrated facility, which produces cotton yarn, dyed yarn, and crude and finished fabrics. It is a private company with less than 30% of shares owned by the state. Production volume of the plant is six million meters of fabric per year. Over the past five years production volume has been stable, with a 5% increase last year.

The plant uses large amounts of steam for fabric production and for heating. Energy sources used are heavy oil-fueled boilers and the electric grid. The plant also uses large amounts of water from the city water supply system, mainly for steam generation and cooling.

The average annual consumption of heavy fuel oil is 4,800 tons, of electricity 7,300 MWh, and of water 700,000 cubic meters. As a result of this high energy and water usage, Galatex's average annual energy cost is approximately $1.5 million.

Galatex's energy and water usage is high for a number of reasons. There are long distances between buildings on the plant site (the plant covers 400,000 square meters); the nature of the production process requires multiple stages of wetting, drying, and heating; and efficient energy management practices are not followed. Galatex's daily energy consumption is constant over the entire year in spite of varying production volume and weather conditions. This fact, along with the high-energy consumption per unit of production, indicates significant potential for energy savings.

In addition, the high energy and water consumption result in increased environmental problems. Emissions of CO_2 are estimated at 12,000 to 15,000 tons annually, generated by Galatex's boilerhouse and by power plants that supply the national power grid. Not entire pre-treated wastewater from the dyeing and finishing activities can be discharged into the city sewer and undergo further treatment. About one half of the water ends up discharged directly into the Black Sea because of the huge total volume of discharged wastewater and the small diameter of the sewer-connecting pipeline.

Project Description

In order to reduce energy and water consumption, reduce air and water pollution and lower production costs, the plant's management decided to identify and implement cost-effective energy and water conservation measures for various stages of the production process. The first step was to conduct an energy audit. Galatex selected a reputable and independent Energy Service Company (ESCo) for this task due to the following considerations:

- The plant lacked the human resources to identify energy efficiency measures alone
- The project would be more attractive to outside investors (banks)
- The plant needed assistance in identifying the best financing options for project implementation
- The ESCo would provide a guarantee that the savings from energy conservation measures would not only cover investment costs but also result in a profit
- The ESCo would assess the entire production process for energy savings potential

The project consisted of the following stages and corresponding activities:

Preliminary audit: The plant's production process and management practices were assessed and areas for a detailed energy audit were identified. The tasks completed under this activity included:

- Established an Energy Council
- Collected and assessed available energy and water consumption data;
- Identified and assessed the present condition of plant's production process, equipment, and installations;
- Identified main heat (steam) and water consumption points;
- Assessed existing measuring and flow control equipment;
- Started to measure heat and water consumption;
- Prepared preliminary heat, electricity, and water balances;
- Identified areas to be analyzed in the detailed energy audit.

Detailed energy audit: Based on the findings and conclusions of the preliminary audit, a more detailed energy audit was conducted with the following tasks:

- Conducted measurements and collected data regarding heat, electricity, and water consumption;
- Prepared complete energy and water balances;
- Identified possible malfunction of energy and water systems;
- Verified correlation between energy production and consumption,
- Identified necessary equipment to measure and control energy production and consumption.
- Calculated potential energy and cost savings and investment needs

Analyses and Planning: The gathered data was analyzed from both a technical and financial perspective in order to identify possible energy and water conservation measures. First, a list of short-term (low-cost) and long-term (higher-cost) energy conservation measures was developed. Next, an energy efficiency program was prepared that included a Proposal for Development of an Energy Efficiency Business Plan. Finally, opportunities were identified to further improve energy conservation in line with the plant's growth.

An important aspect of EETEK's approach was to establish an energy council at the beginning of the project. The council included representatives of different departments of the plant (energy, production, maintenance, sales, control and management) as well as representatives of the ESCo. The council served to obtain shared ownership of the project, to keep everyone informed of project developments, to identify and solve problems and to coordinate activities. This decision-making body met regularly and was chaired by Galatex's Executive Officer.

Outputs/Results

The main project outputs/results are below listed:

Assessment of energy and water losses

The following main reasons of energy and water losses were identified:

1. Lack of energy and water management and monitoring system
   - Lack of institutionalized managerial support to save energy and water;
   - Working environment that tolerates inefficient use of energy and water;
   - Lack of basic measuring equipment;

2. Obsolete or lack of proper equipment in the steam generation and supply system
   - Obsolete boilerhouse (poor control over burning process, no automatic control of steam pressure, obsolete burners, and no independent oil heating system);
   - No control over parameters of steam supplied to the production process;
   - No proper control of space heating and ventilation systems;

3. Lack or poor insulation of tanks and of the steam pipelines as well as very long steam distribution system;

4. Poor or lack of energy and water recovery in various installations. For example, most of the condensate is discharged directly to the sewage without any heat recovery;

5. Inefficient generation and usage of compressed air;

6. Large water losses and unnecessary generation of wastewater;

Proposed energy conservation measures

A set of energy conservation measures related to different energy systems was identified that address the above findings. These measures were prioritized in terms of the plant's organizational and financial resources to implement them. The list of measures together with expected energy savings, necessary investment outlays, financial benefits, and payback period is attached to this report. (Appendix 1).

Of special attention is the first identified energy conservation measure – Energy Management. The objective of this measure is to establish an energy monitoring and control system. The system would be comprised of an energy policy, energy-use norms based on the production level and weather conditions, an assigned energy manager, a computer-based monitoring program, energy-utilization data reported on a weekly basis, a management system for quick reaction, and an energy-utilization reporting procedure. The total costs for implementation of the measure would be approximately $100 000 and it would result in a 5% reduction in energy consumption.

Description of each conservation measure

For each energy and water conservation measure, a separate comprehensive form was completed. The form included a description of the existing condition of the related energy production/utilizing system, recommended actions to improve the efficiency of the energy system, expected results (energy savings), and cost-benefit projections. The purpose of the form is to report each identified energy conservation measure in a consistent and clear manner and serve as a basis for financial analyses. An essential benefit of the form is that it communicates in an understandable manner the results of the analyses and assures credibility of the technical and financial information. A model form is provided as attachment to this report. (Appendix 2).

Financial Projections

Cost estimates and cash-flow projections for the entire energy and water conservation program were developed based on realistic assumptions.

Energy Performance Contract

An Energy Performance Contract for services, to be further discussed and possibly signed between the two organizations (Galatex and EETEK), was prepared. In general, the contract sets out the terms and conditions for services to be provided in designing and implementing the

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energy conservation program. In particular, the contract includes a list of measures selected for technical evaluation; criteria for determining the viability of the measures; the scope and financing arrangements for undertaking further technical evaluation and preparing a business plan; the general provisions for implementing the agreement; the provisions for arranging financing of the measures; the provisions for investment costs calculation; terms for provision of guarantees for the services and allocation of savings; and the terms for maintenance, monitoring, and operations support. The following main obligations arise from the contract:

(1) EETEK agrees to arrange financing from its own capital or debt for each selected and approved energy conservation measure, unless Galatex finances the measures from its own funds;

(2) EETEK agrees to provide a guarantee that the savings accrued from implementation of the program, or group of approved measures, will sufficiently cover the total annual debt service costs from financing or EETEK will pay the shortfall;

(3) For the period of all principal and interest repayments to the lender (loan term), the value of saving above debt service costs will be split evenly (50%-50%) between both organizations.

Costs of EcoLinks Project

The total cost of the EcoLinks project was $27, 420 of which $17,370 was funded by the EcoLinks grant and $10,050 was provided as cost share by both organizations. To keep costs as low as possible, EETEK used the assistance of local consultants. A breakdown of total costs follows:

Labor	$15,220 (55.5%)	Travel	$ 3,480 (12.7%)
Equipment	$ 3,400 (12.4%)	Other costs*	$ 5,320 (19.4%)

* publications, translation services, computer services, and communication costs

Expected Environmental and Economic Benefits

The results of the analysis show that implementation of the energy conservation program will lead to the following benefits:

Environmental Benefits
Reduced air pollution as follows:

Air pollutants	Current emissions (t/year)	Expected reductions (t/year)
CO_2	9,391.3	3,117.9
CO	2.6	0.87
SO_2*	297.4	98.7
NO_x	26.1	8.7
Particulates	14.3	4.8

* Assumed content of sulfur in heavy fuel oil: 3,0%

Note: All emissions are related only to consumption of heavy fuel oil in Galatex's boilerhouse

Y2

Economic Benefits

Reduced energy and water consumption as follows:

	Consumption*	Expected reductions
Heavy fuel oil (t/year)	4,800	33.2%
Electricity (MWh/year)	7,300	18%
Water (c. meters/year)	700,000	44%

* Average annual consumption for the period 1995-1999

This reduction in energy and water usage will result in an annual cost savings of $800,000.

Financial Analysis

Economic indicators	Value
Total project investment costs (million USD)	1.1
Annual cost savings (million USD)	0.8
Overall project pay back time (years)	1.4
NPV (at 35% discount rate) (million USD)	1.04
IRR (%)	77
Loan term (years)	4

If all energy efficiency measures are implemented, the EcoLinks grant of approximately $17,400 will foster environmental investment of $1.1 million (leverage ratio over 60).

Transferability

The basic scheme and components of this methodology can be easily transferred to many production facilities in the CEE/NIS region where energy production is not their main activity. Many plants in the region face similar problems: low efficiency of energy utilization, lack of proper energy management, and lack of awareness that vast environmental and economic effects can be achieved with limited funds. The project does not appear to be site sensitive. However, the costs of developing similar projects may vary to a certain extent, depending on the capacity of other plants.

Lessons Learned

The following lessons were learned during project implementation:

- Selecting an independent and reliable Energy Service Company or a consulting company has significant advantages in the development of energy conservation programs;
- Establishing an energy council and working closely with the 'users' of the energy systems is a valuable way to obtain buy-in from the plant's employees and to coordinate the project;
- Providing sufficient time for systematic data collection and program development is a key success factor;

- The availability and condition of the plant's existing measuring equipment can have important implication on the costs for developing and implementing an energy conservation program.

Additional Information

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Appendix 1

ENERGY CONSERVATION MEASURES (OPPORTUNITIES) IN GALATEX AD

	Energy Conservation Measure	Electricity Reduction (MWh)	Heat Reduction (GJ)	Investment Costs (USD)	Cost Saving (USD)	Simple Payback Period (years)
ECO 01	**ENERGY MANAGEMENT**	**366**	**9 750**	**100 160**	**79 110**	**1.4**
ECO 02	**BOILERHOUSE**	**-45**	**36 556**	**260 160**	**181 798**	**1.4**
ECO 021	*Increasing Efficiency Of Burners*	*315*	*16 631*	*184 470*	*96 600*	*1.9*
ECO 0211	New burners	0	13 325	122 420	66 268	1.8
ECO 0212	Oxygen trim	0	3 306	29 530	16 440	1.9
ECO 0213	FAD	315	0	32 520	13 895	2.3
ECO 022	*Oil Additive*	*0*	*959*	*2 170*	*4 770*	*0.8*
ECO 023	*Reduction Of Steam Consumption In Boilerhouse*	*-360*	*18 669*	*42 235*	*76 970*	*0.5*
ECO 0231	Insulation of heavy fuel oil tanks	0	1 750	17 110	8 700	2.0
ECO 0232	Electrical heating of heavy fuel oil tank	-360	16 919	25 125	68 270	0.4
ECO 024	*De-aerator*	*0*	*297*	*31 285*	*1 480*	*1.4*
ECO 03	**STEAM AND CONDENSATE SYSTEMS**	**0**	**28 424**	**225 590**	**174 040**	**1.3**
ECO 031	*Insulation*	*0*	*21 280*	*147 930*	*113 133*	*1.3*
ECO 0311	Insulation of steam pipes	0	14 080	108 800	102 815	1.1
ECO 0312	Insulation blankets for fittings	0	5 787	32 630	42 260	0.8
ECO 0313	Insulation of steam headers and tanks	0	1 413	6 500	10 317	0.6
ECO 032	*Condensate Recovery*	*0*	*5 894*	*58 070*	*51 775*	*1.1*
ECO 033	*Flash Steam*	*0*	*1 250*	*19 590*	*9 130*	*2.1*
ECO 04	**HEATING**	**-30**	**9 394**	**69 325**	**87 780**	**0.8**
ECO 041	*Automatic Control For HVAC Units*	*0*	*2 265*	*27 375*	*21 475*	*1.3*
ECO 042	*Decentralized Heating*	*-30*	*7 130*	*41 950*	*66 307*	*0.6*
ECO 05	**TECHNOLOGY**	**-30**	**10 657**	**115 980**	**76 510**	**1.5**
ECO 051	*Waste Heat Recovery Form Hot And Wet Air*	*0*	*6 475*	*58 350*	*47 284*	*1.2*
ECO 052	*Proper Steam Pressure Maintenance*	*-30*	*4 182*	*57 630*	*29 230*	*2.0*
ECO 06	**COMPRESSED AIR SYSTEM**	**394**	**671**	**84 590**	**33 545**	**2.3**
ECO 07	**FREQUENCY ADJUSTED DRIVES**	**590**	**0**	**57 890**	**25 990**	**2.2**
ECO 08	**WATER**	**123**	**1 630**	**168 925**	**141 645**	**1.2**
ECO 081	*Water Management, Leak Abatement*	*0*	*0*	*62 095*	*72 580*	*0.9*
ECO 082	*Closed Cycle Cooling*	*123*	*1 630*	*106 830*	*69 060*	*1.5*
	TOTAL	**1 370**	**97 082**	**1 082 620**	**800 418**	**1.4**

Appendix 2

RECOMMENDED ACTION - ENERGY CONSERVATION OPPORTUNITY	GTX06
	ECO 02
	February 2000

Facility name: GALATEX
Address: VARNA G.Stamatov Str.1
Auditor: **EETEK** Hungary Energy Efficiency Technology Ltd. - Budapest, Révay u.12

ACTION Name:	**IMPROVE BOILER EFFICIENCY**
AREA AFFECTED:	Boilerhouse

FINDINGS CONCERNING EXISTING CONDITIONS:

There are two KM12-steam boilers and one newer and more efficient PKM 12 with manual control of oil and air. Practically there is no excess air control. There is no automatic control for steam pressure. The burners are old, deteriorated and with low efficiency. The parameters of oil change frequently and usually the oil is of bad quality. It is impossible to keep the optimum temperature of oil for atomization. The efficiency of the boilers is very low. The combustion is incomplete, the value of excess air parameter is too high, the temperature of the flue gas is high, and a lot of smoke is generated. The oil has to be heated also on non-working days. Often, a boiler is being run only to heat the oil. The storage tank is with bad insulation and is heated with steam. There is no de-aerator in the boilerhouse, what causes corrosion and erosion of fittings.

Work hours 7 200

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Change burners to new RAY rotary burners for the PKM 12 and KM12 boilers. Install full automatic control for the steam pressure, oil temperature, and oil to air ratio. Install oxygen trims in the chimneys for continuous on-line control of excess air. FAD for air fans. Maximum use of the better PKM12 boiler. Install de-aeration tank with automatic control of pressure and water level; this is absolutely needed for proper operation of the steam and condensate system. Insulate the oil tank. Replace the steam heating of oil with electric heating. Use additives to ensure better oil atomization and burning.
It is possible to increase boilers' efficiency with more than 20%. Additionally, elimination of a need for steam heating of noninsulated tanks will save more than 10% of heat.

Work hours 7 200

EXPECTED RESULTS	Electric energy MWh	Heat GJ	Total cost (BGL)
Baseline -existing conditions	6 952	184 976	2 769 427
After recommended action	6 997	148 420	1 372 885
Net reduction	*-45*	*36 556*	***338 144***

COST-BENEFIT ANALYSIS:

Project cost estimate	Cost (BGL)	Notes
Detailed engineering	14 203	
Equipment procurement	345 351	
Installation & commissioning	25 965	
General contractor's fee	57 736	
Technical contingency	40 645	
TOTAL INSTALLED COST	***483 901***	
Price contingency	0	
COST incl. contingency	483 901	Life of assets 10
Additional Op.&maint. cost		
PAYBACK PERIOD:	*1.4* years	**IRR:**

Leak Detection and Abatement in Romania

Leak detection

Project Area: Water Quality Management, Water Conservation

Project Partners:
Project Leader: Regia Autonoma Judeteana Apa-Canal Iasi (RAJAC) (Iasi, Romania)
Project Partner: Cavanaugh & Associates, P.A. (Winston-Salem, North Carolina)

Location of Project: Iasi, Romania

Project duration: August 1999 – April 2000

Abstract: *How to find leaks in water pipes stretching over a 600 km network? This is the problem for RAJAC, a water utility in Romania losing 30 % of its water production each day. These leaks mean a loss in revenue for the utility as well as wasted water and energy resources. With an EcoLinks Challenge Grant, RAJAC partnered with a U.S. environmental technology provider to develop a pilot leak detection and abatement program. As a result of the project, significant leaks were identified in the system, which otherwise would have taken years to find.*

The project is considered a Best Practice because modern leak detection technology was successfully transferred through cooperation with the American partner. The technology proved to be effective and well suited to local conditions. The technology transfer was conducted in tandem with a training program for the RAJAC staff on how to use the leak detection equipment. In addition, the project team developed a plan of water conservation measures to be undertaken by consumers and the utility.

This EcoLinks-funded pilot leak detection project will help pave the way for the implementation of a larger, $40 million program to upgrade the water infrastructure system. The leak detection and abatement program will result in both environmental and economic benefits. About 8 million m^3 of water will be saved per year, saving approximately $3 million.

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Background

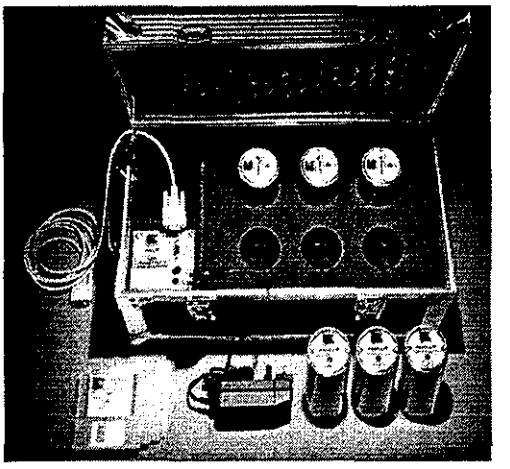
RAJAC is a utility company in Romania, which was established by the Iasi City Council in 1991. The company is responsible for providing water to the city and for operating the municipal sewage system. The RAJAC utility serves over 550 000 inhabitants and 2100 institutions (mainly industrial) with a distribution network that comprises 600 km of pipes. 70% of individual clients have water meters. RAJAC's annual production of water is 56 million m^3, and annual client consumption of water totals 40 million m^3. Thus, losses due to leaks in the RAJAC system equal 16 million m^3 of water annually.

Before RAJAC was established in Iasi, the water supply was unreliable and the quality of drinking water did not comply with Romanian standards. The equipment in the seven water treatment plants operated by the company was obsolete and energy inefficient and the distribution network was mainly comprised of outdated pipes. Moreover, the company's staff was not trained to operate the system efficiently, and the company had an unfavorable public image.

RAJAC undertook many measures to improve this situation, including providing clients with a regular supply of drinking water. Water treatment plants were upgraded, and analytical laboratories were established at each plant. New water pipes were installed. The personnel was trained. The company became more transparent due to the establishment of a Public Relations and Strategy Marketing Office which disseminated information about the company and increased public awareness of water problems.

Problem Statement

Despite efforts to improve service, prior to the project implementation RAJAC faced water losses equaling 16 million m^3 annually, or 30 % of total drinking water production. The water losses are caused by leaks in the pipes, and they represent a waste of potable water as well as a waste of treatment capacity, a waste of energy and, ultimately, waste of money. These leaks are caused by the poor condition of pipes, chemically aggressive soil, the poor installation of pipes, the poor condition of joints, high-pressure fluctuations in the network, and frequent cracks in the pipes due to heavy traffic.



Leak detection equipment

In 1995 RAJAC developed a general program on leak abatement recommended by the European Bank of Reconstruction and Development. The objective is to reduce water losses by at least half, from 30% to 15%. The program includes the following measures:

- mapping of the water supply system
- modeling of water flows
- optimization of network operations based on automatic pressure control systems
- identification of leaks
- repair or replacement of pipelines to eliminate leaks

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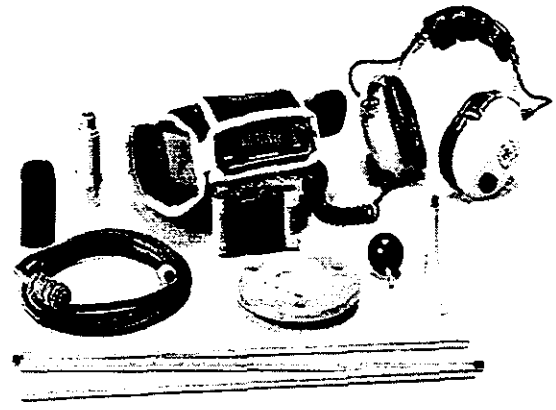
The estimated cost of the program is about $40 million, mainly for the replacement of obsolete pipelines, valves, pumps, and other equipment. It is expected that EU grants will finance a significant portion of this investment outlay.

A bottleneck of this over-reaching leak abatement program has been the identification of leaks. Before project implementation, RAJAC lacked the proper equipment and experience to efficiently detect leaks in the system. This EcoLinks grant enabled RAJAC to team up with an American environmental technology provider, Cavanaugh & Associates, and solve this leak detection problem so that the larger infrastructure project can proceed.



Leak detection equipment

Project Description

The overall objectives of the project were: (1) to develop, implement, and evaluate a pilot leak detection and abatement program in a selected area of Iasi county; (2) to expand the pilot project to the entire RAJAC Iasi network, and possibly to the entire Moldova province; and (3) raise public awareness of water conservation issues.

The project activities were as follows:

1. RAJAC provided maps of the Iasi water system, and RAJAC and Cavanaugh selected Copou, a residential district in Iasi, as the pilot site for project activities. Copou was selected as the pilot site for the project because the Copou water supply system was known to have many leaks, and because most consumers in Copou have water meters, which allow for accurate estimation of water consumption.

2. Cavanaugh trained RAJAC personnel on the use of the Doppler leak detection equipment, in the data logging system and in data analysis. Features of the equipment were demonstrated to the RAJAC employees, such as installation protocol, data interrogation and transfer to a digital format using a laptop computer, and leak chart analysis and interpretation. The Doppler equipment used by Cavanaugh is manufactured by Fluid Conservation Systems (FCS), Milford, Ohio.

3. Cavanaugh, together with Fluid Conservation Systems, provided supplementary information and training to RAJAC regarding the latest practices for leak detection and water conservation used in the US and promoted by American Water Works Association (AWWA). Different types of U.S. leak detection equipment were analyzed and compared.

4. The pilot leak detection project was developed and implemented in Copou. The data obtained from the FCS detectors confirmed the location of known leaks, thus proving the accuracy of the new equipment. However, many additional leaks were also detected, which were not known previously. It was estimated that three of these leaks alone resulted in water losses of 60,000 m^3/year or $24,000. Since the equipment cost was around $20,000, and no further significant investment was needed to eliminate the leaks, the payback period for the equipment used during the pilot project was less then one year.

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5. RAJAC and Cavanaugh analyzed the data from the pilot project and prepared a technical and economic evaluation of the results. The analysis showed that relatively limited staff and equipment can "scan" the entire network of Iasi county and provide current information on the leaks.

6. RAJAC and Cavanaugh prepared a list of basic conservation measures to raise consumer awareness about the water distribution system and conservation and to identify and eliminate leaks.

7. Other utility companies were informed of the project results and a seminar was organized to disseminate the results and discuss the possibilities for applying the technology throughout Romania.

Outputs/Results

The following outputs/results were achieved:

- Introduction of leak abatement technology with proven potential to significantly decrease RAJAC's water losses. When tested in CEE conditions, the equipment demonstrated its accuracy and time saving benefits compared to alternatives.

- RAJAC staff was thoroughly trained to operate the leak detection equipment.

- Water conservation measures were prepared by RAJAC and Cavanaugh and grouped into three categories:

Increasing consumer awareness of the water distribution system.

Consumers can help a public water utility monitor the water distribution system by informing the company about:

- visible leaks from the system
- places where sounds of running water have no reasonable explanation
- cracks and water spots on the streets
- sudden or gradual increase in the amount of water reported in a water bill
- accidental or deliberate contamination of rivers, lakes, or ground water.

Reducing consumption

Individuals may decrease their water bill, conserve water, and avoid water shortages by introducing common conservation practices, such as:

- checking home or apartment fixtures for leaks and repairing them or replacing them with certified water saving devices
- conserving water and making sure taps are shut off
- insulating hot water lines
- running only fully loaded washing machines and dishwashers, as well as many other conservation measures.

These consumer water conservation measures are promoted by RAJAC through media campaigns.

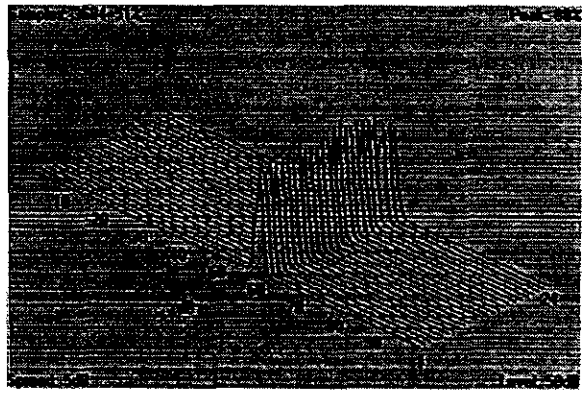
Identifying and eliminating leaks

The basic tasks for RAJAC concerning the leak abatement are as follows:

- developing accurate mapping of the total water distribution system
- localizing leaks through identification of suspected leak-prone areas
- placing acoustic, digital recording loggers at strategic points on the distribution system
- isolating the detected leaks to a particular line segment
- pinpointing the location of the leak
- categorizing the leaks according to their magnitude.

Follow-up Activities

At the project closeout meeting, requests were made to demonstrate the technology in Bucharest, as well as in Poland and Moldova. Also, the Iasi District Heating Company expressed its interest in American leak detection technology.



Leak indication

Costs of EcoLinks Project

The total cost for the preparation of the project was $118,074, of which $46,820 was funded through an EcoLinks grant and $71,254 was provided as cost share, mainly in a form of equipment delivered and consultancy provided by Cavanaugh & Associates.

Expected Environmental and Economic Benefits

Environmental benefits

The pilot leak detection and abatement study is a prerequisite for the implementation of the $40 million infrastructure program. When the infrastructure program is implemented in the entire Iasi County, water losses will be reduced from around 30 to 15% of total RAJAC drinking water production. A 15% reduction in water losses would equal 8 million m^3 in water savings per year.

Economic benefits

The potential savings due to reducing water losses by 8 million m^3 are about $3 million per year. This level of savings, however, requires significant investment in the infrastructure.

Payback period for the leak detection equipment used during the pilot project is less than one year.

Transferability

The project proved that the American state-of-the-art technology for leak detection is fully transferable to CEE, and that personnel of local utility companies can be easily trained to operate this equipment. The equipment could be useful not only for water utility companies but also for

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district heating enterprises and any other institutions that own large networks for water transportation.

Lessons Learned

Proposed technology needs to be tested under local conditions to ensure it is transferable and suitable.

- It is imperative that local staff be thoroughly trained how to operate the equipment under local conditions. This was especially important at RAJAC where the staff lacked the experience to use modern detection devices. In addition, the acoustic method requires practice in interpreting different sounds that vary according to the pipe diameter, the pipe material, type of soil, or the volume of noise from other sources.

- A baseline of current water losses must be established before potential water savings can be determined. Since there were limited water meters in the RAJAC supply network, the project team had to start by installing general flowmeters to estimate the current water losses.

Additional Information

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Energy Efficiency Action Plan for Buildings in Bulgaria

Old building in Sofia

Project Area: Global Climate Change, Energy Efficiency

Project Partners:
Project Leader: Municipality of Sofia, Bulgaria
Project Partner: Good Consulting (Washington Grove, MD)
NGO Associate: Energy Efficiency Foundation (Sofia, Bulgaria)

Location of Project: Sofia, Bulgaria

Project duration: July 1999 – July 2000

Abstract: *Sofia, the capital of Bulgaria with 1.2 million inhabitants, consumes energy for heating purposes at almost twice the rate of the European standard. This results in excessive energy costs and high CO_2 emissions. In order to reduce both energy consumption and air pollution, the municipality decided to establish an energy conservation program. With an EcoLinks Challenge Grant, it teamed up with an American consulting company and a Bulgarian NGO to develop an Energy Efficiency Action Plan.*

Several aspects of the project can be considered best practices. An energy audit methodology was developed to identify and prioritize large-scale heat conservation measures in hundreds of public and residential buildings. A database on energy consumption was created to track progress in reducing consumption. An Energy Efficiency Fund was planned to finance the implementation of energy conservation measures in the municipality-owned buildings. Two new agencies were recommended to finance and implement the measures in the residential buildings through a scheme to repay loans from energy savings. A marketing plan was prepared to obtain the support of the owners of the residential buildings. Finally, institutional barriers to implementation of the program were identified, including legal, financial, administrative and social barriers. For each barrier, a remedy was proposed.

Once the energy conservation program is implemented, it will result in energy savings amounting to 1,100,000 MWh and reduced CO_2 emissions of 240,000 t/year. The necessary investment outlay for the implementation of the basic energy conversation measures is $2.3 million for public buildings and $31.5 million for residential buildings. The average payback period is 1.2 years for public buildings and 1.6 years for residential buildings.

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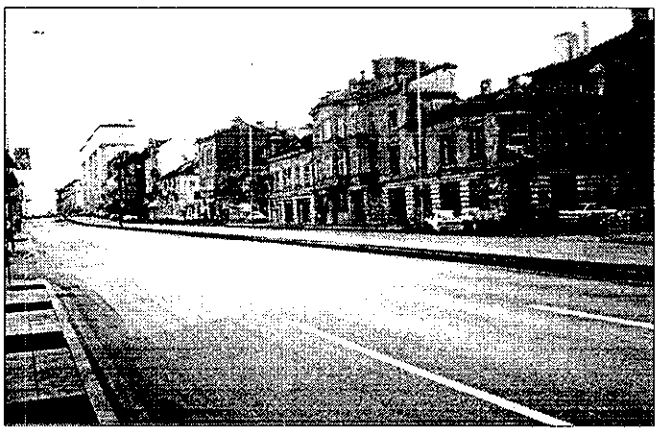
Problem Statement

The Municipality of Sofia, with a population of 1.2 million, is the major national administrative, economic, and cultural center of Bulgaria. It covers 1310 sq. kilometers and is divided into 24 administrative districts.

Heating is provided in the central part of the municipality by a district heating system. Its sources of heat energy are two main central heating plants and fifteen additional ones. Residential buildings account for more than 75% of the overall building stock and cover more than 68% of space heated by the district heating system. Public buildings represent approximately 25% of the building stock and cover 32% of the heated space.

According to a previous study, Sofia's energy consumption for heating purposes is 240 kWh/sqm, which considerably exceeds the average European standard of 140 kWh/sqm. The main reasons for this high rate of consumption are excessive heat losses from the buildings due to inadequate thermal insulation and poor construction; an inefficient heat distribution system; and lack of control devices in the radiators. The distribution system is inefficient partly due to the lack of systems for automatic regulation and the lack of measuring equipment in many of the sub-stations. As a result of the high level of energy consumption, CO_2 emissions are estimated to exceed 800,000 tons annually.



Old buildings in Sofia

Project Description

Sofia Municipality's overall goal is to reduce energy consumption by 30% by introducing cost-effective energy conservation measures in both residential and public buildings. In addition to saving money, the Municipality expected to reduce emissions of CO_2 and other pollutants. The EcoLinks Challenge Grant enabled the Municipality to get started by funding the development of an energy efficiency action plan.

The objectives of this plan were to assess the energy consumption for both the public and residential buildings; identify appropriate energy conservation measures; and prepare a long-term energy conservation plan that defines the necessary financing, possible financial resources, and implementation steps for the selected measures.

Sofia Municipality teamed up with an American consulting company and a Bulgarian NGO to implement the EcoLinks project. The American partner was especially helpful in assessing different energy conservation measures and in developing marketing and business plans.

The main activities of the project were the following:

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Collect data on current energy consumption
The available data on current energy consumption was collected for both the public and residential buildings. This included general characteristics and present condition of the buildings as well as the consumption of heat and electric energy. Based on this analysis, the buildings were classified into different groups according to their function, structure and energy consumption.

Develop audit methodology and conduct audit
It was decided to conduct two kinds of energy audits. First, a preliminary audit was conducted of the approximately 300 buildings owned by the Municipality by administering a questionnaire. The results were input to a database to support project implementation in later stages. Second, a detailed audit was conducted on two sample buildings, a school and a residential building. Computer models were used to determine current heat losses and estimate the potential for energy savings.

Identify energy conservation measures
As a result of the analysis of the audit, a list of energy conservation measures was prepared. The list included such basic measures as installation of meters to measure heat consumption, installation of thermostatic valves, and "weatherization" of doors and windows. For each measure, the necessary investment was determined along with the simple payback period. Also, possible administrative and regulatory barriers to implementation of the energy conservation program were identified.

Prepare action and marketing plans
The action plan detailed all the technical improvements necessary to implement the energy conservation program, along with the costs, risks and possible financing sources. It also provided for the creation of new institutions to operate the program. The marketing plan primarily targeted the owners of the private residential buildings. Their buy-in is essential in implementing the program in the residential buildings. Draft plans were first prepared and discussed in numerous meetings with municipal authorities, consulting companies, associations, equipment suppliers and residents. A separate workshop was organized to present results of the energy audits and to discuss priorities of the action plan. As a result of these public discussions, the action and marketing plans were finalized.

Outputs/Results

Action Plan
The Action Plan scheduled the implementation of the energy conservation measures over a three to twelve-year period, depending upon the different ownership of the buildings; the owners' limited ability to finance the measures and the institutional barriers that needed to be addressed. One consideration was to undertake easy, fairly inexpensive measures in the first three years before the current Mayor's term expired. Then a track record would be established when the new Mayor's term began.

A noteworthy initiative in the Action Plan was the creation of an Energy Efficiency Fund to finance the implementation of energy efficiency measures in the municipality-owned buildings. The Fund would be initially capitalized at $2.5 million. It would invest in energy efficiency measures that have the highest rate of return and shortest payback period. The money saved from

reduced energy consumption would be returned to the Fund and invested in other measures on a revolving basis. It is estimated that the Fund would generate $51 million for energy efficiency investments over a twelve-year period with the initial $2.5 million fully recovered.

Tasks planned for the 314 municipal buildings over the first three years included the following:

- Install calorimeters in all substations (result: initiation of monitoring and accounting of heat consumption, financing from the World Bank loan)
- Establish the self-recovery Energy Efficiency Fund (result: financing solution for implementation of the Action Plan, investment required: $2.5 million from the Municipality or external resources)
- Install regulators in the substations (required investment: $1.4 million, payback period 0.9 years, financing through the Fund)
- Install thermostatic valves on the radiators (required investment: $800,000, payback period 0.8 years, financing through the Fund)
- Repair and tighten the frames of windows and doors (required investment: $125,000, payback period 1.53 years, financing through the Fund)

For the residential buildings, a $31.5 million investment would be needed to implement basic energy efficiency measures over three years. This investment would be funded by bank loans repaid through energy savings. Consumers would continue to pay their heating bills at the regular rate, and the money saved from reduced energy consumption would be directed to loan repayment. Two new agencies would be created to manage this part of the program. An agency, "Energy Agents", would collect payments from consumers. Then it would pay the energy provider for actual heating expenses and send the surplus funds to the banks for loan repayment. It is estimated the loans would be repaid in four years. A Municipal Agency for Energy Management would implement the energy conservation measures in the residential units using the loan proceeds to hire subcontracted companies.

Apartment building in Sofia

Tasks planned for the 300,000 residential units over three years included the following:

- Install calorimeters in substations (10 000 substations, financing by Municipality or through the World Bank loan)
- Install regulators in substations (third party financing or the World Bank loan)
- Install thermostatic valves (financed by occupants through various possible mechanisms, altogether $22.5 million required, payback time 1.25 years)
- Tighten the frames of doors and windows

Marketing Plan

The Marketing Plan was designed to obtain the support of the owners of the residential buildings. Their support is crucial since they are responsible for financing energy efficiency improvements in this sector. The Plan was based on a marketing analysis of the proposed energy conservation measures and the income levels of Bulgarian citizens. It was scheduled for implementation in two stages, a pilot project and a final project. The pilot project would concentrate on encouraging the residents of one building to participate in the program. Equipment suppliers and other businesses would be asked to sponsor this pilot stage. The final project would aim to obtain the participation of 66% of the homeowners in Sofia and reduce their energy bills by at least 16%.

The Plan included the following items:

- Segmentation of the market to identify target customers
- Positioning strategy to communicate a favorable image for the program and create demand for it. The residents would be convinced that the program would result in greater heating, convenience, and cost savings.
- Promotion of the program
- Sponsorship strategy to enlist equipment suppliers and others to support promotional campaigns

Institutional and Other Barriers

The project team identified potential barriers to program implementation. For each one, the team recommended a possible remedy. The following groups of barriers were identified:

Legal barriers:

Numerous changes are necessary in the Law on Energy and Energy Efficiency, and in the Law on Property, such as:

- Determine the procedure for decision-making in the buildings
- Simplify the procedure for the heat distribution company to collect payments
- Regulate the activities of Energy Agents, and the interrelations between consumers and Agents
- Create conditions for a practical implementation of the "shared-savings" scheme.
- Establish a legal base for association of owners and tenants to manage the common property

Financial barriers:

- The Municipal budget does not include a line item for "energy" and the expenses are only examined yearly for statistical reporting
- The Municipal budget is centralized and the users of municipal buildings are not stimulated to save energy
- The Municipality is restricted from funding energy-saving projects from its own resources
- The Sofia citizens have limited financial resources

Organizational and administrative barriers:

- The Municipality has no organizational unit for planning and control of the energy consumption and efficiency
- There is no commission for energy planning
- Information on energy consumption is rarely analyzed and used to prevent over-consumption

- There is no control over the results of energy efficiency measures that are implemented

Social and psychological barriers:

- The citizens and some managers are not aware of energy savings potential
- The citizens mistrust the power production industry due to its monopolistic structure
- The opportunities for a dialogue between the Municipality and non-governmental associations are not fully used

Database

A database was created from the results of the preliminary energy audit. Data was collected from the questionnaires received from the 300 municipal buildings. The database is an MS ACCESS 97 application. For each building, approximately 40 different types of data was collected and input to the database. This information can be analyzed using different criteria. In addition, the database can be easily updated with new information.

Costs of EcoLinks Project

The total costs for preparation of the program were $71, 704 of which $26,404 was provided as cost-share by both organizations.

The breakdown of total project costs is the following:

Labor	$60,749	Travel	$ 2,550	Equipment*	$ 1,994
Other**	$ 6,411	**Total**	$71,704		

* Measuring equipment for energy audits

** Other costs include publications, translation services, computer services and communication costs

Expected Environmental and Economic Benefits

Sector	Annual Reductions of CO_2 Emissions (t/year)	Energy Savings/Reductions (MWh/year)
Municipal buildings	19 600	125 000
Residential buildings	224 000	975 000
Total	243 600	1 100 000

Table 1: Environmental and Economic Benefits

Financial Analysis	Municipal buildings	Residential buildings
Investment outlays (million USD)	2.33	31.5
Annual savings (million USD)	2.05	20.4
Payback period (years)	1.2	1.6

Table 2: Financial Analysis

Note: The figures refer only to the first three years of implementation of the Action Plan, including such priority energy conservation measures as weatherization (tightening doors and windows and application of thermal insulation); installation of thermostatic valves on radiators; and installation of heat-cost allocators.

The EcoLinks grant of $45,300 will foster environmental investments of $33.8 million over the three-year period.

Follow-up Activities

European Union
The project team submitted a proposal to the European Union's SAVE 2 Program to set up the Municipal Agency for Energy Management, as called for in the Action Plan. The proposal was accepted and the project team expects to receive EURO 120,000 for three years. Sofia was one of four European cities selected to receive this grant.

UN ECE
A proposal for additional financing was also submitted to the UN Economic Commission of Europe's Energy 21 program. The decision was still pending as of January 2001.

Transferability

The project team's approach to developing an energy efficiency action plan, including the audit methodology, can be transferred to other municipalities in the region with minimal expense. The plan would need to take account of particular physical and technical features of the buildings and the district heating system. More importantly, the plan would need to consider legal and regulatory barriers to implementation, which may vary from one country to the next.

Lessons Learned

The following lessons learned resulted from the project:

- Although the Action Plan had a long-term outlook (up to twelve years), a short-term window was included to encourage the implementation of concrete, simple measures as quickly as possible. In this way results can be achieved without risk from future political or economic changes, helping to establish a track record that is needed for continued support.

- It is important to obtain political support. The project was helped by the strong commitment from the management of the Sofia Municipality.

- If information is not available on current energy consumption and basic characteristics of the building stock, then it is necessary to plan for collecting this information at the outset. The project team was faced with this situation and spent considerable time in creating a database with this information.

Additional Information

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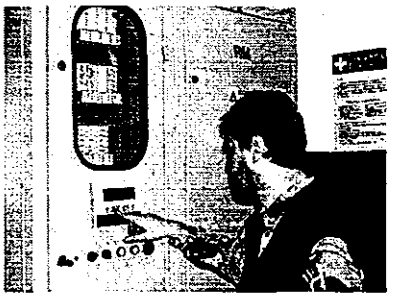
Modernizing Boiler Houses in Slovakia



Boiler house control system, Terming Bratislava

Project Area: Global Climate Change, Energy Efficiency

Project Partners:
Project Leader: Terming, s.r.o. (Bratislava, Slovakia)
Project Partner: Honeywell, spol s.r.o. (Prague, Czech Rep.)
Associate 1: Municipality Old City Bratislava
Associate 2: Slovak Technical University, Faculty of Mech. Engineering, (Bratislava)
Associate 3: NGO Open Circle (Bratislava)
Associate 4: Ecotoxicology Center (Bratislava)

Location of Project: Bratislava, Slovakia

Project Duration: August 1999 – July 2000

Abstract: *Old Town Bratislava in Slovakia has 346 gas-fired boilers that supply heating and hot water to the community. The boilers are obsolete and lack modern measurement and control systems, resulting in excessive gas consumption. The municipality and local utility company, Terming, are concerned with the high-energy costs and air pollution. Their public image has suffered, as the local citizens have become increasingly dissatisfied with their rising heating bills. In addition, any solution must take account of the special historical character of many buildings in the town.*

Terming was awarded an Ecolinks Challenge Grant to establish a multi-disciplined project team and assess the feasibility of modernizing the boiler houses. The project is considered a best practice for a number of reasons. First, special attention was paid to involving different stakeholders on the team and providing transparency of project activities. One of the team members was a NGO whose role was to develop a public information campaign. Second, the team developed a methodology to classify different types of boiler houses into groups and prioritize them for immediate investment. Third, the priority setting process took account of the special historical status of the buildings and the limits on infrastructure development in the area. Finally, a financial analysis and environmental impact assessment were completed, showing both the economic and environmental benefits of the project. The implementation of the project will result in annual cost savings of about $90,000 and reduced CO_2 emissions per year of 1,800 tons.

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Problem Statement

About 500,000 people inhabit Bratislava, the capital city of Slovakia. Its Old Town is located in the central part of the city and forms a separate municipality. Terming, the local utility company that is majority owned by Old Town, provides heating to the municipality from a number of obsolete gas-fired and coke-fired boilers. Some of the gas-fired boilers were installed 30-35 years ago.

There are 146 gas-fired boiler houses in which 346 boilers have been installed. The overall power installed is 60.2 MW, ranging from 100 kW to 3 MW. Only twelve gas-fired boiler houses are equipped with modern combustion, measurement, and regulation systems. The remaining ones have limited, obsolete control equipment, resulting in high gas consumption. The annual gas consumption is 8.4 million m^3, and the consumption per unit amounts to 34.1 m^3 of gas per 1 GJ.

This energy overconsumption, in turn, results in high CO_2 emissions, amounting to 16,500 tons per year, and high prices for thermal energy ($ 6.5 per 1 GJ). The higher prices are also partly due to the large number of employees necessary to manually control the systems.

Other problems facing Old Town and Terming were a negative public image due to consumer reaction to the increasing energy prices and the sensitivity surrounding any infrastructure development in the historical town.

Project Description

Old Town Bratislava and Terming wanted to reduce gas consumption, leading to lower energy costs for both the municipality and consumers and at the same time to reduced air pollution. In addition, they wanted to involve the public to improve their image, and they wanted to take precautionary measures to protect the historical buildings in the community.

With an EcoLinks Challenge Grant, they assembled a project team to assess the possibility of retrofitting 134 gas-fired boiler houses with modern measurement and control systems. The members of the project team contributed different skills and resources, helping to enhance the credibility of the project. They also represented a cross section of stakeholders, increasing its transparency. The project team was comprised of the following organizations:

1. Terming, the local utility company and operator of the heating systems, was represented by technical and economic experts who were involved at every stage of the project implementation
2. Honeywell Prague was the consulting company specializing in heat-generation, distribution, and automation and control systems. Its role was to design a uniform system of measurement and control elements that could be applied in the Old Town's boiler houses, including remote communication with a central control room.
3. Municipality Bratislava Old Town, the majority owner of Terming, was responsible for supplying heat and hot tap water to the inhabitants.
4. Slovak Technical University, Department of Automated Control and Measurement at the Faculty of Mechanical Engineering, contributed experts to analyze the current condition of the heating systems and assess options for their modernization in cooperation with Honeywell.

5. Otvoreny Kruh (Open Circle) was a Slovak NGO whose role was to raise public awareness of the project and disseminate the results to the community.
6. Ecotoxicology Center, a laboratory in Bratislava, assessed the environmental impact of the prospective investment. It calculated the avoided emissions of different pollutants based on the different levels of gas consumption before and after the modernization of boiler houses.

The main activities of the project were the following:

Collect existing data

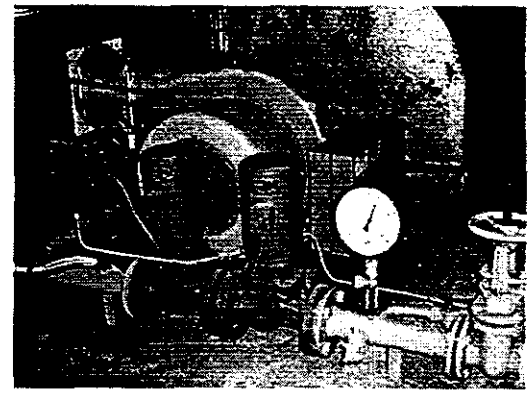
All 134 boiler houses were carefully examined and basic data concerning the condition of existing equipment as well as operation costs was gathered.

Develop database

A database was created to present the gathered information in a comprehensive format. The database included the following information about every boiler house: heat production, hot tap water production, fuel consumption and cost, electricity and water consumption, salaries, insurance costs, costs of inspection certificates, overheads, depreciation, and other operation costs, such as maintenance costs, fines and fees for pollution. The data revealed not only that the unit gas consumption and operation costs were high in the investigated boiler houses, but also that the value of these parameters varied considerably from one site to the next. As expected, the boiler houses without the measurement and control systems or supported by only basic control equipment had higher unit gas consumption and operation costs than the boiler houses with more sophisticated measurement and control systems.

Classify boiler houses to set priorities

Based on an analysis of the information provided in the database, the boiler houses were classified into four different groups according to the amount of power installed in the boiler houses, the number of boilers, and their seasonal operation. Boilers designed to produce energy only for heating purposes operate in the cold winter months, while boilers that supply both heating and hot water operate year round. This classification helped to allocate resources in such a way to maximize energy savings with the minimal investment. It was decided to install the most complex measurement and control systems in the largest boilers that were operational the entire year. Even a small decrease in gas consumption would result in a significant reduction in fuel costs. The basic measurement and control devices would be installed in the smaller units.



Equipment in a boiler house, Terming Bratislava

The boiler houses were classified into the following four groups:

1. Plants with the highest power installed, having more than one boiler, and producing both heating and hot tap water. They are operational the entire year, and they are targeted for

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connection to the central control system. The most complex measurement and control systems would be installed in this group.

2. Medium size units, generating both heating and hot tap water and being operational the entire year. Relatively sophisticated measurement and control equipment would be installed in these units.

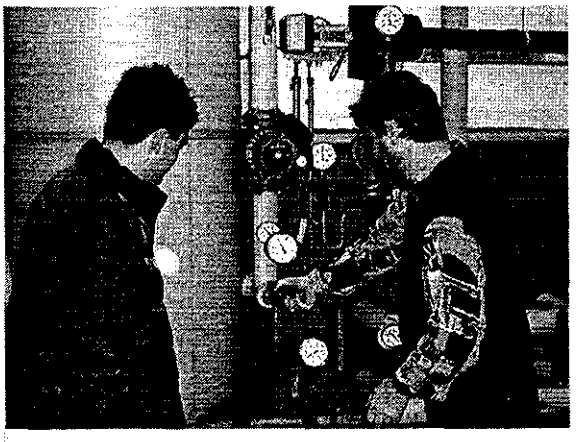
3. Medium size boiler houses, generating only heating and being operational only during the heating season. The different capacity of each boiler would determine the selection of equipment in the future.

4. The smallest units, supplying heating to no more than two buildings. Only basic measurement and control equipment would be installed in these units.

As part of the priority-setting process, special considerations were taken into account for the boiler houses located near the historical buildings in Old Town. Construction is limited for particular buildings or areas, and in some cases modernization of the boiler houses would be complicated by the existing infrastructure. It was recommended to modernize 25 heating plants on a priority basis. The remaining plants would be modernized later when funding was secured and other problems were resolved, such as the ownership of the boiler houses and the necessary permits.

Prepare engineering designs

A detailed engineering design for the installation of measurement and control equipment was prepared for a sample boiler house from each of the above groups. Technical documentation for each sample boiler house included a description of its present condition, a description of the new design, specification of the needed equipment, and the cost estimation.



Equipment in a boiler house, Terming Bratislava

Estimate investment requirements

Based on the above technical evaluation, the necessary investment outlays, future operation costs, and other economic parameters were estimated. Different scenarios were prepared assuming stable fuel prices as well as a possible 20% increase in the price of a gas.

Assess environmental impact

The environmental impact of the proposed investment was assessed, showing the lower emission levels of different pollutants that would result.

Disseminate results

The results of the project were disseminated to the community through an informational brochure and articles in local newspapers.

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Outputs/Results

The following results and outputs were achieved:

- Development of a comprehensive and detailed database for existing gas-fired boiler houses. This data can serve many different purposes, such as an analysis of current operation costs or investment planning. The database will be regularly updated with new information.
- Development of sample detailed engineering designs for the planned installation of measurement and control equipment in different types of boiler houses
- Investment analysis and environmental impact assessment of the project
- Increased public awareness of the economic and environmental issues related to district heating.
- Supporting information for the preparation of bankable documents to secure financing for the project.

Costs of Ecolinks Project

The total cost for the preparation of the project was $ 68,990, of which $ 48,175 was funded through an Ecolinks grant and $ 20,815 was provided as cost share.

Expected Environmental and Economic Benefits

Environmental Benefits
Reduced air pollution as follows:

Air pollutants	Current emissions (t/year)	Expected reductions (t/year)
CO_2	16 500	1788.6
CO	5.3	0.6
SO_2	0.08	0.01
NO_x	13.1	1.42
Particulates	0.6	0.07

Table 1: Environmental Benefits

Economic benefits
The project is estimated to reduce gas consumption by 10.8%. The expected fuel savings range from 3 to 25 %, depending on the boiler house, and total savings amount to 0.91 million m^3 of natural gas per year. This reduction will result in annual cost savings of $ 89,200.

Financial analysis
Total project investment outlays amount to $ 310,000. The simple payback time of the investment varies from 1.7 to 9 years for each boiler house, with an average value of 4.25 years.

If all boiler houses are equipped with the measurement and control systems, the Ecolinks grant of approximately $ 48,000 will foster environmental investments amounting to $310,000.

Transferability

The methodology applied in the project can be easily transferred to other utility companies that supply heating and hot water in the cities as well as water supply companies. This included the development of the database, its analysis, elaboration of technical documentation, economic and environmental analysis, and final prioritization of the investments. The special criteria for the unique location of the planned investment may be applied to other cities with historical buildings that have a diversified ownership structure.

Lessons Learned

The following lessons were learned during project implementation:

- It is important to involve different stakeholders when implementing similar projects. This can be achieved in two ways. First, the project team should represent different stakeholders. An ideal team might include the municipality, local utility, an independent consulting company or independent experts and a NGO. Second, a public information campaign should be developed to inform the community of the nature of the project and the problems it addresses, the on-going activities and the results. The public needs to understand both the economic and environmental consequences of the proposed project and have an opportunity to provide feedback

- When developing an investment program in a city's historical center, many additional factors need to be considered, such as ownership of the site, its location in the historical center, any limits on construction, and the state of existing infrastructure.

- The critical factors for a successful project are clear and effective cooperation between project team members, well-defined goals and tasks, and realistic expectations.

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Training Environmental Auditors in Russia Far East

Amur in Khabarovsk

Project Area: Environmental Management Systems

Project Partners:
Project Leader: Khabarovsk Krai local government administration (Khabarovsk, Russia)
Project Partner: American International University Network, Ltd. (Lincoln, Nebraska)
Project Associate: Center for Ecological Services and Expertise (Khabarovsk, Russia)

Location of Project: Khabarovsk region, Russia, with a one-week training session in Washington, DC.

Project Duration: January-July 2000

Abstract: *In 1999, of the approximately 500 environmental auditors in the Russian Federation, there were only 7 environmental auditors in the entire Russia Far East region (an area approximately two-thirds the size of the continental United States). Furthermore, the State Committee on the Environment of the Russian Federation, the federal government body empowered to license environmental auditors, only licensed auditors who had completed training courses of the Center for Environmental Security (CES), located in Moscow, seven time zones away from Khabarovsk.*

In the winter of 1999, the Khabarovsk Krai local government administration, together with their American partner, the American International University Network, was awarded an EcoLinks Challenge Grant to develop a model program to train environmental auditors in the Russia Far East region. The Project Team worked with trainers from CES to prepare a cadre of environmental auditors in Russia Far East consistent with Russian Federation standards. As a result of this EcoLinks-funded project, 26 environmental auditors were trained, and licensed by the State Committee on the Environment of the Russian Federation. The Project Team also developed a "train the trainers" component, whereby the newly licensed environmental auditors completed additional course work, qualifying them to conduct environmental audit training. This is the first instance of duel licensing of an environmental audit-training program in the Russian Federation.

In order to ensure the sustainability of the model training program, the Project Team worked to establish environmental audit and training components within the Center for Ecological Services and Expertise (CESE), in Khabarovsk. The components were developed in order to

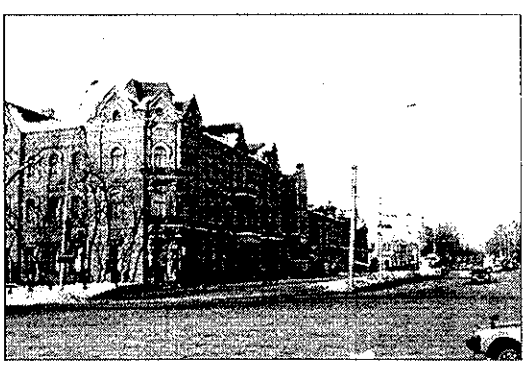
train future environmental auditors in the region and to help meet the need for conducting environmental audits in Russia Far East. CESE received accreditation from the State Committee on the Environment in July 2000. It is now the only organization outside of CES accredited by the State Committee on the Environment to train environmental auditors in the Russian Federation.

The project can be considered a Best Practice for several reasons. First, a successful model program to train and license environmental auditors was developed, in cooperation with the appropriate government authorities. Second, the training program materials were adapted to develop a university course, "Environmental Auditing of Businesses and Enterprises", which is currently offered at two universities. Third, to ensure sustainability of the project, an environmental auditor-training component was established at an environmental consulting organization. In the first six months of operation, it received over $30,000 in contracts to conduct environmental audits of several manufacturers in the area.

Problem Statement

In the Russian Federation, environmental audits are carried out to check one of three technical parameters: (1) to check an enterprise's compliance with national or regional nature protection laws; (2) to evaluate an enterprise's impact on the environment; (3) to verify that funds earmarked for implementing environmental protection measures have been used for their intended purpose. Before the collapse of the Soviet Union, environmental audits were mandatory in nature, conducted in the cases of suspected environmental malfeasance. Increasingly, however, as international trade and investment opportunities open up, companies are electing to conduct voluntary audits in order to demonstrate to potential investors or lenders parameters of environmental risk or to show international consumers that their products meet specific export standards.

Before project implementation, of the approximately 500 environmental auditors in the Russian Federation, there were 7 environmental auditors in the entire Russia Far East region (an area approximately two-thirds as large as the continental United States). Furthermore, the State Committee on the Environment of the Russian Federation (SCE), the federal government body empowered to license environmental auditors, recognized only the audit training program of the Moscow-based Center for Environmental Security (CES), located seven time zones away from Khabarovsk. While the need for a cadre of licensed environmental auditors was high in Russia Far East, no nationally recognized, accredited programs to train and license environmental auditors existed in the region.



Khabarovsk

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Project Description

The main goal of the project was to develop a model program to train environmental auditors in the region.

The main project activities were as follows:

Preparatory Work: Negotiations and Curricula Development, November-February 2000:
Joe McNulty and Sergei Polozov from the American International University Network travel to Moscow in November 1999 and again in January 2000 to meet with representatives from IIUEPS, the Ministry of Education, the Center for Environmental Security, and the State Committee on Environment, to discuss the proposed training program and negotiate potential joint licensing of environmental audit trainers. A deal is reached whereby the model training program will use trainers accredited by both MoE and SCE, and in January 2000, after reviewing the planned model-training program, an agreement on joint licensing of the model-training program is reached.

Khabarovsk

Project team members work in collaboration with trainers from the Center for Environmental Security, IIUEPS and local experts to develop the model environmental auditor-training program course materials and methodology. The model auditor-training course is developed to include two components, a classroom study component and a field work component, during which students will conduct practice audits on two enterprise sites. The proposed course packet is discussed and cleared with IIUEPS and the State Committee on Environment.

Two sites are selected, Chechzirskii Wood Factory and Igristii Vina Winery, on which trainees will work with instructors to conduct practice audits during the model-training program. The two sites are selected because they are representative of major industrial sectors in the RfE, and because of plant management's commitment to making environmental improvements. Before the training program begins, complete environmental audits are first conducted at the two sites by licensed auditors. Results of the audits are discussed with CES, and distributed to Chechzirskii Wood Factory and Igristii Vina Winery management.

Environmental Audit Training, March 2000:
During March, 26 students complete the model environmental-audit training program. Instructors and trainers from IIUEPS, CES, the State Environmental Committee of the Russian Federation, the Khabarovsk Region Environmental Committee, the NGO "Center on Environmental Works", and professors from various Khabarovsk environmental and technical institutes present course materials. The model auditor training course is divided into two components, a classroom study component and a field work component. Two weeks of classroom study cover the following training modules: Prevention, Safety and Remediation (including a review of corresponding laws and normative acts); Environmental Audit Process, Russian Federation Standards; International

Environmental Audit Standards, ISO Standards and Environmental Management Systems; Professional Ethics in Conducting Audits; and Environmental Legislation, International and Domestic.

During the third week, students work with senior environmental auditors in conducting environmental audits at two sites, Chechzirskii Wood Factory and Igristii Vina Winery. At both sites, students gain first-hand experience in data collection, analysis and preparation of documentation for an environmental audit. At Igristii, students work with trainers to evaluate Igristii's environmental management system as a whole, and the plant's impact on the environment, including how Igristii treats and stores plant wastes. At Chechzirskii, students evaluate the plant's adherence to forest protection environmental legislation and normative acts. After student groups complete their practice audits at each site, trainers review their reports, comparing them with the official audits conducted earlier by licensed auditors.

US Study-tour, April 2000:
Five representatives of Khabarovski Krai administration and one representative from CESE travel to the United States for a one-week study tour focused on environmental management systems of local government administrations in the USA. Material covered includes reviewing municipal environmental zoning practices and city and state environmental legislation; international auditor standards in practice; city and state government policies, procedures and practices for waste management. The study tour is organized by the American project partner, American International University Network, Ltd.

During the study tour, Professor Larry Hourcle, the Assistant Dean of the Environmental Law Department at Georgetown Law School reviews and assesses the environmental auditor model-training program, including the results of the environmental audits conducted at Chechzirskii and Igristii.

Follow-up Activities May-July 2000:
In order to ensure sustainability of the project, the Project Team also decides to pursue accreditation of the developed model-training program from the State Committee on Environment. During May and June 2000, Project Team members prepare necessary documentation to apply for accreditation of the model training program. In July of 2000, the Center for Ecological Services and Expertise is accredited by the State Committee on the Environment to train environmental auditors.

Using materials from the training program, the Project Team develop a university course "Environmental Auditing of Businesses and Enterprises". This course is currently offered at the Khabarovsk Technical University and the Far East State University, Vladivostok.

Dissemination of Results

The results of the project were disseminated at a round-table discussion, held at the conclusion of the environmental auditor training program, and attended by trainers, trainees and mass media representatives. The Khabarovsk TV station SET, Ltd included coverage of the model environmental auditor training program in the TV program "Guberniya". A course for universities entitled "Environmental Auditing of Businesses and Enterprises" was developed, and has been taught at Khabarovsk Technical University and the Far East State University, Vladivostok.

Outputs/Results

The project resulted in the following outputs:

- 26 environmental auditors were trained and licensed as environmental auditors (by the State Committee on the Environment of the Russian Federation) in Khabarovsk. In addition, these 26 environmental auditors completed additional training and were licensed by the Ministry of Education of the Russian Federation to train others. This is the first instance of such duel licensing in Russia.

- An environmental audit component was established within the Center for Ecological Service Center, Khabarovsk. Using 16 of the environmental auditors trained, the Center will help to meet the need to conduct environmental audits in the region. Since project completion, the Center has received contracts amounting to over $30,000 to conduct audits at the following sites in RfE: Dal Tekecom, Khabenergo (an electricity supplier), AVEST (television set manufacturer), the Far East Railway, and at several alcohol producing companies in the region.

- An environmental auditor-training component was established within the Center for Ecological Service Center, Khabarovsk. The Center is now authorized by the State Committee on Environment to train environmental auditors, ensuring further sustainability of the project. The Center in Khabarovsk is the first outside of Moscow authorized to conduct environmental audit training, enabling the Center to help meet the need for licensed environmental auditors throughout Russia Far East.

- Two environmental audits were completed: one at Igristii Vina winery and a second at Chechzirskii Wood Factory.

- The university-level course "Environmental Auditing of Businesses and Enterprises" was developed from training materials. This course is currently offered at the Khabarovsk Technical University and the Far East State University, Vladivostok.

- The NGO "Association of Environmental Auditors" was established and registered. The purpose of the NGO is to provide information support to environmental auditors in the RfE region and to act as a watchdog organization to ensure that money going to state-owned enterprise to implement environmental control measures is in fact used for this purpose.

The total cost for the project preparation was $68,034 with $49,804 funded by EcoLinks and $18,230 provided as cost share by the Project Team.

Transferability

The establishment of an accredited training program for environmental auditors can be replicated in other regions in the Russian Federation where industry/business development is sufficiently high.

Lessons Learned

The following lessons were learned during project implementation:

- *It is important to reach agreement with all necessary licensing* bodies in Moscow and their training arms. Regular communication, and travel to Moscow for face to face discussions is key.
- It is important to work with qualified, licensed trainers, preferably from CES, who have in-depth understanding of licensing bureau (in this case the State Committee on the *Environment) criteria and standards*
- It is important to carefully weigh the demand of industry/business in the region for environmental audits, to ensure the post-project sustainability

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EcoLinks Grant Program
Best Practice #6

Treatment of Wastewater from Abandoned Pyrite Mine in Slovakia

Abstract

In 1991 the Smolnik Mine in eastern Slovakia was abandoned due to economic hardship. The mine, like many other inactive mines in Slovakia, has since become a significant source of water pollution impacting water quality both locally and internationally. Slovakia, a country facing many economic and political challenges after the demise of communism, needs a creative and low cost solution to address this serious environmental problem. Searching for this solution was the focus of this project.

AQUIPUR, a consulting firm in Slovakia and Knight Piesold, a consulting company based in the United States, collaborated to develop a strategy for reducing water pollution associated with the Smolnik Mine. An EcoLinks Challenge Grant provided support to explore the feasibility of using passive treatment technology to improve the water quality of mine effluent.

Several best practices can be learned from this project. This project demonstrates the usefulness and applicability of passive treatment technology for reducing water pollution. The pilot test generated by this project revealed that heavy metal pollutants such as aluminum, copper, and zinc are reduced by almost 70% and acid levels are significantly improved. The pilot also demonstrated that the materials needed to build a passive treatment system are attainable and inexpensive compared to active water treatment systems. While active water treatment requires ongoing maintenance that is costly, passive treatment is low maintenance. Given the effectiveness, applicability, and economic efficiency of this approach, it can be usefully applied to improve other mine waters throughout Central and Eastern Europe.

Name of Project: Feasibility Test for Water Quality Improvement Using Passive Treatment System on Effluent Waters from the Smolnik Mine in Slovakia

Project Area: Water Quality Management

Organizations Involved:

Project Leader: AQUIPUR a.s., Bratislava, Slovakia
Project Partner: Knight Piesold and Company, Denver, Colorado
Associate: Faculty of Sciences, Comenius University, Bratislava, Slovakia

Location of Project: Smolnik, Slovakia

Project Duration: *August, 1999 - September, 2000*

Problem Statement:

An important consideration in improving water quality in Central and Eastern Europe is minimizing wastewater effluent from inactive or abandoned mines. These waters can be highly acidic and contain heavy metals that are detrimental to human health and aquatic ecological vitality. Mine water treatment, however, can be costly and complicated to implement and maintain. To address water quality problems associated with mine effluents in Central and Eastern Europe, creative and economically efficient ways to minimize and treat contaminated mine waters must be explored.

This project tests the feasibility of a low cost, low maintenance technique for passively treating mine water. The Smolnik Mine in Smolnik, Slovakia is used as a test site. This site is ideal for this project because there is an existing knowledge base on the mine's properties and other remediation efforts are already underway. The Smolnik Mine, once a notable source of pyrite, became inactive in 1991 due to economic constraints. The mine eventually flooded with water leading to acid rock drainage. From eight to twenty five liters per second of acidic water contaminated with heavy metals now flows in the form of underground seepage from the mine into tributaries of the Ruzin Basin eventually crossing the international border into Hungary. The metal content of the Smolnik mine effluent far exceeds allowable pollution levels and has diminished ecological conditions in the Smolnik stream, the Hornad River, and transboundary waters.

The scientific community has shown much concern over the environmental destruction associated with the inactive mine that is owned by the Slovak government. The Slovak government, while concerned for water quality, has not yet been able to dedicate the economic and political resources necessary for attacking the environmental problems associated with the closed mine. Demonstrating feasible and

inexpensive ways to improve water quality as this project does, however, may attract more resources and support.

It has to be emphasized that the amount of water that infiltrates the mine has already been significantly reduced (before Ecolinks project). This has been achieved through diverting the surface water to bypass the most intensive infiltration points.

Project Description:

Acidic water contaminated with heavy metals can be treated using active or passive methods. Active methods bear relatively lower investment outlays, however, they have significant operating costs. The passive treatment technologies, which are based on immobilization of metals by bacteria and by plants in a man-made wetlands are gaining acceptance in many parts of the world. Slightly higher investment outlays of these technologies are counterbalanced by insignificant operation costs.

Passive methods can be aerobic or anaerobic. The choice between the methods is driven by the wastewater chemical composition. For this particular case, it was decided that the anaerobic method would be tested. Anaerobic method utilizes sulfate reducing bacteria and organic matter in the cell to raise the pH and to form the sulfide ions, which combine with the metals to form insoluble sulfides.

The purpose of this project was to determine empirically a feasible plan of an effective, full-scale, passive, anaerobic water treatment system for reducing water pollution associated with the inactive Smolnik Mine. This was done in two phases: 1) bench-scale study, and 2) pilot-scale study. The first phase of the project, the bench-scale study, focused on determining the appropriate mixture of sulfate-reducing agents most effective at reducing the acidity and removing metal contaminants of effluent mine water. The second phase of the project, the pilot-scale study, involved constructing a pilot cell to test the most favorable mixture under continuous flow conditions.

Phase I: Bench-Scale Study

The bench-scale study involved preparing four different sulfate-reducing bioreactors. The bioreactors each contained different combinations of crushed limestone, aged sawdust, moldy hay, and aged cow manure. The flow from each bioreactor was tested to determine which of the four cell mixtures was most effective at improving the pH and reducing the amount of heavy metals. This test was performed under discontinuous flow conditions. Once the appropriate mixture was determined, it needed to be tested under continuous flow conditions.

Phase II: The Pilot-Scale Study

The pilot-scale study involved the construction of the anaerobic sulfate-reducing, 12m x 6m x 1m cell using the most effective sulfate-reducing mixture determined by the bench-scale study. The location of the cell was selected to allow gravity flow from the mine to the cell. The cell was filled with 14,700 kg of limestone, 19,000 kg of old sawdust, 4,250 kg of hay, and 5,600 kg of manure. Then the cell was tested under

constant flow conditions and the output was periodically monitored for pH, temperature, conductivity, redox, iron, aluminum, copper, zinc, sulfate, magnesium, and calcium. The flow varied from 8,000 to 13,000 liters per day. The experiments lasted approximately 5 months. Based on the results of the pilot-cell experiments, a plan was constructed for a full-scale treatment system.

Upon completion of Phase I and Phase II, the project results are to be presented to the Slovak Ministry of Environment and the Slovak Ministry of Economy in hopes of achieving future support for the construction of a final passive water treatment system. Research results obtained from project were shared at an International Environmental Symposium in Prague and published in conference proceedings.

Outputs/Results:

Through this project, it was determined that passive water treatment technology is an effective, feasible, low cost solution for treating mine effluent water at the Smolnik Mine. It was further indicated that this technique might be favorably applied to other similar mines throughout Central and Eastern Europe to improve water quality. The following points specify the outputs and results of this project:

- The project demonstrated that the pilot cell effectively and consistently reduced heavy metals by up to 70%, and improved the pH of the water even when the cleansing cell was overloaded. The test revealed that the sulfate-reducing cell could eliminate metals in loading conditions that are much higher than anticipated.
- Based on findings from the pilot test, a set of design parameters was obtained and a conceptual design for a complete treatment system was developed.
- By running the pilot test, the challenges and opportunities to using the passive treatment system were identified. The problems identified in the pilot cell test were corrected for the final full-scale design of the treatment system and will thus be avoided in this and other future applications of this technique. For example, the trial test cell showed that feed pipes can become clogged with iron hydroxide precipitates. To remedy this in the final design of the full-scale treatment system, it is indicated that feed pipes are to have smooth walls and be easily accessible for cleaning purposes. The pilot-cell study also revealed that the system can handle an influx six times larger than originally predicted by the bench-scale tests. Since the cells can handle a larger flow, fewer cells can be used conserving the amount of land needed to build the system. Note, however, that this decreases the longevity of the cells by half.
- Due to the experience gained through testing the passive water treatment technology at the Smolnik Mine, AQUIPUR now has the knowledge and experience to implement passive treatment systems for other inactive mines in the region as well as train others in applying the passive water treatment technique for its application throughout Central and Eastern Europe.
- This project affirmed a low-cost solution to water pollution associated with inactive mines. Many other water treatment approaches require more costly and less accessible materials and sustained maintenance and monitoring. The passive water treatment system, however, employs inexpensive materials that are more readily available and requires only minimal, periodic maintenance.

Through this test pilot it was also discovered that if the cell is built on an incline, water enters the cell via gravity, consequently a pump is not needed, thereby reducing the costs of this technique even further.

- In addition to economic savings through exploring low cost water treatment methods, this project built social capital in the form of network formation and information exchange. This project engaged a partnership between the Slovak consulting firm, AQUIPUR, the Faculty of Sciences at Comenius University in Slovakia, and a US firm, Knight Piesold. This network allowed for the exchange of information and generated the implementation capacity to develop the plans for a full-scale passive water treatment system. Valuable knowledge was also obtained on how to collaborate effectively to improve the success of the project.
- Paper titled "Bench Scale Passive Treatment of Heavy Metals, Smolnik Mine, Slovakia" was presented at the American Society for Surface Mining and Reclamation" in June, 2000 in Tampa, Florida. The paper was peer reviewed and well received.

Costs of EcoLinks Project:

The total expenditures for the project were $ 54,822 of which $36,310 was funded through an EcoLinks grant and $18,512 was provided as cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

The environmental benefits of this project are derived through providing the technological capacity for constructing passive water treatment systems to reduce mine water pollution. The potential for water quality improvement using the developed system was demonstrated by the results from testing the pilot-cell discharge. The last data set gathered for metal content of discharge from the pilot-cell is presented in the table 1:

Tab.1 Results of pilot scale tests

Component	Concentration before treatment [ppm]	Concentration after treatment [ppm]
Aluminum	165	3.25
Copper	6.29	0.08
Zinc	21.7	0.36
Manganese	44.9	37.4
Total iron	617	322

Altogether 70 % of metals were removed. Sulfate flow was reduced from 18.7 moles/day/m3 to 1.38 moles/day/m3. Note that while these readings were taken in September, the readings were also just as impressive at the beginning of spring in May when flow rates can be much higher (by 50 %). The pilot test also revealed that the pH was increased by one to two units reducing the acidity of the water.

Economic Benefits and Financial Analysis

The passive treatment system developed in this project is less costly than an active treatment system. The materials for a passive treatment system are less expensive, easily accessible, and the maintenance and monitoring are less demanding. A chemical treatment option was considered for improving the Smolnik Mine effluent but due to costs it was dismissed. Further, an active treatment system produces a sludge by-product requiring further investment while the passive treatment generates insignificant amount of solid waste as the content of the cells is operational typically around twenty years. The technology was demonstrated as easily workable in poor conditions.

The table below shows details concerning cost effectiveness analysis of passive and active treatment of wastewaters from Smolnik mine:

Tab. 2: Comparison of costs of active and passive methods of water treatment for the case of Smolnik mine

	Active method	Passive method
Investment outlays [$ million]	2.0	4.1
Operation costs [$ million/year]	0.5	0.0
Annualized cost (over 15 years, 6 % discount rate) [$million/year]	0.71	0.42

The result shows that the passive technology annualized costs are $ 0.42 million, almost twice lower than the annualized costs of an active method.

Project's follow-up

AQUIPUR and Knight Piesold seek local and international funds for a full-scale application of the treatment system from the Slovak Ministry of Economy and US Trade and Development Agency and US Environmental Protection Agency.

Transferability:

The passive water treatment technique can be easily applied to improve water conditions associated with other similar inactive mines in Slovakia, Poland, Germany and throughout Central and Eastern Europe. Other applications of this technique can benefit from the lessons learned in the pilot testing of this method at the Smolnik Mine. For example, the pilot test revealed that the cells could handle higher loads than originally anticipated. This knowledge can be easily transferred to others applying this technique.

Lessons Learned:

The following lessons were learned during this project:

- A clear work plan and regular site visits by the key parties involved in the project improves project implementation, the work plan should outline not only the time schedule but also communication schedule
- More collaboration (e.g., more communication) and more site visits are needed to secure consistent data collection and reporting of results.
- Several unexpected insights were gained from the research alone.
  1) Acquiring sufficient land to locate the system can be difficult. Multiple sites may be needed to have sufficient space for the entire treatment system, or fewer cells can be used.
  2) Locating the cell where water can flow into it by gravity eliminates the need for a pump.
  3) There can be problems with vandalism and materials being taken from the site.
- The technology verification was very satisfying, especially as regional geochemical differences were overcome.
- Timing of financing of similar projects should correspond with construction needs

Additional Information:

Contact Data

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EcoLinks Grant Program
Best Practice #7

Underground Pollution by Petroleum at Romanian Refinery

Abstract

The Astra Romana Oil Refinery has been active for more than a century. While an economic asset to Romania, it has led to a dangerous accumulation of petroleum residues in underground water resources and soil in the area surrounding the refinery. Leaked petroleum has accumulated in the free-phase layer of variable thickness above the groundwater (i.e. up to seven meters deep underground) over a 400 – 500 hectare area surrounding the refinery. In addition to soil and water contamination, leaked petroleum residues are a source of hydrocarbon vapors that may infiltrate the basements of surrounding residential homes. Different methods for removing the residual petroleum from soil and water have been attempted. These methods, however, have had deleterious environmental and human consequences and have been energy-intensive.

The purpose of this project was to explore an environmentally sound and economically efficient way to minimize petroleum contamination of soil and water resources in areas surrounding oil refineries. State-of-the-art American technology was transferred to Romania and used to recover petroleum from contaminated soil and to prevent the spread of further contamination in ground water resources.
This project can be considered a Best Practice because it demonstrates the feasibility and effectiveness of the American double-pump system that was installed to recover petroleum from two extraction wells in the refinery. The pilot system recovers 5 t of petroleum per month. The simple payback time of the pilot system, as well as of the complete, twelve-well system which will be installed in the nearby future, is between 3.5 and 4.5 years.,

Name of Project: Implementation of a Cleaner Technology to Contain the Underground Pollution by Petroleum in the Vicinity of the Astra Romana Refinery in Ploiesti, Romania.

Project Area: Water Quality Management

Organizations Involved:

Project Leader: Astra Romana Refinery (Ploiesti, Romania)

Project Partner: Leggette, Brashears & Graham, Inc., White Plains, NY, USA

Associates:

- INCERP CERCETARE, Ploiesti, Romania
- TL Stevens Well Company, Maple Plain, MN, USA
- "People and Environment", Ploiesti, Romania
- TIAB, Ploiesti, Romania
- FORADEX, Bucharest, Romania
- Environmental Protection Inspectorate, Ploiesti, Romania

Location of Project: Ploiesti, Romania

Project Duration: September 1999 - August 2000

Problem Statement:

The Astra Romana Oil Refinery in Ploiesti, Romania, has been both an economic asset as well as an environmental hazard for decades. First established in 1880, it was the largest private refinery in Romania. Before the World War II, there were 12 oil refineries operating around Ploiesti and they were used to process almost 80 % of the oil in Romania. Among these 12 refineries, Astra Refinery used to process some 30% of the total quantity processed in Ploiesti area (and almost 25% of the total oil processed in Romania in 1939). All these oil refineries have contributed to water pollution and soil contamination with increasing severity since World War II, as caused by bombardments during the war, major earthquakes of 1940, 1977, and 1986, pipeline ruptures, and product spills and leakages. Astra Romana and other refineries in the Ploiesti vicinity, as well as the underground network of transport pipelines have also contributed to further contamination of soil and ground water. Leaked petroleum has accumulated in the free-phase layer of variable thickness above the groundwater

(i.e. up to seven meters deep underground) over a 400 – 500 hectare area surrounding the refinery. In addition to soil and water contamination, leaked petroleum residues are a source of hydrocarbon vapors that may infiltrate the basements of surrounding residential homes.

Different methods for removing the residual petroleum from soil and water have been attempted. These methods, however, have had deleterious environmental and human consequences and have been energy-intensive. For example, small businesses and private individuals have been removing free-phase petroleum floating on ground water using open excavations. Removal of leaked petroleum through open excavations has spread ground water contamination and increased fire and asphyxia hazards. Several people have died from vapors released from the excavation sites. Farmland has been destroyed. Mechanically driven mobile belts have also been used to remove leaked petroleum, but have proven to be inefficient. An environmentally sound and economically efficient method for removing and recovering petroleum from the surrounding refineries has become desperately needed.

The purpose of this project was to explore an environmentally sound and economically efficient way to minimize petroleum contamination of soil and water resources in areas surrounding oil refineries. To test the feasibility of a clean technology system, a monitoring and prevention plan was developed and two double pump systems were installed at the Astra Romana Refinery in Ploiesti, Romania. The pump systems were provided by the American Partner to the project.

Project Description:

The goal of this project was to assess and minimize soil and water contamination from petroleum leaked in the vicinity of Astra Romana Refinery.

The project consisted of four main activities:

Activity 1. The extent and impact of petroleum contamination in and around the Astra Romana Refinery was determined. Existing files on data gathered from monitoring wells around the refinery were reviewed. Current data on the status of petroleum residue, contamination of soil, water, and land, and the impacts and degree of inefficiency of previous free-phase petroleum removal attempts were gathered and analyzed. This was conducted with the assistance of INCERP, an associate of Astra Romana Refinery.

Activity 2. Spill assessment was conducted. Prevention plan was developed. Field investigations of the oil leakage sites were made. Spill detection and control systems were evaluated and updated to produce a new general plan for spill prevention including recommendations for implementation. The plan was formulated by Legette, Brashers and Graham, the American Partner.

Activity 3. Preparation, installation and testing of the state-of-the-art hydrocarbon recovery system in two extraction wells.

The double-pump system technology was selected for this site due to the relatively high permeable sediments and the large accumulation of petroleum. High-risk contamination areas on the site were evaluated and the most suitable intervention locations were identified. Based on hydrological and geological status assessments of these suitable locations, specific procedures for installing extraction/recovery wells were determined. Two wells were drilled by FORADEX, an associate of the project, and tested for performance.

Hydrocarbon recovery and ground water extraction equipment from the United States was acquired and installed. A control system and two main pumps, a submersible water pump and a petroleum recovery pump, were installed in each extraction/recovery well. The double pump system allows for the safe extraction of petroleum residues floating on the surface of water. The water pump, which extends just below the water table, takes in ground water forming a cone of depression. The smaller product pump located above the water table recovers petroleum floating on top of the water. The cone of depression is maintained by a sensory activated water pump allowing petroleum residues to accumulate and be continuously removed from the water surface. Further, the spread of contamination is avoided by preventing the movement of ground water and petroleum by continuously pumping water out.

Start-up activities were completed and the system was tested. The monitoring wells were observed for petroleum accumulation. Upon calibration of pumps and controls, removal of hydrocarbons was observed and evaluated.

Activity 4. Information sharing on the use of cleaner technology for environmental remediation and pollution prevention and control.

Information on the application of this technology was made in several ways. A workshop was conducted and a public technical report was produced. A workshop on the application of the technology was conducted which included presentations, a question and answer period, and field visits to the site. A technical report on the system was produced for the public that details the findings of the results of this project. This report was shared during a workshop on the technology and is intended for further distribution to local government and the business sector.

Outputs/Results:

Several benefits were generated through this project:

- Compared to other previously used methods, preliminary testing of the double pump system revealed that this method was the most effective at recovering petroleum and minimizing further contamination of soil and water. After two months of operation, ten tons of petroleum were removed from the subsurface.

- A spill monitoring and control plan was generated for the Astra Romana Refinery.

- Experience doing collaborative projects was gained.

- Information about the project in the form of a public technical report, an awareness brochure, slideshow presentation, photo album, and final project report were produced.

- A workshop was conducted

Costs of EcoLinks Project:

The total expenditures for the project were $74,995 of which $48,359 was funded through an EcoLinks grant and $26,636 was provided as cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

The two recovery/extraction wells with double pumps installed at Astra Romana Refinery collectively can recover 200 liters of petroleum per day. The recovery system, during its first two months of activation, is attributed with removing ten tons of petroleum residue floating on ground water.

Implementation of a full-scale system of 10-12 extraction/recovery wells will prevent even further deterioration of soil and water resources by removing 250-300 tons of petroleum per day. By pumping out petroleum residue floating on ground water, the system prevents against further hydrocarbon contamination by significantly reducing free-phase petroleum migration from contaminated areas.

There are no environmental and human health risks from applying the technology itself.

Economic Benefits

Operation of the double-pump system for the removal of petroleum from contaminated soil and water resources has several economic benefits:

- separation of petroleum takes place in the well (no additional processing is needed);
- petroleum can be recovered and reprocessed;
- system features low maintenance costs and requires medium capital investment.

The largest savings involved in using this system, however, result from the avoided clean-up costs through the prevention of further contamination:

- removing ten tons of free-phase petroleum prevents soil contamination through further petroleum movement and allows for savings of $14,000 - $ 45,000,

depending on the soil clean-up technology that would be considered for application

- theoretically, removing 10 tons of free-phase petroleum from the subsurface leads to preventing contamination of 8 – 10 million cubic meters of ground water and allows for savings of $4 – 20 million in water clean-up costs.

In the case of the Astra Romana Refinery, leaked petroleum spread through the soil and water at a rate of 30 meters per year. Installing a complete system of 10-12 extraction/recovery wells at the Astra Romana Refinery could prevent this spread and allow for a total savings of $40,000 – $50,000 per year (the value of estimated recovered petroleum that can be reprocessed as crude).

Financial Analysis

The cost of installing a complete system/barrier of 10-12 extraction wells at Astra Romana Refinery would amount approx. $ 120,000 (including well installation & development, water & petroleum pumps, control panels, power supply & water discharge lines, but excluding geology & hydrogeology survey on local subsurface conditions that are already completed).

Yearly operation & maintenance costs for a 12-well recovery network would amount to approximately $10,000. Groundwater monitoring costs for a network of 24 monitoring wells adjacent to the extraction/recovery wells would add $3,800-4,000 annually.

The estimated yearly quantity of petroleum possibly recovered from the subsurface through the 12-well recovery network is between 250-300 tons (around $40,000 – 50,000).

The table below summarizes the estimated costs and benefits:

Tab. 1 Financial analysis for a system of 12 extraction wells

Investment outlays [$]	120,000
Operation & Maintenance Costs [$]	10,000
Monitoring [$]	3,800 – 4,000
Value of the petroleum recovered [$]	40,000 – 50,000
Simple Payback Time [years]	4.6 – 3.3

The Simple Payback Time is relatively low, even if the benefits from avoiding soil and water contamination are not included in calculations.

Transferability:

This project provides a framework for easy transferability of the technology to other sites in Romania. This system, adjusted for local conditions, could be applied to other

similar refineries in Romania to help minimize the degradation of soil and water conditions.

Lessons Learned:

The following lessons were learned during this project:

- Difficulties arise in project implementation due to unforeseen circumstances. For example, each site will be different and may require different preparation. The monitoring wells on this site, for instance, had to be cleaned out. Also, one of the water pumps broke and a local equivalent had to be acquired. In some cases, however, certain pieces of equipment that might malfunction or break and for which there is no local equivalent have to be imported which stalls implementation.

- Importing needed US-produced equipment can require lengthy customs processing.

- Weather conditions must be suitable for equipment installation.

Additional Information:

Contact Data

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EcoLinks Grant Program
Best Practice #8

Environmental Management System for Dredging on the Bulgarian Black Sea Coast

Abstract

The Black Sea provides important economic opportunities for the six countries that line its coast - Bulgaria, Georgia, Romania, the Russian Federation, Turkey, and Ukraine. It is also a vital marine environment supporting diverse biological life. Efforts to promote and strengthen economic vitality in the Black Sea region must incorporate environmentally sensitive methods. Trade and water transportation are two important economic opportunities for countries on the Black Sea. Improving water trade and transportation, however, requires dredging to provide transport vessels with port access. Dredging, while favoring economic opportunities, is detrimental to the environment and must be carried out in a way that minimizes environmental damage.

The purpose of this project was to develop an environmental management system (EMS) that provides a framework for environmentally sensitive dredging activities. The EMS developed in this project includes several elements. An assessment of the status of the coastal and seabed environment and dredging activities in two port areas in Bulgaria, the Port of Varna and the Port of Bourgas was conducted to determine future dredging activities. Recommendations on the institutional and legal framework necessary to carry out dredging activities that minimize environmental damages were developed. An action plan for implementing the EMS including a computerized program to record and compile dredging data to assure monitoring and provide a complete data set regarding dredging activities was also developed

This project can be considered a Best Practice because it generates a method for conducting dredging activities that provide economic benefits and are less detrimental to the environment. While dredging itself provides significant economic opportunities for trade and marine transportation, the implementation of the EMS developed in this project will reduce dredge disposal costs, prevent costs associated with environmental damage and allow dredging companies to improve their ability to operate in a free market system. Implementing an EMS for dredging on the Black Sea will minimize the environmental impacts of dredging by reducing the suspension and dispersal of contaminants in water, by improving the energy efficiency of dredge material removal and by improving the coordination of management responsibilities, providing a greater capacity to assure the implementation of environmental policies and laws.

Name of Project: Basic Structure of an Environmental Management System (EMS) Related to Dredging Works on the Bulgarian Black Sea Coast

Project Area: Cleaner Production

Organizations Involved:

Project Leader: Black Sea Coast Association (BSCA), Varna, Bulgaria
Project Partner: Ogden Beeman & Associates, Inc., Portland, OR USA
Project Associate: QUEST Management International, Englewood, Colorado USA

Location of Project: Black Sea Coast, Bulgaria

Project Duration: July 20, 2000 – January 20, 2001

Problem Statement:

Countries surrounding the Black Sea have experienced especially turbulent times due to political instability that have had dramatic impacts on their economy. Bulgaria, for example, only recently emerged from a period of economic crisis. Efforts that encourage economic growth are critically important to Bulgaria's future. Two main seaports of industrial significance in Bulgaria, the Port of Varna and the Port of Bourgas, provide opportunities for water transport and trade growth. To promote economic activities at these port sites, the approach channels and port vicinity must be deepened and maintained and embankment levels must be regenerated through dredging.

In the port and harbor areas such as Varna and Bourgas in Romania, years of industrial activity and non-point source enterprises such as agriculture have polluted the surrounding waters and seabed. Dredging disturbs and removes the sediment in which chemical and toxic substances are imbedded in order to allow for vessel transportation. Dredging in this area would stir up heavy metals and inorganic and organic compounds causing damage to marine ecological systems, human health, and the tourist industry. The ecological status of the Black Sea has been declining and dredging activities need to be conducted in a way that minimizes the suspension and dispersal of these contaminants which would cause damage to an already sensitive ecosystem. This project developed an Environmental Management System (EMS) that maximizes economic opportunities and minimizes environmental impacts of dredging activities.

Project Description:

The purpose of this project was to establish an Environmental Management System (EMS) for dredging in the Black Sea on the Bulgarian coastline around two port sites,

the Port of Varna and the Port of Bourgas. To accomplish this, three main activities were conducted:

Activity #1: Assessment of current conditions, expected development and demand for dredging.

- An assessment of the existing and anticipated port activities and expected dredging requirements was conducted. The assessment included determining the trends in ship and cargo type and cargo handling operations. For example, more modern vessels are up to two meters deeper than earlier carriers. Dredging, therefore, must be deep enough to accommodate newer vessels.

- Hydrographic information and data, sediment types, historic dredging activities, available disposal sites, and equipment and resources of Bulgarian dredging companies were determined to assert the specific capacity for EMS dredging on the Bulgarian Black Sea coast.

- A legislative framework for dredging in Bulgaria was considered. A review of international and regional law and policy considerations and sediment management standards was conducted.

Activity #2: Development of an EMS conceptual framework for dredging.

- The regional environmental conditions and marine impacts of Bulgarian dredging operations were determined. The elements of an EMS appropriate for the Bulgarian context were developed. They included: environmental policy; environmental aspects and impacts of dredging; legal requirements; objectives and targets; environmental management programs; structure and responsibility; training, awareness and competency; communications; EMS documentation; document control; operational control; emergency response; monitoring and measurement; non-conformance and corrective/prevention action; record keeping; dredging EMS auditing; and management review.

- A process for outlining information exchange and clarification of roles and responsibilities of involved parties necessary for implementing a dredging EMS was developed.

- An assessment of the existing framework for dredging activities was conducted and gaps were identified. Based on the results of this assessment, an action plan was then established for initiating a dredging EMS.

- A report, "Reducing Contaminated Sediment Impacts at Dredging Areas" by B. Savov, V Pentchev, and M. Johnson was presented at the Second International Conference on Port Development and Coastal Environment.

Activity #3: Guidelines and Recommendations for Implementation

- System requirements were developed. They included: a dredging contractors EMS policy; a dredging EMS implementation plan; an EMS computer-based manual outlining procedures and guidelines; an outline of technical

requirements such as machinery and software; description of monitoring requirements; and an EMS training program.

- Coordination activities with local dredging contractors were initiated.

- The results of this project were shared with interested Bulgarian companies and representatives of governmental bodies including the Ministry of Environment and Waters, and port administrators.

Outputs/Results:

This project provides a methodology for reducing the environmental impacts and costs of dredging. Several project outputs were generated to build the capacity for environmentally sensitive dredging. They include the following:

- Assessments of the current dredging framework and activities and requirements and the gaps therein.
- Dredging Contractors EMS Policy: guidelines for dredging contractors using an EMS.
- Dredging EMS Implementation Plan: steps that need to be taken for applying an EMS to dredging activities.
- Technical Requirement Specifications (including equipment and software needed).
- EMS Monitoring Requirements including the technical requirements, issues regarding monitoring during dredging, data collection, etc.
- Procedures, documentation, and guidelines integrated in an EMS Computer Based Manual. The EMS computer program facilitates record keeping regarding hydrographic data, dredging records, sediment data, and environmental monitoring data. This information is important for evaluating activities and providing a general database of information regarding dredging activities and impacts.
- EMS Training Program that trains relevant personnel in the environmental aspects of dredging operations, EMS implementation and the operation and quality control of the EMS computer software.
- Workshop introducing project results to major Bulgarian companies.
- Published special report titled "A Contribution to Environmental Management Strategy of Dredging Works on Bulgarian Black Sea Coast." This was presented at the International Conference "Black Sea-2000", November 6-8, 2000, Varna, Bulgaria.
- Productive and cooperative relationships were established between parties involved in or concerned about dredging activities.

Providing dredging companies with guidelines, technical notes, training program, etc., can be considered as the first stage of the EMS implementation.

Costs of EcoLinks Project:

The total expenditures for the project were $75,000 and were covered by an EcoLinks grant totaling $48,600 and $26,400 contributed as a cost share by the grantee.

Expected Environmental and Economic Benefits:

Environmental Benefits

With the implementation of an EMS several environmental benefits are generated.

- An EMS applied to dredging activities reduces the spread of sediment pollutants (e.g., lead, copper, zinc, cadmium, nickel, chromium, arsenic, mercury) into the water column and across the seabed where they interrupt important marine life cycles. The visibility of the suspension-clouds is decreased to a distance of approximately 50 meters.
- Reducing the water content of the dredged material reduces the amount of dredge waste. An EMS improves the discharge of return water by 80% of its present level. This reduces the amount of energy needed to process dredged material and puts less impact on disposal sites. For example, the concentration of dredge material removed is improved by 10%.
- Energy efficiency of the dredge removal process is improved.
- There is better management across institutions which improves compliance with environmental laws and policies including sustainable coastal zone development.
- An EMS reduces conflicts between dredging contractors, central and local authorities and non-governmental organizations since it addresses environmental impacts.
- Generating the EMS itself provided opportunities for building important networks and generating and sharing information that is needed to improve the environmental aspects of dredging.

Economic Benefits

Several economic benefits can be derived from an EMS. They include:

- The implementation of the EMS developed in this project leads to a reduction in overdredge, i.e., to decreased costs of dredging works.
- Costs for dredge disposal are reduced since the water content of the dredged material is lessened through the application of an EMS.
- Costs associated with non-compliance with environmental laws and regulations are reduced.
- Companies that apply an EMS approach improve their bidding status.

Transferability:

The process and the materials involved in developing the EMS for Bulgaria could be applied in other countries where the environmental impacts of dredging activities are not sufficiently considered.

Lessons Learned:

The following lessons were learned during this project:

- Transferring technological experience from one country to another (Bulgaria and the United States in this case) requires adjustments for a different legislative framework and different standardization levels by extensive exchange of expertise and regional knowledge.
- Flexibility and strong cooperation amongst the involved parties is needed to alleviate the difficulties associated with coordinating project activities in an unstable political, economic, and social environment.
- Bulgarian dredging companies could benefit greatly from expertise on the design and implementation of EMS, additional equipment to do monitoring, improved dredging vessels that are less damaging to the marine environment, and financing to support these investments.
- A serious challenge to implementing the EMS developed in this project is acquiring sufficient financing to cover the costs of equipment, software, hardware, etc.
- Early preparation to establish relationships between those advocating an EMS approach and those who will implement it improved the success of this project.

Additional Information:

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EcoLinks Grant Program
Best Practice #9

Energy Audit at Romanian Petrochemical Plant

Abstract

OLTCHIM is one of the biggest manufacturers of chemicals in Romania. It produces several products including vinyl chloride, propene oxide and chlorinated substances. Steam, electricity and natural gas are used intensively to produce these various chemicals and make up 30% of the company's operating costs. This energy consumption leads to high emissions including nitrous oxide and carbon dioxide that ultimately contribute to global climate change. To improve the efficient use of energy resources and reduce greenhouse gas production, the focus of this project was twofold: 1) to conduct an evaluation of the company's energy use, and 2) to develop a plan for introduction of energy efficiency measures combined with emissions reduction and improved economic efficiency.

With the support of an EcoLinks Grant, this project generated several possibilities for reducing pollution and improving economic efficiency. The project showed that an annual reduction of up to 9,000 tons of nitrous oxide and 326,000 tons of carbon dioxide could be achieved by introducing energy efficiency measures. Economic benefits of implementing the project recommendations would result in a savings of $1 million/year in the short-term. The implementation of the long-term measures would provide a savings of $1.9 million/year. The payback time for identified energy efficiency measures varies from a couple of months to 5 years.

The project is considered as a Best Practice for other chemical industry plants because it included a process audit for assessing energy consumption at different divisions and plants. By measuring energy consumption for each piece of equipment in each division, it was possible to recommend change in equipment, electrical substations, and process lines.

Name of Project: Energy Audit and Feasibility Study of OLTCHIM SA Petrochemical Plant

Project Area: Cleaner Production

Organizations Involved:

Project Leader: SC OLTCHIM SA, Ramnicu Valcea, Romania
Project Partner: Robert A. Watts, Consulting Engineering, Annapolis, MD USA
Associates: Petrodesign, Bucharest, Romania

Location of Project: Valcea, Romania

Project Duration: January 10, 2000 to July 10, 2000

Problem Statement:

OLTCHIM is one of the largest manufacturers of chemicals in Romania. It operates several plants producing a variety of products such as polyvinyl chloride and propene oxide. These plants are energy intensive and generate carbon dioxide and nitrous oxide that contribute to global warming. Emissions are also responsible for the degradation of local air quality. The purpose of this project was to improve energy efficiency at OLTCHIM providing economic and environmental benefits.

Romania has experienced a difficult transition from the socialist era and suffers from a lagging economy and low levels of investment relative to the advanced transition countries of Central Europe. Growth in the industrial sector must be a priority for Romania for economic and social reasons. However, it is essential that new and existing industrial activities conform to international standards for environmental performance. Socialist-era plants typically utilize energy inefficiently, making improvements in efficiency and fuel composition and quality an optimal area for solid and immediate returns on environmental investments. With the support of an EcoLinks Grant, a consortium consisting of OLTCHIM, a US engineering firm, and a Romanian consulting firm collaborated to determine how to improve energy efficiency at OLTCHIM.

Project Description:

This project can be divided into two phases: 1) Project Planning and Training, and 2) Project Implementation. The purpose of these activities was ultimately to improve energy efficiency at OLTCHIM by identifying and recommending corrective measures where energy was being wasted. The environmental goals included reducing greenhouse gases and energy resource conservation.

Phase I: Project Planning and Training

Project Initiation: The project began with several meetings to coordinate the different participants including OLTCHIM SA, Robert Watts Engineering Consulting, and

Petrodesign. Training materials for OLTCHIM were prepared and a training session was conducted with OLTCHIM.

Phase II: Project Implementation

Energy Audit, Steam Plant: The first major step of the implementation of the project involved conducting an energy audit. The steam plant, one of several plants at OLTCHIM, was evaluated regarding the equipment used and the steam, air, water, and fuel flows. The following major recommendations for improving the steam plant were provided:

- boilers should be converted from methane to methane/hydrogen mixture (hydrogen is manufactured on-site),
- condensate return lines should be installed,
- combustion and exhaust air fans should be replaced,
- deaerating equipment should be installed,
- boilers' automatic control system should be upgraded,
- heat exchangers should be repaired where necessary.

Energy Audit, Process Lines: A process audit was conducted which involved measuring and recording energy consumption at the different divisions and plants at OLTCHIM including the chloralkali electrolysis plant, the chlorinated products plant, the vinyl chloride plant, the polyvinyl chloride plant and the propene oxide plant. The consumption of electricity, steam, water, and methane gas by each piece of operating equipment was calculated. The equipment with the highest energy consumption was identified. The total electricity consumption of each division and installation was then determined and the daily energy consumption for each division was calculated. To determine energy loss, the difference between energy delivered and energy consumed for each division was determined. Recommendations for equipment, electrical substations, and process lines were made. The examples include:

- adding heat recovery equipment,
- adding certain unit operations to improve entire processes,
- replacement of pumps, fans, compressors, and motors,
- retiring some electrical substations or disconnecting them and leaving as spare ones.

Assessment of Emissions Avoided: The effects of excess energy use on the emission of nitrous oxides and carbon dioxide were calculated. Also, an analysis of different fuel types used to generate energy was conducted to determine the most feasible, efficient, and least polluting source.

Transfer of Technological Information: A visit to a chemical plant in the USA was organized for OLTCHIM representatives from Bucharest, Romania to visit and learn from practices in the United States. OLTCHIM representatives visited Reichhold Chemical in Jacksonville, Florida and gained several new ideas for improving the efficiency of their plant.

Review of the Legislation: A review of the legislation regarding the generation of steam and electricity was conducted by OLTCHIM. Steps were taken by OLTCHIM to access less polluting fuels when possible.

Plan Implementation and Evaluation: The findings generated through the energy audit and feasibility study are to be implemented over the next five years. Based on an evaluation of costs, payback, and expected life of needed equipment, short-term and long-term plans were generated. Those improvements that can be implemented with minimal cost shall be activated within one year. Other proposals generated from this project shall be implemented over a longer term as sufficient funding mechanisms are put into place and sufficient preparation is done.

Verification: A method for verifying projected energy savings was then developed. The method involved seven steps:

1) establish base line from which to measure annual savings;
2) determine new energy use;
3) compare these readings with the base line;
4) determine cost of plant modification;
5) review and evaluate results;
6) calculate emissions reductions; and
7) produce annual report that itemizes costs of plant modifications, annual savings from plan implementation, emissions reductions, and next steps for long-term plan implementation.

Project Finalization: General meeting of all project partners was convened and a final feasibility study was produced.

Outputs/Results:

- A precise database on OLTCHIM energy consumption and energy losses was produced.
- Several short and long term measures to decrease energy losses were identified, thoroughly assessed and proposed for implementation.
- A report titled, "The effect of power excess on nitrous oxide and carbon dioxide emissions" was compiled.
- New possibility for using less polluting energy source (i.e., fuel mixture comprising hydrogen) was evaluated.
- A good working arrangement between OLTCHIM and an US firm was developed which may be applied to future projects that also provide environmental and economic benefits.
- OLTCHIM personnel acquired sufficient knowledge and skills to perform energy audits in their plants as well as for other similar companies.

Costs of EcoLinks Project:

This project was made possible by an EcoLinks Grant of $50,000 and a cost sharing contribution by grantees of $41,693.

Expected Environmental and Economic Benefits:

Environmental Benefits

The overall benefit of this project is a reduction in energy use. The fuel that is used to generate electricity and steam is reduced which reduces the emission of CO2 and NOx. With the implementation of the project recommendations, an annual reduction of up to 9,000 tons of nitrous oxide and 326,000 tons of carbon dioxide would be achieved.

Economic Benefits and Financial Analysis

The implementation of the short-term measures recommended by this project would allow a savings of $1 million with varied pay back periods. The implementation of the long-term measures would provide a savings of $1.9 million. Table 1 presents examples of energy saving measures, their costs, expected annual savings and a payback period.

Table 1: Examples of identified energy saving measures – financial data

Energy saving measure	Investment outlays [$]	Annual savings [$/year]	Simple Payback Time [years]
Single boiler conversion to CH4/H2 mixture[1]	100,000	173,000	0.6
Replacement of combustion and exhaust air fans[2]	84,000	120,000	0.7
Adding waste water heat recovery system to waste water discharge line[3]	280,000	372,000	0.8
Adding heat recovery furnace at dichloroethylene cracking furnace[4]	250,000	230,000	1.1
Pump replacement at chlorine removal plant	980	2,100	0.5

[1] – The same amount of steam is generated but the CH4 required is reduced: part of currently burnt methane is replaced by hydrogen what reduces the emission of CO2, and also improves the efficiency of a boiler

[2] – The fans are oversized so more air goes into the boiler than is needed. The boiler then needs more fuel to get minimal amount of steam production. Fans are driven by an electric motor, so changing the fans to adjust amount of air that goes into the boiler saves electricity, improves efficiency, and reduces pollution.

[3] – The measure results in heat recovery from the process so less steam is needed

[4] – Heat value of dichloroethylene is captured, moreover, the measure prevents environmental damage by not dumping dichloroethylene into the atmosphere

Transferability:

While the project generated specific analyses relevant to OLTCHIM, some of the analysis applies to equipment and energy consumption in general which can be usefully applied to other settings with similar features. Hence, the latter can be transferred to other contexts with ease. Also, the methodology of energy audit based on thorough process analysis and identification of main energy consumers along the process lines is transferable to other chemical plant utilizing similar technologies.

Lessons Learned:

- Initial meetings in Romania and the site visit to a US chemical plant assisted with building cooperation amongst the project members.
- Obtaining visas for overseas travel cannot be assured and may be rejected for reasons unknown. In the case of this project, two representatives from Romania were to attend a workshop in Washington, DC but were denied visas for unknown reasons.
- Having a record of basic energy requirements and excess energy use is essential for future planning regarding operations and equipment replacement.

Additional Information:

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Ecolinks Grant Program
Best Practice #10

Modernization of Municipal Solid Waste Management in Bulgaria

Abstract

The management of solid waste in the Danube Region of Bulgaria (Region) presents several environmental and economic challenges. The quantities of agricultural crop residues and manure are increasing as a consequence of the urbanization of the agricultural sector since the collapse of communism. Appropriate methods for managing the agricultural wastes have not been established. Many active dumpsites do not meet modern environmental standards, and threaten groundwater supplies and ultimately impact the Danube River. The collection and disposal of solid waste in the Region is frequently performed inefficiently and without the use of proper equipment and methods. These problems are exacerbated by the lack of coordination across the Region to assess needs and the lack of collaboration among the public and private sectors to address these needs.

Modernization of solid waste management provides a basis for overcoming the challenges. With an EcoLinks Challenge Grant, the Association of Danube River Municipalities assembled a project team to explore and initiate several creative methods and practices for improving the management of solid waste in the Danube Region of Bulgaria. Several key actions were taken: 1) a diagnostic survey was conducted to assess the challenges and opportunities related to solid waste management, 2) based on the results of the survey, appropriate technical assistance was developed to target specific needs, and 3) two workshops were held to share information and initiate and build collaborative efforts for implementation of a regional, modern solid waste management program. Based on the survey and the workshops, several subprojects were initiated including developing a demonstration program for composting manure at a local dairy cooperative, upgrading equipment, improving cooperation and coordination among the Region's municipalities, and establishing partnerships with the private sector.

The project is considered as a Best Practice for two primary reasons. First, it provides a model for regional collaboration in addressing solid waste management that allows for the efficient use of resources across communities. Second, the Diagnostic Research of Municipal Solid Waste Management (MSWM) of the Danube Region, prepared within the project, is a demand-driven tool that is useful in targeting technical assistance to communities and identifying opportunities for improvement in solid waste management.

Name of Project: Modernization of Municipal Solid Waste Management in Partnership with the Private Sector: A Danube River Initiative

Project Area: Cleaner Production

Organizations Involved:

Project Leader: Association of Danube River Municipalities (ADRM)

Project Partners:
Institute for Environmental Strategies, Ltd., Sofia, Bulgaria
CalRecovery Inc., Hercules, CA, USA

Location of Project: Danube Region, Bulgaria

Project Duration: August 1, 1999 – November 30, 2000

Problem Statement:

Communities throughout Eastern and Central Europe have suffered greatly under the stresses of transitioning to a market economy. Municipalities are especially hard hit by such changes as they face the immediacy of local problems, the high competition for limited support resources, and the difficulties associated with applying international integration policies of the European Union (EU) at the regional, "on-the-ground" level. One area that specifically reflects all of these challenges is the management of solid waste. Many regions in Central and Eastern Europe continue to rely on traditional solid waste management methods. Poorly managed dumpsites, out-of-date equipment, and a lack of collaboration among municipalities and between municipalities and the private sector contribute to environmental degradation and economic hardship. There is a need to explore modern solid waste management approaches that include fewer, well-planned dumpsites, modern equipment, and regional collaboration.

The Danube Region in Bulgaria is a prime site for the modernization of solid waste management. The population of the Region is about 730,000 and its total area is 8,800 km^2. The Region is mainly rural and it is divided into twenty-four municipalities, members of the Association of Danube River Municipalities. Of the twenty-four municipalities, twenty have organized waste management services and reported on the quantities and composition of waste. Total waste generation in these twenty municipalities (490,000 people) is 333,000 tons/year.

Project Description:

The main project goal was to improve municipal solid waste management (MSWM) and to create opportunities for public private partnership in the MSWM for the Bulgarian Association of Danube River Municipalities (ADRM). The main project's objectives were as follows:

- Formulate cost-effective and market-based solutions to MSWM
- Transfer of techniques for waste minimization
- Enhance public awareness of good practices in MSWM
- Promote regional cooperation between municipalities
- Transfer of techniques for the establishment of public-private partnerships (PPP)
- Promotion of private investment in MSWM in the Region

The project consisted of five main processes: an initial workshop; diagnostic assessment using a survey; interviews and field research; technical assistance and the development of subprojects, and a final workshop.

1) Initial workshop: The workshop titled, "Practical Approaches for Modernization of Solid Waste Management," provided a forum for collaboration between project participants and between project participants and municipality representatives. Thirty-seven people representing the municipalities, NGOs and the media attended. This workshop stressed the exchange of information between project participants and municipality representatives about possibilities and problems with solid waste management in the Danube Region. For example, one daunting problem that municipalities face regarding solid waste management is insufficient means to deal with large amounts of agricultural waste. Through this exchange between project members and attending municipalities, a work plan for initiating a composting program was developed.

2) Second workshop. This workshop consisted of the training of municipal representatives and others in the theory and practice of composting organic wastes. Instruction was given in the classroom as well as in the field. A composting demonstration was conducted with the assistance of a local dairy cooperative using locally available animal manure and straw as the feedstocks. Among other training, representatives of the cooperative were given instruction on initiating, maintaining, and monitoring the composting process.

3) Diagnostic Research of MSWM of the Danube Region: A survey was based on extensive interviews and field visits regarding the status of solid waste management in the Danube Region of Bulgaria. The target audience of the survey comprised:
    - Twenty four Danube River Municipalities;
    - Policy makers;
    - External funding agencies;
    - Potential private strategic investors.

    The data gathered included information about the equipment, methods, costs, and management structure involved in collecting and transporting solid waste. The survey was used additionally as a diagnostic tool to determine the opportunities for improving solid waste management. The main problems identified during the survey were as follows:

Organization of MSWM

- Existing organization is inefficient;
- The frequency of the waste collection is rare;
- The vehicles are not full on some trips to the landfills;
- Only the main towns have organized service;
- There is no separate collection for agricultural waste and manure and ash.

Waste Generation

- There is no reliable measurement of generated waste;
- The amount of the generated agricultural waste and manure is high and is mixed with household waste.

Equipment and vehicles

- The vehicles are obsolete and too expensive to operate and maintain;
- The containers are too old and too few.

Landfills

- There are too many authorized landfills;
- Generally, the landfills are poorly operated in terms of management of land use
- Some closed landfills could use remediation to mitigate their probable environmental impacts
- Almost all of the landfills are uncontrolled and without security (e.g., a guard and gate);
- Landfills in the smaller towns are mainly used for disposal of agricultural crop waste and manure since these are the majority of the types of waste that are produced and require disposal in these locations.

Financial issues

- The waste fee is insufficient to cover the cost for waste management;
- The expenses for maintenance and repair are too high.

Basic recommendations resulting from the survey are as follows:

Organization

- New know how should be introduced for modern waste management through modernization of municipal waste management companies, and privatization of the service or the company;
- Organized waste management should be introduced to all settlements.

Waste Generation

- Measurement stations should be installed in some of the landfills;
- Agricultural manure and organic waste should be handled separately and wherever feasible through composting.

Equipment and vehicles

- Modern vehicles with compacting systems should be introduced;
- The old containers should be gradually replaced and standardized;
- Most of the landfills should be closed;
- At first, there should be no more than one landfill in each settlement, later landfills should become regionalized.

Financial issues

- Replacement of the existing vehicles with modern equipment will reduce operating costs;
- Use fees should be introduced on guarded landfills.

The results of the survey, interviews, and field visits were then used as a basis for targeting technical assistance to design and carry out the following subprojects:

- Modernizing equipment and introducing more efficient management practices in MSWM
- Establishing public private partnership
- Improving landfilling practices and rehabilitation
- Identifying opportunities for cooperation between municipalities in developing regional landfills
- Minimization of the waste by composting of agricultural and organic waste
- Promoting micro-enterprises for MSWM in towns without organized services.

4) Subproject Development and Technical Assistance on MSWM: The technical assistance provided to Municipalities was demand driven. The Municipalities (members of ADRM) agreed with the Project Team Members as to their needs for assistance and the method of delivering it. The initiated subprojects were as follows:
   a) Modernization of the Waste Collection Equipment in Belene, Nikopol and Gulyantzi;
   b) Cooperation between the Municipalities for Construction of a Regional Landfill for Household Waste in Oriahovo;
   c) Waste Minimization in Borovo Municipality;
   d) Privatization of MSWM in Vidin Municipality;
   e) Environmental Service by Small and Medium Enterprise in Tsenovo; and
   f) Public Awareness Campaign.

A list of typical documents generated for every subproject includes multi-option financial analysis of different solutions, analysis of legal options for cooperation between institutions, draft agreements for cooperation, applications to Environmental Agencies (e.g., the National Environmental Fund) for financial support, tender documents, draft contracts, and promotional materials. For the subproject in Borovo Municipality, a pilot composting project was implemented

that provided the necessary data for developing guidelines on the collection and composting of organic waste and manure.

5) Final workshop for planning follow-up activities: In this workshop, alternatives and recommendations from each subproject were presented. These alternatives and recommendations are published in a paper, "Guidelines on Modernization of MSWM." Follow-up activities were discussed.

Outputs/Results:

Several products were generated through this project:

- Published results of the diagnostic survey on solid waste management in 24 municipalities that outline waste management needs and opportunities for improving solid waste management in the Danube Region in Bulgaria.
- Templates for building public-private partnerships, including examples of contracts for services and tender documentation that can be used in other similar circumstances.
- Upon the successful application for funds from the National Environmental Fund in Bulgaria, two member municipalities in the Danube Region were supplied with a modern waste collection vehicle and containers.
- Six subprojects were developed and implemented that yielded important information for modernizing solid waste management. Recommendations and alternatives for reducing waste, reducing the costs of waste collection and disposal, and improving opportunities for the construction of a regional landfill and for collaboration with the private sector were generated.
- Two workshops were conducted that strengthened collaborative ties in the Region and helped to identify local problems, coordinate solid waste management both among municipalities and between municipalities and the private sector, and explore different funding mechanisms.
- A public awareness campaign specifically generated several designs for an informative brochure and posters, two case studies, and an overall public awareness campaign strategy. The survey results were published with EcoLinks in a document titled, "Survey of Municipal Solid Waste Management in the Danube Region."

Costs of EcoLinks Project:

The total expenditures for the project were $49,972 of which $37,492 was funded through an EcoLinks grant and $12,480 was provided as cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

The environmental benefits derived from this project included:

- Reduced air pollution. The collaborative purchase of new trucks and containers for transportation and disposal of waste reduced air pollution from fuel exhaust since there were fewer trucks carrying fuller loads and making fewer trips to the dumpsite. Trucks with compactors require fewer trips to the dumpsite.
- Waste minimization and improved soil quality. The recommendations for implementing a composting program for organic waste provided ways for minimizing waste, reducing water pollution, and improving soil conditions. The implementation of a composting program would divert organic waste from the landfills avoiding increased contamination of surface and ground waters and environmental damage to the Danube River. Through composting, organic waste is transformed into a useful material that improves soil quality.
- Leachate prevention. If implemented, a modern regional landfill would be more sanitary than localized, unregulated landfills. A modern landfill is more effective in preventing leachate than localized landfills that tend to be poorly regulated.
- Improved regulation. With the promotion of public-private partnerships, the municipalities could take on a stronger regulatory role while allowing the private sector to take care of waste collection and disposal activities. With improved regulation of solid waste collection and disposal, environmental damages can be minimized.

Economic Benefits

Each subproject provided alternatives for generating several economic benefits. The benefits from these subprojects included the following:

Reduced annual expenses of waste collection and disposal. Purchasing co-shared machinery with a five-year payback period (as promoted by the Bulgarian National Environment Protection Fund) and weekly collection can reduce county annual expenses associated with waste collection and disposal approximating fifty percent. In some counties annual costs are reduced by more than fifty percent. Belene County could reduce annual expenses for machinery and containers and direct expenses of waste collection from $43,943 to $22,199, reducing its annual costs by $21,744. In Oriahovo County, the existing collection system costs $26,657 per year. With upgraded co-shared equipment, annual costs would be $10,508, an annual savings of $16,149. With a twice-a-week disposal scheme, expenses would be even less with 15 to 20% cost reduction compared to the existing waste collection and disposal system.

Reduced financial and management burdens for municipalities. By opening up the provision of solid waste management services to private enterprises, certain economic benefits may be realized. Municipalities may be entitled to dividends from sold shares. Capital flow is increased and can be used to invest in new equipment that can lead to further savings. Municipalities can take on a predominantly regulatory role possibly decreasing their workload.

Reduced construction costs. *It is less costly to engage counties in a collaborative* effort to construct a regional landfill than to reconstruct municipal landfills. For example, with four participating counties of the Danube Region including Oriahovo, Kozlodui, Mizia, and Kneza, the expenses associated with the construction of a regional landfill would be $1,819,588. The total reconstruction value of existing municipal landfills would be more costly at $3,729,700. Constructing a regional landfill, therefore, could provide a savings of $1,910,340.

Greater conservation of landfill space and increased value of soil. Several economic benefits are accrued from composting organic waste. Composting organic waste diverts waste from 1) unregulated sites where it can cause environmental damage, which is costly to repair or mitigate, and 2) the municipal landfills where the increased load adds to transportation costs and unnecessarily places burdens on landfills meant solely for disposal of household waste. In some communities in the Region, manure constitutes 70% of the total waste generated. Manure compost has a high nutrient content. Therefore, the compost product generated from agricultural waste and manure can increase the value and crop yield of marginal agricultural soils. The economic value inherent in the nutrient content can be realized as an in-kind payment to employees who help to process the organic waste or by selling the compost to cover the cost of composting the material.

Transferability:

The project's regional approach to solid waste management can be adopted by other small municipalities in Central and Eastern Europe and NIS. Specifically, the diagnostic survey can be used to address particular problems of different localities and yet inspire regional solutions. This averts a "cookie cutter" approach and allows for problems to be defined at the local level while broadening the possibilities for creative solutions that can only be generated on a regional scale.

Lessons Learned:

The following lessons were learned during this project:

- Local government elections can delay project implementation as transition to the new governing body takes place. Further, support from newly elected officials may need to be recruited and adjustments to the project may have to be made to consider their perspectives.
- "Thinking regionally" is generally new to Bulgarian municipalities. It may be necessary to train municipalities to think on a regional level to help them to conceptualize and implement projects at the regional scale.
- The needs and interests of the different parties should be clarified during discussions to initiate public-private partnerships.
- The viability of commercial activities regarding solid waste management needs to be clearly articulated to municipalities in order for them to consider it a priority agenda item.
- A low-cost alternative to the EU-standard landfill should be explored because municipalities in the near- to medium-term may not be able to financially support high-technology landfill operations.

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EcoLinks Grant Program
Best Practice #11

Rehabilitation of Small Hydro Power Plants in Macedonia

Abstract

Out of a total of eighteen Small Hydo Power Plants (SHPPs) in Macedonia, seven have been in operation for more than forty years. The equipment installed in these plants is obsolete and worn-out to an extent that their future operation is in question. Disconnecting these plants from the system would require replacing the energy they produce with energy from thermal plants resulting in increased greenhouse gas emissions.

The goal of this project was to analyze the basic technical, financial and environmental aspects of rehabilitating these seven small-scale hydro power plants (SHPP). A Rehabilitation Study was prepared and will be used as a basis for obtaining financing for the actual rehabilitation.

The project was led by the Electric Power Company of Macedonia working in cooperation with Elektroprojekt, a Croatian consulting firm. Additional assistance was provided by the faculty of mechanical engineering at the Hydraulic Engineering and Automation Institute in Macedonia.

As a result of this project, it was determined that rehabilitation of these seven SHPPs is a feasible and profitable venture. The rehabilitation will result in increased generation of electric energy by 17% from 86.4 GWh to 101.4 GWh annually. With this increase in production, an additional income of $320,000 to $640,000 per year is expected. In addition, the rehabilitation of the SHPPs will result in avoided emissions of 136.3 tons of CO2/annually, as well as achieving other important environmental and social effects.

To finance the rehabilitation, the leader decided to use a rehabilitate-operate-transfer (ROT) financing model to rehabilitate all seven SHPPs as a package. The findings of the EcoLinks financed project will be used as a baseline during the discussions and negotiations with the prospective investor.

This project provides a detailed model for other organizations seeking to maximize the efficiency of electricity generation using older hydro power plants.

Name of Project: Rehabilitation of Small Hydro Power Plants

Project Area: Global Climate Change, hydro power, energy efficiency

Organizations Involved:
Project Leader: Electric Power Company of Macedonia
Project Partner: Elektroprojekt, Zagreb, Croatia
Associates: Faculty of Mechanical Engineering, Hydraulic Engineering and Automation Institute, Skopje, Macedonia

Location of Project: Macedonia

Project Duration: September 11, 2000 to April 16, 2001

Problem Statement:
The system of electrical energy production and distribution in Macedonia is centralized and operated by the Electric Power Company of Macedonia – the Project Leader for this EcoLinks financed project. Annual production of electrical energy in Macedonia amounts to 6500 GWh. Electrical energy is produced mainly from lignite coal and heavy fuel oil, which results in heavy air pollution. Energy generation using hydro power represents 20% of the total amount, i.e., 1300 GWh. Out of this amount, 170 GWh are produced by small hydro power plants (SHPP). Out of the total of 18 SHPP in Macedonia, 7 have been in operation for more than 40 years. The equipment installed in these plants is obsolete and worn-out to an extent that their future operation is in question. Disconnecting these plants from the system would require replacing the energy they produce with energy from thermal plants resulting in increased greenhouse gas emissions.

Project Description:
The goal of the project was to analyze the technical, financial and environmental aspects of rehabilitating the seven SHPPs. This was done by preparing a feasibility study that will be used as a basis for obtaining financing for the actual rehabilitation of the plants.

The project consisted of the following activities:

- Visit each plant. This activity provided a visual review of each facility and its current condition. The powerhouses, mechanical and electrical equipment, and intake facility were reviewed in detail. Also, the civil works that need to be undertaken were noted.
- Collect data. All existing data and documentation from the leader's database and SHPPs were collected. This activity was crucial because it set up the basis for all of the following activities. Documents collected for each plant included the development plans, tariff information, map of the plant location, monthly generation of the plant, traffic connections, water management issues, technical data and documentation, map of the electric power system, and single line diagrams of the plant's grid connections.
- Review existing documentation. During this activity, the collected data and documentation was reviewed and analyzed in order to define the present condition of each plant's facilities and equipment.

- Develop the baseline for the rehabilitation. The present condition of each plant's civil structures and equipment was evaluated to determine the need for rehabilitation and the possibilities for enlargement of the installed capacity.
- Formulate and analyze the alternatives for rehabilitation. Three possible alternatives were formulated regarding the rehabilitation of the plants. Case 1 involved rehabilitation of the existing equipment without enlargement of its basic technical and operational performances. Case 2 provided rehabilitation and upgrading of the equipment with possible increasing of the installed flow, within the existing dimensions. Finally, Case 3 required a full replacement of main and auxillary equipment, with the ability to increase the installed flow.
- Select and recommend technical solutions for the rehabilitation of each SHPP. Based on the findings during the inspections of the plants and the analyses completed during the previous activities, recommendations for reconstruction of civil engineering works, as well as hydro-mechanical and electrical equipment rehabilitation was presented for each plant.
- Assess the costs and benefits of the rehabilitation. During this activity, the optimal solution for each rehabilitation case study was selected for each plant.
- Develop implementation models. This activity concluded the preparation of the documentation needed to complete the Rehabilitation Study. The implementation models for the project were developed according to Macedonian legislation.
- Compile the information and prepare the Study for Rehabilitation. The information and results regarding the evaluation of the technical solutions, economic and financial assessment, proposed strategies for project implementation, and the assessment of project financing schemes where discussed within the team and the final study was prepared.

Outputs/Results:
Major conclusions of the feasibility study regarding the rehabilitation are as follows:
(1) All 7 SHPPs are maintained in a condition that justifies their rehabilitation;
(2) The rehabilitation should be completed in a manner that would allow operation of the plants as variable or peak (energy production) plants. This results in construction of daily inflow compensation reservoirs, for the plants where construction of such facilities is possible;
(3) The existing hydro mechanical equipment should be partially replaced and upgraded in all 7 SHPPs. The extent of rehabilitation depends on the existing condition of the equipment and is based on the feasibility of rehabilitation and/or upgrading for each plant;
(4) The existing electrical equipment should be rehabilitated on all 7 SHPPs.

Costs of EcoLinks Project:
This project was made possible by an EcoLinks Grant of $49,266 and a cost sharing contribution by grantees of $21,193.

Expected Environmental and Economic Benefits:
Environmental Benefits
The rehabilitation of the 7 SHPPs will result in avoided emissions of 136.3 tons of CO2/annually. In addition, since all 7 SHPPs are an integral part of the water management system in Macedonia, the rehabilitation and extension of the plants' life span will result in significant social effects as well as non-measurable environmental effects such as sustained water management and reduced soil deterioration.

Economic Benefits and Financial Analysis

The rehabilitation will result in increased generation of electric energy by 17% from 86.4 GWh to 101.4 GWh annually. With this increase in production, an additional income of $320,000 to $640,000 per year is expected.

The total investment outlays for the rehabilitation amount to $14.5 million. For all 7 plants, the Internal Rate of Return (IRR) ranges from 45.8% to 16.9%. IRR for one of the analyzed plants has a negative value, -6%, but this plant will also be rehabilitated with the costs to be covered from the increased income of the other 6 plants.

Below is a chart which provides information for each of the 7 plants regarding yearly energy production, total investment, average yearly benefits and costs, as well as, internal rate of return (IRR).

Hydro Power Plant	Yearly Energy Production Before rehab	After rehab	Total Investment	Ave. Yearly Benefit	Ave. Yearly Costs	IRR
Dosnica	15,020 MWh	16,050 MWh	$2,118,150	$ 745,110	$ 391,684	23.0%
Kalimanci	17,330	18,790	2,520,300	1,509,600	563,163	45.8%
Pena	9,430	10,250	947,670	435,625	262,378	25.8%
Pesocani	10,290	11,010	1,571,235	511,360	299,136	19.9%
Sapuncica	9,960	10,700	1,421,370	489,090	295,905	20.2%
Zrnovci	4,190	4,430	1,148,020	209,440	276,982	-6.0%
Matka +	20,140	30,180	4,787,454	1,282,650	743,492	16.9%
Total	**86,360MWh**	**101,410MWh**	**$14,514,199**	**$5,182,875**	**$2,832,740**	

Regarding the possibilities for financing the rehabilitation, based on the company's present financial status, the Leader decided to use a rehabilitate-operate-transfer (ROT) financing model that would embrace the rehabilitation works for all 7 SHPPs. In this respect, the findings of the EcoLinks financed project will be used as a baseline during the discussions and negotiations with the prospective investor.

Transferability:

The project can be easily transferred and implemented by any other public or private organizations in the region dealing with energy production using hydro power. Issues that appear to be site sensitive and that should be carefully analyzed for each specific project are: (1) determining the energy production regime in which the rehabilitated plants work (base, variable or peak – typically, SHPPs work as peak energy plants); and, (2) determining the price of energy that will be used as the baseline for financial/profitability analyses.

Follow-up:

The Leader has decided to finance the rehabilitation of the analyzed SHPPs through a rehabilitate-operate-transfer model. The procedure for the selection of an investor/co-owner has already started. It is expected that the actual rehabilitation will start soon.

Lessons Learned:

- Rehabilitation of existing hydo power plants can lead to increased electricity generation as well as positive environmental effects and should be looked as an alternative to developing a new facility.
- A critical factor for the successful implementation of similar projects is the scope and reliability of existing input data, such as flow measurements, electrical energy production records, and technical documentation for the plants.
- The Rehabilitate-Operate-Transfer (ROT) financing model is a viable option for many enterprises in the region that have limited financial resources.

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Ecolinks Grants Program
Best Practice #12

Improving Environmental Performance at a Potato Chip Plant in Kazakhstan

Abstract

The Almaty Snack Food Company (ASF) potato chip plant is a newly established (1998) company located in Talgar, Kazakhstan. The ASF plant is relatively small, employing 40 people and producing about 80 metric tons of chips per year. The potato chip processing plant is located in a former fruit storage warehouse, which did not have any on-site wastewater treatment facilities and is not hooked up to city sewage. As a result, during ASF's first year in production, over two metric tons of untreated wastewater from the plant were dumped into a nearby stream. Energy and water use levels were about 30% higher per unit of production than comparably sized plants in the United States, and correspondingly, production costs were almost prohibitively high. Plant management decided to look for options to minimize their impact on the surrounding environment and to make more efficient use of resources in order to lower their production costs.

Together with American partners Savory Snacks, LLC and Environmental Control Opportunities (ECO), ASF was awarded an EcoLinks Challenge Grant in February 2000 to design and implement an Environmental Management System (EMS) at the factory and to identify and implement measures to make more efficient use of natural resources in the production process. As a result of this EcoLinks funded project, a wastewater filtration and partial water recycling system was installed at the plant site. Improvements in processing and management practices were implemented, which have significantly reduced water and energy consumption at the plant. Following implementation of these practices, ASF's cost of production for 1 kilogram of chips dropped from $3.60 to $1.70. Working together with the American partner ECO, an EMS system was designed and implemented at ASF plant facilities.

The project can be considered a Best Practice because it shows the value of using a systematic approach to assess and address environmental problems. Using EMS training and development as a framework, the project team looked at the entire production process, from initial inputs to final product and waste outputs. This approach resulted in improvements that not only lowered the toxicity of waste and pollution, but also in several stages, prevented waste/pollution altogether. The project also demonstrates that for most small and medium sized producers in the NIS, relatively low cost improvements and changes in management practices may bring significant results not only to the environment, but to the company's bottom line.

Name of Project: Environmentally Friendly Potato Chip Production at the ASF Plant in Talgar, Kazakhstan

Project Area: Environmental Management Systems, Water Conservation and Recycling

Project Partners:
Project Leader: Almaty Snack Food Company Talgar Potato Chips Producing Factory (Talgar, Kazakhstan)
Project Partner: Savory Snacks, LLC (Madison, Wisconsin)
Project Partner: Environmental Control Opportunities, LLC (Richmond, Virginia)
Project Associate: FoodMaster (Kazakhstan)

Location of Project: Talgar, Kazakhstan

Project duration: February 2000 - January 2001

Background

The ASF potato chip plant is a newly established (1998) company located in Talgar, Kazakhstan. It is the first potato chip plant established in Kazakhstan. The ASF plant is relatively small, employing 40 people and producing about 80 metric tons of chips per year.

The potato chip plant is located in a former fruit storage warehouse that prior to project implementation, did not have any on-site wastewater treatment facilities. ASF facilities are not hooked up to city sewage.

Before project implementation, ASF used small, poor-quality potatoes in chip production. The poor quality of potatoes used resulted in a high waste/output ratio. In addition, ASF, does not have access to fresh potatoes for over half of the year, which means long-term storage of potatoes during out of season months. Due to the poor quality of potatoes used and the need for long-term potato storage, "blanching" the raw chips in hot water before the frying process was necessary in order reduce the sugar content of the potatoes to prevent browning. The blanching process is the single largest user of energy and water at the plant (about 75% of the plant's energy and 33% of the plant's water needs). Water released from the blancher has an extremely high starch content, which in turn threatens the integrity of the stream to which wastewater flows.

Problem Statement

During ASF's first year in production, over two metric tons of untreated wastewater from the plant were dumped into a nearby stream. This processing wastewater from the ASF plant has a very high starch content, which in turn overloads the nearby stream with biological contamination.

Energy and water use levels were about 30% higher per unit of production than comparably sized plants in the United States, and correspondingly, production costs were almost prohibitively high. Plant management decided to look for options to minimize their impact on

the surrounding environment and to make more efficient use of natural resources in order to lower their production costs.

Together with American partners Savory Snack, LLC and Environmental Control Opportunities (ECO), ASF was awarded an EcoLinks Challenge Grant in February 2000 to design and implement an Environmental Management System (EMS) at the factory and to identify and implement measures to make more efficient use of natural resources in the production process. As a result of this EcoLinks funded project, a wastewater filtration and partial water recycling system was installed at the plant site. Increases in process efficiencies and management practices have significantly reduced water and energy consumption at the plant, and unit production costs have correspondingly dropped from $3.60 to $1.70 per kilogram. Working together with the American partner ECO, an EMS system was designed and implemented at ASF plant facilities.

Project Description

The main objective of this project was to improve environmental performance of the ASF Talgar Potato Chips Producing Factory. Specifically, plant management wanted to reduce water consumption and address wastewater problems at the plant site; to improve the input to product output ration, to introduce ISO 14000 standards at the plant and to develop and implement an Environmental Management System.

The project activities were as follows:

1) Initial environmental assessment of plant facilities and management processes. ECO focused their assessment on water issues: on the source and cost of the water supply, general information on topography and soil, cleaning practices for the fryer and use of chemical cleaners, investigation of local options for sampling and analysis of wastewater, amounts of water used at each stage in the process, evaluation of wastewater from the plant on surrounding surface waters and review of legal regulatory requirements at the plant. Savory Snaks looked at the production process itself, from the quality of input potatoes and their processing (specifically the blanching, peeling, and frying stages) to the ratio of inputs to product produced, and the corresponding waste streams.

2) ECO and Project Associate FoodMaster conducted initial introductory training for staff on EMS and ISO standards. The training involved an overview of the ISO 14001 Standard, explaining each clause of the Standard with examples of implementation. During the training, information for a gap analysis at ASF was also gathered.

3) During February 2000, samples of wastewater outputs at all stages in the production process were taken and tested on site for pH levels, conductivity, turbidity, dissolved oxygen, temperature and salinity. Samples were brought to the United States for laboratory analysis and tested for total solids, total suspended solids, and total dissolved solids. Wastewater samples showed that ASF's biggest problem is the low level of oxygen (due to biological overloading) in its discharge water, which threaten integrity of the stream into which the wastewater flows.

4) ECO provided recommendations to address ASF's wastewater problems based on environmental analysis and results of lab samples. Specifically, ECO recommended introducing a water filtration and partial recycling system at various points in processing. The system recommended by ECO begins with the installation of a settling tank, where starch can be settled out from process waters, and re-used locally. After starch is removed, the water passes through a sand filtration system, combined with a mild disinfectant. Following sand filtration, the water can be recycled to be used at least twice in the process washing basins. A trickling filter is constructed for the final wastewater output, using crushed stone to aerate the wastewater (due to financial constraints, more expensive methods such as a commercial aerator or circulating pump were not feasible), in order to increase the oxygen level in ASF's wastewater.

5) Savory Snacks developed recommendations on improving input to product ratios. Recommendations focused on introduction of an optimal potato variety (a larger, high starch, low-sugar potato), implementing optimal storage methods (appropriate temperature control and the use of dormancy enhancers) and processing techniques in order to reduce the need for the blancher and improve input/output ratios. Savory Snacks also trained ASF staff to use a hydrometer to test the dry content of potato varieties (optimal potatoes for chipping have a high dry matter content).

6) ASF began working with local farmers in Talgar to optimize potato varieties and to harvest larger potatoes (thereby reducing the peel/potato ratio) according to Savory Snack recommendations. ASF modified the blancher, equipping it with additional conveyers, which improve the water consumption/chip ratio.

7) Four employees from ASF traveled to the United States to learn about pollution prevention methods at US chips-producing facilities and to attend SnaxPo 2000, an annual exhibition sponsored by the Snack Food Association of America. The group visited the Poore Brother, Inc. potato chip plant in Arizona and toured the plant's wastewater facility. They also visited the Good Chips, Herr Foods and Martin's Chips plant sites. This trip was arranged by Savory Snacks, LLC.

8) During June, ECO continued training for ASF employees on the ISO 14001 Standard Clauses: Environmental Aspects/Impacts Analysis; Objectives, Target, and Environmental Management Programs; and Environmental Procedures. Training involved reviewing environmental aspects/impacts related to the ASF plant and its operations. ECO worked with staff to develop environmental objectives and targets. Upper management developed a schedule to complete EMS documentation with employees.

9) Documentation for obtaining an environmental passport was prepared (an environmental passport is much like a permit, and is required for all industrial producers in Kazakhstan. Environmental Passports are issued by the regional department of the Ministry of Ecology). Required documentation prepared included description of all inputs, the production processes and facilitates, the impact of the plant on the environment, and a description of local climatic and hydrological conditions. Based on this application, ASF was granted a passport in December 2000. The passport outlines allowable wastewater and pollution concentration limits for ASF production facilitates.

10) The wastewater filtration, treatment and partial recycling system recommended by ECO was installed at the ASF plant.

11) ECO developed core ISO 14001 Environmental Procedures related to the ASF plant (this is a core document required by the ISO 14001 Standard, and necessary for an effectively functioning Environmental Management System) in cooperation with ASF plant management. ASF and ECO worked together to develop an Environmental Management System Manual. ECO recommends that ASF implement EMS for two to three years before attempting to receive official registration. Prior to this, ASF may opt for self-declaration.

Outputs/Results

The following outputs/results were achieved:

- An Environmental Management System was developed and implemented at ASF plant facilities. An EMS manual for ASF was developed, which identifies the environmental policy of the company.
- Testing on potato varieties in order to identify the most optimal sort which could be grown locally and which would result in a reduced need for the blanching process was conducted. New potato strains and growing techniques were introduced to produce a more optimal potato.
- A plan for achieving ISO 14000 standard certification was developed.
- A water filtration and partial recycling system was installed at ASF plant facilities. This system will reduce the amount of wastewater ASF creates by approximately 70%.
- The blancher was equipped with additional conveyers, which improve the water consumption/chip ratio.
- An environmental passport was received from the regional department of the Ministry of Ecology.
- Improved management and processing procedures were put in place. As a result, it was possible to completely phase out the blancher from September to January, saving 75 % of total energy and 33% water use during these months.
- Wastewater from plant processing is now regularly analyzed and monitored on site.
- The coal-fired boiler used to heat the administrative offices of ASF's facility was replaced with a LP gas turbine.

Follow-up Activities

ASF continues to work with local farmers to introduce farming techniques and high starch potato strains, which will further reduce the need for the blancher.

ASF continues to implement the Environmental Management System. ASF plans to implement EMS for two to three years before attempting to receive official registration.

Costs of Ecolinks Project

The total cost for the preparation of the project was $61,950, of which $46,350 was funded through an Ecolinks grant and $15,600 was provided as cost share.

Expected Environmental and Economic Benefits

Environmental benefits

As a result of this project, wastewater volume was reduced by nearly 100%. In addition, final wastewater output reaching the stream is less polluted, containing less starch and a higher oxygen content.

Energy needs were decreased by over 30% annually.

Economic benefits

The implementation of improved management practices and processing efficiencies reduced production costs of 1 kilogram of chips from $3.60 from to $1.70

Transferability

The Environmental Management System Manual and Procedures, developed for ASF as a part of this project, could be useful for other small-scale producers in the NIS interested in developing and implementing EMS.

The low-tech water filtration and aeration system installed at ASF can be used by other small-scale food/drink producers in the NIS.

Lessons Learned

- Like most small to medium size producers in the NIS, ASF production profits have not reached the level where the purchase of state of the art environmental controls and technologies can be justified. Project recommendations were successfully implemented because the American partners presented low-cost solutions, that could be implemented using local materials and that are easily maintained.

- Due to financial constraints, ISO 14001 certification is probably not realistic for most small scale producers in the NIS. However, even without certification, the Standard, and specifically EMS sections, can be a very useful tool in implementing a systematic approach to assessing and addressing environmental problems.

- Most small and medium sized producers in the NIS can implement relatively low cost improvements and changes in management practices that may bring significant results not only to the environment, but to the company's bottom line.

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Ecolinks Grants Program
Best Practice #13

Reducing Fly-Ash Emissions at the Vladivostok Municipal Waste-to-Energy Facility

Abstract

Speczavod N1 is the only waste-to-energy facility in Russia Far East. The Speczavod facility was built in a residential area of Vladivostok in 1979. The facility has three incinerator units and was designed to burn up to 432 tons of unsorted municipal waste per day and produce almost 400,000 tons of steam annually for residential heat and hot water production. Speczavod was originally equipped with electrostatic precipitator systems (EPS) to capture fly ash generated during the waste incineration process. These EPS units captured about 80% of the fly ash, however, due to the humid climate conditions in Vladivostok, they lasted only about 10 years. Speczavod was built without controls for acid gas emissions.

Before project implementation, Speczavod had a very negative public image and the previous city mayor had tried to close the facility. Speczavod was forced to run at less than full capacity because of unacceptably high fly ash emissions (approximately 2000 tons per year -- over 14 times higher than permitted levels). 232 tons of SOx, 78 tons of NOx, and 84 tons of CO were also emitted annually. Incinerator efficiency was low and burning temperatures frequently dropped to 300-500C. As a result of low incineration temperatures and the high level of organic material in Vladivostok's waste steam, dioxin emissions were also high.

In January 2000, Speczavod and its American partner Energy & Environmental Consulting Engineers (EECE) were awarded an EcoLinks Challenge Grant to identify options for reducing Speczavod's pollution emissions. Speczavod has already secured funding to implement several recommendations from the EcoLinks-funded project, which have resulted in significant decreases in fly-ash emissions, dioxins, CO and SO_2 emissions. As a result of the EcoLinks funded project, the energy efficiency of one of the incinerator units was increased by 36%, which in turn has resulted in significant economic benefits for Speczavod through increased steam production and sales and reduced auxiliary fuel purchase.

This project can be considered a Best Practice for several reasons. The Project Team was careful to develop low-cost recommendations appropriate to local conditions. The Team prioritized possible options, so that the most pressing needs could be addressed first. Furthermore, the Team's project findings/recommendations, and even developed technical plans, are highly transferable to waste-to-energy facilities in other countries in the region..

Name of Project: **Clean Sky for Vladivostok: Incorporation of Environmentally Acceptable Air Pollution Control and Ash Utilization Technology at the Vladivostok Municipal Waster to Energy Facility**

Project Area: Cleaner Production

Project Partners:
Project Leader: Vladivostok Municipal Waste to Energy Facility "Speczavod 1"
Project Partner: Energy & Environmental Consulting Engineers (EECE), Mission Viejo, CA, USA
Project Associates: Daltechenergo (DTE); Testing Center Dalstroiipysania (TDC); Pacific Institute of Distance Education and Technologies, Far Easter State University (PIDET)

Location of Project: Vladivostok, Russia

Project duration: February 2000 – January 2001

Background

Speczavod N1 is the only waste-to-energy facility in Russia Far East. The Speczavod facility was built in a residential area of Vladivostok in 1979. The facility has three incinerator units and was built to process up to 432 tons of unsorted municipal waste per day. Speczavod was originally equipped with electrostatic precipitator systems (EPS) to capture fly ash created during the waste incineration process. These EPS units captured about 80% of the fly ash, however, due to the humid climate and cold winter temperatures in Vladivostok, they lasted only about 10 years. The filters were made in East Germany and could not be replaced after the reunification of Germany and the collapse of the Soviet Union. Speczavod was built without controls for acid gas emissions.

Problem Statement

Before EcoLinks project implementation, Speczavod had a very negative public image and the previous city mayor had tired to close the facility. Speczavod was forced to run at less than full capacity because of unacceptably high fly ash emissions (approximately 2000 tons per year -- over 14 times higher than permitted levels). 232 tons of SOx, 78 tons of NOx and 84 tons of CO were also emitted annually. Incinerator efficiency was low and burning temperatures frequently dropped to 300-500C. As a result of low incineration temperatures and the high level of organic material in Vladivostok's waste flow, dioxin emissions were high.

In January 2000, Speczavod and their American partner Energy & Environmental Consulting Engineers (EECE) were awarded an EcoLinks Challenge Grant to identify options for reducing pollution emissions at Speczavod.

Project Description

The overall objectives of the project were to: (1) address Speczavod's fly-ash emission problem through development and installation of a fly-ash capture system; (2) assess the potential for utilization of fly-ash in concrete materials; (3) identify technical options for reduction of SOx and NOx pollution.

The project activities were as follows:

1 During the initial stages of the project, the Project Team, including the American partner, met with local government officials, and the mayor of Vladivostok to lobby support for the project. The city administration agreed that if the project developed realistic and low cost options, money could be secured from the municipal budget for implementation of modernization of one incinerator unit and installation of a fly-ash control system on one incinerator unit.

2 Daltechenergo conducted a baseline environmental and technical assessment of Speczavod. Using a QUINTOX gas analyzer, Daltechenergo determined SO_2, NOx, fly ash and CO emission levels. [Annual pre-project emission rates for one incinerator unit: SOx: 232 tons; CO: 84 tons; NOx: 78 tons; fly ash: 2000 tons]. Another important finding of the technical assessment was that bag houses and electrostatic precipitation systems (the two most common fly-ash capture systems) are not suitable for Speczavod. The Vladivostok climate is too humid for EPS units and the high content of calcium and food in the municipal waste processed at Speczavod generates acid gases that require special materials for bag houses and frequent replacement of EPS units.

3 EECE analyzed and provided Speczavod with information on American experience in environmental controls on similar sized waste-to-energy facilities. EECE provided Speczavod with engineering options and designs of pollution control equipment from the following US manufacturers: BELCO Technologies, Environmental Elements Corporation, Wheelabrator Air Pollution Control, Research-Cotter, Procedair, and Western Precipitator. EECE also provided Speczavod with literature on municipal waste combustion and ash. Over 100 pages of this literature were translated into Russian and are available on the cleansky website.

4 EECE researched and introduced the Project Team to acceptable US and European environmental standards.

5 April 23-28 2000 the director and chief engineer of Speczavod, and the director of International Programs, PIDET, traveled to visit waste utilization facilities in Southern California. The group studied US technology, equipment manufactures, and US regulations and standards for operating solid waste management facilities. The trip was organized by EECE. Information received during the trip on the use of phosphate additions in ash-based concrete slabs was translated into Russian and is published on the cleansky web site.

6 Using information gained from Daltechenergo's environmental and technical assessment of Speczavod, Speczavod prepared a document entitled "Expert Conclusions on Speczavod's Technical and Ecological Characteristics". This document was submitted to the Regional Department of the Government Committee on Nature Protection (GosKomPrirody). GosKomPrirody subsequently set emission quota standards for Speczavod. Emission quotas were needed before pollution reduction equipment could be selected.

7 Creation of web site http://www.dvgu.ru/vido/cleansky/ and e-mail list serve dedicated to disseminating international experience on "greening" waste-to-energy facilities and on the project's achievements.

8 The Far Eastern Research Institute on Construction Testing Center Dalstroiipytania ran a series of tests on Speczavod fly ash composition and to determine the appropriateness of its use in concrete materials and optimal processing. Testing demonstrated that Speczavod fly ash can be most suitably used in asphalt/road construction. (Speczavod fly ash durability and water absorption characteristics are unacceptable for use in cement materials without additional processing).

9 Daltechenergo developed technical plans and costs estimates of a fly-ash control system. The fly-ash control system designed by Daltechenergo is a two-phase system, consisting of a four-section precipitation camera and a battery of 16 cyclones. The total estimated efficiency of this system is 93%. EECE provided information to Daltechenergo on American fly-ash control systems and reviewed EECE's plans. Permits from GosKomPrirody to install the equipment have been applied for.

10 Using information provided by EECE, Daltechenergo studied available NOx and SOx gas control systems and developed recommendations for Speczavod. Daltechenergo recommends a dry scrubber lime-injection system to neutralize acid gases, complemented by limestone injection into the incinerator units. The main factors in considering technical options for acid gas control are (1) absence of space at Speczavod to house the wet or semi-dry scrubber equipment; (2) limited water resources to dedicate to a wet scrubber. The recommended system should bring acid gas levels down to approximately 35% of pre-project levels.

11 Incinerator # 2 was modernized, to ensure a more complete and stable burning process. Modernization included installation of new incinerator tubes and air heating system in the gas convection area, replacement of the main components of the slag removal equipment, repair of the incinerator grate, modernization of the hydraulic equipment and incinerator framework, and installation of new electric generators.

Outputs/Results

The following outputs/results were achieved:

A pre-project baseline of technical and environmental characteristics of Speczavod was developed.

Technical plans and cost estimates for capturing fly-ash were developed.

Analysis of appropriate utilization of fly-ash was completed. Laboratory tests demonstrate that Speczavod's fly-ash can be most suitably used in asphalt/road construction.

An analysis of existing acid gas control systems and selection of most appropriate system type for Speczavod was made. Technical plans for this acid gas control system have been developed.

With additional funding from Vladivostok City Ecological Fund, incinerator #2 was modernized. This modernization has already resulted in significant environmental improvements (reduction of dioxins, increase in energy efficiency) while producing real economic benefits for Speczavod in fuel savings and increased steam sales.

A project web site http://www.dvgu.ru/vido/cleansky and e-mail list serve dedicated to disseminating international experience on environmentalizing waste to energy facilities and on the project's achievements was created.

Follow-up Activities

The fly-ash control system is currently being installed on incinerator #2. It is estimated that this system will capture 93% of fly ash. Additional funding for construction and installation of this system was secured through the Vladivostok municipal government.

Speczavod plans to apply to the Regional Environmental Fund for additional financing to construct and install the acid gas control system and to install fly-ash control systems on the remaining two incinerator units.

Costs of Ecolinks Project

The total cost for the preparation of the project was $101,775 of which $50,000 was funded through an Ecolinks grant and $51,775 was provided as cost share.

Expected Environmental and Economic Benefits

Environmental benefits

Modernization of one incinerator unit: total cost $52,000 (Completed)

Pollutant	Pre-project emission	Reduction to
CO	84/tons per year	32.2 tons/year
SO_2	17.5 tons per year	2.5 tons/year

Dioxin emissions were also significantly reduced through improved temperature control in the incinerator (prior to the project, temperature levels fell to as low as 300C. After modernization of the incinerator, temperature is in the 900- 1000C range), however, pre-project dioxin levels were not measured.

Installation of fly-ash capture system on one incinerator unit: total cost $70,000 (Currently under construction)

Pollutant	Pre-project emission	Expected Reduction
Fly-ash	2000 tons per year	1820 tons per year

Installation of acid gas control system: total estimated cost $1,000,000

Pollutant	Pre-project emission	Expected Reduction
SOx	464 tons per year	108 tons per year
NOx	156 tons per year	78 tons per year

Economic benefits

Modernization of one incinerator unit increases over-all efficiency of the incinerator, and as a result, significantly less auxiliary fuel (mazut) is needed for the incineration process. Before incinerator modernization, approximately 1,700 tons of mazut were purchased at $114/ton for a total annual cost of roughly $190,000. After modernization, only 240 tons of mazut were needed, resulting in annual cost savings of over $160,000. Modernization of incinerator #2 also resulted in reduction of heat losses and a 36% increase in steam production. This results in potential increased steam sales of $70,000. Thus, the total economic benefit of modernization of an incinerator unit is $230,000 during one year of operation. The simple buy-back period of the $52,000 investment to upgrade the incinerator unit and boiler is about 4 months.

Installation of fly-ash capture system on one incinerator unit will result in reduced environment fees equaling $52,000 year. The simple buy-back period of this $70,000 investment is 1.3 years.

Installation of acid gas control system is a significant investment ($1,000,000) with minimal direct economic benefits for Speczavod. Speczavod will seek grant funding to construct and install the acid gas control system.

Transferability

Results of this project (including technical designs of pollution control equipment) are highly transferable to other waste-to-energy facilitates in the NIS countries, especially those which were constructed before the collapse of the Soviet Union. In addition, technical plans developed for the fly-ash control system are also transferable to small-scale steam-generating coal incinerators in the NIS.

Lessons Learned

- American experience and pollution control engineering design can be transferred to NIS waste to energy facilitates, but it must be adapted to local climatic conditions, budgetary constraints and specific waste streams.

- Most NIS municipal facilities, such as the Speczavod N1 waste-to-energy facility, have extremely limited budgets with which they can implement pollution control and efficiency improvement measures. Of primary importance is realistically assessing budgetary capabilities, prioritizing needs so that the most critical issues can be addressed, and being willing to upgrade part and parcel, as financing allows. Support from the municipal government and local environmental funds should be sought from the initial stages of the project.

- Most NIS municipal facilities, such as the Speczavod N1 waste to energy facility, have gone without even basic up keep for many years. Relatively low-cost upgrades and

environmental controls on these facilities can have very significant environmental and economic impacts.

Additional Information

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EcoLinks Grant Program
Best Practice #14

Energy Efficient Refrigeration with Zero Ozone Depletion Potential

Abstract

The Institute for Refrigeration and Air Conditioning (IRAC) JSC, Bulgaria, engages in research, design, manufacturing, engineering, testing and trade in the field of refrigeration and air-conditioning. The company is a successful actor in the Bulgarian market for refrigeration and air-conditioning and strives toward increasing its presence in the international market. In response to market trends demanding more efficient and environmentally friendly products, the company became interested in the design and production of quality, industrial cold rooms that use less energy and operate without ozone-depleting agents.

With the support of an EcoLinks Challenge Grant, IRAC in collaboration with a Hungarian firm Femtechnika Kft. was presented with the opportunity to design efficient, environmentally sensitive, low and medium temperature cooling rooms. The first stage of the project consisted of putting together the cold room design that would meet their goals of low energy use and minimal environmental impact. The cooling rooms were then constructed and tested. Measures to market the new technology in several countries in Eastern and Central Europe were taken.

This project is a Best Practice because it generated a new technology that enhances economic benefits and minimizes environmental impacts. This project opened a new market for efficient cooling rooms that use the refrigerant R404A with zero ozone depleting potential, unlike refrigerants such as chlorofluorocarbons (CFCs) that contribute to ozone depletion. The cooling products developed through this project use 10-20 % less energy than the current Bulgarian alternative equipment, do not contribute to ozone depletion, and help to reduce the impact on global climate change.

Name of Project: Low and Medium Temperature Cooling Rooms with Zero Ozone Depletion Potential and no Emissions of Greenhouse Gases

Project Area: Global Climate Change

Organizations Involved:

Project Leader: Institute of Refrigeration & Air-Conditioning J.S. Co., Sofia, Bulgaria
Project Partner: FEMTECHNIKA, Hodmezovasarhely, Hungary

Location of Project: Sofia, Bulgaria

Project Duration: Jan. 2000 – Nov. 2000

Problem Statement:

Most refrigeration units in Bulgaria involve equipment that is energy intensive and uses ozone-depleting gases such as CFCs and HCFCs. Inefficient use of energy unnecessarily pollutes the environment and puts pressure on valuable resources some of which are not renewable. There is a need to design and produce technology that minimizes energy use and does not contribute to further depletion of the ozone layer.

While the market for more efficient and environmentally friendly products is expanding, Bulgaria's production of refrigeration units which meet these criteria has been non-existent. Prior to the implementation of this project, the Institute of Refrigeration and Air-Conditioning J.S., a Bulgarian firm, did not have the sufficient resources and expertise to develop efficient, environmentally friendly refrigeration units. With the support of an EcoLinks Grant, the Institute of Refrigeration and Air-Conditioning J.S., in collaboration with FEMTECHNIKA of Hungary, prepared the design and prototype for cooling rooms that use less energy than their Bulgarian counterparts and do not use ozone depleting refrigeration agents.

Project Description:

The purpose of this project was to design and construct three types of efficient and environmentally sensitive cooling rooms and initiate corresponding marketing efforts. To accomplish this, four main activities were conducted:

Activity 1: Research and Design: Working plans for the construction of the cooling rooms and the doors were made. Different door types, insulation, refrigeration schemes, machines, equipment, and refrigeration automation mechanisms were reviewed to select the optimal alternatives for minimizing energy-loss. The building of the cooling rooms was initiated.

Activity 2: Construction: Three cooling rooms were erected at the Institute of Refrigeration and Air-Conditioning. This included the development and installation of insulation, condensing units and refrigerant, air cooler, refrigeration automation, and electrical devices for control and operation of the unit.

Activity 3: Testing: Tests were conducted to assure that the design and operation of the products complied with Bulgarian standards, and to assess thermotechnics, electrosafety, reliability, and acoustics. Testing protocols were developed.

Activity 4: Marketing: The new products were promoted in Bulgaria, Macedonia and Albania. International exhibits of the equipment were displayed and part suppliers were identified. Seminars with potential clients were organized and the cooling rooms were also presented at an annual fair in Bulgaria. Marketing brochures were created.

Outputs/Results:

Project results include:

- A design for efficient and environmentally friendly cooling rooms was developed. Tests proved that the refrigerant R404A can be effectively used in cooling rooms. R404A is a mixture of the following substances: 44 % of R125, 52 % of R 143a, and 4 % of R134a. None of these components contains chlorine atoms, therefore, the Ozone Depletion Potential (ODP) of the new refrigerant is zero.
- Three cooling room prototypes were constructed and tested (two cooling rooms of capacity 35 m3 and one of capacity 225 m3).
- Information about the cooling rooms was disseminated through displays and demonstrations at various fora involving potential clientele.
- A marketing strategy for the cooling rooms was developed and initiated.
- An agreement for new cooling rooms to be included in the marketing strategy of the two project partner companies for Bulgaria, Hungary, and other countries in the region, was reached.

Costs of EcoLinks Project:

The EcoLinks Grant supporting this project totaled $45,000. Cost sharing by the grantees of both cash and in-kind sources equaled $42,559.

Expected Environmental and Economic Benefits:

<u>Environmental Benefits</u>

During operation, the energy consumption of the cooling rooms is 10-20% lower than similar cooling rooms currently used in Bulgaria.

Table 1: Comparison of unit energy consumption for new and old cooling rooms

Capacity of cooling chamber	Unit energy consumption [W/m3]	
	Old design	New design
Small (35 m3)	20-25	18
Large (200 m3)	16-18	14

The cooling systems that were developed during the project do not use ozone-depleting refrigerants. Table 2 presents values of the ODP for the new and for currently used refrigerants.

Table 2: Ozone Depletion Potential (ODP) for various refrigerants

Refrigerant	ODP
R404A	0
R12	1
R502	0.28
R22	0.055

ODP – a parameter calculated based on molecular structure of the particular chemical compound. If ODP equals zero, the compound does not destroy ozone molecules; if ODP equals 1, the compund is particularly dangerous to the ozone layer.

Economic Benefits

- By offering environmentally friendly cold rooms and doors for cold-storage rooms, Femtechnika will expand its distribution net in the Balkans and increase its exports. Starting from the year 2000 Femtechnika sold altogether 37 new freezer doors and sliding gates of different types.
- New job opportunities are created in companies applying the new technology developed through the project.
- Those purchasing the cooling rooms will reduce their energy costs by approximately 5 % of total energy costs for refrigeration

Transferability:

The technology and expertise for developing the cooling rooms is easily transferable, although it is most likely that the Institute and Femtechnika will be marketing this item and making it available throughout Eastern and Central Europe. R404A can be substituted as a refrigerant agent in the manufacturing of any cooling room.

Lessons Learned:

The following lessons were learned during this project:

- Materials should be ordered in advance so that their arrival does not delay construction time. Also, some manufacturers of the necessary parts of the cooling rooms are closed in the summer.
- In regions where there is political, economic, and social instability, marketing activities may be delayed or hindered. For example, a trip to Albania to market the cooling rooms was delayed for various reasons including lack of regular flights. This was resolved by driving to the destination.
- Information regarding new technology should be gathered in the early stages of the project to avoid delays in the execution of the project.

Additional Information:

Contact Data

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EcoLinks Grant Program
Best Practice #15

Increasing Energy Efficiency at a Beauty Products Manufacturer in Slovakia

Abstract:
De Miclen is a producer of beauty products in Levice, Slovak Republic. De Miclen was originally organized under the former communist regime that subsidized the energy market resulting in inefficiency and averted the competitive framework assumed in a free market system. Energy consumption at De Miclen is high due to out-of-date production facilities, insufficient information about energy use patterns, and the lack of a comprehensive energy savings strategy. Inefficient energy use makes it difficult for De Miclen to keep the consumer costs of its beauty products low. It also leads to unnecessary CO2 production that contributes to air pollution and to global warming trends associated with greenhouse gas production.

With the support of an EcoLinks Challenge Grant, this project improves the capacity for energy efficiency at De Miclen through the development of an Optimum Energy Management System (OEMS). An energy audit was conducted to provide a thorough analysis of the energy system and determine critical energy flow consumption. Based on the energy audit, technical solutions were generated based on a cost benefit analysis and an environmental assessment.

It is a best practice because it uncovers the main problems of inefficiency of the energy management system at De Miclen and provides mechanisms for their resolution. Several economic and environmental benefits are derived through this project. With the implementation of the Optimum Energy Management System (OEMS) there is an energy savings of 30%; a decrease in emissions by 30%; a wastewater volume decrease of 85%; and a waste volume decrease of 63%. The company will save 50% of current energy and water costs while decreasing total volume of environmental burdens (emissions) by 82%.

Name of Project: Minimization of Energy Consumption and Decrease of Air Pollution using Energy Audit, Application of Renewable Energy Sources and Optimization of Critical Energy Flows

Project Area: Global Climate Change

Organizations Involved:

Project Leader: De Miclen, Levice, Slovak Republic
Project Partner: Aton Centrum, s.r.o., Zelenec v, Cechach, Czech Republic
Associate(s): 1) Ecotoxicological Centre, Bratislava, Slovak Republic
2) Academia Istropolitana Nova, Svaty Jur, Slovak Republic

Location of Project: Levice, Slovak Republic

Project Duration: January 13, 2000 – January 15, 2001

Problem Statement:

Since the fall of communism, De Miclen faces the challenges of increasing energy costs, operating within the competitive framework of a free market economy, and social and political pressures to address global climate change concerns. Energy prices in Slovakia will soon be comparable to energy costs throughout the European Union (EU). Energy costs will rise further as CO2 reduction measures associated with wide spread efforts to minimize global warming trends are implemented. De Miclen must decrease its costs through energy efficiency, keep the cost of its beauty products as low as possible for consumers in order to survive, and reduce its production of CO2.

The causes of excess energy consumption at De Miclen relate to inefficient machinery and a lack of organization and vision regarding energy consumption. The power distribution networks at De Miclen are too long and there are high losses of energy during the process of distribution. De Miclen needs a practical plan to improve its energy efficiency and make it a viable competitor in the beauty products industry.

Project Description:

The project focused on developing an Optimum Energy Management System (OEMS), that included the following eight steps:

1) Screening: A survey of the present distribution of energy flows (heat and electricity) was conducted. Overall energy flow, consumption, and losses were identified. Special attention was paid to assessing critical flows and identifying weak sites.

2) Energy Audit: Each individual technological unit network or supply facility was examined and changes in energy consumption efficiency were measured.

3) List of Low-Cost Immediate Measures. Based on the energy audit, low cost immediate measures were generated to eliminate unnecessary energy losses. Low and high cost efficiency measures were determined and a procedure for eliminating high cost daily consumption peaks was developed.

4) Proposal of Possible Alternative Solutions: A list of alternative options for implementing energy efficiency measures was generated.

5) Comparative Cost Benefit Study: In reviewing the proposed alternatives, a cost benefit analysis to determine the most efficient solution package was conducted.

6) Environmental Impact Assessment: The environmental benefits of each proposed alternative including the quantification of differences in potential gains of each proposed energy management solution in terms of volume of CO2, NOx, and SO2 as well as changes in production of different kinds of solid waste (dangerous, special, other) were assessed and ranked.

7) Final plan for Optimum Energy Management System (OEMS): Based on the economic and environmental assessments, an implementation plan was designed.

8) Model Case Study (Educational Model): A document describing one case of energy consumption as a model for solving real problems with energy was developed. It outlined the strategies used in this project including the screening of critical energy flows and the analysis of the environmental and economic costs and benefits.

Outputs/Results:

The outputs of this project involve a variety of materials. The project products outlined below can be used as manuals for company managers.

- An analytical framework for determining the crucial problems regarding the energy system at De Miclen.
- A set of alternative actions for addressing energy efficiency issues. A step-by-step solution guide with an enumeration of the financial and environmental parameters of each action.
- An implementation plan outlining the preferred option referred to as the Optimum Energy Management System (OEMS).
- A case study of De Miclen energy efficiency measures.

Costs of EcoLinks Project:

The total contribution to this project by EcoLinks was $72,650. Cost sharing by project participants was $16,430.

Expected Environmental and Economic Benefits:

Environmental Benefits

Upon implementation of the OEMS (Optimum Energy Management System) set forth by this project the following environmental benefits are derived:

- There is an energy savings of 30%: 261,000 kWh and 50,000m3 of natural gas will be saved annually
- Pollution emissions (e.g., CO2) are decreased by 30% (around 80,000 kg per year)
- Wastewater volume produced by company operations is decreased by 85% (by 12,100 m3/year)
- The volume of solid waste produced is decreased by 63%.

Economic Benefits

The economic benefits of implementing the OEMS include the following:

- The current company energy and water costs are reduced by 50% ($130,000/year).
- Company competition in the beauty products industry is increased through savings generated from the efficient use of energy.

Transferability:

The transferability of generating the benefits derived through this project is high for two main reasons:

1) Problems in energy management systems are similar in other companies and therefore they too can benefit from the specific process developed and implemented in this project to improve energy efficiency.
2) The model generated through this project can be used across companies that vary in size and structure.

Lessons Learned:

The following lessons were learned during this project:

- This project provided the opportunity for successful regional cooperation and the transfer of project know-how.
- Simple, low-cost energy efficiency measures are easy to identify and bring substantial savings in operational costs

Additional Information:

Contact Data

Project Leader	Project Partner
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EcoLinks Grant Program
Best Practice #16

Reducing Emissions of Volatile Organic Compounds at a Paint Manufacturer in Slovakia

Abstract:

Chemolak in Smolenice is the biggest manufacturer of coatings (e.g., paints, varnishes, thinners, resins, etc.) in the Slovak Republic. It produces approximately 20,000 tons of coatings per year. The traditional production of coatings at Chemolak has involved the use of volatile organic compounds (VOC). Volatile organic compounds emit noxious fumes that threaten the health of producer employees and the users of the coatings. They degrade air quality and interrupt important ecological processes. To thrive in an international market that increasingly stresses safe and environmentally friendly products and to minimize negative health and environmental consequences of VOC, alternative substances for producing quality coatings must be introduced.

With the support of an EcoLinks grant, Chemolak and its project partner, SYNPO a.s. from Czech Republic, collaborated to decrease Chemolak's use of VOCs and generate coatings that are more sensitive to the environment and less threatening to human health. To achieve this, they examined the production possibilities for producing a polyurethane dispersion that is water based and significantly reduces the need for VOCs. A market study and an environmental assessment were then conducted to determine the most suitable polyurethane dispersion for production with the fewest health risks and environmental impacts. A legislative analysis was conducted to clarify the parameters of compliance for producing new water-based coatings. An implementation plan and information sharing strategy was generated to commence production and marketing of the new product.

The project can be considered a Best Practice because it successfully considered all the technical, market, legal and financial aspects of replacing VOC-based paints with water-based polyurethane dispersions in the coatings production process. With the introduction of polyurethane technology, noxious organic solvents are reduced by 500t per year in the production process. Moreover, almost no VOCs are emitted during the application of paints and varnishes by the end user.

Name of Project: Emission Reduction by Cleaner Technology Application in Coatings Production Unit of Chemolak a.s.

Project Area: Cleaner Production (CP)

Organizations Involved:

Project Leader: Chemolak, a.s., Smolenice, Slovak Republic; leading paint manufacturer in Slovakia
Project Partner: Synpo, a.s., Pardubice, Czech Republic; R&D company specializing in synthetic resins and paints
Associate(s): Open Circle, Bratislava, Slovak Republic; NGO responsible for public participation and transparent control over implementation of a new technology

Location of Project: Smolenice, Slovak Republic

Project Duration: January 13, 2000 – January 15, 2001

Problem Statement:

Traditional, solvent-based coating materials, such as paints and varnishes contain large amounts (50-70%) of volatile organic compounds (VOCs). VOCs are hydrocarbons, mostly aliphatic, aromatic, oxygenated or even chlorinated, volatile chemical substances that are not only toxic and carcinogenic, but also ozone forming. Ozone is a dangerous compound as it destroys human lung tissue, ultimately impacting breathing capacity and weakening the whole immune system.

Yearly, 25,000 tons of VOCs are released into the air in Slovakia and reduction of VOC emissions is a high priority in the Slovak Republic. This priority is articulated in the Slovak environmental policy, the National Program for VOC Emissions Reduction. One of the major targets of this program is the manufacturing of coating materials, which are known to be one of the largest contributors to VOC emissions. A main source of VOC emissions is the transportation sector.

Chemolak is a leading paint manufacturer in the Slovak Republic producing 20,000 tons of coatings per year. The company continuously upgrades its products to meet environmental standards. In 1998 the company implemented an Environmental Management System according to ISO 14001 standards. The purpose of this EcoLinks funded project was to establish the technical and legal framework for manufacturing water-based coatings such as polyurethane suspension, which avoid the hazards associated with traditional coatings involving large amounts of VOCs.

Project Description:

The main goal of this project was to facilitate and prepare a plan for minimizing harmful organic solvents used in manufacturing paints and lacquers. In this effort, polyurethane is explored as an environmentally friendly alternative to the VOC-based products traditionally used. This project involved several activities which are outlined below.

Activity 1. Screening Study: An assessment of the current production facilities at Chemolak was conducted. The possibilities for modifying the reactor systems for the efficient production of polyurethane were identified. More specifically, suitable dispersion choices, manufacturing capacity for the selected dispersion, and environmental benefits were analyzed. A survey of the occupational health risk parameters was conducted. It was determined that with some extension of the temperature control and heat exchange systems, a polyurethane-based dispersion could be manufactured.

Activity 2. Market Study: Data on the market aspects of polyurethane products was collected and analyzed. A literature review of the relevant issues on coatings was also conducted. Several markets for polyurethane dispersions were identified in the Slovak Republic, Czech Republic, and several countries in the European Union including Italy and Germany.

Activity 3. Survey of Environmental Benefits: The environmental aspects of manufacturing and using the new, water-based, polyurethane product were considered. For example, emission sources and levels under current and proposed manufacturing conditions were identified. Ecotoxicological testing was also conducted to determine the impacts of new polyurethane production on water organisms. It was determined that the new technology is not toxic to water organisms. An evaluation of the emissions associated with the raw materials used to produce water-based products such as polyurethane dispersions was conducted and the evaluation revealed that almost no emissions are generated in the production and application of polyurethane coatings. The new technology was then tested to assure product quality.

Activity 4. Investigation of Emissions Legislation: A thorough review of current and expected legislation regarding volatile organic compounds was conducted in sales-target countries. Legislative rules regarding material safety data sheets were also reviewed. Issues regarding new product categorization, labels, and packaging were considered with respect to Slovak legislation on chemical substances and European Union (EU) rules and directives. A literature search on additional relevant Slovak and EU legislation was conducted.

Activity 5. Implementation Study: Several subprojects were conducted as part of the implementation study. They include:

1) a cost/benefit analysis;
2) an assessment of current environmental practices at Chemolak;
3) a study of new product compliance with the National Program for VOC Reduction;

4) a detailed proposal for manufacturing polyurethane dispersion including polyol preparation, polyurethane dispersion synthesis, quality control, and safety measures;
5) raw materials toxicity assessments; and
6) a proposal to modify existing facilities.

Activity 6. Technology Implementation Plan: A manufacturing trial was conducted. This included purchasing raw materials, preparing equipment, on-site measuring of emissions and wastewater contamination, and practicing operating procedures.

Activity 7. Project Information Sharing and Presentation: The project outcomes and contributions to environmental protection were published in several languages including Slovak, English, French and Russian. Leaflets on the new polyurethane dispersion were published in Slovak.

Outputs/Results:
This project demonstrated Chemolak's capacity to produce polyurethane waterborne dispersion for wood and metals. The results of this project include:

1) A technical report outlining the recommendations for changing current production facilities to focus on polyurethane (water-soluble) production to replace current manufacturing practices involving the use of volatile organic compounds.
2) A parquet varnish V1610 (Parketolak) using the new polyurethane dispersion introduced to production.
3) Documentation of the current and proposed environmental legislation in the Slovak Republic for coating materials.
4) A report on the sale and marketing of polyurethane products in Central and Eastern Europe.
5) A technical report on the properties of raw materials and products involved in the manufacture of coatings.
6) A presentation by Open Circle on the present state of emissions at Chemolak, Smolenice.
7) Information documents on eco-labeling of new products, safety sheet templates setting standards for new European products, and the role of new technology in efforts to comply with the National Program of Volatile Non-Methane Organic Compound Emission Reduction.
8) An implementation plan for reducing VOC and providing alternative coatings with fewer health and environmental consequences.
9) An article on the project written by Open Circle for Enviromagazin published by the Slovak Environmental Protection Agency.

Costs of EcoLinks Project:

The total cost of this project was $79,994. EcoLinks provided $49,584, and the rest was provided through cost sharing of cash and in-kind sources.

Expected Environmental and Economic Benefits:

Environmental Benefits

There are significant environmental benefits associated with producing and providing coatings with minimal to zero VOC. These include:

- There is little to no emission of VOC during the production and use of polyurethane products. With the substitution of this environmental friendly technology, emissions are reduced to 10% of former levels at Chemolak as new coatings contain only up to two percent of VOCs. This reduces the health risks to employees, users and to the general environment. During application of paints and varnishes, almost no VOC is emitted. Chemolak will manufacture over 1000t of the new product yearly while avoiding emissions of 500 t of VOC per year.
- The polyurethane products do not harm aquatic organisms. This alleviates some of the environmental impacts of coatings production and of the disposal of paints and lacquers.
- The new dispersion is very low in VOC as it contains only 3% of acetone.
- There are no fire risks associated with water-based dispersions. This reduces further impacts on human health and the environment.

Economic Benefits

The major economic benefits are the following:

- The polyurethane product is 5% less expensive than currently available similar products.
- The polyurethane dispersion results in quality varnish products. For example, they bind well to wood and metal surfaces and are highly resistant to erosion. This makes it appealing in a local and an international market setting.
- The market potential is increased. Polyurethane dispersion can be used for in-house production of coatings as well as for sales to other coating manufacturers. Thus, this increases the potential consumer sales base.
- Chemolak is prepared to comply with new environmental legislation. By reducing VOC emissions now, Chemolak avoids having to make drastic and perhaps more costly changes later to comply with emerging environmental legislation

The financial analysis of the investment project revealed the following results:

Necessary investment outlays - $ 80,000
Simple Payback Time – 3 years
Net Present Value (rate of return 11%) - $ 520,000

Transferability:

The implementation of a polyurethane waterborne dispersion manufacturing technology could be easily transferred to other similar companies. The market for polyurethane coatings is growing and there is a need for an environmental friendly technology to produce them in the region.

Lessons Learned:

The following lessons were learned during this project:

- Efficient cooperation and active involvement of all the project parties are especially important in contract relations that require collaborative implementation.
- The involvement of a non-governmental organization (in this case, Open Circle NGO) helps with the promotion of new environmentally sound technologies.

Additional Information:

Contact Data

Project Leader	Project Partner
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EcoLinks Grant Program
Best Practice #17

Biogas Extraction and Utilization System in Bulgaria.

Abstract:

The municipality of Bourgas, the fourth largest city in Bulgaria, operates one of the few sanitary landfills in the nation. The Bratovo landfill opened in 1981 and is expected to reach full capacity (and be closed) in 2007. The landfill currently receives 60,000 tones of solid waste annually generated by households and industry in the region inhabited by 270,000 people.

As the biological waste in the landfill decomposes, gas is produced. These gases, known as landfill biogas (LBG) contain large amount of methane and are associated with global warming and the general decline of air quality. If managed appropriately, however, the municipality of Bourgas could extract and convert Bratovo LBG to a useable energy source.

The biogas emitted from the Bratovo landfill is in sufficient quantities to create health, safety, and environmental problems. Although Bratovo landfill incorporates many effective design and operational features to minimize the landfill's environmental impacts, it does not include a system to extract and manage the biogas produced by the decomposition of organic waste in the landfill. This study investigates various options for capturing the biogas and converting it into a useable energy resource.

With the support of an EcoLinks Challenge grant, the municipality of Bourgas and an U.S. consulting firm, Brown, Vence & Associates, Inc., collaborated to conduct an assessment of Bratovo landfill biogas emissions and review options for capturing the biogas and converting it into a useable energy resource. This project is considered a Best Practice because it included a comprehensive methodology to assess the financial viability of various options for biogas capture and conversion. This methodology included an assessment of potential markets for the recovered energy, an assessment of different technologies to convert biogas into marketable products and consideration of the institutional setup regarding ownership and operation of the facility.

Implementation of the proposed plan allows for several environmental and economic improvements. Implementation of a landfill biogas system would reduce methane emissions by 17,300-29,400 tons over a period of 20 years. In addition, the capture and conversion of biogas allows the Bratovo landfill to turn biogas into a useable energy resource and to generate revenue from energy sales.

Name of Project: Landfill Biogas Extraction and Energy Utilization System at the "Bratovo" Landfill in Bourgas, Bulgaria

Project Area: Cleaner Production

Organizations Involved:

Project Leader: Municipality of Bourgas, Bourgas, Bulgaria
Project Partner: Brown, Vence & Associates, Inc. (BVA), Roseville, California USA

Location of Project: Bourgas, Bulgaria

Project Duration: January, 2000 - March, 2001

Problem Statement:

The Bratovo landfill in Bourgas, Bulgaria currently receives 60,000 metric tones of solid waste annually. It is one of the few active sanitary landfills in the nation and is therefore important for waste management in Bulgaria. As the biological waste in the landfill decomposes, however, it produces landfill biogas (LBG). These gases pollute the air and contribute to greenhouse gas emissions. Hence, while the Bratovo landfill provides an important waste management service, it also exacerbates environmental problems.

Currently, landfill biogas produced at Bratovo poses significant environmental problems as it is freely emitted into the atmosphere. Landfill biogas emissions contribute to poor ambient air quality and global warming. Potential, uncontrolled combustion of landfill biogas poses additional hazards at the site. Initially, carbon dioxide and hydrogen are emitted from decomposing biological material at the landfill. During the anaerobic phase of waste decomposition, mostly methane and carbon dioxide are produced. Methane is an especially potent greenhouse gas.

Unmanaged LBG is an environmental hazard, but if the LBG is captured and converted it becomes a useable energy resource. With the appropriate information, technology, and financing mechanisms, Bratovo landfill can convert its environmental problem into an economic resource. Upon assessing the current biogas production and the environmental and economic benefits of various alternatives, various financing frameworks and technologies were explored to develop an implementation plan for converting biogas emissions into electricity at Bratovo.

Project Description:
This purpose of this project was to implement an efficient, environmentally sound landfill biogas (LBG) extraction and utilization system at the Bratovo landfill in Bourgas, Bulgaria. The project involved the following tasks:

Task 1. Start-Up: Start-up activities consisted of convening with project participants and clarifying project expectations.

Task 2. Assessment of Recovered Energy Markets: This task involved identifying potential markets for energy recovered from landfill biogas (LBG) generated at the Bratovo landfill. Additionally, information was gathered and compiled on the new legislation regarding energy sales and pricing.

The following potential markets for the energy were assessed:

- electricity sales to the National Energy Company
- biogas sales to the District Heating Plant
- electricity sales to industrial facilities
- biogas sales to industrial facility
- compressed natural gas sales for vehicle fuel
- use of the biogas on site for medical waste sterilization.

The following assessment criteria were used when comparing different market opportunities:

- market reliability
- delivery costs
- pricing and price stability
- unique requirements
- ease/difficulty of contracting

The analysis revealed the following:

- Electricity sales to the National Energy Company is a feasible option. Beginning Jan. 1, 2002, the "Ordinance on Setting and Applying prices and Rates of Electric Energy" goes into effect in Bulgaria. According to the Ordinance, renewable power enjoys preferential pricing, moreover, transmission and distribution enterprises must purchase all quantities of renewable power that independent producers make available. Under such conditions, the LBG power plant will be able to recover its capital and operating costs, even if its production costs are higher than conventional energy supplies.
- Biogas sales to the District heating Plant is not feasible because of a relatively long distance from the landfill to the heating plant (15 km) and problems with the construction of the pipeline to transport the gas through protected wetlands and breeding grounds.
- Direct electricity or biogas sales to an industrial facility needs further investigations. There is no neighboring large gas or electricity using facilities, the only remaining option would be to sell electric energy to the Municipality. However, evaluation of this option requires negotiations with the National Power Grid.
- Selling compressed gas for vehicle fuel is not feasible as no sizeable vehicle fleet was identified in the vicinity of the landfill that would be interested in utilizing compressed natural gas
- Use of the biogas on site for medical waste sterilization is feasible.

Task 3. Identification of Quantities and Characteristics of Biogas Generated at the Bratovo Landfill: The amount and nature of biogas generated at the Bratovo landfill was determined. Already available information about forecasting methane production and accelerated biogas generation using bioreaction methods was compiled.

The total methane production in the year 2000 was estimated to be about 2.4 million cubic meters of methane per year, increasing to a maximum of about 3.0 million cubic meters per year in 2007, when the landfill reaches its capacity, and decreasing after reaching the peak.

Task 4. Preparation of a Conceptual Layout for an LBG Collection and Destruction (Burning) System: The design and costs (system capital and maintenance costs) of an LBG collection system were established. Destruction system was also analyzed and designed as it will be used when the utilization system undergoes maintenance. The destruction system may also be implemented alone if the energy utilization does not prove to be economically feasible. The conceptual layout includes a series of gas wells, a network of gas conveyance pipes, a collection header, an enclosed flare station, and a blower. The total capital costs for the collection and destruction system are about $300,000, operation costs will amount to $20,000.

Task 5. Review of Technology Options: Technologies that convert landfill biogas into marketable products and their commercial availability were reviewed. Several options were generated including:

- generation of heat through biogas combustion;
- generation of electricity using an internal combustion engine fueled by biogas;
- cogeneration of electricity and steam using an internal combustion engine fueled by biogas;
- utilizing the biogas to incinerate or sterilize medical wastes
- generation of electricity with a fuel cell using biogas as a source of hydrogen; and
- production of compressed natural gas.

The list of criteria that were used to evaluate the options included:

- degree of demonstration in similar situations
- reliability
- O&M requirements
- emissions
- efficiency

Based on these criteria three options were recommended for further consideration:

- incinerating or sterilizing medical waste
- generating electricity
- combination of the first two options.

Task 6. Economic Analysis of Alternatives: The costs and revenues of the three potential project options were determined.

An economic analysis including lifecycle assessment of capital costs, construction and installation costs, operation and maintenance costs and financing costs was conducted for each project option.

Task 7. Identification of Options for Project Financing and Institutional Arrangements: Private and public options for financing the biogas project were identified. Three basic institutional arrangement were identified:

- public ownership and operation;
- public/private joint venture with private operation; and
- private ownership and operation.

A proposal outlining an organizational structure, technical and economic requirements, and alternatives for the development of a biogas utilization enterprise at Bratovo landfill was generated.

Task 8. Review of Significant Environmental Impacts of Selected Alternatives: Significant environmental impacts of the project were reviewed including an estimate of emissions from the existing uncontrolled landfill and potential benefits associated with landfill biogas control and utilization.

Task 9. Development of Recommendations and an Action Plan: Recommendations regarding further program developments were developed. The criteria important to the recommendations included:

- characteristics of available LBG supply
- marketability of products
- technical reliability of the installation
- economic feasibility
- financeability
- environmental impacts

The recommendations are as follows:

- City of Bourgas should implement an LBG-to-electricity project in combination with a medical waste incineration facility
- Before sizing the power plant, additional testing on the LBG production and quality should be performed
- Bioreaction methods should be tested on the landfill to confirm that methane production can be enhanced
- A public-private joint ownership structure with private operation of the projects is recommended

An implementation plan including a time line and estimated costs of each task was produced. Implementing the recommended projects is estimated to require approximately 18 months, beginning with selecting a strategic partner and ending with operation of the projects.

Task 10: Convening of a Workshop: A workshop on LBG conversion at Bratovo Landfill was conducted. Local and national government representatives, private enterprises, and media representatives attended the workshop.

Outputs/Results:

Several outcomes were generated through this project. They include:

- A conceptual layout of an LBG collection and destruction system.
- An environmental impact assessment of proposed alternatives of methane utilization.
- A document assessing economic costs and benefits for a range of project alternatives.
- Networks for collaborating on and generating funds for LBG projects in Bulgaria.
- A workshop on LBG utilization technologies in Bulgaria.

Currently (as a project direct follow-up), the permits for building and operation of the plant are negotiated with the appropriate institutions.

Costs of EcoLinks Project:

EcoLinks provided $43,000 in support through an EcoLinks Challenge Grant. Cash and in-kind contributions made by grantees as cost-share totaled $24,000.

Expected Environmental Benefits and Financial Analysis:

Environmental Benefits

- Implementation of a landfill biogas system would reduce methane emissions by 17,300-29,400 tons over a period of 20 years depending on the methane recovery level. Between 50% and 85% of generated LBG can be recovered through an LBG-to-electricity facility.
- An LBG-to-electricity plant compared to a landfill without a conversion plant reduces either uncontrolled emissions of methane and carbon dioxide (if methane is not collected and burnt on-site) or emissions of sulfur dioxide, nitrogen oxides and carbon dioxide from the flare if the LBG collection and destruction system is installed.
- An LBG-to-electricity plant reduces the demands for other fuel resources such as fossil fuels and nuclear power (which is associated with significant human health risks and conflict-based waste disposal problems).
- Captured landfill biogas decreases ambient smog formation and reduces fire hazards that result from the uncontrolled emission of LBG.

Financial Analysis

Table below presents the results of a financial analysis of different system options:

System	Investment outlays	Production costs
Collection and destruction system	$0.3 million	-
Medical waste incinerator	$0.6 million	0.58-0.61 $/kg
485 kW power plant (50% methane recovered)	$0.7 million	0.056-0.061 $/kWh
830 kW power plant (85% methane recovery)	$1.0 million	0.048-0.052 $/kWh
2,000 kW power plant (acceleration of methane generation required employing bioreaction methods)	$2.3 million	0.038-0.042 $/kWh
Combined medical waste and 2,000 kW power plant	$2.9 million	0.53-0.56 $/kg 0.036-0.039 $/kWh

Investment outlays for medical waste incinerator and for various power plants do not include costs of collection and destruction system However, the collection and destruction system has to be installed in every case.

Production costs for every system vary, depending on the ownership and financing conditions built into the analysis. Combining the power plant project with the incineration of medical waste reduces the incineration project costs by an average of 8% and the electricity costs are reduced by 5%.

The revenues generated through operation of the methane utilization system will depend on the results of future negotiations concerning the price of electric energy and charges for medical waste destruction.

Transferability:

Other municipalities and landfill owners in Bulgaria will be able to learn about the range of LBG utilization technologies evaluated at the Bratovo Landfill. This learning can then be transferred to other landfill facilities throughout Bulgaria, and also in the Central and Eastern Europe.

Lessons Learned:

The following lessons were learned during this project:

- When implementing partnership projects extra time should be allotted for international work due to business cultural differences and language differences (i.e., document translation).

- The challenge of implementing projects in Bulgaria is only a lack of financial resources and not a lack of professional skills amongst Bulgarian professionals.
- To help ensure a realistic and conservative economic analysis, costs estimates should be a combination of U.S.-based costs and Bulgarian-based costs as it is difficult to obtain appropriate estimates for project capital costs considering only data available in Bulgaria.

Additional Information:

Contact Data

Project Leader	Project Partner
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EcoLinks Grant Program
Best Practice #18

Wind Power Production in Poland

Abstract:
Electrical energy production in Poland is traditionally based on coal combustion. The combustion of coal releases high levels of pollution in the form of carbon dioxide (CO2). Pollution from CO2 in Poland is measured at 350 million tons per year. Poland, a supporter of the Kyoto Protocol calling for emissions reductions of air pollutants such as CO2, is embracing efforts to provide alternative energy sources. This project is one such effort by the municipality of Kisielice, to assess the potential for introducing wind power generation in Poland.

The project can be considered a Best Practice because it successfully developed a methodology for assessing wind resources under local conditions and an investment plan to implement a wind power project in a small municipality.

As a result of reducing combustion through the substitution of wind power as an energy source, greenhouse gas production is reduced and air quality is enhanced. The following reductions in emissions will be achieved due to the substitution of coal combustion with wind power after project implementation: 1213.3 tons of CO2 per year; 210 tons of CO per year; 4.6 tons of NOX per year; 280.8 tones of SO2 per year, and 3.9 tons of ashes per year.

Name of Project: Development of Wind Energy Investment Project for the Municipality of Kisielice, Northern Poland –Wind Resource Assessment and Feasibility Study

Project Area: Global Climate Change

Organizations Involved:

Project Leader: Municipality of Kisielice, Poland
Project Partner: AWS Scientific, Inc., Albany, NY, USA
Associate(s): EC Baltic Renewable Energy Centre (EC BREC), Poland

Location of Project: Municipality of Kisielice, Poland

Project Duration: January, 2000 – January, 2001

Problem Statement:

Poland has relied heavily on coal combustion as a source of electrical energy. Coal combustion results in considerable pollution contributing to global warming and the degradation of ambient air quality. Three hundred and fifty million tons of carbon dioxide are released in Poland into the atmosphere each year. Significant efforts must be taken to reduce Poland's emissions.

The importance of alternative energy sources such as wind and sun is increasing as supporters of the Kyoto Protocol attempt to reduce emissions from burning fossil fuels, especially coal. While Poland supports the expanded use of alternative energy sources, the country needs to improve their knowledge base about feasible investment strategies in alternative energy production and experience with the implementation of renewable energy projects. This project explores the technical and financial mechanisms necessary for developing a modern wind power station in the municipality of Kisielice (population: 6500 inhabitants).

Project Description:

Activity 1: Start-Up Activities and Site Identification: Project partners convened to discuss roles, responsibilities and activities for implementation of the project. An on-site visit was made to the municipality of Kisielice to select possible wind measurement sites and identify a suitable location for the wind turbine. Topographical data was also collected. The final site was selected with safety considerations being a priority.

Activity 2: Data Collection on Wind Resources and Meteorological Conditions: Wind measurement equipment was installed on the selected site. To assess on-site, local short-term wind conditions data on wind speed at 10 and 30 meters, wind

direction, and the humidity and temperature of air was collected. In order to assess the long-term local wind conditions, data was obtained from meteorological stations. The entire data set was recorded on a CD.

Activity 3: Analysis of Technical and Legal Parameters: An assessment of the conditions necessary for connecting to the electrical grid was conducted. The technical infrastructure and geological conditions were evaluated. Vector maps were digitized so they can be incorporated as part of the larger data set. The legal and administrative requirements were researched and documented.

Activity 4: Wind Resources Evaluation: Using a computer-based model of the terrain and conditions that influence wind potential, an evaluation of wind resources was conducted. It was determined that the municipality of Kisielice has medium wind resources with an average wind speed of 6.2 meters per second at a height of 85 meters.

Activity 5: Preparation of Guidelines for Investors and US Suppliers of Wind Technology: A publication titled, "Guidelines for Investors" outlining wind energy investment in Poland, including information about wind resources, conditions for investment, administrative and legal parameters for wind energy investment by domestic and foreign investors. Also, an overview of Polish policies and incentives for wind energy development is provided.

Activity 6: Identification of Technological Provisions: Wind technology suppliers were identified and the most suitable supplier was selected. A list of wind technologies appropriate for Kisielice wind power generation was made and the most optimal equipment was proposed. One windmill will be installed in Kisielice; the mill's technical parameters are as follows: power – 1500kW, height – 85m, blade diameter – 77m, energy production – 3600MWh/year.

Activity 7: Preparation and Implementation of Feasibility Study: An Environmental Impact Assessment (EIA), calculation of project costs, and an economic analysis were conducted.

Activity 8: The appropriate applications were prepared and financing institutions were approached. The following financial mechanism was generated in a Draft Feasibility Report: 50% of the investment outlays from grants, 40% from a preferential loan at 8.6% interest rate with a repayment period of eight years, and 10% financing from municipal funds. Applications for financial support to implement the plan developed in this project were submitted to the EcoFund and the Polish National Fund for Environmental Protection.

Outputs/Results:

- Installation of a wind speed monitoring stations in the municipality of Kisielice, Poland.
- Publication "Guidelines for Potential Investors."
- CD with data on short-term and long-term wind conditions in the region.
- Digital terrain map for substantial part of the municipality.

- Assessment of technical infrastructure, grid connections, possible wind turbine sites, and estimated energy production.
- Financial strategy for support of wind energy production.
- Environmental Impact Assessment for the proposed wind energy production project.
- Successful technical information exchange achieved between project partners: the groundwork for future collaboration on wind energy development activities in Poland was established.
- Applications for grants from EcoFund and National Fund.

Costs of EcoLinks Project:

The total cost of this EcoLinks project was $67,352 of which $50,000 was provided by an EcoLinks Challenge Grant and $17,352 was cost-share support by the project partners and associate.

Expected Environmental and Economic Benefits:

Environmental Benefits
Several environmental benefits are identified in the Draft Feasibility Report. They include annual emissions averted by implementing a wind power development strategy. The avoided emissions are as follows:

Table 1: Emissions avoided due to operation of windmill in Kisielice

Pollutant	Emission avoided (t/year)
CO2	1213.3
CO	210
Nox	4.6
SO2	280.8
Particles	3.9

Financial Analysis and Economic Benefits

Table 2 presents the main financial data concerning the project:

Table 2: Kisielice project – financial data

Investment outlays	$ 2 million
Grant	$ 1 million
Soft loan (8.6%)	$ 0.8 million
Municipality's budget	$ 0.2 million
Operation costs	$ 2 % of investment outlays
Economic benefits:	
Profits from energy sold	$ 187 500
IRR after financing	9.23 %

The project has already been awarded a non-repayable grant by the Polish EcoFund for Environmental Protection that covers 30% of the investment costs. It can be expected that additional grant funds of 20-30% of the investment and preferential loans to cover a large portion of the remaining costs will be obtained from other institutions.

Transferability:

The methodology used for assessing wind resources and analyzing the feasibility for generating electrical power from wind can be easily transferred and used in other municipalities throughout Poland. Transferability to other countries poses certain challenges regarding the existence of favorable financial and regulatory conditions including the appropriate legal framework and the market price of energy.

Lessons Learned:

The following lessons were learned during this project:

- It is challenging to develop a financing scheme that would, under the current prices and regulations in Poland, enable realization of a renewable energy investment project based on sound market principles, i.e., without significant financial support in a form of a grant and soft loans.
- A wind resources assessment is an expensive process. Any previous analyses or rough estimates of wind potential in a given area should be carefully considered.
- This project confirmed that even small communities in Poland can develop and implement investment projects for utilization of wind energy resources.
- Collaboration between project partners was improved through a close working relationship involving weekly correspondence through email and daily contact for the implementation of on-site activities, and the transfer of documents, data, and results

Additional Information:

Contact Data

Project Leader	Project Partner	Associate
Organization: Municipality of Kisielice Contact Person: Tomasz Koprowiak, Mayor Location: 14-220 Kisielice, ul. Daszynskiego 5 Telephone: 0-55-275-61-05 Fax: 0-55-275-61-80	Organization: AWS Scientific Inc. Contact Persons: Robert Putnam Location: CESTM, 251 Fuller Road, Suite B220, Albany, NY 12203 USA Telephone: 01-518-437-8652 Fax: 01-518-437-8659	Organization: EC Baltic Renewable Energy Centre Contact Person: Location: Rakowiecka 32 Str., 02-532 Warsaw, Poland Telephone: 48-22-848-4832 E-mail: ecbrec@ibmer.waw.pl

	E-mail: rputnam@ awsscientific.com	

EcoLinks Grant Program
Best Practice #19

Improving Water and Energy Efficiency at a Meat-Processing Plant in Croatia

Abstract:

The Gavrilovic Company is a meat-processing plant in Petrinja, Croatia. In 1998, Gavrilovic joined a program called, "Capacity Building for Cleaner Production" supported by UNIDO and the Croatian government with direct support from the Croatian Ministry of Economy and the State Directorate for Protection of Nature and Environment. The purpose of this program is to develop and apply technical and organizational measures that prevent environmental problems and that provide both environmental and economic benefits for industrial enterprises. With the support of an EcoLinks Challenge Grant, Gavrilovic began demonstrating its commitment to this program by initiating a project to reduce water consumption and wastewater effluent and by improving its energy efficiency.

Gavrilovic uses approximately 2000 m3 of water each day. The water, accounting for the biggest share in the company's operation costs (53 %), is used for cleaning the plant, generating steam for processing meat, sterilizing products, and cooling equipment. The wastewater generated by the company empties into the Kupa River creating significant pollution.

The goal of this EcoLinks-supported project was to improve water and energy efficiency at Gavrilovic. In collaboration with a U.S. firm based in California, Universal Aqua Technologies, and two associates, Enerkon Ltd., and the Faculty of Food Technology and Biotechnology at the University of Zagreb, Gavrilovic developed a Water Management Program and a feasibility study on a cogeneration of heat and electric energy.

The project is considered a Best Practice for several reasons. First, several benefits result from the implementation of a full-scale Water Management Program at Gavrilovic. The Company can save over $500,000 per year by introducing various water saving measures. The introduction of the Water Management Plan has already resulted in a decrease in water consumption by 30% from 6 million to 4.5 million m3 just by implementing good housekeeping practices. Second, the installation of a cogeneration unit will result in savings of $250,00-$400,000 per year with a simple payback time between 3.9 and 5.8 years depending on the market for electric energy.

Name of Project: Cleaner Production: Reduction of Water Consumption and Waste Water Production

Project Area: Cleaner Production

Organizations Involved:

Project Leader: "Gavrilovic, The First Croatian Salami Factory, Mate Gavrilovic Descendants, Ltd.", Petrinja, Croatia

Project Partner: Universal Aqua Technologies, Inc. (UAT), Torrance, CA

Associate(s):
1) Faculty of Food Technology and Biotechnology (FFTB), University of Zagreb, Zagreb, Croatia
2) Enerkon Ltd., Zagreb, Croatia.

Location of Project: Petrinja, Croatia

Project Duration: November 1999 – March 2000

Problem Statement:

Gavrilovic is a meat-processing plant in Petrinja, Croatia. As a result of its location in a former war zone, plant operations have been hindered in many ways. The plant currently operates at only 30% of its capacity. In order to increase production and avoid waste of limited resources such as water and energy, the company needs to be more efficient. Also, the plant's wastewater treatment facility was destroyed during the recent war and needs to be rebuilt.

Gavrilovic uses large amounts of water in its production process. Water is used for product sterilization, steam generation for meat processing, cleaning the plant, and for cooling purposes. Currently, the plant does not use demineralized water what results in significant scaling in the installations and pipes. The plant's water bill accounts for up to 53% of the production costs. In addition, the plant uses significant amount of electric energy in the production process.

The water used for product sterilization and for cooling purposes, although only slightly polluted, is discharged directly into the factory's wastewater treatment facility. As the treatment facility is not operational now, the non-treated effluent water is discharged into the nearby river. By recycling water used for sterilization and cooling and closing a loop of water flow in the supply system, significant water savings can be achieved that also result in lower production costs. In addition, the plant also decided to address the problem regarding the extensive electric energy consumption, by assessing the feasibility of installing a cogeneration plant in order to reduce the amount of electricity purchased from the grid.

Project Description:

The goal of the project was to upgrade from a "one-through" water system to a "closed-loop" water system, and to improve the efficiency of energy generation. Objectives of the project were to install a water consumption monitoring system in the plant; conduct a study to analyze water consumption rates; construct a pilot wastewater recycling facility and assess its performance; develop a list of measures to reduce water consumption; and assess the feasibility of installing a cogeneration plant in the factory.

This project involved a series of activities, outlined below:

1) Installation and Activation of Flow Meters: At the initial stage of the project, several flow meters were installed by the plant's technical staff at various discharge points, in the can sterilization room, in the boiler room and on wash hoses. Water consumption data was collected for a Water Management Plan. As a result of the analyses at the end of the project period, a number of large water discharge (consumption) points were detected. The Factory's management decided to install more flow meters and continue the process of data collection and analyses as a follow-up to this project.
2) Development of Water Management Plan Concept: Water consumption was audited and water consumption rates were analyzed. Monitoring procedures and data processing methods for water recycling were developed.
3) Installation of the Pilot Water-Recycling Facility: The parameters were determined for the pilot reverse-osmosis, water-treatment facility, based on the laboratory analyses of samples of wastewater discharged at different points in the factory. The pilot water treatment plant was designed and constructed by the Project Partner – UAT. Capacity of the plant is 25 000 liters per day. The plant was adjusted and tested onsite, to determine the quality of treatment of wastewater discharged from different points. As a final result, the factory's management decided to install three similar treatment plants that would enable recycling of wastewater discharged from the factory's can sterilization production process, recycling of condensate from steam generation, recycling of water from cooling system, and use of rain water collected on the site. The reverse-osmosis unit not only purifies the wastewater but also demineralizes it.
4) Staff Training: The staff that conducts the washing and cleaning of containers and the facilities was trained in water management to introduce the new system and to promote efficient water use.
5) Wastewater Treatment Plant: Preliminary designs for the wastewater treatment plant were developed. The plant will treat wastewater before discharging it into the nearby Kupa River.
6) Study on energy cogeneration: The feasibility of the simultaneous generation of heat and electric energy at the Gavrilovic factory was assessed. It was proposed to install a cogeneration plant with two units of approximately 1,000 kW. The plant will be used to produce electric energy using natural gas from the factory's gas supply system, significantly reducing the electricity bill of the factory. In addition, waste heat from the cogeneration units will be used for preparation of hot water and steam for heating purposes, enabling significant reduction of the plant's heat energy costs.

7) Final Assessment and Recommendations. The project leader and project partner, in collaboration with Gavrilovic management, assessed the results of the project and developed a list of follow-up activities.

Outputs/Results:

This project resulted in several outputs including:

- A Water Management Plan was developed, which outlines water savings strategies based on water consumption and effluent patterns. The implementation of the part of the Plan has already resulted in immediate savings and environmental benefits.
- Flow meters were installed and data on water flow patterns was collected and analyzed.
- A pilot reverse-osmosis, water-recycling unit was installed, and an analysis of its operation was performed.
- The process of designing the wastewater treatment plant has been initiated. Due to the reduction in water consumption and in discharged wastewater, the needed capacity of the wastewater treatment facility will be significantly lower.
- Water saving measures and guidelines were developed for the staff.
- The staff responsible for washing and cleaning was trained to increase the level of awareness on water savings.
- A feasibility study on cogeneration was developed.
- Project results were presented at the Fourth International Conference, "Water Supply and Water Quality" in Krakow September 11-13, 2000.
- A student project was prepared for the National Competition in Chemistry for high school students in which the possibilities for saving water at Gavrilovic was explored. The project received the highest grade.

Costs of EcoLinks Project:

The total expenditures for this project were $118,270. Ecolinks provided $25,680 and project Partners provided $92,590 as a cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

This project resulted in several environmental benefits, including:

- Water consumption is reduced by 30%, from 6.0 to 4.5 million m3 per year. This is an immediate result of the implementation of low-cost, good housekeeping measures as measured by the factory's main flow meter. Further reductions in water consumption (minimum 20% of the present demand) are expected after installing the reverse-osmosis treatment unit and closing water–wastewater loops.

- Following the decreased demand for water, the stream of wastewater that needs to be treated in the treatment plant before release into the Kupa River will be proportionally decreased (by 30-50 %)
- The reverse-osmosis, water-treatment unit will not only purify water but also demineralize it. Using demineralized water in the boilers will secure a longer service life of installations and facilities and reduce the consumption of gas needed for water heating.
- The constant analysis of water supply requirements allows for the ongoing efficient use of water.
- The training and education of plant staff in water conservation improves their ability to implement environmental practices at the plant.

Economic Benefits

The economic benefits generated through this project include:

- Implementation of the Water Management Program at Gavrilovic will provide the following savings on a yearly basis:

Reduced water consumption due to good housekeeping measures	$170,000
Return of the condensate (enabled by installation of reverse-osmosis unit)	$28,000
Recycling of water from cooling system - (enabled by installation of reverse-osmosis unit)	$11,000
Recycling of water from can sterilization (enabled by installation of reverse-osmosis unit)	$17,500
Collecting and processing of rainwater 25,000 m3/year (enabled by installation of reverse-osmosis unit)	$25,000

These savings are based only on water savings. If other measures are implemented in the Water Management Plan, there are additional benefits:

- Implementation of the Water Management Program at Gavrilovic reduces the plant's operating costs by 20% ($130,000 per year), in addition to savings from decreased water demand. For example, the life of the equipment that transfers water can be extended with the use of demineralized water. Lower operation costs result from the decreased need for maintenance and replacement of parts and from reduced electricity consumption associated with heating the water used for sterilization.
- By increasing water-use efficiency, water treatment costs are reduced (water treatment before discharge into the river). The volume of treated water is reduced from 1500 m3 per day to 1000 m3 per day, resulting in a savings of $500 per day or $150,000 per year.

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- Initial investments in the reverse-osmosis, water-treatment unit have a simple pay back period of less than two years as a result of water savings.
- A feasibility study for a cogeneration plant at Gavrilovic shows the following results:

	Variant IA (part of electric energy sold to the National Grid)	Variant IB (electric energy produced only for plant's own use)
Investment outlays	$1.5 million	$1.5 million
Lifetime of the investment	15 years	15 years
Net savings (including operation costs)	$0.4 million/year	$0.25 million/year
Simple Payback Time	3.9 years	5.8 years
Internal Rate of Return	18%	12%

In the table only the two most profitable variants are listed (two out of five analyzed in the study).

Project's follow-up

As a follow-up to this project, the plant has decided to continue water consumption data collection and analyses until the full balance of water flow is measured by the main plant's flow meter and all in-house flow meters. The plant also decided to install three reverse-osmosis water treatment units and to install the cogeneration plant. At present, various options for obtaining finances (loans) are being analyzed.

Transferability:

The project can be easily transferred and implemented by other plants with similar production processes. There are no issues that appear to be site sensitive. The results of the project - water consumption reductions, energy efficiency improvement, and the financial projections - confirm its effectiveness and should be an incentive for other plants to undertake similar activities.

Lessons Learned:

The staff assigned to water and energy efficiency projects on a similar scale should work full time in developing and implementing them. Their time and efforts devoted to the project will pay off handsomely.

Additional Information:

Contact Data

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EcoLinks Grant Program
Best Practice #20

Environmental Management System at an Iron and Steel Works in Romania

Abstract:

Sidex, the biggest iron and steel works plant in Romania, produces various steel plates, sheets and pipes. Through its operations the company has a serious negative impact on environment. It generates vast quantities of wastewater and solid waste, and it unnecessary consumes a lot of energy. In order to improve the position of company's products on the world market, improve compliance with environmental regulations and limit adverse effects on the environment, the company's management decided to develop an Environmental Management System (EMS) under the ISO 14001 Standard.

With the support of an EcoLinks Challenge Grant, SIDEX teamed with the Czech company, Aquatest, to prepare the company for introduction of EMS. The project can be considered a Best Practice because it demonstrates how to introduce an environmental management system at a company, from initial environmental review through pre-certification assessment, and reduce operating costs at the same time. Recovered oil and recycled waste will both improve SIDEX's environmental performance and save money. SIDEX's experience can be easily replicated in similar facilities throughout the region.

Name of Project: Development and Implementation of EMS at the Steel Production Flow of SIDEX Galati

Project Area: Cleaner Production

Organizations Involved:

Project Leader: SIDEX S.A. Galati, Romania
Project Partner: AQUATEST, Prague, Czech Republic
Associate(s): KPMG Romania

Location of Project: Galati, Romania

Project Duration: January, 2000 – December, 2000

Problem Statement:

Sidex, the biggest iron and steel works plant in Romania produces various steel plates, sheets and pipes. The operations of the company have a serious negative impact on the environment. It generates vast quantities of wastewater and solid waste, and it unnecessary consumes a lot of energy. The company's management decided to develop and implement EMS under the ISO 14001 Standard. The goals of this project were:

1. Environmental goals
   - controlling and continuously decreasing the adverse environmental impacts of production
   - compliance with environmental regulations
   - reduction of environmental accident risk
2. Economic and social goals
   - improvement of the company's market position
   - reduction of production costs
   - improvement of public access to environmental information
3. Capacity building goals
   - training the responsible personnel
   - acquiring experience from EMS implementation
   - preparation of EMS documentation standards

EMS implementation includes the following action steps:

1. Performance of an initial environmental analysis and development of an environmental policy of the company and EMS implementation design based on a review of results.
2. Development of a plan for implementing the environmental policy.
3. Formulation of environmental management programs.
4. Monitoring and assessment of the environmental aspects of the site operations and their effects on the environment.

5. Evaluation of the major material and energy consumption flows in order to identify possibilities for pollution prevention.
6. Continuous review and improvement of the site EMS to gradually reduce the adverse effects of production on the environment.

Project Description:

The project supported by Ecolinks started with initial meetings and preliminary environmental analysis and ended with the pre-certification assessment. The list of activities comprises the following items:

1) Initial Meeting: The project partners met to clarify the list of activities to be accomplished and confirm a schedule for project implementation.
2) Initial Environmental Review and Report: An assessment of the legal issues and reporting procedures and a meeting with the anticipated certification agency (TUV Romania) were conducted. Using registration sheets, an auditing mechanism of the environmental impacts was established.
3) Employee Training Preparation: Training courses for the management team and the implementation team were prepared.
4) Design and Preparation of EMS Documentation: The environmental aspects of SIDEX operations were determined and prioritized. Environmental objectives and targets were established. An environmental manual was written. System and operational procedures were established. Posters and leaflets were prepared. A training course for the personnel was designed.
5) Employee Training Implementation: KPMG, the project associate, conducted a training-for-trainers in preparation for training employees. Employee training sessions were then conducted by the implementation team.
6) Finalization of the Environmental Management Program: The EMS documentation was finalized after a comment and review period by section chiefs. The final draft was submitted to the plant management and SIDEX management who then signed and initiated implementation of the Environmental Management Program. Specific implementation instructions were established by specialized departments and section coordinators.
7) Study Tour: A study tour of the EMS programs at the iron and steel plants at VSZ Kosice in the Slovak Republic and Nova Huta Ostrava in the Czech Republic was conducted.
8) Implementation of EMS in SIDEX. An environmental management system was designed, documented, and implemented within specific departments of SIDEX. The list of departments included: Hot Rolling Mill, Cold Rolling Mill, Heavy Plates Rolling Mill, and Longitudinal Welded Pipes Departments.
9) Pre-Certification Audit: A pre-certification audit was conducted that included 1) an on-site review of EMS documentation, 2) an on-site inspection and interviews with the management and staff, 3) a presentation of the EMS Implementation Team and management of preliminary findings, and 4) a reporting of findings and recommendations.
10) Pilot activity - Waste Water Monitoring: A portable ultrasonic flow meter and an automatic measurement and pH control loop were used to monitor wastewater at SIDEX. Water samples were analyzed weekly in a specialized

laboratory. The list of measured parameters includes pH, amount of suspended solid waste, concentration of $SO4^{-2}$ ions, and total concentration of Fe. The data gathered in the monitoring process was used to control the wastewater quality and to prevent polluted effluent from being released into the river Siret.

Outputs/Results:

This project resulted in several outputs. The EMS was implemented in four sections at SIDEX. Several key components lead to the implementation of the EMS and include:

- The establishment of an EMS Implementation Team at SIDEX.
- The development of training courses on ISO 14000 series for the management and the SIDEX Implementation Team.
- Study tours of Environmental Management Systems at other sites in the Slovac Republic and the Czech Republic.
- The implementation of an environmental review
- The preparation of documentation supporting the EMS: Environmental Management Program; Awareness Raising and Advertising; Environmental Manual, System Procedures, and Operational Procedures.
- Pre-certification audit.

Costs of EcoLinks Project:

Total cost of the project amounted to $80,000, of which $50,000 was covered by Ecolinks, the rest was provided by the Project Team members as a cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

Several immediate environmental benefits were generated through this project. They are as follows.

1) Approximately 5000 employees were trained in environmental issues. This raises employee awareness of environmental problems and the link between health and the environment at SIDEX. Ultimately, the training provided the basis for improving the environmental conditions at SIDEX through changing personnel work behavior.
2) The maintenance of equipment was improved after an evaluation of lubricant losses. As a result, oil and grease losses were reduced by 10% and 650 liters of oil were recovered in one month.
3) A selective waste collection system for recycling was established which was unanimously accepted by the management and the workers. Six different types of waste (e.g., waste oil, waste grease, rubber, paper, and plastic) are now collected in separate containers.
4) Wastewater management significantly improved and it was possible to significantly increase the rate of recycling of wastewater.

5) The company is less wasteful overall reducing energy and material consumption through improvements in maintenance and monitoring.

Economic Benefits

All economic benefits resulting from the project will be quantified at the beginning of 2002. They are mainly connected with the oil and grease savings through the organizational and technical improvements. Also selective industrial waste collection will bring additional benefits, as the factory will recycle ferrous waste and reuse it as a raw material in the main production lines. Another benefit will be an improved image of SIDEX in the market due to the EMS certification expected by the end of 2001.

The immediate economic benefits derived through this project include:

1) As a result of improved maintenance of company equipment, 650 liters of oil is now recovered monthly, resulting in an annual savings of $3,000.
2) Waste materials separated and prepared for recycling can be delivered to recovery facilities, which will result in an anticipated savings of $2,000 per month. Further savings are expected with the implementation of a waste separation system in other areas of SIDEX.

Transferability:

The outcomes of this project indicate that an EMS can be easily implemented throughout SIDEX. The general steps and procedures used to develop the EMS at SIDEX could also be used to guide the development of an EMS in other companies.

Lessons Learned:

The following lessons were learned during this project:

- The success of an EMS requires physical changes in company operations as well as changes in the perspectives of employees.
- Establishing a fully equipped office at SIDEX for the Implementation Team was "a big help for this project."
- Sites visits to plants where EMS has been implemented facilitated specific knowledge transfer.
- The implementation of an EMS may require more resources than originally anticipated including financial resources as well as human resources. It is important to try to approximate these needs closely in advance.
- Communication can be improved amongst the people developing the EMS documentation by clarifying individual tasks before work is started.
- Outreach and media relationships should be stressed to share the benefits of the EMS both for the company as well as for the community-at-large.

Additional Information:

Contact Data

Project Leader	Project Partner
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EcoLinks Grant Program
Best Practice #21

Plastics Recycling in Romania.

Abstract:

The landfill in Iasi, Romania, is filling up. A large portion of the solid waste that is sent to the landfill is plastic, especially PET plastic waste. Multiple industries in the region import and use large quantities of PET as a raw material for making food and beverage packaging and for fiber production. PET use for containers is growing in Romania at a rate of 5-10 % per year. While some plastics are recycled in Romania, there is no comprehensive plastics recycling program that addresses the problems associated with PET waste.

This project, supported by an EcoLinks Challenge Grant, is a collaborative effort between Carmis, an environmental consulting and research firm in Romania, and GeoScience & Technology, a consulting firm in the United States. The purpose of the project is to develop a plastics recycling program for the municipality of Iasi with potential for broad application across Romania. While this project initially focused on recycling PET, comprising the largest amount of plastic waste in Romania, the initial research element of the project revealed that an optimum plastics recycling program should include the collection and recycling of all types of plastic.

This project was implemented in two phases. The first phase was an assessment of plastic waste composition and a calculation of the percentage of plastic waste that goes to the landfill in Iasi. The second phase of the project applied the information gathered in the first phase to generate alternatives and select the best option for recovering and recycling plastics in Iasi. This involved a public outreach program as well as a plan for the construction and operation of a recycling facility.

This is a best practice due to the significant environmental and economic benefits derived through the project. With the implementation of the plastics recycling program outlined in this project, approximately 300 tons of plastic waste per year will be removed from the solid waste stream currently going to the landfill in Iasi. Within five years, it is predicted that a total of 4,000 tons of plastic material per year could be diverted from the landfills throughout Romania. The economic benefits of operating a recycling facility for Iasi would be the immediate employment of more than 20 people, investments of $100,000 in facilities and equipment, and an increased tax base for the City and County of Iasi. A five-year projection indicates that this project would generate an income of up to $3 million.

Name of Project: Recycling and Reuse of PET Waste in Iasi County, Romania

Project Area: Cleaner Production

Organizations Involved:

Project Leader: S.C. Carmis S.R.L., Iasi, Romania
Project Partner: GeoScience & Technology, P.A., Winston-Salem, N.C. USA

Location of Project: Iasi, Romania

Project Duration: January, 2000-August, 2000

Problem Statement:

The landfill in Iasi will soon reach full capacity. Further, while the landfill space in Iasi is decreasing, the quantity of solid waste generated is increasing as the population in Romania grows. Romania has the second largest population in Central Europe. There is a need to explore environmentally and economically sound ways such as recycling and re-use to address solid waste management problems in Romania.

Plastic waste, especially PET, constitutes a large portion of the solid waste in Romania. PET is imported and used largely by industry to produce packaging for food and beverages and for textile manufacturing. The figures for years 1997-1999 indicate a 5 – 10% increase in PET for containers. Romania imports approximately 30-40,000 tons of PET per year, out of which 10,000 tons is used for textile manufacturing.

Iasi produces a total of 970 tons of PET waste per year. Approximately 80% of this PET waste ends up in the local landfill. Demands on the landfill are exceeding its capacity. PET waste, and plastic waste in general, must be diverted from the landfill.

A feasibility study conducted by the Project Partner, GeoScience and Technology, revealed that there is a strong local market for recycled PET in Iasi. While the possibilities for a recycling and re-use program for plastic waste were encouraging, there was first a need to assess the quantities and quality of plastic waste (especially PET waste); to apply appropriate methods and technology for collecting, separating, and processing the waste; and to identify financial mechanisms for implementing the program. There were several challenges that had to be overcome to accomplish these tasks successfully. Collection, for example, requires public support so the provision of a successful public awareness raising campaign is critical the recycling effort.

With the support of an EcoLinks Challenge Grant, this project provided the elements necessary for initiating a successful plastic waste recycling and re-use program for Iasi. This project developed a scenario for the collection of plastics, identified local

partners and investors, identified the latest recycling technologies, found markets for the recycled materials and gained support of the City and County governments and local industries of Iasi. The information and experience attained through this project can then be used to solve similar plastic waste management problems in other parts of Romania, the Moldova Republic, and possibly throughout Central and Eastern Europe.

Project Description:

This project was implemented in two phases. The first phase consisted of the following steps:

1) Assessment of Plastic Waste: All sources of PET waste in Iasi County were identified. Surveys of the landfill and commercial sources were conducted. Information regarding the opportunities, statistics, and companies involved in plastics recycling was acquired from the Romanian National Commission for Recycling Materials in Bucharest. Current recycling efforts were also researched.
2) Public Outreach: Educational and awareness raising activities were conducted in Iasi schools. Outreach activities also targeted the general public and commercial organizations. Five conferences were organized for high school students. Information centers stressing the importance of collecting and recycling plastic waste were established.

The second phase of the project involved the following:

1) Business Plan for Processing Plastic Waste: A draft PET business plan was developed and translated into Romanian. It outlined the technical and economic aspects of plastics recycling. The Business Plan suggests the establishment of a recycling company, and includes detailed information on the business description, financing, and financial projections for the recycling facility. Partners and investors to support and implement the plan were identified.
2) Plan Finalization: The business plan was finalized outlining the best alternative plastics recycling methods available. The most feasible alternative was selected based on its applicability and implementation capacity for Iasi city and county. A flow diagram of the plastic waste recycling effort was generated. Needs regarding equipment, facilities, and personnel were established. Contact with potential investors was made.

Outputs/Results:

This project generated several outputs that were important for establishing a plastics recycling program in Iasi that can be used as a framework for implementing plastics recycling throughout Romania. These outputs include:

- A compilation of data regarding plastics use and disposal, especially PET, in Iasi and in Romania in general.
- An educational and public outreach program promoting plastics recycling.

- A list of companies and organizations that might be interested in investing in a facility for the collection and recycling of plastic materials and establishment of the recycling company; the list includes two metal recycling companies, solid waste utility, Romanian Post Privatization Fund, and others.
- A business plan for implementing a plastic recycling program and a methodology for the selection of the best alternative of such a program.
- A finalized business plan outlining a comprehensive plastics recycling program for Iasi city and county.

Costs of EcoLinks Project:

The total expenditures for this project were $41,001. EcoLinks provided $35,000 and project partners provided $7,859 as cost share.

Expected Environmental and Economic Benefits:

Environmental Benefits

There are notable environmental benefits derived from implementing a plastics waste recycling program as outlined in this project. They include:

- Approximately 300 tons of plastic waste per year will be removed from the solid waste stream currently going to the landfill in Iasi. Within five years, it is predicted that a total of 4,000 tons of plastic material per year will be diverted from the landfills throughout Romania thanks to the operation of a recycling facility in Iasi.
- There will be less demand for newly manufactured plastics as recycled sources of plastic are collected and processed for re-use. This reduces industrial activity that contributes to air pollution as well as reducing pressure on landfills.
- Plastics generally do not degrade in the landfill and the incineration of plastic produces air pollution with particularly noxious particulates. Landfills while necessary are an environmental blight. Diverting waste from landfills and avoiding incineration of plastic waste reduces the need for landfills and alleviates air pollution problems.

Economic Benefits

Through the research and planning conducted as part of this project, it was shown that the recycling of plastic waste, especially PET, can be very profitable. The economic benefits of investment, employment, earnings, exports and the reduction of imports, can be substantial especially if applied throughout the country. The details of these benefits are outlined below.

- The economic benefits of establishment of a recycling facility for Iasi would be the immediate employment of more than 20 people, investments of $100,000 in facilities and equipment, and an increased tax base for the City and County of Iasi.
- A five-year projection indicates that this project would generate investments of $3.5 million (total), and expenditures of approximately $500,000 (also total)

associated with a labor-intensive collection process; the projected total sales in the fifth year of operation would be $3 million, earnings before interest, taxes, and depreciation are projected to be $1.6 milion.

- Capital flow would increase as property is purchased for the construction of new facilities or redevelopment of existing unused facilities.
- Overseas benefits include lucrative investment opportunities in environmentally friendly operations in a developing country, i.e., Romania, and increased sales in technologically advanced equipment.

Project's follow-up

The project team members are currently working to begin Phase I of their plan, which is to collect, sort and bale plastics. If the results of this pilot phase are successful, they will consider investment for a full scale PET recycling facility with automated sorting, grinding, and cleaning. This fully automated plant would need about 500 tons of PET/year to make the investment worthwhile. They believe a collection, sorting and baling operation in Romania can be economically successful with much smaller quantities of materials in comparison with the US, mainly because of the low cost of labor.

Transferability:

The solutions for recycling plastic waste in Iasi can be applied throughout Romania. Also, during the development of this project, it became clear that the problem of collecting and recycling plastic wastes, particularly PET, is the same for other countries, such as the Republic of Moldova. Hence, the information and experience gathered through implementing this project can be transferred to develop plastic recycling programs in different regions.
Similar programs may be developed for other recyclable materials, such as aluminum and glass.

Lessons Learned:

The following lessons were learned during this project:

- The key to establishing a successful recycling operation is emphasizing collection over processing. It is important to ensure that sufficient material is collected before large capital investments are put into processing. Developing a business plan for a recycling facility can be difficult without an established program for collecting waste. This predicament also makes it difficult to attract investors given the speculative nature of the facility without a collection program in place. With a plastic waste collection system in place, however, investors are very interested in supporting a recycling facility.
- The research part of this project revealed that it is economically and environmentally preferable to collect and recycle all types of plastics, not just PET as was originally planned. The research aspect of this project, therefore, was important ultimately to defining the project.

- Acquiring prices from various Romanian organizations can be difficult. Concise information about unit rates for rail transportation of the waste, for example, can require repeated requests made to multiple parties and the results are not always the most useful. It may be that the rate of inflation and constant devaluation of the Romanian currency in relation to the US dollar make it difficult to gain commitment on pricing of various services or equipment necessary to implement a recycling program.
- Communication can be most challenging and time consuming if there are significant language barriers (i.e., parties do not speak the same language).

Additional Information:

Contact Data

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