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**WORLD ENVIRONMENT CENTER**

**UKRAINE**

**WASTE MINIMIZATION DEMONSTRATION PROJECT**

**AT**

**“YENAKIEVO” IRON AND STEEL PLANT**

**IN YENAKIEVO**

**Final Report**

**USAID/WEC COOPERATIVE AGREEMENT  
NO. ANE-0004-A-00-0048-00**

**World Environment Center  
419 Park Avenue South, Suite 1800  
New York, New York 10016**

**SEPTEMBER 1997**

<b>Project Description:</b>	Reduction of natural gas usage at soaking pits
<b>Project Type:</b>	Energy Conservation/Waste Minimization Project
<b>Country:</b>	Ukraine
<b>Industrial Sector:</b>	Iron and Steel
<b>Funding Source:</b>	United States Agency for International Development
<b>Participants:</b>	Yenakievo Iron and Steel Plant and World Environment Center
<b>Project:</b>	Improvement to control of heating value of mixed fuel gas to the soaking pit

**REPORT DISTRIBUTION:**

Alexandra Burke, Bureau for Europe and New Independent States, United States Agency for International Development

Michael Kalinoski, Bureau for Europe and New Independent States, United States Agency for International Development

Robert F. Ichord, Jr., Chief, Energy and Infrastructure, Bureau for Europe and New Independent States, United States Agency for International Development

Robert A. Archer, Deputy Chief, Energy and Infrastructure, Bureau for Europe and New Independent States, United States Agency for International Development

Lea E. Swanson, Director, Environment Development, USAID Regional Mission for Ukraine, Belarus and Moldova

Natalia Kulichenko, USAID Regional Mission for Ukraine, Belarus and Moldova

Patricia A. Swahn, Document Acquisitions, United States Agency for International Development

Ties van Kempen, CH2M Hill, Ukraine

Nicholas P. Cheremisinoff, Environmental Policy & Technology Project, Ukraine

Yuri V. Orobotsev, Deputy General Director, Yenakievo

Leonid Sebko, Deputy Technical Director, Yenakievo

Svjatoslav Kurulenko, Head of Department, Donetsk Oblast, Department of Ministry of Environmental Protection, Ukraine

Gregory Shmatkov, National Academy of Sciences of Ukraine

Gennady Merkhelevitch, WEC Coordinator, Ukraine

Antony G. Marcil

Thomas J. McGrath

Romuald Michalek

**REPORT DISTRIBUTION: (continued)**

Bohdan Aftanas

Frank Szymborski

Raymond L. Feder

Ernest J. Bolduc

Valerie Sepe

Philip Breese

John Barker

File

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## I. INTRODUCTION

In September 1995, an amendment was added to the United States Agency for International Development's (USAID's) and World Environment Center (WEC's) Cooperative Agreement No. ANE-0004-A-00-0048-00 to include Ukraine as one of the additional countries to receive WEC's technical assistance, training and information dissemination services related to urban and industrial pollution.

WEC activities in Ukraine are implemented in two phases as follows:

**Phase I** - Initiated in October 1995. Under this phase, the program focuses on reduction of environmental pollution caused by industrial activities through waste minimization. This includes better utilization of natural resources and conservation of energy, with emphasis on financial benefits. Waste Minimization Demonstration Projects (WMDP) were established at four industrial enterprises in the Donetsk region. The goal was to demonstrate to these enterprises the cost savings and reduction in environmental pollution from waste minimization and to encourage the incorporation of this program into the permanent policy of plant management.

**Phase II** - Initiated in September 1996. This program is similar to Phase I, with additional emphasis on energy conservation, specifically on reduction of natural gas consumption. Six Waste Minimization/Energy Conservation Demonstration Projects (WM/ECDP) are being implemented at various plants in Donetsk and Dnipropetrovsk regions.

This report describes the benefits achieved from implementing a demonstration project at the Yenakievo Iron and Steel Plant, which was one of the four enterprises selected for a WMDP under Phase I in the Donetsk region. The project was initiated in December, 1995 and concluded in July 1997 with a close-out meeting at the plant.

Final findings and benefits resulting from this Waste Minimization Demonstration Project are presented in this report. Highlights of the close-out ceremony are also described.

## II. EXECUTIVE SUMMARY

Pursuant to the technical assistance program for Central and Eastern European countries by the United States Agency for International Development, the World Environment Center (WEC) conducted a Energy Conservation/Waste Minimization Demonstration Project (ECWMDP) at the Yenakievo Iron and Steel Plant in Yenakievo, Donetsk region, in Ukraine.

WEC teams conducted two visits to the Yenakievo Iron and Steel facility in December, 1995 and in March, 1996 and jointly with the plant management recommended implementing a Energy Conservation Demonstration Project to reduce the usage of natural gas fuel to the soaking pits by installing a process flow controller and calorimeter to maintain automatic control of the heating value of mixed natural gas and blast furnace gas used as fuel. The project was subsequently implemented with the following results as confirmed by Yenakievo Iron and Steel Plant management:

Project Description	Equipment Provided by WEC	Monetary Benefits	Environmental/ Energy Conservation Benefits
Improvements to process control at soaking pit facilities (and which could result in quality improvements).	Process Controllers, Calorimeter & Strip Recorder @ cost of \$22,500.	<b>\$140,000/year</b> for reduction of natural gas use.  (Payback less than 3 months)	Savings of <b>1,700,000 m<sup>3</sup>/year</b> of natural gas equivalent. Reduction by <b>26 tons/year</b> of carbon monoxide and <b>12 tons/year</b> of nitrogen oxide air emissions.

A close-out ceremony was conducted on July 22, 1997 at the Yenakievo Plant which summarized the achievements of the demonstration project and the progress made by Yenakievo Plant in conserving energy. Formal ownership of the WEC supplied instrumentation was transferred by the USAID representative to the Yenakievo Iron and Steel Plant during the close-out meeting.

More details of the WMECDP are provided in Progress Report No. 1 issued in February 1996.

### III. GENERAL BACKGROUND

Yenakievo Steel Plant is located in the city of Yenakievo, population 210,000, approximately 80 kilometers northeast of the city of Donetsk in the far eastern end of Ukraine. The city has grown around the steel mill so that the mill now is completely surrounded by residential areas; this greatly magnifies and complicates the mill's pollution problems.

Yenakievo is a very large, integrated steel complex with a rated capacity of 3.1 million tons annually. In 1994, however, the economy was such that Yenakievo actually produced only 1,551,045 metric tons of steel, or about 50% of capacity. Through November 1995, the mill continued to operate at 40-50% of capacity.

This integrated steel complex consists of the following major units:

- An ore yard, with overhead cranes used for mixing and blending;
- A 4-strand sinter plant;
- Four blast furnaces with rated capacities of 1,033 to 1,386 metric tons;
- A 3-vessel Basic Oxygen Converter Shop; each vessel has a 160-ton capacity;
- A blooming mill;
- A rod mill;
- A mill to produce various structural shapes;
- A lime calcining plant with 4 kilns;
- An oxygen plant; and
- Various shops and support facilities.

### IV. DESCRIPTION OF PROJECT

At the soaking pits, blast furnace gas and natural gas are mixed at a ratio of 5 to 1 to supply fuel to the heat soaking pits. The ideal gas mixture would have a calorific content of 2,300-2,400 Kilo calories per cubic meter (258-270 BTU/cubic foot). Previously, the dampers in the blast furnace gas line and the natural gas line were adjusted manually, based on the historical data, to attempt to achieve the ideal calorific content of the mixed gases. However, the plant did not have a calorimeter in the downstream mixed gas line. The operators, therefore, were not sure what the actual heat content of the mixed gases was.

Pressure in the blast furnace gas line varied greatly and quite frequently, which made it very difficult to maintain the desired 5 to 1 ratio of the two gases. Plant personnel and WEC's specialist suggested installation of a calorimeter in the mixed gas line to continuously measure the calorific value, and to use the signal from this meter to automatically control the damper settings to achieve the desired fuel mix.

It was originally estimated that installation of the calorimeter and automatic control of natural gas flow would provide an annual savings of \$60,000 from a reduction in natural gas usage of 720,000 m<sup>3</sup>/year if the mill operated at full capacity.

Based on actual performance of the calorimeter and flow controller from April 1 - June 30, 1997, Yenakievo estimated a 5.4% reduction in unit equivalent fuel consumption amounting to 17.1x10<sup>9</sup> Kcal for all of 1997, equivalent to 1,700,000m<sup>3</sup>/yr of natural gas valued at \$149,000/yr.

## V. PERSONNEL

During the plant visits and during subsequent engineering effort, the key participants included:

Yenakievo Iron & Steel Plant -	Yuri V. Orobtssev, Deputy General Director Leonid Sebko, Deputy Technical Director
World Environment Center -	Mr. Thomas McGrath, Vice President WEC Dr. Bohdan Aftanas, WEC Program Manager John Barker, Consulting Engineer Dr. Ray Feder, WEC Consultant Gennady Merkhelevitch, WEC Coordinator

## VI. CHRONOLOGY OF PROJECT

October 1995	-	Reconnaissance visit by WEC team
December 1995	-	Follow-up visit by WEC team to identify a waste minimization demonstration project and necessary equipment
June 1996	-	WEC issued purchase orders for instrumentation and accessories
November 1996	-	Instrumentation arrival at Yenakievo
March 1997	-	Instrumentation installed and collection of data initiated
July 1997	-	Close-out of project

## VII. CLOSE-OUT CEREMONY

On July 22, 1997 a close-out ceremony was held at the Yenakievo Steel and Iron Plant to formally conclude the demonstration project. There were 25 participants representing the plant management and the municipal and regional administration, the U.S. Agency for International Development, the World Environment Center and the local press and television.

The ceremony was chaired by Mr. Yuri Orobtssev, Technical Director, who in his opening statement, expressed his great satisfaction with the results of the demonstration project, which he considered as a first step in implementing a plant-wide waste minimization and energy conservation program. Also he indicated the company's significant interest in future cooperation with the WEC, specifically on the Impact Program. Mr. Thomas McGrath of the World Environment Center outlined WEC's current and upcoming programs in Ukraine, and thanked the plant management for their interest and cooperation.

Mr. Michael Kalinoski from the U.S. Agency for International Development expressed the Agency's appreciation for Yenakievo Steel and Iron Plant's participation in the program. Also, he briefly described other funded assistance activities by USAID in Ukraine.

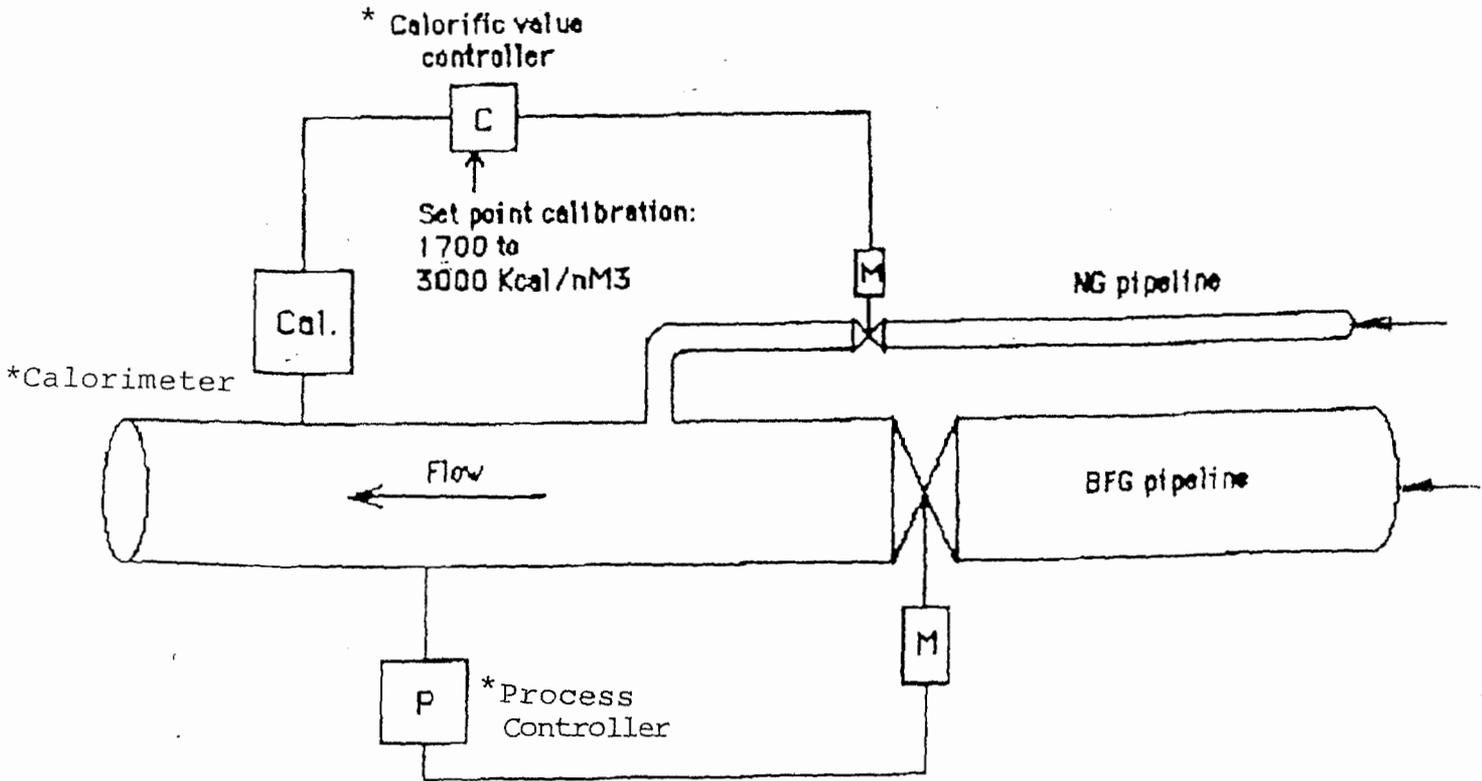
A short presentation of the completed demonstration project, including its environmental and financial benefits was made by Mr. Leonid Debko, Deputy Technical Director at the Yenakievo Steel and Iron Plant. At the conclusion of the ceremony, Mr. Kalinoski, on behalf of USAID, transferred ownership of the equipment to the Yenakievo Steel and Iron Plant and presented the plant with a Certificate of Recognition.

The list of close-out ceremony participants is included in Appendix 3.

**APPENDIX 1**

**DIAGRAM OF CALORIMETER INSTALLATION**

CALORIMETER INSTALLATION  
AT SOAKING PIT



\* Equipment Provided  
by WEC

**APPENDIX 2**

**FINAL ESTIMATE OF BENEFITS**

PROJ 111 11 11 11 11

TO: Mr. Thomas McGrath,  
WEC's Vice President

SUBJECT: About Effectiveness of Use of the Calorimeter  
at the Section Mill

Please be informed that the calorimeter was put into operation at the soaking pits area on March 14, 1997. When the automatic control device was under adjustment, the remote control of the mixed gas quality was applied. Since June 13, 1997, the instrument is included in the automatic control system to maintain the calorific value at the constant level required.

The operating data describing the performance ~~conditions~~ at the soaking pits area during all the period the calorimeter was used for, are specified in the Table 1.

The following conclusions were made on the basis of the calorimeter performance analysis, and the operating and economical data obtained for the soaking pits area:

1. The instrument was installed and adjusted properly by the staff of the instrumentation workshop and of the mill.
2. The instrument is able to maintain the mixed gas calorific value at 2,100 through 2,200 Kcal/m<sup>3</sup> required to get the ingots heated. It has been operated in that mode since June 13, 1997.
3. There was a reduction of the unit equivalent fuel by 2.2 per 1 ton of the rolled steel reached during the period from April 1, 1997, to June 30, 1997. It is 5.4% lower than it was in 1996. The saving of the fuel for April-June, 1997, period is as follows:
  - for the natural gas.....446,512.5m<sup>3</sup>,
  - for the blast furnace gas..1,523,395.5m<sup>3</sup>.

The final saving figures for the period passed and the figures which are planned to be reached for 1997 are tabulated in Table 2.

Sincerely,

Leonid V. Sebko,  
Deputy Technical Director  
For Environmental Protection

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1 of 2

Translation of the Table 1 Columns' Headings (the table is attached in Russian)

- Column1 - Date;
- Column2 - Amount of steel charged in the pits, tons;
- Column3 - Amount of the natural gas consumed,  $\text{m}^3$ ;
- Column4 - Amount of the blast furnace gas consumed,  $\text{m}^3$ ;
- Column5 - Minimal calorific value of the mixed gas,  $\text{Kcal/m}^3$ ;
- Column6 - As above, but average;
- Column7 - As for Column5, but maximum.
- Column8 - Performance hours of the instruments per day.

Table2  
SAVINGS

Time Period	Reduction of the Equivalent Fuel Consumption, tons	Reduction of Heat Consumption, Kcal	Monetary Saving, GRN/USD
April- June, 1997	722.3	$5.1 \times 10^9$	76,275/41,453.8
1997	2,446.8	$17.1 \times 10^9$	1258,382/140,425

Note: 1. the above calculations were made through the planned price of the equivalent fuel for June, 1997, that is 105.8 grivnas per ton.  
 2. the rate of exchange used is 1griv = 1.84USD

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**APPENDIX 3**

**LIST OF CLOSE-OUT CEREMONY PARTICIPANTS**

## PARTICIPANTS

to

COSE OUT CEREMONY AT THE STEEL MILL  
in Yenakievo

DATE: July 22, 1997

PROJECT: WMDF

Participants to the Ceremony:1. The Plant's Personnel:

1	Leonid Litvinov	General Manager
2	Yuri Orobtssev	Technical Director
3	Leonid Sabko	Deputy Technical Director
4	Nickolas Demura	Acting Head of Technical Department
5	Leonid Degteryov	Head of OPKRMN Department
6	Vladimir Padalka	Chief Blast Furnace Man
7	Vasily Fomenko	Acting Chief Energy Man
8	Victor Dembitsky	Head of Technology Laboratory
9	Nickolas Sviridov	Manager of Instrumentation Workshop
10	Sergey Lifantiy	Foreman of Instrumentation Workshop
11	Vladimir Kirilenko	Manager Assistant of Billet Mill
12	Vladimir Serdyuk	Foreman of Billet Mill
13	Sergey Azarov	Production Department
14	Sergay Alyokhin	Manager of Billet Mill

2. Press:

15	Galina Romanenko	"Za Metall" Newspaper
16	Sergey Dratch	"Yenakivskiy Rabochiy" Newspaper
17	Yuri Khanin	TV Company in Yenakievo

3. USAID:

18	Michael Kalinovsky	Project Officer
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4. WEC:

19	Thomas McGrath	Vice President
20	Bohdan Aftanas, D.Ph.	Project Manager
21	Gennady Merkhelovitch	In-Country Coordinator

5. Regional Administration:

22	Svyatoslav Kurulenko	Head of Regional Environmental Inspectorate
23	Mark Rymar	Head of Energy Distribution & Energy Conservation Department
24	Yuri Khivrich	Deputy Mayor of Yenakievo
25	Sergey Alistratov	Head of Municipality Economy Department

**APPENDIX 4**

**CERTIFICATE OF RECOGNITION**



# **WORLD ENVIRONMENT CENTER**

under its cooperative agreement with the

**United States Agency for International Development**

presents its

**Certificate of Recognition**

to

**ENAKIEVO IRON AND STEEL WORKS**

**Enakievo, Ukraine**

**For Participation In A Waste Minimization/Energy Conservation Demonstration Project  
Reducing The Consumption Of Natural Gas Equivalent by 1,700,000 m<sup>3</sup>/Year**

**October 1995 to July 1997**

**“Every Day is Earth Day”**

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Antony G. Marcil, President & CEO