PN-ACD-755

Environmental Policy and Technology Project

Contract No CCN-0003-Q-15-3165-00

UKRAINE

Report on National Workshop on Disseminating USAID's Urban Water Energy-Efficiency Activities in Lviv

Lviv, 10 July 1998

Delivery Order 15 (Amendment No 1) - Task 4(D)

Prepared for
Ukraine, Belarus and Moldova Mission
United States Agency for International Development

Prepared by
Ukraine, Belarus & Moldova Regional EPT Office in Kyiv
Environmental Policy and Technology Project
A USAID Project Consortium Led by CH2M HILL

PREFACE

Under the 1992 Freedom Support Act the United States Congress initiated a program to provide various forms of assistance to new independent states (NIS) of the former Soviet Union Cooperative Agreements were signed between representatives of the U S government and each country in which assistance was to be undertaken The U S Agency for International Development (USAID) was given the responsibility to coordinate all U S government assistance to the NIS under the Act

Through competitive bidding USAID awarded a multi year contract to a team managed by CH2M HILL International Services, Inc (CH2M HILL) to support implementation of an environmental assistance program to republics of the former Soviet Union Under this contract termed the Environmental Policy & Technology (EPT) Project CH2M HILL is to assist USAID's missions in Moscow, Kyiv, and Almaty to undertake a program to promote environmental improvements in the NIS The USAID mission in Kyiv supports environmental and other assistance programs to Ukraine, Belarus, and Moldova CH2M HILL established an office in Kyiv from which to perform services in these countries under the EPT Project

This report was prepared as a contractually required deliverable under a contract between USAID and CH2M HILL Although work on this report was conducted in cooperation with the assisted governments and USAID the findings and recommendations are those of the CH2M HILL team They do not necessarily represent official positions of the governments of the assisted countries nor of the United States of America

The CH2M HILL team includes the following organizations

- Center for International Environmental Law
- Clark Atlanta University/HBCUMI Environmental Consortium
- Consortium for International Development
- Ecojuris
- Environmental Compliance Inc
- Harvard Institute for International Development
- Hughes Technical Services Company
- International Programs Consortium
- International Resources Group Ltd
- Interfax Newsagency
- K&M Engineering
- Ogden Environmental and Energy Services Company
- Price Waterhouse
- World Wildlife Fund (US)

For additional information regarding the EPT Project contact the following

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NOTIFICATIONS

NOTE ON TRANSLITERATION

Ukrainian personal, institutional, and place names used in this document are transliterated into English from Ukrainian (not Russian), according to the modified U S Library of Congress standard for Ukrainian-to-English transliteration that has been adopted by many Western organizations and publications, including the *Encyclopedia of Ukraine* (University of Toronto Press, 5 vols, 1984-1993) and O Subtelny's authoritative *Ukraine A History* (University of Toronto Press, 1988, 2nd ed 1994), as well as by the Ukrainian Commission on Legal Terminology (Resolution No 9 dated 19 April 1996)

NOTE ON COST ESTIMATES

Any opinions of cost presented herein, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time the opinion was prepared The final costs of any project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors As a result, the final project costs may vary from any opinions of cost presented herein

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ABBREVIATIONS, ACRONYMS AND GLOSSARY

ASD	adjustable speed drive
atm	atmosphere
CCC	connections, consumers, and collections
CCN	cooperating country national
CH2M HILL	CH2M HILL International Services, Inc (a U S -based international environmental engineering consulting firm under contract to USAID to implement a large component of the EPT Project)
COWI	COWI Consulting Engineers & Planners (a Danish-based international environmental engineering consulting firm under contract to the Danish Environmental Protection Agency and the World Bank to undertake water and wastewater studies in Lviv)
DO	Delivery Order
EPT Project	Environmental Policy & Technology Project USAID-funded project to provide environmental assistance to New Independent States of the former Soviet Union
FSU	former Soviet Union
HMRSC-NGO	Housing & Municipal Reform Support Center, Non-Government Organization
IFI	international financial institution
kbv	karbovanets (Ukrainian currency from 1992-1995)
kWh	kilowatt-hour
lcd	liters per capita per day
lch	liters per capita per hour
LEM	Local Environmental Management (enterprise)
l/s	liters per second
LVK	Lviv Vodokanal
m^3/d	cubic meters per day
m^3/h	cubic meters per hour
m^3/h	cubic meters per year
NIS	New Independent States (of the former Soviet Union)
oblast	A government territorial-administrative unit in the FSU that is still in use following Ukraine's independence A U S analogue would be something between a state and a county
PADCO	Planning & Development Collaborative (a U S -based international consulting company under contract to USAID to implement housing sector assistance in Ukraine)
PS	pump station
TDH	total dynamic head
US$	United States dollar
USAID	United States Agency for International Development
vodokanal	A quasi-government agency responsible for municipal water supply and wastewater collection and treatment, a U S analogue would be a water utility
VK	Vodokanal
WB	World Bank
ZhEK	A municipal entity responsible for operation and maintenance of houses and multi-apartment buildings owned by city administrations, as well as water, sewerage, gas, electricity, and heating systems within them ZhEK is a Russian/Ukrainian abbreviation, used in the FSU, of a city's department of housing and communal services that continues to be used

Section 1

INTRODUCTION

As part of a United States government bilateral assistance program, the U S Agency for International Development (USAID) is supporting environmental management in Ukraine Under direction from USAID, a consortium led by CH2M HILL International Services, Inc (CH2M HILL), is implementing part of USAID's Environmental Policy & Technology (EPT) Project by undertaking various tasks that have been agreed to by representatives of the governments of both countries

Since 1995, the EPT Project has been providing technical assistance and equipment to the City of Lviv, and its water utility (Lviv Vodokanal - LVK) in order to develop technical and management methods that can also serve as models for nationwide implementation of municipal water and wastewater sector reform Under Task 4 of Delivery Order (DO) #15, Amendment 1, of the EPT Project, CH2M HILL is to design and implement one or more projects that would demonstrate cost-efficient reductions in energy consumption by LVK, and which can be effectively replicated at other water utilities in Ukraine Subtask 4D required CH2M HILL to

> *transfer the knowledge and experience gained in the [energy efficiency] demonstration project to other vodokanals through workshops*

At the USAID-sponsored *Ukraine Energy Efficiency Summit*, organized by CH2M HILL as part of Task 1 of DO #15 (Amendment 1) and held in Slavutych on 26-27 February 1998, a presentation was made by representatives of LVK and CH2M HILL regarding energy-efficiency improvements being implemented at Lviv Vodokanal Attendees at this *Summit* included senior officials from the State Committee of Ukraine for Energy Savings, and the Ministry of Energy On 10 July 1998, a nationwide workshop was held in Lviv to further disseminate information, to representatives from Ukrainian cities and their water utilities, regarding the USAID-sponsored energy-efficiency improvement projects being undertaken at Lviv Vodokanal This report presents highlights of the July 1998 workshop

Section 2

WORKSHOP

From EPT Project activities with LVK, together with preliminary surveys conducted at several other vodokanals, it is evident that electricity costs amount to 60-70% of the total direct operating costs of vodokanals in Ukraine Significant opportunities exist to address the current adverse energy situation in Ukraine, which suffers frequent mandatory demand curtailment, by reducing electricity consumption of water utilities, as their electricity-consuming requirements is similar throughout the country Further, reductions in electricity consumption would help improve the financial viability of vodokanals by reducing their operating costs

A workshop was held on 10 July 1998 at the Palace of Youth Culture in Lviv, to share with a nationwide audience experience gained by Lviv Vodokanal regarding projects that demonstrate reductions in energy consumption The agenda for the workshop is given in Appendix A

Workshop sessions included theoretical and practical sessions The main emphasis of theoretical sessions was on outlining approaches and methods for assessing efficiency of energy usage in a water supply system as a whole, and of its separate components wellfields, transmission system and pump stations Energy-efficiency demonstration projects currently being implemented in Lviv were presented in detail, namely adjustable speed drive (ASD) controls at a pump station, replacement of existing inefficient water pumps with more efficient units, and improvement of data acquisition and data processing systems The effect of network leakage on energy use, and possibilities for reducing energy consumption using cement mortar lining of pipes and zoning of distribution systems, as well as various aspects of using off-peak power rates to reduce energy costs, were also addressed During the field trip, Workshop participants viewed demonstration projects involving replacement of pumps at Kryvchytsi pump station, and installing an ASD pump control unit at the Sokilnyky pump station

Invitations to participate in the Workshop were sent out to 47 cities in Ukraine, including 22 cities of oblast subordination (see Appendix B) Invitations were addressed to also sent some central governmental agencies dealing with housing and energy, municipal authorities, and local water utilities A list of workshop attendees is presented in Appendix C

The presenters generally used overhead transparencies to clarify and enhance their presentations A copy of these transparencies (see Appendix D), and a short introduction for workshop participants outlining the background and objectives of the workshop and USAID's EPT Project, were included with the handout package provided to each participant

Materials presented at the Workshop created considerable interest among participants Almost all presentations were followed by series of questions on methodology for making an energy survey of a water system, estimating water losses, calculating tariffs, etc At the end of the Workshop, a representative of the State Committee for Architecture, Construction, &

Housing Policy of Ukraine, Mr Dmytro Ganzha, mentioned the value and organization of the Workshop and outlined the activities of the State Committee

Section 3

CONCLUSIONS

As a result of the workshop, the following can be concluded

1 The potential for nationwide energy reduction in Ukrainian water systems is estimated to be over 1 5 billion kWh per year

2 Many components of a water supply system which have excessive energy consumption can be identified by

- analyzing data from log books
- brief measurements and hydraulic calculations
- improvement of data acquisition and analysis

3 Based on experience gained in the course of cooperation between USAID's EPT Project staff in Lviv, and the vodokanals of Lviv, Ivano Frankivsk, and Rivne, some of the following measures can be used to reduce energy costs

- shut-down inefficient pumps that are operated but do not significantly contribute to the overall flow
- improve hydraulics of transmission mains
- replace poorly matched pumps (pump to system characteristics) at major pump stations with efficient units having proper hydraulic characteristics
- installing ASD controls for motors of large pumps that have a need to provide a variable hydraulic output

4 Improved system hydraulics, and reduced leakage from distribution network by pipe replacement and rehabilitation using cement mortar lining as well as setting pressure zones, can also significantly contribute to energy savings

5 Many of the energy-efficiency measures discussed have payback periods of less than five years, but would be only be considered as being cost-efficient if all service payments are made in cash

6 The workshop created significant interest, as indicated by the response of participants and the number and types of questions asked

Appendix A

WORKSHOP AGENDA

Schedule of Nationwide Workshop on Energy Efficiency in Vodokanals Friday 10 July 1998		
Time	**Session Title**	**Lecturer**
09 00 - 09 45	Registration of workshop participants	
09 45 - 10 00	Introduction to Workshop	Buros
10 00 - 10 40	A Summary of the Energy Efficiency Demonstration Projects in Lviv	Sharkov
10 40 - 11 00	Break	
11 00 - 11 20	Making an energy survey of a water system - specific energy usage	Gipp
11 20 - 11 40	The impact of water losses and wastage on energy use	Tryliovska
11 40 - 12 20	Energy saving in pump stations with adjustable speed drive (ASD) units and pump-matching	Karpina
12 20 - 15 20	Field trip to visit energy demonstration projects at Sokilnyky and Kryvchytsi pump station	
15 20 - 15 40	Break	
15 40 - 16 00	Energy saving in well fields	Tryliovska
16 00 - 16 20	Use of off-peak power rates to reduce energy costs	Kopytin
16 20 - 16 40	Application and operation of pressure zones and dispatch control to save energy	Sharkov
16 40 - 17 00	Break	
17 00 - 17 45	The potential for nationwide energy reduction in water systems	Erickson
17 45 - 18 00	Conclusion	Buros
End of Workshop		

Appendix B

LIST OF WORKSHOP INVITEES

1 Bila Tserkva - Kyiv oblast (adm)
2 Fastiv - Kyiv oblast (adm)
3 Donetsk (adm)
4 Kramatorsk - Donetsk oblast (adm)
5 Makiivka - Donetsk oblast (adm)
6 Mariupol - Donetsk oblast (adm)
7 Horlivka - Donetsk oblast (adm)
8 Zhytomyr (adm)
9 Korosten - Zhytomyr oblast (adm)
10 Zaporizhia (adm)
11 Ivano-Frankivsk (adm & vodokanal)
12 Kolomyia - Ivano Frankivsk oblast (adm & vodokanal)
13 Kirovohrad (adm)
14 Luhansk (adm)
15 Severodonetsk - Luhansk oblast (adm)
16 Lutsk (adm)
17 Kovel - Volyn oblast (adm)
18 Mykolaiv (adm)
19 Odesa (adm)
20 Poltava (adm)
21 Kremenchuk - Poltava oblast (adm)
22 Rivne (adm & vodokanal)
23 Sumy (adm)
24 Ternopil (adm & vodokanal)
25 Lviv (adm & city vodokanal & oblast vodokanal)
26 Stryi - Lviv oblast (adm & vodokanal)
27 Truskavets - Lviv oblast (adm & vodokanal)
28 Boryslav - Lviv oblast (adm & vodokanal)
29 Drohobych - Lviv oblast (adm & vodokanal)
30 Zolochiv - Lviv oblast (adm & vodokanal)
31 Sambir - Lviv oblast (adm & vodokanal)
32 Chervonohrad - Lviv oblast (adm)
33 Kharkiv (adm)
34 Kherson (adm)
35 Kahovka - Kherson oblast (adm & vodokanal)
36 Khmelnytsky (adm)
37 Kamianets-Podilsky - Khmelnytsky oblast (adm)
38 Shepetivka - Khmelnytsky oblast (adm)
39 Cherkasy (adm)
40 Chernivtsi (adm)
41 Chernihiv (adm)
42 Dnipropetrovsk (vodokanal)
43 Dniprodzerzhynsk - Dnipropetrovsk oblast (adm)

44 Kryvy Rih - Dnipropetrovsk oblast (adm)
45 Uzhhorod (vodokanal)
46 Simferopol (adm & vodokanal)
47 Bakhchysarai - Crimea (vodokanal)

Appendix C

LIST OF WORKSHOP ATTENDEES

CH2M HILL EPT/Lviv

Dr Kris Buros	Senior Technical Advisor, Project Manager
Mr Michael Cholewka	Site Manager
Ms Tamara Gipp	Senior Project Engineer
Mr Michael Sharkov	Senior Project Engineer
Ms Maria Tryliovska	Project Engineer
Ms Eliionora Karpina	Project Engineer
Mr Anatoly Kopytin	Project Engineer
Mr Oleh Tsarynnyk	Team Leader

CH2M HILL, EPT/Kyiv

Mr Ulian Bilotkach	Water Programs Manager

Ministry for the Economy of Ukraine

Mr Oleksandr Dykhnenko	Deputy Head of Department

State Committee for Architecture, Construction, and Communal Services of Ukraine

Mr Dmytro Ganzha	Chief Specialist

State Committee for Energy Conservation of Ukraine

Mr Andriy Shchokin	Deputy Head of Department

Regional Scientific Research Institute of Experimental Design (Kyiv)

Ms Natalia Diomina	Chief Specialist, Energy Saving Center

Lviv City Administration, Engineering Department, Directorate for Communal Services

Mr Borys Stefanyshyn	Chief Engineer
Mr Hryhory Shevtsiv	Head of Engineering Services Department
Mr Oleh Pikh	Lead Engineer

State Ecological Safety Inspectorate for Lviv oblast

Ms Liudmyla Sorokina	Chief Specialist on Water Resources Protection

Lviv Vodokanal

Mr Lev Gipp	Deputy Director
Ms Oksana Turchyn	Head of Well Fields and Pump Stations Department
Mr Valentyn Parkhomenko	Head of Production Department
Mr Orest Holovatchyk	Head of Dispatch Department
Ms Zinaida Benko	Engineer of Central Dispatch Department
Mr Yury Batih	Engineer of Public Relations Department
Ms Irena Gipp	Production Engineer
Mr Ivan Boiko	Engineer
Ms Tetiana Beliaeva	Engineer

Lviv Municipal Services Design Institute (Lvivdiprokomunbud)

Mr Yuri Matiunin	Head of Department
Mr Anatoly Andreev	Chief Specialist
Mr Ivan Volobaiev	Chief Specialist
Mr Ivan Tomenchuk	Chief Specialist
Ms Liudmyla Starikova	Group Leader
Ms Natalıya Dudchenko	Group Leader
Ms Nadıya Kryva	Group Leader
Ms Hrystyna Vierna	Senior Engineer
Ms Nadıya Malaniy	Engineer

Ivano Frankivsk Vodokanal

Mr Anatoly Riabkov	Chief Engineer
Ms Larysa Polischuk	Head of Production Department
Mr Volodymyr Babych	Head of Capital Construction Department
Mr Mykhailo Rusak	Technician

Rivne Vodokanal

Mr Volodymyr Netsky	Director
Mr Volodymyr Khomko	Chief Engineer
Mr Serhiy Kononchuk	Technician

Ternopil City Administration, Directorate for Housing and Communal Services

Mr Roman Romaniv	Deputy Head

Ternopil Vodokanal

Mr Oleh Baran	Director
Mr Mykhailo Hladiy	Deputy Director
Mr Vasyl Hladkyi	Technician

Khmelnytsky Vodokanal

Mr Vasyl Lomako	Chief Engineer
Mr Anatoly Makodzeba	Chief Electrical Engineer
Mr Yuri Yurkovsky	Technician

Chernivtsi Vodokanal

Ms Liudmyla Semeniuk	Chief Economist
Ms Nina Havryliuk	Head of Customer's Department
Mr Ivan Havryliuk	Computer Engineer

Lutsk Vodokanal

Mr Serhiy Strok	Chief Engineer
Mr Volodymyr Nespay	Chief Electrical Engineer
Mr P Cherchuk	Technician

Kharkiv Vodokanal

Mr Serhiy Vasylenko	Director of Water Resources Enterprise

Mr Viktor Baibula — Head of Technical Department

Zolochiv (Lviv oblast) Vodokanal
Mr Pavlo Kupreiev — Chief Engineer

Stryi (Lviv oblast) Vodokanal
Mr Marian Pikho — Chief Engineer

Kalush (Ivano Frankivsk oblast) Vodokanal
Mr Roman Stadnyk — Chief Engineer

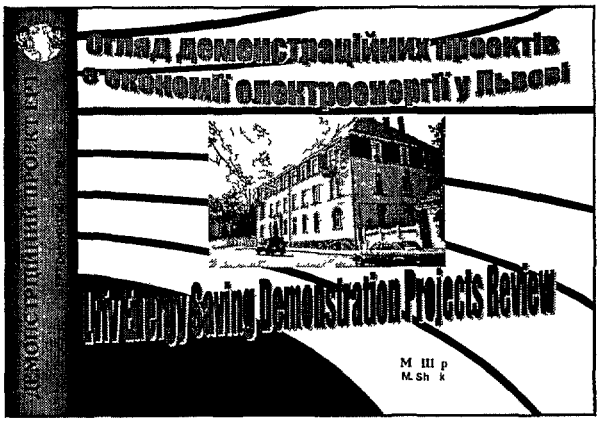
"MID" TV Channel (Ivano Frankivsk)
Ms Olena Polischuk — Correspondent

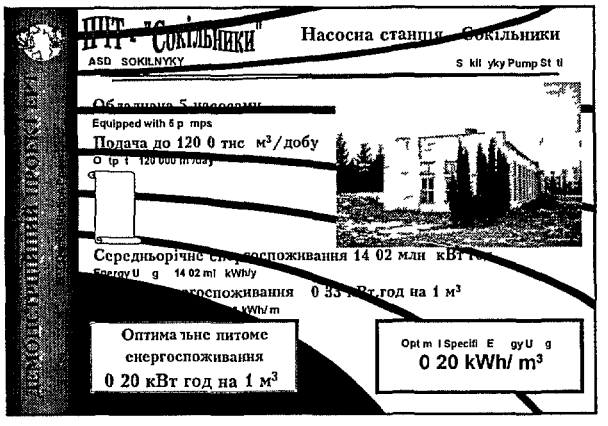
Appendix D

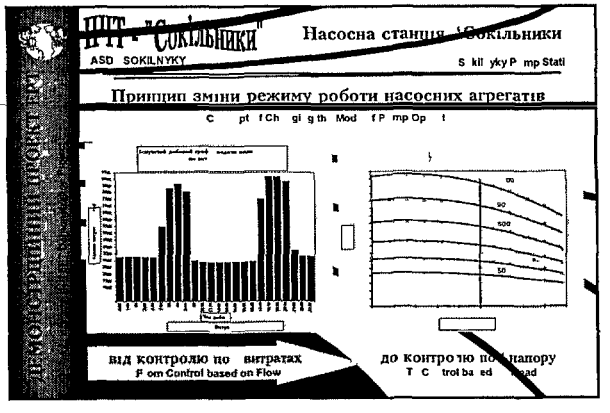
WORKSHOP PRESENTATION MATERIALS

Following is a copy of selected presentation materials distributed to workshop attendees

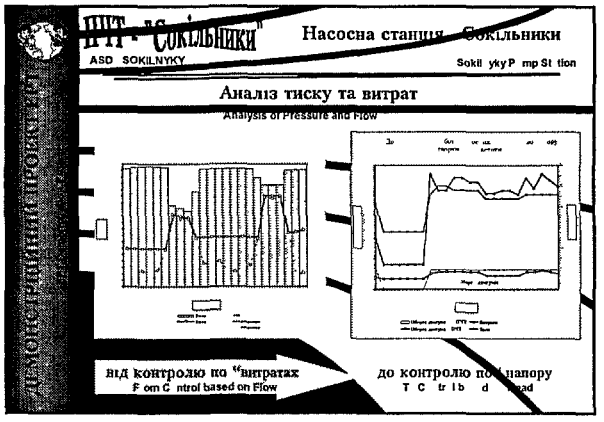
М Шарков Огляд демонстраційних проектів з економії електроенергії у Львові
M Sharkov Lviv Energy Saving Demonstration Pojects Review

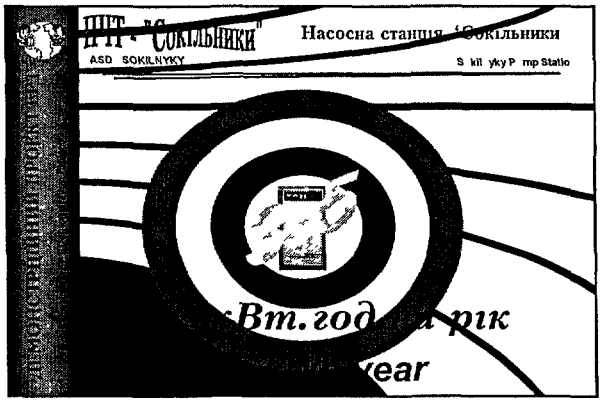






М Шарков Огляд демонстраційних проектів з економії електроенергії у Львові
M Sharkov Lviv Energy Saving Demonstration Pojects Review





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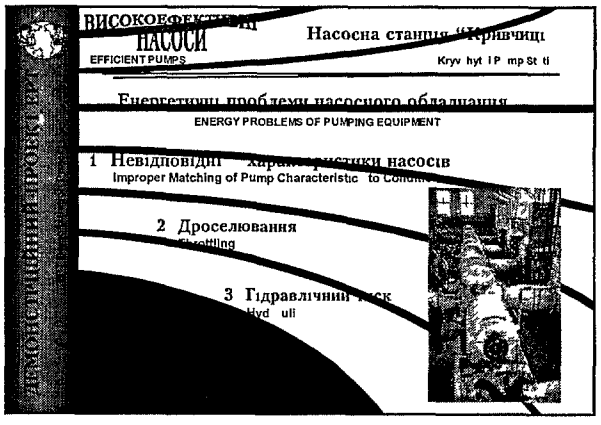

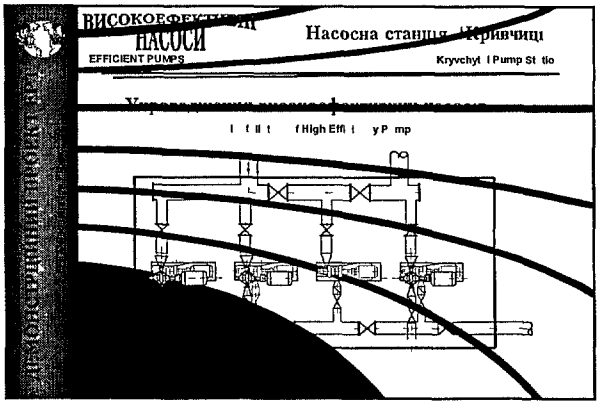

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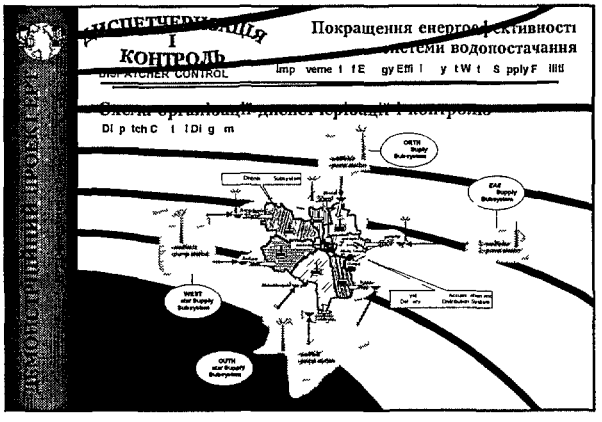

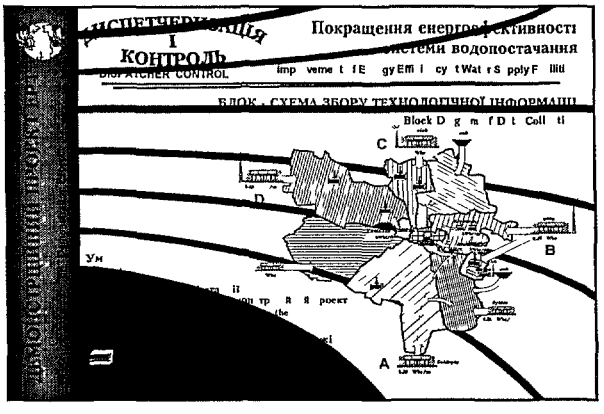

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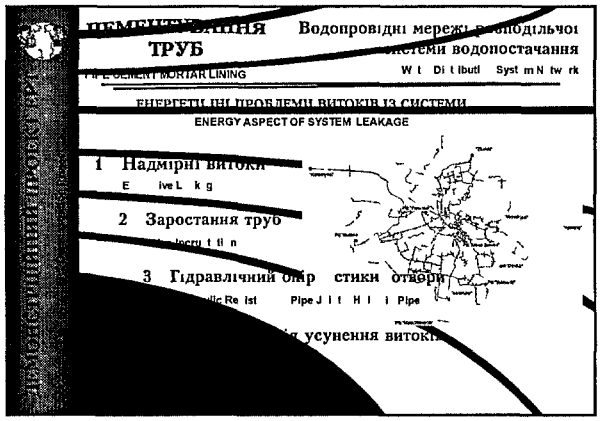

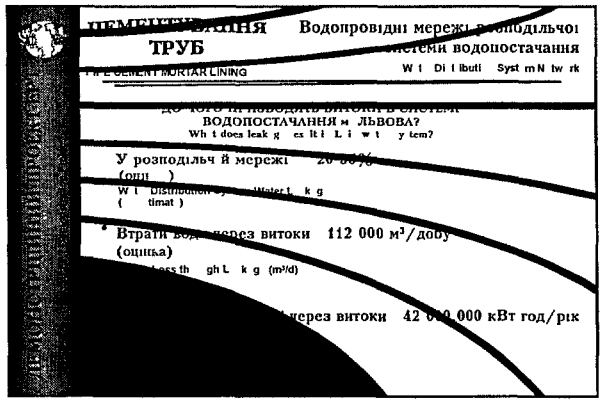

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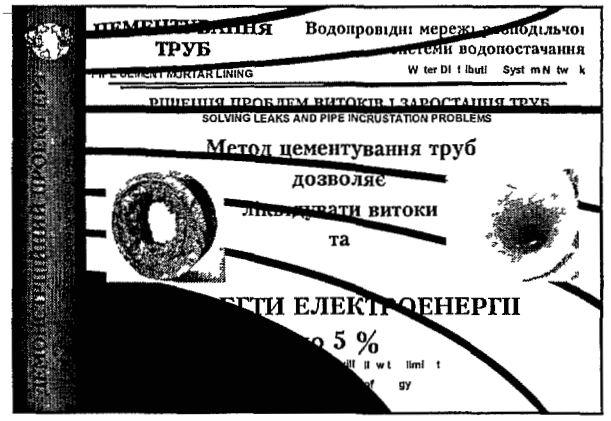


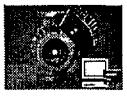
Т Гіпп Дослідження енергоспоживання систем водопостачання через визначення питомого енергоспоживання їх елементів
T Gipp Making an energy survey of a water system - specific energy

ДОСЛІДЖЕННЯ ЕНЕРГОСПОЖИВАННЯ СИСТЕМ ВОДОПОСТАЧАННЯ ЧЕРЕЗ ВИЗНАЧЕННЯ ПИТОМОГО ЕНЕРГОСПОЖИВАННЯ ЇХ ЕЛЕМЕНТІВ
MAKING AN ENERGY SURVEY OF A WATER SYSTEM SPECIFIC ENERGY

Інженер ЕРТ Львів Т Гіпп
E gi EPT Lviv T Gipp

ОЦІНКА ЕФЕКТИВНОСТІ РОБОТИ
ESTIMATION OF SPECIFIC ENERGY CONSUMPTION IN WATER SYSTEMS

Основні критерії
Main Criteria



- **Питоме енергоспоживання**
  Specific Energy Consumption
- **Середній коефіцієнт корисної дії**
  Average Efficiency

МЕТА АНАЛІЗУ
PURPOSE OF ANALYSIS

- **Визначення необхідності модернізації насосних станцій**
  Determine Need for Pump Station Modifications
- **Економічна доцільність**
  Estimate Economic Efficiency

Т Гіпп Дослідження енергоспоживання систем водопостачання через визначення питомого енергоспоживання їх елементів
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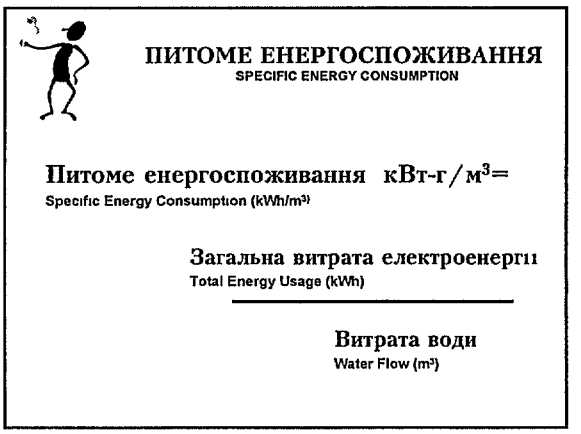
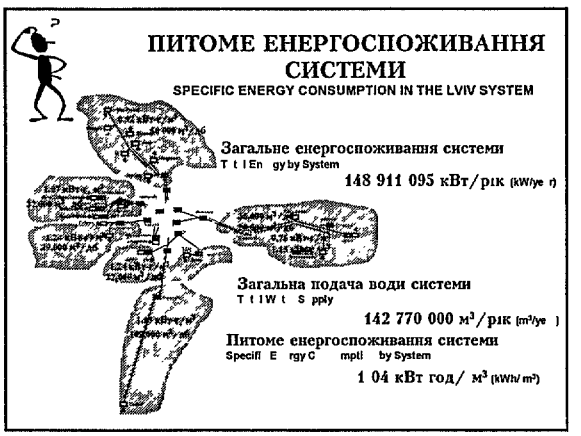
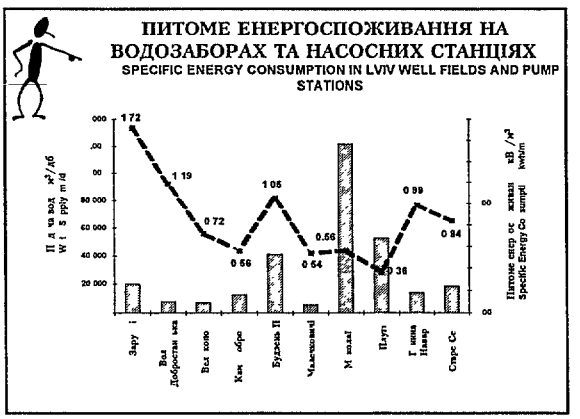
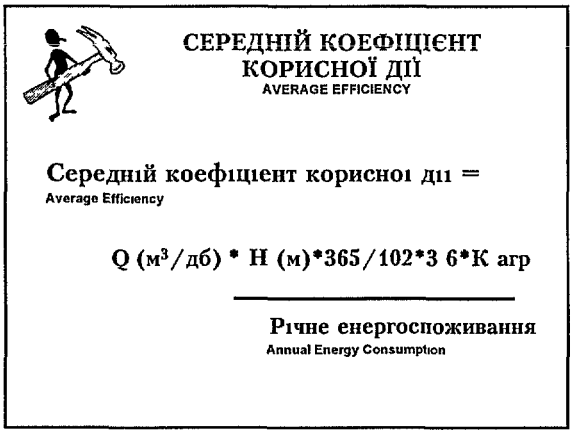
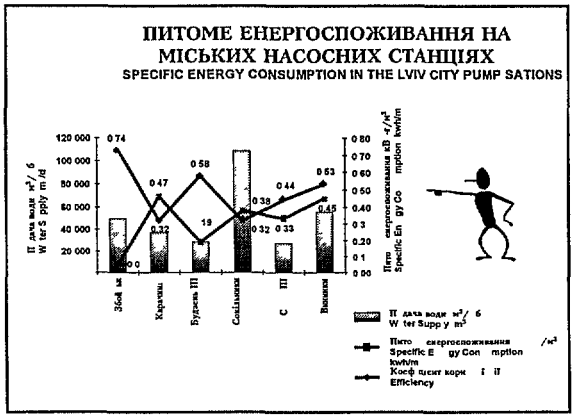






Т Гіпп Дослідження енергоспоживання систем водопостачання через визначення питомого енергоспоживання їх елементів
T Gipp Making an energy survey of a water system - specific energy





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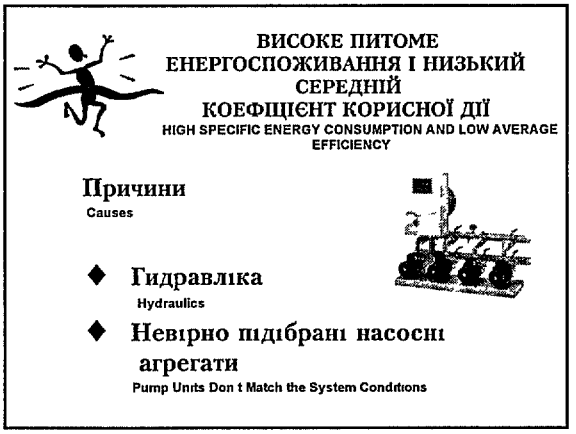
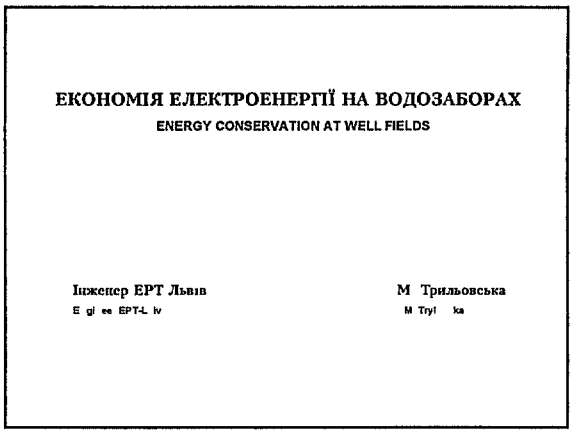
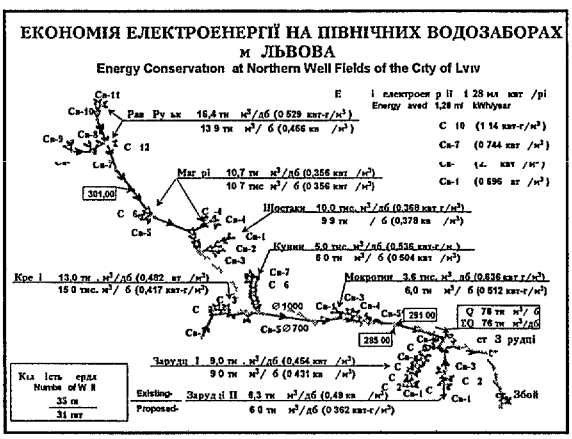
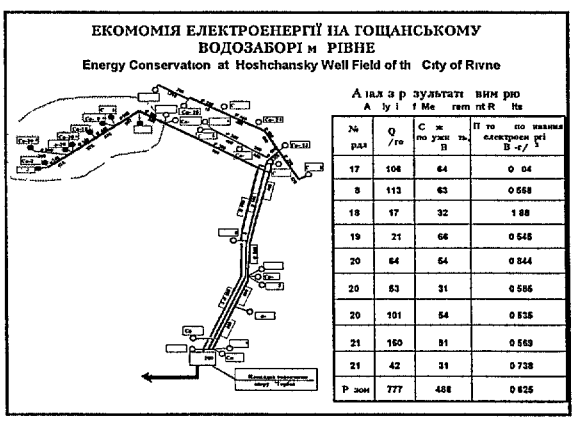


М Трильовська Економія електроенергії на водозаборах

M Trylıovska Energy savings ın well fields

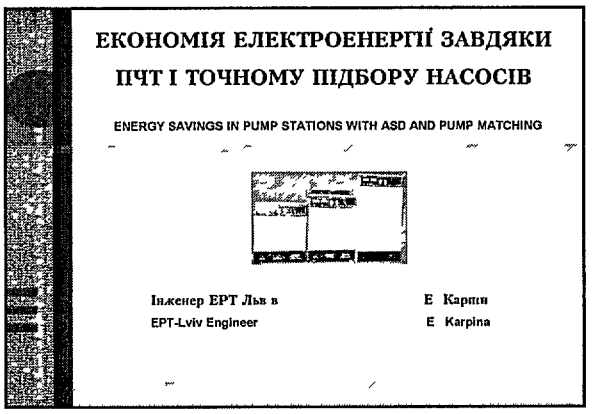


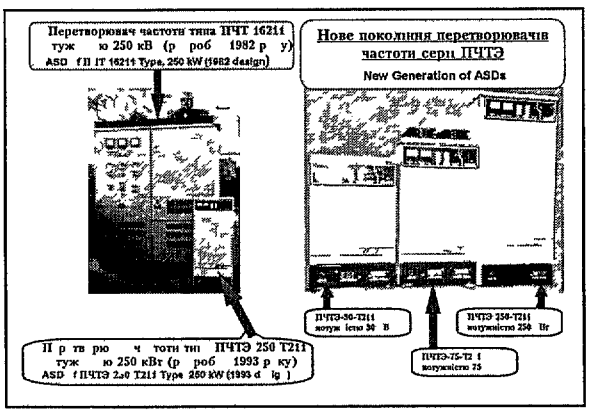


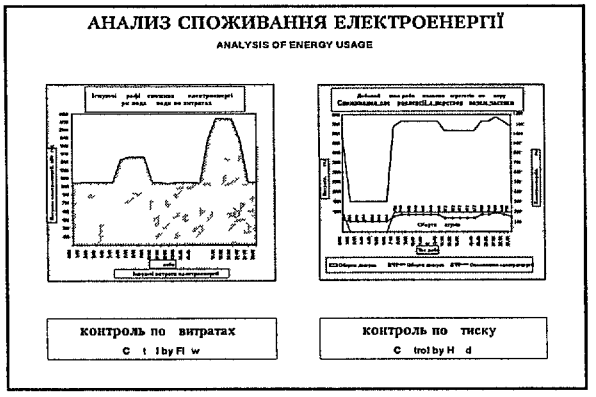


№ рдя	Q /го	С ж по ужи В	П то по ивлення електроен ргі В -г/ х
17	108	64	0 04
8	113	63	0 568
18	17	32	1 88
19	21	66	0 545
20	64	54	0 844
20	63	31	0 586
20	101	54	0 535
21	160	81	0 563
21	42	31	0 738
Р зом	777	488	0 625

Е Карпіна Економія електроенергії завдяки ПЧТ і точному підбору насосів
E Karpina Energy savings in pump stations with ASD and pump matching



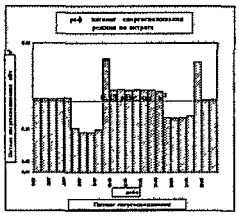


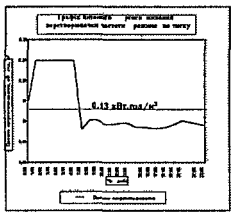


Е Карпіна Економія електроенергії завдяки ПЧТ і точному підбору насосів
E Karpina Energy savings in pump stations with ASD and pump matching

ПИТОМЕ ЕНЕРГОСПОЖИВАННЯ НАСОСНИХ АГРЕГАТІВ

SPECIFIC ENERGY CONSUMPTION OF PUMP UNITS



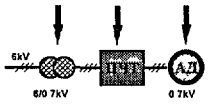


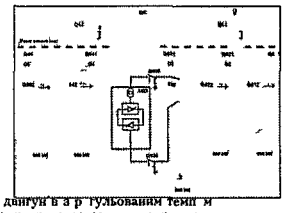
контроль по витратах
C trol by Flow

контроль по тиску
C t lby H d

ПРИНЦИПОВА СХЕМА УПРАВЛІННЯ НАСОСНИМИ АГРЕГАТАМИ

BLOCK DIAGRAM OF PUMP UNITS CONTROL





ПЧТ ЗАБЕЗПЕЧУЄ
Adju t bl Speed D i (ASD) PROVIDES

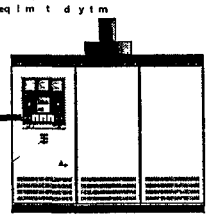
- плавний пуск та гальмування двигун в з р гульованим темп м
  gentl m t t rt and low d wn by dju ting th l ctric l f eq cy t the m t
- плавне регулювання у заданому діапазоні швидкості
  l bl dju m t f th peed withi ig ed ra g
- обмеження току та моменту у динамічному режимі роботи (пуск гальмування)
  t d t q t l t p atio pe iod (tart, low d wn)

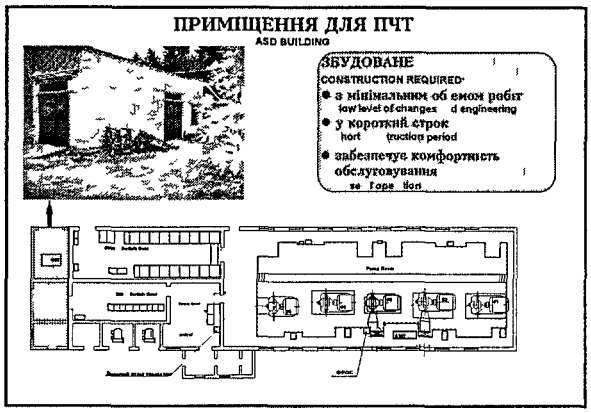
ПЧТ НОВОГО ПОКОЛІННЯ

NEW GENERATION ASD

ВПРОВАДЖЕННЯ ПЧТ ЦЕ
INTRODUCE ASD IN THE APPROPRIATE APPLICATIONS M MEAN THAT

- м я л ктр н рг і до 25 %
  up 25 % f rgy be ed
- б льш ння стр ку плуатац і ел ктр двигун в
  m t rvic life will be l d
- а томатиз ц я та птим ац я технолог чног пр ц у
  th i p ti l f inc d ut m tio d ptimizati f eq l m t d y t m

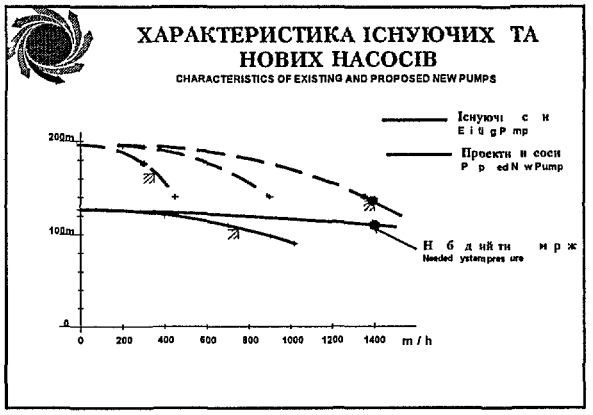



ПРИМІЩЕННЯ ДЛЯ ПЧТ
ASD BUILDING
ЗБУДОВАНЕ
CONSTRUCTION REQUIRED
з мінімальним об ємом робіт
low level of changes d engineering
у короткий строк
hort truction period
забезпечує комфортність обслуговування
Pump Room

ЕФЕКТИВНІСТЬ ВПРОВАДЖЕННЯ ПЧТ
EFFICIENCY OBTAINED FROM INSTALLED ADJUSTABLE SPEED DRIVE (ASD) UNIT
Capital I estments 500 000 UAH
Energy sa ings nnually 3,200 000 kWh/y
Energy costs reduction 260 000 UAH
Capital in estments pay-back period– 2,5 years

ПЧТ дозволяє зекономити до 25 % електроенергії
ASD ALLOWS ENERGY SAVINGS UP TO 25 %

Е Карпіна Економія електроенергії завдяки ПЧТ і точному підбору насосів
Е Karpina Energy savings in pump stations with ASD and pump matching



ЕФЕКТИВНІСТЬ ЕНЕРГОЗБЕРІГАЮЧИХ ПРОЕКТІВ (н/с КРИВЧИЦІ)

ENERGY EFFICIENT PROJECTS (KRYVCHYTSY PS)

З мі umps replacement		З м н і рс б тац ПЧТ Pumps replacement and rehabilitation
1400	Р мі ктр р і ти В д nergy sa ngs nnua ly thou and kWh/y	1800
110	З ж р л ктро рг ю ті гр Energy costs aduction, thous nd UA	145
7 2	Е м ід ж я б р ст 1000 м і р Energy ings btaine f om lowered production cos per 1 000 m³ of water UAH	8 5
20	К ж д н 1000 м од гр Capital in estments per 1 000 m³ of water UAH	30 5
2 8	Т рм н у ст ка х кл ден р Pay-back f capital nv stments years	3 3

ВИСОКОЕФЕКТИВНІ НАСОСИ
ЗБЕРІГАЮТЬ 20 25% ЕЛЕКТРОЕНЕРГІЇ
EFFICIENT PUMPS CAN SAVE
20 25% OF ENERGY

М Трильовська, Вплив витоків та нераціонального водокористування на споживання електроенергії
M Trylıovska, The impact of water losses and wastage on energy use

ВПЛИВ ВИТОКІВ ТА НЕРАЦІОНАЛЬНОГО ВОДОКОРИСТУВАННЯ НА ЕНЕРГОСПОЖИВАННЯ
WATER LEAKAGE AND WASTAGE IMPACT ON ENERGY CONSUMPTION

Інженер ЕРТ Львів
Engi ee EPT-Lvi

М Трильовська
M. Tryli k

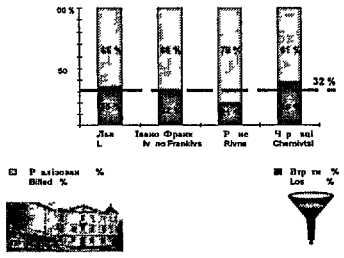
НЕРАЦІОНАЛЬНЕ ВИКОРИСТАННЯ ЕЛЕКТРОЕНЕРГІЇ
INEFFICIENT ENERGY USAGE

10 20 / Невідповідне насосне обладнання
Poorly Mat hed Pump

10 15 / Витоки в системах
E ive System L k g

7 10 / Непродуктивні втрати води в системах
Exc ive L In th System

ОБСЯГИ ВТРАТ ВОДИ У РІЗНИХ СИСТЕМАХ ВОДОПОСТАЧАННЯ
WATER LOSSES FOR DIFFERENT WATER SUPPLY SYSTEMS



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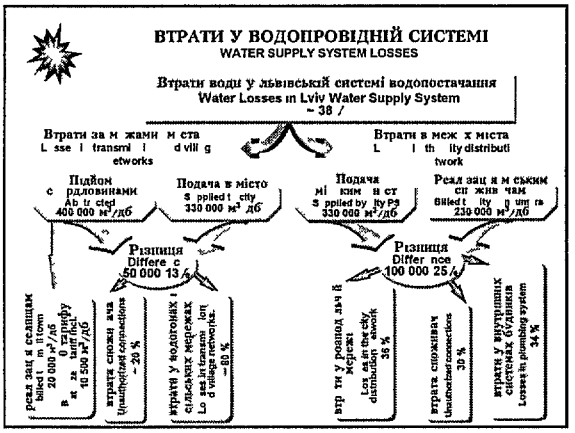
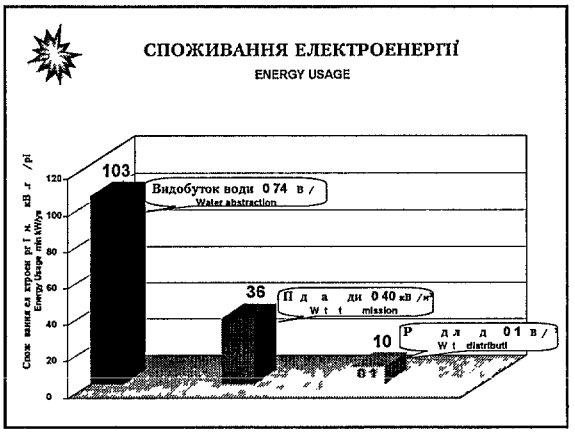
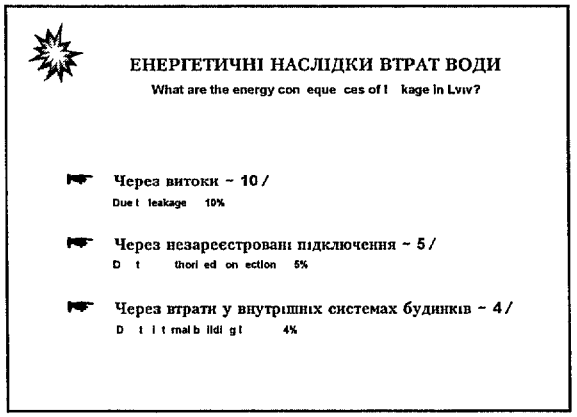






М Трильовська, Вплив витоків та нераціонального водокористування на споживання електроенергії
M Tryhovska, The impact of water losses and wastage on energy use

ПІДВИЩЕННЯ ЕНЕРГЕТИЧНОЇ ЕФЕКТИВНОСТІ СИСТЕМ ВОДОПОСТАЧАННЯ

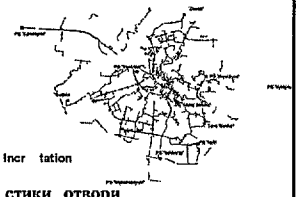
IMPROVEMENT OF ENERGY EFFICIENCY AT WATER SUPPLY FACILITIES

Вивчення проблеми
Identify Problems

Пошук шляхів вирішення
Find and Implement Solutions

Економічна доцільність
Economic Expediency

ЕНЕРГЕТИЧНІ АСПЕКТИ
витоків із системи
ENERGY ASPECT OF SYSTEM LEAKAGE



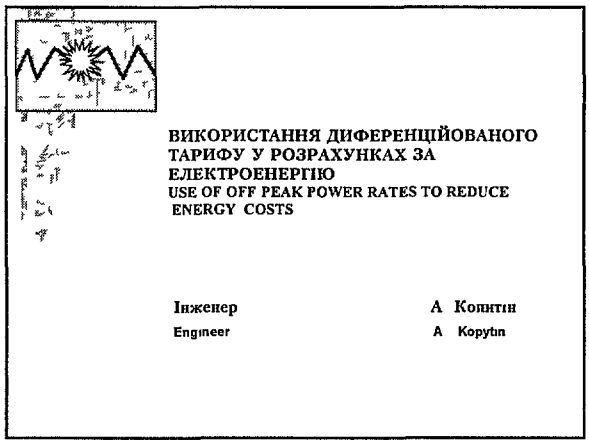
1 **Висока аварійність**
High Breakdown Rate

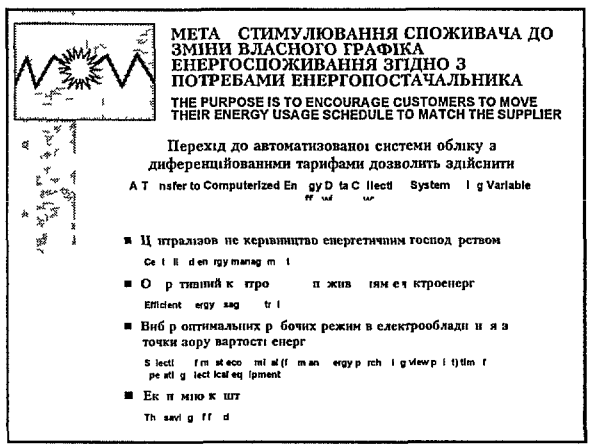
2 **Заростання труб**
Incre sed H d Los Due to Pipe Incr tation

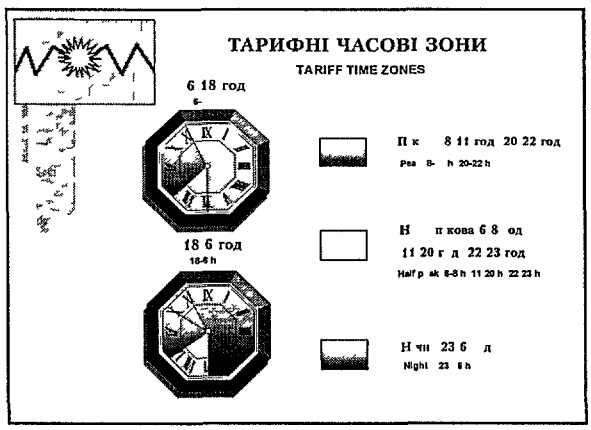
3 **Гідравлічний опір стики отвори**
Head Loss from Leakag In Bad Joint & Holes In Pipe

4 **Організація усунення витоків**
R pair Practices Excessive Time for Repairs

А Копитін Використання диференційованого тарифу у розрахунках за електроенергію
A Kopytin Use of off-peak power rates to reduce energy costs







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ТАРИФИ
TARIFFS

Тарифи на електричну енергію диференційовані за періодами часу
E ergy tariff th t ry d ri g diff ent period f th d y

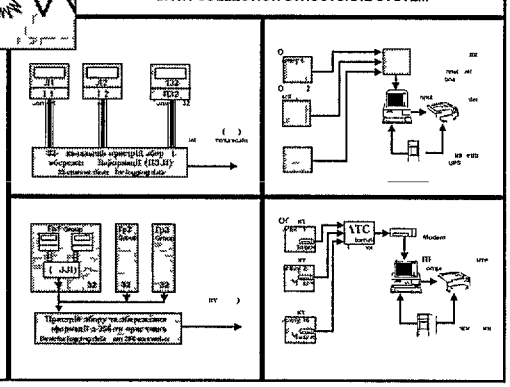
Цент / т д
US ents/kWh

ДАЕК St t rgy h h ldi g mp y	Гру I G p I			Гру II G p II		
	II igh	НП half-p k	П pe k	II ight	НП half-pe k	П pe k
Львівобленерга Lviv energy company	1,0	4,2	8 0	1 0	4,3	8 4

Груп I промислові спожив з ри дн і ю п тужністю б льш 750 вт
Група II промислові сп жив ч при дн і ою потужн стю д 750к т

Gro p I I d strial t m rs with th p we d mand ve 750 kW
G p II I d stri l st mer sl g with th power d m d l ss th 750 kW

СТРУКТУРНІ СХЕМИ СИСТЕМ ОБЛІКУ
DATA COLLECTION STRUCTURAL SYSTEM



ОСНОВНІ ТЕХНІЧНІ ХАРАКТЕРИСТИКИ
MAIN TECHNICAL CHARACTERISTICS

К л сть б кт ідклю я до од ПК до 16
N mber ac itl ected t per al mput p

- К ьк ть ал об ку к нтролю- д 256
  N mber f loggi g/m it i g h p 25
- Види зв язку м д м гий р д з ВЧ зв я ок
  Typ f comm icati modem adi mm icati telep ne mm ic ti
- Час зберігання (з і к пиче п ям) д них в ПЗЗІ 7д б
  Loggi g dat p riod i th loggi g dat d vic 7 d y
- Система атесто Держстанд ртом Укра ни
  Th y t m h bee ertified by th St t St nd rd Dep rtm t of Ukrai
- Ор ентові а варт сть с ст ми д ею п дстанц ею 19 тн гр
  E timated t of th Sy tem i cludi g on bst y t m 19 000 UAH

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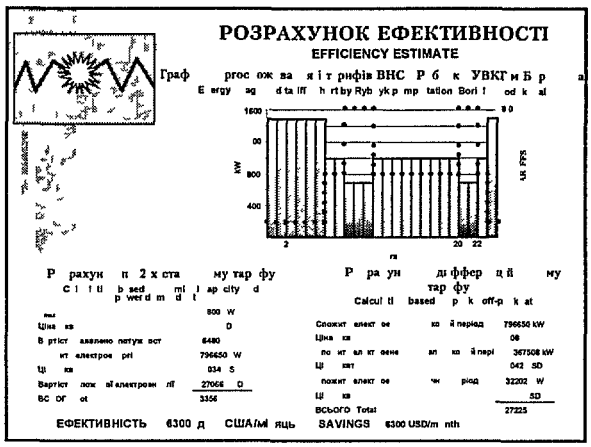
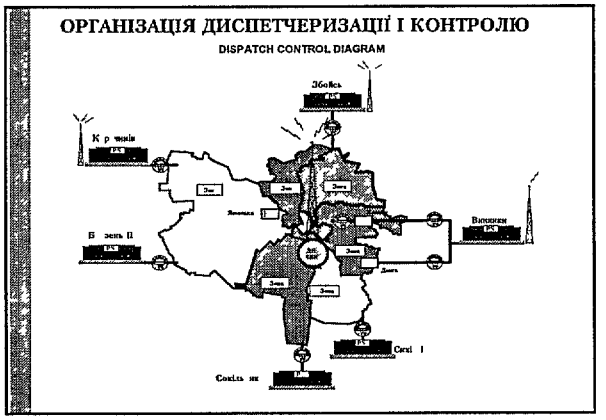
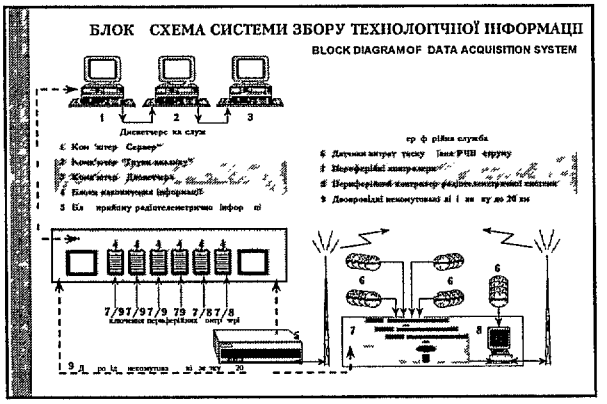


М Шарков Зони тиску та система збору і контролю технологічної інформації як шлях зменшення енергоспоживання

M Sharkov Pressure zones and data collection and control system to reduce energy usage





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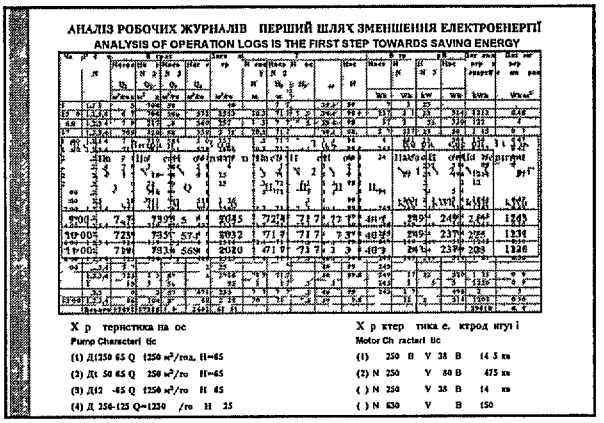
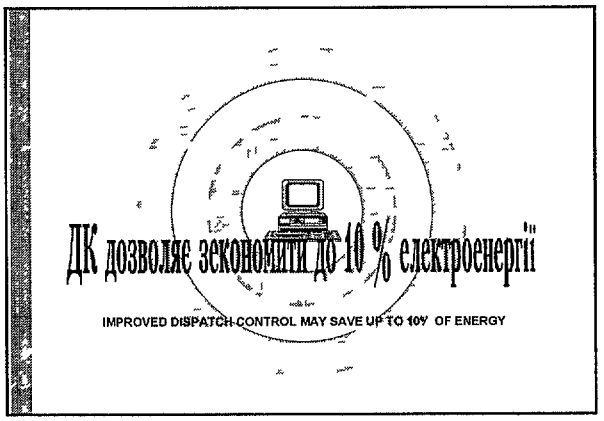
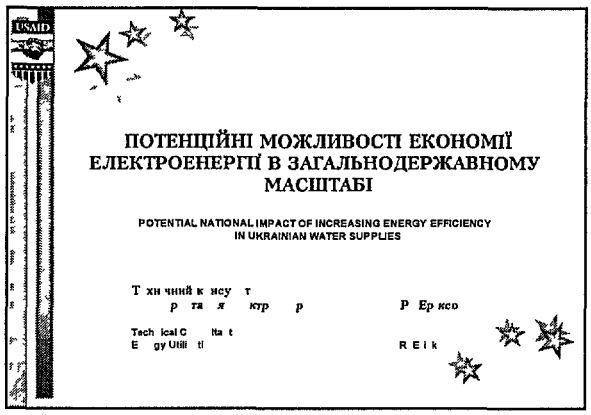
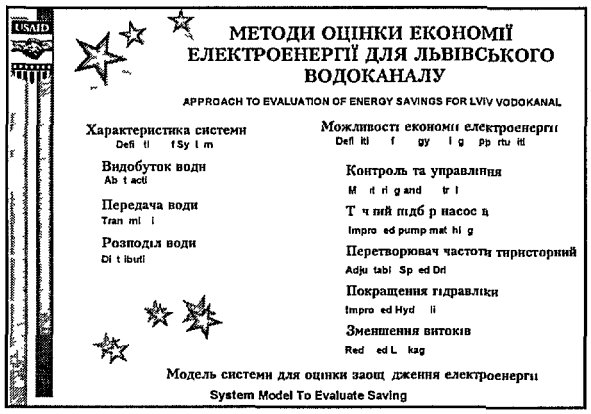
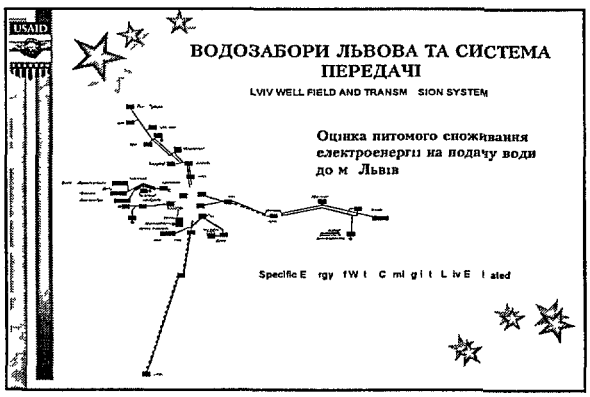




Р Ериксон Потенційні можливості економії електроенергії в загальнодержавному масштабі
R Erickson The potential for nationwide energy reduction in water systems







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P mp Station Name	Specific Power In-Coming Water	Added Specific Powe Con um	Specific Power Lea ing Water	Water Pumped Into City	Water Used Before City
	kWh/m³	kWh/m³	kWh/m³	m³ /day	m³ /day
Sokilnyky	0 78	0,34	1 12	116 000	15 000
Budz l	1 05	0 32	1 37	29 000	12 000
Karachyni	0 8	0 42	1 02	37 000	13 000
Zbol k	0 75	0 19	0 94	49 000	27 000
Vynnyky (K)	0 38	0,36	0 74	36 000	3 000
ynnyky (D)	0 38	0 76	1 14	20 000	0
Sykhi III	0 58	0 6	1 18	40 000	10 000
			T t l	307 000	80 000
an vsky	1 02	0 64	1 66	000	
Kryv htsi	0 74	0 51	1,25	36 000	
Dovh	1 14	0 15	1,29	5 000	
Myska umh	1 12	0 19	1 31	5 000	
Tel center		0 07		500	
B onev		0 27		1 500	
			T tal Di t.	55 000	

П ч я д у м Water de ed to City (m³ day)	307 тн м /д бу
П м р ж д ст м м д бут у р д д City water pecifi power consumption (kWh/ m³)	1 13 В д/м³
П м р жи м ю д ст ys m water pecifi power on umption (kWh/ m³)	1 28 В д/
П м р ж д н м м д бутку р да і д We fie ds tra mi ion energy onsumption (kWh)	119 168 850 В
П м р ж р д м ю д м Di bution before ity boundary energy on umption (kWh)	21 640 850 В
Пнт м р ж я м ю Di tribution withi city boundary energy cons mpt on (kWh)	8,581,150 кВт г
В Tota (Wh)	149 390 850 Вт
В рг сть ел ктро рг і A erage Electricity Unit Cost ($/kWh)	0 045 д л/кВт г д
З га рт т л ктр р Total Electricity Cost, $	6 722 588 д л США

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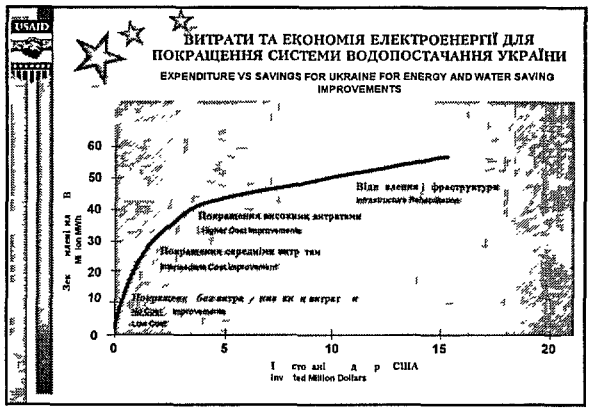
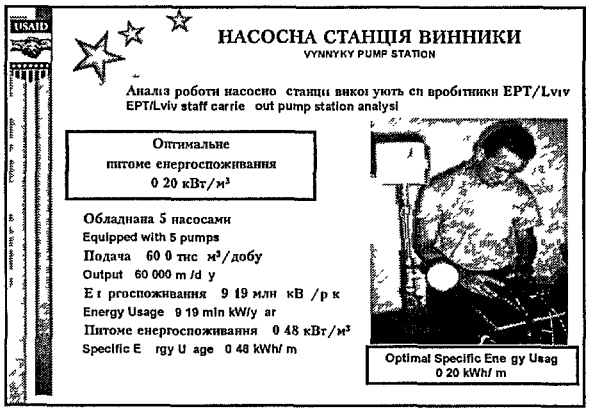
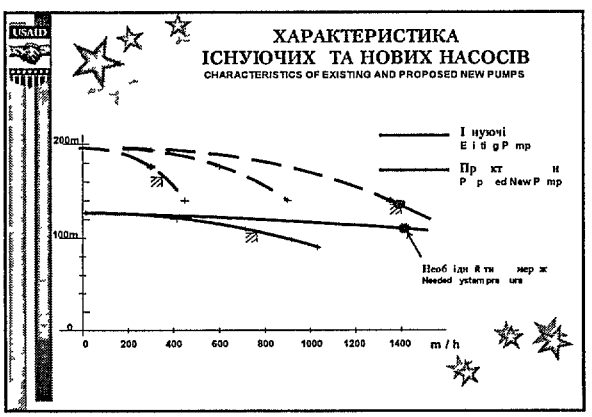
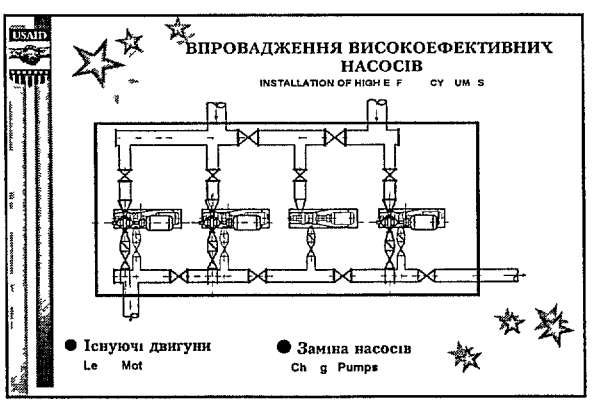




НАСОСНА СТАНЦІЯ КРИВЧИЦІ
KRYVCHYTSI PUMP STATION
Оптимальне питоме енергоспоживання 0 35 кВт на 1 м³
Облад і на 4 насосами
Eq ipped with 4 p mp
Под ча 36 0 тис м /добу
O tp t 36 000 m /d y
Енергоспоживання 8 57 млн кВт/р к
E gy U g 8 57 ml kW/y
Питоме енергоспоживання 0 51 кВт год/м³
Spe ifi E gy U g 0 51 kWh/ m
Optimal Specific Energy Usage
0 35 kWh/ m


ХАРАКТЕРИСТИКА
ІСНУЮЧИХ ТА НОВИХ НАСОСІВ
CHARACTERISTICS OF EXISTING AND PROPOSED NEW PUMPS
200m
100m
0
0
200
400
600
800
1000
1200
1400
m / h


ВПРОВАДЖЕННЯ ВИСОКОЕФЕКТИВНИХ НАСОСІВ
INSTALLATION OF HIGH E F CY UM S
Існуючі двигуни
Le Mot
Заміна насосів
Ch g Pumps

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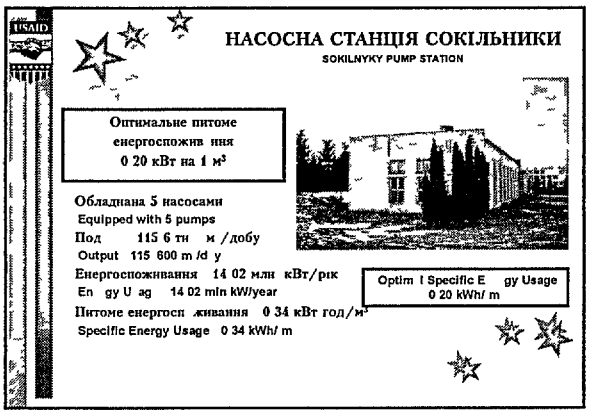

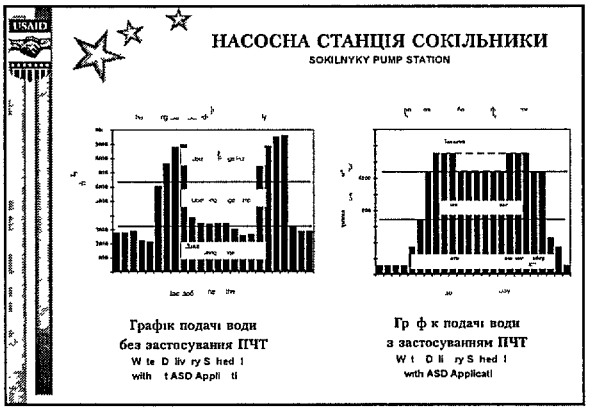

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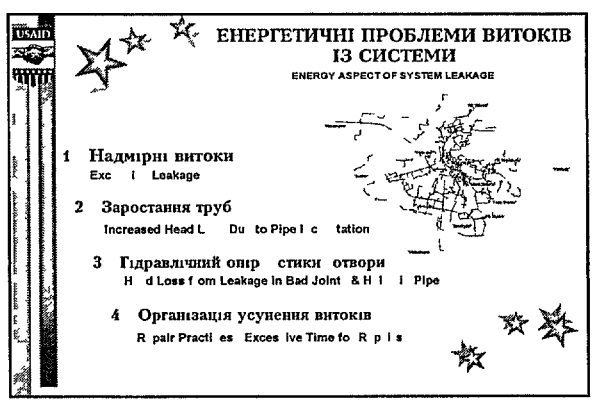

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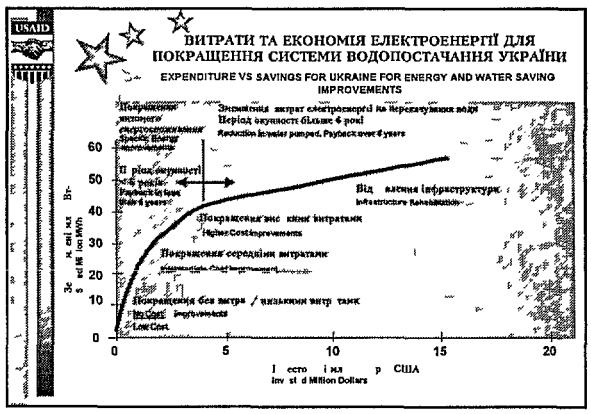

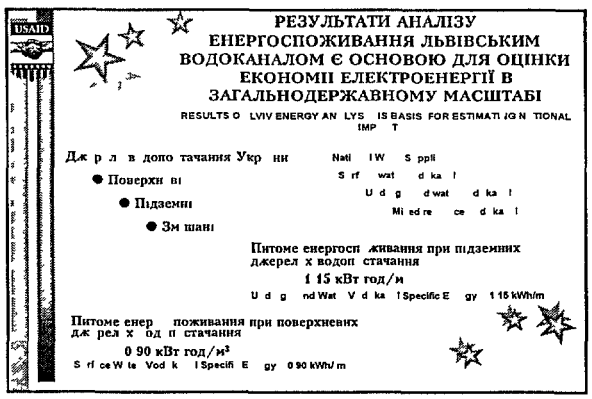

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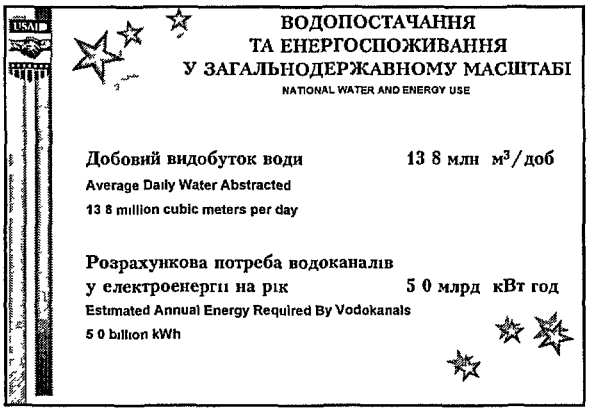

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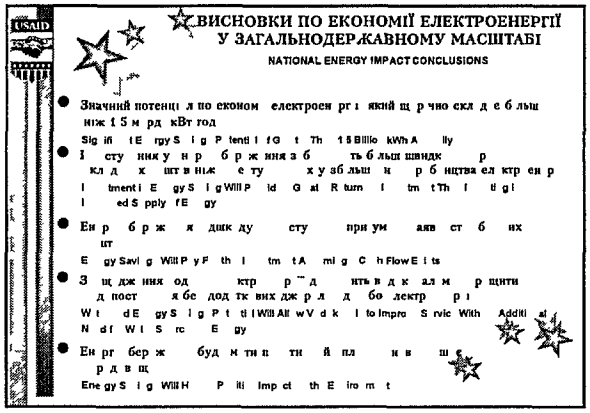

The Environmental Policy and Technology (EPT) Project Environmental degradation and natural resource mismanagement threaten public health biodiversity and economic vitality in the New Independent States (NIS) To assist the NIS in alleviating these problems the U S Agency for International Development (USAID) began the EPT Project in 1993 EPT provides technical assistance and policy advice in the environmental sector and promotes environmentally sound economic development through public and private U S and NIS partnerships The EPT Project is managed by USAID with support from the U S Environmental Protection Agency (USEPA) For assistance in project design management and implementation USAID has agreements with CH2M HILL International Harvard Institute for International Development and ISAR As the primary EPT contractor CH2M HILL International has the lead role in delivering technical assistance logistical support and policy support for selected projects EPT Regional Offices are located in Washington D C Moscow Russia Kyiv Ukraine and Almaty Kazakstan

CH2M HILL International Consortium of Subcontractors Center for International Environmental Law Clark Atlanta University/Historically Black Colleges Universities and Minority Institutions Technology Consortium Consortium for International Development Ecojuris Environmental Compliance Inc Harvard Institute for International Development Hughes Technical Services Company International Programs Consortium International Resources Group Interfax K&M Engineering Ogden Environmental and Energy Services Price Waterhouse the World Wildlife Fund and numerous local subcontractors and cooperators throughout the NIS

Environmental Policy and Technology Project
A USAID Project Consortium led by CH2M HILL

CH2M HILL International Services Inc
P O Box 24548 Denver Colorado 80224 U S A