ENERGY EFFICIENCY IN WSS UTILITIES CAPACITY-BUILDING PROGRAM

WORLD BANK

ESMAP
Energy Sector Management Assistance Program

IAWD DANUBE WATER PROGRAM
Smart policies, strong utilities, sustainable services

Final Report

August 2015

ECONOLER

ABBREVIATIONS

BiH	Bosnia and Herzegovina
CF	Cohesion Fund
CUR	Certified in the use of RETScreen
EBRD	European Bank for Reconstruction and Development
EE	Energy efficiency
EEEF	European Energy Efficiency Fund
EERSF	Energy Efficiency and Renewable Sources Fund
EIB	European Investment Bank
EPC	Energy performance contracting
ERDF	European Regional Development Fund
ESCO	Energy service company
ESMAP	Energy Sector Management Assistance Program
EU	European Union
FLAG	Fund for Local Authorities and Governments
GGF	Green for Growth Fund
IAWD	International Association of Water Supply Companies in the Danube River Catchment Area
IFC	International Finance Corporation
IGA	Investment grade audit
IIET	International Institute for Energy Training
MEGLIP	Municipal Environment Grant-Loan Investment Program
M&V	Measurement and Verification
PBP	Payback period
REEF	Romanian Energy Efficiency Fund
REEP	(Western Balkan) Regional Energy Efficiency Programme
SCADA	Supervisory Control and Data Acquisition
UIP	Urban Infrastructure Project
VSD	Variable speed drive
WB	World Bank
WSS	Water supply and sanitation

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EXECUTIVE SUMMARY

The Danube Water Program supports policy dialogue and capacity development in the water supply and wastewater (WSS) sector in the Danube region. The program is jointly run by the World Bank and the International Association of Water Supply Companies in the Danube River Catchment Area (IAWD) with seed financing from the Energy Sector Management Assistance Program (ESMAP) and the Government of Austria. The program works with regional, national and local stakeholders to (1) promote and inform policy dialogue around the core challenges facing the water utility sector; and (2) strengthen the technical and managerial capacities of the sector's utilities and institutions, including preparing and supporting service efficiency improvement activities.

Implemented from October 2013 to August 2015, the **Energy Efficiency in WSS Utilities Capacity-Building Program** organized wholesale technical assistance and capacity building on energy efficiency (EE) to water and sanitation utilities in three targeted countries (Romania, the Serbian hub and Ukraine). The program includes the following four phases:

I. Development of a capacity building program;
II. Delivery of a capacity building program;
III. Support for the implementation of training outcomes; and
IV. Documentation of the approach and outcomes.

In each country, technical training workshops were organized with the aim of building the utilities' capacity in (a) submitting energy audits; and (b) preparing a transaction for EE improvements. The capacity building program included three training sessions:

I. Initial workshop with utilities from all three targeted countries, involving all of Econoler's international and national experts assigned to the project, along with WB and IAWD representatives;
II. National event No. 1 (one for each country) conducted by the national experts;
III. National event No. 2, conducted under the same conditions as No. 1, but also involving Econoler's international financing expert.

Those workshops were organized in close collaboration with national utility associations, which were very useful in gathering participants and helping with logistics.

Overview of Project Outcomes

Out of the 36 WSS utilities that were selected for the program, 20 reached Phase III and required support to finalize their energy audit or identify suitable financing mechanisms. Out of these 20 utilities, 18 were able to submit an energy audit report, while seven could confirm financing. These results are close to the WB's initial expectations of 20 energy audit reports and 10 project financial completions. The progress of utilities broken down by country is presented in the chart below:

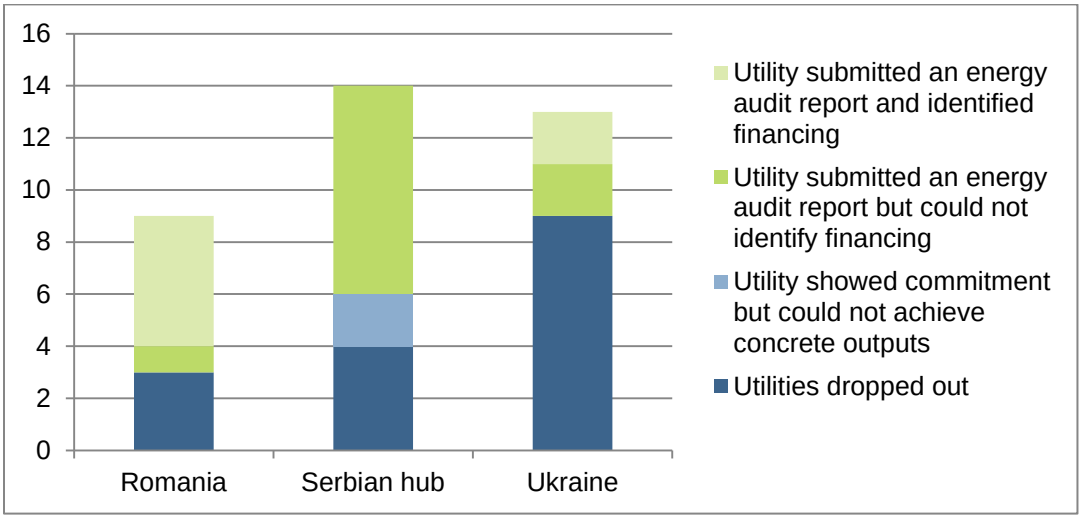

Figure 1: Utilities Progress Broken Down by Achievements and Country

As shown in Table 1 below, the total identified investments amount to 6,502,966, while the committed investments coming out of the initiative amount to EUR 2,362,920. Although a majority of the investments were self-financed or covered by municipality funds, some of them were financed by an ESCO or through the private investor.

Table 1: Project Aggregated Results

Project inputs	Project Outputs		
	Investments Identified	Investments Committed	
15 person-months EUR 202,501[1]	1,489,223	1,678,102[2]	Romania
	1,797,675	0	Serbian hub
	3,216,068	684,818	Ukraine
202,501	**6,502,966**	**2,362,920**	**TOTAL**

[1] As per the contract no 7169105 signed between the World Bank and Econoler on October 2013. The contract price is USD 228,280 but was converted to euro for comparison purposes.
[2] The amount of investment completed is higher than the investment identified because Aquaserv higher management decided to have a full rehabilitation of the Luduş water treatment plant. Their EUR 30,994 investment therefore became a EUR 320,000 investment.

Program Evaluation by Participating Utilities

The capacity building program got very positive reviews form the participating utilities, even for those that could not necessarily complete the energy audit report. The program's main benefits, as highlighted by the utilities, are listed below:

- The capacity building program promoted EE initiatives among water utilities and motivated them to conduct energy audits.
- The comprehensive and user-friendly EE manual and complementary training tools enabled the utilities to work autonomously on identifying energy savings measures.
- The streamlined energy audit approach and evaluation methodology for water pumping systems helped the utilities.
- The practical training sessions were aimed at increasing abilities with RETScreen software and addressing specific national circumstances.
- The Program was based on interactions between the participants and peer reviewers.

Suggestions to improve the future replication were collected at the end of the project with a short questionnaire filled out by some utilities and national consultants. They include, among others, (i) the need for the project to include concrete financial mechanisms, (ii) more training sessions to increase technical and financial capacities, and (iii) measures to address the lack of measuring equipment through small grants. Prospective solutions were also developed and are presented in the lessons-learned section of the report (Section 5).

INTRODUCTION

The Energy Efficiency in WSS Utilities Capacity-Building Program was implemented from October 2013 to August 2015. Its main goal was to provide technical and financial support to utilities form three targeted countries. This support was given through training sessions and individual support from Econoler. The program included four phases:

I. Development of a capacity building program;
II. Delivery of a capacity building program;
III. Support for the implementation of training outcomes; and
IV. Documentation of the approach and outcomes.

Econoler's team was made up of international technical and financial experts as well as three national experts, one for each of the targeted countries: Mihai Cruceru (Romania), Dragoslav Sumarac (Serbian Hub) and Oleksandr Nikolaienko (Ukraine)

In each country, technical training workshops were organized with the aim of building the capacities of utilities in (a) submitting energy audits, and (b) preparing a transaction for EE improvements. The capacity building program included three training sessions:

I. Initial workshop with utilities from all three targeted countries, involving all of Econoler's international and national experts assigned to the project, along with WB and IAWD representatives;
II. National event No. 1 (one for each country) conducted by the national experts;
III. National event No. 2, conducted under the same conditions as No. 1, but also involving Econoler's international financing expert.

This final report summarizes the implementation of each phase, presents and analyzes the project's main outcomes, overviews the utilities' main evaluation points of the capacity building program and reasons for attrition rate, and underlines lessons learned for future replication.

1 PROJECT IMPLEMENTATON PROCESS

The project consisted of four phases whose implementation spanned from February 2013 to August 2015 with a final objective of a maximum number of utilities completing an energy audit report and identifying suitable mechanisms to finance the identified EE measures. Each section presents the phase's main goals, work undertaken to achieve the objectives and the barriers encountered specifically within this phase, as well as the prospected solutions.

1.1 Phase I: Background Research and Country Selection

The objective of Phase I was to develop a background document to evaluate and compare current approaches related to EE in WSS, and review potential financing mechanisms in the region and beyond. This first assessment would enable the project team to conceptually plan and design the Capacity Building Program for EE in WSS based on international best practices, existing approaches and local circumstances.

While developing the project's initial approach, the project team worked on targeting countries and designing a call for proposal for interested utilities. The country selection was based on four main criteria as presented in Figure 2 below.

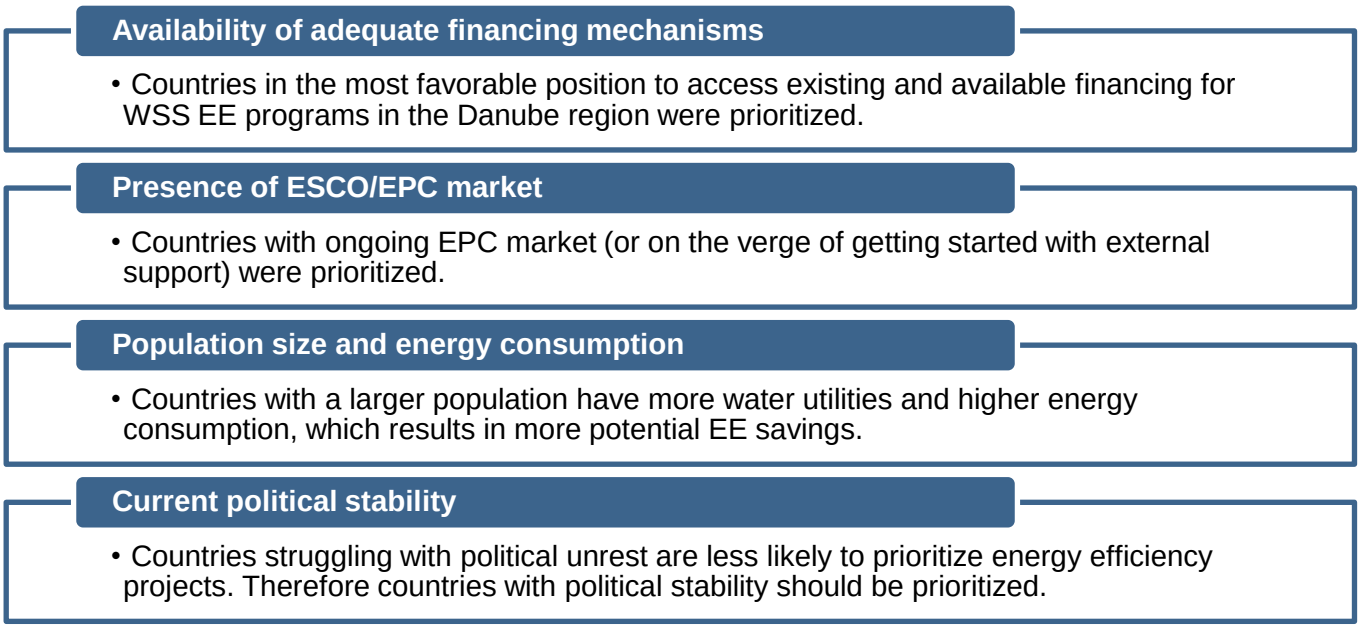

Figure 2: Criteria for Targeting Countries

Those selection criteria were set form the early stages of the program, but unfortunately could not be strictly followed due to the reality on the ground. For example, after having launched the call for proposals in the initially targeted countries, some of them had too few responses to make it worthwhile to implement the program. The Econoler team and the World Bank eventually selected some of the countries based on the high number of applications, even if they did not strictly comply with the criteria.

Utilities who applied for the call for proposals were evaluated based on three main criteria: (1) financial capacity, (2) technical potential, and (3) willingness to participate in the initiative. Subcriteria were also applied as follows:

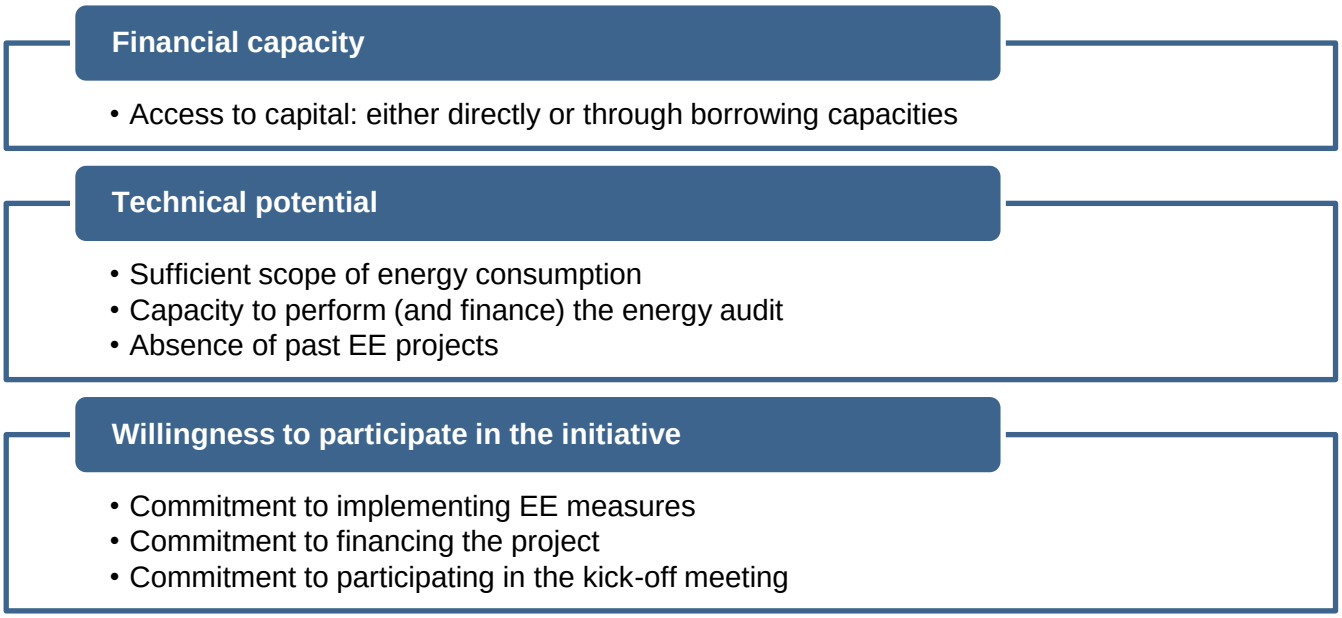

Figure 3: Criteria for Selecting Utilities

The country selection had to diverge from the initial criteria, however, since some of the countries selected had almost no utilities that applied. For example Bulgaria was initially selected but due to the small number of utilities applying the country wasn't kept for the project. The final countries targeted were Romania, Serbia and Ukraine.

1.2 Phase II: Delivery of a Capacity Building Program

The objective of Phase II was to deliver the capacity building program designed in Phase I to achieve concrete action plans based on the results of the energy audit. It was implemented in close coordination with the three national consultant and the water associations. The capacity building program was broken down into three training sessions: (1) an international initial workshop held in Sofia, Bulgaria, where all the utility representatives were gathered; (2) national event No. 1 organized in each of the participating countries which focused on technical aspects; and (3) national event No. 2

organized in each of the participating countries, which combined technical and financial aspects. This section highlights the knowledge and capacity transfer undertaken at each event and suggests avenues for improvement.

1.2.1 Participating Utilities

The WB, supported by the Econoler team, initially selected 36 utilities through a call for interest advertised on the DWP website and via national water utility associations. The utilities that officially participated in the project are broken down by country and size in Figure 4, while Figure 5 shows a map of the utilities attending the initial workshop. The complete list of registered utilities with their main characteristics and the names of their representatives can be found in 0.

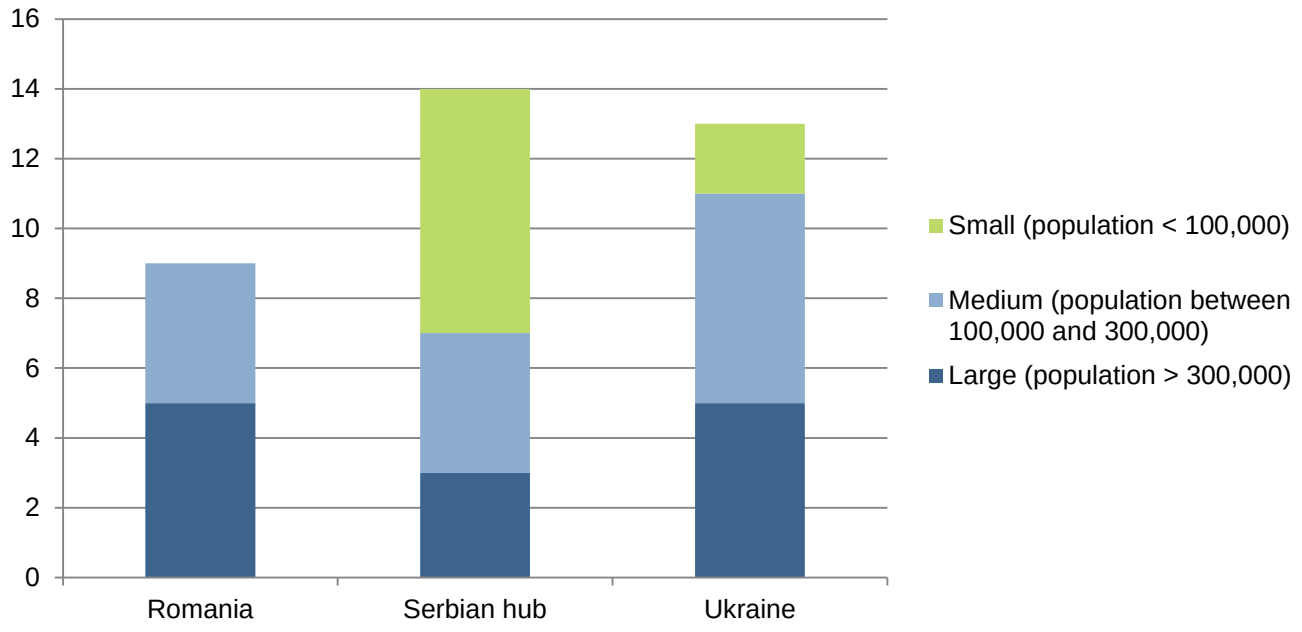

Figure 4: Participating Utilities by Country and Size

As shown in Figure 4 above, among the participating utilities at the initial workshop, nine were from Romania, 14 form the Serbia or its neighboring countries (the Serbian hub) and 13 from Ukraine. In addition to the utilities counted above, three utilities from other countries attended the initial workshop for their own interest, but did not participate in the project: Prishtina (Kosovo), Prizren (Kosovo), Aquasan mreža (Bosnia and Herzegovina).

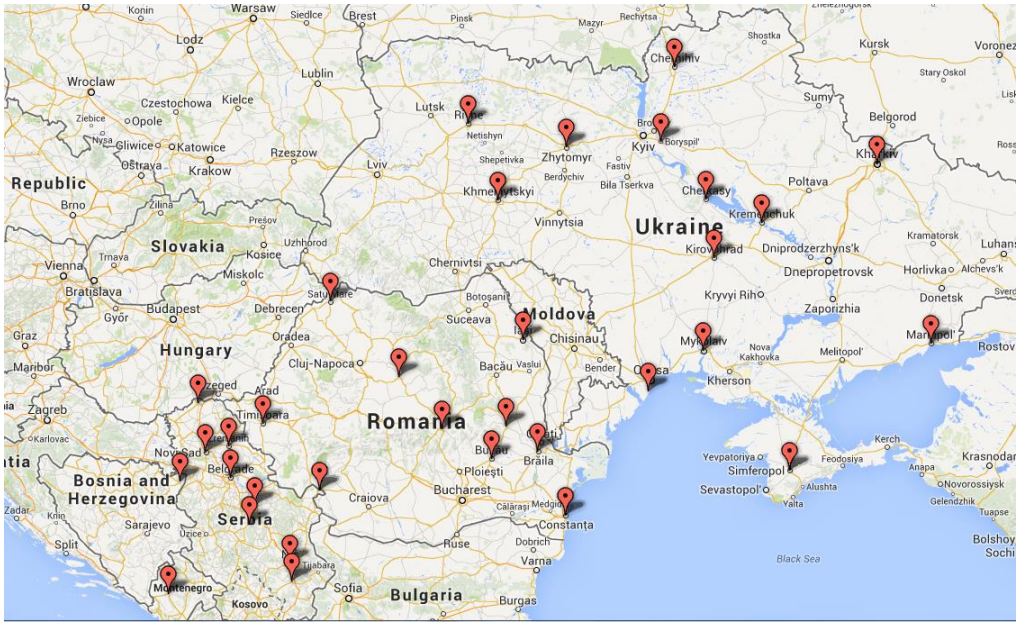

Figure 5: Map of Participating Utilities

1.2.2 Initial Workshop

The initial workshop was crucial for the successful implementation of the program. The three-day workshop was held from April 8 to April 10, 2014 in Sofia, Bulgaria. It brought together a total of 39 utilities, which were advised to send two representatives to attend the initial workshop—one technical expert and one from the management staff. The workshop aimed at transferring essential knowledge on energy savings in the water sector as well as building capacities of technical managers for conducting an energy audit. Gathering representatives from all participating utilities and meeting peers facing the same energy challenges also create a stimulating and motivating atmosphere.

Workshop Content and Structure

This section provides an overview of the various training sessions and the training material that was handed to the workshop participants. The training was conducted either in plenary sessions simultaneously translated into four languages (Bulgarian, Romanian, Serbian and Ukrainian) or in individual workshops facilitated by local experts in every language. An overview of the workshop structure is presented below in Table 2, while the detailed agenda of the event is available in Appendix II.

Table 2: Overview of Initial Workshop Content and Structure

Training Sessions	Description
Technical training part 1 **Duration :** Half a day **Training Schedule:** Day 1 am	Introduced the general aspects of EE The training continued with energy audits, including data collection activities and requirements, field measurements activities, introduction to different measurement equipment, compilation of information surveyed to determine the energy usage by equipment or category of equipment and engineering analysis on measured or collected data to determine systems efficiency.
Technical training part 2 **Duration:** 1 day **Training Schedule:** Day 1 pm and 2 am	Focused on the identification of energy savings opportunities, introduction to RETScreen, calculation of transformer losses, electrical motors efficiency, pumping systems efficiency, application of variable speed drive, hydraulic network, maintenance of water pumping systems, typical operation problems, lighting measures, cooling, chillers and compressed air.
Individual Workshop no 1 **Duration:** Half a day **Training Schedule:** Day 2 pm	Enabled each participant to present himself and share his technical expertise. The Individual workshops then continued with an activity on identifying potential EE measures, followed by a presentation of the audit report template to be used with under this program and the detailed work plan for utilities to follow until next national workshop.
Individual workshops no 2 **Duration:** Half a day **Training Schedule:** Day 3 am	Involved an in-depth presentation of RETScreen® with some case studies focused on EE improvement of pumping systems in a wastewater treatment plant. At the end of the national workshop, utilities were ask to draft a to do list of tasks to be undertaken until National Event no 1.
Training on Financial Aspects of EE projects and Action Plan Design **Duration:** Half a day **Training Schedule:** Day 3 pm	Focused on the economic evaluation of EE projects and the financing mechanisms available to utilities to implement the EE projects. Also, utilities were presented the action plan template to follow in the program and how to build it.

Individual workshops were also an opportunity for: (1) water associations to actively participate and present local EE characteristics to their respective groups; (2) utilities to work as a team and complete various activities, such as building an initial EE analysis using RETScreen® and drafting an initial EE action plan for their utility; and (3) utilities to obtain specific and customized guidance from an international technical expert.

EE Training Material

The EE training material was developed based on three main learning tools: (1) RETScreen software; (2) EE Manual; and (3) data collection forms. It was provided in four languages: Bulgarian, Romanian, Serbian and Russian.

RETScreen Software

The Econoler project team recommended the use of a common tool to have standardized audits and to facilitate the performance of the financial audit. RETScreen®, an Excel-based clean energy project analysis software tool, helps decision makers quickly and inexpensively determine the technical and financial viability of potential renewable energy, EE and cogeneration projects. This tool is also used for conducting energy audits. Developed by CANMET, the laboratory of Natural Resources Canada, this tool is available free of charge and includes a workbook to help users during its application. This software tool is available in 36 languages, including most European languages. It has been proven to be very easy to use and support the work of local experts in many countries without any needs for adaptation. Econoler developed the training materials to use the tool and participants had the opportunity for hands-on practice during the individual workshop sessions.

EE Manual

The EE Manual featured the complete EE assessment methodology to help utilities self-assess the efficiency of their facilities (both water and wastewater), and for them to identify and adopt the best available technologies and practices. The specific objective was to provide the utilities with the most cost-effective and energy-efficient sources of primary energy and standby power to improve supply-side EE and reduce their energy costs. The EE Manual was broken down into five modules, as shown in Figure 6 below.

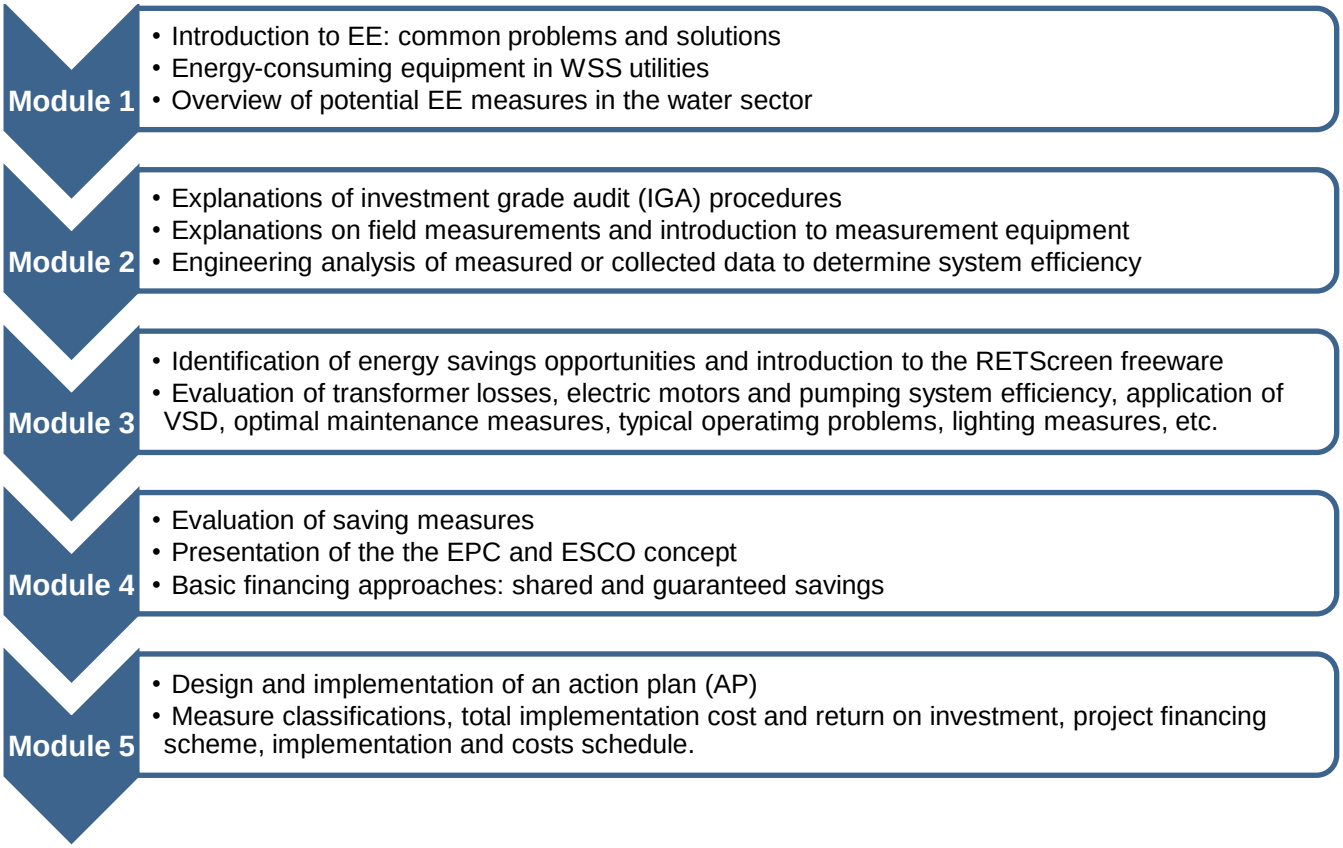

Figure 6: Overview of the EE Manual Content

Throughout the modules, all the required steps for the implementation of the energy assessment methodology were presented. Indeed, performing an energy assessment on a water and wastewater system involves the development of a sequence of phased steps to determine where and how much energy is used in the system, the level of efficiency, measures and specific projects to implement to reduce consumption and cost, the cost benefit or cost-effectiveness of such actions, an implementation plan, and methods to evaluate and monitor results. The six steps are shown in Figure 7 below and further explained in Appendix III.

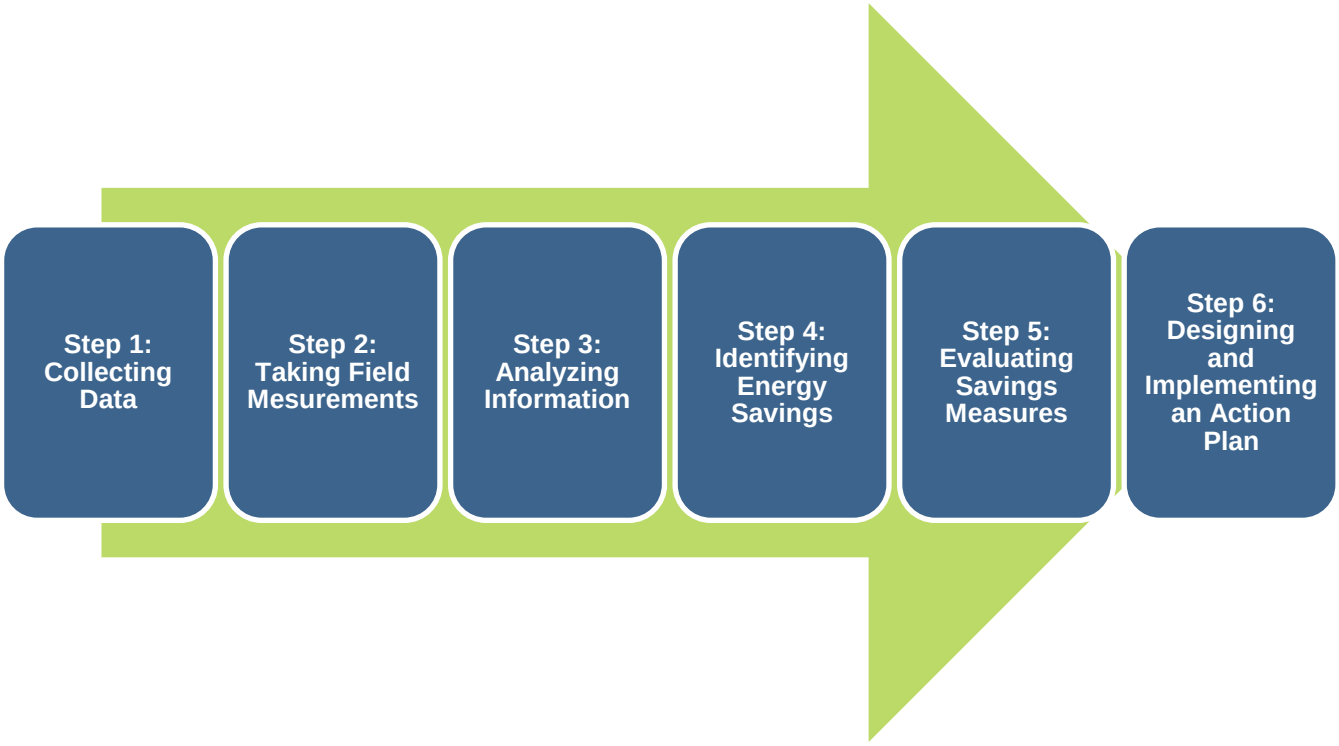

Figure 7: Steps to Perform an Energy Assessment

Data Collection Forms and Complementary Learning Material

It was essential to include complementary training material to make sure utilities would not find it too overwhelming. A data collection form based on RETScreen® was provided to all participating utilities to allow them to use uniform, relevant data when performing EE calculations. The form enabled the local consultants to make quick revisions and allowed to simplify the evaluation from a finance perspective. Other learning tools included:

- RETScreen case studies tailored to EE in the water sector
- Data collection form
- Audit Report Template for WSS utilities
- Action Plan template

Overview of Workshop Appreciation and Results

According to the participants and speakers, the initial workshop provided valuable information, plus valuable guidance and essential capacity building on technical, financial and managerial aspects of implementing EE projects in WSS utilities.

The Capacity Building Program for EE in WSS is intended to address issues and challenges facing water utilities and propose concrete solutions. It was therefore not surprising that the kick-off event was welcomed with general enthusiasm among the participants (evaluation results are available in Appendix IV). Such enthusiasm clearly indicates that such a discussion and knowledge-sharing platform were highly relevant and strengthened the utilities' motivation to implement EE measures. Participants hoped that more such opportunities would be offered for them to meet with colleagues facing similar issues and realities and thus encourage peer learning.

As for the training material, the national consultants and utilities confirmed that after a first introductory workshop, the EE Manual can be used autonomously by the participants and provide all the instructions needed for the implementation of actions that are expected from utilities. Some prospective improvement regarding the workshop structure to enhance participation of higher management can be found in the section on lessons learned.

1.2.3 National Event No. 1

National Event No. 1 was conducted in mid-July 2014 and organized in close coordination with the respective national water associations.[3] All trainings were conducted in the country's national language and the participants had to pay for their own travelling expenses (only catering and the venue were covered by the IAWD). The agenda is available in Appendix II, while further information on participating utilities is displayed in Appendix VI.

Table 3: Information on National Event No. 1

Training Details	Romania	Serbian Hub	Ukraine
Location	Brasov	Kladovo	Kiev
Number of Utilities	6	9	6
Number of Delegates	15	18	8

Objectives

The main objectives of National Event No. 1 were to (1) present the country's main EE developments in the water sector; (2) allow the utilities to present their progress on steps 1 to 4 of the energy assessment and engage in peer-review; (3) develop potential EE measures under the guidance of the national consultants; and (4) overview the main EE financing opportunities.

[3] Due to a change in management, the Ukrainian Water Association could not take part in the organization of National Event No. 1, but did help for the second event.

Training Approach

The training approach was very flexible and systematically tailored to the needs of each group of trainees. The main goal was to leverage peer-learning as an optimal knowledge-sharing tool and a way to motivate the utilities in progressing with the implementation of the six steps of the energy assessment. Participants could also have a privileged access to the national consultant so as to present the barriers encountered and seek solutions. Training material included a report on EE financing, specifically designed for the three targeted countries, which presented international and regional best EE practices in the water sector. The Romanian Water Association also presented a case study on the Brasov Water Company. Guest speakers were also invited to enhance the knowledge-transfer process by providing a more diverse range of skills and information. The list of guest speakers is provided below:

- Silviu Lăcătuşu, President of the Romanian Water Association
- Teodor Popa, Financial Manager of the Brasov Water Company
- Mihai Marius Voronca, General Manager of the Romanian Energy Efficiency Fund (REEF)
- Predrag Bogdanovic, Serbian Water Association
- Alksandar Krstic, Serbian Water Expert at GFA Consulting Group

Training Results

Overall, the utilities preferred this type of training event more than the initial training. This is mainly due to the fact that the national events were run in the participants' own language, that smaller groups allowed for better interaction and that the training agenda was not excessively packed. Three workshop reports (one per country) were delivered as to provide an overview of the presentations and present a detailed utility-by-utility progress update based on the six steps of the energy assessment methodology.

1.2.4 National Event No. 2

National Event No. 2 was conducted in October 2014 (Romania and the Serbian Hub) and November 2014 (Ukraine), and was organized in close coordination with the respective national water associations. All training sessions were conducted in the country's national language and participants had to pay for their own expenses (only catering and the venue were covered by the IAWD). The agenda is available in Appendix II, while further information on participating utilities is displayed in Appendix VI.

Table 4: Information on National Event No. 2

Training Details	Romania	Serbian Hub	Ukraine
Location	Târgu Mureș	Belgrade	Kiev
Number of Utilities	6	7	6
Number of Participants	14	12	8

Objectives

The main objectives of National Event No. 2 were to (1) allow the utilities to present their progress on steps 5 and 6 of the energy assessment and engage in peer reviewing; (2) provide additional instructions for the implementation of detailed energy audits and the drafting of audit reports; (3) run a training session on financing measures in the WSS sector (by Econoler's financial expert); and (4) visit a WSS utility and become familiar with the EE measures implemented.

Training Approach

The training approach for National Event No. 2 was similar to the first event, putting the individual presentations of utilities and peer reviews at the forefront. The Serbian hub and Romania also organized visits of water treatment plants, which proved very useful to make theoretical knowledge more concrete.

Since utilities were mostly done with the energy audits and then had to identify sources of financing, the training session focused on specific solutions to finance EE projects in WSS utilities. Econoler's financial expert, Ivan Gerginov, attended each of the three training events to deliver a presentation focusing on (1) government grants, (2) EU-supported programs, (3) ESCO financing, (4) bank loans, and (5) other project financing sources, depending on the country. IFC representatives also presented the credit line opportunities in Romania and the Serbian hub.

Guest speakers were again invited to enhance the knowledge-transfer process by providing a more diverse range of skills and information. The list of guest speakers is provided below:

- Aleksandar Krstic, Water Expert at GFA Consulting Group
- Valentin Miron, IFC Bucharest office
- Ivan Gerginov, Econoler financial expert
- Milica Sredanovic, IFC Belgrade office
- Branka Milutinovic, Serbian Water Association
- President of Ukrainian Water Association

Training Results

Both national events provided the utilities with valuable knowledge and skills. This was clearly demonstrated by the strong correlation between attending all the training sessions and submitting an energy audit report (see Appendix VI on utilities progress). Only four utilities out of 18 were able to submit a report without having attended the whole capacity building program. Although the participants had to cover their travelling expenses, many of them actively participated in both national events. Again, three workshop reports (one per country) were delivered to provide an overview of the presentations and present a detailed utility-by-utility progress update based on the six steps of the energy assessment methodology.

1.3 Phase III: Support for the Implementation of Training Outcomes

The objective of Phase III was to provide further support to selected utilities in delivering an energy audit report and seeking suitable financing for the implementation their EE project. Throughout Phase III, the Econoler project team provided technical and financial assistance tailored to each participating utility. Econoler documented the supporting activities and the progress of utilities with five monthly reports. The section also includes an overview and assessment of each country's result.

1.3.1 Participating Utilities

One the one hand, 20 utilities (around 55% of the initial selection) showed strong commitment to submitting an energy audit report and identifying suitable financing mechanisms (the complete list is shown in Table 5). On the other hand, 16 utilities withdrew from the program during the implementation of Phase II and therefore did not make it to Phase III. Further analysis of the attrition rate is presented in Section 3 on the utilities' evaluation of the program. Among the 20 utilities below, 18 could submit an energy audit report and seven were able to secure the financing of their EE projects.

Table 5: List of Participating Utilities by Country

Romania	Serbian Hub	Ukraine
› Aquaserv (Targu Mures) › Focsani › Apaserv (Stau Mare) › Raja (Constanta) › Buzau › Brasov	› Vacar (Belgrade) › Zvezdara (Belgrade) › Izvoriste (Leskovac) › Gorina (Leskovac) › Subotica › Bijeljina (BiH) › Niksic (Montenegro) › Naissus Nis › Kladovo › Novi Sad	› Chernihiv › Kremenchuk › Kharkiv no 26 › Pyatihaki (Kharkiv)

1.3.2 Country Assessment

The following section shows EE measures identified per country/per utility and briefly analyzes the national situation regarding EE.

Romania

Since joining the European Union, Romania has been more stringent on energy efficiency so as to meet the requirements calling for the full transposition the EU Energy Efficiency Directive.[4] This has resulted in the adoption of Romanian Law No. 121/2014 on EE and the establishment of the Energy Efficiency Department. Romanian Law No. 121/2014 on EE introduces certain obligations imposed on economic operators that must carry out an energy audit conducted by competent professionals every four years, and prepare programs to improve energy efficiency, including short-, medium- and long-term measures. The government also plans on establishing a specialized fund for energy efficiency investments that will be accessible to a wide range of energy efficiency suppliers, from energy service companies to final consumers. The legal and policy framework aims at:

- training energy auditors and conducting independent energy audits;
- creating standards, rules and regulations that lead to the adoption of energy-efficient technologies;
- supporting the development of ESCOs (energy services companies which provide services and implement measures to improve the energy efficiency of the consumer's facilities, while the consumer takes some financial risks, for payment for such services is based on improving energy efficiency and meeting other performance criteria agreed upon by the parties).
- establishing a specialized investment fund for energy efficiency and financing instruments or tax incentives to implement energy efficient techniques.

This is likely to boost EE initiatives, and it could trigger the emergence of new specialized energy services suppliers. It will also generate increased interest among banks in terms of offering financial incentives to players in this field.

In the Romanian WSS utilities sector, large infrastructure projects have already been financed by European grants, which greatly helped in complying with European environmental standards and had a considerable impact on the development of communities. This approach aimed to increase both efficiency investment costs and operating costs of new investment objectives.

Nearly EUR 7 billion were invested in the Romanian water sector. The technological flows at sewage and treatment plants were upgraded, and the cost of electricity decreased from over 20% to 10% thanks to lower operating costs, but water and wastewater utilities still have significant potential for energy saving opportunities. The Romanian WSS utilities have enough experience in managing EE

[4] Commission requests AUSTRIA, CROATIA, IRELAND, LATVIA and ROMANIA to fully transpose the EU Energy Efficiency Directive, Press Release, 29 April 2015,

projects, but the Danube Water Program offered them the possibility of analyzing various EE solutions without the costs involved by specialized companies.

Out of the nine initial Romanian participating utilities, six submitted an energy audit and five secured financing. Table 6 presents an overview of those results, while more detailed data on identified EE measures can be found in Appendix V.

Table 6: Overview of the Results in Romanian Utilities

Utility	Energy Saving Opportunities	Energy Savings (%)	Total Investment (EUR)	Confirmed Financing
Aquaserv Targu Mures	Replacing pumps No. 1 and 2	34.65	30,994	X
	Installing VSD			
Apaserv Satu Mare	Water pumps replacement at Carei	21.81	30,634	X
	Water pumps replacement at Sanatatii	40.23	7,474	
	Water pumps replacement at Str. Independentei	23.84	5,068	
	Water pumps replacement at Str. Closca	31.07	1,921	
Focsani	Replacement of five GM50L-type blowers	20.10	126,483	X
Raja Constanta	Construction of two on-site, fully-equipped electricity transformation substations in existing buildings	-	1,198,745	X
Buzau	Replacing motors and pumps	40.56	62,504	
Brasov	Replacing water pumps and electric motors	18.00	25,400	X
		TOTAL	**1,489,223**	

The table shows results as they were stated by the energy audit report. However, along the implementation of Phase III, the two utilities changed their EE project and investment plans:

- Aquaserv Targu Mures finally diverged from the initial EE project. In the first quarter of 2015, their identified measures were re-assessed and higher management decided to have a full rehabilitation of the Luduş water treatment plant. The EUR 30,994 investment therefore turned into an investment of EUR 320,000.
- Apaserv Statu Mare only financed one out of four measures identified (water pump replacement at Sanatatii), which was an investment of EUR 7,474.

As for financing, three utilities decided to self-finance their measures (Apaserv Satu Mare, Focsani and Brasov), while Aquaserv Targu Mures chose the ESCO scheme and Raja Constanta went into an agreement with Enel Group[5], the largest private investor in Romania's energy sector.

Serbian Hub

Serbian utilities mostly had well-trained staff who successfully completed all the analyses. Since the systems in the utilities are inefficient and largely outdated, representatives recognized the need to improve EE in the generation and processing of water. Utilities were also facing numerous challenges in the implementation of Phase III. Serbia is indebted at 70% of its GDP and no government—neither local nor central—will grant additional credit lines. Utilities are run by local governments, which often have political agendas, and the decisions that they make are often linked to political strategies. There was frequent divergence between higher management and technical experts regarding the importance of a future development strategy for utilities, whose absence hinders the implementation of identified EE projects. Any financial decision requires the consent of management, often politically appointed out of touch with the real and long-term needs. The management of utilities moreover avoids long-term financial commitment in the form of taking out loans from banks.

The water sector in Serbia definitely needs financial help to boost the EE in plants for the generation and processing of water. What could help are non-refundable and low-interest loans. It is essential to overcome the problems that arise with loans that are impossible to repay on time. The water sector in Serbia should turn to funds offered by the developed countries and the EU, which are intended for that very purpose. Commercial loans offered by banks are not sufficiently favorable, so utilities avoid them.

Out of the fourteen initial participating utilities from the Serbian hub, eight submitted an energy audit and none secured financing. Table 7 presents an overview of those results, while more detailed data on the identified EE measures can be found in Appendix V.

[5] Enel Group: http://www.enel.ro/eng/companie/profil/companie_profil.htm

Table 7: Overview of the Results in Utilities from the Serbian Hub

Utility	Energy Saving Opportunities	Energy Savings (%)	Total Investment (EUR)	Confirmed Financing
Zvezdara (Belgrade)	Changing No. 1 pump at CS17a pumping station	60.1	437,724	
	Changing No. 2 pump at CS17a pumping station	56.5		
	Changing No. 3 pump at CS17a pumping station	56.1		
Vracar (Belgrade)	Changing No. 1 pump at CS16 pumping station	53.3	325,071	
	Changing No. 2 pump at CS16 pumping station	51.5		
	Changing No. 3 pump at CS16 pumping station	54.8		
Subotica	Increasing biogas production by 10%-15%	-	540,000	
Izvoriste (Leskovac)	Energy savings in maintenance and operations	39.3	14,238	
Gorina (Leskovac)	Building a small hydroelectric plant	-	379,080	
Biljeljina (BiH)	Replacing existing 64 kW pump with 45kW pump at B2 pumping station	-	32,562	
	Replacing 75kW existing pump with a 45kW pump at B11 well	-		
	Replacing existing 75kW pump with 45kW pump at B12 well	-		
Niksic (Montenegro)	Pump replacement at Vitalac	39.7	69,000	
	Pump replacement at Široka street	43.1		
	Pump replacement at Donja Luka škola	40.1		
	Pump replacement at G. Rubeža	46.2		
	Pump replacement at Donja Luka Relejska	42.9		
	Pump replacement at Donja Rubeža	19.1		
Naissus Nis	Changing No. 1-2 pumps at Mediana 2	51.2	82,054	
	Changing No. 3-4 pumps at Mediana 2	64.2		
		TOTAL	**1,797,675**	

Ukraine

The implementation of Phase III in Ukraine was laborious due to several factors:

› The majority of the participants from Ukraine were participants of the World Bank Urban Infrastructure Project (WB-UIP). This project provided long-term loans with the lowest interest rates available in Ukraine. The range of loan amounts was about USD 10-50 million depending

on the utility, which fully covered the implementation of the main energy efficiency measures at utilities. Several utilities claimed that their technical staff would be busy with the heavy workload involved in UIP2, which forced them to stop their collaboration with the Energy Efficiency in WSS programme.

› Ukraine's economy has been in recession since the beginning of 2014, and the inflation rate has skyrocketed since the project kick-off (25% in January 2015 compared to 6.9% in April 2014).[6] These dire economic and financial conditions greatly hindered EE investments. The budgets of water utilities have shrunk because of public deficits, and upper management is reluctant to take out loans due to high interest rates (which could reach up to 30% in commercial banks according to our national consultant). Also, the devaluation of the national currency prevents utilities from importing new material (such as pumps).

› When participating at the initial workshop, practically all utilities from Ukraine expected to receive additional financing with grants. Thus, some of the utilities had no real technical specialist (energy engineer) present at the kick-off meeting who could provide an energy audit. Also, the representatives from the utilities did not understand why they needed to produce an energy audit report. They expected that the WB would provide a consultant or give financing to hire a consultant (as it was under UIP).

Out of the thirteen initial participating utilities from Ukraine, four could submit an energy audit and two could secure financing. Table 8 presents an overview of those results, while more detailed data on identified EE measures can be found in Appendix V.

Table 8: Overview of the Results in Ukrainian Utilities

Utility	Energy Savings Opportunities	Energy Savings (%)	Total Investment (EUR)	Confirmed Financing
Chernihiv	Replacement of waste water pumping station	32.0	344,250	
	Replacement of compressors at waste water treatment plant			
Kremenchuk	Installation of a combined heat and power generator	-	2,187,000	
Kharkiv no 26	Replacement of pumps	75.0	174,590	X
	installation of VFD motors			
Pyatihatki (Kharkiv)	Replacement of pumps	47.4	510,228	X
	installation of VFD motors			
		TOTAL	**3,216,068**	

[6] Ukraine, Economic Indicators, tradingeconomics.com/ukraine/indicators

1.4 Phase IV: Documentation of the Approach and Outcomes

In addition to submitting a final report documenting the project outcomes, the objective of the fourth phase was to prepare a final revised version of all relevant training material and tools for use in future such activities. To facilitate the replication and scaling-up of the initiative by national water utility associations, detailed lessons learned were also developed for each of the phases and are included in Section 4.

1.4.1 Finalizing the Training Material

The initial training document and tools were validated by our international and local experts to readjust or clarify some information, based on the participant's comments during the initial workshop. The three national consultants also thoroughly reviewed the translations of written documents to identify and correct the errors and weaknesses with technical terms.

Econoler conducted two rounds of evaluation of the training program: (1) after the initial workshop, and (2) at the end of the program. The main comments from utilities and national consultants were compiled and addressed in the final version of the training material. The changes are presented in the list below, while a full overview of the rationale for proposed changes to the training program is included in Section 4 on lessons learned.

› The number of training sessions and opportunities for practical applications should be increased by adding National Event No. 3, as shown in Figure 8 taken from the revised EE manual.

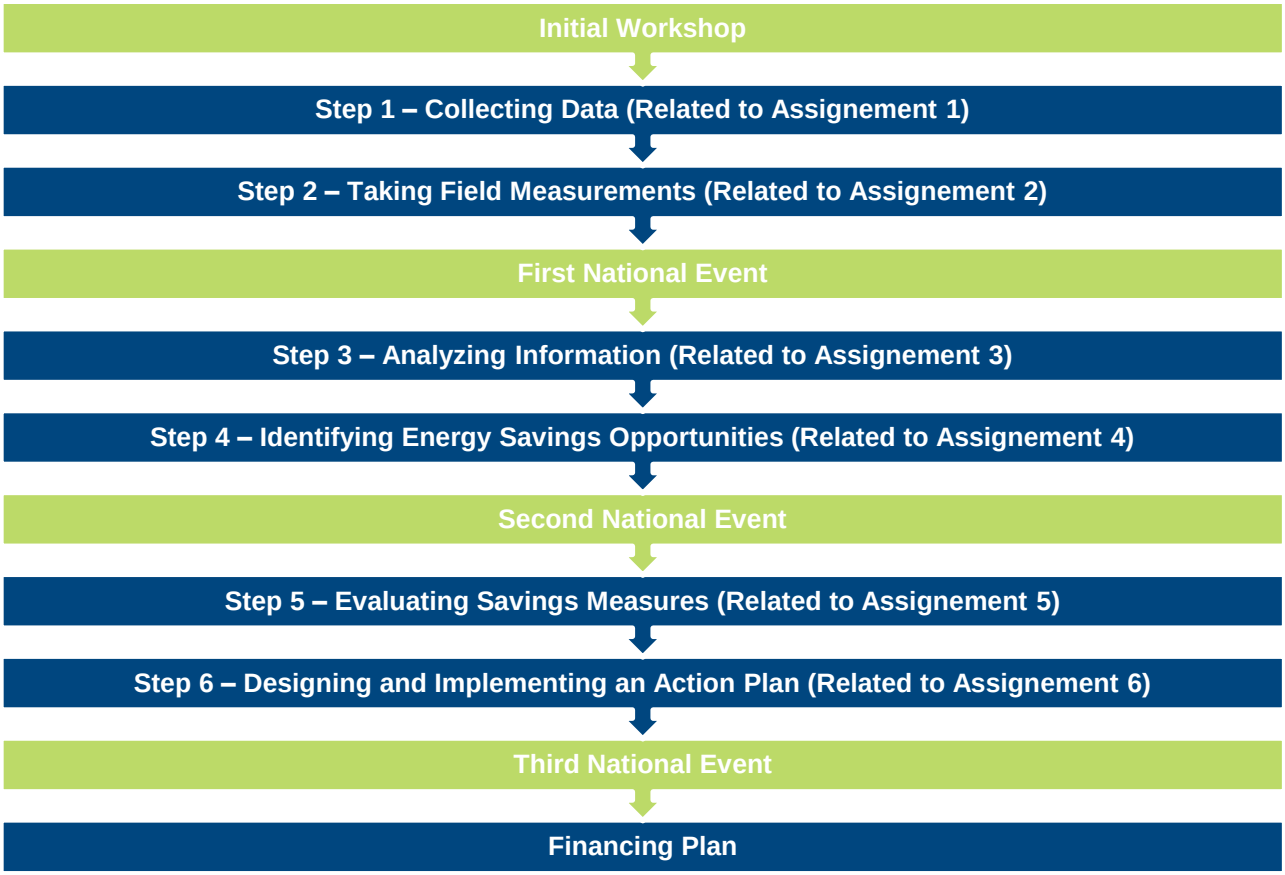

Figure 8: Recommended EE Program Timeline and Links between Events

› More comprehensive training on RETScreen would be beneficial.

› The capacity building program should include RE on the same terms as EE in future replication. This would avoid utilities withdrawing from the project because their focus is toward RE.

› The Initial workshop structure should be extended to four days and the option of having three national initial workshops instead of one international workshop should be considered.

› More stakeholders should be involved in the training sessions, such as higher management staff, municipality representatives and local financial institutions.

2 PROJECT OUTCOMES

Overall, project outcomes were positive with utilities showing great interest and commitment in the program. This part will present and appraise the main project outcomes, including the number of utilities that successfully delivered an energy audit report, identified financing sources, and provided details on the confirmed investment.

2.1 Overview of Utility Outputs

Out of 36 utilities selected, 20 reached Phase III and required support to finalize their energy audits or identify suitable financing mechanisms. Out of these 20, 18 were able to submit an energy audit report, while seven confirmed financing (results broken down by country in Figure 9). Two utilities from the Serbian hub identified potential financing but could not provide their confirmation during the project implementation timeframe. Therefore they could not be counted as having officially identified financing. These are:

- Bijeljina (BiH) received a donation from an NGO for pump B12
- Subotica (Serbia) was negotiating for a loan of $ 0.5 million (including a 20% grant), as part of the KfW Municipal Environment Grant-Loan Investment Program (MEGLIP)

More details on the progress of each participating utility can be found in Appendix VI. These results are close to the WB's initial expectations of 20 energy audit reports and 10 project financial completions.

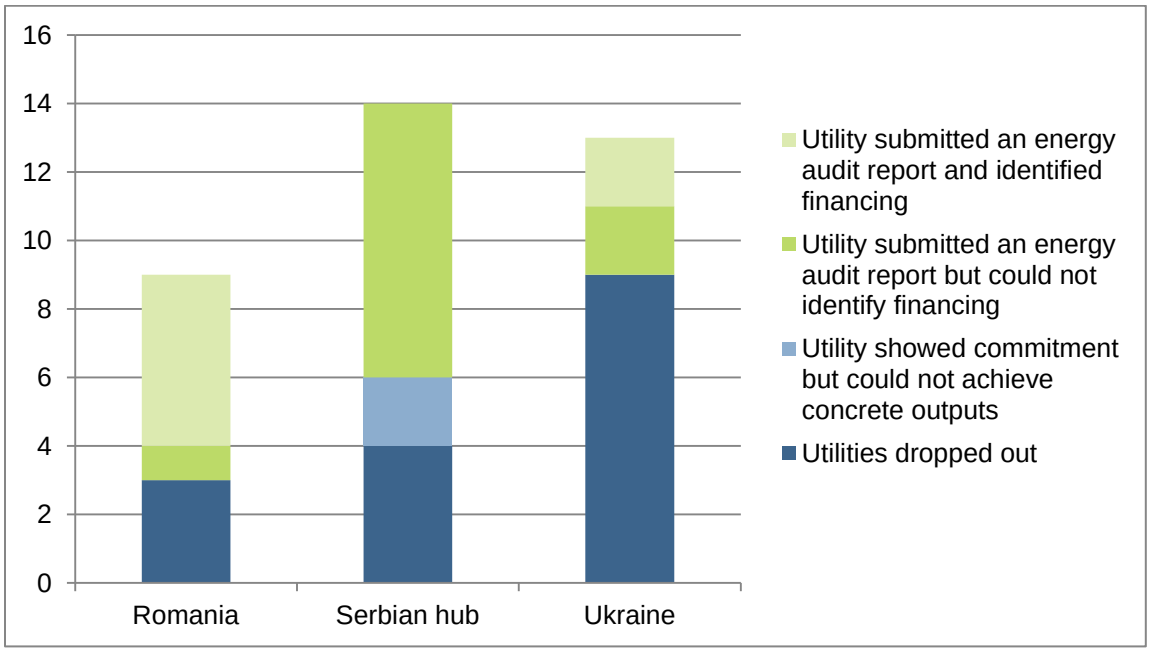

Figure 9: Utility Participation Broken Down by Output and Country

2.2 Investments Identified and Committed

This section provides an overview and appraisal of the investments that were identified and committed by the utilities. Firstly, Table 9 shows the project aggregated results, comprising project inputs (the level of effort and contract price) and the projects outputs divided between investments identified and investments completed and broken down by countries.

Table 9: Project Aggregated Results

Project inputs	Project Outputs		
	Investments Identified	Investments Committed	
15 person-months EUR 202,501[7]	1,489,223	1,678,102[8]	Romania
	1,797,675	0	Serbian hub
	3,216,068	684,818	Ukraine
202,501	**6,502,966**	**2 362 920**	**TOTAL**

Then, Figure 10 shows the size of the 18 investments identified by conducting the energy audit and RETScreen analysis. Comprehensive information on the individual EE measures identified by each utility is displayed in Appendix V.

[7] As per the contract no 7169105 signed between the World Bank and Econoler on October 2013. The contract price is USD 228,280 but was converted to euro for comparison purposes.
[8] The amount of investment completed is higher than the investment identified because Aquaserv higher management decided to have a full rehabilitation of the Luduş water treatment plant. Their EUR 30,994 investment therefore became a EUR 320,000 investment.

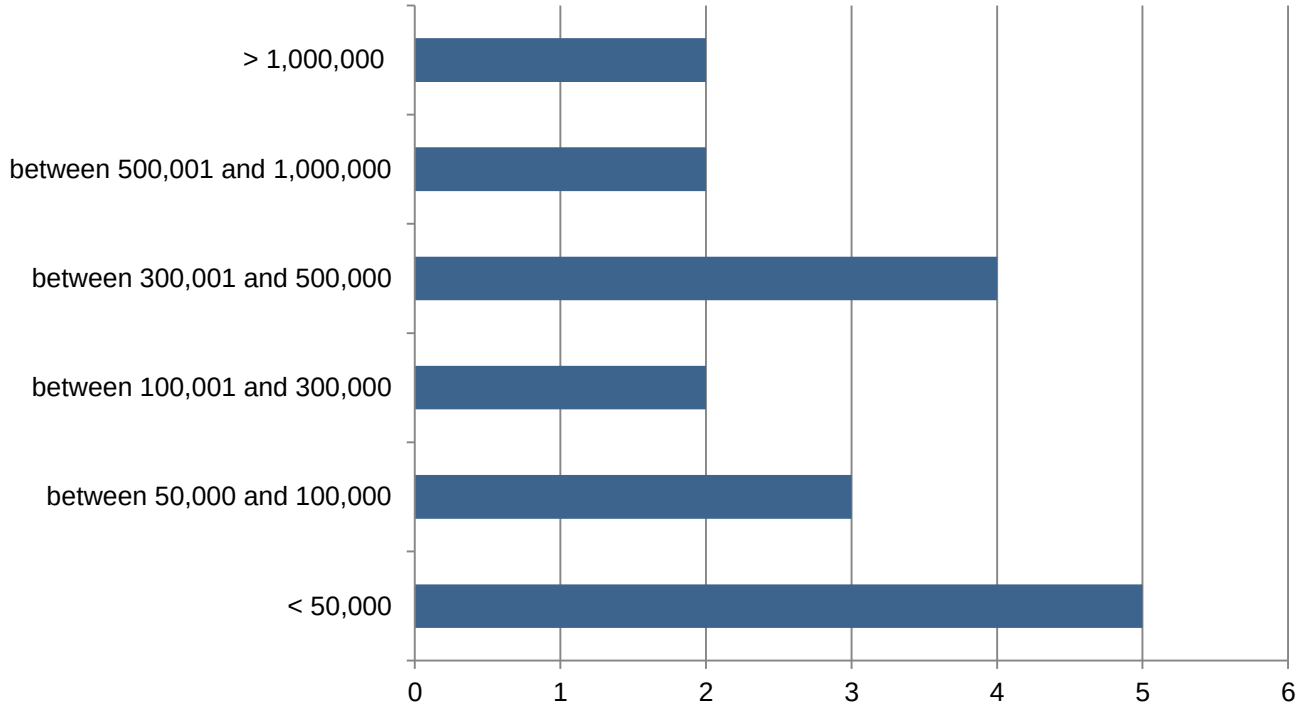

Figure 10: Size of Identified EE Investments (EUR)

As shown in the figure above, the majority of projects were under EUR 100,000, with five of them being small investments under EUR 50,000. Total investments per country are presented below:

- Romania : EUR 1,489,223 for six utilities
- Serbian Hub: EUR 1,797,675 for eight utilities
- Ukraine: EUR 3,216,068 for four utilities

Except for Raja Constanta (investment of EUR 1,198,745), all of Romania's identified EE investments were small and involving pump replacements or energy savings in maintenance and operations. This can be explained by the large investments (nearly EUR 7 billion) that were injected into the Romanian water sector in recent years, already decreasing electricity costs from over 20% to 10% within operating costs. Remaining EE opportunities were therefore quite modest. Ukraine did, however, identify large investments—the biggest one being Kremenchuk with EUR 2,187,000 for the installation of combined heat and power generation—indicating that there is still a large untapped EE potential in this country's water sector.

Finally, Table 10 below presents the seven investments that were confirmed by the utilities, representing a total of EUR 2,362,920.

Table 10: Final Total Investment and Financing Sources of the Committed EE Project

Utility	Country	Financing Source	Total Investment (EUR)
Aquaserv (Targu Mures)	Romania	ESCO	320,000[9]
Focsani	Romania	Self-financed	126,483
Apaserv (Statu Mare)	Romania	Self-financed	7,474[10]
Raja (Constanta)	Romania	Private investor	1,198,745
Brasov	Romania	Self-financed	25,400
Kharkiv no 26	Ukraine	Municipality funds	174,590
Pyatihaki (Kharkiv)	Ukraine	Municipality funds	510,228
		Total	**2 362 920**

2.3 Evaluation of Project Outcomes

The three main findings from evaluating the program's results are shown below:

2.3.1 Strong Correlation Between Attending the Capacity Building Program and Submitting an Energy Audit Report

When the participation of utilities in the training sessions is analyzed, a strong correlation between attending the whole training program and submitting an energy audit report is revealed. This can be seen in Appendix VI, which features the participation of utilities in the training sessions and whether they submitted an energy audit report and completed a financial transaction. Looking at the table, only a few utilities were able to submit a report without having attended all training sessions: (1) Izvoriste (Leskovac), (2) Gorina (Leskovac) and (3) Naissus Nis. Only two utilities were unable to do so despite having attended all the events: (1) Kladovo, and (2) Zhytomyr.

2.3.2 Large Discrepancies Between Country Results

The results also show great discrepancies between the achievements of countries, which can be explained by numerous factors:

The size of participating utilities

Larger utilities (serving populations larger than 300,000 inhabitants) usually have more internal technical expertise and measuring equipment than medium (population between 100,000 and 300,000) and small (population less than 100,000) utilities. Therefore, it could be argued that Romania—which had five large utilities among its nine participants—had more opportunities to identify

[9] In the first quarter of 2015, Aquaserv identified measures to be re-assessed, and higher management decided to have a full rehabilitation of the Luduş water treatment plant. The EUR 30,994 investment therefore became a EUR 320,000 investment.
[10] Apaserv Statu Mare only financed one out of the four measures identified (water pump replacement at Sanatatii).

EE and RE measures and thereafter submit an energy audit than the Serbian hub, which had only three out of 14.

Public debt and economic situation

Since WSS utilities are public entities, they depend on the approval of municipalities or local self-governments for taking out a loan. Those political entities are much more reluctant to approve a new investment if the country is heavily indebted or in an adverse economic situation. Among the selected countries, Serbia and Ukraine have high public debt (respectively 71% and 66.2% of the GDP), compared to 39.6% for Romania.[11] The level of public debt is a burden, particularly for Serbian utilities, which regularly invoked the restrictions on municipal investments by the national government. As for Ukraine, the economy has been in recession since the beginning of 2014, and the inflation rate has skyrocketed since project kick-off (25% in January 2015 compared to 6.9% in April 2014)[12], and the national currency is strongly devaluated. These dire economic and financial conditions have greatly hindered EE and RE investments in Ukraine.

Legal and policy framework

Strong legal and policy frameworks promoting EE initiatives have the potential of stimulating the development and implementation of EE projects in all sectors. For example, Romania has greatly improved its EE laws and policies in the recent years due to requests to fully transpose the EU Energy Efficiency Directive.[13] This has, among other things, resulted in the adoption of Romanian Law No. 121/2014 on EE and the establishment of the Energy Efficiency Department.

Political stability

EE is not a usual priority sector for governments. It takes political will to boost EE initiatives, which is unlikely to happen without political stability. This was a key negative factor for Ukraine, which has been entangled in violent conflicts since the beginning of the project.

Viability of the ESCO market

The presence of a diversified and strong ESCO market is conducive to higher EE investments. While Romania has a thriving ESCO market—making it a good financing option and increasing the motivation of utilities—this is not the case with Serbia and Ukraine, where the ESCO market is weaker or non-existent.

[11] CIA World Factbook, data from 2014.
[12] Ukraine, Economic Indicators, tradingeconomics.com/ukraine/indicators
[13] Commission requests AUSTRIA, CROATIA, IRELAND, LATVIA and ROMANIA to fully transpose the EU Energy Efficiency Directive, Press Release, 29 April 2015,

2.3.3 Many Projects led to Modest Investments, Mostly Self-financed by the Utility, due to the Absence of a Planned EE Financing Strategy

From the initial workshop, utilities were informed that no financial mechanism was included in the program and that one of the objectives was for them to identify financing sources of their own. This has contributed to more self-financed projects or projects financed via the municipality funds. No loans from financial institutions were taken out.

3 EVALUATION OF THE PROGRAM BY UTILITIES

After the initial workshop and at the end of the process, utilities provided their feedback on the capacity building program, highlighting the positive aspects and making suggestions for improvement. We hereby present a short overview of those reviews, along with an appraisal of the project attrition rate.

3.1 Review of the Capacity Building Program by Utilities

Utilities were generally very satisfied with the training sessions and training material that was provided. It was highlighted that the material was comprehensive and user-friendly and included a streamlined energy audit approach and evaluation methodology. Those aspects made the material very suitable for utilities to use autonomously between each training event. In fact, a strong correlation between attending the whole training program and submitting an energy audit report is revealed when analyzing the participation of utilities in the training sessions,. Indeed, out of 18 utilities who submitted an energy audit, 15 participated in all three training sessions. The table included in Appendix VI monitors the participation of utilities in the training sessions, if they submitted an energy audit report and completed their financial transaction.

> "Providing a streamlined energy audit approach and evaluation methodology for water pumping systems really helped the utilities."
>
> – Dragoslav Sumarac, National EE Consultant for the Serbian Hub

> "The interactions between the participants, opportunity for knowledge and experience sharing between colleagues in charge of EE in the water sector were by far the main benefit of the project."
>
> – Darius Bör, Financial Expert at Statu Mare (Romania)

Most of the utilities considered the introduction to the RETScreen software to be a strong added value to the training program. This Excel-based clean energy project analysis software tool helped technical experts and management staff to quickly and inexpensively determine the technical and financial viability of potential EE projects. This tool proved very easy to use and helped support the work of local experts in every country without a need to make adjustments. Participants appreciated the opportunity for hands-on practice during the individual workshop sessions and national events.

Most of all, interaction between participants who all experience the same energy challenge in their WSS utilities was the most beneficial part of the project. At the national events, utilities were offered the opportunity to present their progress and the barriers they encountered. Then they could all participate and take the advantage of the peer-reviewing process, supervised by the National Consultant who could intervene if necessary.

> "The capacity building program provided technical experts with capacities to conduct energy audit and to inform the managers on the best energy savings measures to implement."
>
> – Yuri Yarochenko Vadimovitch, Head of the Energy Department, Kharkiv No. 26 (Ukraine)

3.2 Assessment of the Attrition Rate

Throughout program implementation, 16 utilities (44%) left the program. This section analyzes this attrition rate and looks for the main reasons by country. For definition purposes, the attrition rate only refers to those utilities that officially withdrew or stopped showing interest in the project. Utilities that kept reporting their progress with the National Consultant—and confirmed their interest in EE even if they could not submit an energy audit report—were considered to still be interested in the program and in improving EE in their facilities. They were therefore not considered as drop-outs. Utilities were also asked why they had withdrawn from the program and found out that most of them could fit within five main categories, as featured in Table 11 below.

Table 11: Main Reasons for Withdrawal

Reason for Withdrawal	Description
External factors	Include major event beyond the utility's control that prevented the utility from completing the program (e.g., natural disaster, social and political unrest).
Lack of support	Lack of support from decision makers, including the utility's higher management, the municipality council or the local government, but mainly due to a change in higher management or municipal elections.
Other expectations or needs	Mostly due to utilities' expecting to secure loans from the program, but also include utilities wanting to develop renewable energy projects for which the training material and sessions were not as adapted.
Concurrent EE opportunity	When other EE programs were being implemented in the country and utilities could not or did not want to participate in both.
Unresponsive	Utilities eventually stopped returning calls and emails without providing information.

Figure 11 and Figure 12 below show the main reasons for withdrawal analyzed against the number of utilities that cited them as well as against the number of drop-outs broken down by country. There is not one leading reason for withdrawal, but rather a mix of different factors that compelled utilities to abandon the program.

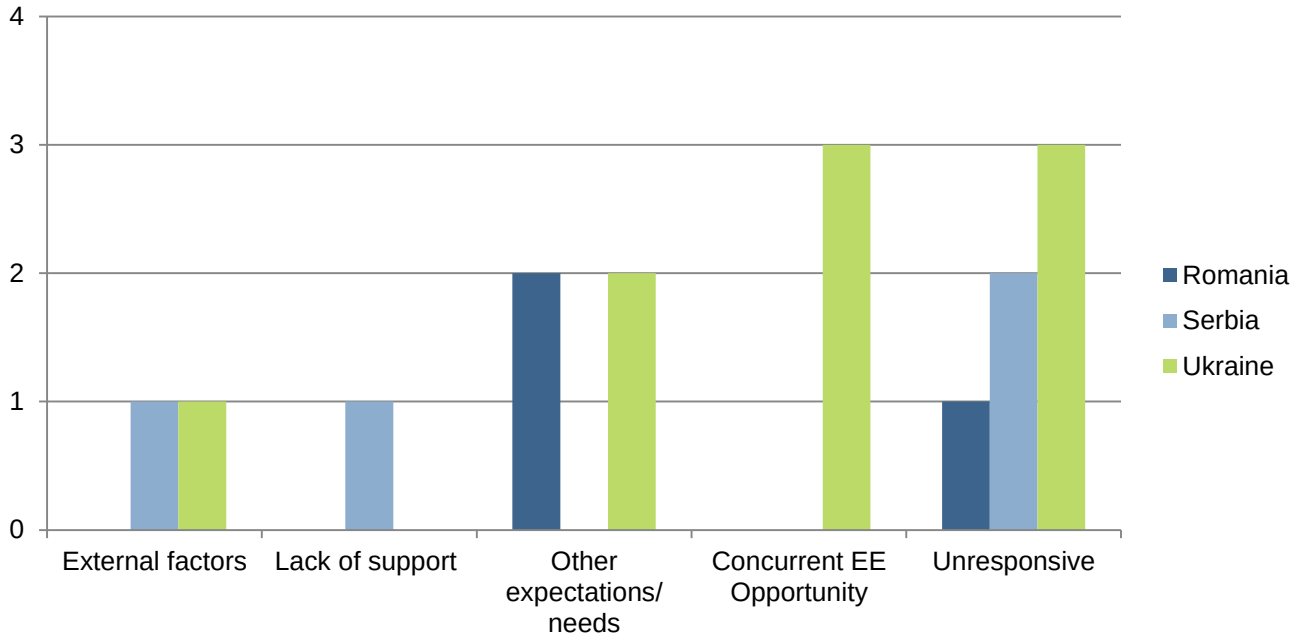

Figure 11: Number of Drop-Outs Shown by Reason and Country

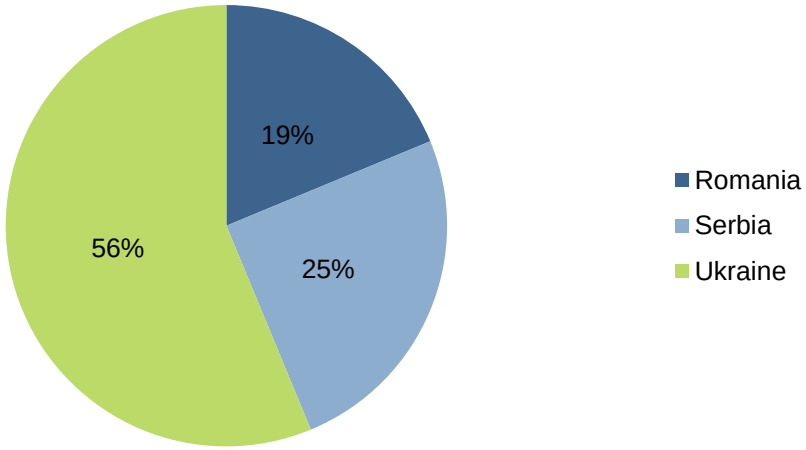

Figure 12: Proportion of Withdrawal per Country

There is not one leading reason for withdrawal, but rather a mix of different factors that compelled utilities to abandon the program. In addition, the attrition rate greatly varied from one country to another, as shown in Figure 12 above. In Ukraine, we deem that most utilities became unresponsive because of the country highly adverse political and economic situation that has been unfolding since 2014.

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4 LESSONS LEARNED

This section underline the barriers encountered throughout each phase of project implementation and the lessons learned so as to develop prospective solutions that could facilitate project replication by other stakeholders, such as the national water utility associations. This analysis was done in light of the initial project objectives:

- designing and delivering the results-based EE in WSS capacity-building program, based on international best practices and existing approaches as well as local circumstances;
- supporting follow-up activities, such as the implementation and/or financing of EE measures;
- documenting approaches, tools, instruments, lessons learned and good practices developed during the activity.

Lessons learned aim primarily at (1) magnifying the capacity building and knowledge transfer; (2) reducing the attrition rate; and (3) promoting EE initiative in the targeted countries.

4.1 Phase I: Background Research and Country Selection

Looking at the project outcomes, we can conclude that the countries targeted and utilities selected largely determine the extent to which the project is successful. The point here is not to ban any country or utility that could be in a challenging context, but rather to ensure a project implementation plan that will not be unnecessarily cumbersome. The following lessons were drawn from Phase I:

- **A difficult financial or political situation in the country directly hinders the project outcomes**

The political and financial situation in any given country should be assessed at the early stages of a project so that countries are selected accordingly. Specific criteria must then be fulfilled even if a problematic country presents a high number of applications from utilities. Particularly challenging is to find a balance between having many utilities applying and choosing a country with an economic, social and political situation that is likely to yield positive results. For example, Romania—with the smallest number of participants—had by far the best results in terms of submitting energy audits and identifying financing sources.

- **An all-expenses-paid international event can be appealing for utility representatives and does not necessarily speak to their commitment in implementing the whole project**

A posteriori, the initial workshop was very appealing to utility representatives since all their expenses were covered. The criterion “Willingness to participate in the kick-off meeting” may therefore not be the right selection criterion to evaluate the commitment of utilities towards the whole project. Several utilities only went to the initial workshop, but were unresponsive shortly after. Two solutions could address this: (1) utilities could be requested to pay part of their expenses to take part in the event (such as their flight fares); or (2) there could have been several kick-off events (one per country),

which would have attracted utilities for the actual workshop content and not for the workshop destination.

4.2 Phase II: Delivery of Capacity Building Program

The development and delivery of the capacity building program was crucial in achieving the projects' expected outcomes. Overall, the utilities and national consultants had very good feedback about the capacity-building approach and training material. Among other things, it was highlighted that for inexperienced stakeholders in EE within WSS, a strong emphasis on technical assistance and training was a mandatory step that helped leverage future access to financing (see Section 3 on the evaluation of the program by utilities for more details). Given the positive reception and results from the capacity building program, the training structure and material content would not need to be substantially changed. Suggested improvements were, however, written down and the following recommendations were made:

Increasing the Number of Training Sessions and Opportunities for Practical Applications

The two national events were considered as the best way for utility representative to share their experience, exchange knowledge and revise each other's work with peer-reviewing. They also allowed the participants to get a practical application of theoretical knowledge through extra RETScreen exercises and support, case studies, presentations from guest speakers and visits of WSS utilities by the general manager. As shown in Figure 8 taken form the revised EE manual, we suggest including one more national event, so that utilities can meet at every single step of the EE assessment methodology. As the Serbian consultant pointed out, "It is absolutely necessary to actively and continuously involve the representatives of utilities throughout the course of the program in order to have more frequent and more comprehensive response from their side."

Providing more Comprehensive Training on RETScreen

When evaluating the initial workshop, utilities were adamant that RETScreen was a strong added-value for simulating energy saving measures and identify required investment (see Appendix IV for evaluation results). There is strong potential in providing utilities' technical experts (as well as other relevant stakeholders) with better skills and knowledge of this software through an extended training session to ensure an optimal replication of the project.[14]

[14] CANMET, through a partnership with the International Institute for Energy Training (Econoler's subsidiary) has developed a 3-day training on RETScreen, entitled the Certified in the Use of RETScreen (CUR) , that could be easily adapted to the needs of the Danube region (the training has already been delivered in Croatia). In addition, a training certificate is provided to each participant who successfully completed the training, a request that was expressed by several participants following the initial workshop.

Including RE in the Training Curriculum

Some utilities showed great interest in reducing their energy consumption by implementing renewable energy initiatives. For example:

- Aquatim Timisoara (Romania) planned on developing a solar park with a 1.94 MWp capacity.
- Gorina Leskovac (Serbian hub) conducted an energy audit to install a small hydro power plant.
- Subotica (Serbian hub) pushed for interesting projects to produce biogas.

The capacity building program should include RE on the same terms as EE in future replication. This would avoid utilities withdrawing from the project because training is not adapted to their needs. It should be noted that even if RE was not the main focus of the program, the RETScreen tools had others modules dedicated to RE and this could be easily added to a future replication of the project through an extended training session on RETScreen.

Changing the structure of the initial workshop

Due to its comprehensive coverage of the EE technical and financial aspects, the three-day initial workshop was considered overwhelming by many. Other points flagged are that management staff had to undergo heavy technical training, and that large groups and simultaneous translation limited the possibilities for interaction. This last point was applicable to the plenary sessions, while the individual workshops were praised for their atmosphere conducive to learning. In light of those comments, the following recommendations can be made:

- Extending the initial workshop to four days;
- Inviting the management representatives for a reduced period of time (the first two days) and managing the training schedule so that they can attend trainings specifically relevant for them, namely Modules 1 and 4 of the EE manual.
- Simultaneous translation was flagged as an issue for understanding and interacting.

A posteriori there are only limited advantages in having an initial international workshop—apart from gathering all participants in one place and providing a motivating atmosphere. Organizing three national initial workshops seems like a more suitable option.

Involving more Stakeholders in the Training Sessions

As initially planned in the program, water utility associations were involved throughout the capacity building program and their involvement proved very useful in organizing and facilitating the national events. Positive outputs resulting from the involvement of Predrag Bogdanovic of the National Water Association of Serbia were pointed out by the national consultant and utilities.

In addition to this precious involvement, it is recommended to also have utilities' higher management, municipality representatives and financial institutions participate for further project replication.

- Higher management staff was invited at the initial workshop and most of the utilities had one management representative present. This approach should be replicated for subsequent training sessions to ensure higher management understands the issues at stake and the benefits from EE measures. The more the directors and senior managers of the utility are involved in the project development process, the less likely they are to drop the project before it reaches the implementation stage.
- Municipalities have a large role to play in approving WSS EE measures and their financing. The project team sometimes faced the case where a utility wanted to go further with EE project implementation but encountered reluctance from the municipal government. An involvement of municipalities officials early in the program could be beneficial to ensure a buy-in required to proceed to the investment phase of the project.
- Financial institutions must be involved beforehand, as soon as the initial workshop starts. This way their potential input can be appraised from the beginning and lessons about the financial benefits from EE projects can be drawn. Econoler's financial expert contacted some Serbian banks during Phase III to investigate their interest in financing EE projects, and some did show interest in financing municipal projects. The main challenge would be to limit their financial risks as they grant loans to public institutions. Ultimately, the involvement of financial institutions would motivate utilities by showing that financial support could be available from their local commercial banks.

4.3 Phase III: Support for the Implementation of Training Outcomes

Phase III is the most challenging part of the project since it involves transforming the knowledge and capacity transferred into concrete results, namely the drafting of an energy audit report and the financing of identified EE measures. Although the project outcomes presented in Section 2.1 were deemed positive by the project team, some factors could be better addressed so as to enhance the results and reduce the attrition rate. Those factors, with their prospective solutions, are presented below.

Providing additional resource for measuring equipment

Small and medium utilities usually have less internal technical expertise and are ill-equipped to conduct energy audits by themselves. Additional resources should be mobilized to support these utilities, such as a specific budget for measuring equipment (renting or buying).

Ensuring the program addresses financing challenges

Many times utilities expressed the need for the project to include adapted financing mechanisms. Procuring financing on the lending market of their respective countries was in the majority of cases either too expensive (Ukraine, Serbian Hub) or too difficult to process internally and to get approval from the main municipality.

The project should offer concrete financing opportunities applicable to the water sector with favorable conditions and loan financing. A number of options were discussed during the events that could potentially address the lack of adapted financing, such as:

- Project bundling among utilities within a country can result in an aggregated investment volume, which will be of interest to the IFC, the EBRD or other IFIs to develop a targeted EE financing program. Such interest by the IFC had already expressed and discussed in detail among the utilities and an IFC representative in Romania. A similar facility is currently being structured by the EBRD in Serbia, focusing on street lighting and water utilities. It was made clear that a minimum investment volume of the project bundle should be EUR 10 million, and utilities should allow up to a year for the program to be structured and disbursed through one of the commercial banks in the country.
- Enabling utilities to tap more easily into local dedicated EE investment funds at under-market interest rates will be very beneficial. Such a facility already exists in Romania (the Romanian EE Fund – FREE). A similar one is currently being designed by the Ukrainian government.
- Supporting small utilities with a small revolving credit line in parallel of the project would enable micro projects under EUR 100,000 to be carried out more easily.

Enhancing communication between participating utilities

Utilities indicated they had little opportunity (outside of the two national events) to exchange with their peers on barriers encountered, technical issues, potential financing schemes, etc. They would certainly benefit from enhanced communication channels. Targu Mures from Romania suggested creating a website or a Facebook/LinkedIn page for each targeted country that would be dedicated exclusively to EE in the water sector, ongoing projects, funding sources, etc.

Other suggestions

To limit the attrition rate, the Romanian national expert expressed the interesting idea to create an award system, such as the best EE project being awarded with measurement equipment or participation in an international workshop. If announced at the very beginning of the project, such a contest could create a buzz and encourage stronger commitment.

APPENDIX I
LIST OF PARTICIPATING UTILITIES

The tables below lists the utilities that were selected through the call for interest and that participated in the initial workshop. The first table is a matrix showing the participating utilities by size and country, while subsequent tables indicate contact information of representatives for each utility who participated in the initial workshop, as well as the General Manager.

Matrix of Utilities by Country and Size

Size	Romania	Serbian Hub	Ukraine
Small Population served <100,000		Izvoriste Leskovac Gorina Leskovac Milos Mitrovic Kladovo Niksic Bijeljina Surdulica	Boryspil Illichivsk
Medium Population served between 100,000 and 300,000	Apaserv Satu Mare Focsani Braila Buzau	Subotica Velika Plana Naissus Nis Zrenjanin	Chernihiv Rivne region Khmelnitsky Zhytomyr Kremenchuk Cherkassy
Large Population served >300,000	Raja Constanta Apavital Lasi Aquatim Timisoara Brasov Aquaserv Targu Mures	Vracar Belgrade Zvezdara Belgrade Novi Sad	Kharkiv no 26 Pyatihaki Kharkiv Dnipro-Kirovograd Mariupol Nikolayev

ROMANIA

No	Name of Utility	Name/Title of Delegate #1	Tel. of Delegate #1	E-mail of Delegate #1	Name/ Title of Delegate #2	Tel. of Delegate #2	E-mail of Delegate #2	Director's Representative
1	Apaserv (Satu Mare)	Istvan Hvozdak, Energy Manager	0735 400 756	hvozdak_istvan@apaservsm.ro	Darius Bör, Financial Expert	0744 647 421	bor_darius@apaservsm.ro dariusbor@gmail.com	Stegergan Danutiu, General Manager
2	Apavital (Iasi)	Traian Olinici, Head of Technical Services	0722633696	traian.olinici@apavital.ro	Octavian Stoian, Economist	0737009102	octavian.stoian@apavital.ro	Dr. Ing. Ion Toma
3	Aquaserv (Targu Mures)	Gyorgy Petro, Energy Manager	0745520216	gypetro@aquaserv.ro	Calin Toma, Design Engineer	0744576941	ctoma@aquaserv.ro calinhorea@yahoo.com	Horobet Sergiu
4	Aquatim (Timisoara)	Luminita Napau, Change Manager	0722379642	Luminita.cocard@aquatim.ro	Claudia Benghia, Head of Financial Department	0730643988	Claudia.benghia@aquatim.ro	Ilie Vlaicu, General Director
5	Braila	Constantin Iulian, Technical manager	0728.857.395	Cupdunarea.electric@yahoo.com	Niculina Moisescu	0734.776.141	Nmoisescu03@yahoo.com	Mihail Chirita
6	Brasov	Adrian Serban, Head of Power Department	0745016618	adrian.serban@apabrasov.ro	Claudiu Cotet, Electrical Engineer	0746.955.436	Claudiu.cotet@apabrasov.ro	Dorin Fatu
7	Buzau	Badea Buzea, Engineer	0727271589	badea.buzea@cabuzau.ro	Gheorghe Popescu	0238402225	gheorghe.popescu@cabuzau.ro	Tescaru Ionel
8	Focsani	Gabriel Ducu Caraene,** Contract Coordinator	0732122235	ducu_caraene@yahoo.com	Raiber Laurentiu Marian, Head of Electrical Engineering	0734732372 0745618505	mraiber@hotmail.com	Gheorghe Vasilescu
9	Raja (Constanta)	Elena Magda Chichelus, Engineer	0754236948	elenamagda@gmail.com	Elena Iliescu, Financial Manager	0720037125	Iliescu_leny@yahoo.com	Presuro Aurel, Deputy Managing Director

SERBIAN REGIONAL HUB

No	Name of Utility	Name of Delegate #1	Tel. of Delegate #1	E-mail of Delegate #1	Name of Delegate #2	Tel. of Delegate #2	E-mail of Delegate #2	Director's Representative
1	Vracar Belgrade	Branka Milutinović, Maintenance Manager	+381648131070	branka.milutinovic@bvk.rs	Golub Babić, Chief Engineer	+381648131584	golub.babic@bvk.rs	Svetozar Veselinovic
2	Zvezdara Belgrade	Branka Milutinović, Maintenance Manager	+381648131070	branka.milutinovic@bvk.rs	Golub Babić, Chief Engineer	+381648131584	golub.babic@bvk.rs	Svetozar Veselinovic
3	Novi Sad	Zlatko Arvaji,** Chief of Management and IT	+381648521972	zlatko.arvaji@vikns.rs	Sanda Nastić, Head of Planning and Analysis	+381695550741	sanda.nastic@vikns.rs	Nikica Ivic, Technical Director
4	Subotica	Petar Pižurica, Head of Water Purification Sector	+38164835668	pizurica@vodovodsu.rs	Momir Tasić, Process Engineer, Investement Sector	+381648356098	tasic@vodovodsu.rs	Gligor Gelert / Šugar Đerđ
5	Zrenjanin	Vojislav Čabrilo, Engineer	+381648116150	vojislav.cabrilo@vodovoikanalizacija-zr.rs	Tatjana Paskaš, Chief of Customers services	+381648116330	tatjana.paskas@vodovoikanalizacija-zr.rs	Goran Tajdic, Director
6	Miloš Mitrović (Velika Plana)	Aleksandar Veličković, Head of Waste Water Treatment	+381605548511	jkpmm.ppov@gmail.com	Željko Milenković, Manager of Financial and Commercial Activities	+381642079784	proreptile@yahoo.com	Vladan Radosavljevic
7	Kladovo	Zoran Petrović, Director	+381648754100	jpjedinstvo@kladovo.net	Ljubiša Predić Technical Director	+381648754101	jpjedinstvo@kladovo.net	Ljubisa Predie

No	Name of Utility	Name of Delegate #1	Tel. of Delegate #1	E-mail of Delegate #1	Name of Delegate #2	Tel. of Delegate #2	E-mail of Delegate #2	Director's Representative
8	Naissus Niš	Miloš Đorđević, Deputy Director	+381631050339	milos.djordjevic@naissus.co.rs	Mirjana Bekčić Vićentijević, Engineer for Investment and Development	+38163899545	mirjana.bekcic@naissus.co.rs	Dejan Adrejevic
9	Surdulica	Slobodan Gavrilović, Deputy Director	+381654720440	kalifer@open.telekom.rs	Saša Ilić, Technical Director	+381654420205	sasadilic1@gmail.com	Olivera Ristic
10	Izvoriste Leskovac	Ljiljana Randjelović, ** Project Manager	+38163444953	ljiljana.randjelovic@gmail.com	Tatjana Filipović, Head of Planning and Analysis	+38162225630	tatjana.filipovic@vodovodle.rs	Zoran Stojanovic, General Director
11	Gorina Leskovac	Ljiljana Randjelović, ** Project Manager	+38163444953	ljiljana.randjelovic@gmail.com	Tatjana Filipović, Head of Planning and Analysis	+38162225630	tatjana.filipovic@vodovodle.rs	Zoran Stojanovic, General Director
12	Nikšić (Montenegro)	Ratko Bakić, Mechanical Engineer	+38267603981	ratko.bakic@vodovodnk.me	Olivera Kojović, Financial Operations Manager	+38268575330	olivera.kojovic@vodovodnk.me	n/a
13	Bijeljina (Bosnia and Herzegovina)	Predrag Perković	065511411	predrag.perkovic@bnvodovod.com	Rada Jekić,	065893617	rada.jerkic@bnvodovod.com	n/a
14	Bihac	Milena Mihajlović	065727339	milena.mihajlovic@bnodovod.com	Milojko Todorović	065581354	milojko.todorovic@bvodovod.com	n/a

UKRAINE

No	Name of Utility	Name/Title of Delegate #1	E-mail of Delegate #1	Name/Title of Delegate #2	E-mail of Delegate #2	Tel. of Utility	Director's Representative
1	Kharkiv No. 26	Vladimir Aleksandrovitch Serdyokov, Head of Construction Department	rpmu.hkov@mail.ru	Arkadiy Anatoliyovich Romanenko, Chief Power Engineer	energy_aqva@ukr.net	+38 (057) 712-15-21	Korinko Ivan Vasilovych
2	Pyatihaki Kharkiv	Vladimir Aleksandrovitch Serdyokov, Head of Construction Department	rpmu.hkov@mail.ru	Arkadiy Anatoliyovich Romanenko, Chief Power Engineer	energy_aqva@ukr.net	+38 (057) 712-15-21	Korinko Ivan Vasilovych
3	Kremenchuk	Yurii Sergeyovitch Kostyuk, Chief Power Engineering	vodakpkvk@gmail.com	Ala Petrivna Ganus, Deputy Director on Finance	alla-ganus@yandex.ru	+38(0536) 77-97-01	Solodiachkin Victor Ivanovych
4	Chernigov	Ivan Borisovitch Atroshtenko, Software Engineer	n/a	Iryna Vitalivna Shtypa, Head of Legal Department	ibogayevska@chernihiv-water.org	+38(0462) 649-091	Oleksandr Chekanovych
5	Dnipro-Kirovograd	Mikola Aleksandrovitch Romanyuk, Technical Director	n/a	Olga Georgievna Shibakina, Financial Manager	pani_olga@inbox.ru	+38(0522) 33-21-93	Roman Igrovych
6	Zhytomyr	Fedir Vasylovych Guyvan, Chief Engineer	zvodokanal@mail.ru	Lyudmila Oleksiyvna Vikarchuk, Head of Economic Planning Department	zvodokanal@mail.ru	+38(0412) 246810	MIhailo Mikolaiovych
7	Mariupol	Larisa Yurivna Semyonova, Head of Production and Technology Department	vodokanal@mvk.org.ua	SvitlanaVitaliyevna Cherbytyh, Head of Economic Planning Department	vodokanal@mvk.org.ua	+38(0629) 336287	Klimenko Igor Georgiovych

No	Name of Utility	Name/Title of Delegate #1	E-mail of Delegate #1	Name/Title of Delegate #2	E-mail of Delegate #2	Tel. of Utility	Director's Representative
8	Boryspil	Oleksandra Volodimirivna Lytvynenko, Head of Economic Planning Department	sandy-l@ukr.net	Yurii Mikolayovitch Noga, Mechanical Engineer	energo_bvk@ukr.net	+38(04595) 6-10-16/ +38(04595) 6-00-80	n/a
9	Khmelnytskyi	Aleksey Vladimirovitch Lunkin, Vice Director	kmwater_plan@ukr.net	Oleksandr Demyanovich Seredyuk, Head of Water Supply Sector	n/a	+38 (0382) 787506	n/a
10	Rivne region	Andrey Petrovitch Karaush, Deputy Director	voda@ukrwest.net	Aleksandar Anatolievitch Chaban, Head of Geo-Information System Department	voda@ukrwest.net	+38(0362)22-23-55	Petrovsckyi Iaroslav Vitaliovych
11	Illichivsk	Volodymyr Mykolayovich Levchenko, Head Accountant	ivk@odessa.ukrtel.net	Oleg Prokofyev, Chief Engineer	n/a	+38(04869) 60248	n/a
12	Nikolayev	Misyura Anadrin Valeriovitch, Deputy Director	misyura@vodokanal.mk.ua	Olchevcka Maria Cergïvna, Accountant	olshevskaya@vodokanal.mk.ua	+38(0512) 24-21-55	Telpik Vassyl Stepanovych
13	Cherkasy	Garitch Serguiy Volodimirovitch, Head of production Department	qapych_water@ukr.net	Liskovets Svetlana Volodimirivna, Deputy Director	liskovec_water@ukr.net	+38(0472)37-33-00	Ovcharenko Sergiy Volodimirovych

OTHER UTILITIES

No	Name of Utility	Name/Title of Delegate #1	E-mail of Delegate #1	Name/Title Delegate of #2	E-mail of Delegate #2	Tel. of Utility	Director's Representative	No
1	Prishtina (Kosovo)	Yiber Zabergja	+37744220082	ylber.zabergja@leur-prishtina.com	n/a	n/a	n/a	n/a
2	Prizren (Kosovo)	Aranit Ukimeri	+37744149788	aukimeri@hotmali.com	n/a	n/a	n/a	n/a
3	Aquasan mreža (Bosnia and Herzegovina)	Sandi Zulić	0038737224038	sandi.zulic@unaconsulting.ba	Sead Badnjević	+38737224038	sead.badnjevic@unaconsulting.ba	n/a

APPENDIX II
AGENDA OF TRAINING SESSIONS

INITIAL WORKSHOP

Tuesday, April 08, 2014		
Time	**Content**	**Speaker**
9:00	**Welcome remarks and workshop objectives**	David Michaud, World Bank Philip Weller, IAWD
9:15	Introduction of local experts and their functions Presentation of Econoler's tasks during the assignment	Pierre Baillargeon, Econoler
9:45	**Technical training part 1:** › Module 1 – Introduction to EE: common problems and solutions, energy consuming equipment in Water and wastewater utilities, overview of potential EE measures. › Module 2 – IGA Procedures: data collection activities and requirements explained, field measurements activities explained and introduction to different measurement equipment, compilation of information surveyed to determine the energy usage by equipment or category of equipment and engineering analysis on measured or collected data to determine systems efficiency.	Pierre Baillargeon, Econoler
10:30	**Q&A**	
10:45	*Coffee break*	
11:15	**Technical training part 1 (Continued)**	Pierre Baillargeon, Econoler
12:15	**Q&A**	
13:30	Case Study: EE project in water utility	TBD
15:15	Q&A	
15:30	*Coffee break*	
16:00	Technical training part 2: › Module 3 – Identification of Energy Savings Opportunities: introduction to RETSceen, transformer losses, electrical motors efficiency, pumping systems efficiency, application of variable speed drive, hydraulic network, maintenance of water pumping systems, typical operation problems, lighting measures, cooling – chillers and compressed air	Pierre Baillargeon, Econoler
16:45	Q&A	
17:00	Debriefing and end of Day 1	

Wednesday, April 09, 2014		
Time	**Content**	**Speaker**
9:00	**Recap of previous day and plan for the day**	Pierre Baillargeon, Econoler
9:15	**Technical training part 2 (Continued)**	Pierre Baillargeon, Econoler
10:45	*Coffee break*	
11:15	**Technical training part 2 (Continued)**	Pierre Baillargeon, Econoler
12:15	**Q&A**	
12:30	*Lunch*	
13:30	**Individual workshops**: › Presentation of each utility and participants' technical expertise › Discussion on local tariffs, key stakeholders and other local particularities	**Romanian -** Mihai Cruceru and Mihai-Marius Voronca **Serbian hub -** Dragoslav Sumarac **Russian -** Oleksandr Nikolaienko
15:30	*Coffee break*	
16:00	**Individual workshops (continued)**: › Activity on potential EE measures › Presentation of Audit Report Template › Detailed work plan until next national workshop	**Romanian -** Mihai Cruceru and Mihai-Marius Voronca **Serbian hub -** Dragoslav Sumarac **Russian -** Oleksandr Nikolaienko
17:00	**Debriefing and end of Day 2**	

Thursday, April 10, 2014		
Time	**Content**	**Speaker**
9:00	**Recap of previous day and plan for the day**	
9:15	**Individual workshops:** › Case studies using RETScreen®: EE Improvement of Pumping Systems in Wastewater Treatment Plant	**Romanian -** Mihai Cruceru **Serbian hub -** Dragoslav Sumarac **Russian -** Oleksandr Nikolaienko
10:45	*Coffee break*	
11:00	**Individual workshops:** › Case studies using RETScreen® (Continued)	**Romanian -** Mihai Cruceru **Serbian hub -** Dragoslav Sumarac **Russian -** Oleksandr Nikolaienko
12:00	**Individual workshops:** › Drafting of To Do List of tasks to be undertaken until National Event # 1	**Romanian -** Mihai Cruceru **Serbian Hub -** Dragoslav Sumarac **Russian -** Oleksandr Nikolaienko
12:30	*Lunch*	
13:30	**Training on Financial Aspects of EE Projects:** › Module 4 – Economic and Financing	Ivan Gerginov, Econoler
15:00	**Q&A**	
15:15	*Coffee break*	
15:45	**Group Session:** › Module 5 – Action Plan Design › Recap and next steps	Pierre Baillargeon, Econoler
16:45	**Q&A**	
17:00	**Final debriefing and Conclusions**	Anastasia Shegay, World Bank

NATIONAL EVENT NO 1

July 2014		
Time	**Content**	**Speaker**
9:00	**Welcome remarks and National event objectives**	National Consultant
9:15	**Overview of water sector**	Representative from Country's Water Association
9:30	**Educational session** Case study on Water Company, presentation of other relevant EE programs, etc.	Guest Speaker
10:00	Q&A	
10:15	**Presentations of utilities** Each utility will make a short power point presentation to follow up on step 1 to 4 of the energy assessment methodology: (1) Collecting data; (2) Taking field measurements; (3) Analyzing information; (4) Identifying Energy savings opportunities	Representatives of Utilities
10:45	*Coffee Break*	
11:15	**Presentations of utilities (continued)**	Representatives of Utilities
12:15	Q&A	
12:30	*Lunch Break*	
13:30	**Identification/ development of potential EE measures** Following the individual presentations, the participants will together carry out a peer review of the utilities' progress on the methodology (step 1 to 4). Under the guidance of the national expert, they will develop potential EE measures, review the energy audit in progress, identify the challenges and ascertain the utilities that are more energy consuming. This will also be the opportunity for the national consultant to evaluate the utilities technical needs and develop a strategy for know-how transfer.	National Consultant

14:30	**Further discussion on key aspects to consider while developing projects** Presentation on the main elements to consider while developing an EE project: Project identification; Energy analysis; Defining the project; Assessing the costs and benefits; Identify sources of funding; Structuring financial plan; Identifying donors and participants; Project organization; Risk assessment and allocation; Business Plan.	National Consultant
15:15	Q&A	
15:30	*Coffee Break*	
16:00	**EE projects financing** Presentation on the main themes of EE project financing such as the potential barriers to financing EE projects and their related solutions, developing a business plan and the available national and international financing mechanisms available to EE projects in the WSS sector. Presentation of the report on EE financing mechanisms.	National Consultant or guest speaker
16:45	Q&A	
17:00	**Next steps - Detailed work plan until next national workshop** Assignment #5 – Evaluation of the saving measures Assignment #6 – Action Plan Date and location for the National Event #2	All participants

NATIONAL EVENT NO 2

October/ November2014		
Time	**Content**	**Speaker**
9:00	**Welcome remarks and National event objectives**	National Consultant Representative of Country's Water Association
9:20	**Presentations of utilities** Presentations will focus on step 5 and 6: (5) Evaluating saving measures; (6) Designing and implementing an action plan. They will also present their audit reports and opportunities for financing the projects. (20 min presentation + Q&A for each utility	Representatives of Utilities
10:45	*Coffee Break*	
11:15	**Presentations of utilities (continued)**	Representatives of Utilities
12:30	*Lunch Break*	
13:30	**Support on Energy auditing and developing EE measures** Following the individual presentations, the participants will together carry out a peer review of the utilities' progress on the methodology (step 5 to 6). The national expert will provide additional instructions for implementing detailed energy audits and drafting audit reports. This will be the opportunity for the national consultant to evaluate the utilities technical needs and share on specific challenges. A schedule for submitting Energy Audit Report will be discussed with the utilities.	National Consultant
14:30	**Financing measures in the WSS Sector** Based on the individual presentation of each utility Econoler's Financial Expert will provide support on structuring EE projects financial and business plan, assessing costs and benefits, project organization, risk assessment and allocation, etc. The workshop will also identify relevant donors and financing opportunities specific to the utilities' needs.	Ivan Gerginov Financial Expert Econoler

16:00	**Next steps - Detailed work plan until the end of the project** Detailed work plan will be made and discussed for each company to complete energy audits and structure financing.	National Consultant
16:30	**Visit of Water Supply and Sanitation Utility** The participants will have the opportunity to see the equipment, familiarize with the EE measures implemented and get complementary information from the General Manager	General Manager of the targeted WSS utility All participants
18:00	End of National Event #2	

APPENDIX III
DETAILS ON TRAINING MATERIAL

Detailed Description of the Six Steps for Performing an EEP

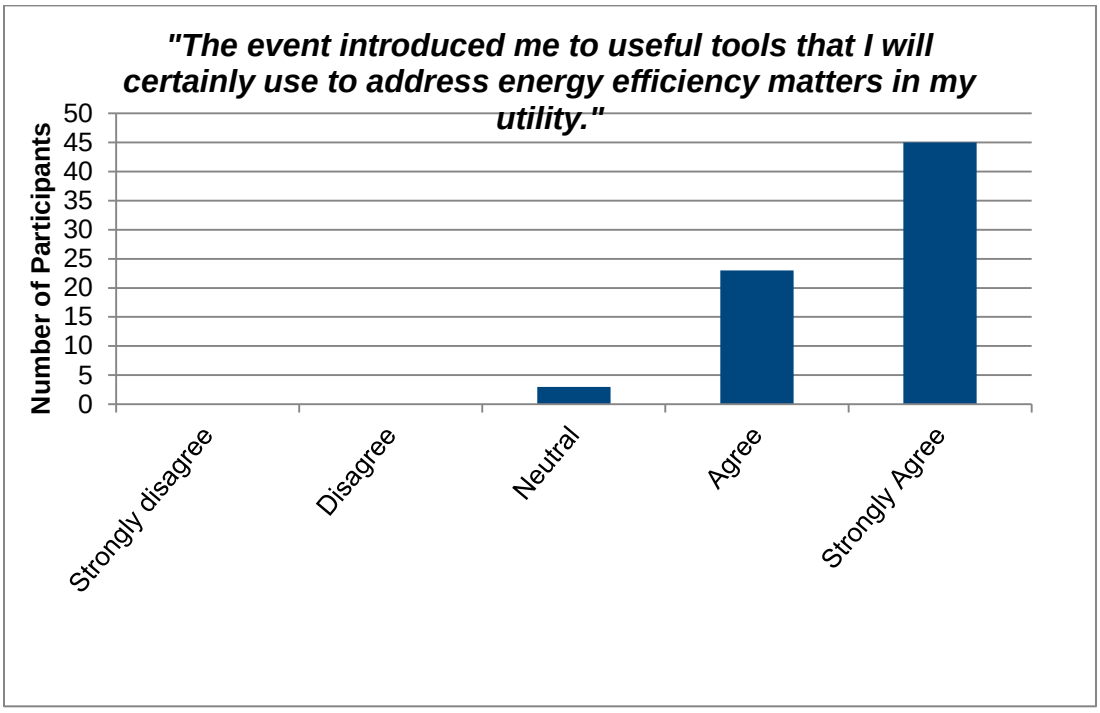
Steps for Performing an EEP	Description
Step 1 – Collect Data	Collecting data establishes the general operation conditions of a water and wastewater company and determines which installations present the greatest potential energy savings. Data collection should be accomplished in two steps. **Preliminary evaluation** – Review the legal context for water utilities. Examining previous audits or evaluations or conducting a walk-through audit allows determining which systems and equipment would benefit from an IGEA. **Data needed for an Enegry audit** – After the preliminary evaluation, basic data from the pumping and distribution systems, motors, pumps, pipes, tanks as well as additional data such as conditions of operation (flow, pressure), population connected to the plant and topography must be collected.
Step 2 – Take Field Measurements	Field measurements of electrical and hydraulic parameters must be made to enable an energy balance calculation, which will in turn serve to determine where the main losses of energy. With this information, the elements and equipment with significant energy savings potential will be identified and the corresponding EE measures will be proposed. This step should also include maintenance observations such as: temperature readings, the observation of excess vibrations, lubrication of mechanical components, leakage in valves and main discharge pipes, and cleaning of electrical installations. This is necessary to define maintenance actions within the Action Plan. Measurement equipment need for the field measurement activities will be discussed during the kick-off meeting.
Step 3 – Analyze Information	The analysis proposed in this methodology refers to loss calculations and analysis of the following information: › Analysis of energy indicators based on historical data › Calculation of energy losses in electrical conductors and transformers, electrical motor efficiency, pump efficiency, head loss in piping, leaks in water network › Analysis of operations, and maintenance practices › Elaboration of energy balances These analyses identify items with a high rate of losses or low efficiency and thus the savings measures which may improve upon them.

Steps for Performing an EEP	Description
Step 4 – Identify Energy Savings Opportunities	After the analysis and evaluation of the largest energy-consuming elements, savings measures for the proposed action plan are determined within one or more of the following categories: › Achieving savings by changing tariffs for energy supply › Improving electrical installations (transformers, capacitors, etc.)Improving the efficiency of electric motors, efficiency of pump operations within water systems, maintenance practices › Reducing losses in the distribution network › Implementing leakage reduction programs › Consider renewable energies
Step 5 – Evaluate Savings Measures	The evaluation of the savings measures is a crucial step of the IGEA. This evaluation consists of: › Calculating direct and indirect energy and cost savings to be achieved with the measure Estimating implementation cost for the measure (detailed design, equipment, installation, field supervision, security, storage, shipping, commissioning) › Estimating additional operation costs (operation, maintenance and equipment materials e.g., lubricants or gaskets) associated with the measure › Determining the financial indicators (pay-back, net present value, and analysis of the lifecycle of the project)
Step 6 – Design and Implement Action Plan	Once all of the possible EE measures have been evaluated and that the most interesting ones have been selected by the senior management of the company, the action plan is ready to be designed and implemented. First, the total energy savings and the resulting cash flow should be recalculated to provide a complete overview of the project. The implementation of the action plan consists of those sub-activities: project implementation, activities and critical path identification, financing plan; commissioning.

APPENDIX IV
UTILITIES' EVALUATION RESULTS

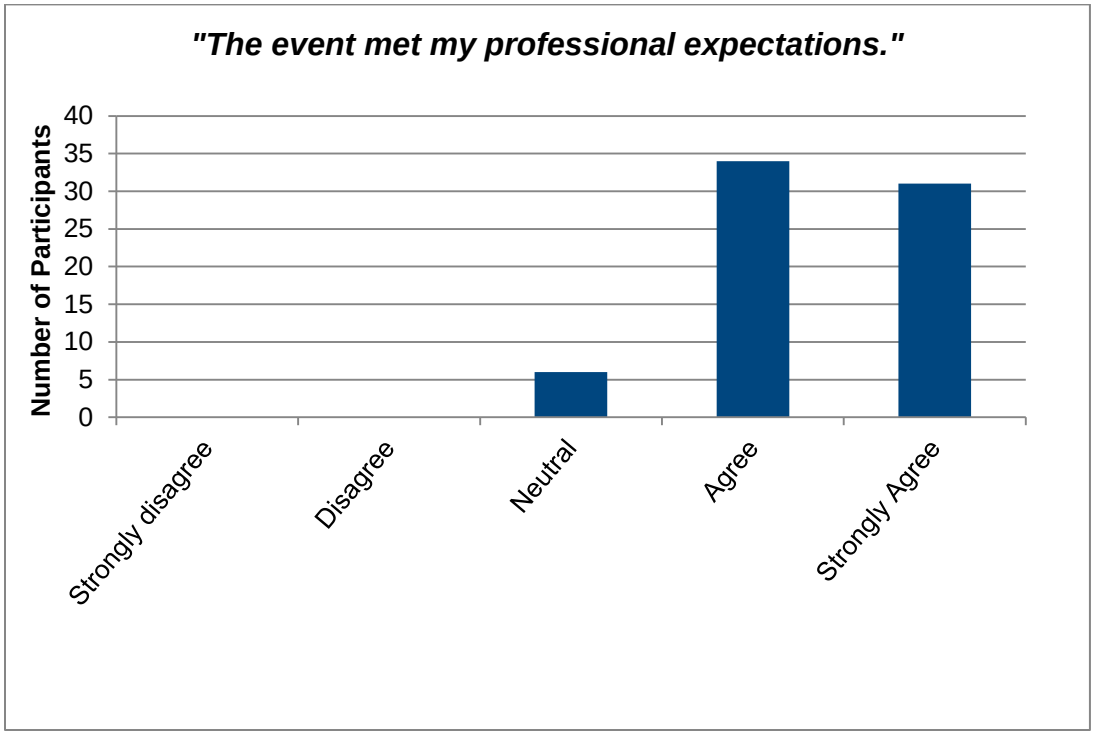
Overview of the Initial Workshop Evaluation Results

The following three figures provide an overview of the participants' feedback regarding the event, that were compiled with an evaluation questionnaire.



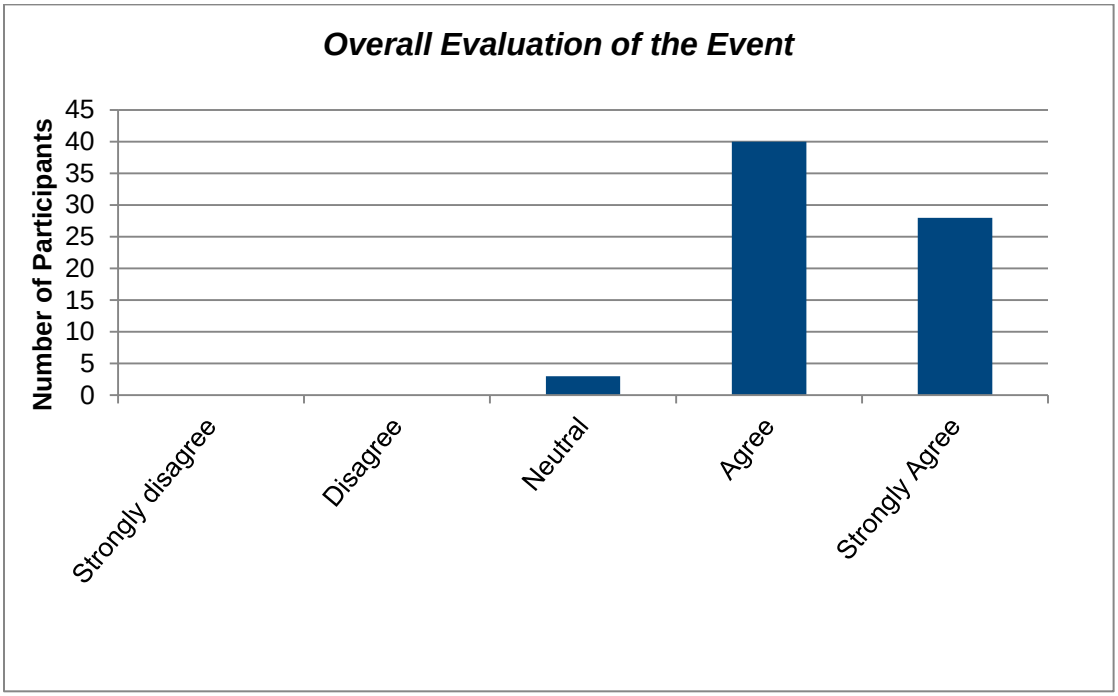
"The event introduced me to useful tools that I will certainly use to address EE matters in my utility."

This chart above illustrates that participants considered the tools introduced during the kick-off event highly relevant and useful, including the RETScreen software, the EE manual, the energy audit templates and tools, etc. Forty-five of them strongly agreed with the statement and 23 agreed while 3 were neutral. This high level of satisfaction was mainly due to the training approach and methodology applied, and particularly the training on RETScreen, which is a user-friendly software tool very useful for identifying EE measures.



"The event met my professional expectations."

As highlighted in the chart above, most of the participants thought that the event was relevant to their field of work and met their professional expectations. Thirty-one participants strongly agreed with the statement, 34 agreed and 6 were neutral. The participants mentioned that it was very helpful for them to meet with their colleagues in the same field to share their working experience and views on challenges. They said that the training, the discussions and the exchanges with EE experts provided them with a highly effective learning environment, project ideas and solutions to their energy challenges.



Overall Evaluation of the Event

Finally, this chart shows that the participants were generally satisfied with the kick-off event. Twenty-eight mentioned that they were very satisfied, 40 were satisfied and 3 neutral. Generally, the participants showed much enthusiasm about participating in the kick-off event and getting involved in the subsequent steps of the program. The “neutral” results can be explained by the high expectations among some utilities regarding technical and financial support, which were not always met. These issues are analyzed and discussed in the “Program Challenges” section and the “Recommendations” section.

APPENDIX V
ENERGY MEASURES IDENTIFIED

Romania

		Individual EE Measures					
Utility Name	**Energy Savings Opportunities**	**Energy Savings (MWh/ yr)**	**Monetary Savings (EUR/yr)**	**Energy Savings (%)**	**Investment Required (EUR)**	**Payback Period (years)**	**Total Investment (EUR)**
Aquaserv Targu Mures	Replacing pumps no 1 and 2 Installing VSD	158.0	18,754	34.65	30,994	2.1	30,994
Apaserv Satu Mare	Water pumps replacement Carei	62.3	7,850	21.81	30,634	5.4	45,097
	Water pumps replacement Sanatatii	7.1	898	40.23	7,474	8.3	
	Water pumps replacement str. Independentei	2.9	365	23.84	5,068	17.4	
	Water pumps replacement str. Closca	3.1	387	31.07	1,921	6.2	
Focsani	Replacement of five GM50L-type blowers	497.0	59,627	20.10	126,483	2.1	126,483
Raja Constanta	transformation substations in existing buildings		715,130		1,198,745	1.6	1,198,745
Buzau	Replacing motors and pumps	355.0	42,616	40.56	62,504	1.5	62,504
Brasov	Replacement of water pumps and electrical motors	60.0	8,000	18.00	25,400	4	25,400
	Total	**1145.4**	**834,873**				**1,489,223**

Serbian Hub

		Individual EE Measures					
Utility Name	**Energy Savings Opportunities**	**Energy Savings (MWh/ yr)**	**Monetary Savings (EUR/yr)**	**Energy Savings (%)**	**Investment Required (EUR)**	**Payback Period (years)**	**Total Investment (EUR)**
Zvezdara (Belgrade)	Changing No. 1 pump at CS17a pumping station	583	38,397	60.1	145,908	3.8	437 724
	Changing No. 2 pump at CS17a pumping station	563	36,477	56.5	145,908	4.0	
	Changing No. 3 pump at CS17a pumping station	545	35,587	56.1	145,908	4.1	
Vracar (Belgrade)	Changing No. 1 pump at CS16 pumping station	333	21,671	53.3	108,357	5.0	325 071
	Changing No. 2 pump at CS16 pumping station	332	21,671	51.5	108,357	5.0	
	Changing No. 3 pump at CS16 pumping station	512	33,862	54.8	108,357	3.2	
Subotica	Increase biogas production by 10–15%	103	40,075		540000	13.5	540 000
Izvoriste (Leskovac)	Energy savings in maintenance and operations	76	4,895	39.3	14,238	3.1	14 238
Gorina (Leskovac)	Construction of a small hydroelectric plant	2,212	161,000	-	379,080	3.0	379 080
Biljeljina (BiH)	Changing existing 64 kW pump with 45kW pump, B2 Pumping station	28	1,300	-	11,178	8.6	32 562
	Changing 75kW existing pump with a 45kW pump, B11 Well	44	1,944	-	10,692	5.5	
	Change of existing pump of 75kW with 45kW, B12 Well	107	4,649	-	10,692	2.3	
Niksic (Montenegro)	Pump replacement Vitalac	52	5,207	39.7	12,000	2.3	69 000
	Pump replacement Široka street	56	5,607	43.1	12,000	2.1	
	Pump replacement Donja Luka škola	48	4,806	40.1	12,000	2.5	
	Pump replacement G. Rubeža	56	5,607	46.2	12,000	2.1	
	Pump replacement Donja Luka Relejska	52	5,207	42.9	12,000	2.3	
	Pump replacement Donja Rubeža	25	2,529	19.1	9,000	3.6	
Naissus Nis	Changing No. 1-2 pumps at Mediana 2	64	7,740	51.2	41,027	6.2	82 054
	Changing No. 3-4 pumps at Mediana 2	80	9,600	64.2	41,027	5.00	
	Total	**5,871**	**430,491**				**1 797 675**

Ukraine

		Individual EE Measures					
Utility Name	**Energy Savings Opportunities**	**Energy Savings (MWh/ yr)**	**Monetary Savings (EUR/yr)**	**Energy Savings (%)**	**Investment Required (EUR)**	**Payback Period (yr)**	**Total Investment (EUR)**
Chernihiv	Replacement of waste water pumping station	206	15,200	32.0	76,950	2.5	344,250
	Replacement of compressors at waste water treatment plant	800			267,300	2.7	
Kremenchuk	Installation of combined heat and power generator	3,910	326,000	-	2,187,000	6.7	2,187,000
Kharkiv no. 26	Replacement of pumps	2,978	18,948	75.0	126,348	6.7	174,590
	installation of VFD motors	0	7,240	0.0	48,242	6.7	
Pyatihatki (Kharkiv)	Replacement of pumps	6,623	276,206	47.4	413,745	1.5	510,228
	installation of VFD motors	0	28,945	0.0	96,483	3.3	
	Total	**14,517**	**672,539**				**3,216,068**

APPENDIX VI
WSS UTILITIES PROGRESS

This Appendix features the detailed participation of utilities at every step of the training sessions, their submission of an energy audit reports and completion of financial transaction. The cells in blue show a positive result in terms of participation, submission of report or confirming financing of the EE project.

WSS Utility	Initial Workshop	National Event No. 1	National Event No. 2	Submission of Energy Audit Report	Financial Transaction Completed
Romania					
Aquaserv (Targu Mures)					
Focsani					
Apaserv (Statu Mare)					
Raja (Constanta)					
Buzau					
Brasov					
Apavital (Lasi)					
Aquatim (Timisoara)					
Braila					
Serbian Hub					
Vacar (Belgrade)					
Zvezdara (Belgrade)					
Izvoriste (Leskovac)					
Gorina (Leskovac)					
Subotica					
Bijeljina (BiH)					
Niksic (Montenegro)					
Naissus Nis					
Kladovo					
Novi Sad (VIKNS)					
Bihac					
Surdulica					
Milos Mitrovic (Velika Plana)					
Zrenjanin					

WSS Utility	Initial Workshop	National Event No. 1	National Event No. 2	Submission of Energy Audit Report	Financial Transaction Completed
Ukraine					
Chernihiv					
Kremenchuk					
Kharkiv no 26					
Pyatihaki (Kharkiv)					
Zhytomyr					
Boryspil					
Rivne region					
Cherkasy					
Dnipro-Kirovograd					
Illichivsk					
Khmelnytskyi					
Mariupol					
Nikolayev					

160 Saint-Paul St., Suite 200, Quebec City, QC G1K 3W1 CANADA | Tel.: +1 418-692-2592 Fax: +1 418-692-4899
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