

Experience in the Europe & CIS Region with Clean Energy – UNDP, GEF and UNECE



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TABLE OF CONTENTS

| | |
|---|----|
| PART I – UNDP AND GEF CASE STUDIES FROM THE EUROPE & CIS REGION ON ENERGY EFFICIENCY | 2 |
| INTRODUCTION | 3 |
| ARMENIA: “IMPROVING ENERGY EFFICIENCY IN BUILDINGS” | 5 |
| BELARUS: “IMPROVING ENERGY EFFICIENCY IN RESIDENTIAL BUILDINGS” | 8 |
| GEORGIA: PROMOTION OF BIOMASS PRODUCTION AND UTILIZATION IN GEORGIA | 13 |
| ROMANIA: IMPROVING ENERGY EFFICIENCY IN LOW INCOME HOUSEHOLDS AND COMMUNITIES IN ROMANIA | 16 |
| RUSSIAN FEDERATION: BUILDING ENERGY EFFICIENCY IN THE NORTH-WEST OF RUSSIA | 20 |
| SERBIA: REDUCING BARRIERS TO ACCELERATE DEVELOPMENT OF BIOMASS MARKETS | 23 |
| TURKEY: IMPROVING ENERGY EFFICIENCY IN INDUSTRY | 26 |
| UKRAINE: SUPPORTING “ENERGY FARMING” AND WASTE AGRICULTURAL BIOMASS UTILIZATION FOR MUNICIPAL PURPOSES | 29 |
| CONCLUSION | 33 |
| PART II - GOVERNMENT POLICIES TO REMOVE BARRIERS TO IMPLEMENTING ENERGY EFFICIENCY MEASURES | 34 |
| INTRODUCTION | 35 |
| THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA: “ENERGY MATHEMATICS” | 36 |
| SERBIA: “BUDGET FUND FOR ENERGY EFFICIENCY” | 38 |
| UKRAINE: IMPROVING ENERGY EFFICIENCY | 40 |
| CONCLUSION | 41 |

**PART I – UNDP AND GEF CASE STUDIES
FROM THE EUROPE & CIS REGION ON
ENERGY EFFICIENCY**

INTRODUCTION

The sixth day of October 2016 was a historic day for global efforts to combat climate change. The Paris Agreement entered into force as more than 55 countries representing 55% of total global greenhouse gas emissions have now ratified the agreement. Entry into force of the Paris Agreement bodes well for the urgent, accelerated implementation of climate action that is now needed to realize a better, more secure world and to support also the realization of the Sustainable Development Goals which include helping countries significantly reduce greenhouse gas (GHG) emissions. The ability of clean energy including energy efficiency and renewable energy to meet world energy demand and to transform economies while at the same time helping countries meet their climate change commitments under the Paris Agreement is widely acknowledged. In many countries, both developed and developing, energy efficiency has become the first fuel to meet rising energy demand and the first tool to mitigate greenhouse gas emissions. In their Nationally Determined Contributions, or NDCs, many countries have identified improving energy efficiency and investing in renewable energy as the major measures to achieve their NDC goals.

This brochure “Experience with Energy Efficiency in the Europe and the Commonwealth of Independent States (CIS) Region – the United Nations Development Programme (UNDP), the Global Environment Facility (GEF) and United Nations Economic Commission for Europe (UNECE)” shows the important role that measures taken to improve energy efficiency can play in order to help countries with meeting their commitments under the Paris Agreement. First part of this brochure presents eight case studies of UNDP-GEF technical assistance projects in energy efficiency in eight countries in the region (Armenia, Belarus, Georgia, Romania, Russian Federation, Serbia, Turkey, and Ukraine) whereas second part of the brochure presents UNECE experiences related to energy efficiency in the region.

The eight countries selected in the first part were chosen because of their outstanding inefficiency in use and development of energy. A common tool for assessing the potential gains from energy efficiency investments is to examine a country’s energy intensity. Energy intensity, calculated as unit of energy consumption per unit of Gross Domestic Product (GDP), is a measure of the energy efficiency of a nation’s economy. According to the International Energy Agency (IEA,2015), energy intensities in these countries were 5 to 10 times higher than in The Organisation for Economic Co-operation and Development (OECD) countries’ average. This brochure describes the cost-effectiveness of public grant investments in energy efficiency in these countries with an objective to deliver maximum global environment commons. In the area of renewable energy, three case studies deal with support for developing biomass markets in Georgia, Ukraine, and Serbia. These case studies illustrate the barriers and the opportunities in developing sustainable biomass markets.

Commissioned to commemorate the 7th International Forum on Sustainable Energy Development in October 2016 at Baku, Azerbaijan, this brochure only presents a small portion of the impacts of UNDP-GEF interventions in sustainable energy in the Europe and the CIS region. The UNDP and the GEF currently have 40 projects in the Europe and CIS region with total committed GEF funds of US\$128 million. Of these 40 projects, 24 of them are dealing with the issue of energy-efficiency which means that 60% of the overall portfolio deals with the issue of energy efficiency and this simply shows the importance of energy efficiency measures, as a tool to combat climate change, in the Europe and CIS region. Within the area of energy efficiency in the region, the UNDP and the GEF are working closely with projects that deal with lighting, with district heating, with industry, and with buildings (both public and residential).

The UNDP, as one of the original founding implementing agencies of the GEF, is a strong partner of the GEF. The UNDP currently has a portfolio of over \$500 million dollars of GEF projects, working in some 88 countries on issues related to climate change mitigation. In each of the eight case studies presented, this brochure focuses on the following areas:

1. What is the project about?
2. What were the challenges?
3. What has been achieved?
4. What have been learned?

One of the main lessons learned from this brochure is that putting in place the right legal and regulatory framework is absolutely critical as a tool to promote energy efficiency and renewable energy. The results from these case studies show that there is considerable scope for the UNDP and the GEF to continue assisting national government policy makers, GEF national operational focal points, and other country partners in designing and implementing strong and robust sustainable energy projects which create green jobs, build stronger economies and help reduce greenhouse gas emissions.

ARMENIA: “IMPROVING ENERGY EFFICIENCY IN BUILDINGS”

Project Overview:

Project implementation period:

July 2010 - July 2016

GEF funding:

USD 1,045,000

Co-financing:

USD 2,350,000

Targeted GHG reduction: 54 ktCO₂eq.

What is the project about?

The UNDP GEF ‘Improving Energy Efficiency in Buildings’ project aimed to reverse the existing trends and reduce consumption of electrical and thermal energy and associated greenhouse gas emissions in new and refurbished buildings in Armenia. The country has a significant rate of urban population and almost year-round need for heating and cooling due to sharp continental climate and high extremes of air temperature in summers and winters. Almost 90 percent of buildings belong to residential sector and the majority of the buildings were designed and constructed in the Soviet era without concern of energy efficiency. Consequently, making these energy inefficient buildings to comply with the requirements of the current building codes is a critical part of the sector’s development agenda and provided rationale for the project.

The project was implemented from July 2010 - July 2016 and was structured into four major components:

1. Design and enforcement of new energy efficient building codes and standards;
2. Quality control, testing and certification of energy efficient materials and equipment;
3. Outreach, training and education for sector actors and public at large;
4. Demonstrating integrated building design via pilot projects in selected residential buildings.

The Project was co-financed by the GEF, the UNDP and the Government of the Republic of Armenia (GoA). The implementing partner for the project was the Ministry of Nature Protection, while the Ministry of Urban Development provided sector-relevant support. The project partnered a wide range of state agencies, private companies, academic institutions and other stakeholders.

What were the challenges?

The project responded to certain structural barriers related to energy efficiency improvement in buildings.

In particular, building standards were outdated with no specific reference to energy performance and integrated building design approach. Enforcement capacity was low with few energy audits implemented by questionable methodologies and no energy performance certification for construction materials.

In addition, building sector actors had low capacities due to insufficient skills to integrate energy efficient technologies and design techniques. Market for energy efficient products was immature with low motivation for application of modern technologies and materials and inertia-driven practices in construction and maintenance, as well as low awareness of sector actors on energy performance incremental costs and application options to lower the operational costs, energy consumption and financial savings.

Inflexible procurement and investment decision-making practices were also important challenges as they discarded energy efficiency approaches due to higher initial construction costs with little consideration of life-cycle costs that are central to the issue.

What has been achieved?

Achievements of the project include (1) multiple legislative and regulative improvements; (2) introduction of modern energy efficient practices into testing and certification procedures to piloting thermal retrofit in

residential buildings; (3) completed technical and educational literature for the sector actors and students of relevant specialties; (4) upgraded Law “On Energy Efficiency and Renewable Energy” introduces novel categorizing tools for industries, which enables mandatory energy performance requirements for public construction, as well as clarifies energy labeling issues, and outlines procedures for circulation and further utilization of hazardous substances; (5) updated codes of “Thermal Protection of Buildings”. Because of that, RACN 2401-2016 construction norms now include energy performance related provisions; (6) harmonized EU Building Energy Performance Directive with its supporting six standards which allows approximating Armenian practices to those of the EU. Due to the above project achievements, Armenia’s “Methodology for implementation of energy audit in residential and public buildings” AST 371-2016 national standard is developed to provide a consistent holistic approach, including its online calculation tool, and is supported with GoA-adopted amendments to the energy audit implementing procedure.

As a first testing and certification laboratory in Armenia, an educational and testing laboratory was equipped with modern devices and tools. The staff were trained respectively and provided with a manual on instrumental measurement of thermal technical parameters that were approved by the National University of Architecture and Construction of Armenia. Market and industry research produced a bilingual database on locally produced and imported construction and insulation materials. Eight widely applied materials were locally tested and their producers granted a certificate or technical specification.

Testing the developed methodologies, the project performed seventeen energy audits in residential buildings including six based on instrumental measuring with building energy passports developed. The skills came handy during activities for thermal insulation and improvement of ventilation and lighting systems in social housing in Goris town as an energy efficiency demonstration project.

Energy efficient solutions for building envelopes are promoted via summarizing the major recommendations in GoA-approved Advisory handbook of technical solutions for thermal insulation of building envelopes and Catalog of designs of five replicable-typical energy efficient individual residential houses for communities of Armenia. The curricula of the profile Universities are enriched with materials of bilingual “Green Architecture” textbook. About 180 sector professionals and over 90 students were trained via professional development events at home and abroad on building insulation techniques, integrated building design approach, building codes and construction materials certification issues, construction and insulation materials testing and certification, voluntary rating standard and energy passports and energy efficiency labels for buildings in Armenia, including Summer Extension Course on Solar Architecture organized jointly with American University of Armenia.

The proven success of the Project's pilots with energy performance exceeding 60 percent. Figure 1 with two pictures shows the investment results of the GEF/UNDP project in Avan. The two pictures were taken in the same place for the same buildings, one with a conventional camera, and another with an infra-ray camera which capture the image of heat released from the envelopes of the buildings. The building on the left side of the two pictures look more beautiful. More importantly, the average temperature of the building envelope on the left side building is approximately 10-degree F lower than the right hand side building. The flagship thermal retrofit of operating nine-level residential building in Avan, gave a way to “De Risking and Scaling-up Investment in Energy Efficient Building Retrofits” project with US\$ 20 million grant of the newly established Green Climate Fund and co-financing of European Investment Bank and Yerevan city municipality that became the first project approved for the Eastern Europe region.

Indeed, the most recent public opinion survey performed within the flagship pilot revealed that all the respondent residents perceived their comfort improved in the heating season after thermal retrofit with almost 80% of apartments having indoor temperature of 19°C and higher. More than a half of the respondents acknowledged that their monthly heating costs decreased by up to US\$ 40, while in 33% of the apartments heating bill did not exceed about US\$ 60.

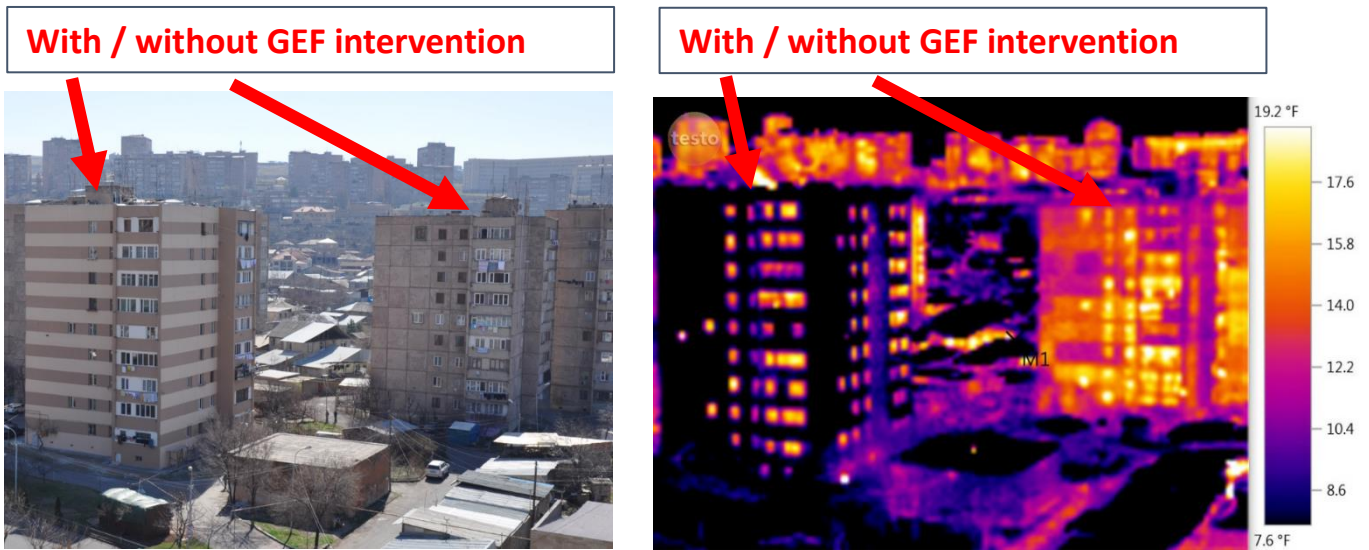


Figure 1 Efficiency of buildings in Avan with and without GEF Intervention

Internationally, the most visible achievement was successful hosting of the Sixth International Forum on Energy for Sustainable Development held by the UNECE, UNDP Armenia, Government of Armenia and other UN agencies with over 260 delegates from 38 countries. The adopted Yerevan Statement of Common Action is a road map for relevant stakeholders around the globe to encourage countries to pursue coherent and integrated energy policies that tackle global energy problems, thereby accelerating the transition to an affordable, reliable, sustainable and modern energy system.

Project Achievements:

- Actually mobilized co-financing: USD 12.1 million
- Cumulative emission reductions from new residential buildings constructed during project lifetime: 64.2 ktCO₂eq.
- 180 sector professionals and 90 students of relevant specialties in profile Universities were trained.
- Overarching “Thermal Protection of Buildings” RACN 24-01-2016 construction norms introduced, the Law “On Energy Efficiency and Renewable Energy” upgraded, and 12 building codes, standards, methodologies and procedures approved.
- The project’s flagship pilot enabled replication of thermal retrofit of residential buildings via “De-Risking and Scaling-up Investment in Energy Efficient Building Retrofits” project that was granted 20 million USD by Green Climate Fund with co-financing of European Investment Bank and Yerevan city municipality, and became the first project approved for the Eastern Europe region.

BELARUS: “IMPROVING ENERGY EFFICIENCY IN RESIDENTIAL BUILDINGS”

What is the project about?

Project Overview:

Project implementation**period:**

January 2013 - June 2018

GEF funding:

USD 4,500,000

Co-financing:

USD 13,700,000

Targeted GHG reduction:

220 ktCO₂eq.

The “Improving Energy Efficiency in Residential Buildings in the Belarus” project aims at reduction of energy consumption and related GHG emissions in the country through significant increase of energy efficiency performance of new housing compared to existing practice. Belarus, as a Party to the Paris Climate Change Agreement, established long-term goals for GHG emission reduction and is currently pursuing respective climate change mitigation policy. The policy includes, inter alia, enhancement of international cooperation in facilitating introduction of clean energy technologies and energy efficiency improvement measures particularly in the housing sector, for it currently devours more than 21% of the total final electricity consumption and about 45% of total final thermal energy consumption. In the last decade, residential buildings with a total living area of approx. 50.7 million m² were put into operation. There

is no residential building with thermal energy consumption by any HVAC system lower than 30 kWh/m², although in Europe the level of consumption lower than this has already become a common practice. As to hot water supply systems, common current practice in Belarus is the value of around 90 kWh/m², and no houses have been built with such parameter lower than 60 kWh/m².

In order to bridge this gap, the project has been structured into four major components:

1. Strengthening legal and regulatory framework and mechanisms to enforce the legislation for improving the energy efficiency of residential buildings;
2. Enhancing capacity of Belarusian specialists to implement and effectively introduce new energy performance standards and best practices with the primary focus on new residential buildings;
3. Demonstrating energy and cost-saving potential of new energy efficient measures in at least three new residential buildings;
4. Documenting, disseminating and institutionalizing the project results thus providing a basis for further replication.

The project is co-financed by the GEF), the UNDP and the Government of the Belarus. The implementing partner for the project is the Department for Energy Efficiency of the State Standardization Committee. The Ministry of Architecture and Construction provides sector-relevant support. Other project partners represent a wide range of state agencies, private companies, academic institutions and other stakeholders, including NGOs.

What were the challenges?

First, it was no integrated approach to the energy performance standards in the housing sector. There were only prescriptive thermal standards adopted in 2010 defining minimum mandatory U-values for the building envelope. Corresponding average annual thermal energy specific consumption was thereby about 60 kWh/m² for space heating of typical multi-apartment buildings and 120-130 kWh/m² together with sanitary hot water preparation. As a result, there was no construction norms and standards establishing the minimal energy performance of buildings, no methodologies for energy performance monitoring and calculation, and thus there was no energy efficiency certification and compliance checking system in the housing sector.

Second, there was an acute need of raising capacity, knowledge and experience of all relevant decision-makers and specialists of design institutions, construction companies and housing operation entities in the tasks related

to techniques, measures and engineering systems applicable to residential buildings for energy efficiency improvement.

Third, in Belarus, there were no convincing example of cost-effective design solutions that were introduced in construction practice to significantly increase the share of energy efficient multi-storey residential buildings. Several technologies are used since 2010 to achieve the level of 30-40 kWh/m² per year for space heating (e.g., taking into account of shape, layout, orientation, etc.; increase of tightness and thermal insulation of envelope; individual control of heat consumption), although the share of such buildings is only ca. 1.3% of total leaving area. In addition, no houses have been built with annual specific energy consumption by hot water supply system lower than 60 kWh/m², while common current practice is around 90 kWh/m². Therefore, the real challenge for the project was to demonstrate, through the design, construction, operation and monitoring of three, at least, buildings, that there are a number of affordable technologies and engineering systems available in the market, which will help reducing the energy consumption of new residential buildings for space heating and hot water together below 60 kWh/m².

Forth, almost all sector actors, including dwellers, have almost no incentives to invest in the energy efficient housing construction due to the current tariff policy. For residents, the current price for thermal energy is around 20-25% of its actual cost. This policy must be changed soon; otherwise, the progress in energy efficiency improvement of housing will be farther impeded.

What has been achieved?

On component 1:

The integrated approach to the energy performance monitoring and calculation became a basis for most of amendments proposed and supported by the Project for current norms and standards and incorporated into the approved official State List of Technical Norms and Standards with six core standards already adopted.

The Technical Code "Energy Efficiency of Buildings", a regulatory enactment that contains, inter alia, the minimal energy performance requirements and corresponding provisions for energy certification system and was developed in cooperation with the project on a basis of EU Directive 2010/31/EU. Along with national addenda it has been approved by the Technical Committee on Standardization in the Field of Architecture and Construction (TCS-14) in its third hearing. The document was also approved by the State Standardization Committee in its first hearing in Dec 2015. The document has been included in the State Development Program of Technical Regulation, Standardization and Conformity Assessment in the Field of Energy Saving for 2016-2020 and is expected to be duly adopted in December 2016.

The methodology for energy audit of residential buildings drafted by the Project is being currently verifying during energy audit campaign for 55 buildings and will be submitted for adoption late in 2016.

On component 2:

Owing to the project, there are already at least 9 local design companies exercising new design approach, out of ca. 120 companies. To reach the target of 30% of companies as well as to disseminate the best practices among local developers and construction companies, the project developed and published online more than 200 technical reports and conducted a training campaign of 9 two-day courses for more than 100 specialists and about 30 companies. The project also provided support to 76 decision-makers and relevant specialists for 5 study visits and 12 international events abroad where they have become acquainted with design, construction and operation practices as well as with legal framework, standards and policies exercised in three leading European countries (Germany, Austria, and Czech Republic) in the field of energy efficient buildings. The project cooperates with one of the leading institutions in the field of advanced training and with three national universities.



Figure 2: Practical training on energy audit



Figure 3: Study visit in Austria

On component 3:

Owing to the GEF grant and contributions from local partners, the project possesses one more instrument to demonstrate in practice the energy-saving potential of new energy efficient measures in housing. Three new multi-storey residential buildings of different structural specification are currently being built in three Belarusian cities. The first building is a one-entrance 19-storey 133-apartment large-panel residential house in Minsk. The second building is a three-entrance 10-storey 120-apartment residential house in Hrodna being constructed of brick partition crosswalls with the outer walls made of foam concrete blocks. The third building is a four-entrance 10-storey 180-apartment semi-frame panel residential house in Mahilou.

In the end of 2013, the Project hired NIPTIS, the most advanced design company in Belarus, to develop design and construction documentations for three different pilot residential buildings of mass construction. In June 2015, the NIPTIS finalized the design documentations, which were based on the best international practices taking also into account local operational capacity and baseline designs of the buildings. In October 2015, the Project and the developers/builders obtained all necessary permissions.

In these buildings, the project and its partners applies the design principles based on the best international practices taking also into account local operational capacity and baseline designs of the buildings. In addition to the technologies being exercised in energy efficient housing since 2014, the following new technologies were introduced in the design of the three pilot buildings:

- ventilation with recovery of up to 80% of exhaust air heat that provides annual saving of 0.030 Gcal/m²;
- heat recovery of household sewage and utilization of geothermal resources that provides annual saving of 0.04-0.05 Gcal/m²;
- use of solar heating system that provides annual saving of 0.025-0.030 Gcal/m²;
- use of solar PV-panels that provides annual saving of about 4 kWh/m²; and
- remote control and accounting of energy consumption.

These buildings are characterized with annual specific energy consumption lower than 25 kWh/m² for HVAC system and lower than 40 kWh/m² for hot water supply system. It is more than 60% lower than it is achieved in the best practice currently exercised in Belarus. No residential building in Belarus has such performance yet. If all new buildings in Belarus inherit similar performance, this will provide at least twofold reduction of total energy consumption in new housing.

The project, in line with the design documentation, has already acquired and properly warehoused most of the energy efficient equipment, units and components, and handed some of them over to builders for installation. The buildings in Minsk and Mahiliou will be commissioned in November-December 2016. The building in Hrodna will be put in operation in April 2017.

The pictures below demonstrate the current construction status of the buildings.



Figure 4: Pilot building in Mahiliou



Figure 5: Pilot building in Hrodna



Figure 6: Pilot building in Minsk



Figure 7: Outside the Pilot Building in Minsk

On component 4:

Five International Conferences on the best practices in energy efficiency improvement in residential buildings were organized and held by the project for more than 700 participants (in total) from eight countries. Other public outreach activities under this component are as follows: 31 conferences / roundtables / seminars, 22 brochures, handbooks and manuals, more than 70 articles, more than 170 technical reports, 3 press-conferences, 3 exhibitions, about 90 releases and news. The partnership network includes more than 25 media resources. The website: 190 hits and 1700 downloads monthly.



Figure 8: International Conference on EE



Figure 9: UNDP and GEF officials visit Minsk pilot building

Project Achievements:

- Actually mobilized grant resources (GEF+UNDP): USD 4.5 million
- Actually mobilized co-financing: USD 11.5 million
- Cumulative emission reductions from new residential buildings being constructed: 24.1 ktCO₂eq.
- The minimum energy performance standards have been included in the Technical Code On Energy Efficiency of Buildings, and 6 building core standards, methodologies and procedures approved.
- More than 100 specialists from about 30 companies and about 200 students of relevant specialties in profile Universities were trained.
- Owing to the technologies applied to the pilot buildings the following performance will be achieved:
 - fourfold reduction of thermal energy consumption if any new building is constructed according to the model suggested by the Project;
 - saving up to 5 thousand toe per building in the course of its lifetime.

GEORGIA: PROMOTION OF BIOMASS PRODUCTION AND UTILIZATION IN GEORGIA

Project Overview:

Project implementation period:

June 2013 – October 2016

GEF funding:

USD 925,000

Co-financing:

USD 1,255,000

Targeted GHG reduction:

7,000 tonnes of CO₂

What is the project about?

The UNDP GEF “Promotion of Biomass Production and Utilization in Georgia” project has been implemented in Georgia since 2013 and is scheduled to finish in October 2017. The overall objective of the project is to promote sustainable production and utilization of upgraded biomass fuels in Georgia, encouraging the stakeholders to establish pilot production projects through grant investments, as well as start and develop biomass fuel utilization in the municipal sector.

Since its start, the project accomplished a number of important activities aimed at not only obtaining important data and information on bioenergy development in Georgia but also catalyzing investment in biomass as a renewable energy source. These included research of

biomass raw materials availability in Georgia, feasibility study of production and utilization of biomass fuel in Tbilisi, study of available funding sources and review of access to finance for start-up businesses in Georgia, production of promotional and study materials.

What has been the challenges?

The original challenge faced by the Government of Georgia is how to diversify its energy supply away from gas and move more towards renewable energy. Much progress has been made in the area of hydropower production where the country has ample capacity but in the area of biomass the country faces significant challenges including lack of feedstock, lack of demand, lack of awareness, and higher prices than for gas. According to the original project document, Tbilisi City Hall was considered as a partner and a biomass production plant was planned to be built in Tbilisi while at the same time the City Hall would procure biomass boilers. However, feasibility studies showed that there were limited biomass resources in or nearby Tbilisi to create production plant and the cost of biomass pellets or briquettes was clearly going to be higher than the cost of gas. Tbilisi city hall decided to withdraw from the project and the co-financing of up to US\$3 million that they had indicated they hoped they would provide to the project did not materialize. This issue created a great challenge for the project. It was decided to finance production in Georgian regions and the best three proposals were selected through a nationwide competition plan for biomass fuel production and utilization business.

What has been achieved?

During the business plan competition twenty-eight proposals are received. Winner organizations are identified during two stage selection process. Six out of twenty-eight were developed into full scale business plans. Three business plans were identified and funded as winners of the competition. Other applicants continue to work with project and try to develop biomass business. Winners are “Greenenergy” LTD, “Nisoni” LTD and National forestry Agency. Businesses were financed using investment grant mechanism through supporting NGOs. All three winners consider production of woody biomass briquettes. Projects are located in Sagarejo, Fonichala and Akhmeta accordingly. Fonichala project will supply Marneuli municipality. Akhmeta production will supply Akhmeta and Dedoplistskaro municipalities. Micro Capital Grants are awarded to following NGOs: Greens Movement of Georgia and Energy Efficiency Center. Grant activities consider providing support for mentioned organization. NGOs will purchase equipment, provide logistics support, help with issues related with biomass fuel, and conduct monitoring of implementation of business plans.



Figure 10 Wood (biomass) chipper loads small logs and branches. "Teeth" of this "jaw" chip and shred biomass into small pieces for further production.

Biomass production sites that will produce briquettes are almost ready to start production in full capacity. By the end of 2016 there will be three completed active biomass fuels production companies in Georgia with a combined production capacity of up to 4,000 tonnes of briquettes per annum. The combination of investment grants from the project and co-financing leveraged from the three project partners means that slightly over US\$1 million will have been invested in Georgia into biomass in the last 12 months. Some portion of their products will be utilized by municipal buildings. Some part will be sold on market thus increase popularity of biomass fuel. These small scale biomass production plants may be considered as a major achievement of the project even if they are on a smaller scale than was originally envisaged in the project document. Figure shows the GEF/UNDP project produced biomass briquettes.

What has been learned?

The mid-term review of the project, carried out in late 2015 found that there were several key actions that could and should be undertaken to improve the project. One of the key actions is to immediately hire an international expert on biomass energy to support and guide the development of key project outputs. The international expert was selected by open competition. He conducted first visit to Georgia and elaborated recommendations and suggestions for improving production and streamlining operations. Also he provided suggestions regarding strategy and action plan development, biomass association establishment, information needs, etc. Other recommendations were addressed accordingly as well. In order to accomplish all of the planned tasks, the Project decided to engage interested stakeholders in related consultations and discussions on regular basis, so to establish a forum where all stakeholders will be able to discuss issues related to biomass energy and influence processes facilitated by the project to promote and establish a solid basis for bioenergy sector development in Georgia. Several stakeholder

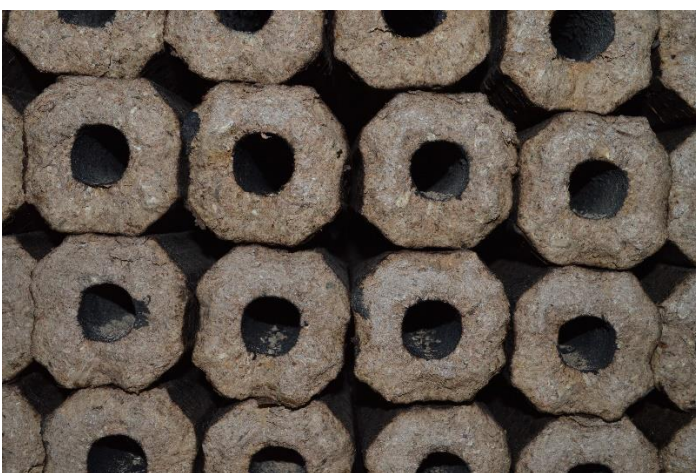


Figure 11 Stoked completed biomass briquettes from the side view

meetings were already conducted. Representatives of ministries (ministry of environment, ministry of energy), NGOs (partner or potential partner NGOs), representatives of municipalities, private companies, winners of business plan competition participated to these meetings where project plans and achievements were discussed.

Meetings will continue to be held regularly three or four times a year. Some stakeholders expressed willing to participate in initiative groups that will try to support project in accomplishing some tasks, such as elaboration of a national of biomass strategy and action plan, and establishment of a biomass association.

All of the above has laid a foundation for developing the bioenergy sector in Georgia. Several important activities are ongoing or planned in the project for the remaining period, i.e. until mid-2017. These activities include:

- completing procurement process and finalizing of biomass production plants as well as procurement and installation of utilization equipment (Figure shows part of the installed equipment);
- support of producers and consumers in technical, business and energy efficiency issues;
- facilitation of development of national bioenergy strategy and action plan;
- assistance in development of quality standards of biofuels and equipment;
- help in bioenergy association establishment process; and
- various public awareness activities related to popularization of biomass fuel in Georgia.

Project Achievements:

- Actually mobilized USD 650,000 until now
- Development of a national biomass inventory
- Creation of 15 jobs
- Establishment of three pilot projects
- 100 tonnes of biomass produced (briquettes) during the few months of operations
- Development of mapping of resources
- Launch of a website on biomass in Georgia – www.biomass.ge

ROMANIA: IMPROVING ENERGY EFFICIENCY IN LOW INCOME HOUSEHOLDS AND COMMUNITIES IN ROMANIA

Project Overview:

Project implementation period:

June 2011 - June 2016

GEF funding:

USD 3 million

Co-financing:

USD 119,2 million

Targeted GHG reduction:

666,800 tonnes of CO2 reductions

What is the project about?

The UNDP GEF “Improving Energy Efficiency in Low Income Households and Communities in Romania” project aimed to dismantle the barriers to the implementation of energy efficiency measures among poorer households and in poorer communities in Romania and alleviate fuel poverty. The project was designed in 2009-2010 and implemented from January 2011 – June 2016. Project finance (\$102.36 million) consisted of funds from the national government (\$99.23 million - Ministry of Regional Development and Public Administration and Ministry of Environment, Waters and Forests), NGO sector (\$0.08 million), UNDP (\$0.05 million) and a GEF grant of \$3 million. This project could not have been implemented without GEF/UNDP support, especially for catalyzing

the national efforts in addressing Energy Efficiency and Fuel Poverty issues.

What were the challenges?

The political and operational limiting factors have diverted the project from its course and have caused implementation delays. These elements were underestimated in the initial risk-assessment process and due to issues related to project design.

The project was designed to focus on utilization of “Romanian only energy efficiency” building materials. This was despite the fact that a market for “Romanian only energy-efficiency” building materials did not exist at the start of the project and did not develop during the project lifetime. At the end of the project there was only one company in Romania that met the criteria of Romanian only certified energy efficient building materials. The experience with trying towards the end of the project to work with this Romanian certified energy-efficient building material was a failure.



Figure 12 Vulcan Kindergarten - before thermal rehabilitation

What has been achieved?

For removing the Legal, regulatory barriers, actions have been taken at both national and local level.

At national level, the project:

- Facilitated the national dialogue among the line ministries and national agencies responsible for development and approval of the secondary legislation for the latest EU Directive on Energy Efficiency and Cogeneration with High Efficiency (27/2012)

- Made proposals for definition of “fuel poverty” concept in Romania submitted to the Government and developed a proposal of a Possible Methodology for Fuel Poverty Assessment in Romania, so that through specific means those vulnerable costumers might be helped to receive a basic service ensuring thermal comfort at an acceptable level.

The project will be further leveraged through the existing or future planned Governmental interventions regarding the energy efficiency in buildings and in particular if the fuel poverty related legislation and regulations are put in place and adopted, this can be said to have been a big success of the project.

At local level, the project continuously worked with the local municipalities, registering good progress in the mainstreaming of fuel poverty measures into the local development strategies/energy strategies.

“We are the first Metropolitan Area that has developed, together with UNDP, a plan for sustainable energy efficiency, which was finalized as part of the development strategy of Craiova and its Metropolitan area, for the next 7 years.” Cosmin Vasile, Executive Director – Craiova Metropolitan Area



Figure 13 Vulcan Kindergarten - before thermal rehabilitation

In terms of removing financial barriers for avoiding the work duplication during application process for Government programs, the project developed the technical documentation for 50 types of apartment blocks. These projects, the Municipalities can benefit of - for free, are and will be used for further works aimed to increase the energy efficiency of buildings.

The project has developed several demonstration project of thermal rehabilitation of social building blocks using grant financing. These projects on the one hand supported the local public authority, which owns these buildings, and on the other hand, demonstrated how an investment in energy efficiency measures, instead of social aid to the low-income households, can produce multiple benefits that include improving the thermal comfort of the tenants, reducing the heating costs and improving the external aspect of the blocks.

Measures addressing Capacity and technical barriers were aimed to secure an increased number (826) of building professionals, local government authorities and technical personnel capable of providing technical advice and services on the application of EE measures and techniques in the design, construction and operation of buildings.

The project contributed not only through trainings to build capacity and dismantle technical barriers. There were identified and promoted two sustainable locally produced EE insulation materials: one (Mopatel) using as raw material slaked lime and the second (Izomiorita) using as raw material wool, materials that can be produced locally from locally available, renewable and affordable raw materials, using local workforce in the

poor communities. The project provided support for the accreditation process of both companies that produce these materials and obtained the necessary technical agreements for using them for public buildings.

For removing the awareness barriers, a series of activities were successfully developed within the project:

- 50 information points at national level (covering 28 counties) have been established, aimed to distribute information and materials on how to implement EE measures in houses, sources of funding and on locally-available materials.
- In order to encourage and reward the efforts of local authorities on applying energy efficiency measures and use of renewable energy sources, a contest was organized. The contest “Energy Efficiency Begins with Local Communities” was aimed at involving as many communities in the pilot areas as possible. The prizes for the local administrations ranked in the top three consisted in the provision and installation of a sustainable heating system for an institution (school, nursery, home for the elderly, etc.) in their respective municipalities: Vulcan, Galicea Mare and Brad Local Municipalities.
- Participation or organization of conferences, forums, workshops at national and international level contributed both to enhance the knowledge on energy efficiency and to disseminate the project experience and results.



Figure 14 The project received E.ON Energy Globe Award

To make data and information available for decision-makers for designing programs to address fuel poverty, the project developed an energy management information system. The Buildings Registry is an important monitoring and decision-making tool for other extra purposes than the ones preliminary envisaged (such as Energy Policies, EU Directives compliance for public buildings, public energy management, flagging atypical variations of utilities’ consumptions, etc.). For the potential users of this instrument 23 training sessions were delivered in Bucharest, Iasi, Cluj Napoca, Timisoara, Craiova, Pitesti, Constanta and Brasov.

Through its all activities the project has reduced heat energy consumption in buildings in Romania during its lifetime by an estimated 82,309 MWh/yr. 91% of this amount is accredited to the legislative changes and the remainder to demonstration projects carried out. This amount is double than the target for direct energy savings (41,177 MWh) outlined in the Project Document. In terms of achieving its overall direct energy savings target, the project can thus be considered successful.

What have been learned?

Policies: The external intervention, as the one of the GEF/UNDP projects, for the clarification of new “concepts” in Romania – fuel poverty and vulnerable costumers was necessary and beneficial.

Demonstration projects: A greater impact of the demonstration projects can be obtained, if (1) these projects are sustained by other components (like building capacity, increasing awareness), (2) the selected buildings have proper energy management; and (3) the local community government is directly involved in the execution of the demonstration projects.

Energy Management: energy management needs to be a priority from the start to the end of such projects. It is important not to underestimate the amount of work involved in designing, transferring, installing, operating, and maintaining an energy management information system.

Project Achievements:

- Actually Mobilized USD 102,36 million
- 71 EE pilot EE projects developed
- 293.774 citizens benefited from Energy Efficient buildings and had access to increased thermal comfort
- 82.309 t CO₂eq reduced/year / 1.646.180 t CO₂ reduced through the lifetime of investment
- 826 people got trained
- 2 technology patents transferred
- 9 Policy and regulations developed
- 1 Energy Management System developed
- 50 types of technical documentation developed for building retrofitting
- 50 information points established on EE

RUSSIAN FEDERATION: BUILDING ENERGY EFFICIENCY IN THE NORTH-WEST OF RUSSIA

Project Overview:

Project implementation period:

2010-2017

GEF funding:

USD 5,840,000

Co-financing:

USD 27,500,000

Targeted GHG reduction:

2380 tonnes of CO₂ per year

What is the project about?

The “Energy Efficiency in the North West of Russia” project started in November 2010 and is scheduled to finish in November 2017. The project is implemented under the framework of the “Russia Energy Efficiency Programme” – a partnership of UNDP, European Bank for Reconstruction and Development (EBRD) and United Nations Industrial Development Organization (UNIDO) involving key Russian federal sectoral agencies and regional authorities. Three regions in the North West Federal District - Pskov, Vologda and Arkhangelsk - are involved in the project. The Russian Energy Agency (REA), Federal State Budget Institution of Russian Ministry of Energy, acts as Executing Entity/Implementing Partner of the Project.

Last year the delegation of the GEF/UNDP Project "Building energy efficiency in the North-West of Russia" participated in a study tour in order to replicate the best practices of GEF/UNDP Croatia on the establishment of a municipal energy management system, which has been successfully operated on the territory of the Republic for several years. For Russian Federation the creation of such a system is a novelty, although the relevance of this topic is obvious – the Energy Management Information System (EMIS) will help municipal administrations not only to receive data on energy flows in a public sector, but to control permanently, regulate, and the most important– to respond quickly to various contingencies and manage the process of consumption, meanwhile saving budget.



Figure 15 Day of energy saving for elementary school in Pskov

Four buildings were selected for retrofitting (one in Pskov, one in Vologda and two in Arkhangelsk Oblasts) with project’s involvement. The tenders on construction works have already been announced and the contracts are planned to be concluded in September 2016. So it is very likely that the demo retrofits will be finalized in early 2017.

What were the challenges?

The project was not able to initiate demo retrofitting of old buildings yet, as is envisaged by the project document, due to internal bureaucracy and shortage of funds at regional administrations. However, the project has undertaken some adaptive management measures: In order to develop examples of Energy Efficiency investment projects in municipal sector project experts carried out detailed screening of 40 public buildings in Arkhangelsk, Pskov and Vologda Oblast and prepared 12 detailed investment plans for retrofitting with the involvement of external co-financing sources including ESCO schemes.

What has been achieved?

Russian and Croatian experts worked in partnership for the implementation of a software for energy management and energy monitoring system (EMIS) in Russian Federation. Mr. Alexander Novak the Russian Minister of Energy, supported the extension and localization of the EMIS in Russian Federation within an international cooperation and exchange of experience in the field of energy saving. Federal State Budget Institution "Russian Energy Agency" is entrusted to create a roadmap for the dissemination of EMIS in Russian Federation.

The EMIS system enables any institution or a building to analyze power consumption statistics depending on various parameters such as the time of day, time of year, weather conditions (see **Error! Reference source not found.**). You can also bring into the system the objects of power generation and energy suppliers, to conduct statistics of change of tariffs and make the right and timely management decisions based on the received information. All existing data can be viewed graphically, with the specified time interval. The software might provide energy certificates, reports on energy audits, project documentation and any required documents, which will relieve and accelerate the search of necessary information for energy manager or other responsible person.

In July 2016, the project organized the first grant training course for young international specialists from developing countries. The benefits of EMIS was presented during the event and in August an international delegation of experts on energy efficiency, energy savings, and environmental protection, representatives of authorities, experts, and project managers of UNDP from Armenia, Kazakhstan, and Turkmenistan visited Russian Federation and saw the experience of the project on the development of the municipal energy management system.



The project also established a continuing education system in the field of energy efficiency and energy saving, starting from the primary school and until training courses for pensioners (see *Figure 16 Automated individual heat regulating unit.* **Error! Reference source not found.**).

Training modules and educational-methodical modules were developed for the implementation of this education system:

- Elementary school students: A training module “How to save electricity at home” (grades 2-4), and an elective course “School of energy savings” (grade 3); The festive of energy savings were held in Pskov, Arkhangelsk and Vologda schools.
- Secondary schools and secondary vocational education institution: An educational module on industrial and domestic energy efficiency;
- Institutions of secondary and higher professional education: An educational-methodical complex of the discipline “Fundamentals of energy saving and energy efficiency” for different areas of training. A set of eight manuals was developed and published within the methodological support of the discipline.

These materials have been piloted in the Arkhangelsk, Pskov, and Vologda regions, Kaliningrad and St. Petersburg. Training materials developed under the project are publicly available.

The next step is the establishment of an inter-regional training center for professional training and re-training on energy efficiency. An inter-regional network of branches for vocational education, using distant learning technologies, and dissemination of knowledge, is also being established in order to build educational capacity and address information issues, prepare and implement proposals to improve energy efficiency and energy savings, and form a unified environment for the dissemination of new knowledge in the field of energy efficiency. Soon, the project will present the first Russian learning portal in the field of energy efficiency.

The project, within a joint implementation of this work, funded the installation of energy-saving engineering equipment, lighting and additional insulation of external enclosing structures. The set of energy-saving measures implemented during the construction of this house has been specifically chosen by experts of UNDP, taking into account climatic characteristics of the region, availability of construction materials and equipment and restrictions on funding (not more than 20% of the cost of civil works). In new house facades, basement and attic floor are additionally insulated, the windows are triple-pane with energy-saving coating, filled with argon, and all radiators are equipped with balancing valves and thermostats.

A modular individual heating unit was built near the house (boiler running on domestic gas of low pressure), which in automatic mode is able to adjust the temperature schedule of heating depending on the air temperature outside and inside. In combination with the dispatching system this solution will help to exclude overheating and save heat energy. Other innovative solutions implemented during the construction of the house are supply and exhaust ventilation with heat exchangers installed in each residential unit that keeps heat inside of the house, due to the fact that cold air which is coming from outside is heated by air which is leaving the house and illuminating of public areas with energy-saving led lamps, equipped with motion sensors, which will significantly help to save energy. The potential savings of thermal energy in a new building, compared with other residential buildings in Parfino, according to experts, up to 57% on windows and up to 86% on the fronts.

Energy savings, according to their calculations, will reach 115 Gcal of heat and more than 13.5 million kWh of electricity per year. In money terms– more than 265 thousand rubles in a year. Do not forget about the important environmental aspect: the implementation of energy saving measures at the object in Parfino will reduce harmful CO₂ emissions by almost 30 tons per year. Similar technical solutions were implemented on the new pilot construction in Porkhov.

Project Achievements:

- Actually Mobilized USD \$5,000,000
- 2 Energy Efficiency pilots on new construction completed
- 4 Energy Efficiency retrofits projects developed for 2016-2017
- Around 200 citizens resettled from barracks to energy efficient apartments
- 76t CO₂eq reduced on completed pilot sites
- Up to 1000 people were trained on energy efficiency
- 7 National and regional level policy and regulations developed
- 2 regions integrated Energy Management System operation

SERBIA: REDUCING BARRIERS TO ACCELERATE DEVELOPMENT OF BIOMASS MARKETS

Project Overview:

GEF funding:

USD 2.845 million

Co-financing:

USD 27.63 million

Targeted installed capacity of new biomass/biogas plants:

3 MW

Targeted GHG reduction:

1,247,480 tonnes of CO₂

What is the project about?

Biomass is a bankable and realistic solution to a significant share of Serbia's needs not only for renewable energy, but also for investment opportunities which can yield significant financial returns and thus spur an additional impetus to much needed economic recovery and job creation.

Combined biomass from forestry, agriculture and livestock residues provides viable options for co-generation projects, delivering both electricity and heat, with a good geographic spread across Serbia, focusing on agriculture and livestock residues in the Northern and Central Serbia, and shifting to forestry biomass abundance in the South.

Working in close partnership with the Serbian Ministry of Mining and Energy, as its lead partner, and with the Ministry of Agriculture and Environmental Protection, the United Nations Development Programme (UNDP) in Serbia is implementing a four-year UNDP GEF project "Reducing Barriers to Accelerate Development of Biomass Markets in Serbia" to support a variety of actors in coordinated efforts to turn biomass from an attractive opportunity into reliable energy source.

The Project started in 2014. With US\$ 3.1 million from the GEF and UNDP, the Biomass Project have a total budget of US\$ 30 million. Co-financing is being provided by Serbian institutions and private investors.

The objective of the Biomass Project is to increase the share of energy from renewable sources in the energy mix of Serbia, namely the share of biomass in power generation.

What has been the key challenges?

Centered on the newly formed Biomass Support Unit (BSU) in the Ministry of Mining and Energy, the Project will broker additional partnerships with key stakeholders, such as the Serbian Chamber of Commerce, various financial institutions, the Standing Conference of Towns and Municipalities (SCTM), municipalities, Regional Development Agency of Srem and the Institute for Standardization, in order to tackle existing barriers.



Figure 17 Biogas CHP Plant in Bac: Aerial view onto digesters, feeders, biogas storage, engine containers and transformers

On the supply-side, these barriers include lack of robust market information systems, low awareness of efficient technologies for biomass extraction and logistics, as well as lack of long term certainty and continuity

of biomass supply. On the demand-side, high up-front costs and high perception of risk make debt financing more difficult for project developers.

What has been achieved?

The Project will empower key stakeholders to ensure a vibrant and resilient biomass market in Serbia by:

- Improving institutional and regulatory frameworks;
- Enhancing the capacity of all relevant stakeholders to develop, finance, construct and operate bankable biomass energy projects;
- Developing instruments for ensuring financial sustainability of investments in biomass fired plants, such as model contracts for long term biomass supply along with elaborated technical biomass catalogues;
- Implementing investment support mechanisms, such as grant schemes to support construction of selected combined heat and power plants (CHP) and other biomass plants;
- Supporting technical preparation of additional projects in terms of elaboration of feasibility studies and technical documents;
- Implementing complementary activities like number of trainings for municipalities, investors and banks, as well as capacity building and planning activities at the national and local level;
- Developing biomass e-trading platform.



Figure 18 Biogas CHP Plant in Alibunar: Trench silos and biomass feeders of CHP plant

The Public Call for awarding grants for construction of biomass/biogas CHP plants was successfully implemented by BSU in cooperation with UNDP. The Public Call was implemented through the investment support mechanism supported by the Project and was intended for the private sector. Six biogas CHP projects have been selected with total installed capacity of 6.35 MW and total investment of US\$ 22.6 million. Individual grants per project make up to 15% of the investment value, or the maximum of US\$ 275,000, while the investment value of each project

exceeds US\$ 1.2 million. In November 2015 contracts totaling US\$ 1.6 million have been signed by the Minister of Mining and Energy of the Republic of Serbia. New projects will increase the total installed capacity of biomass/biogas CHP plants in Serbia by 130%.

The flagship biomass facilities, which will continue beyond the lifetime of this project, and the establishment of institutional support mechanisms will boost the confidence of investors and financing institutions by demonstrating that biomass projects are commercially viable with proven technology and adequate legislation in place, thus encouraging the construction of new biomass/biogas facilities in the future.

Mr. Milos Banjac, National Project Director and Assistant Minister in the Ministry of Mining and Energy of the Republic of Serbia:

“This is a hands-on project which provides Serbia much needed support in achieving its renewable energy target. It strengthens valuable competences of relevant stakeholders in identifying, preparing, financing and operating biomass/biogas CHP projects, thus tackling the energy sector transition to low-carbon pathway.”

Project Achievements:

- Biogas CHP projects developed and co-financed: 6 (construction works in course)
- Total installed capacity of biogas plants: 6.35 MW
- Total investments mobilized: 22.6 mil USD
- Total support from GEF: 1.6 mil USD
- Estimated CO2 reduction: 1,200,000 tonnes of CO2

TURKEY: IMPROVING ENERGY EFFICIENCY IN INDUSTRY

Project Overview:

Project Implementation Period:

October 2010 – August 2017

GEF Funding:

USD 6 Million

Co-financing:

USD 29 Million

Targeted energy saving:

16,340 toe (tonnes of oil equivalent) (annually)

Targeted CO2 emission reduction:

60,900 tonnes (annually)

What is the project about?

The Turkish economy, listed within the top 20 world economies, is constantly expanding. Even 2009 global economic crisis did not prevent its growth which was reported as 4.8 per cent.

In order to sustain growth within the economy, it is crucial to establish and develop an appropriate sustainable energy system which requires improving energy performance significantly by encouraging industrial enterprises to implement effective energy management systems, utilizing both energy efficiency management practices and enhanced uptake of energy efficient technologies.

Improving Energy Efficiency in Industry project, supported by The GEF and implemented jointly by the UNDP and UNIDO, has been running since 2010 and is scheduled to finish in August 2017. The project has been developed to support a wide range of measures to assist industrial enterprises to undertake effective energy management in their plants and operations. In that sense, it aims to measure and encourage the energy saving in the industrial firms by

utilizing efficient energy technologies and accommodation of an active management in terms of energy consumption. The project is designed to improve existing elements such as financial mechanisms and also to help Turkey achieve its 2023 energy intensity objectives.

What has been the key challenges?

This ambitious project has encountered some challenges which has enabled the 6-year project ever more enriching. The main challenges for the project were:

1. Lack of adequate data and insufficient policy framework
2. Lack of and/or limited internal and external financing
3. Limited knowledge and awareness of EE opportunities in industry (particularly in the top managements of industrial plants)
4. High transaction cost and insufficient capacity

What has been achieved?

The project has gained ground against these challenges and secured several achievements. For example, Energy Auditing Guide and a comprehensive Checklist design for audit activities were two crucial achievements of the project (see **Error! Reference source not found.**). Both tools contain fundamental questions on utilities such as boilers, pumps, compressed air systems, etc.



Figure 19 Measuring equipment training. Devices were delivered to organized industrial zones and their energy managers were trained for undertaking walk-through energy audits.

Under favor of these components energy service companies (ESCOs) were trained and both tools are disseminated to energy professionals.

Walk through and detailed energy audits were organized in nine selected industrial companies by relying on the developed methodology. Reports obtained from these audits were reviewed and conveyed to ESCOs after necessary feedback given in order to enhance auditing skills (see **Error! Reference source not found.**).

More than 400 people were trained in the scope of ISO 50001 and Energy Management System under User Level trainings. Participants were mainly from industrial plants, consultancy companies, certification firms, energy companies and utilities.

Expert Level training, which is the second phase of the program, was also implemented with a considerable success. For this stage 36 industrial firms were selected from different regions of Turkey. All participant firms were in touch via web based applications which made it likely to monitor company-based progress as well as to enhance local capacity by common file sharing. Through this program approximately 60 demo projects were created and a considerable amount of energy and CO2 was saved. The new round of the EnMS training program will be launched in October 2016.

New financial mechanisms were designed for Technology Development Foundation of Turkey (TTGV) and Small and Medium Industry Development Organization (KOSGEB), yet the application of new mechanisms is strongly subject to political circumstances. General Directorate of Renewable Energy's (YEGM) mechanisms were also reviewed and revised. An integrated mechanism covering different public and private entities was developed. The developed methodology was opened to discussion and accordingly a workshop on



“Financial Mechanisms for Energy Efficiency in Industry” was organized in November 2015 in Ankara.

Six Organized Industrial Zones (OIZS) were selected in order to establish Energy Management Units (EMU) serving their own regions. For this end a set of basic measuring equipment (infrared camera, infrared temperature meter, ultrasonic liquid meter, energy analyzer, multifunction

HVAC and indoor air quality meter, flue gas analyzer, ultrasonic leak detector, tachometer, and water conductivity meter) was delivered to 6 OIZS separately. With a three-day hands-on training for the OIZ members realized in Ankara, the first step for establishing EMUs was completed. Successive trainings on data

collection, financial evaluation, measurement and verification are also underway.

Figure 20 Scene from an audit activity. Energy audits were used as a tool to develop investment projects.

“We appreciate the efforts of the Project for developing capacity in organized industrial zones. Such a dedicated effort has firstly happened in industrial zones. We expect to see more progress and are ready to support this initiative.” Serkan Ata, Secretary General of OSBUK (High Board of all OIZS in Turkey)

Technical training package about pump, fan, compressed air and steam packages, whose total size is more than 3000 pages, were translated. Those packages are planned to be summarized and printed as reference books for energy professionals.

Nine short films on boiler, burner, compressor, fans, furnace, lighting, pumps, refrigeration and steam traps were produced in order to present how the units in YEGM Technical Training Centre operate.

A book called Energy Management Systems-Practical Guide prepared by UNIDO was translated into Turkish and printed. In early-2016 this book was sent to 2,500 energy managers who previously trained by the YEGM and currently work in industrial facilities.

In order to determine what should be done for transforming energy efficiency consultancy companies into real ESCOs, what are the main obstacles and prospective improvement steps, ESCO Gap Analysis study was initiated and completed. Totally 5 reports were delivered to YEGM.

In order to define the energy consumption characteristics of industry, the breakdown of energy consumption into industrial subsectors, and the possible improvements and opportunities, a baseline study was conducted. In this study, the energy consumption of Turkey manufacturing industry was forecasted by top-down and bottom-up approaches together for the first time in Turkey.

The studies for creating a new data collection, processing and reporting system for strengthening the capacity of the implementing agency (YEGM) has been initiated. The IT expert has completed the initial studies for software and hardware purchasing. The RFP is being negotiated with the implementing agency.

What have been learned?

1. A systematic methodology was identified in the project document so that all activities would somewhat be interrelated to each other. Although theoretically this seems very appropriate to conduct the scores of activities in parallel, any delay in one of the activities negatively influences the other. This may result in successive delays and accumulation of duties. It would be better to design the Project activities relatively independent from each other so that possible delays could be minimized.
2. The different angels of the project partners on specific issues such as energy audits and promoting energy management standards (ISO 50001) could end up with serious problems affecting the success of implementation. Sometimes even the common understanding of the same terminology could not be fulfilled. So, in the preparation process of the projects such challenges should be fixed.
3. The unrealistic project targets, which were set without taking the local circumstances into account, may cause disputes throughout the project implementation. Modest and more realistic targets based on good quantitative studies would be more beneficial.

Project Achievements:

- Achieved energy saving: 39,354 toe (annually)
- Achieved CO2 emission reduction: 182,475 tonne (annually)
- Demo projects developed directly by project activities:
 - Number of industrial companies: 30
 - Number of projects: 59
 - Amount of investment: 5,588,350 USD
- Number of people got trained:
 - User-level EnMS /energy management system) training: 233
 - Training of trainers: 55
 - Expert-level EnMS training: 103
 - Organized industrial zone equipment training: 44
 - ESCO audit methodology training: 27
 - EE Forum non-energy benefits training: 77

UKRAINE: SUPPORTING “ENERGY FARMING” AND WASTE AGRICULTURAL BIOMASS UTILIZATION FOR MUNICIPAL PURPOSES

Project Overview:

Project implementation period:

June 2014-March 2018

GEF funding:

USD 4,700,000

Co-financing:

USD 30,057,500

Targeted GHG reduction:

361,000 tonnes of CO₂ over 20-year period

What is the project about?

Covering more than a half of its energy demand through external supplies and having one of the world’s most energy intensive economies, Ukraine makes persistent efforts towards energy conservation, improving energy efficiency in the municipal sector and wider use of renewable energy.

While bioenergy (particularly agricultural biomass) is one of the most promising renewable energy sources in Ukraine, its productive use, notwithstanding the country’s reputation as the “breadbasket” of Eastern Europe having plenty of agricultural residues, remains very limited. By contrast, studies suggest that energy from biomass could provide at least six times more energy to Ukraine’s energy mix which would bring the share of biomass up to as much as 7 percent-9 percent

of the overall energy supply.

The UNDP GEF “Development and Commercialization of Bioenergy Technologies in the Municipal Sector in Ukraine” project aims to support a long term vision of the Ukrainian Government towards sustainable agricultural biomass utilization for municipal heat and hot water supply and create “a platform” for at least 7 percent replacement of fossil fuels by biomass resources in Ukraine’s municipal heat and hot water supply sector by 2030 (as envisaged by the Energy Strategy of Ukraine for the period until 2030).

The project seeks to achieve the following specific objectives:

- Help formulate and introduce a streamlined and comprehensive market-oriented policy and regulatory framework to promote municipal biomass for heat and hot water services in the country.
- Promote investments in municipal biomass through the establishment of a Financial Support Mechanism within financial institution(s).
- Facilitate private sector participation in utilizing agricultural biomass and production of energy crops to supply municipal heat and hot water services.



Figure 21 Ukrainian straw pellets before loading to the boilers

What has been the key challenges?

Although Ukraine is one of the six largest grain exporters of the world and a large producer and exporter of oilseeds, and sugar beets, and the total potential from forestry, energy crops and agricultural waste estimated at approximately 1000 petajoules, the Ukrainian biomass-to-energy market is underdeveloped and rather fragmented.

Key challenges to the use of agricultural biomass include:

- The “food versus fuel” argument despite the estimated availability of 4.7 million hectares of free land for energy crops.
- Uncertainty among Ukrainian farmers about biomass crops’ effects on soil fertility and potential environmental damage.
- Technology is generally imported that results in an increase of start-up costs.
- Absence of sustainable biomass supply chain.

What has been achieved?

To help create a sustainable business model based on few biomass sources and support energy crops cultivation on different soils aimed at optimizing productivity whilst avoiding negative impact on environment and biodiversity, the project has implemented two types of pilots:

- 1) Installation of straw-fired biomass boilers to provide heat and hot water services to municipal facilities;
- 2) Establishment of energy willow nurseries in three regions of Ukraine with different climate, soil and agronomic characteristics.

Over one thousand children from the small town of Uman’ in Cherkassy region of Ukraine stayed warm last fall and winter thanks to bioenergy after three straw-fired boilers were installed in the local kindergarten allowing to save over US\$ 30,000 on heating bills annually.



Figure 22 Farmer and energy willow: First year energy willow nursery monitoring



A concept was to arrange heat and hot water generation by using the renewable biomass resource. Straw is a natural, renewable, agricultural residue resource. In addition to the undoubted environmental benefit, using straw creates a local added value. The economic benefit applies to the whole supply chain which is especially interesting for areas with a weak economic structure.

The boilers run on locally-grown biomass from waste wheat straw pressed into pellets, which is rather unique for Ukraine and can potentially solve feedstock and logistics issues commonly associated with other types of biomass. Straw pellets are a good solution for further scaled replacement of fossil fuels at municipal facilities because “traditional” wood pellets are of limited availability and costly due to their export to the EU: Ukrainian forest industry is relatively small and bulk straw is difficult as well as not feasible to transport and store.

Both the straw pellets and boilers are produced by an Uman’-based company, assisting the struggling local economy and creating badly needed jobs for the town.

The money saved during the last heating season were used to install energy-efficient windows in the kindergarten and allowed buying advanced teaching equipment and better food for children, all thanks to the straw that used to be burn on the local fields.

The town officials are very enthusiastic about the pilot's results and plan to allocate future year savings for further energy-efficient initiatives, engaging more schools and kindergartens in the eco-virtuous circle.

The pilot has been replicated at the selected educational facilities in Zhytomyr and Kyiv cities of Ukraine. While visiting one of the project sites in Kyiv, the Minister of Education and Science of Ukraine Ms. Liliia Hrynevych has confirmed the commitment to switch more schools and kindergartens to biomass heating using locally generated biomass feedstocks: "There are some 17,000 general education schools in Ukraine financed from the state budget. Installation of biomass burning boilers will reduce considerably the public spending on heating, allowing for redirection of the saved funds for other education needs thus helping improve the quality of education for all".

In line with its objectives, the project helped formulate regional biomass programmes and identify opportunities for energy crops cultivation in the selected regions of Ukraine. In order to provide practical assistance to the local government and accelerate biomass cultivation and utilization in the pilot regions, it was decided to establish energy willow nurseries to make rootstock available for further dissemination and to showcase the viability and feasibility of energy crops cultivation.

In the Spring of 2016, the project has cooperated with the GEF Small Grants Programme to better cover local communities and NGOs in an attempt to prove the energy crops' viability as a heating fuel that would be cheap, easy-to-produce and eco-friendly.

With the help of local Ukrainian environmental NGOs, three pilots on dedicated energy crops cultivation have started in three regions of Ukraine where energy willow nurseries have been planted over 15 ha of privately-owned lands to support further utilization of energy willow for municipal biomass heat and hot water supply.

On three experimental pilots of 5 ha each over 310,000 Swedish energy willow seedlings have been planted on different soils in Zakarpattia (extreme west), Ivano-Frankivsk (west) and Poltava (center) regions of Ukraine. The productivity of 5 ha energy willow nurseries can be up to 3 million shoots. The idea is to establish and promote energy willow (and potentially other energy crops) cultivation on the local lands among local farmers and land-owners to further harvest the crop every few years, chop into chips, then sell and transport to local municipal facilities and burn in special biomass boilers to supply heat and hot water to schools, kindergartens and hospitals.

Energy willow is very fast-growing – the average rate of growth is 1,5 metres a year and they can be eventually higher than 8 metres – vastly higher than any crop seen in Ukraine. Felling can take place every 3-4 years, and once harvested, the willow does not need to be replanted — it grows right back continuously up to at least 25 years if kept well.

Energy willow has a relatively high thermal *energy* storage density of 1500 to 2000 kJ/kg. It is entirely renewable and, as already proved by the project, and farmers can grow it locally. One ha of the energy willow plantation can produce 50 tons of biomass annually, which makes it very attractive for farmers.

One farmer in the project pilot region (Ivano-Frankivsk) has already followed the lead and planted energy willow over some 21 ha of its own land with the purpose to have a good and cheap fuel for his farmstead, as well as establish a biomass-supply business. "I simply made cost estimates for this energy crop cultivation and also learned about its benefits as a fuel at the early planning stage of energy willow nursery arrangement in my region. Eventually I decided to invest into the energy efficiency of my farming business and planted my

own willow plantation” – says Bogdan Vlasiy, the 48-year-old owner of the farming business in Pomoniata village, Ivano-Frankivsk region of Ukraine.

Starting from the next year energy willow cultivation is possible at approximately 20,000 ha of free or “nonproductive” lands in each pilot region. The harvesting of biomass will help save the forest (as the estimated available woody biomass supply in the regions is less than for 7 years) and provide cheaper product for municipal heat and hot water services.

Project Achievements:

- 10 pilot projects on biomass boilers installation: 3 in Uman, 4 in Zhytomyr and 3 in Kyiv;
- 3 EE projects on energy willow nurseries establishment in Zakarpattia, Ivano-Frankivsk and Poltava oblasts
- 3 Regional Programs on Bioenergy technologies utilization developed in Poltava, Ivano-Frankivsk and Zakarpattia oblasts
- Over 10.000,00 children and students in Ukrainian educational establishments accessed to central heating and hot water
- 9 laws related to bioenergy technologies utilization revised by the project’s experts, 4 draft laws formulated and submitted for review to the Parliament.

CONCLUSION

Sustainable energy investments have become major UNDP-GEF project investments in climate change mitigation in the Eastern Europe region with a total of over US\$128 million which has mobilized a significant amount of additional co-financing. Without UNDP and GEF intervention in energy efficiency and renewable energy, many people in these countries would have paid more for energy bills and the cost of energy would be higher. Energy efficiency improvement and renewable energy development are both important tools to mitigate climate change, and help countries meet their commitments under the Paris Agreement.

Based on the eight case studies, this brochure concludes the following:

- (1) Clean energy investment is resource-intensive and requires a long-term focus. Improving energy efficiency for buildings remains the major area for future clean energy investments in the region because the potential for reducing energy consumption and greenhouse gas emissions is simply huge;
- (2) Clean energy governance is critical to ensure that strong policy/legal frameworks for countries are ready for investors to rely on, and that project implementation on ground is effective without delay. Time-based targets with clear accountabilities from government agencies will greatly help project implementation. It is very important to have strong systems of monitoring, reporting, and verification in place.
- (3) Development of efficient business models and financial mechanisms, such as credit lines, loan guarantees, energy service companies, utility programs, labeling schemes, are more important than technologies. In the process of developing these models and mechanisms, national government plays the most important role. It is necessary to use GEF grants to train government officers in developing policies that will catalyze these models and mechanisms.
- (4) Accessibility to finance clean energy projects is very important. Having assisted these countries in accessing affordable financing in clean energy, the GEF may continue de-risking clean energy financing and make the financing affordable to project investors in the countries to assist with scaling up.
- (5) Strong project design at the beginning and during the project preparatory phase is very important. Countries and GEF agencies need to make more efforts in the project beginning stage in order to avoid larger loss or significant delay of the project. It is very important, when designing a strong project, to have strong government buy-in as well as the strong commitment of local stakeholders and partners.
- (6) Adaptive management is also an important part of all UNDP and GEF projects. Often, over time, circumstances change and activities and outputs that made sense two years ago do not make sense today. Successful projects always undertake effective adaptive management. Activities and outputs can be changed with the agreement of the Project Board in order to better meet the overall objective of the project.

For technical issues, please contact:

Mr. John Obrien of the UNDP at john.obrien@undp.org;
Ms. Nazife Ece of the UNDP at nazife.ece@undp.org; and
Dr. Ming Yang of the GEF at myang@thegef.org

Contributions are gratefully acknowledged from: Ms. Andreea Ihos, Mr. Kubilay Kavak, Mr. Volodymyr Lyashchenko, Ms. Maja Matejic, Mr. Vakhtang Berishvili, Mr. Vitaly Bekker, Ms. Diana Harutyunyan, and Mr. Igar Tchoulba.

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**PART II - GOVERNMENT POLICIES TO
REMOVE BARRIERS TO IMPLEMENTING
ENERGY EFFICIENCY MEASURES**

INTRODUCTION

In addition to the UNDP/GEF project case studies that were presented in the first section of this brochure, UNECE has asked several countries in the region to provide descriptions of programmes that they have put in place to accelerate improvements in energy efficiency. The presentation of these programmes has been structured to parallel what was presented for the projects:

1. What is the project about?
2. What were the challenges?
3. What has been achieved?

UNECE has worked for a number of years with countries in the region to help overcome obstacles to investments in energy efficiency and renewable energy explicitly for climate change mitigation. Indeed, the international fora on Energy for Sustainable Development emerged from a GEF-funded project entitled Financing Energy Efficiency and Renewable Energy Investments for Climate Change Mitigation initiated in 2007, in which barriers to investment were identified and policies were pursued to overcome the barriers. It was followed by two joint projects with other United Nations Regional Commissions funded by the United Nations Development Account: Financing Energy Efficiency Investments for Climate Change Mitigation and Sustainable Development (2012-2015) and Financing Renewable Energy Efficiency for Climate Change Mitigation and Sustainable Development (2015-2017). UNECE's work in this area was designed to assist countries in improving the efficiency with which they use energy and to implement energy efficiency and renewable energy investment projects. In this regard, UNECE undertook activities related to:

- policy reforms;
- capacity building;
- systematic exchanges of experience; and
- development of self-financing projects to reduce greenhouse gas emissions.

The country case studies presented in this section for the former Yugoslav Republic of Macedonia, Serbia, and Ukraine, reinforce the lessons learned both in those projects and in the specific project descriptions found in the first section.

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA: “ENERGY MATHEMATICS”

Project Overview:

Implementation period:
July 2014 – June 2015
(first phase). Ongoing

Targets: Reduced energy intensity in the building sector.

What is the project about?

The “Energy Mathematics” campaign, which began in July 2014 and is ongoing, was designed to show customers how small changes in their daily habits and relatively minor investments can significantly reduce energy consumption. The campaign was conceived as a response to growing energy consumption in the country and more specifically the rising energy intensity of the housing sector. The government decided that the best way to reverse the adverse energy intensity trend was to launch a promotional campaign and to engage the general public in understanding how they use energy on a daily basis. This approach was chosen because it was considered to be optimal in terms of affordability, outreach, and impact.

The Energy Mathematics campaign is part of the Republic of Macedonia’s Platform for Energy Efficiency, a long-term cooperation among the privately-owned electricity distribution company EVN Macedonia, the Ministry of Economy, and the Energy Agency of the Republic of Macedonia. The platform has functioned since 2012.

The Platform for Energy Efficiency comprises a wide range of educational activities aimed at various categories of customers:

- A targeted television series of eight episodes explained in layman’s terms different ways of saving energy in households;
- Illustrative billboards have been erected in key locations;
- Explanatory informational materials have been included in consumers’ energy bills;
- Targeted activities for students, businesses and media provide educational tools for current and future professionals, thus further increasing the impact of the campaign.



Figure 23 Screenshot from the campaign: 1 kWh = 5 hours of Internet use

The Platform for Energy Efficiency was selected for an award at the national Corporate Social Responsibility (CSR) Awards for 2014 as the most socially responsible market relations project. The Platform was also

mentioned as a positive aspect of the country's progress in a 2014 report of the European Commission on Macedonia.

What were the challenges?

The Energy Mathematics campaign and the Platform for Energy Efficiency responded to specific behavioral issues and investment barriers to improving energy efficiency generally and specifically in buildings. The government undertook a detailed statistical analysis of the challenge of energy efficiency, and realized that the greatest impediments were lack of understanding by the general public and by professionals of the potential for improvements.



What has been achieved?

As a consequence of the Energy Mathematics campaign and the broader Platform for Energy Efficiency, estimated 1.6 million citizens and 18 thousand small businesses have been able to learn

about principles of energy efficiency at home and in everyday life. They also have been able to appreciate how energy auditors work in the field. In the first year (2014 - 2015) of the "Energy Mathematics" campaign, gross national electricity consumption per capita declined 2.3% (from 4,129 kWh per capita to 4,031 kWh per capita), and final electricity consumption in households per capita decreased by 1% (from 1,438 kWh per capita to 1,473 kWh per capita). In the same period overall energy intensity decreased by 6.3% (from 471.3 kgoe per EUR 1,000 of GDP to 441.5 kgoe per EUR 1,000 of GDP). Of that amount, 2.4% were directly attributed to the campaign "Energy Mathematics". Saved energy is estimated at 202.8 GWh. Estimated greenhouse gas emissions reduction is estimated at 393 kt CO₂. Energy Agency attributes 50% of these savings and reductions to the campaign. As this campaign is ongoing, the expectation is that similar trends in decreasing electricity consumption and energy intensity will be observed in the next 2 years.

Figure 24 Screenshot from the campaign: What you can get from 1 kWh

This year, the expert jury of the International Public Relations Association (IPRA) has awarded the most prestigious Golden Award to the "Energy Mathematics" campaign that EVN Macedonia, the Ministry of Economy and the Energy Agency of the Republic of Macedonia have been implementing as a part of the Platform for Energy Efficiency.

SERBIA: “BUDGET FUND FOR ENERGY EFFICIENCY”

Project Overview:

Implementation period:

February 2014 - April 2016

Overall funding: EUR

660.000

Co-financing

- Budget Fund for Energy Efficiency Improvement

What is the project about?

The Republic of Serbia established a Budgetary Fund for Energy Efficiency Improvement (BFEE) to finance energy efficiency measures. This fund was part of the government’s annual financing program for activities and measures to improve energy efficiency and was operational from February 2014 to April 2016.

Funding from the BFEE was implemented through public tenders issued by the Ministry of Mining and Energy. Additional funding for selected projects was available through municipal budgets.

What were the challenges?

The main challenge for implementation of the BFEE was the evaluation of applications submitted in response to the public tender, which set forth the required documentation and defined the assessment criteria. The rules governing the allocation of funds were modified in 2016 to clarify and accelerate the evaluation process. An additional challenge given the limited capacities of the Ministry was establishment of a system to monitor and assess selected projects.

What has been achieved?

In 2014, the first public tender was issued for financing energy efficiency projects in municipal buildings. Eleven projects were selected from over 50 that were submitted, and contracts were signed on 25 December 2014. The selected projects were implemented during 2015 and the first quarter of 2016. The overall level of investment was EUR 660,000, and as a consequence of the investments energy consumption declined by 2 GWh (40%) compared to the previous period.

The most successful funded projects were the following:

1. Energy efficiency in Kindergarten “Poletarac”

- replaced obsolete windows with new PVC windows;
- installed insulation on the roof and outer walls;
- replaced the existing oil boiler with a new pellet boiler;
- installed thermostatic valves on radiators.



Energy savings

Energy consumption before the project: 89,048 kWh

Energy consumption after the project: 28,050 kWh

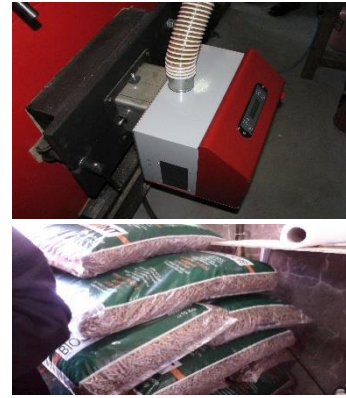
Energy savings 68.5%

Investments:

Total investment: RSD 6,099,773 (EUR 50,000)

Contribution of the Budgetary Fund: 65%

Implementation period: 2015



2. Reconstruction of thermal envelope/replacing windows on administrative building (Babušnica)

- replaced old windows with PVC windows;
- installed insulation on roof and outer walls;
- installed thermostatic valves on radiators.



Energy savings

| | |
|--|-------------|
| Energy consumption before the project: | 241,789 kWh |
| Energy consumption after the project: | 120,000 kWh |
| Energy savings | 50.37 % |

Investments:

| | |
|-------------------------------------|-----------------------------|
| Total investment: | RSD 12,178,920 (EUR 99,015) |
| Contribution of the Budgetary fund: | 100% |

Implementation period: 2015

UKRAINE: IMPROVING ENERGY EFFICIENCY

Project Overview:

Implementation period:
2014-2020

Targets: Improved energy efficiency

What is the project about?

The Government of Ukraine launched the State Programme on Energy Efficiency in 2016. The programme foresees loans to finance the costs for a variety of energy-efficient materials and equipment, such as insulation materials, energy-efficient windows, and energy meters for individual households and condominiums.

The programme is part of Ukraine's National Energy Efficiency Action Plan that is designed to run until 2020. The plan was developed in line with the EU Directive 2006/32 and Ukraine's obligations as a member of the Energy Community. The goal of the National Energy Efficiency Action Plan is to reduce final energy consumption by 9 percent. Around EUR 35 billion will be

required to meet the Action Plan's targets.

What were the challenges?

Energy independence is a matter of national security for Ukraine. One of the priority issues for ensuring energy independence for the Government of Ukraine is the reduction of natural gas consumption, including both through substitution of natural gas by renewable energy sources and through improvements in energy efficiency.

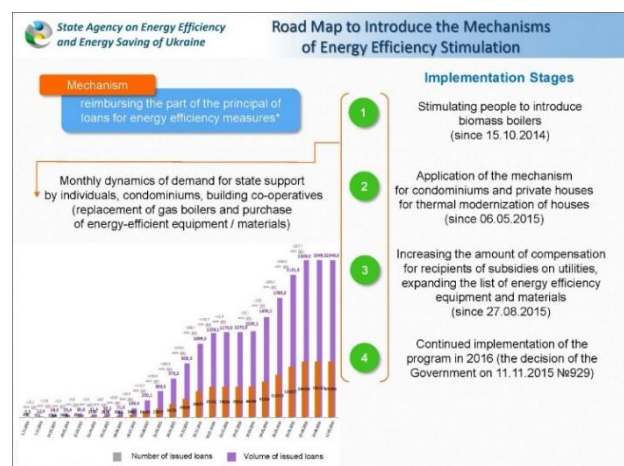
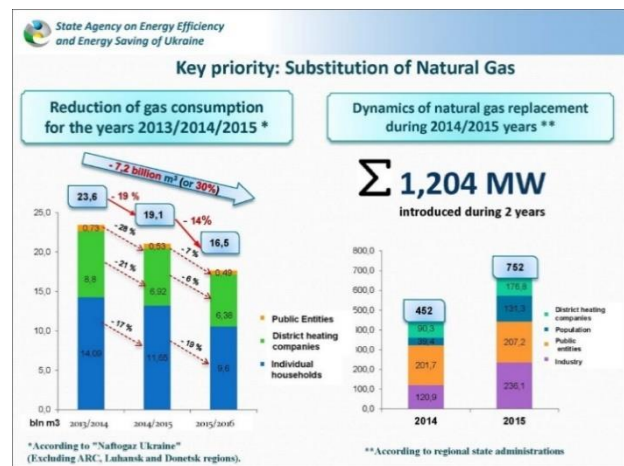
In order to receive reimbursement for energy-efficient materials or equipment a household or a condominium must apply to a designated bank with required documents (invoice for the purchased goods). The bank contacts the State Agency on Energy Efficiency and Energy Saving for approval, receives funds and transfers money to the borrower. Key challenges for the programme were raising awareness among consumers and building owners of the availability of the programme and the procedures for qualifying. In addition, the programme obliged the potential beneficiaries to invest in the measures before initiating the approval procedures, creating both uncertainty and risk for the households and owners.

What has been achieved?

The total amount of loans issued as of September 2016 is over **US\$ 80 million**.

As a result of the various measures and incentives implemented in the period from 2013 to 2016, **7.2 billion cubic meters of natural gas (or 30% of annual consumption)** were saved by individual consumers, heat production companies and public institutions.

In line with the renewable energy source development strategy, **1.2 GW of modern heat capacity was installed in the last two years**. About EUR 75 million were invested in these projects which are expected to substitute **416 million cubic meters of natural gas** per year.



CONCLUSION

In addition to the conclusions made in the first part of the brochure, the following lessons can be learned from the three country case studies:

- (1) There are several obstacles to improving energy efficiency both generally and specifically in buildings that relate to specific behavioral issues and investment barriers. These obstacles are related to customer awareness and engagement in the investment process. The greatest impediment is often a lack of understanding by the general public and by professionals of the potential for improvements.
- (2) As noted in the first section, access to financing for clean energy projects is very important.
- (3) A related challenge for improving energy efficiency is the lack of awareness among some consumers and building owners of the availability of support programmes and the procedures for qualifying.
- (4) In addition, programmes often oblige potential beneficiaries to invest in measures before initiating approval procedures, which creates both uncertainty and risk for households and building owners.
- (5) A final obstacle to programmatic efficiency is the capacity (or lack thereof) of administrations to evaluate project proposals and to monitor the performance of approved projects.
- (6) Clean energy governance is critical to ensure that strong policy and legal frameworks for countries are ready for investors to rely on, and that project implementation on the ground is effective without delay. Time-based targets with clear accountability from government agencies will greatly help project implementation.

For technical issues, please contact:

Mr. Oleg Dzioubinski of the UNECE at oleg.dzioubinski@unece.org

Mr. Scott Foster of the UNECE at Scott.foster@unece.org; and

Contributions are gratefully acknowledged from: Mr. Aleksandar Dukovski, Ms. Antonela Solujic, and Mr. Kostiantyn Gura,

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