

# EXPERIENCE IN EUROPE AND THE CIS REGION WITH CLEAN ENERGY: UNDP, GEF, AND UNECE



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**PART I. UNDP AND GEF CASE STUDIES  
FROM EUROPE AND THE 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 percent of total global greenhouse gas (GHG) emissions have now ratified the agreement. This bodes well for the urgent, accelerated implementation of climate action needed to realize a better, more secure world and to support the realization of the Sustainable Development Goals, which include helping countries significantly reduce GHG emissions. The ability of clean energy, including energy efficiency and renewable energy, to meet world energy demand and 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 GHG emissions. Many countries have identified improving energy efficiency and investing in renewable energy as the major measures to achieve their Nationally Determined Contributions (NDCs).

*Experience in Europe and the CIS Region with Clean Energy: UNDP, GEF, and UNECE*, shows that improving energy efficiency can play an important role in helping countries meet their commitments under the Paris Agreement. The first part of the brochure presents eight case studies of technical assistance projects by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) in energy efficiency in eight countries: Armenia, Belarus, Georgia, Romania, Russian Federation, Serbia, Turkey, and Ukraine. The second part presents United Nations Economic Commission for Europe (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, 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 countries’ average. This brochure describes the cost-effectiveness of public grant investments in energy efficiency in these countries, with the objective to deliver maximum benefit to the global environment commons. In the area of renewable energy, three case studies deal with support for developing biomass markets, in Georgia, Serbia, and Ukraine. These case studies illustrate the barriers and the opportunities in developing sustainable biomass markets.

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

The UNDP is one of the founding institutions of the GEF and remains a strong partner. The UNDP currently has a portfolio of over US\$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 questions:

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

The brochure notes that one of the main lessons learned from these projects is that putting in place the right legal and regulatory framework is critical to promoting 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 that create green jobs, build stronger economies, and help reduce GHG emissions.

## ARMENIA: IMPROVING ENERGY EFFICIENCY IN BUILDINGS

### Project Overview

**Project implementation period:**

July 2010–July 2016

**GEF funding:**

US\$1,045,000

**Cofinancing:**

US\$2,350,000

**Targeted GHG reduction:**

54 ktCO<sub>2</sub>eq

### What is the project about?

The UNDP-GEF Improving Energy Efficiency in Buildings project aimed to reverse existing trends and reduce consumption of electrical and thermal energy and associated GHG 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 a continental climate with extreme air temperatures in summers and winters. Almost 90 percent of buildings are in the residential sector, and the majority of the buildings were designed and constructed in the Soviet era without concern for energy efficiency. Making these energy inefficient buildings comply with the requirements of current building codes was a critical part of the sector's development agenda and provided the rationale for the project.

The project was implemented from July 2010 to July 2016 and was structured in 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. Demonstration of integrated building design via pilot projects in selected residential buildings

The project was cofinanced 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 with a wide range of state agencies, private companies, academic institutions, and other stakeholders.

### What were the challenges?

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

In particular, building standards were outdated, with no specific reference to energy performance and integrated building design. Building code enforcement capacity was low, with few energy audits implemented—and those 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. The market for energy efficient products was immature, with low motivation for the application of modern technologies and materials and inertia-driven practices in construction and maintenance. There was also low awareness among sector actors on incremental costs of energy performance and application options to lower 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 the following: (1) made multiple legislative and regulative improvements; (2) introduced modern energy efficient practices in testing and certification procedures for 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,” which introduces novel categorizing tools for industries and thus enables mandatory energy performance requirements for public construction, clarifies energy labeling issues, and outlines procedures for circulation and further utilization of hazardous substances; and (5) updated codes of “Thermal Protection of Buildings.” Because of that, RACN 2014–16 construction norms now include energy performance–related provisions that result in a sixth achievement: (6) harmonized EU Building Energy Performance Directive with its supporting six standards, which allows for approximating Armenian practices to those of the EU. Due to these achievements, Armenia’s “Methodology for Implementation of Energy Audit in Residential and Public Buildings” AST 371-2016 national standard was developed to provide a consistent holistic approach, including its online calculation tool, and is supported with GoA-adopted amendments to the energy audit procedure.

A first testing and certification laboratory was established in Armenia, equipped with modern devices and tools. The staff was trained 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 were granted a certificate or technical specification.

Testing the developed methodologies, the project performed 17 energy audits in residential buildings, including six based on instrument measuring, with building energy passports developed. The skills were invaluable during activities for thermal insulation and improvement of ventilation and lighting systems in social housing in Goris as an energy efficiency demonstration project.

Energy efficient solutions for building envelopes are promoted via summaries of the major recommendations in GoA-approved advisory handbook of technical solutions for thermal insulation of building envelopes and a catalog of designs of five replicable, typical energy efficient individual residential houses. The curricula of universities were enriched with a 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, building code and construction materials certification issues, construction and insulation material testing and certification, voluntary rating standards, and energy passports and energy efficiency labels for buildings. These efforts included a summer extension course on solar architecture organized jointly with American University of Armenia.

The project’s pilots proved successful, with energy performance exceeding 60 percent of efficiency. Photo I.1 shows the investment results of the GEF-UNDP project in Avan. The two pictures were taken of the same buildings from the same vantage, one with a conventional camera and another with an infrared camera that captures the image of heat released from the envelopes of the buildings. The building on the left side of the two pictures looks more attractive. More important, the average temperature of the building envelope on the left-side building is approximately 10°F lower than the right-side building. The flagship thermal retrofit of the operating nine-level residential building in Avan gave way to the De-Risking and Scaling-up Investment in Energy Efficient Building Retrofits project with a US\$20 million grant from the newly established Green Climate Fund and cofinancing by the European Investment Bank and Yerevan city municipality. It became the first project approved for the Eastern Europe region.

The most recent public opinion survey performed within the flagship pilot revealed that all the respondent residents perceived their comfort had improved in the heating season after thermal retrofit, with almost 80 percent 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 percent of the apartments heating bills did not exceed about US\$60.

**Photo I.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, the UNDP Armenia, other UN agencies, and GoA. More than 260 delegates from 38 countries participated. The adopted Yerevan Statement of Common Action is a roadmap stakeholders around the globe may use 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 cofinancing: US\$12.1 million
- Cumulative emission reductions from new residential buildings constructed during project lifetime: 64.2 ktCO<sub>2</sub>e<sub>q</sub>
- 180 sector professionals and 90 students of relevant specialties in 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 the De-Risking and Scaling-up Investment in Energy Efficient Building Retrofits project that was granted US\$20 million by the Green Climate Fund, with cofinancing from European Investment Bank and Yerevan municipality. This became the first project approved for the Eastern Europe region.



### Project Overview

**Project implementation****period:**

January 2013–June 2018

**GEF funding:**

US\$4,500,000

**Cofinancing:**

US\$13,700,000

**Targeted GHG reduction:**

220 ktCO<sub>2</sub>eq

### What is the project about?

The Improving Energy Efficiency in Residential Buildings in the Belarus project aims to reduce energy consumption and related GHG emissions through a significant increase of energy efficient performance in new housing compared to existing practice. Belarus, as a party to the Paris Agreement, established long-term goals for GHG emission reduction and is currently pursuing 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. The sector currently devours more than 21 percent of the country's total electricity consumption and about 45 percent of total final thermal energy consumption. In the past decade, residential buildings with a total living area of

approximately 50.7 million square meters were put into operation. There is no residential building with thermal energy consumption by any heating, ventilation, and air conditioning (HVAC) system lower than 30 kWh/m<sup>2</sup>, although in Europe a lower consumption level has already become common practice. Common current practice in Belarus for hot water supply is around 90 kWh/m<sup>2</sup>, and no houses have been built lower than 60 kWh/m<sup>2</sup>.

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

1. Strengthening the 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 the 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 cofinanced by the GEF, the UNDP, and the government of the Belarus. The implementing partner 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 nongovernmental organizations (NGOs).

### What were the challenges?

First, there was no integrated approach to 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. The average annual thermal energy-specific consumption was about 60 kWh/m<sup>2</sup> for space heating of typical multi-apartment buildings and 120–130 kWh/m<sup>2</sup> when combined with sanitary hot water preparation. There were no construction norms and standards establishing the minimal energy performance of buildings, no methodologies for energy performance monitoring and calculation, and thus no energy efficiency certification and compliance checking system in the housing sector.

Second, there was an acute need to raise capacity, knowledge, and experience of all 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 examples of cost-effective design solutions in construction practice that significantly increased the share of energy efficient multistory residential buildings. Several technologies have been used since 2010 to achieve the level of 30–40 kWh/m<sup>2</sup> per year for space heating: for example, considering the shape, layout, orientation, and so forth of a building; increasing the tightness and thermal insulation of envelope; and providing for individual control of heat consumption. The share of such buildings, however, is only about 1.3 percent of Belarus’s total leaving area. In addition, no houses have been built with an annual energy consumption by a hot water supply system lower than 60 kWh/m<sup>2</sup>, and the common current practice is around 90 kWh/m<sup>2</sup>. Therefore, the real challenge was to demonstrate, through the design, construction, operation, and monitoring of at least three buildings, that there are a number of affordable technologies and engineering systems available in the market that will help reduce the energy consumption of new residential buildings for space heating and hot water together to below 60 kWh/m<sup>2</sup>.

Fourth, 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 percent 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?**

### *Component 1*

The integrated approach to energy performance—monitoring and calculation became the basis for most of the amendments proposed and supported by the project to 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 an energy certification system, 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 December 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 2016–20 and is expected to be duly adopted in December 2016.

The methodology for energy audits of residential buildings drafted by the project is currently being verified via an energy audit campaign for 55 buildings and will be submitted for adoption late in 2016.

### *Component 2*

Owing to the project, there are already at least 9 local design companies exercising new design approaches, out of about 120 companies in the country. To reach the project target of 30 percent 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 nine, 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 frameworks, standards, and policies exercised in three leading European countries in the field of energy efficient buildings: Austria, Czech Republic, and Germany (photos I.2 and I.3). The project cooperates with one of the leading institutions in the field of advanced training and with three national universities.

**Photo I.2 Practical Training on Energy Audit**



**Photo I.3 Study Visit in Austria**



### *Component 3*

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

At the end of 2013, the project had hired NIPTIS, the most advanced design company in Belarus, to develop design and construction documentation for three large residential buildings to serve as pilot projects. In June 2015, NIPTIS finalized the design documentations, which were based on the best international practices and taking into account local operational capacity and baseline designs of the buildings. In October 2015, the project and the developer builders obtained all necessary permissions.

In addition to incorporating technologies used in energy efficient housing construction as of 2014, the following new technologies were introduced in the design of the three pilot buildings:

- Ventilation with recovery of up to 80 percent of exhaust air heat that provides annual savings of 0.030 Gcal/m<sup>2</sup>
- Heat recovery of household sewage and utilization of geothermal resources that provide annual savings of 0.04–0.05 Gcal/m<sup>2</sup>
- Use of a solar heating system that provides annual savings of 0.025–0.030 Gcal/m<sup>2</sup>
- Use of solar photovoltaic panels that provide annual savings of about 4 kWh/m<sup>2</sup>
- Remote control and accounting of energy consumption

These buildings have annual energy consumption lower than 25 kWh/m<sup>2</sup> for HVAC systems and lower than 40 kWh/m<sup>2</sup> for hot water supply systems. This is more than 60 percent lower than achieved in the best practice currently exercised in Belarus. No other residential building in Belarus has such performance yet. If all new buildings in Belarus achieve similar performance, it will provide at least a 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 Mahilou will be commissioned in November-December 2016. The building in Hrodna will be put into operation in April 2017.

Photos I.4 through I.7 illustrate the construction status of the buildings as of October 2016.

**Photo I.4 Pilot Building in Mahiliou**



**Photo I.5 Pilot Building in Hrodna**



**Photo I.6 Pilot Building in Minsk**



**Photo I.7 Outside the Pilot Building in Minsk**



#### *Component 4*

Five international conferences on best practices in energy efficiency improvements to residential buildings were organized and held by the project for more than 700 participants from eight countries. Other public outreach included 31 smaller conferences, roundtables, and seminars (photos I.8 and I.9); production of 22 brochures, handbooks, and manuals; publication of more than 70 articles and more than 170 technical reports; 3 press conferences; 3 exhibitions; and about 90 press releases and news briefs. The partnership network includes more than 25 media. The website achieved 190 hits and 1,700 downloads monthly.

**Photo I.8 International Conference on EE      Photo I.9 UNDP and GEF Officials Visit Minsk Pilot Building**



## Project Achievements

- Actually mobilized grant resources (GEF+UNDP): US\$4.5 million
- Actually mobilized cofinancing: US\$11.5 million
- Cumulative emission reductions from new residential buildings being constructed: 24.1 ktCO<sub>2</sub>eq
- Minimum energy performance standards included in the Technical Code On Energy Efficiency of Buildings; 6 building core standards, methodologies, and procedures approved
- Trained more than 100 specialists from about 30 companies and about 200 students of relevant specialties in universities.
- 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
  - Savings of up to five thousand tonnes of oil equivalent per building over its lifetime

## GEORGIA: PROMOTION OF BIOMASS PRODUCTION AND UTILIZATION IN GEORGIA

### Project Overview

**Project implementation****period:**

June 2013–October 2016

**GEF funding:**

US\$925,000

**Cofinancing:**

US\$1,255,000

**Targeted GHG reduction:**

7,000 tonnes of CO<sub>2</sub>

### 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 is to promote sustainable production and utilization of upgraded biomass fuels in Georgia by encouraging stakeholders to establish pilot production projects through grant investments as well as to start and develop biomass fuel utilization in the municipal sector.

Since its start, the project has undertaken 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.

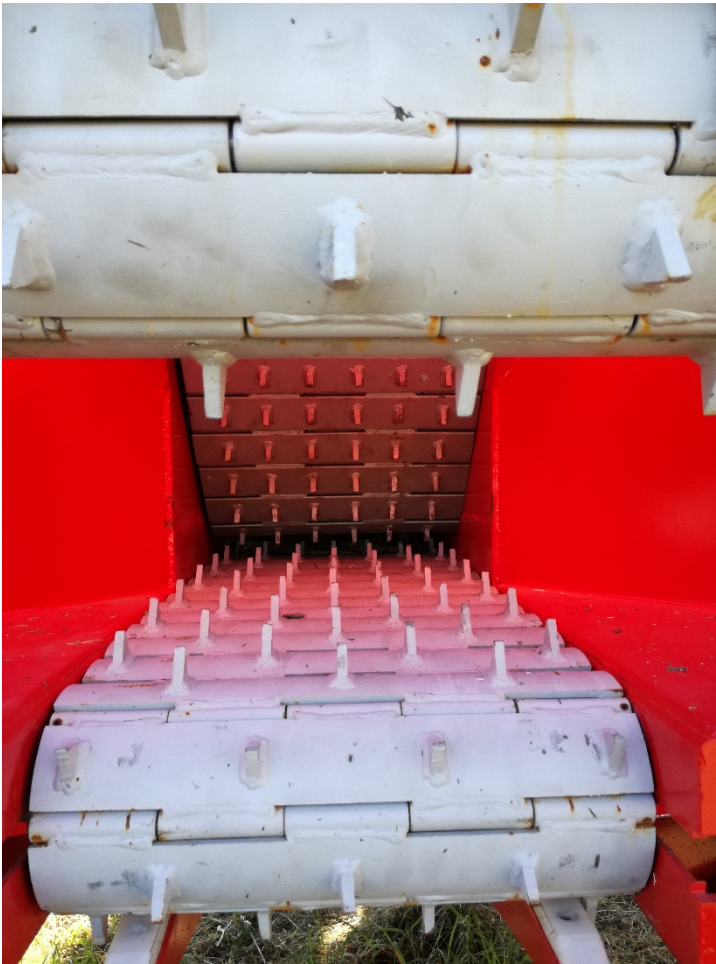
These included research on biomass raw material availability in Georgia, a feasibility study of production and utilization of biomass fuel in Tbilisi, a study of available funding sources and review of access to finance for start-up businesses in Georgia, and production of promotional and study materials.

### What were the challenges?

The original challenge faced by the government of Georgia was how to diversify its energy supply away from gas and move more toward 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 with which to create a 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 cofinancing of up to US\$3 million that it had indicated it hoped to provide to the project did not materialize. This issue created a great challenge for the project. It was decided to finance production in other Georgian regions, and the best three proposals were selected through a nationwide competition plan for biomass fuel production and utilization business.

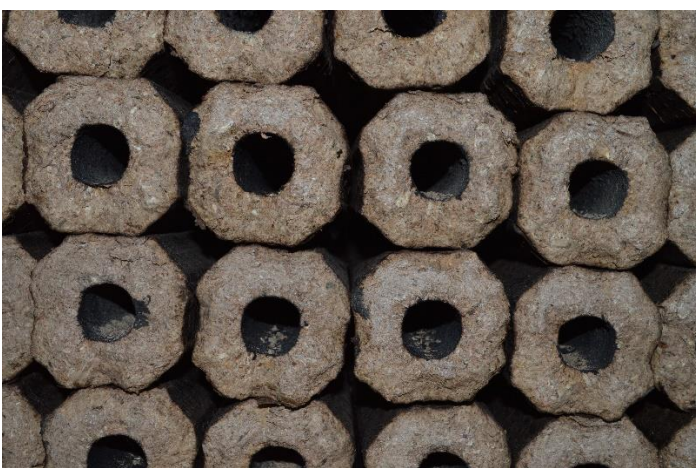
### What has been achieved?

During the business plan competition, 28 proposals are received. Winner organizations were identified during a two-stage selection process. Six of the 28 had been developed into full-scale business plans. Three business plans were identified and funded as winners of the competition. Other applicants continue to work with the project and try to develop biomass business. Winners are Greenergy Ltd., Nisoni Ltd., and the 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. The Fonichala project will supply Marneuli municipality. Akhmeta production will supply woody biomass briquettes to Akhmeta and Dedoplistskaro municipalities. Microcapital grants have been awarded to the NGOs Greens Movement of Georgia and the Energy Efficiency Center. The NGOs will purchase equipment, provide logistics support, help with issues related to biomass fuel, and conduct monitoring of implementation of business plans.



**Photo I.10 Wood (biomass) Chipper Loads Small Logs and Branches: Teeth of This Jaw Chip and Shred Biomass into Small Pieces for Further Production**

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 a first visit to



**Photo I.11 Stoked, Completed Biomass Briquettes**

Georgia. Several stakeholder meetings have already been conducted. Representatives of two ministries (environment and energy), partner or potential partner NGOs, municipalities, private companies, and winners of the business plan competition participated in these meetings, where project plans and achievements were discussed. Meetings will be held regularly three or four times a year. Some stakeholders

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 cofinancing leveraged from the three project partners means that slightly over US\$1 million will have been invested in Georgia biomass production in the past 12 months. Some portion of their products will be utilized by municipal buildings. Some part will be sold at market, hopefully increasing the 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. Photo I.10 shows the GEF-UNDP project wood chipper and photo I.11 shows 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 is to undertake to improve the project. One is to

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expressed a willingness to participate in initiative groups that will try to support the project in accomplishing some tasks, such as elaboration of a national biomass strategy and action plan and establishment of a biomass association.

All of this 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—until mid-2017. These activities include the following:

- Completion of the procurement process and finalizing of biomass production plants as well as procurement and installation of utilization 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 efforts to establish a bioenergy association
- Various public awareness activities related to popularization of biomass fuel in Georgia

## Project Achievements

- Actually mobilized US\$650,000 until now
- Development of a national biomass inventory
- Creation of 15 jobs
- Establishment of three pilot projects
- One hundred 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](http://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:

US\$3 million

#### Cofinancing:

US\$119.2 million

#### Targeted GHG reduction:

666,800 tonnes of CO<sub>2</sub> reduction

### What is the project about?

The UNDP-GEF Improving Energy Efficiency in Low-Income Households and Communities in Romania project aimed to dismantle barriers to implementing energy efficiency measures among poorer households and in poorer communities and alleviate fuel poverty. The project was designed in 2009–10 and implemented from January 2011 to June 2016. Project finance (US\$102.36 million) consisted of funds from the national government (\$99.23 million, the Ministry of Regional Development and Public Administration and the Ministry of Environment, Waters and Forests), NGOs (\$0.08 million), the UNDP (\$0.05 million), and a GEF grant of \$3 million. This project could not have been implemented without GEF and the UNDP support, especially for catalyzing the national efforts to address 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 were due to issues related to project design.

The project was designed to focus on utilization of Romanian-only, energy efficient building materials—despite the fact that a market for Romanian-only, energy efficient 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 for Romanian-only certified energy efficient building materials. Efforts to work with this Romanian certified energy efficient building material were unsuccessful (see Photo I.12)



Photo I.12 Vulcan Kindergarten before Thermal Rehabilitation

### What has been achieved?

*For removing legal, regulatory barriers to energy efficient building,* actions have been taken at both the national and local levels.

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), and
- made proposals for definition of the *fuel poverty* concept in Romania, submitted them to the government, and developed the proposal “Possible Methodology for Fuel Poverty Assessment in Romania,” so that vulnerable costumers might be helped to receive basic service ensuring thermal comfort.



The project will be further leveraged through existing or planned governmental interventions in the energy efficiency in buildings. In particular, if the fuel poverty–related legislation and regulations are adopted, they will represent a major success of the project.

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

“We are the first Metropolitan Area that has developed, together with the 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 seven years.”

—Cosmin Vasile, Executive Director of Craiova Metropolitan Area

To avoid duplication in the application process for government programs—and their associated costs to businesses—the project developed technical documentation for 50 types of apartment blocks. The municipalities can benefit freely from this work, and the documentation will be used for further works aimed



Photo I.13 Vulcan Kindergarten during Thermal Rehabilitation

to increase the energy efficiency of buildings.

Several demonstration projects of thermal rehabilitation of social building blocks were developed using grant financing. These projects supported the local public authority, which owns these buildings, and

demonstrated how an investment in energy efficiency measures, instead of social aid to the

low-income households, can produce multiple benefits, including improving the thermal comfort of the tenants, reducing heating costs, and improving the external aspect of the blocks (see Photo I.13).

*Measures addressing capacity and technical barriers* aim to increase the 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.

Through various efforts, including training, the project helped to build capacity and dismantle technical barriers. Two locally produced, sustainable EE insulation materials were identified and promoted: one, Mopatel, uses slaked lime as a raw material and the second, Izomiorita, uses woolen raw materials that can be produced locally from locally available, renewable, and affordable sources, using a local workforce in the poor communities. The project provided support for the accreditation process of both companies and obtained the necessary technical agreements for using the materials for public buildings.

*For increasing awareness*, a series of activities was successfully developed:

- Fifty information nodes covering 28 counties have been established. These distribute information and materials on how to implement EE measures in houses, on sources of funding, and on locally available materials.

- In order to encourage and reward the efforts of local authorities to apply energy efficiency measures and the use of renewable energy sources, a contest was organized. “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 was provision and installation of a sustainable heating system for an institution (school, nursery, home for the elderly, and the like) in their respective municipalities: Vulcan, Galicea Mare, and Brad municipalities.
- Participation in or organization of conferences, forums, and workshops at the national and international levels contributed to enhancing knowledge on energy efficiency and to disseminating the project’s experience and results.

*To make data and information available to decision makers, enabling them to design programs address fuel poverty, the project developed an energy management information system. The buildings registry is an important monitoring and decision-making tool that was found useful for purposes beyond its original one—such as informing or applying energy policies, EU directives compliance for public buildings, public energy management, flagging atypical variations of utility consumptions, and so forth. For the potential users of this instrument, 23 training sessions were delivered in Bucharest, Iasi, Cluj Napoca, Timisoara, Craiova, Pitesti, Constanta, and Brasov.*



**Photo I.14 The Project Received the E.ON Energy Globe Award**



Through its activities, the project has reduced heat energy consumption in buildings in Romania during its lifetime by an estimated 82,309 MWh/yr. Ninety-one percent of this amount is accredited to the legislative changes and the remainder to demonstration projects carried out. This amount is double 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 (Photo I.14).

### **What has been learned?**

#### *Policies*

The clarification of new “concepts” in Romania—fuel poverty and vulnerable costumers—was necessary and beneficial.

### *Demonstration projects*

Greater impact of the demonstration projects can be obtained if (1) these projects are sustained by other components (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 start to finish 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 US\$102.36 million
- Seventy-one EE pilot EE projects developed
- A total of 293,774 citizens benefited from EE buildings and had access to increased thermal comfort
- A total of 82,309 t CO<sub>2</sub>eq reduced per year an 1,646,180 t CO<sub>2</sub> reduced through the lifetime of investment
- A total of 826 people trained
- Two technology patents transferred
- Nine policies and regulations developed
- One energy management system developed
- Fifty types of technical documentation developed for building retrofitting
- Fifty information nodes established on EE

## RUSSIAN FEDERATION: BUILDING ENERGY EFFICIENCY IN THE NORTHWEST OF RUSSIA

### Project Overview

**Project implementation****period:**

2010–17

**GEF funding:**

US\$5,840,000

**Cofinancing:**

US\$27,500,000

**Targeted GHG reduction:**2,380 tonnes of CO<sub>2</sub> per year

### What is the project about?

The GEF-UNDP Building Energy Efficiency in the Northwest 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 the UNDP, European Bank for Reconstruction and Development, and the United Nations Industrial Development Organization (UNIDO). It involves key Russian federal sectoral agencies and regional authorities. Three regions in the Northwest Federal District—Pskov, Vologda, and Arkhangelsk—are involved in the project. The Russian Energy Agency, federal state budget institution of the Russian Ministry of Energy, acts as executing entity and implementing partner of the project.

In 2015 a delegation of the GEF and the UNDP participated in a study tour in order to replicate the best practices of a GEF-UNDP Croatia project on the establishment of a municipal energy management system, which has been successfully operated for several years. For the Russian Federation the creation of such a system is a new undertaking, although its relevance is obvious—the project’s 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, most important, to respond quickly to various contingencies and manage the process of consumption, meanwhile saving budget.

### What were the challenges?



Photo I.15 Day of Energy Saving for Elementary School in Pskov

The project was not able to initiate a demonstration of retrofitting of old buildings yet, as envisaged by the project document, due to internal bureaucratic issues and shortage of funds at regional administrations. However, the project has undertaken some adaptive management measures. In order to develop examples of EE investment projects in the 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 cofinancing sources, including energy service

company schemes. Four buildings were selected for retrofitting (one in Pskov, one in Vologda, and two in Arkhangelsk Oblasts) with the project’s involvement. The tenders on construction works were announced and the contracts were planned to be concluded in September 2016. It is likely that the demonstration retrofits will be finalized in early 2017.

### What has been achieved?

Russian and Croatian experts worked in partnership to implement software for the EMIS in the Russian Federation. Alexander Novak, the Russian minister of energy, supported the extension and localization of the EMIS in the Russian Federation within an international cooperation and exchange of experience in the field of energy saving. The Russian Energy Agency is entrusted to create a roadmap for the dissemination of EMIS in the Russian Federation.

The EMIS enables any institution or a building to analyze power consumption statistics depending on various parameters, such as the time of day, time of year, and weather conditions (see photo I.16). One can also bring into the system the objects of power generation and energy suppliers to conduct statistics of tariff changes and make right and timely management decisions. 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 documents, which will relieve and accelerate the search for information by energy managers or other responsible persons.

In July 2016, the project organized the first grant-funded training course for young international specialists from developing countries. The benefits of EMIS were presented during the event and in August an international delegation of experts on energy efficiency, energy savings, and environmental protection and representatives of authorities, experts, and project managers of the UNDP from Armenia, Kazakhstan, and Turkmenistan visited the Russian Federation and saw the effects of the project on the development of the municipal energy management system (Photo I.16).



Photo I.16 Automated Individual Heat-Regulating Unit



The project also established a continuing education system in the field of energy efficiency and energy savings, starting in primary school and continuing through training courses for pensioners (photo 1.15). 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) were developed. Festivals 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 was created.
- *Institutions of secondary and higher professional education:* An educational-methodical complex of the discipline “Fundamentals of Energy Saving and Energy Efficiency” was developed 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 interregional training center for professional training and retraining on energy efficiency. An interregional 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 launch the first Russian learning portal in the field of energy efficiency.

Within a joint implementation of this work, the project 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 a model building was specifically chosen by experts of the UNDP, taking into account climatic characteristics of the region, availability of construction materials and equipment, and restrictions on funding (not more than 20 percent of the cost of civil works). In new houses, facades, basements, and attic floors are additionally insulated; the windows are triple-paned with energy-saving coating and filled with argon; and all radiators are equipped with balancing valves and thermostats.

A modular individual heating unit was built near the model (its 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 avoid overheating and save heat energy. Other innovative solutions implemented during the construction of the building are supply and exhaust ventilators with heat exchangers installed in each residential unit that keeps heat inside—cold air which coming from outside is heated by air that is leaving. Illumination of public areas is done 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, was up to 57 percent on windows and up to 86 percent on the front facades.

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 265,000 rubles per year. There is also the important environmental aspect of the work: the implementation of energy-saving measures in Parfino will reduce harmful CO<sub>2</sub> emissions by almost 30 tons per year. Similar technical solutions were implemented on the new pilot construction in Porkhov.

## Project Achievements

- Actually Mobilized US\$5,000,000
- Two energy efficiency pilot projects on new construction completed
- Four Energy Efficiency retrofits projects developed for 2016–17
- Around 200 citizens resettled from barracks to energy efficient apartments
- A total of 76t CO<sub>2</sub>eq reduced on completed pilot sites
- Up to 1,000 people were trained on energy efficiency
- Seven national and regional level policy and regulations developed
- Two regions integrated energy management information system operation

## SERBIA: REDUCING BARRIERS TO ACCELERATE DEVELOPMENT OF BIOMASS MARKETS

### Project Overview:

**GEF funding:**

US\$2.845 million

**Cofinancing:**

US\$27.63 million

**Targeted installed capacity of new biomass or biogas plants:**

3 MW

**Targeted GHG reduction:**

1,247,480 tonnes of CO<sub>2</sub>

### 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 that could yield significant financial returns and thus be an impetus to much needed economic recovery and job creation.

Combined biomass from forestry, agriculture, and livestock residues provides viable options for cogeneration projects, delivering both electricity and heat, with a good geographic spread across Serbia, focusing on agriculture and livestock residues in 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 lead partner, and with the Ministry of Agriculture and Environmental Protection, the 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 the UNDP, the biomass project has a total budget of US\$30 million. Cofinancing is being provided by Serbian institutions and private investors.

The objective of the 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 were the challenges?

Centered in 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, municipalities, Regional Development Agency of Srem, and the Institute for Standardization, in order to tackle existing barriers (Photo I.17).



Photo I.17 Biogas CHP Plant in Bac: Aerial View of 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, and 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 difficult for project developers.



## What has been achieved?

The project will empower key stakeholders to ensure a vibrant and resilient biomass market in Serbia via the following:

- 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 such as trainings for municipalities, investors, and banks as well as capacity-building and planning activities at the national and local levels
- Developing biomass e-trading platform

The public call for awarding grants for construction of biomass/biogas CHP plants was successfully



**Photo I.18 Biogas CHP Plant in Alibunar: Trench Silos and Biomass Feeders**

implemented by BSU in cooperation with the 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 percent 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 had been signed by the minister of mining and energy. New projects will increase the total installed capacity of biomass/biogas CHP plants in Serbia by 130 percent (Photo I.18).

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.

“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 cofinanced: six (construction works in progress)
- Total installed capacity of biogas plants: 6.35 MW
- Total investments mobilized: US\$22.6 million
- Total support from GEF: US\$1.6 million
- Estimated CO<sub>2</sub> reduction: 1,200,000 tonnes of CO<sub>2</sub>

## TURKEY: IMPROVING ENERGY EFFICIENCY IN INDUSTRY

### Project Overview

**Project implementation period:**

October 2010–August 2017

**GEF funding:**

USD 6 Million

**Co-financing:**

US\$29 million

**Targeted energy savings:**

16,340 tonnes of oil equivalent (toe) annually

**Targeted CO<sub>2</sub> emission reduction:**

60,900 tonnes annually

### What is the project about?

The Turkish economy, listed among the world's top 20 economies, is constantly expanding. Even the 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.

The 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 was 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 savings 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 were the challenges?

This ambitious project has encountered some challenges, which has made the six-year project ever more enriching. The main challenges for the project were the following:

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

### What has been achieved?

The project has gained ground against these challenges and secured several achievements. For example, an energy auditing guide and a comprehensive checklist design for audit activities were crucial achievements of the project (see Photo I.19). Both tools contain fundamental questions and guidance on utilities such as boilers, pumps, compressed air systems, and so on. Energy service companies (ESCOs) were trained in their use,



**Photo I.19 Measuring Equipment Training**

*Note:* Devices were delivered to organized industrial zones and energy managers were trained for undertaking walk-through energy audits.

and both tools were disseminated to energy professionals.

Walk-through and detailed energy audits using the developed methodology were organized in nine selected industrial companies. Reports obtained from these audits were reviewed and conveyed to ESCOs after feedback was provided to enhance auditing skills (see Photo I.20).

More than 400 people were trained in the scope of ISO 50001 and energy management systems 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 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 possible to monitor company-based progress as well as to enhance local capacity by common file sharing. Through this program, approximately 60 demonstration projects were created and a considerable amount of energy and CO<sub>2</sub> was saved. The new round of the EnMS training program will be launched in October 2016.

New financial mechanisms were designed for the Technology Development Foundation of Turkey and the Small and Medium Industry Development Organization, 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.



Photo I.20 Scene from an Audit Activity

*Note:* Energy audits were used as a tool to develop investment projects.

Six Organized Industrial Zones (OIZs) were selected in which to establish energy management units (EMUs). 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 each of the six OIZs. With a three-day hands-on training for the OIZ members in Ankara, the first step for establishing EMUs was completed. Successive trainings on data collection, financial evaluation, measurement, and verification are also under way.

“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)

A technical training package about pump, fan, compressed air, and steam was translated. Those packages are planned to be summarized and printed as reference books for energy professionals. The total size of each exceeds 3,000 pages.

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 titled *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 had been previously trained by the YEGM and currently work in industrial facilities.

In order to determine what should be done to transform energy efficiency consultancy companies into real ESCOs—including the main obstacles and prospective improvement steps—an ESCO gap analysis study was initiated and completed. Five 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's 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 information technology expert has completed the initial studies for software and hardware purchasing. The request for proposals is being negotiated with the implementing agency.

### **What has been learned?**

First, a systematic methodology was identified in the project document so that all activities would be related to each other. Although theoretically it 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.

Second, the different angles 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 common understanding of a given terminology could not be achieved. Such challenges should be addressed in the preparation process of the projects.

Third, 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

## **Project Achievements**

- Achieved energy saving: 39,354 toe annually
- Achieved CO<sub>2</sub> emission reduction: 182,475 tonne annually
- Demonstration projects developed directly by project activities:
  - Number of industrial companies: 30
  - Number of projects: 59
  - Amount of investment: US\$5,588,350
- Number of people 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 nonenergy benefits training: 77

quantitative studies would be more beneficial.

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

### Project Overview

**Project implementation period:**

June 2014–March 2018

**GEF funding:**

US\$4,700,000

**Cofinancing:**

US\$30,057,500

**Targeted GHG reduction:**

361,000 tonnes of CO<sub>2</sub> 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 toward 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 and having plenty of agricultural residues, remains very limited. By contrast, studies suggest that energy from biomass could provide at least six times more energy than the current biomass use to Ukraine’s energy mix, which would bring

the share of biomass up to as much as 7 to 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 toward sustainable agricultural biomass utilization for municipal heat and hot water supply. It seeks to create a platform from which to achieve 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.



Photo I.21 Ukrainian Straw Pellets before Loading to the Boilers

### What were 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 energy from forestry, energy crops, and agricultural waste is estimated at approximately 1,000 petajoules, the Ukrainian biomass-to-energy market is underdeveloped and rather fragmented.

Key challenges to the use of agricultural biomass include the following:

- 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 that is generally imported, resulting 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 to support energy crop cultivation on different soils aimed at optimizing productivity while 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 1,000 thousand children from the small town of Uman’ in the Cherkassy region of Ukraine stayed warm last fall and winter thanks to bioenergy after three straw-fired boilers installed in the local kindergarten. The installation also allowed a savings of more than US\$30,000 on heating bills annually.

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 European Union. The Ukrainian forest industry is relatively small, and bulk straw is difficult as well as not feasible to transport and store—meaning its best use is local or national (Photo I.22).

Photo I.22 Farmer and Energy Willow: First-year Energy Willow Nursery Monitoring

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 past heating season was used to install energy-efficient windows in the kindergarten and allowed the purchase of 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 savings for further energy-efficient initiatives, engaging more schools and kindergartens in the eco-virtuous circle.

The pilot has been replicated at selected educational facilities in Zhytomyr and Kyiv cities of Ukraine. While visiting one of the project sites in Kyiv, Minister of Education and Science of Ukraine Liliya Hrynevych 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," she said. "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 programs and identify opportunities for energy crop 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 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 crop cultivation have started in three regions of Ukraine where energy willow nurseries have been planted over 15 hectares of privately owned lands to support further utilization of energy willow for municipal biomass heat and hot water supply.

Over 310,000 Swedish energy willow seedlings have been planted on different soils in five hectare pilots in the Zakarpattia (extreme west), Ivano-Frankivsk (west), and Poltava (center) regions of Ukraine. The productivity of five-hectare 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 landowners to further harvest the crop every few years, chop it into chips, then sell and transport it to local municipal facilities and burn it 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 meters a year and they can eventually grow higher than 8.0 meters, vastly higher than any other crop seen in Ukraine. Felling can take place every three to four years, and once harvested, the willow does not need to be replanted—it grows right back from the root, continuously, up to at least 25 years if kept well.

Energy willow has a relatively high thermal energy storage density of 1,500 to 2,000 kJ/kg. It is entirely renewable and, as already proved by the project, farmers can grow it locally. One hectare 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 of Ivano-Frankivsk has already planted energy willow over some 21 hectares of his own land with the purpose of having good and cheap fuel for his farmstead as well as establishing 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 in the energy efficiency of my farming business and planted my own willow plantation,” said Bogdan Vlasiy, the 48-year-old owner of the farming business in Pomoniata village.

## Project Achievements

- Ten pilot projects on biomass boilers installation: 3 in Uman, 4 in Zhytomyr, and 3 in Kyiv
- Three EE projects on energy willow nurseries establishment in Zakarpattia, Ivano-Frankivsk, and Poltava oblasts
- Three 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 given access to central heating and hot water
- Nine laws related to bioenergy technologies utilization revised by the project’s experts; 4 draft laws formulated and submitted for review to the parliament.

Starting in 2017, energy willow cultivation is possible at approximately 20,000 hectares 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 seven years) and provide cheaper product for municipal heat and hot water services.

## CONCLUSION

Sustainable energy investments have become major GEF-UNDP 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 cofinancing. 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 GHG emissions is huge.
2. 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 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, and 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 for 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 projects. 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.

## REFERENCE

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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 Part I of this brochure, the United Nations Economic Commission for Europe (UNECE) has asked several countries in the region to provide descriptions of programs that they have put in place to accelerate improvements in energy efficiency. The presentation of these programs 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 them overcome obstacles to investments in energy efficiency and renewable energy explicitly for climate change mitigation. Indeed, the international forums on energy for sustainable development emerged from a GEF-funded project titled Financing Energy Efficiency and Renewable Energy Investments for Climate Change Mitigation, initiated in 2007. In this effort, 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 (2012–15) and Financing Renewable Energy Efficiency for Climate Change Mitigation and Sustainable Development (2015–17). 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 the following:

- Policy reforms
- Capacity building
- Systematic exchanges of experience
- 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 Part I.

## 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 FYR 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 (Photo II.1).
- Targeted activities for students, businesses, and media provide educational tools for current and future professionals, thus further increasing the impact of the campaign.



Photo II.1 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 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 both 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, and estimated 1.6 million citizens and 18,000 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 (2014–15) of the Energy Mathematics campaign, gross national electricity consumption per capita declined 2.3 percent (from 4,129 kWh per capita to 4,031 kWh per capita), and final electricity consumption in households per capita decreased by 1 percent (from 1,438 kWh per capita to 1,473 kWh per capita). In the same period, overall energy intensity decreased by 6.3 percent, from 471.3 kgoe per €1,000 of gross domestic product (GDP) to 441.5 kgoe per €1,000 of GDP. Of that amount, 2.4 percent was directly attributed to the campaign. Saved energy is estimated at 202.8 GWh. Estimated greenhouse gas (GHG) emissions reduction is estimated at 393 kt CO<sub>2</sub>. The country's Energy Agency attributes 50 percent 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 two years (Photo II.2).

Photo II.2 Screenshot from the campaign: “What You Can Get from 1 kWh”

In 2016, the expert jury of the International Public Relations Association awarded the 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: €660,000

#### Cofinancing:

- Budget Fund for Energy Efficiency Improvement
- Municipalities

### 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 €660,000, and as a consequence of the investments energy, consumption declined by 2 GWh (40 percent) compared to the previous period.

The most successful funded projects were the following:

#### 1. Energy efficiency in Kindergarten “Poletarac”

- Replaced obsolete windows with new polyvinyl chloride (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



Photo II.3 Kindergarten “Poletarac” in Mali Zvornik (main entrance)

#### 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 SRD 6,099,773 (€50,000)

Contribution of the Budgetary Fund 65%

#### Implementation period

2015



Photo II.4 Kindergarten “Poletarac” in Mali Zvornik (clockwise from left: entrance hall, boiler room, pellet stock)

## 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



Photo II.5 Administrative building in Babušnica

### **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	SRD 12,178,920 (€9,015)
Contribution of the Budgetary Fund	100%

### **Implementation period**

2015



## UKRAINE: IMPROVING ENERGY EFFICIENCY

### Project Overview

**Implementation period:**

2014–20

**Targets:** Improved energy efficiency

### What is the project about?

The government of Ukraine launched the State Program on Energy Efficiency in 2016. The program 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 program 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 €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 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 program were raising awareness among consumers and building owners of the availability of the program and the procedures for qualifying. In addition, the program 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 percent 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 past two years. About €75 million were invested in these projects, which are expected to replace 416 million cubic meters of natural gas per year.

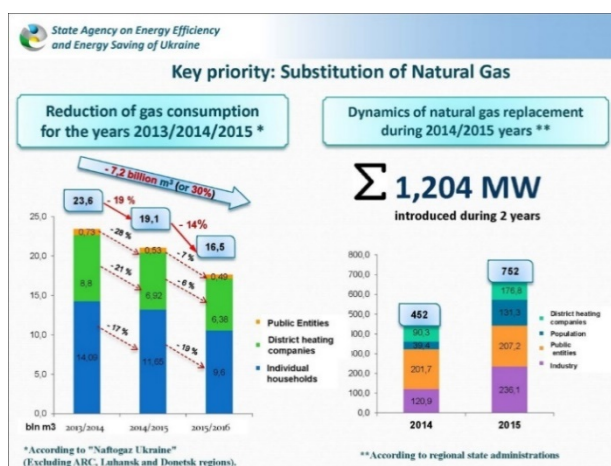


Photo II.6 Substitution of natural gas in the period 2013-2015

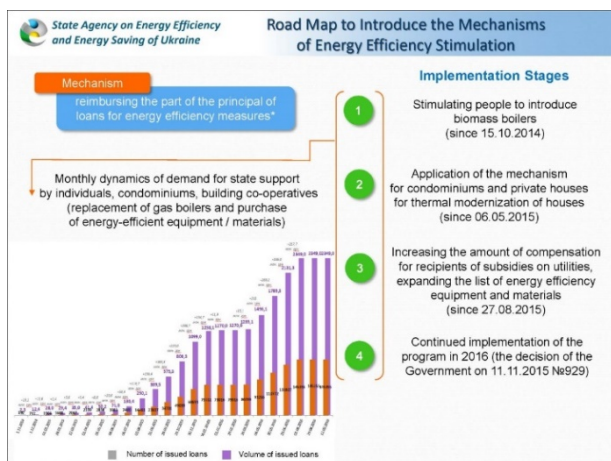


Photo II.7 State support for energy efficiency measures for housing sector in Ukraine

## CONCLUSION

In addition to the conclusions made in Part I 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 Part I, 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 programs and the procedures for qualifying.
4. In addition, programs 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.

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