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# LOCAL ALTERNATIVE ENERGY SOLUTIONS IN MYRHOROD (LAESM)

FINAL REPORT

JUNE 1, 2013 – NOVEMBER 30, 2015



## December 2015

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## **DISCLAIMER**

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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## ACRONYMS

AE	alternative energy
Gcal	giga calorie
GOU	Government of Ukraine
CE	clean energy
EE	energy efficiency
EIA	Environmental Impact Assessment
LAESM	USAID Project “Local Alternative Energy Solutions in Myrhorod”
MDI	All-Ukrainian Charitable Organization “Municipal Development Institute”
Minregion	Ministry of Regional Development, Construction, and Housing and Municipal Economy
MOU	Memorandum of Understanding and Cooperation
PPP	Public Private Partnership
PMEP	Project Monitoring and Evaluation Plan
RLC	Resource and Logistics Center for Bioenergy Development (Myrhorod)
SAEE	State Agency for Energy Efficiency and Energy Saving of Ukraine
SMEs	small and medium-sizes enterprises
USAID	U.S. Agency for International Development

## EXECUTIVE SUMMARY

This Final Report discusses the activities of the Project “Local Alternative Energy Solutions in Myrhorod” (LAESM) during the period from June 1, 2013 through November 30, 2015. The LAESM Project was designed to develop sustainable solutions for increased utilization of locally available alternative energy sources (biomass) in Myrhorod Rayon of Poltava Region in compliance with market and environmental requirements for increasing the quality of life of the local community, substituting imported natural gas with renewable energy, and reducing CO<sub>2</sub> emissions and energy bills. The Final Report serves as a tool for evaluating the Project’s progress and achievements and provides a summary of Project activities, accomplishments, issues, and problems encountered in implementing the activities set by the Project Work Plan. It also weights the accomplishments in the context of indicators set by the Project Monitoring and Evaluation Plan.

Ukraine is one of the most energy inefficient countries in the world, with practically all energy consumption satisfied by fossil fuels, most of which are imported. The skyrocketing energy prices coupled with the enormous energy waste and excessive reliance on the imported fossil fuels make Ukraine’s economy extremely vulnerable and limit its competitiveness. The key present day tasks for Ukraine are to improve its economy’s energy efficiency, reduce the share of the imported natural gas in its energy balance, diversify energy supply, and address growing environmental problems. While diversification of traditional energy sources is impeded by a large number of geopolitical and technical factors and requires capital-intensive long-term measures and solutions, locally available alternative energy resources can be utilized much faster and with lower investment costs. In addition to resolving energy related problems, the use of local biomass and bio-fuels will reduce CO<sub>2</sub> emissions in the country thus reducing its global carbon footprint.

In Ukraine, which is the world’s largest producer of sunflower oil and a major global producer of grain and sugar, agricultural waste represents the inexhaustible source of energy biomass. Abundant in Ukraine straw surplus is one of the potential biomass sources that can and shall be used for production of energy rather than allowing it to decay in stacks or burning it in the fields that is a common practice for the Ukrainian farmers. The number of bio-energy projects usually have been done as installation of bio-boilers for which the analysis of the local market conditions and a potential for replication at a larger scale was not conducted.

Myrhorod, a resort town well-known for its mineral water and health spas, can now also claim to be an alternative energy innovator in Ukraine. USAID support helped the town develop an entire infrastructure for harvesting, transporting and storing straw for use as biomass. Straw will now replace natural gas to generate heat and hot water for the entire city district, including 10 residential buildings, a school, and a kindergarten. For the reconstructed boiler house, the expected annual reduction of natural gas consumption is estimated at over 650 thousand m<sup>3</sup> and CO<sub>2</sub> emissions reduction – by 1350 tons. For Myrhorod Heating Company “Myrhorodteploenergo”, boiler house reconstruction will effect a saving of about UAH 1250 thousand during the heating season 2015-2016. In the future, when heat energy tariffs for population will become cost effective, the expected saving for Myrhorod Heating Company is estimated at around UAH 3.5 million a year. For the Myrhorod Rayon, boiler house reconstruction will effect a saving of around UAH 2 million, which instead of being spent for the imported natural gas, will remain in the rayon as income for agricultural producers, salaries, income for the Utility Company “Spetscomuntrans” from supplies of straw for the bio-boiler.

The LAESM Project reconstructed a straw storage facility to store up to 2000 tons of straw, created a bio-fuel supply chain, and developed and tested the system for equipment and machinery subcontracting for quick and efficient straw harvesting and transportation from the field to the storage facilities in Myrhorod. With assistance from the USAID LAESM Project, local agro-producers harvested 1764 tons of straw (5188 straw bales) from 410 hectares and delivered the straw bales to the temporary storage by five trucks, two telescopic loaders, one tractor with a frontlift loader, and one tractor with a baler (total 9 items of machinery).

With the aim to replicate the Myrhorod model, LAESM prepared feasibility studies, a business plan, and design and estimation documents for bioenergy projects for five municipalities of Poltava Region: Poltava, Myrhorod, Lubny, Velyka Bahachka, Karlivka.

The LAESM Project built the capacity of local authorities to implement bio-energy projects through on-the-job training in preparation of PPP documents for bio-energy projects and by means of organization of Round Tables and other public events to discuss CE/EE in the region.

The National Energy and Utilities Regulation Commission issued a license for heat energy production from biomass for the Myrhorod Heating Company “Myrhorodteploenergo”.

USAID LAESM established a Resource and Logistic Center in Myrhorod to ensure the uninterrupted supply of straw for the bio-boiler, disseminate best practices, promote the innovations initiated by the LAESM Project via public private partnerships (PPPs); provide recommendations and facilitate the use of bio-energy solutions and incentives in Poltava Region.

As a result of an extensive information campaign, in 2015, 56% of Myrhorod population (against 22% of supporters in 2014) have supported the substitution of natural gas with local biomass and understood the importance of this solution for Ukraine’s energy independence.

In the situation when the local partners and stakeholders doubted that the implementation of such bioenergy project in Myrhorod was possible from the technical standpoint, the LAESM Project successfully overcame barriers and dispelled doubts and fears. They were: the lack of straw in Myrhorod Rayon would jeopardize an uninterrupted operation of the bio-boiler; lack of equipment for an efficient burning of straw for production of heat energy and hot water; agro-producers might not want to sell straw, and even if they do, the Project would not be able to properly collect it from the field, bring it to the storage facility and preserve it from decay and moisture.

A complicated political and economic situation in Ukraine and personnel shifts in Poltava Oblast State Administration, the beneficiary of LAESM, resulted in the delayed decisions regarding co-financing and delayed start of the reconstruction activities at the boiler house. Nevertheless, with the support from the local partners, all relevant reconstruction works were completed on time.

For the first time in Ukraine, the reconstruction activities were part of a comprehensive approach that included establishment of the logistics infrastructure for bio-fuel harvesting, transportation and storage, and creation of the conditions for bioenergy development in the Region through multiplication of best practices. It is estimated that the PPP arrangements proposed by the USAID LAESM Project will allow to substitute 6 176 000 m<sup>3</sup> of natural gas, reduce CO<sub>2</sub> emissions by 12.5 thousand tons a year, and attract UAH 75.6 million (equivalent of \$3 566 million) as investments into bioenergy projects.

# 1. ABOUT THE LAESM PROJECT

The USAID Local Alternative Energy Solutions in Myrhorod (LAESM) was a two-year international technical assistance project, funded by the United States Agency for International Development (USAID) and implemented by the All-Ukrainian Charitable Organization “Municipal Development Institute” (MDI) under the Cooperative Agreement #AID-121-A-13-00002. LAESM was launched on June 1, 2013, to develop sustainable solutions for increased utilization of locally available alternative energy sources (biomass) in Myrhorod Rayon of Poltava Region in compliance with market and environmental requirements.

The LAESM Project promoted the sustainable use of renewable energy technologies combined with energy efficient end-use technologies. It developed the capacity of local communities, governments and businesses to develop public-private partnerships (PPPs) to use locally available renewable and alternative energy sources to replace fossil fuels used for heating and hot water supply and other energy-related needs. LAESM worked to mobilize potential players in the market for use of biomass in energy production; establish the infrastructure for biomass by small and medium-sized enterprises (SMEs); prepare and implement the bio-fuel project on heat energy production from the local biomass; prepare the PPP framework for investors in the bio-energy production in the region; prepare conditions for introduction of a network of bio-fuel burning plants in the region and a large scale knowledge of best practices of use of local biomass for energy production; and increase awareness of stakeholders and provide them with access to knowledge on best practices on the use of biomass for energy production.

The LAESM Project followed five implementation steps:

**Preparation of legal and regulatory basis for implementation of bio-energy renewable projects in the Myrhorod Rayon of Poltava Region.** LAESM prepared recommendations on the necessary changes in legislation and regulations governing heat energy production of renewable and alternative sources of energy at the national level. At the regional level, the Project provided assistance to the Myrhorod Heating Company “Myrhorodteploenergo” to obtain a license for heat energy production from biomass.

**Development of the infrastructure for collection, treatment and storage of biomass in the region.** For the first time in Ukraine a complete infrastructure for straw collection, treatment, transportation from the field to the storage facility and proper storage was established.

**Preparation of the engineering solution and implementation of a pilot project on bio-fuel energy production in Myrhorod.** The LAESM Project prepared and implemented the bio-energy project in Myrhorod with support from the local authorities of Myrhorod City and Poltava Region. The gas boiler house was reconstructed and a multi-fuel bio-boiler installed. The uninterrupted supply of straw for the bio-boiler was organized by means of creating two storage facilities. The operating storage was attached to the boiler house building. The central storage facility (including two annexes attached to the existing storage building) located on the territory of the logistics enterprise, the Municipal Utility Company “Spetscomuntrans”, was reconstructed to store 2000 tons of straw bales.

**Establishment of market conditions for bio-fuel production by private sector participants under PPP arrangements in the region.** LAESM provided assistance to Karlivka Rayon State Administration to prepare the documents for the bioenergy PPPs.

**Preparation of a Business Plan and design documentation for bio-fuel investment project: network of bio-fuel burning plants in the Myrhorod Rayon.** LAESM identified municipalities (Poltava, Myrhorod, Lubny, Karlivka, Velyka Bahachka) for further work regarding establishment of a network of bio-fuel burning plants in Poltava Region and provided assistance to them regarding identification and development of proposals on reconstruction of the existing gas boiler houses and installation of bio-boilers. LAESM provided assistance to the local authorities of these cities to prepare feasibility studies, a Business Plan, and design and estimation documentation for bio-energy projects.

**Carrying out an education and information campaign on introduction of local bio-fuel solutions and multiplication of best practices.** The LAESM Project carried out a comprehensive information campaign to increase awareness of public of renewable and alternative sources of energy and educate the locals on the advantages of energy independence of Ukraine.

## 2. ACCOMPLISHMENTS AND PERFORMANCE INDICATORS

### 2.1 ACCOMPLISHMENTS

As a result of the analysis of legislation, taxation policy, and regulations governing the use of the alternative energy sources, the LAESM Project suggested a number of changes in the regulatory environment. USAID LAESM provided the entities which intend to produce heat and electric energy from biomass with the use of the “Green” tariff” with an action algorithm. At the local level, the Myrhorod Heating Company “Myrhorodteploenergo” received assistance in preparation of the necessary documents and tariff calculations for obtaining a license on heat energy production from unconventional and renewable energy sources. In October 2015, the National Regulator issued the license.

An infrastructure for straw harvesting, transportation, and storage for substituting natural gas with local biomass in the municipal district heating system was established in Myrhorod. This also included development and testing of the system for equipment and machinery leasing for straw transportation from the field to the central storage facility. The capacity of the central storage, 1980 m<sup>2</sup>, allows keeping the annual stock of straw of up to 2000 tons. The amount of 1764 tons of straw was harvested and 5188 straw bales were produced to ensure an uninterrupted operation of the bio-boiler during the 15-months period.

A gas boiler house was reconstructed; five obsolete gas-fired boilers were replaced with three energy efficient gas-fired boilers with modern gas burners; a multi-fuel bio-boiler (straw; wood chips; pellets) was installed; and an operating bio-fuel storage annex was constructed. The boiler house produces heat energy from biomass for one of Myrhorod micro-rayons, which includes 10 residential buildings (1275 residents), a school (253 students and 45 employees) and a kindergarten (100 children and 24 employees).

In the preparation for establishment of a bio-fuel burning plants network in Poltava Region, USAID LAESM identified and analyzed potential locations for the bio-boiler projects from the perspective of their compliance with relevant technical requirements. As a result, LAESM selected five municipalities (Myrhorod, Lubny, Velyka Bahachka, Karlivka, and Poltava) for further establishment of a bio-fuel burning plants network. With the limited local financial resources, there are two potential sources of financing of the bio-energy projects: private investments and money allocated under the regional target programs. As the next step, USAID LAESM assessed attraction of the private sector participants to the bio-fuel projects under PPP arrangement and identified concession as the best PPP model. USAID LAESM provided assistance to the above-mentioned five cities of Poltava Region to prepare proposals for potential investors for initiation and implementation of bioenergy projects, including the bio-fuel PPPs, in the region with the estimated investment under the PPPs reaching UAH 75 785 070.

In 2015, LAESM signed Memoranda of Understanding and Cooperation regarding implementation of bioenergy projects with Myrhorod City Council and Karlivka Rayon State Administration. Other municipalities, which did not sign such a memorandum, received assistance from USAID LAESM regarding preparation of the feasibility studies and design and estimation documents and can now apply for financing under the special regional programs. The availability of the design and estimation documentation for a bioenergy project (that is part of the feasibility study) is a requirement for applying for financing under such programs.

As a result of the LAESM Project Information Campaign in 2015, in Myrhorod, public support to renewable and alternative energy sources increased by 34 % (from 22% in 2014 to 56% in 2015).

### 2.2 PROJECT PERFORMANCE MONITORING AND EVALUATION

The Project Performance Monitoring and Evaluation Plan (PMEP) is based on the program objective and expected results that were described in the LAESM Technical Approach section and in LAESM Project LogFrame. The PMEP served as a critical management tool in the implementation of the LAESM Project. The Project LogFrame identified the links between the overall project objective, intermediate results and output of project activities. The overall project objective was to reduce CO<sub>2</sub> emissions through increasing the effectiveness of the energy sector in Poltava Region. LAESM analyzed, reviewed, and reported program

results on a regular basis. This regular reporting included a summary of activities implemented to control, verify, and validate the reported data, any anomalies discovered, and corrective measures taken to resolve them. This also included monitoring information that might not be encompassed fully by the indicators identified in the attached tables.

## 2.3. PERFORMANCE INDICATORS AND THE PROJECT'S IMPACT

The Performance Monitoring and Evaluation Plan (PMEP) (sent separately with the Final Report) presents a detailed description of key performance indicators used to track progress toward the goal of the project. Table 2: PMEP Data Table - LAESM of the PMEP presents indicators' data for each year of the project implementation.

- 1) The Indicator *“Number of people with increased access and use of modern energy services as a result of USG assistance”* (number of people with new or improved service connections and use of modern fuels (from biomass alternative sources of energy) was achieved for 2015 (1518 local residents against the planned 1500 local residents of Myrhorod micro-rayon were provided with heat energy and hot water produced from the alternative energy source – biomass as a result of the boiler house reconstruction).
- 2) The Indicator *“Greenhouse gas (GHG) emissions, estimated in metric tons, reduced, sequestered, and/or avoided as a result of USG assistance”* (tons of CO<sub>2</sub> equivalent reduction resulting from substitution of fossil fired boiler by biomass installation) was achieved in 2015 (1360 tons of CO<sub>2</sub> equivalent). Since the boiler house reconstruction was completed and the bio-boiler was put into operation in October 2015 (one month before the end of the LAESM Project), the planned total CO<sub>2</sub> reduction (2,200 tons of CO<sub>2</sub> equivalent) will be reached in full by 2017. In addition, LAESM anticipates that the implementation of bio-boiler projects in five municipalities of Poltava Region, for which LAESM prepared the feasibility studies, will result in CO<sub>2</sub> reduction at 12.5 thousand tons a year.
- 3) The Indicator *“Number of institutions with improved capacity to address climate change issues as a result of USG assistance”* (number of rural enterprises, rayon and oblast institutions, involved in development of bio-fuel projects with assistance of USG) was exceeded in 2015 (17 institutions against the planned 10). The 17 institutions include: Poltava Oblast State Administration; Myrhorod City Council, Poltava City Council, Velyka Bahachka City Council, Karlivka City Council and Karlivka Rayon State Administration, Lubny City Council; heating companies: Poltava Heating Company *“Poltavateploenergo”* and Lubny Heating Company *“Lubnyteploenergo”*, ; five agroproducers of Myrhorod Rayon who signed MOUs with the LAESM Project; Public Utility Company *“Spetscomuntrans”*; Resource and Logistics Center for Bioenergy Development (established by the USAID LAESM Project).
- 4) The Indicator *“Policy reforms/laws/regulations/administrative procedures drafted and presented for public/stakeholder consultations to enhance sector governance and/or facilitate private sector participation and competitive markets as a result of USG assistance”* (number of regulations and administrative developed to enhance municipal sector governance and/or facilitate private sector participation and competitive markets as a result of USG assistance) was achieved. LAESM prepared five drafts of laws as was set forth by PMEP. LAESM discussed the drafts of laws with stakeholders at the public events.

Three drafts of laws were prepared in the framework of the working group with the State Agency for Energy Efficiency and Energy Saving of Ukraine (SAEE). The SAEE working group was established to develop drafts of laws and regulations to reduce natural gas consumption (as stipulated by the GOU Decree 1014-p *“On approval of the short- and medium-term actions to reduce natural gas consumption till 2017”* dated October 16, 2014). Three drafts of laws include:

- a) draft law *“On amendments to the Laws of Ukraine “On Heating” and “On Natural Monopolies”* (regarding incentives to use EE technologies/implement EE projects, more extensive use of alternative fuels, and incentive based regulation);
- b) draft law *“On amendments to certain legislative acts of Ukraine to reduce the number of permits required for activities aiming at substitution of natural gas with other fuels”*;

- c) draft law “On Concession” (including amendments on the concession agreements for the municipal facilities).

In the framework of improving the legislation on heat energy generation from alternative energy sources, LAESM contributed to the preparation of other two drafts of legislation:

- d) draft of law “On changes to the Law of Ukraine “On heat supply”;
- e) draft of the GOU decree “On changes to the GOU Decree 869 dated June 1, 2011”.
- 5) The Indicator “*Local infrastructure established to support biomass clean energy projects as a result of USG assistance*” (measures biomass infrastructure preparation and establishment to support implementation of clean energy production projects) was achieved in 2015. LAESM established local infrastructure by means of creation of the central biomass storage facility, signing long-term agreements with local agriculture producers of the Myrhorod Rayon of Poltava Region on biomass supply, establishment of the Resource and Logistics Center for Bioenergy Development.
- 6) The Indicator “*Public acceptance of clean energy production as a result of USG assistance*” (20% increase in the percentage of people surveyed who expressed support of a shift to clean energy production) was exceeded in 2015 (34% against the planned 20%). In 2014, the number of people who expressed support of a shift to clean energy production was 22% (data confirmed by a focus group and a TV Forum conducted in 2014). In 2015, USAID LAESM surveyed the total of 1551 locals (men: 49%, women: 51%) by means of conducting two surveys. LAESM conducted the first survey in August 2015 and surveyed 766 respondents. LAESM conducted the final survey in November 2015 and surveyed 785 respondents. The findings of the final survey showed that 56% of the Myrhorod population expressed support of clean energy production (against 44% of supporters in the first survey). Total of 1551 locals were surveyed (men: 49%, women: 51%).
- 7) The Indicator “*Person hours of training completed in climate change supported by USG assistance*” (measures the number of person hours of training on use of local biomass to substitute imported gas and decrease CO<sub>2</sub> emissions) was exceeded. LAESM completed 3094 person hours of training against the planned 1200 person hours. This included: 1188 person hours of training in the operation of bio-fuel boilers delivered for the boiler house personnel (three persons) by a specialized training institution (including three days of in-house training in operation of the bio-boiler); 1882 person hours of training for various target audiences; 24 hours of the on-the-job training for the staff of the Resource and Logistics Center for Bioenergy Development. By the time when PMP was prepared (beginning of the LAESM Project) it was anticipated that the bio-energy solutions proposed by the LAESM Project would be multiplied in the bigger number of cities of Poltava Region and that trainings in technical, financial and economic literacy of bio-energy projects would be delivered in each of the cities. Some of the trainings were delivered at the premises of Poltava Oblast State Administration for which Poltava Oblast State Administration mobilized the representatives of all cities of Poltava Region.
- 8) The Indicator “*Number of events undertaken to promote clean energy (renewables) reforms and institutionalize a public participation process*” (number of events: public opinion surveys and focus groups, conferences, Round Tables, high-level discussions, public hearings, public city councils, public information campaigns) was exceeded in 2015 (16 events against the planned 10). USAID LAESM held presentation events on the feasibility studies for bio-energy projects in five municipalities of Poltava Region, including presentation of a Business Plan for Myrhorod; a media briefing and a media workshop; Round Table discussions; two TV Forums; a public hearing; ribbon-cutting ceremonies to launch the Resource and Logistics Center for Bioenergy Development and reconstructed boiler house and central storage facility; presentation of the LAESM Project documentary “Source of Energy that would Change Ukraine to the Better”.
- 9) The Indicator “*Amount of investment leveraged in US dollars, from public and private sources for climate change as a result of USG assistance*” (measuring the amount of dollars that were mobilized from the public, donors, and private sectors) was not achieved. USAID LAESM leveraged \$385,213.45 of investment instead of the planned \$2.5 million. The economic and financial crisis in Ukraine, problems with the imported natural gas, and the delayed (six months) start of the pilot bio-boiler project resulted in the situation when the products developed under LAESM Tasks 4 and 5 (bioenergy PPPs, design and estimation documentation, Business Plan) couldn’t be financed during the remaining project period (till November 30, 2016). It is expected that the feasibility studies for

the bioenergy projects and a Business Plan for Myrhorod which were developed by LAESM will be realized in 2016-2017 with financing from the regional development fund and other sources.

- 10) The Indicator “Number of proposals, business plans and feasibility studies for financing Clean Energy municipal infrastructure projects” (measures the number of proposals and/or loan applications for financing to make heating infrastructure and investments in clean energy (renewables)) was exceeded. LAESM prepared three feasibility studies, one bioenergy PPP arrangement, and a Business Plan for Myrhorod that makes the total of five prepared documents against two planned in PMEP.
- 11) The *Environment Compliance Indicator* (inclusion of environmental compliance issues within project documents, regulations, plans, and activities) was achieved. LAESM assessed environmental risks, developed Environmental Monitoring Plans, incorporated risk mitigation measures in the project activities, documents, plans and regulations.

Overall, the project accomplished planned tasks. Despite political and economic situation in Ukraine during the project implementation, USAID LAESM succeeded in completing the reconstruction of the boiler house and central storage facility and putting a bio-boiler into operation in Myrhorod of Poltava Region.

## 3. PROJECT'S ACCOMPLISHMENTS

### 3.1 INCEPTION PHASE ACTIVITIES



Kick off meeting of the LAESM Project, Myrhorod City Council, September 2013

During the period of June - July 2013, the team of 24 experts was mobilized and remained more or less within this number of consultants throughout the project lifespan. Three project experts worked in the project office in Poltava that was set up in the fall of 2013.

The start of LAESM was delayed because of the protracted project registration process with the Ministry of Economic Development and Trade of Ukraine. The Project registration card was issued by the Ministry on September 4, 2013. The LAESM Project Opening Event was held in Myrhorod on September 13, 2013.

Following the Opening Event, in September 2013, LAESM established the municipal and regional Coordination Groups with the stakeholders for monitoring the implementation of the LAESM Project. A Coordination Group with Myrhorod City Council was established based on the Memorandum of Understanding and Cooperation between LAESM and Myrhorod City Council; the first meeting of the Myrhorod Coordination Group held on September 13, 2013.

A Coordination Group in Poltava Region was established by the Governor's of Poltava Resolution #416 dated September 25, 2013; the first meeting of the oblast Coordination Group was held on October 1, 2013, in Poltava. Four working groups were created with the oblast Coordination Group: Working Group #1 worked on legal issues; Working Group #2 worked on technical issues; Working Group #3 – PPP arrangements for bio-fuel projects; Working Group #4 – public education on alternative and renewable sources of energy and information dissemination. The Working Groups met two-three times on a monthly basis.

### 3.2 IMPLEMENTATION OF THE PROJECT'S TASKS

#### TASK 1: PREPARE LEGAL AND REGULATORY BASIS FOR IMPLEMENTATION OF BIO-ENERGY RENEWABLE PROJECTS IN MYRHOROD RAYON OF POLTAVA REGION

All activities under Task 1 were accomplished and are presented below.

**USAID LAESM conducted the analysis of national laws and regulatory policy on alternative sources of energy (biomass) and assessed the stakeholders' knowledge on clean energy.**



Participants of the Round Table in Myrhorod discuss the Report, December 17-18, 2013

The results of the analysis, including recommendations on necessary amendments to laws and suggestions regarding effectiveness of the tax incentive mechanisms for supporting energy efficiency and bio-energy development, were presented in the Report “Legal and regulatory assessment of current legislation, taxation policy, and regulations governing the use of alternative sources of energy. Recommendations for facilitation of implementation of a pilot project in Myrhorod”.

This Report included detailed and comprehensive analysis for all stakeholders concerned with bio-energy projects in Ukraine.

With the aim of informing the broader audience about heat energy production from biomass, almost 200 copies of the Report were disseminated to the Ministry of Regional Development, Construction, and Housing and Municipal Economy of Ukraine, National Energy and Utilities Regulation Commission, Kyiv City State Administration and 22 oblast state administrations, 7 associations and unions, donors and technical assistance projects.

The Report was also presented at the public events in Kyiv such as: The 9th International Conference on Biomass for Energy (September 24-25, 2013); The 5th European-Ukrainian Energy Day (May 29, 2014); and during a Round Table on “Natural Gas Replacement with Alternative and Renewable Energy Sources: from Investment Project Development to Implementation” on August 28, 2014, in Vinnytsia.

**USAID LAESM prepared the recommendations and an action algorithm for production of heat and electric energy from biomass (with the use of the “Green” tariff).** LAESM analyzed whether “Green” tariff can be applied for heat and electric energy produced from biomass. The results of the analysis were presented in a Report on “Research, preparation of recommendations, and design of an action algorithm for entities that intend to produce heat and electric energy from biomass with the use of the “Green” tariff”.

The research revealed that entities operating in the heating sector have some misunderstanding and confusion regarding the “Green” tariff terminology relative different types of bioenergy (produced from biomass): electric and heat energy. The research confirmed that the “Green” tariff in Ukraine is used exclusively for production of electric energy and is not applicable to production of heat energy. The Report was disseminated to over 63 recipients, including 3 ministries (Energy and Coal Industry; Regional Development; Agriculture Policy and Food), National Energy and Utilities Regulation Commission; State Agency for Energy Efficiency and Energy Saving; National Investment Agency; rayon and oblast administrations; producers of bio-fuel from straw; agriculture enterprises; NGOs; international foundations and institutions.

**USAID LAESM conducted a research for assessing whether the Kyoto Protocol tools could be applied for bio-energy projects.** LAESM experts conducted a research to assess effectiveness of the Kyoto Protocol tools in Ukraine and using the Kyoto Protocol tools for bio-energy projects. The research revealed that the rules for implementation of stage two of the Kyoto Protocol were not approved due to Ukraine’s delegation refusal to continue the discussion on this issue during the 20th session of the Conference of the Parties to the Kyoto Protocol and 10th Lima Climate Change Conference in December 2014 and it was agreed to continue the debate in Bonn in June 2015. The developed countries want to make CO<sub>2</sub> reduction norms almost equal for all participating countries while developing countries insist they should be given grants for adaptation purposes. The new framework agreement would have replaced the Kyoto Protocol that terminated in 2012.

Given the above, the decision on the Kyoto Protocol tools, including financing with the Kyoto Protocol tool, was expected to be taken in Paris in December 2015. Since until December 2015 state and private partners did not have opportunities to use the Kyoto Protocol tools for bio-energy projects and since the framework conditions regarding the use of Kyoto Protocol tools for Ukraine were to be defined, it was decided not to continue with the research on the use of the Kyoto Protocol tools for bio-energy projects.

**USAID LAESM supported amendments to legislation and regulations needed to create the incentives for the substitution of natural gas with local biomass in Ukraine.** LAESM joined the working group at the State Agency for Energy Efficiency and Energy Saving of Ukraine (SAEE) created for developing

drafts of laws and regulations for reducing natural gas consumption<sup>1</sup>. The LAESM Project contributed to the preparation of the following draft laws and regulations:

- Amendments to laws of Ukraine “On Heating” and “On Natural Monopolies” (regarding incentives to apply EE technologies/implement EE projects, more extensive use of alternative fuels, and incentive based regulation);
- Draft of law “On introducing changes in certain legislative acts of Ukraine to reduce the number of permits necessary for the projects providing for substitution of natural gas with other fuels”;
- Draft of law “On changes to the Law of Ukraine “On heat supply”;
- Draft of the GOU decree “On changes to the GOU Decree 869 dated June 1, 2011”.

The amendments were proposed for making the GOU Decree #869 “On the single approach to setting tariffs for housing and communal services”<sup>2</sup> compliant with the provisions of the Law of Ukraine “On Heating” which (Article 20) stipulate that a heat energy tariff for consumers is set as the total of tariffs for heat energy production, transportation, and supply. Neither this law, nor other relevant legislation includes the requirement as to setting heat energy tariffs as the total of several tariffs. As of December 1, 2015, the National Energy and Utilities Regulation Commission developed the draft of the Commission’s decree “On approval of the Procedure for setting tariffs for heat energy, heat energy production, transportation, and supply, district heating and centralized hot water supply”<sup>3</sup> which included the LAESM Project proposals.

With the aim of simplifying the regulation system for entities which produce heat energy from conventional and alternative energy sources, LAESM prepared the recommendations on improving tariff regulation and setting cost recovery tariffs for heat energy produced from the alternative energy sources. The recommendations were sent to the Local Government Ombudsman in Ukraine and will be included into the System Report on State Natural Monopolies (expected publication in January 2016).

**USAID LAESM provided assistance to the Myrhorod Heating Company “Myrhorodteploenergo” (operating and maintaining the pilot boiler house) to obtain a license on heat energy production from unconventional and renewable energy sources.** The reconstructed boiler house on 8, Spartakivsky Provulok in Myrhorod is operated and maintained by the Myrhorod Heating Company “Myrhorodteploenergo”. According to the national legislation, entities producing heat energy from the unconventional and renewable sources of energy should obtain a special license from the National Energy and Utilities Regulation Commission and a tariff on heat energy produced from the unconventional and renewable energy sources should be approved by the National Commission.

LAESM provided assistance to “Myrhorodteploenergo” to prepare necessary documents required by the National Commission and to make heat energy tariff calculations. As a result of the assistance from the USAID Project, in October 2015, “Myrhorodteploenergo” obtained the License #2609<sup>4</sup> from the National Energy and Utilities Regulation Commission.

**USAID LAESM coordinated activities with USAID P3DP on legal issues.** LAESM coordinated its activities with the USAID P3DP Program. The USAID P3DP Program shared PPP experience and practices during the LAESM Round Tables and seminars and reviewed PPP documents prepared by LAESM for implementation of clean energy PPPs in five municipalities of Poltava Region. Although the MOU was signed between LAESM and the Commercial Law Center (CLC), the Center’s and LAESM’s tasks and scopes of activity were somehow different, so no cooperation between LAESM and CLC in fact took place.

## **TASK 2: DEVELOP INFRASTRUCTURE FOR COLLECTION, TREATMENT AND STORAGE OF BIOMASS IN THE REGION**

All activities under Task 2 were accomplished and are presented below.

**USAID LAESM carried out market research as regards energy potential of biomass stock in the region.** LAESM collected relevant data, screened the available assessment methodologies, and estimated

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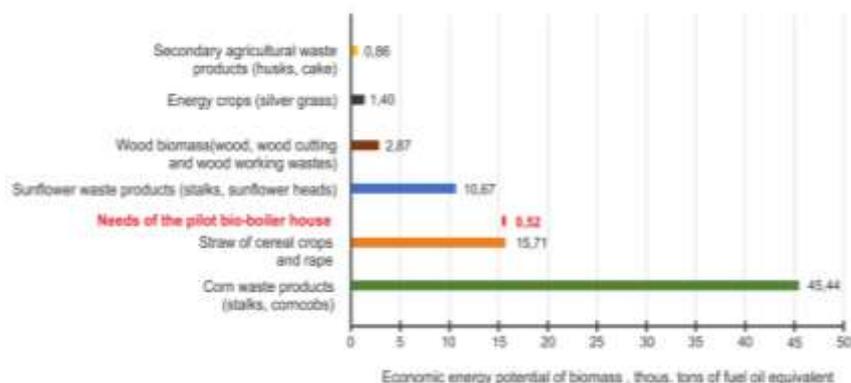
<sup>1</sup> as stipulated by the GOU Decree 1014-p “On approval of the short- and medium-term actions to reduce natural gas consumption till 2017” dated October 16, 2014.

<sup>2</sup> <http://zakon3.rada.gov.ua/laws/show/869-2011-%D0%BF>

<sup>3</sup> to replace the Decree #869 effective till January 1, 2016.

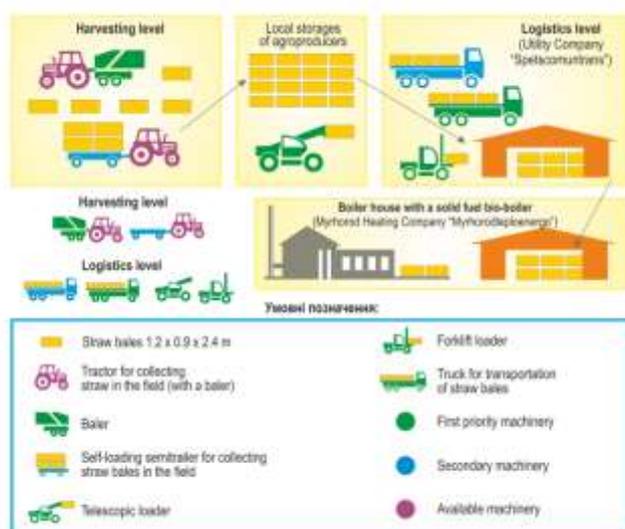
<sup>4</sup> <http://www.nerc.gov.ua/?id=17776>

the theoretical, technical and economic potential for all types of biofuel available in the Myrhorod Rayon of Poltava Region.



Energy potential of biomass, Myrhorod Rayon of Poltava Oblast, 2014.

With the aim of ensuring the uninterrupted operation of the bio-boiler, LAESM organized meetings with 18 local agroproducers operating within 30 km distance from Myrhorod, to discuss volumes of straw that could be purchased from them, pricing, and storage conditions. As a result of the meetings, seven Memoranda of Understanding (MOUs) were signed between LAESM, Myrhorod City Council and local agroproducers. According to the signed MOUs, agroproducers agreed to supply the total of 7500 tons of grain straw annually, while only 1500 tons a year is needed for the reconstructed boiler house. In 2013 LAESM prepared the Catalog of the Agriculture Enterprises of Myrhorod Rayon that includes the largest agroproducers, current or potential biomass suppliers.



Logistics infrastructure on straw collection, transportation, storage and delivery to the bio-boiler

**USAID LAESM prepared a feasibility study of the infrastructure solutions for the use of straw as a bio-fuel in the municipal district heating systems of Myrhorod Rayon.** The feasibility study consisted of the following: technical solutions (including the bio-boiler capacity); capital and operational expenses to be incurred with the uninterrupted supply of biomass for the bio-fuel boiler; recommendations regarding the legal and organizational form of a logistics enterprise; biomass storage solutions; analysis of biomass prices; analysis of risks and sensitivity of the bio-boiler project (including SWOT-analysis); Environmental Impact Assessment; physical and chemical analysis of straw samples collected from the local agroproducers. The feasibility study included a recommendation from the local agroproducers on packing straw in bales and collecting straw bales from the field.

Based on the feasibility study and some additional research, LAESM designed the system of straw harvesting, storage, transportation and supply for the pilot bio-boiler; selected the location for the central straw storage facility and a logistics enterprise for ensuring the uninterrupted supply of straw for the bio-boiler; determined what equipment/machinery should be procured from the LAESM Project funds with cost sharing from the local partners and what equipment could be leased specifically for the harvesting period.

LAESM negotiated straw prices with the local agroproducers that has become the first step towards the development of the new to Ukraine market in which biomass (straw) is used for energy purposes.

LAESM studied best international practices regarding utilization of ashes produced as a result of burning of biomass. LAESM analyzed ash content in straw of cereal plants, ash structure and meltability. LAESM grounded in the study that dry stalks of winter wheat would be the best bio-fuel, ash of which could be used as a fertilizer for crops. LAESM developed the recommendations on application of ashes into soil. The results of the study were presented in the Report "Overview of the best international practices regarding

the use of biomass ashes. Recommendations on how agro-enterprises of Poltava Region may use straw ashes from the pilot bio-fuel boiler as a fertilizer”. The Report also consists of a list of potential suppliers of bio-fuel and a list of agro-enterprises (vegetable growing, planting stock growing, flower growing, mushroom farms, hothouse market-gardening) which may potentially buy ash.

Regarding straw storage solutions, LAESM recommended to have two storage facilities: operational (for ensuring the uninterrupted operation of the bio-boiler during the one-week period) and central (for storing the annual stock of straw). LAESM proposed to locate the central storage facility on the territory of the Public Utility Company “Spetskomuntrans” (86, Shishatska Str.). According to the trilateral MOU between LAESM, Myrhorod City Council and “Spetscommuntrans”, the latter provided the existing storage building (600 m<sup>2</sup>) for location of the central straw storage facility.

In the above-mentioned feasibility study of the infrastructure solutions for the use of straw as a bio-fuel in the municipal district heating systems of Myrhorod Rayon, LAESM determined the capacity of the storage facility as 2000 tons of straw bales. Since the capacity of the existing storage building of “Spetskomuntrans” was too small to contain 2000 tons of straw bales, it was required to expand the existing storage facility by attaching a duplex annex to the existing storage building.

Myrhorod City Council allocated the additional land plot (0,25 hectares) for placing the duplex annex (Resolution #17 of Myrhorod City Council dated October 10, 2014). The land plot was transferred to the balance sheet of the Public Utility Company “Spetscommuntrans”. LAESM provided legal assistance to Myrhorod City Council regarding the land allocation procedure.

**USAID LAESM developed design and estimation documentation for reconstruction of a central straw storage facility.** On June 23, 2015, the design and estimation documentation for reconstruction of the central storage facility was approved by the relevant authorities. LAESM obtained a corresponding statement of approval and all necessary specifications for water and wastewater, gas and electricity networks from the relevant authorities/organizations.

**USAID LAESM reconstructed the central storage facility.** On June 24, 2015, when the Capital Development Department of Myrhorod City Council, the Customer of the reconstruction works, submitted a Declaration on the start of central storage facility reconstruction to the relevant authorities, the reconstruction works at the central storage facility started.

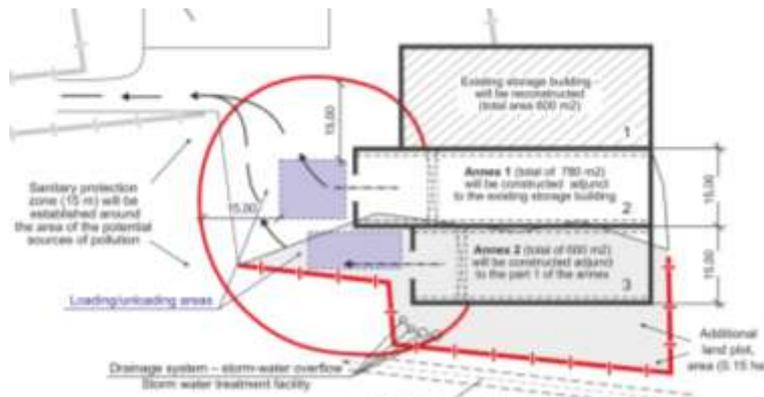


Central storage reconstruction on 86, Shishatska Street in Myrhorod: works in progress (on top) and completed annex, October 2015

The Central storage facility reconstruction consisted of several work phases: reconstruction of the existing storage building (including reconstruction of the front wall; repair of the existing slate roof; leveling of the territory (over 1600 m<sup>2</sup>) for locating two annexes (annex 1 - 780 m<sup>2</sup> and annex 2 - 600 m<sup>2</sup>); cutting old trees and bushes; removing household waste to the landfill); laying the foundation for two annexes (including vertical planning and geodesic planning; reinforcing the foundation with 52 ferroconcrete build-in-place piles); making brick walls and covering the annexes with the reinforced concrete constructions and metal structures (for the purpose of fire prevention, the walls of the annexes were made of bricks, the external wall of annex 2 was made of metal); arranging a fire extinguishing system, storm water system, and executing finishing works.

LAESM was monitoring the construction/assembly works at the central storage facility site, consistency of the works with the Environmental Review Checklist (ERC) on central storage reconstruction. LAESM prepared and concurred with USAID the quarterly monitoring reports on reconstruction of the central storage facility.

The layout of the reconstructed central storage facility (1980 m<sup>2</sup> of storage space) is presented below.



Layout of the central storage facility in Myrhorod, 2015.

In November 2015, with assistance from USAID LAESM, Public Utility Company “Spetscomuntrans” put the reconstructed storage facility into operation and loaded the annual stock of straw in to the storage buildings.

**USAID LAESM assisted local partners to develop the additional components of the transport and logistics infrastructure of the bio-boiler project.** LAESM conducted a research on the equipment and machinery for harvesting and transportation of straw that is available at the local agro-producers of Myrhorod Rayon and that could be used for the logistics infrastructure. The research showed that most of the needed equipment and machinery was not available. Even if some machinery could be leased from the agro-producers, the fact that they are located within 15-20 km distance from the boiler house would raise the cost of straw transportation for the pilot boiler house. The best solution was to use the facilities and machinery of the Public Utility Company “Spetscomuntrans” in Myrhorod and have it as the logistics enterprise responsible for bio-fuel supply for the pilot bio-boiler.

“Spetscomuntrans” satisfied the following key requirements:

- 1) Location. “Spetscomuntrans” is located within 1.5 km distance from the pilot boiler house.
- 2) Vehicle fleet. “Spetscomuntrans” owns vehicles that can be used as reserve or additional vehicles for project purposes, if necessary: five trucks (MAZ 3551; ZIL 4205; ZIL 130; GAZ 3307), a tractor YuMZ-6 with a loader KYN-10 (the loader was procured by Myrhorod City Council as cost share under the LAESM Project in 2014 for loading straw bales in the field), a weighbridge Aksis (30 tonnes);
- 3) Central storage facility is located on the territory of “Spetscomuntrans”;
- 4) Equipment for production of other bio-fuel. “Spetscomuntrans” has the equipment for production of wood chips that could be used as an alternative bio-fuel in case of some unexpected breaks in straw supplies for the pilot bio-boiler;
- 5) Maintenance workers. Maintenance personnel can deal with equipment and machinery maintenance and repair.

A trilateral Memorandum of Understanding and Cooperation signed between Myrhorod City Council, “Spetscomuntrans”, and LAESM Project on November 24, 2014, included a list of special machinery and equipment for bio-fuel supply that was not available at “Spetscomuntrans” and couldn’t be leased because of lease cost considerations or unavailability or distance considerations. The Memorandum also determined sources of financing of procurement of the necessary equipment. It stipulated that Myrhorod City Council purchases two loaders and moisture meters, and the LAESM Project procures a special truck with a semitrailer for transportation of rectangular straw bales and a loader.

As a result of the competitive tender for the procurement of equipment, USAID LAESM procured a MAZ truck with the semitrailer (manufacturer: Automobile Company “Auto-MAZ, Ltd.”) and a telescopic loader Massey Ferguson MF9407 (manufacturer: U.S. Company “AGCO Corporation”). The MAZ truck is used for transportation of straw bales from the central storage facility to the pilot bio-boiler. The telescopic loader is used and for handling operations at the central storage facility.



Machines procured by LAESM from USAID funds:  
telescopic loader Massey Ferguson MF9407 and  
MAZ truck with the semitrailer.

Myrhorod City Council procured a forklift loader for the operating storage facility and two dry meters. LAESM provided legal and technical assistance to Myrhorod City Council to put the forklift loader and dry meters into operation and to organize technical training for the staff.

The procured equipment was used during the harvesting season in summer of 2015. In August 2015, 1764 tons of straw (enough for 15 months of the uninterrupted operation of the bio-boiler) was collected from the agricultural field of 410 hectares and delivered to the temporary storage facilities.

The LAESM Project assisted the local partners in:

- 1) preparation of the model contracts for purchase of straw from the agroproducer in the field (including assistance to negotiate prices on straw with agroproducers);
- 2) identification of the locations for the temporary storage of straw (done in partnership with Myrhorod City Council, a supplier of straw, and an agroproducer who would sell straw);
- 3) transfer the collected straw to the “Spetscomuntrans” balance sheets, including amendments to the Statute of “Spetscomuntrans” made to expand the scope of functions of the Public Utility “Spetscomuntrans” regarding supply of straw for the pilot bio-boiler;
- 4) straw price calculations to include handling operations and straw delivery from the central storage facility;
- 5) preparation of a model contract for purchase of straw between the Public Utility Company “Spetscomuntrans” (logistics enterprise) and Myrhorod Heating Company “Myrhorodteploenergo”;
- 6) development of the system of payments between “Spetscomuntrans” and “Myrhorodteploenergo”; and
- 7) preparation of the additional contracts (on ashes removal/utilization and on waste removal) between “Spetscomuntrans” and “Myrhorodteploenergo”.



Director of the USAID Office of Economic Growth Stephen Gonyea at the ribbon cutting ceremony at RLC, September 10, 2014, Myrhorod

**USAID LAESM established the Resource and Logistics Center in Myrhorod for working with farmers, agroproducers and other enterprises for which straw is an agriculture waste product.** The Resource and Logistics Center (RLC) was created in the premises of Myrhorod City Council (17, Nezalezhnosti St). The Center was established to provide support to the local entities regarding implementation of biomass (straw) projects, including legal, marketing, methodological assistance and assistance in negotiations with potential investors. The Center will disseminate best bioenergy practices; organize training and public events to raise awareness of modern approaches to biomass collection, storage and transportation; establish information partnerships with equipment producers for providing RLC clients with comprehensive and up-to-date information on new equipment and technologies in the bioenergy sector.

After the end of the LAESM Project, the Center will continue its activities relative development of bioenergy in Myrhorod City and in Myrhorod Rayon.

### TASK 3: PREPARE ENGINEERING SOLUTION AND IMPLEMENT A PILOT PROJECT ON BIO-FUEL ENERGY PRODUCTION IN MYRHOROD

All activities under Task 3 were accomplished and are presented below.

**LAESM analyzed available engineering solutions for bio-fuel energy production in the Myrhorod Rayon of Poltava Region.** In the framework of the analysis LAESM reviewed available technical solutions for bio-fuel boiler on straw and existing locations of gas boiler houses in Myrhorod to be replaced by bio-fuel. LAESM prepared a pre-construction research (feasibility study) regarding selection of the best scenario of the bio-fuel boiler installation on 8, Spartakivsky Prov. in Myrhorod. The results of the analysis were presented in the Report on the feasibility study with recommendations regarding installation of bio-boilers.

LAESM proposed to install bio-boilers in the reconstructed existing gas boiler houses. Such approach provided for creating gas boiler houses into the so-called hybrid boiler houses where a multi-fuel bio-boiler and gas-fired boilers are installed in the boiler house room. The multi-fuel bio-boiler (working on several types of bio-fuel such as chips, straw, pellets) is used for production of heat energy and hot water with gas-fired boilers being a reserve source of heat energy to be used during the peak periods (as a rule, not more than 30 days a year in the central part of Ukraine during the coldest time of the year).

LAESM analyzed all 18 existing gas boiler houses operated by the Myrhorod Heating Company “Myrhorodteploenergo” against the following important parameters: 1) boiler house territory is big enough for locating the operating storage facility and the automatic fire extinguishing system is available; 2) residential and public buildings are located no closer than 50 m from the boiler house building meaning that a sanitary protection zone and fire breaks exist around the boiler house; 3) boiler house building is large enough for installation of a bio-boiler and peripheral equipment in there (including bio-fuel supply lines, exhaust gases treatment system, ashes removal equipment, etc.), while the existing gas-fired boilers remain in the boiler house; 4) water supplying capacity of the existing water supply line (or a possibility to lay one) is not less than 15 l/second during 2-3 hours period and installation of fire reservoirs and a pump station is possible.



Pilot gas boiler house on 8, Spartakivsky Prov. in Myrhorod before reconstruction (yard view and machinery room), 2014.



As a result of the analysis of the available engineering solutions for bio-fuel energy production, LAESM selected the boiler house located on 8, Spartakivsky Prov. in Myrhorod as the pilot boiler house for reconstruction. Two other initially pre-selected boiler houses (80, Shishatska St. and 181, Gogolia St.) were removed from the list of the potential pilot sites as a result of the preliminary calculations which showed worse technical and economic values for these boiler houses.

Not least important for the USAID project's success was selection of the bio-boiler. LAESM conducted a market research of over 20 bio-boiler equipment manufacturers and recommended tree bio-boilers for the pilot project: Komkont bio-boiler (produced in Belarus), Lin-Ka bio-boiler (produced in Denmark) and Kriger bio-boiler (produced in Ukraine).

On February 5, 2014, the pilot bio-boiler reconstruction plan prepared by LAESM was approved by the oblast Coordination Group at Poltava Oblast State Administration. According to the plan and in order to not to interrupt provision of heating and centralized hot water supply services to the micro-rayon around the pilot boiler house (10 residential buildings, a school and a kindergarten, and one commercial consumer), the selected boiler house reconstruction was split into two phases.

As a result of the competitive tender, LAESM selected a design organization to prepare the design and estimation documentation for the boiler house reconstruction Phases 1 and 2 separately. As required by relevant national legislation, the design and estimation documentation for construction and/or reconstruction works should be approved by the relevant national expertise authorities. On July 1, 2015, LAESM received a positive statement on the design and estimation documentation for the boiler house reconstruction Phases 1 and 2 (as required by the relevant legislation) from the state expertise authorities.

Other necessary documents were endorsed by relevant local authorities, necessary specifications were received, and necessary permits were obtained from the relevant permit-issuing authorities. The mentioned above documents included: town planning conditions and limitations; specifications regarding water supply and sanitation, and electricity networks; gas supply permit; fire and anthropogenic safety permit.

**USAID LAESM executed reconstruction works under Phases 1 and 2 of boiler house reconstruction.**

During Phase 1, the following reconstruction activities were completed: fire safety of the existing boiler house building was improved through the additional fire prevention coating to enforce walls, floor, and ceiling; 14 wooden windows were replaced, three new modern 1.0 megawatt gas boilers Kolvi-1000 (made in Ukraine) and peripheral equipment (heating pumps, pipes, a new smoke pipe) were installed; start-up and adjustment works were completed and new gas boilers were put into operation. Procurement of three modern gas fired boilers and gas burners for the boilers was co-financed by Myrhorod Heating Company and Poltava Oblast State Administration.



Three gas-fired Kolvi-1000 boilers (made in Ukraine) were installed at the reconstructed boiler house on 8, Spartakivsky Prov. in Myrhorod to replace five obsolete NIISTU gas-fired boilers.

As a result of the regular site visits by the LAESM technical team, it was observed that during Phase I of boiler house reconstruction, a sub-contractor selected to execute Phase I of boiler house reconstruction violated certain rules and did not observe certain requirements of the design documentation regarding laying the foundation for the smoke pipe. One of the solutions proposed by the local partners was to dismantle the foundation and lay the new one. The LAESM Project technical specialists, in partnership with the design organization, proposed a technical solution according to which the foundation was reinforced and not dismantled.

During Phase 2 of reconstruction, the following reconstruction activities were completed: five obsolete gas boilers NIISTU-5 (with capacity of 0,65 MW each and with the efficiency coefficient less than 80%) were dismantled; a multi-fuel bio-boiler Komkont CH 90 (with straw being the main bio-fuel) and peripheral equipment installed and tested (done with assistance from the Belarus Komkont plant experts); an operating bio-fuel storage building (cubic capacity 420 m<sup>3</sup>) was constructed adjunct to the existing gas boiler house facility for ensuring an uninterrupted bio-boiler operation during a one-week period; the straw packs feed line was installed in the operating bio-fuel storage; a new smoke pipe (over 20 m in height) was installed; a fire safety system was installed; the boiler house was connected to the high pressure water supply system for fire extinguishing purposes.

LAESM completed the open tender and procured the bio-boiler Komkont CH 90. The procurement included the peripheral equipment: straw bales storage band, a shredder and a conveyer to transport shredded straw to fuel spreader, fuel distributor, a conveyer to supply straw bales to the furnace of the bio-boiler, an operation control system, a conveyor to remove ashes from the bio-boiler.



Multi-fuel bio-boiler KOMKONT CH 90 installed at the reconstructed boiler house on 8, Spartakivsky Provulok in Myrhorod.

The Komkont bio-boiler met the following key requirements formulated by the LAESM project technical team: automated treatment of boiler pipes by the pressed air; movable grate with necessary devices; window for monitoring bio-fuel in the bio-boiler furnace; automatic (self-operating) recirculation system to prevent melting of ashes and fluxing of the fire grate; automatic fuel supply to the bio-boiler and automatic regulation of bio-fuel supply depending on the operation regimes of the bio-boiler; temperature regulation for the heat carrier to avoid evaporation inside of the bio-boiler, in gas pipes, and in the smoke pipe; automatic cooling system for the fire grate; claimed heat capacity is reached even if high moisture bio-fuel (up to 50%) is used; main processes are automated (“bio-fuel - air” proportion, regulation depending on the outside air temperature, etc.); automatic fire protection to prevent the bio-fuel start burning in the fuel supply system; multi-zone supply of air, re-circulation of smoke gases; power reserve of the boiler furnace should be not less than 20% of the nominal (rated) power of the boiler.

On May 28, 2015, the Acceptance Certificate was signed by the Myrhorod City Council and the bio-boiler (and peripheral equipment) was handed over to Myrhorod City Council.



Reconstructed boiler house. Machine room, 2015.



Reconstructed boiler house, 2015.  
Boiler house building (left). Operating storage building (attached to the boiler house) (right).

The political situation in Ukraine in early 2014 and the unexpected cadre shifts in Poltava Region resulted in the six-months delay of the boiler house reconstruction which, in the long run, resulted in the substantial modifications in the LAESM Project Work Plan and the need in the no-cost six-month extension of the Project.

LAESM conducted 12 site monitoring visits during reconstruction. The design organization that prepared design and estimation documentation for the boiler house reconstruction was in charge of reconstruction works supervision; the Capital Development Department of Poltava Oblast State Administration conducted the technical monitoring.

At the beginning of October 2015, site territory was improved, new trees and bushes were planted, garbage removed, and access roads improved.

In November 2015, LAESM organized specialized training for the bio-fuel boiler house personnel. Belarus Komkont specialists delivered the training. In addition, six staff workers of the Myrhorod Heating Company “Myrhorodteploenergo” were trained in bio-fuel boiler operation by the specialized training institution – Poltava Technical Training Center. The trained bio-fuel boiler personnel received the national diploma certifying they are qualified to operate bio-fuel boilers.

On October 27, 2015, in Myrhorod, the reconstructed boiler house was launched with the ribbon-cutting ceremony and the multi-fuel bio-boiler was started and put into operation.



Ribbon cutting ceremony at the reconstructed boiler house in Myrhorod.  
(From the left) USAID/Ukraine Deputy Mission Director John Pennel, First Deputy Governor of Poltava Oblast Andiy Pisotskyi, Mayor of Myrhorod Serhiy Solomakha, LAESM Project Manager Ruslan Tormosov.

As of December 31, 2015, the reconstructed boiler house provides heat energy and hot water from biomass to ten multi-family residential buildings (425 apartments), a school, and a kindergarten, and a commercial consumer.

#### **TASK 4: ESTABLISH MARKET CONDITIONS FOR BIO-FUEL PRODUCTION BY PRIVATE SECTOR PARTICIPANTS UNDER PPP ARRANGEMENTS IN THE REGION**

One of the main tasks of LAESM Project was to initiate a systematic approach to sustainable substitution of natural gas with alternative and renewable energy sources one of the prerequisites of which is attraction of investments into the bioenergy sector.

The limited municipal budgets and scarce resources of municipal heating companies result in the situation when in Ukraine there remain only two realistic sources of investment: IFI loans and private investments. IFI loans are not available for small Ukrainian towns and urban-type settlements under the current legislation of Ukraine, and also due to the inability to service more or less large loans. Therefore for such type of settlements only private investments remain a single source of investments, which can be attracted under public-private partnerships (PPPs).

The activities under Task 4 were accomplished and are presented below.

**USAID LAESM assessed the available PPP options for attraction of private sector participants in bio-fuel projects and identified the best PPP model for attraction of private investments into bioenergy projects.** The Law “On Public-Private Partnership” was adopted in Ukraine in 2010 but despite of several amendments still remains imperfect, especially as regards heat supply. So, this Law couldn’t be used as guidelines for the private sector investment into bioenergy.

As a result of the assessment of the existing models, options and forms of how private investors may participate in bio-fuel projects, including risk analysis, LAESM determined concession as the best form of the PPP.

Concession allows private investors to participate in the reconstruction of the existing facilities or construction of new facilities as a result of which bio-fuel will be used for production of heat energy in the municipal heating systems. It is noted for clear contract provisions, payment procedure, guaranteed support from the state, favorable taxation conditions. In addition, a PPP project can be initiated by a private partner.

LAESM proposed the PPP arrangement model that provides for the transparent tender mechanism, a clear contract procedure, a clear procedure governing property related responsibilities and risks sharing between public and private partners while at the same time keeping facilities state owned.

In 2014, LAESM held stakeholder discussions on the proposed PPP model at a special Round Table: on “Creation of the market environment for bioenergy PPPs” on December 17 in Poltava.



LAESM Round Table on attraction of private investments to bioenergy projects (Poltava, December 17, 2014).

The Round Table showed that private investors are interested and ready to participate in the bio-energy PPPs in Poltava Region and local authorities are ready to initiate and support bio-energy projects. Two potential investors who participated in the Round Table articulated specific investment proposals: INTECH Slovakia was ready to invest UAH 32 million and ESTEU Group UAH 4.6 million.

As a result of the PPP Round Table in Poltava, Karlivka, a small town of Poltava Region, initiated the discussion with LAESM on the bioenergy PPPs for the reconstruction of the existing boiler houses and heat generators and installation of bio-boilers. Two other small towns of Poltava Region, Gadyach and Velyka Bahachka, also showed interest but later they dropped out since they have not been able to perform the necessary steps to initiate the bioenergy PPP.

**USAID LAESM developed proposals for potential investors for initiation of bio-fuel PPPs in Poltava Region.** Following the Round Table in Poltava (December 17, 2014), during the period of January - February 2016, LAESM received formal proposals from two cities of Poltava Region, Karlivka and Velyka Bahachka, regarding development and implementation of bio-energy projects under PPP arrangements.

LAESM held Round Table discussions on bioenergy PPPs with three municipalities of Poltava Region (Myrhorod, Velyka Bahachka, Lubny). For Myrhorod and Velyka Bahachka LAESM presented four bioenergy projects at boiler houses operated by the Regional Utility Company "Myrhorodteploenergo". The presentation also included: relevant logistic solutions for bio-fuel supply to the reconstructed boiler houses; results of pre-feasibility studies; potential sources of financing of bio-energy projects, including a loan from NEFCO. LAESM discussed the possible bioenergy PPPs with the local authorities and stakeholders of Lubny. LAESM delivered formal presentations on bioenergy projects to the representatives of the local self-governments, utility companies, general public, and businesses in Velyka Bahachka (on May 13, 2015), Poltava and Karlivka (on June 9, 2015). The presentations focused on the technical and economic solutions regarding substitution of natural gas with local biomass in the municipal district heating systems, preparation of Business Plans for potential private investors, and initiation of bioenergy PPPs.

In June 2015, LAESM signed the Memorandum of Understanding and Cooperation (MOU) with Karlivka Rayon State Administration. According to the MOU, Karlivka obligated to initiate PPPs and implement bioenergy projects to substitute natural gas with local biomass for production of heat energy and hot water for two municipal facilities: school #1 and Karlivka Rayon Hospital. As a result of the LAESM assistance to Karlivka authorities to initiate and develop bioenergy PPPs, Karlivka Rayon State Administration received a package of documents on the bioenergy PPPs.

The package of documents on bioenergy PPPs included: drafts of documents to initiate concession and announce a concession tender (including a concession tender announcement); draft of the decree by the Rayon Council regarding concession of municipal facilities; Regulation on the Concession Tender Committee; concession tender documents (Request for Proposals, including proposal submission requirements; concession tender terms and conditions; key provisions of the concession contract; a concession contract); drafts of documents to be prepared by the Concession Tender Commission (minutes of meetings, including acceptance/rejection of tender quotes; selection of a winner; information for tender participants; etc.); drafts of decrees of the Rayon Council (tender announcement; identification of a winner; conclusion of a concession contract).

This was the unique experience for Ukraine when the entire package of documents for a bioenergy PPP was prepared for the municipality.

It is expected that Karlivka will hold the concession tender after the local elections of the Rayon Council and City Council deputies are completed in January 2016.

## **TASK 5: PREPARE A BUSINESS PLAN AND DESIGN DOCUMENTATION FOR BIO-FUEL INVESTMENT PROJECT: NETWORK OF BIO-FUEL BURNING PLANTS IN MYRHOROD RAYON**

Under Task 5, LAESM worked to create conditions for attracting investment into bioenergy development of Poltava Region, with loans from IFIs rated first among the potential sources of financing of such projects. The main requirement for obtaining the IFI loan is to prepare the Business Plan for the proposed investment project and have it approved by IFI. If funds are earmarked under the special national programs, design and estimation documents on such projects are required. LAESM expects that in 2016 Poltava Region will receive more or less same amount of funds as in 2015 which can be used for bioenergy development. With this in mind, five pilot municipalities of Poltava Region received assistance regarding preparation of the feasibility studies for bioenergy projects.

All activities under Task 5 were accomplished and are presented below.

**USAID LAESM conducted assessment of the Poltava Region municipalities that have centralized heating systems.** Certain passivity of local authorities and senior managers of the heating companies coupled with the unstable situation in the country and the fact that the new Governor of Poltava Region Victor Buhachuk was appointed in March 2014, resulted in the delay of this activity. LAESM Project succeeded in this effort only after Ukraine stopped gas deals with Russia and when gas deficit became a real problem in Ukraine. This was the time when some slender progress of this activity has been observed. As a result of the assessment, LAESM determined that 17 cities and settlements of the Poltava Region have centralized heating systems which are operated by nine heating companies. LAESM identified five municipalities for the further assistance regarding substitution of natural gas with local biomass for heat energy production in the municipal heating systems: Poltava, Myrhorod, Lubny, Karlivka, Velyka Bahachka. The results of the assessment were presented in three reports: 1) Analysis of municipalities with centralized heating systems; 2) Analysis of boiler houses; 3) Analysis of heat generators.

**USAID LAESM assessed energy potential of biomass within 30-40 km distance from the selected pilot cities, estimated the possibilities regarding the shift from the traditional fuels to biomass, and carried out a market research of agro-producers located in the pilot cities.** LAESM completed the assessment of energy potential of biomass within 30-40 km distance from the pilot cities and presented the results for the local authorities of Myrhorod and Velyka Bahachka Rayons of Poltava Region at the Round Table on “Creation of favorable conditions for implementation of bio-energy projects in Myrhorod Rayon and Velyka Bahachka Rayon of Poltava Region” in Myrhorod on March 31, 2015. The results of the biomass energy potential assessment were included in the Final Report on technical solutions regarding installation of bio-boilers in Myrhorod, Velyka Bahachka, Lubny, Poltava, and Karlivka and in the Bioenergy Atlas of Poltava Region produced by LAESM.

LAESM held stakeholder discussions in Myrhorod, Karlivka, Velyka Bahachka, Poltava, and Lubny on the completed pre-feasibility studies and investment opportunities regarding implementation of bio-energy projects in these municipalities. LAESM signed Memoranda of understanding (MOUs) with two municipalities: with Myrhorod City Council on preparation of a Business Plan to attract a NEFCO loan for reconstruction of a bio-boiler house producing heat energy for School #1 and Center for Esthetic Education, and with Karlivka Rayon State Administration on establishment of bioenergy PPPs.

Poltava, Lubny, Velyka Bahachka did not sign the MOUs with LAESM.

**USAID LAESM prepared the feasibility studies of bioenergy projects for the municipalities, MOUs signatories, to help the municipalities to apply for financing from national and regional programs.** LAESM prepared three feasibility studies of bioenergy projects as part of design and estimation documentation for Myrhorod and Karlivka to help these cities to apply for financing from national and regional programs.

USAID LAESM provided assistance to the municipalities signatories (Myrhorod and Karlivka) and non-signatories of the MOUs to prepare:

- Two feasibility studies on reconstruction of two boiler houses (80, Shishatskaya St. and 181, Gogolya St.) in Myrhorod. In the future, Myrhorod authorities intend to use the feasibility study for

the boiler house on 181, Gogolya St. as a basis for the Business Plan to receive a loan from NEFCO. So far, NEFCO issued three loans to Myrhorod. The city may apply for the next loan from NEFCO only in 2017.

- One feasibility study for Karlivka – Reconstruction of the heat generating plants producing heat energy for school #1 and Karlivka Central Hospital.
- Prefeasibility studies on reconstruction of gas boiler houses (operated by Lubny Heating Company “Lubnyteploenergo” and located on 9, Industrialna St. and 45, Osypenko St.) and installation of bio-boilers in Lubny.
- Pre-feasibility study on reconstruction of two gas boiler houses (19a and 6a, Lenin St. ) in Velyka Bahachka.
- Technical solutions and economic calculations for the reconstruction of a boiler house operated by Poltava Heating Company and located on 35, Kahamlyka St. in Poltava.

LAESM decided to develop pre-feasibility studies for the MOU-non-signatories because despite of the fact that at that time local authorities were preoccupied with the autumn elections to local city and village councils (October – November 2015) and were not ready to pay much attention to bioenergy projects, LAESM anticipated that after the elections they might come back to this issue and relevant modifications could be made to the prefeasibility studies included into the Business Plan or design documentation.

The details on the prepared feasibility studies are presented in the grid below.

#	City	Gas boiler houses locations	Gas boiler house reconstruction works	Natural gas saving, thousand m <sup>3</sup> /year	Investment, UAH
1	Velyka Bahachka	19a, Lenin St.	Installation of bio-boilers with automatic supply of bio-fuel and ashes removal; installation of a water cylinder and a smoke pipe; construction of the operating storage for the fuel (underground bunkers with moving bottoms).	416,933	9,622,560.00
2		6a, Lenin St.	Merging two gas boiler houses (19a, Lenin Str. and 6a, Lenin Str.); installation of automatic fuel supply lines and ashes removal equipment; laying pipelines; installation of a water cylinder and a smoke pipe; construction of the operating storage for fuel (underground bunkers with moving bottoms).	700,958	11,755,700.00
3	Lubny	9, Industrialna St.	Installation of bio-boilers with automatic supply of bio-fuel and ashes removal equipment; installation of a water cylinder and a smoke pipe; construction of the operating storage for fuel.	210,680	498,000.00
4		45, Osypenko St.		969,450	12,121,000.00
5	Poltava	35, Kahamlyka St.	Installation of automatic solid fuel bio-boilers on wood chips.	1 998,680	15,848,400.00
6	Karlivka	School #4 (45a, Kotsyubinsky St.)	Installation of solid fuel bio-boiler on wood granules.	75,500	330,000.00
7		Heat generating	Construction of the new boiler house and installation of new	156,600	8,362,000.00

		plant of the Central Rayon Hospital (2, Radevycha St.)	solid fuel and gas-fired boilers.		
8	Myrhorod	181, Gogolya St.	Installation of a bio-boiler on alternative fuels.	676,000	5,945,800.00
9		80, Shishatska St.		923,400	5,957,244.00
10		Heat generating plant of School #1 (173/2, Gogolya St.)	Increasing efficiency of energy consumption through: installation of a solid fuel bio-boiler in the attachment to the gas-fired heat generating plant building, installation of fireproof dividers to separate the area where the bio-boiler is installed from the gas-fired boilers.	47,400	5,344,366.00

LAESM handed over the feasibility study reports to the local partners at the formal event “Presentation of the LAESM Project Results” in Poltava in November 2015.



The formal event “Presentation of the LAESM Project Results” (Poltava, November 24, 2015).  
(right) LAESM Project Manager Ruslan Tormosov hands over the feasibility studies prepared for five pilot municipalities to the Acting Head of the Housing and Communal Services Department of Poltava Oblast State Administration Eduard Reva.

## TASK 6: CARRY OUT AN EDUCATION AND INFORMATION CAMPAIGN ON INTRODUCTION OF LOCAL BIO-FUEL SOLUTIONS AND MULTIPLICATION OF BEST PRACTICES

All activities under Task 6 were accomplished and are presented below.

**LAESM developed and implemented a program for education and outreach activities in the Poltava Region.** LAESM held 27 informational events for local authorities, utility companies, local NGOs, public, and media to present the LAESM Project and raise awareness of renewable energy sources. The information events are listed in the grid below.

2013		
No	Date /City	Event
1.	July 12, Poltava	Kick off meeting of the USAID LAESM Project in Poltava Region
2.	September 13, Myrhorod	Meeting of the municipal Coordination Group
3.	October 1, Poltava	Meeting of the regional Coordination Group
4.	November 27, Myrhorod	Meeting of the municipal Coordination Group
5.	December 17-18, Poltava	Presentation of the Report “Heat energy production from biomass: analysis of legislation, regulations and taxation. Recommendations on the necessary changes in the current legislation and for the implementation of the pilot project in Myrhorod”

2014		
5.	February 5, Poltava	Meeting of the regional Coordination Group
6.	April 30, Poltava	Meeting of the regional Coordination Group
7.	June 11, Poltava	TV Forum on the use of the alternative energy sources for heat energy generation in the municipal district heating systems (Poltava Regional TV and Radio Company "Ltava")
8.	June 12-13, Myrhorod	Meeting to discuss the progress of the USAID LAESM Project
9.	June 17, Poltava	Media briefing "Alternative energy sources in the municipal heating system of Poltava Region"
10.	August 5, Poltava	Expanded meeting of the regional Coordination Group
	September 10, Myrhorod	Opening of the Resource and Logistics Center for Bioenergy Development
11.	September 11-12, Poltava	Workshop for media "Media about alternative sources of energy"
12.	November 18, Poltava	Meeting of the regional Coordination Group
13.	December 17, Poltava	Round Table "Creation of the market for attracting private investments into substitution of natural gas with alternative and renewable energy sources based on the PPP arrangements"
2015		
14.	March 31, Myrhorod	Round Table "Creation of the market for substitution of natural gas with the locally available biomass in the Myrhorod and Velyka Bahachka Rayons of Poltava Region"
15.	April 23, Lubny	Round Table "Creation of the market for substitution of natural gas with the locally available biomass in the Lubny Rayon of Poltava Region"
16.	May 13, Velyka Bahachka	Presentation for stakeholders on the bio-energy development opportunities in the Velyka Bahachka Rayon of Poltava Region
17.	May 13, Poltava	Round Table "Creation of the market for substitution of natural gas with the locally available biomass in the City of Poltava"
18.	June 9, Poltava, Karlivka	Meeting on creation of the favorable environment for bioenergy projects
19.	July 27, Myrhorod	Two focus groups with representatives of the building committees and street initiative groups of the locals for measuring their attitudes to alternative energy sources and, specifically, local biomass
20.	August 5, Myrhorod	Public Forum "Heat energy generation from bio-fuels in the municipal district heating systems"
21.	September 18, Myrhorod	In the framework of the Sustainable Energy Days, two EE lessons for the 2 <sup>nd</sup> and 5 <sup>th</sup> forms students of school #3 were given and information materials disseminated
22.	September 18, Myrhorod	In the framework of the Sustainable Energy Days, the graffiti contest was organized
23.	October 27, Myrhorod	Grand opening of the reconstructed boiler house and central straw storage facility
24.	November 23, Poltava	TV Forum "Bio-fuel in the municipal district heating systems: best practices of Myrhorod"
25.	November 24, Poltava	Public event to present the main results and achievements of the LAESM Project in Poltava Oblast
26.	November 24, Myrhorod	Public Forum "Biofuel in the municipal district heating systems". Presentation of the LAESM Project documentary "Source of heat energy that will change Ukraine to the better"
27.	November 30, Kyiv	Presentation of the main results and achievements of the LAESM Project. Presentation of the LAESM Project documentary "Source of heat energy that will change Ukraine to the better".

**LAESM prepared information and promotion materials (electronic, paper, video) on best practices of the LAESM Project.** The information and promotion materials are listed in the grid below.

Information and promotion materials	Remarks
<b>2014</b>	
<b>Leaflets</b> <b>1. Alternative to natural gas: biomass as a source of energy.</b> <b>2. Bio-fuel from biomass: problems and opportunities.</b> <b>3. Alternative sources of energy and environment.</b> <b>4. Economic aspects pertinent to the use of alternative sources of energy in municipal heating systems.</b> <b>5. What media should know about bioenergy.</b>	Total of 2320 copies were disseminated at public and training events, including 1000 copies each which were provided to the RLC in Myrhorod.
<b>Articles</b> <b>1. Technical aspects pertinent to the implementation of the USAID LAESM Project in Myrhorod.</b> <b>2. Environmental aspects pertinent to the implementation of the USAID LAESM Project in Myrhorod.</b>	The articles were placed on the websites of Myrhorod City Council and of the Municipal Development Institute.
<b>2015</b>	
<b>Pocket calendars</b>	LAESM produced two types of pocket calendars. 1000 copies each were disseminated at public events, including 200 calendars sent to the Resource and Logistics Center in Myrhorod.
<b>Leaflet “Heat energy from the alternative energy sources in Myrhorod”</b>	3000 copies (500 copies disseminated during public events and among members of the building committees in Myrhorod; 2000 copies provided for the Resource and Logistics Center in Myrhorod).
<b>Brochures</b> <b>1. Use of biomass for heat energy generation in the municipal district heating systems.</b> <b>2. Biomass in the agro-business.</b> <b>3. Technical solutions proposed under the USAID LAESM Project in Myrhorod.</b> <b>4. For children about heat from straw.</b> <b>5. Bio-fuel project in Myrhorod: ensuring support from the public.</b> <b>6. Best bioenergy projects practices.</b>	Total of 4000 copies of the brochures were produced. The brochures were disseminated at public events; 70% of the brochures was provided to the Resource and Logistics Center in Myrhorod.
<b>Outdoor advertisement</b> <b>Three types of posters were designed for placement on the big boards in Myrhorod.</b>	Big board locations: 10, Gogol St.; 60, Gogol St.; 260, Sorochinska St.
<b>Manual “Bioenergy projects: from initiation to implementation”</b>	LAESM produced 500 copies of the Manual. LAESM disseminated the Manual at public events and to project partners, including 100 copies provided for the Resource and Logistics Center in Myrhorod.
<b>Documentary “Source of energy that will change Ukraine to the better”</b>	LAESM produced the 45-minutes documentary about the LAESM Project to promote substitution of natural gas with local biomass in municipal district heating systems. The documentary was broadcast by the Regional

TV and Radio Company “Ltava”, TV and Radio Company “Myrhorod” and during public events in Myrhorod.

The documentary is available on YouTube:  
<https://youtu.be/Fcez5FrwCEY>

**LAESM carried out an Information Campaign to increase awareness of the population of Myrhorod of the pilot bio-fuel boiler project and bioenergy development in the region.** 16 public events were undertaken to promote clean energy (renewables) and institutionalize a public participation process.

Following 30 interviews with the local population of Myrhorod carried out in 2013 and a TV Forum on substitution of natural gas with local biomass (191 telephone calls from the residents of Poltava City and Poltava Region – 22% of supporters of the shift to clean energy production), LAESM understood that the extensive information effort was required to increase the awareness of the local population of the renewable and alternative energy sources and bioenergy development. In addition to the information events for stakeholders, LAESM held two TV Forums (June 2014, November 2015) with support from the Poltava Region TV and Radio Company “Ltava” and a Public Forum in Myrhorod (August 2015) to promote the shift to the alternative energy sources for heat energy generation in the municipal district heating systems.



TV Forum “Bio-fuel in the municipal district heating systems: best practices of Myrhorod” (November 2015, Poltava Regional TV and Radio Company “Ltava”).



Public Forum “Heat energy generation from bio-fuels in the municipal district heating systems” (August 2015, Myrhorod).

With the aim of measuring public understanding and acceptance of the substitution of natural gas with biomass in the municipal district heating systems, LAESM held public opinion surveys. In August 2015, LAESM conducted two focus groups with 23 respondents (including 20 women). At the same time, 766 respondents completed the questionnaires independently or went through the questionnaire together with the interviewers.

Based on the results of the survey, LAESM adjusted the Information Campaign tools in order to eliminate myths and stereotypes and develop the energy efficient way of thinking for the locals. In November 2015, LAESM conducted another survey with 785 respondents.

The results of the second public opinion survey proved the effectiveness of the LAESM Project Information Campaign: percentage of supporters to the partial substitution of natural gas with renewable and alternative energy sources for heat energy generation in the municipal heating systems increased from 44% (August 2015) to 56% (November 2015).

The results of the LAESM Project Information Campaign are presented in the grid below.

Indicator	August 2015	November 2015
Percentage of supporters to the partial substitution of natural gas with other energy sources in the municipal heating systems	44%	56%
Percentage of the local population of Myrhorod who support partial substitution of natural gas with other energy sources for heat energy generation in the heating system of Myrhorod	41%	57%
Percentage of the local population of Myrhorod who are aware of the reconstruction of one of the gas boiler houses in Myrhorod and installation of the multi-fuel bio-boiler for heat energy generation	47%	77%
Percentage of the Myrhorod people who support the ideas and activities of the LAESM Project	32%	46%
Percentage of the Myrhorod people who have positive expectations from the use of bio-fuels in the centralized heating systems that, in the long run, would reduce Ukraine's energy dependence on natural gas exporters	27%	36%
Percentage of the local population of Myrhorod who overall have positive expectations from the use of the bio-fuels in the centralized heating systems for reducing CO2 emissions into the atmosphere	25%	34%

## 4. COST-SHARING

Total cost-share for the project is \$385,213.45 or 35.5% of USAID funds spent for the implemented sites (\$1,084,341.33) and is presented in the grid below.

Category	Planned Reporting Period Expenditures, USD	Total Obligated Amount, USD	Reporting Period Expenditures, (January - November 15), USD	Cumulative Expenditures as of 11/30/15, USD	Remaining Agreement Amount as of 11/30/15, USD
Construction / Equipment of Demonstration Projects	\$ 971,954.49	\$ 1,087,349.00	\$ 1,039,299.55	\$ 1,084,341.33	\$ 3,007.67
<b>Total Award Amount (USAID funding)</b>	<b>\$ 1,384,112.53</b>	<b>\$ 1,965,000.00</b>	<b>\$ 1,384,110.30</b>	<b>\$ 1,964,996.85</b>	<b>\$ 3.15</b>
<b>Cost Share (Partner Contribution)</b>	<b>\$ 293,341.92</b>	<b>\$ 300,000.00</b>	<b>\$ 378,555.37</b>	<b>\$ 385,213.45</b>	<b>\$ (85,213.45)</b>
<b>Total Program Costs</b>	<b>\$ 1,677,454.45</b>	<b>\$ 2,265,000.00</b>	<b>\$ 1,762,665.67</b>	<b>\$ 2,350,210.30</b>	<b>\$ (85,210.25)</b>

The contribution from the local partners, monetary and in-kind, included:

- Procurement of three new gas-fired Kolvi boilers and three gas burners for the boilers was financed by Poltava Oblast State Administration and Myrhorod City Council who allocated UAH 300 000 and UAH 200 000 respectively.
- Procurement of a forklift loader and two dry meters for the operating storage facility was financed by Myrhorod City Council. (\$39,000.00 and \$1,168.75 respectively).
- Myrhorod Heating Company “Myrhorodteploenergo” performed the dismantling of the obsolete gas-fired boilers during boiler house reconstruction. (\$11,460.00).

- Capital Development Department of Poltava Oblast State Administration conducted engineering supervision during boiler house reconstruction (\$17,128.49).
- Myrhorod City Council allocated a land plot (0.25 hectares) from the municipal lands for construction of two annexes adjunct to the existing storage building of the central storage facility (\$143,620.13).
- Public Utility Company “Spetscomuntrans” allocated a storage building to which two annexes were attached during central storage reconstruction. “Spetscomuntrans” also executed part of the repair works in the existing storage building and preparatory works on the territory where two annexes were built (\$92,341.25).
- Myrhorod City Council co-financed establishment of the Resource and Logistics Center in Myrhorod and paid utility bills and salaries for the Center’s staff (two persons) (\$14,484.03).

## 5. ENVIRONMENTAL COMPLIANCE

Per ODP DGP IEE FY0813 and DCN: 2014-UKR-014 and DCN: 2015-UKR-008, the project prepared an Environmental Review Checklists (ERC) and Environmental Monitoring and Mitigation Plan (EMMP) for each project site and got USAID Agreement Officer Representative (AOR), Mission Environmental Officer (MEO) and Bureau Environmental Officer (BEO) approvals prior to the works at any site.

Per A.10.6 clause of the Cooperative Agreement, the activities at the sites in Myrhorod were monitored on a regular basis. The subcontractors selected by LAESM to execute reconstruction executed the works in accordance with the approved ERCs.

AOR, MEO and BEO visited project sites for environmental compliance and monitoring the project activities.

## 6. DESCRIPTION OF UNMET TARGETS AND REASONS FOR NOT MEETING THEM

All targets of the USAID LAESM Project were met:

1. Pilot bio-boiler project prepared and implemented.
2. Infrastructure for biomass harvesting, transportation from the field, storage, and supply for the bio-boiler established.
3. PPP framework prepared for investors in bio-fuel energy in Poltava Region.
4. Conditions for introduction of a network of bio-fuel burning plants in Poltava Region and a large scale substitution of natural gas with local biomass prepared.
5. Stakeholders are aware and have access to knowledge on best practices of use of local biomass for energy production.

## 7. ISSUES AND PROBLEMS THAT EMERGED DURING PROGRAM IMPLEMENTATION AND LESSONS LEARNED IN DEALING WITH THEM

1. **Cadre shifts at the local level, and especially at Poltava Oblast State Administration in 2014 resulted in the delayed commitments from the Administration regarding co-financing of the pilot bio-boiler project**

Changes in the political situation in Ukraine resulted in new nominations in Poltava Oblast State Administration: a new Governor Victor Buhaichuk was appointed. It was important for the LAESM Project to have the confirmation of Poltava Oblast State Administration’s commitments regarding co-financing of the pilot bio-boiler project which were articulated and confirmed by the previous Governor. LAESM held

working meetings with partners and public events to increase awareness of stakeholder of the goals and tasks of the LAESM project and its importance for Ukraine's energy independence. As a result of the extensive effort of the LAESM project, supported by USAID/Ukraine, Poltava Oblast State Administration had taken a decision to co-finance the pilot project in the amount of UAH 300 000 (a corresponding resolution taken by the 23rd session of Poltava Oblast Rada on June 27, 2014). Myrhorod Municipality had allocated UAH 200 000 (a resolution taken by the 44th session of Myrhorod City Council on June 27, 2014).

Some changes occurred also in the Oblast Coordination Group on Monitoring the Implementation of the LAESM Project in Poltava Region. In October 2014, the Head of the Oblast Coordination Group Olena Adamovych underwent lustration. The First Deputy Governor of Poltava Oblast Oleg Pruhlo was appointed as the Head of the Oblast Coordination Group. This change in the Coordination Group did not affect the implementation of the LAESM Project.

**2. In quarter 4 of 2014, boiler house Phase I reconstruction works were delayed because of the delayed supply of the new gas boilers.**

The tender on procurement of the new gas boilers was conducted by Myrhorod Heating Company with co-financing from Poltava Oblast State Administration. The tender on procurement of gas burners was conducted by the Capital Development Department of Poltava Oblast State Administration with financing from Myrhorod City Council. By mistake Myrhorod Heating Company procured Kolvi-1000 boilers instead of KCBa-1.0 ECO boilers which were planned in the Environmental Review Checklist (ERC) on boiler house reconstruction. Since both types of gas-fired boilers have similar technical specifications, it was decided to install Kolvi-1000 gas boilers and not to amend the ERC document.

This resulted in the delayed completion of the construction and assembly works under Phase I which would have been completed within one month following the supply of the new gas-fired boilers. The Phase I completion timeframe was set in the LAESM Project Work Plan 2015 as January 1, 2015 – February 15, 2015. Since the new gas boilers were supplied on January 19, 2015, and two more weeks were required for starting-up and adjustment and test works, the deadline for Phase I completion was extended to March 15, 2015.

**3. Design documentation of the central storage reconstruction (regarding the fire extinguishing system) had to be revised and amended to reflect the technical comments received from the national expertise bodies and concerns received from the locals whose vegetable gardens are located in immediate proximity to the central storage facility.**

The Environmental Review Checklist (ERC) on reconstruction of the central storage facility and construction of two annexes for keeping bio fuel in Myrhorod, Poltava Oblast, was prepared during the period of January – April 2015 and approved by USAID on May 12, 2015. The design documentation on central storage reconstruction was prepared during the same period as the ERC and submitted to the state technical expertise institution "Ukrderzhbudekspertiza" at the beginning of June 2015. Following technical expertise of design documentation and based on the comments received from relevant technical expertise bodies and on concerns received from the locals whose vegetable gardens are located in immediate proximity to the central storage facility, areas for improvement of the proposed fire extinguishing system were identified and solutions proposed.

Since capacity of fire reservoirs (50+50 m<sup>3</sup>) allows for having only minimum required quantity of water for fire extinguishing inside the storage facilities, it was proposed to connect fire hydrants to the municipal water network to ensure necessary water supply for fire extinguishing purposes in case of a fire. Myrhorod Utility Company "Spetscomuntrans" had a permit for laying water supply pipes and additional water consumption for fire safety purposes.

The revised design documentation required relevant changes in the ERC on the central storage reconstruction. An Amendment to the ERC #DCN: 2015-UKR-008 (part A6.4 Arrangement of a fire extinguishing system) was prepared. The Amendment was approved by USAID on August 10, 2015. The Ukrainian version of the Amendment to the ERC was distributed to the local partners and relevant subcontractors.

## 8. COMMENTS AND RECOMMENDATIONS REGARDING UNFINISHED WORK AND/OR FUTURE NEEDS AND DIRECTIONS FOR ASSISTANCE IN UKRAINE

According to the research LAESM conducted in 2013, energy potential of biomass is over 19 million tons of fuel oil equivalent and can make Ukraine independent of the imported natural gas that is used as a fuel in the municipal district heating systems. The economic potential of grain straw is 3.2 mln tons of fuel oil equivalent, or 17% of the biomass energy potential.

LAESM prepared and implemented the pilot bio-fuel project in the framework of which the existing gas boiler house was reconstructed and the multi-fuel boiler installed and the infrastructure for bio-fuel harvesting, transportation from the field, storage, and delivery to the bio-boiler was established. This experience has become the best practice for Ukraine since LAESM showed that such projects are feasible and implementable. The reconstructed facilities, boiler house and central storage facility, are open for the representatives of the entities willing to initiate a bio-energy project and use straw as a bio-fuel for heat energy production. In addition, information and training materials, including the Manual “Bioenergy projects: from initiation to implementation”, are available.

At the same time, it is worth mentioning, that straw is not the type of bio-fuel that is available and can be used in all regions of Ukraine. Southern and central parts of Ukraine are noted for the significant potential of corn waste products (stalks, corncobs) that makes 3.1 mln tons of fuel oil equivalent, or 16.3% of the energy potential of biomass in Ukraine. Presently, such type of bio-fuel is not used for energy purposes at all. There are plenty of lands in the western and northern parts of Ukraine which cannot be used for agricultural purposes and could be used for energy crops. In Ukraine, energy potential of willow, poplar, silver grass, etc. exceeds 4.4 mln tons of fuel oil equivalent, or 22.3% of the energy potential of biomass in Ukraine.

Ukraine needs further support regarding reconstruction of the existing gas boiler houses and heat stations and installation of bio-boilers which use corn waste products (stalks, corncobs) and other energy crops as a bio-fuel and establishment of the logistics infrastructure on bio-fuel supply for the bio-boilers. For such bio-energy projects best international practices can be used since such projects have never been implemented in Ukraine and no experience, best practices and lessons learned are available.

LAESM believes that in view of the forthcoming decentralization support for the existing local bio-energy initiatives could be the second area for donor assistance. Decentralization will bring the growing concern of local and regional power bodies about bio-energy development that in its turn will result the increased financial resources earmarked for bio-energy projects. At the same time, there is a gap between the knowledge and experience required for bio-energy projects implementation and that available at the local level. The stakeholders knowledge needs assessment conducted in the framework of LAESM revealed that local stakeholders needs substantial support and assistance regarding:

- preparation of 1) feasibility studies, including justification of the most effective technical and infrastructure solutions on the use of the local biomass for heat and electric energy production in municipalities; 2) Business Plans for financing bio-energy projects from IFI loans; 3) package of documents for bioenergy PPPs;
- training for 1) agroproducers in the technologies and equipment pertinent to bio-fuel harvesting, including corn and sunflower waste products to be used as a bio-fuel; 2) local authorities in working with public and promoting bio-energy technologies through the resource and logistics centers creation of which is a “must” for each municipality willing to implement bio-energy projects.

## 9. DELIVERABLES

The list of deliverables produced during the period of June 1, 2013 – November 30, 2015 is presented below.

#	Deliverables
1.	List of laws and normative documents which govern production of heat energy from renewable sources of energy and alternative fuels
2.	Report on the Stakeholders' Knowledge Needs Assessment in the Sphere of Using Alternative Sources of Energy (biomass)
3.	Report "Legal and regulatory assessment of current legislation, taxation policy, and regulations governing the use of alternative sources of energy. Recommendations for changes in legislation and facilitation of implementation of a pilot project in Myrhorod"
4.	Report on presentation of the legal and regulatory assessment of current legislation, taxation policy, and regulations governing the use of alternative sources of energy, and recommendations for changes in legislation and facilitation of implementation of a pilot project in Myrhorod
5.	Report "Research, preparation of recommendations and an action algorithm for the entities that intend to implement projects on production of heat and electric energy from biomass (with the use of the "Green" tariff)" (2014)
6.	Report "Legal and regulatory assessment of current legislation, taxation policy, and regulations governing the use of alternative sources of energy. Recommendations for facilitation of implementation of a pilot project in Myrhorod" (2014)
7.	Overview of amended legislation pertinent to heat energy production from biomass (2014)
8.	Memorandum on changes in natural gas prices and heat energy tariffs in 2014 and forecasts on the further changes.
9.	Legal and OEG Sector Updates for the period October 1, 2014 – November 30, 2015
10.	Analysis of recent amendments to legislation regarding substitution of natural gas with alternative fuels in the heating sector
11.	Report on the meeting with Myrhorod Heating Company "Myrhorodteploenergo" and Myrhorod City Council to discuss tariff setting for boiler houses which use solid fuel for production of heat energy
12.	Letter to the Anti-Monopoly Committee of Ukraine regarding the interrupted gas supply to the boiler house on 8, Spartakivsky Prov.
13.	Letter to the Governor of Poltava Oblast regarding the interrupted gas supply to the boiler house on 8, Spartakivsky Prov.
14.	Draft law "On changes to the Law of Ukraine "On heat supply"
15.	Draft GOU Decree "On changes to the GOU Decree 869 dated June 1, 2011"
16.	Package of documents prepared for "Myrhorodteploenergo" for obtaining a license for heat energy production at heat and power plants, thermal power stations, nuclear plants, cogeneration plants and from unconventional and renewable sources of energy
17.	Scan copy of the license on heat energy production at heat and power plants, thermal power stations, nuclear plants, cogeneration plants and from unconventional and renewable sources of energy. The license was issued for "Myrhorodteploenergo" (license #2609 dated October 22, 2015).
18.	Report on energy potential of Myrhorod Rayon and assessment of the available calculation methodologies
19.	Report on the market research on energy potential of biomass (straw) stock in Myrhorod Rayon of Poltava Region
20.	Catalogue of Agriculture Enterprises of Myrhorod Rayon
21.	Agro-economic Atlas of Myrhorod Rayon of Poltava Oblast (2014)
22.	Four MOUs between LAESM project and agro-enterprises of Myrhorod Rayon of Poltava Region (Private Entrepreneur Pas'; Private Entrepreneur Yurchenko; Zorya-Agro, Ltd.; Kvar, Ltd. )

23.	RLC documents prepared by MDI and agreed with Myrhorod Municipality: a Concept, regulations governing operations of RLC, and a draft of the resolution to be passed by Myrhorod City Council
24.	Resolution of Myrhorod City Council “On establishment of the Resource and Logistics Centre for Development of Bioenergy” #15 of December 19, 2013
25.	MOU between LAESM Project and Myrhorod Municipality regarding location of a central storage facility
26.	A Memorandum about the preparatory work regarding the establishment of the Resource and Logistics Centre with the Annex “Report about the Preparatory Work Regarding the Establishment of the Resource and Logistics Centre for Bioenergy Development in the Framework of Implementation of the Pilot Bio-Boiler Project of the USAID Project “Local Alternative Energy Solutions in Myrhorod (LAESM)”
27.	Report on the analysis of the quality of straw as of a solid bio-fuel
28.	A comprehensive feasibility study report on infrastructure solutions, including SWOT-analysis
29.	Presentation on “Assessment and development of infrastructure solutions for municipal bioenergy projects in Myrhorod Rayon of Poltava Oblast”
30.	Report “Justification of the cost of straw and the use of straw ashes as a fertilizer. Part I. Analysis of how mineral fertilizer can be a substitute for straw in growing grain crops”
31.	Memorandum on the location of the central straw storage facility and corresponding justification
32.	Memorandum regarding the approval of furniture that will be procured for the Resource and Logistics Center for Bioenergy Development of Myrhorod Municipality
33.	Memorandum on approval of the renovation materials costs for the Resource and Logistics Center for Bioenergy Development of Myrhorod Municipality (approved on June 24, 2014)
34.	Agreement on charitable assistance between MDI and Myrhorod Municipality (P-01-13/06 dated June 27, 2014) for procurement of furniture and office equipment, and renovation materials for the Resource and Logistics Centre for Bioenergy Development of Myrhorod Municipality
35.	ERC for Establishment of the Resource and Logistics Center for Bioenergy Development (including an email copy of the approval, and certification of no adverse or significant effects on the environment (with signatures)
36.	Memorandum on justification of the need to procure bio-fuel (straw) to ensure the uninterrupted operation of the pilot bio-fuel boiler (that will be installed at the pilot gas boiler house as a result of its reconstruction) during March – July 2015
37.	Overview of the best international practices regarding the use of biomass ashes. Recommendations on the use of straw ashes from the pilot bio-fuel boiler by agro-enterprises of Poltava Oblast
38.	Letter from Myrhorod City Council where the latter, as the LAESM Project Recipient, confirms that the furniture, office equipment, and reconstruction materials procured from the LAESM Project funds for the Resource and Logistics Center, are registered on the balance sheet of Myrhorod City Council
39.	Certificate on completion of reconstruction works at RLC (works financed by Myrhorod City Council)
40.	Report on opening of the Resource and Logistics Center for Bioenergy Development (Myrhorod, September 10, 2014) (including a media notice, a press-release, talking points, and a scene setter, a success story).
41.	Report on ecological monitoring of the repair works in the premises of the Resource and Logistics Center (certification on the environment friendly repair materials; waste removal, etc.)
42.	Memorandum on location of the central straw storage facility on the territory of the Utility Company “Spetscomuntrans”
43.	Memorandum on procurement of bio-fuel (straw) to ensure the uninterrupted operation of the pilot bio-fuel boiler in Myrhorod
44.	Marketing report “Marketing analysis and justification on equipment and machines selected for the logistics chain “straw harvesting – transportation - storage”

45.	Report “Statement on selection of machines and equipment that will be used for creation of the infrastructure to supply solid fuel to the pilot bio-boiler on 8, Spartakivsky Prov. in Myrhorod”
46.	Memorandum of Understanding and Cooperation regarding the central straw storage facility between the LAESM Project, Myrhorod City Council, and “Spetscommuntrans” Utility Company
47.	Resolution of Myrhorod City Council on land allocation for the central storage facility (No. 17 dated October 17, 2014)
48.	RFQ of the tender for selection of a design company that would prepare design and estimation documentation for the central straw storage facility
49.	The tri-lateral agreement for preparation of design documentation for reconstruction of the central straw storage facility between MDI, the Entrepreneur Sopilnyak O.V., and Capital Development Department of Myrhorod City Council (December 30, 2014)
50.	ERC for reconstruction of the central straw storage facility for organization of a biofuel supply system in Myrhorod, Poltava Oblast
51.	Memorandum of Understanding and Cooperation regarding transport and equipment necessary for the transport and logistics infrastructure of the pilot bio-boiler project was signed between MDI, Myrhorod City Council, and “Spetscommuntrans” Utility Company (signed on November 24, 2014)
52.	A concept of the public-private partnership for straw harvesting and preparation of straw bales
53.	Expertise of market price of the total land used by the Utility Company “Spetscomuntrans”.
54.	Expertise of market price of the existing garage storage building owned by the Utility Company “Spetscomuntrans”
55.	Expertise of market price of the additional land plot the Utility Company “Spetscomuntrans” allocated for central storage facility
56.	Decree #53 of Myrhorod City Council on approval of the land management design for the land plot of 1535 m <sup>2</sup> dated February 13, 2015
57.	Decree #17 of Myrhorod City Council on approval of development of the land management design for the land plot of 0.25 hectares dated October 10, 2014
58.	Extract from the State Land Cadastre for the land plot of 1535 m <sup>2</sup>
59.	Extract from the State Cadastre on the additional land plot of 1535 m <sup>2</sup>
60.	Request for Quotes (RFQ) for selection of a subcontractor to reconstruct the central straw storage facility
61.	Structural and organizational solutions for private sector participation in development of the infrastructure for the uninterrupted supply of bio-fuel in the framework of the LAESM Project
62.	ERC for central storage reconstruction and construction of two annexes for keeping bio fuel in Myrhorod of Poltava Oblast
63.	Ukrainian version of the ERC for central storage reconstruction and construction of two annexes to keeping bio fuel in Myrhorod of Poltava Oblast
64.	Design and estimation documentation for central storage reconstruction
65.	Approval for design and estimation documentation – a statement from relevant authorities
66.	Declaration on the start of central storage facility reconstruction works (submitted by the Customer)
67.	Amendment to the ERC on central storage reconstruction
68.	Quarterly monitoring report on reconstruction of the central storage facility
69.	Model contract on purchase of large straw bales
70.	Model contract on purchase of straw from the agro-producer in the field
71.	Two straw price calculation files
72.	Draft of the Memorandum on creation of the Reserve Fund at “Myrhorodteploenergo”
73.	Report on available engineering solutions for energy production from solid bio-fuel
74.	Report on technical and environmental aspects of pilot bio-fuel project with analysis of potential locations and their use for the bio-fuel project
75.	Report on a pre-construction research (a feasibility study) regarding the selection of the best scenario of the bio-boiler installation on 8, Spartakivsky Provulok in Myrhorod

76.	Environmental Impact Assessment: Reconstruction of the existing gas boiler house and installation of a bio-boiler that would use straw as an alternative bio-fuel in Myrhorod, Poltava Region
77.	Report “Reconstruction of the existing gas boiler house on 8, Spartakivsky Provulok in Myrhorod, Poltava Oblast. Installation of a bio-boiler that would use straw as a bio-fuel. Town planning calculation. Engineering and economic data”
78.	A letter from Poltava Oblast State Administration about the Customer of design and estimate documentation (no. 052-05/311 dated February 17, 2014)
79.	A scanned copy of the trilateral agreement for preparation of the Environmental Impact Assessment and the Town Planning Calculation
80.	Town planning conditions and limitations for reconstruction of the gas boiler house on 8, Spartakivsky Prov. and installation of a bio-boiler that would use straw as an alternative fuel
81.	A questionnaire on fire and anthropogenic safety regarding location of the boiler house on 8, Spartakivsky Prov.
82.	Technical specifications necessary to start design works
83.	Report on a pre-construction research (a feasibility study) regarding the selection of the best scenario of the bio-boiler installation on 8, Spartakivsky Provulok in Myrhorod
84.	Request for Quotes (RFQ) for the development of design and estimate documentation for reconstruction of the gas boiler house on 8, Spartakivsky Prov.
85.	A trilateral agreement for preparation of design documentation was concluded between the Private Enterprise “Energobud” as a Performer, Department of Capital Development with Poltava Oblast State Administration as a Customer, and All-Ukrainian Charitable Organization “Municipal Development Institute” as a Benefactor (dated June 20, 2014)
86.	Extract from the State Register of Property Rights for Immovable Property and Other Property Rights regarding the land plot where the pilot bio-boiler project will be implemented (8, Spartakivsky Prov.)
87.	Full package of specifications and permits necessary to develop design documentation and to start reconstruction works at the gas boiler house on 8, Spartakivsky Prov.
88.	ERC for reconstruction of the gas boiler house
89.	Ecological monitoring plan
90.	State expertise statement on design documents for Phase I of the gas boiler house reconstruction works
91.	Design documentation on boiler house reconstruction
92.	A tri-lateral agreement on Phase I gas boiler house reconstruction (signed between the Department of Capital Development of Poltava Oblast State Administration, “ECOTEP” Firm”, Prime Contractor, and MDI)
93.	Technical documentation on the foundation (inspection report, working drawing of the foundation, pictures)
94.	Quarterly monitoring report on boiler house reconstruction
95.	Letter to the First Deputy Governor of Poltava Oblast O. Pruhlo requesting assistance regarding boilers registration and facilitation of start and adjustment works
96.	Minutes of the stakeholder and subcontractor meeting (August 28, Poltava)
97.	Report “Assessment of existing models (options, forms) of private sector participation in bio-fuel projects. Analysis of risks and risk sharing options between partners of PPPs considering risk minimization. Identification of conditions of PPPs”
98.	PPP Assessment Report Presentation (prepared by Ukrainian Public-Private Partnership Development Support Center)
99.	Report on the Round Table “Market conditions for private sector participation in projects providing for substitution of natural gas with alternative and renewable sources of energy under public-private partnership arrangements” held on December 17 in Poltava
100.	Letter from the Oblast Heating Company “Poltavaoblteploenergo” regarding biomass potential assessment in Poltava Oblast (dated January 14, 2015)
101.	Cooperation proposal from Karlivka Rayon State Administration

102.	Report on the Round Table “Creation of favorable conditions for implementation of bio-energy projects in Myrhorod Rayon and in Velyka Bahachka Rayon of Poltava Oblast” (March 31, 2015, Myrhorod), including a media notice and a press-release
103.	Report on the Round Table in Lubny (April 23)
104.	Report on the PPP meeting in Velyka Bahachka (May 13)
105.	Report on the PPP meeting in Poltava (June 9)
106.	Report on PPP meeting in Karlivka (June 9)
107.	Letter from the Head Doctor of Karlivka Central Rayon Hospital to special committees of Karlivka Rayon Council to initiate a discussion on construction of a bio-fuel boiler house to produce heat energy for the hospital on a concession basis
108.	Report on the working meeting and presentation in Karlivka
109.	Draft of the decree of Karlivka Rayon Council regarding concession of municipal facilities
110.	Draft of a concession proposal
111.	Action plan on a concession tender
112.	Letter to Poltava Oblast State Administration requesting support to the LAESM Project in collection of information about Poltava Oblast municipalities that have centralized heating systems
113.	Questionnaire distributed to the municipalities of Poltava Region
114.	Report “Identification of potential boiler houses in Poltava Oblast where locally available solid biomass can be used for production of heat energy”
115.	Analysis of municipalities with centralized heating systems
116.	Analysis of boiler houses
117.	Analysis of heat generators
118.	Final report on technical solutions regarding installation of bio-boilers in Myrhorod, Velyka Bahachka, Lubny, Poltava, and Karlivka
119.	MOU between MDI and Myrhorod Heating Company to attract investment for bioenergy projects providing for substitution of natural gas with local biomass at two gas fired boiler houses of Myrhorod Heating Company (located on 181, Gogol Str. and 80, Shishatska Str.)
120.	MOU between MDI and Myrhorod City Council on preparation of feasibility studies on heat generating plants producing heat energy for public buildings of Myrhorod: School #1 and Center for Esthetic Education
121.	Report on the working meeting in Myrhorod discuss selection of facilities in Myrhorod, preparation of a Business Plan, and applying for financing from NEFCO
122.	MOU regarding establishment of a PPP for implementation of bioenergy projects between MDI and Karlivka Rayon State Administration
123.	Package of documents prepared under the feasibility study that is part of design and estimation documentation for reconstruction of the boiler house on 80, Shishatska St. in Myrhorod
124.	Report on meetings with potential investors (NEFCO, GIZ, Demo-Ukraine Foundation, Germany – Ukraine Foundation, Swiss Cooperation Agency, Megabank, Procreditbank, and Active Energy Company) to finance bio-energy projects in Myrhorod
125.	Business Plan on the bio-energy project for school #1 in Myrhorod
126.	Draft of the application from Myrhorod City Council to NEFCO to finance installation of the new heat generating plants for school #1
127.	Prefeasibility study on reconstruction of a boiler house operated by Poltava Heating Company and located on 35, Kahamlyk Str. in Poltava
128.	Pre-feasibility study on reconstruction of boiler houses and installation of bio-boilers on 9, Industrialna Str. and 45, Osypenko Str. in Lubny
129.	Pre-feasibility study on reconstruction of two gas boiler houses (19a, Lenin Str. and 6a, Lenin Str.) in Velyka Bahachka
130.	Brochure “Biomass as alternative to natural gas”
131.	Brochure “Biomass and ecology”
132.	Brochure “Biofuel from biomass”

133.	Brochure “Biomass and economy”
134.	Brochure “Writing about biomass”
135.	Brochure “What source of energy we choose in Myrhorod?”
136.	Public Information and Awareness Plan on Renewables and Project Activities in the Region
137.	Information Materials Dissemination Plan (Quarters I-II of 2014)
138.	Brochure “Biomass as alternative to natural gas”
139.	Brochure “Biomass and ecology”
140.	Brochure “Biofuel from biomass”
141.	Brochure “Biomass and economy”
142.	Brochure “Writing about biomass”
143.	Brochure “What source of heat energy we choose in Myrhorod?”
144.	Materials on the TV Forum in Poltava (June 11, 2014): media notice, press-release, report on the TV Forum
145.	Materials on the media briefing “Poltava Oblast to become the first region in Ukraine that would heat residential buildings with the use of alternative sources of energy” (held on June 17, 2014): media notice, press-release, media briefing report, presentation “Local biomass in municipal heating systems of Poltava Region. USAID Project “Local Alternative Energy Solutions in Myrhorod”
146.	Article “Use of Alternative Sources of Energy: Ecological Aspects”
147.	Article “Implementation of the USAID Project “Local Alternative Energy Solutions in Myrhorod”: Technical Aspects”
148.	Plan of dissemination of the information tools and reports prepared under the LAESM Project tasks
149.	Report on public events held to increase awareness of the population of the pilot bio-fuel project of LAESM
150.	Materials on the workshop “Media about Alternative Energy Sources” delivered on September 11-12, 2014, in Poltava: media notice, press-release, presentations, workshop report
151.	Success story on opening of the Resource and Logistics Center in Myrhorod
152.	Report on participation in the Round Table “Natural Gas Replacement with Alternative and Renewable Energy Sources: from Investment Project Development to Implementation”
153.	Bill board location map – Myrhorod
154.	Report on the Sustainable Energy Days in Myrhorod (September 2015)
155.	Report on the survey for measuring awareness of the Myrhorod population of bio-fuels and alternative and renewable sources of energy (2015)
156.	Manual “Bioenergy projects: from initiation to implementation” (2015)
157.	Agroeconomic Atlas of the Myrhorod Rayon of Poltava Region (2015)
158.	Documentary “Source of energy that will change Ukraine to the better” (45 minutes; 2015)

# ATTACHMENTS

The following documents will be sent separately with the Final Report:

1. Project Monitoring and Evaluation Plan
2. Environmental Review Checklist (ERC) – Reconstruction of a Central Storage Facility and Construction of Two Annexes for Keeping Biofuel in Myrhorod, Poltava Oblast (DCN: 2015-UKR-008) - including Annex I – Record of compliance with activity specific Environmental Mitigation and Monitoring Plans
3. Amendment to the ERC DCN: 2015-UKR-008 (in part A6.4 Arrangement of a fire extinguishing system)
4. Environmental Review Checklist – Reconstruction of a Gas Boiler House and Organization of a Biofuel Supply System in Myrhorod, Poltava Oblast (DCN: 2014-UKR-2014), including Annex I – Record of compliance with activity specific Environmental Mitigation and Monitoring Plans
5. Environmental Review Checklist – Establishment of the Resource and Logistics Center for Bioenergy Development (DCN: IDEA ODP SIEE\_LAESM\_ND), including Annex I - Record of compliance with activity specific Environmental Mitigation and Monitoring Plans
6. Environmental Monitoring Report on renovation of the room of the Resource and Logistics Centre in Myrhorod (November 4, 2014)
7. Environmental Monitoring Report on central storage facility reconstruction (December 3, 2015)
8. Environmental Monitoring Report on boiler house reconstruction (December 1, 2015)

**U.S. Agency for International Development**

1300 Pennsylvania Avenue, NW

Washington, DC 20523

Tel: (202) 712-0000

Fax: (202) 216-3524