

**UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT**

**Enterprise Energy Efficiency - 3E**

***PILOT PROJECT PROPOSAL No. B3-2***  
***BIHAC CULTURAL CENTER COMPLEX***

**SITE VISIT REPORT**  
**AND**  
**PILOT PROJECT PROPOSAL EVALUATION**

**Zoran Morvaj**  
**Chief of Party**

Sarajevo, August 12, 2011

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# 1. Pilot Project Proposal Screening Report

<b>I Partners:</b>		
UNDP and Bihac municipality		
<b>II Proposed EE measures after USAID 3E analysis:</b>		
1. Thermal insulation of the outside walls and top floor ceiling	\$100,000	
2. Replacement of wood framed and repair of aluminum framed windows	\$65,000	
3. Installation of a biomass boiler, heating substation and distribution piping to adjacent buildings and repair of internal heating piping	\$170,000	
4. Monitoring and Verification System	\$15,000	
<b>Total cost of proposed EE measures</b>	<b>\$350,000</b>	
<b>III Co-funding contributions:</b>		
1. Direct co-funding from partner's own funds;	\$150,000	
2. Partner co-financing from borrowed funds;	0	
3. Other donors` co-funding:		
UNDP	\$100,000	
4. Provision of works and services (e.g., decommissioning of old equipment, installation of new equipment, design and supervision services, monitoring and verification (M&V));	0	
5. Provision of materials and equipment (e.g., piping, wiring, insulation material, control equipment); and	0	
6. Partnership with a private sector partner that might contribute any of above.	0	
<b>Total confirmed co-funding by partner/donors:</b>	<b>\$250,000</b>	
<b>IV Co-funding by USAID 3E:</b>		
<b>Total 3E Project co-funding based on best estimate:</b>	<b>\$100,000</b>	
<b>V Compliance with criteria for selection:</b>		
1. Replicability potential and relative ease of implementation;	0 - 12	10
2. Readiness and ability to put in place clear M&V procedures for reporting on post-implementation energy savings;	0 - 12	12
3. Appropriate geographic location, building type and types of technologies so that the total portfolio of 10 pilot projects when implemented demonstrates various EE measures, technologies and practices applied to different building types or EE practices and are located across the country;	0 - 24	20
4. Amount of co-financing for the pilot project that the partner is willing to or able to secure, or the amount of assistance the pilot project can obtain from other donors or private sector;	0 - 24	22
5. For the public sector - willingness to introduce energy management practices into other public buildings that are responsibility of the partner;	0 - 12	12
6. For municipalities - readiness to sign the EU Covenant of Mayors on EE;	0 - 4	4
7. For all – a willingness to support the raising of EE awareness of building users and citizens at large.	0 - 12	12
<b>Total:</b>	<b>100%</b>	<b>92%</b>
<b>VI Environmental Compliance:</b>		
Confirm that the pilot project implementation does not cause any environmental concerns or adverse environmental effects.	Yes	

## 2. Project evaluation summary

The Bihac Cultural Center Complex pilot involves three separate buildings: the Cultural Center, the Cantonal Museum and an Art School.

### 2.1 Basic data about the project:

- The project is to reduce thermal losses in the building, install a biomass boiler and connect adjacent buildings to the heating system
- The year of construction = 1960s
- The building is not thermally insulated
- Number of floors = Basement + 3 floors
- Heated area = 1,245 m<sup>2</sup>
- Heated volume = 5,230 m<sup>3</sup>
- Outside wall area = 1,107 m<sup>2</sup>
- Window area = 455 m<sup>2</sup>
- Number of operating days = Official heating season = 188 days
- Heating supplied by individual electric heaters
- Estimated annual heat energy consumption = 200 kWh/m<sup>2</sup> = 250 MWh<sup>1</sup>
- Estimated annual heating cost for the building = 38,000 KM (\$29,000)
- Estimated annual heating cost for Cantonal Museum and the Art School (14,000 KM (90 MWh) electricity and 8,000 KM firewood) = 22,000 KM (\$17,000)

### 2.2 Recommended measures:

1. Thermal insulation of the outside walls and top floor ceiling
2. Replacement of wood framed windows and repair of aluminum framed windows
3. Installation of a biomass boiler, heating substation and distribution piping to adjacent buildings and repair of internal heating piping
4. Installation of a Monitoring and Verification System

### 2.3 Rationale:

1. The façade is made of 35 cm thick brick walls, and the top ceiling slab is made of reinforced concrete and is covered by a tin roof. The facade and the roof are not thermally insulated. This creates a very large heat loss (much higher than allowed by today's construction code). The roof insulation has a short payback period.
2. The original windows are two separable, back to back, single pane in wood frame windows<sup>2</sup> (Figure 4, left). The windows have not been painted regularly and are in a poor condition. They allow outside air and dust to infiltrate the building and also are a poor barrier to outside noise. One quarter of the windows have been replaced by aluminum framed, double paned windows. These aluminum framed windows do not satisfy today's building code requirements; however, it is very costly to replace them. A more cost

<sup>1</sup> The calculations for the heat energy consumption and cost for the Cultural Center is based on an assumption that the entire building is adequately heated using electric heaters, which is the only available alternative at the moment.

<sup>2</sup> In local language - „krilo na krilo“ prozori

effective alternative to satisfy today's building code requirements and make them energy efficient is to replace the glass with low-E glass package.

3. There are two buildings located less than 50m from the Cultural Center – the Cantonal Museum and the Art School. Originally all 3 buildings were connected to a common heating system with a boiler house located nearby. The boiler house was destroyed during the 1992-1995 war, but all three buildings have radiators and internal heating distribution networks. There is a heating substation in the Cultural Center, but it has been out of operation for several years, has outdated equipment and needs to be replaced by an energy efficient compact heating substation. The Cantonal Museum is fully renovated, while the internal heating distribution networks of the other 2 buildings need minor repairs to be put into operation. Today, the buildings are only partially heated using electric heaters and firewood stoves which is highly inefficient. As a result, adequate thermal comfort is lacking, firewood is piling up in the yard in the heart of downtown Bihac and electricity is used for heating. To resolve these issues a biomass (pellet) boiler and a heating substation should be installed in the Cultural Center and heating distribution pipes laid to heat the Cantonal Museum and the Art School. Since no improvements in the thermal characteristics of the Cantonal Museum and the Art School will be made, they will consume the same amount of energy; but instead of using electricity for heating, they will use biomass - a much cheaper and environmentally friendly fuel.
4. One of the goals of the project is to introduce the practice of energy management. In order to manage energy consumption, first it must be monitored. A monitoring and verification system serves to monitor energy consumption and verify projected (calculated) energy savings. Energy consumption, indoor and outside temperatures are monitored and recorded on an hourly basis and sent to a database that enables easy overview and analysis of data. Continuous monitoring will identify cases of excessive energy consumption and allow timely investigation and removal of its causes.

#### **2.4 Benefits:**

- Demonstrate practical energy savings, usage of renewable energy and improved thermal comfort through new windows, thermal insulation, biomass heating, and energy monitoring
- Promote the application of these measures through achieved energy and financial savings and improved comfort to motivate citizens and governments to save energy and invest in energy efficiency measures
- Motivate local governments to financially support such projects
- Stimulate local economy – local companies will implement measures and use the acquired experience to expand their businesses
- Reduce usage of electricity, firewood and coal
- Reduce CO<sub>2</sub> emissions
- Improve public health

### 3. Project Technical Description and Analysis

#### 3.1 Introduction

The Cultural Center Complex is located in downtown Bihac and is the center of town's cultural activities (

Figure 1). It houses the largest auditorium used for concerts, plays and exhibitions. The complex used to be owned by the army but is now used and financed by the Municipality of Bihac. The Cantonal Museum and the Art School are located in close proximity to each other and to the Cultural Center. In Figure 3 the yellow building on the left side is the Cantonal Museum and the grey building is the side of the Art School.

#### 3.2 Site visit report

The Cultural Center was built in the 1960s according to the building code requirements of the time, which means that the building is energy inefficient by today's standards. The roof and façade are not insulated and most of the windows are in poor condition causing high heat loss. The building has 3 floors with a total surface area of 1276 m<sup>2</sup>. The heating for the Cultural Center, Cantonal Museum and the Art School used to be supplied by a district heating system with a heating substation located in the basement of the Cultural Center (Figure 5). This system is not working, and the heating is provided by firewood and electricity in a decentralized heating system, which is highly inefficient. Also, stockpiles of firewood in the yard between the buildings in downtown Bihac are an eyesore. There are radiators installed in the buildings, but they are not working.

The only EE measure implemented to date was the replacement of about one quarter of all windows in late 1990's. They were replaced by double paned, aluminum framed windows. The rest of the windows haven't been properly maintained and are in poor condition (Figure 4).



Figure 1 Cultural Center in Bihac



**Figure 2. Art School in Bihac**



**Figure 3. Museum (left) and the side of the Art School (right) in Bihac**



**Figure 4 Old windows (left and center) and new windows (right) of the Cultural Center in Bihac**



**Figure 5 Heating substation in the Cultural Center in Bihac**

### 3.3 Technical and financial analysis

The proposed measures are renovation measures. While the payback period is rather lengthy (10 years), the major benefits they provide must be given weight, such as proper thermal comfort of a building which is of great public importance. The estimated energy consumption, before and after measures, for the Cultural Center building are shown in the following table:

**Table 1. Energy consumption**

Energy carrier	Unit	Present	After measures	Savings
Electricity	MWh	335	215	120

The reduction of CO2 emissions achieved by implementation of the measures is 170-200 tons per year.

Besides reducing energy consumption in the Cultural Center, additional financial savings will be achieved through the usage of pellets instead of electricity in all three buildings.

The cost for the measures and the payback period is shown in the following table. It is assumed that the price per kWh remains the same and the payment for actual energy consumed is introduced.

**Table 2. Preliminary cost and benefit analysis for recommended measures**

Measures	Investment [\$]	Annual Savings Est [\$]	Simple payback period [year]
Thermal insulation; Replacement and repair of windows; Installation of a biomass boiler, heating substation and distribution piping to adjacent buildings; Installation of a Monitoring and Verification System	350,000	35,000	10

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