Energy Audits under BEECIFF

Bulgaria Energy Efficiency for Competitive Industry Financing Facility (BEECIFF): Project Preparation, Capacity Building and Implementation Support

Consultancy Contract No: C22081/EEFF-2011-05-03

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Contract Details

Client	European Bank for Reconstruction and Development One Exchange Square, London, EC2A 2 JN
Contractor	Kommunalkredit Public Consulting GmbH Tuerkenstrasse 9, 1092 Vienna, Austria www.publicconsulting.at
Contract	Bulgaria Energy Efficiency for Competitive Industry Financing Facility (BEECIFF) Project Preparation, Capacity Building and Implementation Support Contract No. C22081/EEFF-2011-05-03
Consortium Coordinator	Alexander Linke a.linke@kommunalkredit.at Tel.: +43 1 31631 223 Mobile: +43 67688 3163223 Fax: +43 1 31631 104

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1. Background

The Ministry of Economy, Energy and Tourism ("MoEET") and the European Bank of Reconstruction and Development ("EBRD") are working together to develop and implement the "Energy Efficiency and Green Economy Programme" ("Programme") in Bulgaria.

This new Programme will combine a loan component, provided by commercial banks ("Participating Banks ("PBs")) based on a credit line extended by EBRD, and a grant component (EU Structural Funds), provided by the Ministry from the Operational Program "Development of the Competitiveness of the Bulgarian Economy" ("OP Competitiveness"). A third component, the Technical Assistance ("TA") component will provide implementation support.

Based on the policy objectives of the OP Competitiveness, the Programme aims to:

- Improve the efficiency and productivity of environmentally friendly technology used by Small and Medium Enterprises ("SMEs");
- reduce the energy intensity and any adverse environmental impacts by promoting investments in environmentally friendly, low-waste, energy saving production technologies and utilization of renewable energy sources.

By combining grants, loans and TA in one instrument, this new program overcomes barriers and constraints faced by Bulgarian in designing, implementing and financing sustainable energy projects.

SMEs can submit both Energy Efficiency Projects and Renewable Energy Projects to the Programme. Depending on the project's scale and complexity, two main sub-types of projects are eligible:

- Technology-Driven Projects;
  Technology-Driven Projects are small-scale and simple measures, using technology and equipment as defined in the List of Eligible Materials and Equipment ("LEME");

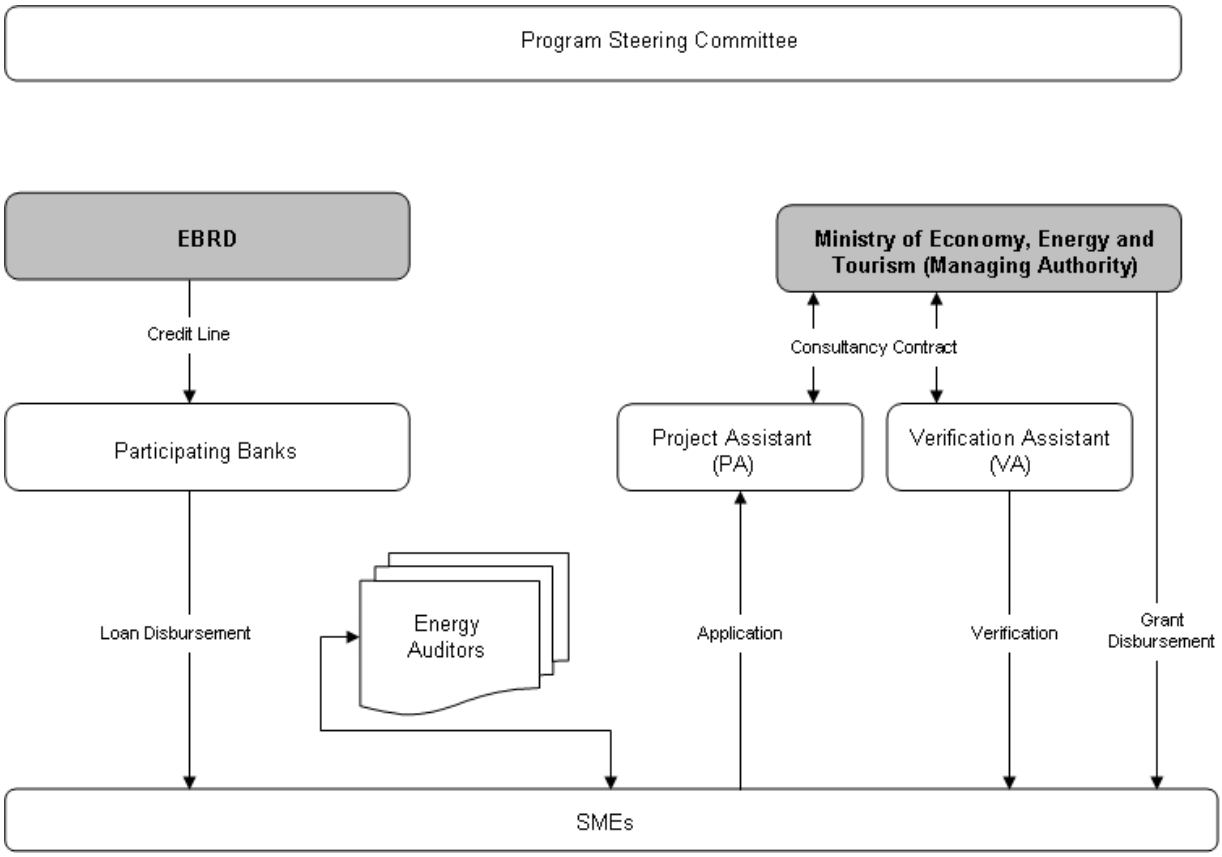
- Energy Audit-Driven Projects;
  Such projects are larger and more complex, and are based on the results of an energy audit, which must be performed by a Certified Energy Audit Company.

The TA is provided by two consultants, the Project Assistant ("PA") and the Verification Assistant ("VA").

The PA will assess the technical eligibility of project applications, the compliance with applicable procurement regulations, will provide information and counselling to potential applicants and will administer the program's database and website.

The VA will check and verify the successful implementation of all projects to be presented in Interim Validation Reports ("IVR") and Completion Validation Reports ("CVR") and will also maintain the LEME.

A graphic summary of the program is presented below:



The PA and VA are to be procured and contracted by the Managing Authority ("MA") at the MoEET in accordance with the applicable legislation.

2. Summary of Energy Audits carried out in the framework of BEECIFF

Eligibility criteria for auditors

1. Energy auditors under this program have to be listed in register of energy auditors of EEA.
2. The list of licensed energy auditors is available under: http://www.seea.government.bg/.
3. Auditors had to attend a training provided by the Programme Preparation Consultant.

Note: *All auditors listed in the register of energy auditors have been invited to participate in training workshops provided by the Programme Preparation Consultant. These trainings have been performed in November – December 2011 (10 trainings across Bulgaria all in total). Each participating auditor received a certificate for successful participation. All eligible auditors are listed (see Annex V) so that the PA can easily check if the auditor fulfills eligibility criteria for providing audit services under this programme.*

When will an Auditor be needed?

1. For each Non-LEME project.
2. On a voluntary basis (e.g. in order to improve the grant intensity).

Selecting and contracting auditor

1. List of eligible auditors is available on website stated above.
2. Applicants can select one of the eligible auditors for the simplified energy audit
3. Depending on project complexity audit shall be performed within 2 to 10 days.
4. Eligible costs for carrying out an energy audit are capped at 5.000 EUR.
5. A contract template for contracting auditors will be provided on the website.

Performing audits

1. Only simplified audits will be needed. Simplified audits focus only on the project itself, planned measures and process that will be targeted by the project. There is no need for auditing all processes of whole company.
2. The auditors shall use audit template (See Annex I).
3. The auditors shall use calculation tool provided during the trainings, these are available on the programme website or upon request from the Project Assistant.
4. Each audit shall include recommendations on further EE measure.
5. Each audit shall be performed before implementation.
6. The quality of audits will be checked by the PA using the checklist (Annex III) provided within this document. PA can easily check if audit report matches with minimum requirement.

Note: *The project assistant (PA) must be technically qualified to examine the energy saving measures proposed by the auditor and see if there are systematic or rough calculation errors. It is repeatedly emphasized during the training courses that each calculation has to be performed with Microsoft Excel, and each digit in the calculation is clearly explained to the participants in the training. If there is suspicion of a wrong calculation, the Energy Efficiency Agency performs a detailed verification of the calculations. Specialists from the EEA also attend the training course.*

Audit costs

1. Costs for energy audit shall be eligible up to an amount of 5.000 EUR[1].
2. Energy audits prepared by licensed companies for investigating the energy efficiency of industrial systems under art. 34, para. 4 of the Energy Efficiency Act, can be used for

[1] As an alternative, during the preparation of the programme also the applicability of a voucher scheme was discussed. Information on such a voucher scheme can be found in the Annex.

applying under OP Competitiveness after three years from the date of application The idea is that companies that have already an energy audit carried out/performed by a licensed (and eligible) auditor shall use that audit, but of course, the audit needs to be updated. This refers to Bulgarian law that obliges companies with huge energy demand to perform a energy audit on regularly basis. Since there this energy is also performed by same auditors, we suggest that this already existing audit report shall be eligible under the pre-condition that it is not older than 3 years

3. If the energy audit needs to be updated, the SME will be eligible for a voucher that covers up to 75% of the costs for the energy audit service.
4. PB shall use audit report as basis for bankable decision.

Note: *The main idea on such an energy audit report is that an auditor comments the planed investment against engineering experiences and BAT. Hence the report can confirm that planned measures meet minimum quality level and calculated savings are based on realistic data and assumptions.*

3. List of Attachments

I. Simplified Energy Audit Report Template

II. Example of an Simplified Energy Audit

III. Checklist for the Project Assistant

IV. Contract template for hiring Energy Auditors

V. List of eligible Energy Auditors

VI. Voucher Systems

ANNEX I

Simplified Energy Audit Report Template

Name of company

BEECIFF

Simplified

ENERGY AUDIT

Final Report

Name of auditor

Sofia, March 2012

IMPRESSUM:

Client:

Contractor:

Project team:

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Executive Summary

1.1 Key message regarding project eligibility

This audit report includes remarks and recommendations on the planned investment projects. All proposed measures have been evaluated against technical economic criteria, the energy saving have been calculated. Also main economic indicators have been calculated. Looking just at the planned measures and their influence on energy performance the project is eligible/not eligible.

1.2 Company profile

The company xxxxx, located in xxxxx produces xxx and an active market player in Bulgaria and xxxx. The annual turnover increased from xx Mio. leva in 2008 to xx Mio. leva in 2010. The production of xx was in 2008 around xx t and increased to around xx t in 2010. Permanent stall in 2010 was xxxx

1.3 The planned investment project

To increase the energy efficiency of the existing production and to decrease the production costs the company plans the following:

1. Measure 1;

2. Measure 2.

1.4 Energy savings and CO2 reductions

	baseline	Forecast	Savings			CO2 savings	
	MWh	MWh	MWh/y	MWh/t	%	[t/y]	%
Measure 1							
Measure 2							
Measure 3							
total							

1.5 Financial costs and benefits

	Investment	Savings	IRR	Payback	NPV
	BGN	BGN	%	Years	BGN
Measure 1					
Measure 2					
Measure 3					
total					

1.6 Risk assessment

all measures show no or only a low risk.

1.7 Further energy saving potential

	baseline	Forecast	Savings			CO2 savings	
	MWh	MWh	MWh/y	MWh/t	%	[t/y]	%
Measure 1							
Measure 2							
Measure 3							
total							

1.8 Assessment of the environmental health and safety standards and regulations:

all proposed measures meet the applicable standards and regulations.

1.9 Assessment of the grant intensity

From the auditors point of view can the proposed project be eligible for grant intensity up to …%

2 Introduction

2.1 Background

This energy audit was prepared within the framework of the Energy Efficiency for Competitive Industry Financing Facility (BEECIFF). The EBRD has established BEECIFF in the form of a dedicated credit facility that provides funds to participating banks for on-lending to Bulgarian private companies. The goal is to support investment in energy efficiency and renewable energy projects, thereby reducing energy consumption and green house gas emissions.

Business sector: *xxxxxxx (code)*

2.2 Audited company and auditing team

This audit has been carried out for the company by:

(Name of the company) license number of EEA……/(date)

The audit was carried out in xxx by the following auditing team:

Auditing team:

Thermal power engineer;

Engineer on Heat engineering;

Electrical engineer.

Factory staff:

xxxxxxx	General Manager
xxxxxxx	Technical director

3 Company Profile

Brief description of the company's products, services and facilities.

3.1 Production data, energy data

The total annual Turnover increased from xx Mio. BGN in 200x up to xx Mio. BGN in 201x. The prospected Turnover for 201x will be xx Mio. BGN. The production volume increased from xx t in 200x up to xx t in 201x. The prospected production amount in 2011 will be around xx t.

The electricity consumption decreased from xx MWh in 200x to xx MWh in 201x (-5%). The electricity costs had a share of xx % of the production costs in 200x and xx% in 201x. The specific electricity consumption per t of product amounted to xx MWh/t in 200x and xx MWh/t in 201x. Explanation of the changes of the values, if any.

The natural gas consumption decreased from xx MWh in 200x to xx MWh in 201x (-xx%). The natural gas costs had a share of xx % of the production costs in 200x and xx% in 201x. The specific gas consumption per t of product amounted to xx MWh/t in 200x and xx MWh/t in 201x. *Explanation of the changes of the values, if any*.

The total energy demand decreased from xx MWh in 200x to xx MWh in 201x (-xx%). The energy costs had a share of xx % of the total production costs in 200x and xx% in 201x0. The total energy consumption per t of product amounted to xx MWh/t in 200x and xx MWh/t in 201x. *Explanation of the changes of the values, if any*.

The table below gives an overview the turnover, production data, energy consumption and specific values

3.2 Description of production process and core business

Brief description of production process with the main process steps, which are relevant for the project.

3.3 Status of energy supply systems

Brief description of the status of the installed energy supply systems. Particular attention will be paid to equipment age, efficiency and performance in comparison to state of the art equipment.

Electricity

The company is directly supplied with electricity by the local electricity utility xxx via a power cable with a currency of 10 kV to the main transformer on the production site.

Electricity measurement devices: At the transformers the main electricity meter is installed.

Between 200x and 201x, the total electricity demand has increased by about x%. In the same period, the costs for electricity went up around xx%.

The electricity demand and expenses between 200x and 201x are been summarized in the Table below.

Natural gas

The company is directly supplied with natural gas by the local gas utility xxx to the main connecting point on the production site.

Natural gas measurement devices: At the main connecting point a gas meter is installed.

Between 200x and 201x, the total natural gas demand has increased by about x%. In the same period, the costs for natural went up around xx%.

The natural gas demand and expenses between 200x and 201x are been summarized in the Table below.

(taking into account climatic conditions for given site, operational patterns, process and indoor requirements and heat gains, this will give a picture about energy conversion efficiencies)

4 Project proposed by the company

4.1 Project 1:

Description of the baseline scenario:

The base line analysis will project the relevant data and calculation for the analysis period under the assumption that the project would not be implemented. Particular attention will be paid to:

- Energy consumption
- Energy costs
- CO2 emissions

Concept of improvement:

Description of the investment

Capital and Operation & maintenance expenditure

Description of the investment costs and operational costs for the measure described above.

Calculation of energy savings in MWh

Comprehensive (understandable) calculation of the energy savings from the proposed measure based on standard methodology

Calculation of emission reduction

Comprehensive (understandable) calculation of the direct CO_2 reduction from the proposed measure based on standard methodology

Implementation schedule

The implementation plan with time schedule and disbursement schedule and the implications for the financing cash flow will be analyzed in this section.

Assessment of permits required

Procurement requirements

Technical feasibility analysis

Statement about the technical feasibility of the proposed measure(s) and assessment whether proven energy technologies and/or Best Available Technologies are used.

Short statement regarding the compliance with health, safety and environment standards of each measure.

4.2 Project 2: xxxx

Description of the baseline scenario:

The base line analysis will project the relevant data and calculation for the analysis period under the assumption that the project would not be implemented. Particular attention will be paid to:

- Energy consumption
- Energy costs
- CO2 emissions

Concept of improvement:

Description of the investment

Capital and Operation & maintenance expenditure

Description of the investment costs and operational costs for the measure described above.

Calculation of energy savings in MWh

Calculation of the energy savings from the proposed measure based on standard methodology

Calculation of emission reduction

Calculation of the direct CO_2 reduction from the proposed measure based on standard methodology

Implementation schedule

The implementation plan with time schedule and disbursement schedule and the implications for the financing cash flow will be analyzed in this section.

Assessment of permits required

Procurement requirements

Technical feasibility analysis

Statement about the technical feasibility of the proposed measure(s) and assessment whether proven energy technologies and/or Best Available Technologies are used.

Short statement regarding the compliance with health, safety and environment standards of each measure.

4.3 Assessment on metering, control, and monitoring system

Metering system

Description how energy data are collected, stored and which meter are in use. Is there a metering management in place? Is staff trained to assess energy consumption on regular basis?

Monitoring

Is there a monitoring system in place? Is energy consumption checked against benchmark default values? Can deviation be detected?

Controling of energy use

Is there any planning of energy consumption in place? Are there anc guidelines on what to do if energy consumptions increases unexpected?

Targeting

Are there any objectives and goals for reducing energy demand in place?

Recommendations

Auditor shall give non-mandatory recommandations on how Metering, control and monitoring can be improved

4.4 Summary of savings, investment costs

Energy savings will be calculated by using a standard methodology.

The overall investment costs (excl. VAT) were estimated to xxx BGN.

The savings of electricity were calculated to xxx MWh per unit of production (reduction of xx % of the 201x consumption) and the savings of natural gas to xxx MWh per unit of production (reduction of xx % of the 201x consumption). The overall amount of CO_2 reductions is around xx t per year.

The overall specific value for energy savings per invested BGN is xx kWh/BGN.

The detailed investment costs and the calculated savings on electricity and natural gas are shown in the table below.

Calculated values:

- Overall Energy savings in MWh per year
- Overall Energy savings in MWh per unit of production,
- Development of output after implementation if any
- energy savings in % against baseline using ISI methodology
- Energy costs after implementation (including best case and worst case scenario)

4.5 Implementation plan

The implementation plan was assessed for each measure.

Measure	Project status	Permits (if required)	Project start	Project end
Measure 1:				
Measure 2:				
Measure 3:				

Table 1: Implementation plan

ad project status

Project cycle: preliminary (preliminary design is available e.g. EA from PC), engineering (engineering documents are available), supplier selected (supplier already contracted, detailed design documents available), implementation (project is under construction), in operation (project is already in operation)

4.6 Monitoring Plan

In order to be able to evaluate the performance of each measure after the project implementation the following measurement equipment should be applied for recording the stated monitoring indicators.

Measure	Monitoring indicator	Evaluation date	Responsibility
Measure 1:			
Measure 2:			
Measure 3:			

Indicators to be used will be provided

5 Assessment of compliance with environmental health & safety laws, regulation and standards

Short statement regarding the compliance with health, safety and environment standards of each measure.

6 Project Profitability analysis

The used model is in accordance with “Guide to cost-benefit analyses of investment projects” prepared for the Evaluation Unit DG Regional Policy European Commission and sponsored by Structural Fund (SF), Cohesion Fund (CF) and Instrument for Pre-Accession Countries (ISPA).

The analysis of financial indicators and the cash flow of the project were made with a software “ENSI Financial calculations”. This software is accepted as legitimate by the Energy Efficiency Agency. An interest rate under an investment loan is accepted, which is equal to xxx % and the grace period is xxx months. Estimated annual inflation rate for 201x (xx%), the value of funds which will be invested by (name of the company) (25% of total investment), and grant obtaining to the amount of xxx % on the loan under BEERECL, costs for operation and maintenance and the loan amount from the commercial bank.

(Name of the company) will repay the loan in equal (annuity) monthly installments. A maximum return period of the investments for the different energy saving measures is adopted– up to 10 years.

In table ……. is presented a financial analysis for the implementation of energy saving measures as a result of the performed calculations, the submitted preliminary offers and the accepted pre-conditions for funding.

Fixed criteria:

- interest rate: 8%%

- Discount rate

- lifetime of invest 20 years

6.1 Investment costs for the project

Printed from the ENSI® Economy Software

Project: **Energy efficiency project**
Profitable Measures

Company: encon services
Licence: 154684610

Real interest rate: 5,5 %

Measures	Investment [EUR]	Net savings [EUR/Year]	Lifetime [Year]	PB [Year]	PO [Year]	IRR [%]	NPV [EUR]	NPVQ	Max. Investment 1) [EUR]	2) [Year]
Energy efficiency measure 1	2.485	1.687	20	1,5	1,6	68	17.728	7,13	20.155	20,0
Energy effciency measure 2	33.387	20.248	20	1,7	1,8	61	209.212	6,27	241.912	20,0
Energy efficiency measure 3	19.327	11.529	20	1,7	1,8	60	118.806	6,15	137.742	20,0
Energy efficiency measure 4	8.801	2.181	20	4,0	4,7	24	17.330	1,97	26.057	20,0
Energy efficiency measure 5	3.474	825	20	4,2	4,9	23	6.411	1,85	9.857	20,0
Energy efficiency measure 6	4.369	925	20	4,7	5,6	21	6.714	1,54	11.051	20,0
Total Profitable Measures	71.843	37.395		1,9	2,1		376.201			

PB = Payback, PO = Pay-off, IRR = Internal Rate of Return, NPV = Net Present Value, NPVQ = Net Present Value Quotient

1) Maximum investment with 2) years pay-o

Calculated by: EnCon Services **Address:** **Phone:**

6.2 Operation and maintenance expenditure

Estimate about the projected operation & maintenance (excluding energy costs) associated with the proposed measures will be provided.

6.3 Cash Flow analysis

The cost benefit analysis compares the "with project situation" with the baseline and analyses the net benefits arising from the project implementation.

The financial analysis will compare baseline and with project situation from a financial perspective. The following performance indicators will be calculated:

- Internal Rate of Return (IRR) of the project
- Net Present Value (NPV) of the project
- Payback time

Key performance indicators will be given in table in this section.

Investment plan and priority classification of energy efficiency measures

Energy efficiency measure		*Feasibility analysis*		*Investment*	*Annual savings*	*Simple payback period*	*IRR*	*NPV*	*Priority*
		Yes	No	BGN	BGN	Years	%	%	
MEE - 01	Energy efficiency measure 1	√		4860	3299	1.5	67.9	34667	Very high
MEE - 02	Energy efficiency measure 2	√		37800	22548	1.7	36.4	54881	High
MEE - 03	Energy efficiency measure 3	√		8830	1810	4.9	20	12856	High
MEE - 04	Energy efficiency measure 4	√		16300	5941	2.7	36.4	54881	Very high
MEE - 05	Energy efficiency measure 5	√		5900	2366	2.5	40.1	22448	High
MEE - 06	Energy efficiency measure 6	√		65300	39602	1.6	60.7	409187	High
MEE - 07	Energy efficiency measure 7	√		294900	143899	2.0	48.8	1429208	High
MEE - Total	**Total for the project**	**√**		**433890**	**219465**	**2.0**		**2018128**	**High**

7 Risk assessment

Identification and description of risks related to

- *Technical risks*
- *Energy supply risks*
- *Commercial risks (e.g. market, off-take arrangements, price, costs, delays)*
- *Environmental risks*

Existing and suggested mitigation measures for these risks are briefly discussed.

The various types of risks that can occur during project implementation or during operation are assessed and described below.

Type of risk	Risk level	Risk mitigation strategy
Technical risks		
Technical performance is lower than calculated		
Equipment is not suitable for the application		
Other risks		
Economical risks		
Investment costs will be exceeded		
Operation & Maintenance cots will be exceeded		
Savings can not be achieved		
Other risks		
Administrative risks		
Authority permits can not be achieved		
Project emissions will exceed the emission limits		
Other risks		
Management risks		

Management is not capable to implement the project		
Other risks		

8 Recommendations to the company

8.1 Additional measures proposed to the client

Low-cost measures

Recommendations on harvesting saving potential without the need of investment. Such awareness raising, motivation strategy, internal rules and guidelines, etc.

1.

2.

3.

Additional investments

Recommendations on useful additional measures to increase energy efficiency and /or improve energy performance. Additional investment shall also help to improve already planned investments.

1.

2.

8.2 Overview of possible additional measures

Measure	Project description	Benefits of implementation	Estimated savings	Estimated Project costs
Measure 1:				
Measure 2:				
Measure 3:				

Energy savings

GHG reduction

Investment costs (estimated)

Estimated savings /year

Priorities

8.3 Cost benefit assessment on proposed measures

8.4 Further benefits from the projects

Apart from the costs and benefits listed above, the proposed investment may bring about further benefits in other fields, such as environmental or social benefits which will be briefly described in this section.

9 Assessment of eligibility under BEECIFF

9.1 Eligibility assessment

All measures are assessed in regard to the applicable eligible criteria under BEECIFF. The assessment shows that all proposed meets the eligible criteria, see table below.

General criteria	**Y / N**	**Remark**
The company is a legal and private enterprise		
The companies business is not listed in the exclusion or referral list of the EBRD		
Project criteria		
The Project is in compliance with Bulgarian environmental, health & safety standards		
Type of all measures is eligible		
EE: Overall value for energy savings reaches 10%		

Table 2: Eligibility assessment

9.2 Grant intensity

Type of project	**Grant intensity** **as % of total eligible costs**	**Yes/no**
Technology–Driven Project (LEME project)	30%	
Energy-Audit Driven Project	40%	
Project features, rewarding a bonus grant intensity (applies to all types of projects, as relevant) - Technology-Driven Projects prepared on the basis of an energy audit - projects implemented in economic sectors which have priority importance for the development of the Bulgarian economy and/or have a higher energy intensity compared to the EU average1 - the project improves the efficiency of or replaces a combined heat and power generation ("CHP") facility - Energy Audit-Driven Project that installs or replaces a renewable energy technology - the project results in fuel switching - the project installs or improves an energy management system; - the project includes the implementation of a quality management system	+ 10% - for each feature	-

[1] Please refer to Annex 5.

9.3 Quality check list (to be completed by the PA)

Question	**YES**	**NO**
Audit report is in line with audit report template		
Audit was performed by registered Energy Auditor		
Situation before implementation is clearly described		
Correct calculation of actual energy consumption using standard methodology		
Clear description of planned measures		
Clear assessment on achievable saving by planed measures		
Clear calculation on GHG reduction using standard methodology		
Economic assessment including main financing indicators		
Reasonably proposed energy efficiency measures		
Risk analyses included		
Eligibility of project is checked correctly		
Energy savings reported are realistic		

ANNEX II

Example of an Simplified Energy Audit

BEECIFF

Company name: MTB Group Ltd

Project No: Example

Industrial Sector: Food production

ENERGY AUDIT REPORT

This Energy Audit Report was prepared for:

XXX Bank

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1 Executive Summary

1.1 Key message regarding project eligibility

the sub borrower as well as the proposed measures meet the eligibility criteria under BEECIFF.

1.2 Company profile

The company MTB Group Ltd operates a production plant in Bulgaria. The company is producing the following products:

- Flour: 30.000 – 35.000 t/a
- Sweets: 1.200 kg/a
- Beverages

The production site comprises of several industrial buildings spread over the company site. The electricity consumption was 2.640 MWh, the natural gas consumption was 3.255 MWh in 2010. The main electricity consumers are grain mills, air compressors, backing stoves, cooling equipment. The main natural gas consumers are two steam boilers in the boiler house.

1.3 The planned investment project

The following measures are envisaged to be implemented by the company:

1) Optimizing of the steam boiler system

Optimization of the steam boiler system by the following measures:

- Insulation of steam and condensate pipes (approx. 50 m) in the boiler house
- Insulation of condensate tanks in the boiler house
- Change feed water pipe system for boiler II (0,8 t/h) to supply the boiler with temperature level of condensate (approx. 95 ℃)
- Upgrading of the control system of boiler I (10 t/h) by a PLC control system incl. two correct dimensioned energy efficient drives for combustion air and flue gas. Furthermore both drives will be controlled by frequency converters (variable speed drives) for a fully automatic operation of the steam boiler system.

2) Optimization of the ventilation system in the sweets production hall

Optimization of the ventilation system in the sweet production hall by the following measures:

- Heat insulation of the backing ovens in order to minimize the internal heat load of the hall and to reduce the electricity respectively natural gas consumption of the ovens
- Reduction of the ventilation demand by sealing leaks in the duct system and closing not used ventilation outlets
- Optimization of the ventilation system by replacing the existing electric drives by correct dimensioned energy efficient drives incl. frequency converters (variable speed drives)

– Adjusting the ventilation demand to the needs of the production

3) Implementation of a chiller system (incl. waste heat recovery system) for a new cold storage warehouse
The company plans to erect a new cold storage warehouse of total 2.000 m² (area A: 1.000 m² < -10 ℃ and area B: 1.000 m² +2℃ to + 5 ℃)
The cooling energy for cooling area A will be produced by a conventional chiller system with waste heat recovery system, cooling energy for cooling area B will be produced by a energy efficient chiller system (variable speed drive) with waste heat recovery system. Waste heat is transported via pipe system to a storage tank (6 m³) in the main building for heating and hot water preparation purposes.

4) Energy data management system
Implementation of an energy data monitoring system comprising of an automatic recording system of energy data of the main 20 consumers and energy data management software

The overall investment costs (incl. VAT) were estimated at 186.216 USD (69.483.582 AMD). The savings of electricity were calculated to 291 MWh per year. The savings of natural gas were calculated to 1.115 MWh per year. The overall amount of CO_2 reduction is around 299 t per year. The overall specific value for energy saved per invested USD is 7,55 kWh/USD.

1.4 Energy savings and CO2 reductions

The detailed investment costs and the calculated savings on electricity and natural gas are shown in the table below.

Summary of calculated savings

			Production		Savings		
	Investment costs		Electricity	Heat	Electricity	Natural gas	CO_2
Project	**USD**	**AMD**	**MWh**	**MWh**	**MWh**	**MWh**	**t/a**
Project 1: Optimization steam boiler system	34.045	12.703.358	0	0	27	588	125
Project 2: Optimization of the ventilation system in the sweets production hall	15.442	5.761.940	0	0	98	0	26
Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	117.426	43.815.672	0	0	86	429	108
Project 4: Energy data management system	19.303	7.202.612	0	0	79	98	40
Sum	**186.216**	**69.483.582**	**0**	**0**	**291**	**1.115**	**299**

Negative values indicates additional consumption

1.5 Financial costs and benefits

The investigated projects 1 to 4 show an overall IRR of > 20,7%, an overall pay back time > 4,1 years and an overall NPV of 119.175 USD for the scenario 1 (constant energy prices over the next 10 years).

Whereas for the more realistic scenario 2 (increased energy prices over the next 10 years) the overall IRR for the projects 1 to 4 was calculated at + 32,8%, the overall pay back time at 3,3 years and the overall NPV at + 317.934 USD.

Cash Flow Analysis								
	Investment	**Savings[1)]**	**IRR**		**Pay back**		**NPV**	
Project	**USD**	**USD/a**	**%**		**years**		**USD**	
Energy price increse 0% / 10%			0%	**10%**	0%	**10%**	0%	**10%**
Project 1: Optimization steam boiler system	34.045	16.118	46,3%	**60,9%**	2,1	**1,8**	74.107	**144.497**
Project 2: Optimization of the ventilation system in the sweets production hall	15.442	6.140	38,2%	**52,0%**	2,5	**2,2**	25.755	**52.567**
Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	117.426	15.914	5,9%	**16,5%**	7,4	**5,4**	-10.644	**58.855**
Project 4: Energy data management system	19.303	7.341	36,3%	**49,9%**	2,5	**2,2**	29.956	**62.015**
Overall	**186.216**	**45.512**	20,7%	**32,8%**	4,1	**3,3**	119.175	**317.934**

1) excl. O&M costs

1.6 Further energy saving potential

	baseline	Forecast	Savings			CO2 savings	
	MWh	MWh	MWh/y	MWh/t	%	[t/y]	%
Measure 1							
Measure 2							
Measure 3							
total							

1.7 Assessment of the environmental health and safety standards and regulations:

all proposed measures meet the applicable standards and regulations.

1.8 Risk assessment:

all measures show a low risk level (except a medium risk for investment costs and the capability of the client to implement the project, but risk mitigation strategy is in place)

2 Introduction

Background

This energy audit was prepared within the framework of the Energy Efficiency for Competitive Industry Financing Facility (BEECIFF). The EBRD has established BEECIFF in the form of a dedicated credit facility that provides funds to participating banks for on-lending to Bulgarian private companies. The goal is to support investment in energy efficiency and renewable energy projects, thereby reducing energy consumption and green house gas emissions.

Audited company:

MTB Ltd

Auditing team:

International energy expert

Local energy expert

Company staff:

Director

Date of Energy Audit: 26.04.2011

3 Company profile, general project information

The company MTB Ltd operates a production plant in Yerevan. The company is producing the following products:

- Flour: 30.000 – 35.000 t/a
- Sweets: 1.200 kg/a
- Beverages

The production site comprises of several industrial buildings spread over the company site. The electricity consumption was 2.640 MWh, the natural gas consumption was 3.255 MWh in 2010. The main electricity consumers are grain mills, air compressors, backing stoves, cooling equipment. The main natural gas consumers are two steam boilers in the boiler house.

3.1 Production data, energy data

The total turnover was 20,5 Mio. USD in 2010. The electricity costs had a share of 0,8% of the turnover in 2010. The electricity consumption amounted to 2.514 MWh in 2008 and 2.640 MWh in 2010 (increase of +5%).

The natural gas costs had a share of 0,4% of the turnover in 2010. The gas consumption amounted to 267 MWh in 2008 (not representative) and 3.255 MWh in 2010.

The total energy costs had a share of 1,2% in 2010 of the turnover.

The table below gives an overview about turnover, energy consumption, specific values.

Summary production and energy data					
		2008	2009	2010	2011
Turnover	USD	-	-	20.503.211	-
Production costs	USD	-	-	-	-
Production flour	t	-	-	30.000 - 35.000	-
Production sweets	t	-	-	1,2	-
Electricity production CHP	MWh/a	no	no	no	no
Electricity consumption	MWh	2.514	2.299	2.640	-
Electricity price	USD/MWh	48,2	59,2	62,5	-
Electricity costs per year	USD	121.089	136.163	164.920	-
Electricity per t product	kWh/t	-	-	-	-
Electricity costs/turnover	%	-	-	0,8%	-
Natural gas consumption	MWh	267	2.307	3.255	-
Natural gas price	USD/MWh	16,2	21,1	24,6	-
Natural gas costs per year	USD	4.326	48.735	79.913	-
Natural gas per t product	kWh/t	-	-	-	-
Natural gas costs/turnover	%	-	-	0,4%	-
Total energy consumption per year	MWh	2.781	4.606	5.895	-
Total energy costs per year	USD	125.415	184.898	244.833	-
Total energy per t product	kWh/t	-	-	-	-
Total energy costs per t	USD/t	-	-	-	-
Total energy / turnover	kWh/USD	-	-	0,3	-
Total energy costs / turnover	%	-	-	1,2%	-

Table 1: Summary of turnover, energy consumption, specific values

3.2 Description of production process and core business

3.3 Status of energy supply systems

Electricty is purchased from local supplier, natural gas also. There is plant in operation for producing electricity. Steam and hot water is produced by own boiler

3.3.1 Electricity

The plant is supplied with electricity by the public electricity utility with an electrical potential of 10 kV to the main transformer of the industrial area of the plant. From the transformer the plant is supplied to the main switchbox by a power cable. Besides the main meter (at the transformer) no additional electricity sub-meters are installed.

The electricity consumption was 2.514 MWh in 2008 and 2.640 MWh in 2010. Only total annual energy costs and total annual energy consumption was provided by the company. The electricity demand and expenses between 2008 and 2010 are been summarized in the table below.

Consumption Electricity								
2008			2009			2010		
Energy MWh	Energy price AMD/MWh incl VAT	Sum AMD	Energy MWh	Energy price AMD/MWh incl VAT	Costs AMD	Energy MWh	Energy price AMD/MWh incl VAT	Costs AMD
no monthly data available	- - - - - - - - - - - -	no monthly data available	no monthly data available	- - - - - - - - - - - -	no monthly data available	no monthly data available	- - - - - - - - - - - -	no monthly data available
2.514	**17.965,8**	**45.166.146**	**2.299**	**22.091,7**	**50.788.812**	**2.640**	**23.301,2**	**61.515.270**
	48,17 USD/MWh			59,23 USD/MWh			62,47 USD/MWh	

Table 2: Electricity consumption (prices and costs incl. VAT)

3.3.2 Natural gas

The plant is supplied with natural gas by the public gas utility to the main gas-station of the plant. The gas consumption is measured at the main gas-station. Besides the main meter no additional gas sub-meters are installed.

The natural gas consumption was 267 MWh in 2008 (the consumption of 267 MWh is not representative for 2008) and 3.255 MWh in 2010. Only total annual energy costs and total annual energy consumption was provided by the company.

The natural gas demand and expenses between 2008 and 2010 are been summarized in the table below.

Consumption Natural Gas								
2008			2009			2010		
Gas m³	Energy price AMD/m³	Costs AMD	Gas m³	Energy price AMD/m³	Costs AMD	Gas m³	Energy price AMD/m³	Costs AMD
no monthly data available	- - - - - - - - - - - -	no monthly data available	no monthly data available	- - - - - - - - - - - -	no monthly data available	no monthly data available	- - - - - - - - - - - -	no monthly data available
26.700	**60,43**	**1.613.468**	**230.700**	**78,80**	**18.178.134**	**325.500**	**91,57**	**29.807.544**
	16,20 USD/MWh			21,12 USD/MWh			24,55 USD/MWh	

Table 3: Natural gas consumption (prices and costs incl. VAT)

4 Investment projects

The following measures are envisaged to be implemented by the company:

1) Optimizing of the steam boiler system

   Optimization of the steam boiler system by the following measures:

   - Insulation of steam and condensate pipes (approx. 50 m) in the boiler house
   - Insulation of condensate tanks in the boiler house
   - Change feed water pipe system for boiler II (0,8 t/h) to supply the boiler with temperature level of condensate (approx. 95 ℃)
   - Upgrading of the control system of boiler I (10 t/h) by a PLC control system incl. two correct dimensioned energy efficient drives for combustion air and flue gas. Furthermore both drives will be controlled by frequency converters (variable speed drives) for a fully automatic operation of the steam boiler system.

2) Optimization of the ventilation system in the sweets production hall

   Optimization of the ventilation system in the sweet production hall by the following measures:

   - Heat insulation of the backing ovens in order to minimize the internal heat load of the hall and to reduce the electricity respectively natural gas consumption of the ovens
   - Reduction of the ventilation demand by sealing leaks in the duct system and closing not used ventilation outlets
   - Optimization of the ventilation system by replacing the existing electric drives by correct dimensioned energy efficient drives incl. frequency converters (variable speed drives)
   - Adjusting the ventilation demand to the needs of the production

3) Implementation of a chiller system (incl. waste heat recovery system) for a new cold storage warehouse

   The company plans to erect a new cold storage warehouse of total 2.000 m² (area A: 1.000 m² < -10 ℃ and area B: 1.000 m² +2℃ to + 5 ℃)

   The cooling energy for cooling area A will be produced by a conventional chiller system with waste heat recovery system, cooling energy for cooling area B will be produced by a energy efficient chiller system (variable speed drive) with waste heat recovery system. Waste heat is transported via pipe system to a storage tank (6 m³) in the main building for heating and hot water preparation purposes.

4) Energy data management system

Implementation of an energy data monitoring system comprising of an automatic recording system of energy data of the main 20 consumers and energy data management software

For each sub-project a specific baseline-scenario was developed. The baseline-scenario describes the scenario what would happen if the proposed saving project will not be implemented. In case of optimization of existing equipment the current used equipment (and it´s energy consumption) represents the baseline-scenario.

In case of a greenfield project or substantial enlargement of the production capacity, new production equipment with the lowest investment costs (and it´s energy consumption) will be considered as baseline–scenario.

4.1 Project 1: Optimizing steam boiler system

Description of the baseline scenario (current situation)

The production plant is supplied with steam from the boiler house for production and heating purposes. In the boiler house 4 natural gas steam boilers are installed (see picture 1, 2, Annex A):

	Boiler I	Boiler II	Boiler III	Boiler IV
Medium	steam	steam	steam	steam
Nominal capacity:	10 t/h at 14 bar	approx. 0,8 t/h	approx. 0,8 t/h	approx. 0,8 t/h
Flue gas temperature:	-	170℃	-	-
T steam/condensate:	-	145/99 ℃	-	-
Operation mode:	in operation	in operation	reserve boiler	reserve boiler
Boiler control:	semi-automatic	manual		

Boiler I is usually in operation during heating season, boiler 2 during non-heating season. Condensate is collected in the production and stored in the storage tank 1 (16 m³, condensate temperature 99 ℃) in the boiler house. Then the co ndensate is pumped to the storage tank 2 (6 m³, condensate temperature 95 ℃) and storage tank 3 (10 m³, condensate temperature 21 ℃). The temperature level of condensate tank 3 is very low due to limited steam demand during non-heating season, no heat insulation and large storage capacity of the tanks (see picture 3 Annex A). The feed water for boiler II is supplied from condensate tank 3 at a temperature level of 21 ℃ (see picture 4 Annex A).

No measurement equipment is installed in the boiler house for individual recordings of gas consumption, steam produced, fresh water demand.

Calculation of the energy consumption of the baseline-scenario (detailed calculation see Annex B):

General data:

Total natural gas consumption in 2010: 3.255 MWh

Utilisation in boiler house (assumption): 90% → 2.930 MWh

Calculation of the energy consumption due to heat losses:

Heat losses of steam pipes 50 m: 53,4 MWh/a

Heat losses of 2 condensate tanks (22 m³): 165,6 MWh/a

Boiler efficiency (average of boiler I and II): 75%

Natural gas consumption: (53,4 + 165,6) / 0,75 = 292 MWh/a

Calculation of optimization boiler II (1 t/h):

Operation time of boiler II (0,8 t/h) during non-heating season: 1640 h/a

Natural gas consumption boiler II (assumption): 1.172 MWh (40 % of total gas consumption)

Boiler efficiency: 70%

Produced heat energy: 1.172 MWh * 0,7 = 820,4 MWh/a

Feed water temperature: 21 °C

Energy demand to produce steam of 7,5 bar, 168 °C: 745 kWh/t

Produced steam: 820,4 MWh / 745 kWh/t / 1.000 = 1.101 t/a

Energy input to heat feed water from 21 °C to 168 ° C and 7,5 bar: 173,46 kWh/t

Total energy input: 1.101 t * 173,46 kWh/t = 191 MWh/a

Natural gas consumption: 191 / 0,7 = 272,9 MWh/a

Calculation of the energy consumption of boiler I:

Operation time of boiler I (10 t/h) during heating season: 1.168 h/a

Natural gas consumption boiler I (assumption): 1.757,7 MWh/a

Boiler efficiency: 80%

Produced heat energy: 1.757,7 MWh * 0,8 = 1.406 MWh/a

Electric input capacity of fans (combustion, flue gas): 38 kW

Load factor: 0,9

Electricity consumption: 38 kW * 1.168 * 0,9 = 39,95 MWh/a

Natural gas consumption: 292 + 272,9 + 1.757,7 = 2.322,6 MWh/a

Natural gas costs: 2.322,6 * 24,55 USD/MWh[1] = 57.014 USD/a

Electricity costs: 39,95 * 62,47 USD/MWh[2] = 2.495 USD/a

Total costs: 57.014 + 2.495 = 59.510 USD/a

CO_2 Emissions: 2.322,6 MWh * 0,2 tCO_2/MWh + 30,95 MWh * 0,264 tCO_2/MWh = 475 tCO_2/a

Concept of improvement

The client plans to optimize the steam system by implementing the following measures:

- Insulation of steam and condensate pipes (approx. 50 m pipes) in the boiler house
- Insulation of condensate tanks (steel surface approx. 69 m²) in the boiler house
- Changing of feed water pipe system for boiler II (0,8 t/h) in such a way that feed water with a temperature of approx. 95 ℃ is supplied to the boiler
- Upgrading of the control system of boiler I (10 t/h) by a PLC control system incl. two correct dimensioned energy efficient drives (energy efficient class: IE 2) for combustion air and flue gas. Furthermore both drives will be equipped by frequency converters (variable speed drives) for a fully automatic operation of the steam boiler system.

Calculation of the energy consumption of the saving project (detailed calculation see Annex B):

General data:

Total natural gas consumption in 2010: 3.255 MWh

Utilisation in boiler house (assumption): 90% → 2.930 MWh

Calculation of the energy consumption due to heat losses:

Heat losses of steam pipes 50 m: 4,1 MWh/a

[1] Natural gas price mix
[2] Electricity tariff mix

Heat losses of condensate tanks 1 and 2 (22 m³): 23,2 MWh/a

Boiler efficiency (average of boiler I and II): 75%

Natural gas consumption: (4,1 + 23,2) / 0,75 = 36,4 MWh/a

Calculation of optimization boiler II (1 t/h) by increasing feed water temperature:

Operation time of boiler II (0,8 t/h) during non-heating season: 1.640 h/a

Natural gas consumption boiler II (assumption): 1.172 MWh (40 % of total gas consumption)

Boiler efficiency: 70%

Produced heat energy: 1.172 MWh * 0,7 = 820,4 MWh/a

Feed water temperature: 95 °C

Produced steam (see baseline): 1.101 t

Energy input to heat feed water from 95 °C to 168 ° C and 7,5 bar: 86,53 kWh/t

Total energy input: 1.101 t * 85,53 kWh/t = 95,3 MWh/a

Natural gas consumption: 95,3 / 0,7 = 136,1 MWh/a

Calculation of optimizing boiler I (10 t/h) by upgrading boiler control system:

Operation time of boiler I (10 t/h) during heating season: 1.168 h/a

Produced heat energy (see baseline): 1.406 MWh/a

Boiler efficiency: 90%

Natural gas consumption boiler I: 1.406 MWh/a / 0,9 = 1.562,2 MWh/a

Electric input capacity of fans (combustion, flue gas): 22 kW

Load factor: 0,5

Electricity consumption: 22 kW * 1.168 * 0,5 = 12,85 MWh/a

Natural gas consumption: 36,4 + 136,1 + 1.562,2 = 1.734,8 MWh/a

Natural gas costs: 1.734,8 * 24,55 USD/MWh[3] = 42.589 USD/a

Electricity costs: 12,85 * 62,47 USD/MWh[4] = 803 USD/a

[3] Natural gas price mix

Total costs: 42.589 + 803 = 43.392 USD/a

CO_2 Emissions: 1.734,8 MWh * 0,2 tCO_2/MWh + 12,9 MWh * 0,264 tCO_2/MWh = 350 tCO_2/a

Capital and operation & maintenance expenditure (incl. VAT)

The total investment costs were estimated at around 34.045 USD (= additional costs to the baseline scenario). Costs for maintenance were estimated at: 0 USD/a (detailed investment costs see Annex B).

Calculation of annual savings (for detailed calculations see Annex B)

	Baseline	Saving project	**Savings**
Natural gas consumption in MWh/a	2.323	1.735	**588**
Electricity consumption in MWh/a	40	12,9	**27,1**
Energy costs in USD/a	59.510	43.392	**16.118**
CO_2 Emissions in tCO_2/a	475	350	**125**

Table 4: Calculation of annual savings

Technical feasibility analysis, recommendations,

All measures are technically feasible.

Recommendations:

- Regular maintenance of the gas boiler system

4.2 Project 2: Optimization of the ventilation system in the sweets production hall

Description of the baseline scenario (current situation)

The production hall for sweets is equipped with several backing ovens (see picture 5, 6 Annex A). The ovens are gas fired but also electricity heated and not heat insulated. Waste heat is removed

[4] Electricity tariff mix

from the ovens and surroundings by the ventilation system. The ventilation system comprises of 2 fans and a duct system (see picture 8, Annex A) and is operated permanently during working hours without any control system for adjusting to the demand of the production (see picture 7 Annex A).

Electric capacity of fans: 25 kWel

Operation hours: 09:00 – 18:00, 26 days per month

Calculation of the energy consumption of the baseline-scenario (detailed calculation see Annex B):

Operation hours of ventilation system: 2.808 h/a

Installed electric capacity: 2 * 25 kWel = 50 kWel

Electricity consumption per year: 2.808 * 50 kW = 140,4 MWh

Electricity costs: 140,4 MWh/a * 62,47 USD/MWh[5] = 8.771 USD/a

CO_2 Emissions: 140,4 MWh * 0,264 tCO_2/MWh = 37 tCO_2/a

Concept of improvement

The client plans the optimization of the ventilation system in the sweet production hall by implementing the following measures:

- Heat insulation of the backing stoves in order to minimize the internal heat load in the hall and to reduce the electricity respectively natural gas consumption
- Reduction of the ventilation demand by sealing leaks in the duct system and closing not used ventilation outlets
- Optimization of the ventilation system by replacing the existing electric drives by correct dimensioned energy efficient drives (approx. electric capacity 15 kWel; IE 2) incl. frequency converter (variable speed drives)
- Adjusting the ventilation demand to the needs of the production

Calculation of the energy consumption of the saving project (detailed calculation see Annex B):

Operation hours of ventilation system: 2.808 h/a

Installed electric capacity: 2 * 15 kWel = 30 kWel

Average load (due to variable speed drives): 50 %

Electricity consumption per year: 2.808 * 30 kW * 0,5 = 42 MWh

[5] Electricity tariff mix

Electricity costs: 42 MWh/a * 62,47 USD/MWh[6] = 2.631 USD/a

CO_2 Emissions: 42 MWh * 0,264 tCO_2/MWh = 11 tCO_2/a

Capital and operation & maintenance expenditure (incl. VAT)

The total investment costs were estimated at around 15.442 USD (= additional costs to the baseline scenario). Costs for maintenance were estimated at: 0 USD/a (detailed investment costs see Annex B).

Calculation of annual savings (for detailed calculations see Annex B)

	Baseline	Saving project	**Savings**
Natural gas consumption in MWh/a	0	0	**0**
Electricity consumption in MWh/a	140,4	42	**98**
Energy costs in USD/a	8.771	2.631	**6.140**
CO_2 Emissions in tCO_2/a	37	11	**26**

Table 5: Calculation of annual savings

Technical feasibility analysis, recommendations,

Automatic control systems ventilation system will reduce the electricity demand. The project is technically feasible.

<u>Recommendations:</u>

- Utilization of waste heat from the backing stoves for heating purposes of the production hall
- Ventilation system should be turned off during breaks

[6] Electricity tariff mix

4.3 Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse

Description of the baseline scenario:

The company owns several buildings at the site which are currently not used. Therefore the company plans to utilize one building complex to implement a new cold storage warehouse.

- Cooling area A (< -10 °C): 1.000 m²; volume of 6.0 00 m³
- Cooling area B (+2 °C to +5 °C): 1.000 m²; volume of 6.000 m³

The cooling energy will be produced by 2 conventional chillers (each around 300 kW cooling capacity) with no waste heat recovery system.

Calculation of the energy consumption of the baseline-scenario (detailed calculation see Annex B):

Cooling area B (+2 °C to +5 °C): 1.000 m²; volume o f 6.000 m³
Specific cooling energy demand per m³[7]: 80 kWh/m³, a

Total cooling demand per year: 6.000 m³ * 80 kWh/m³,a / 1.000 = 480 MWh/a

Chiller I cooling capacity: 300 kWcool

COP chiller: 3,0

Electrical input: 100 kWel

Waste heat recovery: no

Boiler efficiency for hot water preparation and heating: 70%

Waste heat potential (see saving project): 300 MWh/a

Electricity consumption: 480 kWcool / 3,0 = 160 MWh/a

Electricity costs per year: 160 MWh * 62,47 USD/MWh[8] = 9.995 USD/a

Natural gas consumption: 300 MWh/a / 0,7 = 429 MWh/a

Natural gas costs per year: 429 MWh * 24,55 USD/MWh[9] = 10.532 USD/a

Total costs per year: 9.995 + 10.532 = 20.527 USD/a

[7] Average cooling energy demand of European storehouses. Value strongly depends on loading/unloading frequency of the warehouse. Source: Leitfaden „Energieeffizienz für Tiefkühlhäuser“
[8] Electricity tariff mix
[9] Natural gas tariff mix

CO_2 Emissions: 160 MWh * 0,264 tCO_2/MWh + 429 MWh * 0,2 tCO_2/MWh = 128 tCO_2/a

Concept of improvement:

The company owns several buildings at the site which are currently not used. Therefore the company plans to utilize one building complex to implement a new cold storage warehouse.

- Cooling area A (< -10 °C): 1.000 m²; volume of 6.0 00 m³
- Cooling area B (+2 °C to +5 °C): 1.000 m²; volume of 6.000 m³

The cooling energy for cooling area A will be produced by a conventional chiller system with waste heat recovery system, cooling energy for cooling area B will be produced by a energy efficient chiller system (variable speed drive for automatic adjusting on the cooling demand) with waste heat recovery system. Waste heat is transported via pipe system to a storage tank (6 m³) in the main building for heating and hot water preparation purposes.

Calculation of the energy consumption of the saving project (detailed calculation see Annex B):

Cooling area B (+2 °C to +5 °C): 1.000 m²; volume of 6.000 m³
Specific cooling energy demand per m³[10]: 80 kWh/m³, a

Total cooling demand per year: 6.000 m³ * 80 kWh/m³,a / 1.000 = 480 MWh/a

Chiller I cooling capacity: 300 kWcool

COP chiller: 6,5

Electrical input: 68 kWel

Waste heat potential: 1.500 MWh/a

Waste heat recovery rate: 20% → 1.500 MWh/a * 0,2 = 300 MWh/a

Boiler efficiency for hot water preparation and heating: 70%

Electricity consumption: 480 kWcool / 6,5 = 73,8 MWh/a

Electricity costs per year: 73,8 MWh * 62,47 USD/MWh[11] = 4.613 USD/a

Natural gas consumption: 0 MWh/a

Natural gas costs per year: 0 USD/a

Total costs per year: 4.613 USD/a

[10] Average cooling energy demand of European storehouses. Value strongly depends on loading/unloading frequency of the warehouse. Source: Leitfaden „Energieeffizienz für Tiefkühlhäuser“
[11] Electricity tariff mix

CO_2 Emissions: 73,8 MWh * 0,264 tCO_2/MWh + 0 MWh * 0,2 tCO_2/MWh = 19,3 tCO_2/a

Capital and operation & maintenance expenditure (incl. VAT)

The total investment costs were estimated at around 117.426 USD (= additional costs to the baseline scenario, the investment costs for the baseline scenario were estimated at 80.000 USD).

Costs for maintenance were estimated at: 0 USD/a (detailed investment costs see Annex B).

Calculation of annual savings (for detailed calculations see Annex B)

	Baseline	Saving project	**Savings**
Natural gas consumption in MWh/a	429	0	**429**
Electricity consumption in MWh/a	160	74	**86**
Energy costs in USD/a	20.527	4.613	**15.914**
CO_2 Emissions in tCO_2/a	128	19	**109**

Table 6: Calculation of annual savings

Technical feasibility analysis

The installation of an energy efficient chiller system incl. waste heat recovery system for hot water preparation is an energy efficient measure.

Recommendations:

- Since the project is still in a very preliminary status, the PC strongly recommends to evaluate the market situation for cold storage warehouses in Yerevan before implementing the project.
- In order to reduce the energy consumption, sufficient heat isolation should be applied, frequency of loading /unloading of the warehouse should be limited, fast closing gates and energy efficient light system should be implemented.

4.4 Project 4: Energy data monitoring system

Description of the baseline scenario:

Currently no energy and production data are recorded (except total natural gas and electricity consumption).

Calculation of the energy consumption of the baseline-scenario (detailed calculation see Annex B):

Electricity consumption: 2.610 MWh/a

Electricity costs per year: 164.921 USD/a

Natural gas consumption: 3.255 MWh/a

Natural gas costs per year: 79.910 USD/a

Total costs per year: 164.921 + 79.910 = 244.831 USD/a

CO_2 Emissions: 2.610 MWh * 0,264 tCO_2/MWh + 3.255 MWh * 0,2 tCO_2/MWh = 1.348 tCO_2/a

Concept of improvement:

The company intends to install an energy data monitoring system comprising of the following:

- Energy measurements of 20 main consumers
  - Boiler house: natural gas consumption, produced heat energy of each boiler, fresh water consumption, condensate
  - Other natural gas consumers
  - Heat energy consumed by the main heat consumers
  - Electricity consumed by the main electricity consumers
- Automatic recording system of energy data
- Energy data management software

Since the energy demand is substantial PC strongly recommends to implement an energy monitoring system in order to optimize the system. Savings will be achieved by consequent analyzing of the energy consumption, identification of consumers with high energy consumption and optimizing those consumers.

Calculation of the energy consumption of the saving project (detailed calculation see Annex B):

Electricity consumption in 2010: 2.640 MWh/a

Savings of the electricity consumption: 3 %

Electricity consumption: 2.640 MWh * 0,97 = 2.561 MWh/a

Electricity costs per year: 2.561 * 62,47 USD/MWh[12] = 159.986 USD/a

Natural gas consumption: 3.255 MWh

Savings of the natural gas consumption: 3 %

Natural gas consumption: 3.255 * 0,97 = 3.157 MWh/a

Natural gas costs per year: 3.157 MWh * 24,55 USD/MWh[13] = 77.504 USD/a

Total costs per year: 159.986 + 77.504 = 237.490 USD/a

CO_2 Emissions: 2.561 MWh * 0,264 tCO_2/MWh + 3.157 MWh * 0,2 tCO_2/MWh = 1.307,5 tCO_2/a

Capital and operation & maintenance expenditure (incl. VAT)

The total investment costs were estimated at around 19.303 USD (= additional costs to the baseline scenario). Costs for maintenance were estimated at: 0 USD/a (detailed investment costs see Annex B).

Calculation of annual savings (for detailed calculations see Annex B)

	Baseline	Saving project	**Savings**
Natural gas consumption in MWh/a	3.255	3.157	**98**
Electricity consumption in MWh/a	2.640	2.561	**79**
Energy costs in USD/a	244.831	237.490	**7.341**
CO_2 Emissions in tCO_2/a	1.348	1.308	**40**

Table 7: Calculation of annual savings

[12] Electricity tariff mix
[13] Natural gas tariff mix

Technical feasibility analysis

The installation of an energy data monitoring system is an energy efficient measure. The project is technical feasible.

Recommendations:

Energy data and production data (e.g. produced flour, produced sweets) should be monitored and analyzed regularly. Calculation of benchmarks (e.g. kWh/t) will help to recognize malfunctions in the technical system.

4.5 Summary of production, savings, investment costs

The overall investment costs (incl. VAT) were estimated at 186.216 USD (69.483.582 AMD)[14].

The savings of electricity were calculated at 291 MWh per year. The savings of natural gas were calculated at 1.115 MWh per year.

Disregarded of project 3 (Implementation of a chiller system incl. waste heat recovery system for cold storage warehouse), the savings of electricity will reduce the electricity consumption in 2010 by 8%, and the savings on natural gas will reduce the natural gas consumption in 2010 by 21%.

The overall amount of CO_2 reduction is around 299 t per year. The overall specific value for energy saved per invested USD is 7,55 kWh/USD.

The detailed investment costs and the calculated savings on electricity and natural gas are shown in the table below.

Summary of calculated savings							
			Production		Savings		
	Investment costs		Electricity	Heat	Electricity	Natural gas	CO_2
Project	USD	AMD	MWh	MWh	MWh	MWh	t/a
Project 1: Optimization steam boiler system	34.045	12.703.358	0	0	27	588	125
Project 2: Optimization of the ventilation system in the sweets production hall	15.442	5.761.940	0	0	98	0	26
Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	117.426	43.815.672	0	0	86	429	108
Project 4: Energy data management system	19.303	7.202.612	0	0	79	98	40
Sum	**186.216**	**69.483.582**	**0**	**0**	**291**	**1.115**	**299**

Negative values indicates additional consumption

[14] Project preparation costs are incl. in the investment cost.

Table 8: Summary of production, savings, investment costs

4.6 Implementation plan

The implementation plan was assessed for each measure.

Measure	Project status[15]	Permits (if required)	Project start	Project end
Measure 1: Optimization steam boiler system	Preliminary	No permits required	2nd half 2011	End 2011
Measure 2: Optimization of the ventilation system in the sweets production hall	Preliminary	No permits required	2nd half 2011	End 2011
Measure 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	Preliminary	No permits required	2nd half 2011	End 2012
Measure 4: Energy data monitoring system	Preliminary	No permits required	2nd half 2011	End 2011

Table 9: Implementation plan

4.7 Monitoring Plan

In order to be able to evaluate the performance of each measure after the project implementation the following measurement equipment should be applied for recording the stated monitoring indicators.

Measure	Monitoring value	Measurement equipment	Unit	Monitoring value (after implementation)
Measure 1: Optimization steam	steam produced, gas	Gas meter, heat meter,	MWh	Not applicable

[15] Project cycle: preliminary (preliminary design is available e.g. EA from PC), engineering (engineering documents are available), supplier selected (supplier already contracted, detailed design documents available), implementation (project is under construction), in operation (project is already in operation)

boiler system	consumption	water meter		
Measure 2: Optimization of the ventilation system in the sweets production hall	Electricity consumption	Electric meter	MWh	Not applicable
Measure 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	Cooling energy produced, heat energy produced of the waste heat recovery system	Heat meter	MWh	Not applicable
Measure 4: Energy data monitoring system	Energy data	Heat meter, electric meter, gas meter	MWh	Not applicable

Table 10: Monitoring plan

5 Assessment of compliance with environmental, health & safety laws, regulation and standards

A. Does the Company has all the required permits to operate?	
Company to have all environmental, health and safety permits required to operate in accordance with national laws.	
1. Company to list relevant EHS permits and confirm that these permits are currently valid.	*OK*
2. Company to confirm that it complies with the provisions of these permits.	*OK*
B When was the last inspection by the environmental, health and safety authorities and what were the results of the inspection?	
Company is operating to the satisfaction of the local environmental, health and safety authorities.	
Company Compliance Actions:	*Check:*
1. Company to provide date, and results, of last inspection.	*OK*
2. Company to give details of any corrective actions were required by the authorities and which actions, if any, have been undertaken.	*No corrective actions*
C. Is the Company the subject of any fines, penalties, other legal actions or public complaints resulting from non-compliance with applicable laws and regulations?	
Company is not the subject to any outstanding, material fines, penalties, legal actions or complaints likely to affect the viability, or good reputation, of the Company.	
1. Company to provide information on any fines, penalties, legal actions or public complaints received in last three years.	*No fines*
2. Company to demonstrate how it has responded to any such penalties, actions or complaints.	*No fines*
D. Is the Company located near to any protected sites (protected for environmental, archaeological or cultural reasons) which it will have a negative impact or which cause restrictions to the Company's operations?	
Company is not having a negative impact on any sites protected by international or national law.	
1. Company to list protected sites in proximity to its facilities and any negative impacts from the Company's facilities on that site.	*OK, (no protected sites near the plant)*
2. Company to list actions (implemented and planned) to reduce and eliminate impact on any affected protected sites.	*OK, (no protected sites near the plant)*
E. Are there any significant health and safety issues associated with your Company's operations?	
Company is not a source of significant risk to worker or public health and safety.	
1. Company to list key worker health and safety issues associated with its activities.	*OK*
2. Company to list hazardous materials stored and used on site.	*No hazardous materials*
3. Company to demonstrate adequate management procedures and practices for storage and handling of such materials.	*No hazardous materials*
4. Company to provide statistics on accidents and near misses on-site.	*OK*
5. Company to summarise training / procedures / equipment etc. provided to protect worker and public health and safety.	*OK*
F. Is the Company a source of any significant local nuisance in terms of, for example, emissions, noise at day or night or odours?	
Company is not a source of public nuisance or local disputes.	
1. Company to provide information on nearest residential areas?	*OK, (plant is located in idustrial area)*
2. Are there any aspects of the Company's operations which have a negative impact on, or are a source of dispute with, local residents?	*OK, (no negative impact expected)*
3. Company to list actions to minimise any such negative impacts on residential areas.	*OK, (no negative impact)*
G. Is the Company compliant with relevant national and ILO requirements on labour?	
Company is compliant with national labour requirements and ILO conventions on harmful child labour, forced labour and discrimination.	
1. Company has policies and procedures in place setting out working conditions and terms of employment to ensure compliance with national labour requirements.	*OK, (secured by the management)*
2. Company has procedures in place to confirm age of workers and to ensure that workers undertake tasks commensurate with age;	*OK, (secured by the management)*
3. Company does not employ any forms of forced labour;	*OK, (secured by the management)*
4. Company has policies and procedures in place to avoid discrimination on the grounds of, for example, sex or race.	*OK, (secured by the management)*
5. Company to provide results of last labour inspection undertaken by labour authorities.	*OK, (secured by the management)*
6. Company to give details of any corrective actions were required by the authorities and which actions, if any, have been undertaken.	*OK*

All analyzed projects will not violate environmental, health and safety or social laws, regulations, and standards.

6 Profitability analysis

6.1 Capital expenditure, Operation & Maintenance expenditure (incl. VAT)

The overall investment costs (=additional cost to the baseline scenario, incl. VAT) for the projects 1 to 4 were estimated at 186.216 USD (69.483.582 AMD)[16]. The investment costs are based on offers from manufacturers and experiences of the PC.

The detailed breakdown of the investment costs for each measure is shown in Annex B.

The projected operation & maintenance costs (excluding energy costs) associated with the proposed projects were estimated at 0 USD/a (0 AMD/a).

The costs are based on information from manufacturers, the company´s management and experiences of the PC.

	Investment costs		Operation & Maintenance	
Measure	**USD**	**AMD**	**USD/a**	**AMD/a**
Project 1: Optimization steam boiler system	34.045	12.703.358	0	0
Project 2: Optimization of the ventilation system in the sweets production hall	15.442	5.761.940	0	0
Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	117.426	43.815.672	0	0
Project 4: Energy data management system	19.303	7.202.612	0	0
Sum	**186.216**	**69.483.582**	**0**	**0**

Table 11: Capital expenditure, operation & maintenance expenditure

[16] For project 4 the costs for the baseline scenario (one conventional chiller) was estimated to 80.000 USD

6.2 Cash Flow Analysis

All projects were assessed independently due to variations in investment and the different energy savings achieved. For each measure the NPV, Payback-Period and IRR were calculated (see Annex C).

The profitability analysis of the projects was calculated under the following assumptions:

- Discount rate: 8 %
- Electricity price for 2011: 80,43 USD/MWh (day tariff), 45,58 USD/MWh (night tariff)
  It was assumed by the PC that the power supply will be based on 6 kV non-direct connection. Tariffs according energy bills of the client and official tariff information of the Armenian Regulatory Commission.
- Natural gas price for 2011 < 10.000 m³/month: 35,39 USD/MWh. Tariffs according energy bills of the client and official tariff information of the Armenian Regulatory Commission.
- Natural gas price for 2011 > 10.000 m³/month: 24,8 USD/MWh. Tariffs according energy bills of the client and official tariff information of the Armenian Regulatory Commission.
- Scenario 1: constant energy prices over the calculation period
- Scenario 2: energy prices increase of 10% per year over the calculation period
- Calculation period for Cash Flow Analysis: 10 years

The calculated savings represent the savings versus the baseline scenario. The cost benefit analysis compares the project scenario with the baseline and analyses the net benefits arising from the project implementation.

The investigated projects 1 to 4 show an overall IRR of > 20,7%, an overall pay back time > 4,1 years and an overall NPV of 119.175 USD for the scenario 1 (constant energy prices over the next 10 years).

Whereas for the more realistic scenario 2 (increased energy prices over the next 10 years) the overall IRR for the projects 1 to 4 was calculated at + 32,8%, the overall pay back time at 3,3 years and the overall NPV at + 317.934 USD.

Results of the Cash Flow Analysis see the table below and Annex C.

Cash Flow Analysis								
	Investment	Savings[1)]	IRR		Pay back		NPV	
Project	USD	USD/a	%		years		USD	
Energy price increse 0% / 10%			0%	10%	0%	10%	0%	10%
Project 1: Optimization steam boiler system	34.045	16.118	46,3%	**60,9%**	2,1	**1,8**	74.107	**144.497**
Project 2: Optimization of the ventilation system in the sweets production hall	15.442	6.140	38,2%	**52,0%**	2,5	**2,2**	25.755	**52.567**
Project 3: Implementation of a chiller system (incl. waste heat recovery system) for cold storage warehouse	117.426	15.914	5,9%	**16,5%**	7,4	**5,4**	-10.644	**58.855**
Project 4: Energy data management system	19.303	7.341	36,3%	**49,9%**	2,5	**2,2**	29.956	**62.015**
Overall	**186.216**	**45.512**	20,7%	**32,8%**	4,1	**3,3**	119.175	**317.934**

1) excl. O&M costs

Table 12: Results of the Cash Flow Analysis

7 Risk Assessment

The various types of risks that can occur during project implementation or during operation are assessed and described below.

Type of risk	Risk level	Risk mitigation strategy
Technical risks		
Technical performance is lower than calculated	low	
Equipment is not suitable for the application	low	
Economical risks		
Estimated investment costs will be exceeded	medium	Client should ask for at least 2 offers from different suppliers
Operation & Maintenance costs will be exceeded	low	
Savings can not be achieved	low	
Administrative risks		
Authority permits can not be achieved	-	
RES: Feed in Tariffs can not	-	

secured		
RES: Grid access can not achieved	-	
RES: Purchase of land can not be achieved	-	
Project emissions will exceed the emission limits	-	
Management risks		
Management is not capable to implement the project	medium	Client should contract an experienced engineering company for detail engineering tasks

Table 13: Risk Assessment

8 Recommendations to the company

8.1 Overview of possible additional measures

		Energy savings	GHG reduction	Investment costs (estimated)	Estimated savings /year	Priorities	Will be implemented
		MWh	t	BGN	BGN		
1	Improvement of heating system	1.5	4	50,000	12,500	2	Tbd
2	Improvement of insulation	2.6	5	120,000	45,000	1	Tbd
3	Training for staff	0.5	0,4	10,000	2,000	4	Y
4	Optimization of compressors	1.6	3	65,000	30,000	3	Y

8.2 Further benefits from the projects

Apart from the costs and benefits listed above, the proposed investment may bring about further benefits in other fields, such as environmental or social benefits which will be briefly described in this section.

9 Assessment of eligibility under BEECIFF

9.1 Eligibility assessment

All measures are assessed in regard to the applicable eligible criteria under BEECIFF. The assessment shows that all proposed meets the eligible criteria, see table below.

General criteria	**Y / N**	**Remark**
The company is a legal and private enterprise		
The companies business is not listed in the exclusion or referral list of the EBRD		
Project criteria		
The Project is in compliance with Bulgarian environmental, health & safety standards		
Type of all measures is eligible		
EE: Overall value for improvement of energy intensity reaches 10%		

Table 14: Eligibility assessment

9.2 Quality check list (to be completed by the PA)

Question	**YES**	**NO**
Audit report is in line with audit report template		
Audit was performed by registered Energy Auditor		
Situation before implementation is clearly described		
Correct calculation of actual energy consumption using standard methodology		
Clear description of planned measures		
Clear assessment on achievable saving by planed measures		
Clear calculation on GHG reduction using standard methodology		
Economic assessment including main financing indicators		
Reasonably proposed energy efficiency measures		
Risk analyses included		
Eligibility of project is checked correctly		
Energy savings reported are realistic		

Annex III

Checklist for the Project Assistant

Quality check list (to be completed by the PA)

Question	YES	NO
Audit report is in line with audit report template		
Audit was performed by a licensed Energy Auditor		
Situation before implementation is clearly described		
Correct calculation of actual energy consumption using standard methodology		
Clear description of planned measures		
Clear assessment on achievable saving by planed measures		
Clear calculation on GHG reduction using standard methodology		
Economic assessment including main financing indicators		
Reasonably proposed energy efficiency measures		
Risk analyses included		
Eligibility of project is checked correctly		
Energy savings reported are realistic		

Annex IV

Contract template for hiring Energy Auditors

Contract

for conducting an energy

efficiency audit

Today …… in the town of …….. between

…….(company) , address: ……., BULSTAT ……., represented by ……..- Executive director, Personal Identification Number ……., ID card ……. issued by the Ministry of Interior -……., on …….. hereinafter called PRINCIPAL, on the one hand,

and

…….(company) , address: ……., BULSTAT ……., represented by ……..- Executive director, Personal Identification Number ……., ID card ……. issued by the Ministry of Interior –……., on …….. ..

hereinafter called CONTRACTOR, on the other hand,

was concluded as follows:

ART.1

Subject to contract

1.1 The PRINCIPAL assigns, and the CONTRACTOR agrees to make:

1. A simplified audit for investigating the energy efficiency of (name of the company), in the town of ……., under art.7, para.1 from Ordinance RD-16-346 from 14.04.2009 and according to the requirements of the Energy Efficiency Act;
2. A report for the conducted audit according to the results of the investigation and a summary based on the requirements of that ordinance. The methodological guidelines for investigation of the energy efficiency of industrial systems are approved by the Minister of Economy and Energy and other legal documents under the Energy Efficiency Act.

ART.2

Volume and content of work

2.1 The volume and content of the audit, respectively the report for the conducted audit, are described in detail in Annex № 01- an integral part of this contract

2.2 The prepared report for energy efficiency investigation, containing all results from the work of the CONTRACTOR, incl. tables with results from calculations, graphs, charts, digital photographs, etc., will be delivered to the PRINCIPAL in the following form:

1. Printed on paper
2. Electronically (pdf format).

2.3 The working language in which is prepared the contract with all included materials, is Bulgarian. The report can be translated into English after an additional agreement.

2.4 For the report prepared by the CONTRACTOR and delivered to the PRINCIPAL, the parties sign a hand-over protocol.

ART.3

Terms of the contract

3.1 The deadline for the full implementation of the contract in the presented volume, described in Annex № 01 of the Contract, is……..

3.2 Both parties agree:

- The audit should begin no later than 5 days after the conclusion of the contract.
- The contract to be fully implemented by……with a physical delivery of the report for the energy audit.

3.2 The terms of implementation may be extended only by written agreement between the two parties.

Art.4

Prices and Payments

4.1 The contract price for the work amounts to 10,000 (ten thousand) leva without VAT which covers the fees and all expenditure of the CONTRACTOR

4.2 The PRINCIPAL pays 5000 leva or 50% from the agreed remuneration for the overall performance of the contract after signing it, but not later than 5 days

4.3 The PRINCIPAL undertakes to pay the CONTRACTOR the remaining 50% from the remuneration, after physical delivery of the report for the energy audit and bilateral signing of the hand-over protocol.

4.4 The payments between the PRINCIPAL and the CONTRACTOR are made with a payment order of the PRINCIPAL against an invoice submitted by the CONTRACTOR.

4.5 The remuneration is paid in a bank account of the CONTRACTOR in Bulgarian leva. The CONTRACTOR's bank account: .....

ART.5

Rights and Obligations of the CONTRACTOR

5.1 The CONTRACTOR undertakes to perform the contract work qualitatively and on time, as required by the PRINCIPAL.

5.2 To participate in the inspections of the premises, in the collection and processing of primary information for the operation of the site and the analysis of the energy costs as they coordinate all their actions with the representative of the PRINCIPAL. Based on this data and with the assistance of experts/ staff by the PRINCIPAL, to prepare a report for the audit in which to be reflected the energy saving measures in order to increase the energy efficiency of the site.

5.3 To prepare the necessary calculations, analysis, balances, etc. in accordance with the subject of the contract.

5.4 To comply with all regulations, BDS, EN and the technological requirements of the PRINCIPAL.

5.5 To comply with Safety equipment, related to the task.

5.6 To remove at their own expense found weaknesses and errors in the delivered documentation, in terms, further agreed with the PRINCIPAL. These terms to be indicated in findings upon delivery of the report.

5.7 The CONTRACTOR undertakes not to take advantage and not to disclose information obtained as a database for work, as well as facts, information, documents on the project, representing a company secret. With proven violation of this Agreement, the CONTRACTOR restores the moral and material damage to the PRINCIPAL under the existing legislation in the country.

ART. 6

Rights and Obligations of the PRINCIPAL

6.1 To provide the CONTRACTOR and their collaborators with access to the site and suitable premises for the team from the auditing company and to assist in capturing the status quo with a view to providing the necessary input data for the implementation of the project.

6.2 To provide the CONTRACTOR with all available in the enterprise data for the site, incl. documentation archive, financial, technical and accounting data for current and past periods according to the needs and requirements of the CONTRACTOR and necessary for the implementation of the agreed task.

ART.7

Sanctions

7.1 For the delayed implementation of the contract obligations, the guilty party owes a penalty in the amount of 0.5% per day of the contracted price, but no more than 10% of its size.

7.2 When the contract is terminated by the PRINCIPAL, they pay in full size to the CONTRACTOR the carried out work by the time of termination.

7.3 In breach of contract from the CONTRACTOR, they return to the PRINCIPAL the received amount, implemented as an advance under point 4.2 from the contract together with the legal interest for the period of its detention.

Art.8

Proprietorship

8.1 Any results or patents, received by the CONTRACTOR in the implementation of the negotiated agreement, will be owned by the PRINCIPAL

8.2 Copyright and other proprietary rights with respect to reports, documents, data, manuscripts or parts of them belong exclusively to the PRINCIPAL, except where proven that copyright or other proprietary right already exist before the date of this agreement.

Art.9

Confidentiality clause

The CONTRACTOR undertakes not to take advantage and not to disclose to third parties, except with the prior consent of the PRINCIPAL facts, information, documents and other issues, known, reported or brought to their attention during the execution of this agreement as well as any issues arising from them.

Art.10

Final provisions

1. Any amendments under this contract are made in writing and become an integral part of it;
2. For the outstanding issues in this contract are applied the provisions under the Law on Obligations and Contracts and the other legal documents;
3. The PRINCIPAL may assign to the CONTRACTOR additional work beyond the current contract indicated with an addendum to this contract.

This contract was signed in 2 (two) identical copies, one for each party.

PRINCIPAL: **CONTRACTOR:**

…… **.....**

ANNEX № 01

TO CONTRACT DATED .....

CONTENT OF AN AUDIT

FOR INVESTIGATION OF ENERGY EFFICIENCY

Annex V

List of eligible Energy Auditors

Number of trainer	Mr/Ms	First name	Family name
1	Mr.	Ivan	Trichkov
2	Mrs.	Tanya	Hisova
3	Ms.	Ivana	Serafimova
4	Mr.	Alexander	Penchev
5	Mr.	Ivo	Dimov
6	Mrs.	Vera	Mincheva
7	Mr.	Angel	Hristov
8	Mr.	Georgi	Stoynov
9	Mrs.	Elena	Dicheva
10	Mr.	Anton	Todorov
11	Mr.	Blagomir	Zhelqzkov
12	Mr.	Kamen	Simeonov
13	Mr.	Alexander	Stankov
14	Mr.	Ventsislav	Mirchev
15	Mr.	Krasimir	Stefanov
16	Mr.	Kristian	Spasov
17	Mr.	Peter	Zhelev
18	Mr.	Dobromir	Dobrev
19	Mr.	Georgi	Rashkov
20	Mr.	Ivan	Prodanov
21	Mr.	Dimitar	Baev
22	Mr.	Nikola	Stankov
23	Mr.	Bozhidar	Ivanov
24	Mr.	Zdravko	Georgiev
25	Mr.	Venelin	Draganov
26	Mrs.	Ekaterina	Taneva-Papen
27	Mr.	Ivan	Zahariev
28	Ms.	Hristina	Budinova
29	Mr.	Hristiyan	Terziev
30	Mr.	Alexander	Vodenicharov
31		Dobrin	Oreshkov
32	Ms.	Ina	Boyadzhieva
33	Mr.	Vladislav	Aleksandrov
34	Mr.	Lyubomir	Lyubomirov
35	Ms.	Nina	Penkova
36	Mr.	Kalin	Krumov
37	Mr.	Emil	Vladimirov
38	Dr. eng.	Lyubomir	Tsokov
39	Assist. Prof.	Kamen	Stokov
40	Assist. Prof.	Momchil	Vasilev
41	Mr.	Rosen	Tsekov
42	M. Sc. Eng.	Mihael	Deliyski
43		Zhivko	Dimov
44	Mr.	Plamen	Stanev
45	Ms.	Tsvetanka	Naydenova
46	Mr.	Julian	Radev

47	Ms.	Maria	Nikolova
48	Ms.	Maria	Stariradeva
49	Mr.	Bojidar	Borisov
50	Mr.	Todor	Lefterov
51	Mr.	Yordan	Torbov
52	Mr.	Vladimir	Stanoev
53	Mr.	Borislav	Stoimenov
54	Mr.	Lazar	Nikolaev
55	Mr.	Teodor	Vuchkov
56	Mr.	Aleksi	Krastev
57	Mr.	Boncho	Katinov
58	Ms.	Aneliya	Raycheva
59	Ms.	Merima	Zlateva
60	Mr.	Lyuben	Karabojikov
61	Mr.	Alexander	Kirii
62	Mr.	Nikolay	Stankov
63	Mr.	Radoslav	Raychev
64	Mr.	Goergi	Kostov
65	Mr.	Zahari	Dimanov
66	Mr.	Radi	Radev
67	Mr.	Lyudmil	Radev
68	Mrs.	Dimitrina	Gencheva
69	Mrs.	Iliyana	Hadzhieva
70	Mr.	Stoyan	Vladimirov
71	Mr.	Tsvetko	Shokov
72	Mr.	Georgi	Vodenicharov
73	Mr.	Veselin	Chaushev
74	Ms.	Desislava	Chausheva
75	Mr.	Konstantin	Delisivkov
76	Mr.	Boyan	Tsvetkov
77	Mr.	Plamen	Nikolov
78	Mr.	Rumen	Sirakov
79	Mr.	Daniel	Valev
80	Mr.	Evstati	Ilchev
81	Mr.	Boyko	Salin
82	Mr.	Yulian	Yovchev
83	Mr.	Plamen	Shindarski
84	Ms.	Kostadinka	Todorova
85	Ms.	Ivanka	Koemdjieva
86	Ms.	Veselina	Yancheva
87	Mr.	Bojidar	Naldjiev
88	M. Sc. Eng.	Peter	Evrosimovski
89	Ms.	Desislava	Chalamova
90	Ms.	Gergana	Hristova
91	Ms.	Yordanka	Nikolova
92	Mr.	Boyan	Yankulov
93	Mr.	Georgi	Velikov
94	Mr.	Konstantin	Velev
95	Ms.	Rosiza	Mladenova

96	Mr.	Kosta	Todorov
97	Mr.	Tihomir	Galov
98	Dr. eng.	Pencho	Penchev
99	Dr. eng.	Valentin	Bobilov
100	Dr. eng.	Jivko	Kolev
101	Dr. eng.	Pencho	Zlatev
102	Mr.	Plamen	Mushakov
103	Mr.	Lyuben	Mukov
104	Mr.	Venko	Kirilov
105	Mr.	Georgi	Atanasov
106	Mr.	Lyubomir	Serkedzhiev
107	Mr.	Konstantin	Stoyanov
108	Mr.	Angel	Kolev
109	Mr.	Hristo	Anev
110	Mr.	Georgi	Georgiev
111	Mr.	Alexander	Valkov
112	Mr.	Georgi	Naldjiev
113	Ms.	Gergana	Naldjiev
114	Dr. eng.	Violeta	Rasheva
115	Dr. eng.	Stanislava	Tasheva
116	Dr. eng.	Georgi	Dinkov
117	Prof.	Mincho	Minchev,
118	Prof.	Milcho	Angelov,
119	Mr.	Konstantin	Delisivkov
120	Ms.	Olga	Popova
121	Mr.	Iliya	Doychinov
122	Mr.	Nikola	Abadzhiev
123	Mrs.	Nina	Raycheva
124	Mr.	Krasimir	Lachev
125	Mr.	Andon	Georgiev
126	Mr.	Ivan	Raskov
127	Mr.	Rumen	Hristov
128	Ms.	Maria	Toneva
129	Mr.	Nikolay	Genov
130	Mr.	Elenko	Bojkov
131	Mr.	Angel	Angelov
132	Mr.	Ivan	Yankov
133	Ms.	Gergana	Georgieva
134	Mr.	Hristo	Gospodinov
135	Mr.	Tanio	Germanov
136	Mr.	Shtilian	Kunev
137	Ms.	Marushka	Koleva
138	Mr.	Metodi	Nikiforov
139	Mr.	Vladimir	Tunev
140	Mr.	Milen	Venkov
141	Mr.	Ivaylo	Aleksiev
142	Mr.	Nikolay	Kolev
143	Mr.	Peter	Staev
144	Mr.	Todor	Nikolov

145	Mr.	Alexander	Nedelchev
146	Mr.	Gospodin	Tabakov
147	Mr.	Emil	Boev
148	Mr.	Grigor	Grigorov
149	Mr.	Yosif	Genov
150	Mr.	Rumen	Sapundzhiev
151	Mr.	Alexander	Popov
152	Dr. eng.	Nikolay	Angelov
153	Dr. eng.	Atanas	Mirchev
154	Mr.	Hristo	Hristov
155	Mrs.	Olga	Radeva
156	Mrs.	Velichka	Radeva
157	Mrs.	Svetla	Damyanova
158	Mr.	Vasil	Aleksiev
159	Dr. eng.	Neven	Krastev
160	Ms.	Dimitrinka	Koeva
161	Ms.	Velichka	Radeva
162	Mr.	Atanas	Kumanov
163	Mr.	Deyan	Atanasov
164	Mr.	Todor	Horozov
165	Mr.	Mincho	Peev
166	Prof.	Peter	Kostov
167	Assist. Prof.	Koicho	Atanasov
168	Mr.	Petko	Cankov
169	Mr.	Mincho	Minchev
170	Mrs.	Vesela	Dimitrova
171	Mr.	Georgi	Georgiev
172	Mr.	Ivelin	Dimitrov
173	Mrs.	Evelina	Pirushkina
174	Mr.	Galin	Velikov
175	Mr.	Ivaylo	Pavlov
176	Mr.	Plamen	Nikolov
177	Mr.	Boyan	Tzvetkov
178	Mr.	Stoyan	Ralchev
179	Mr.	Nikola	Rusinov

ANNEX VI

Voucher Systems

Most SMEs have a lack of experience with EE measures and in applying for funding for such projects. Furthermore, paying for the cost of energy auditors or other project preparation activities is a major obstacle.

This might lead to

- Limited number of SMEs will contract energy auditors;
- SME will select non-appropriate equipment due to lack of expertise;
- SME might assume they are not eligible and therefore will not apply.

A voucher system could mitigate the above mentioned obstacles, and provide an easy to administer financial incentive and pre-financing of part of the project preparation costs. A voucher could be used by the SMEs to contract energy advisers/energy auditors to perform one of the following services:

- Support in the selection of appropriate equipment under LEME
- Performance of an simplified energy audit
- Improvement of an existing energy audit report

Two different vouchers could be offered:

- “Basic” voucher covering the cost for general project preparation advice, e.g. for selection the most appropriate equipment from the LEME list
- “Energy Audit” voucher covering the cost of a simplified energy audit.

En example of a voucher scheme is presented below:

SUMMARY OF THE AUSTRIAN

SME ENERGY EFFICIENCY INITIATIVE (VOUCHER SYSTEM)

WWW.KMU-SCHECK.AT

The SME Energy Efficiency Initiative

Austria has about 280.000 small- and medium sized enterprises (SMEs), and they have a large potential to save energy and decrease the reduction of emissions.

Various studies confirm an energy savings potential between 20% and 30%, depending on the economic sector.

In the context of the SME Energy Efficiency Initiative a comprehensive, region-wide incentive system was developed to foster energy audits and support the implementation of the identified measures.

The SME Energy Efficiency Initiative is funded by the Austrian Climate and Energy Fund, and implemented by the Austrian Federal Economic Chamber, with a strong involvement of the Energy Institute of the Economic Chamber. Kommunalkredit Public Consulting is also supporting this programme in the financial control of its implementation. The involvement of the Chamber shall ensure a strong participation of SMEs in this Initiative.

Objectives of the Initiative:

- Awareness raising among enterprises and employees through information, consulting, standardised trainings and standardized performance control.
- Creation of demand from SMEs for energy consulting services.
- Support in a quick implementation of economically sound energy efficiency measures based on recommendations from energy consulting.
- Conclusions about effective incentive systems for the implementation of the energy efficiency measures.
- Development of practical benchmarks for energy relevant sectors.
- Development of case studies of mitigation strategies, which support the reduction of CO2 emissions and which ultimately lead to a zero-emission energy cycles.
- Utilisation of highly efficient energy efficiency technologies.
- Development of potential financing strategies to reduce CO2 emissions.

The Energy Efficiency Voucher

In the framework of the SME Energy Efficiency Initiative grants in the form of an “Energy Efficiency Voucher”, which partly cover the cost of energy consultants, are provided. The program supports “Initial Consulting Services” and “Implementation Support”.

Initial Consulting provides recommendations for energy efficiency improvements. Accredited energy consultants will develop specific energy efficiency measures and provide guidance in obtaining additional funding.

Implementation Support offers advisory and/or engineering services, which are directly connected to the implementation of specific energy efficiency measures.

The grant for Initial Consulting and for Implementation Support covers 90% of the consultancy fee, capped at EUR 675. Each SME can apply for only one voucher for Initial Consulting and Implementation Support within one year. The implementation of the SME Energy Efficiency Initiative is regulated by specific grant regulations, which must be applied.

Procedures

Each SME has to apply for the grant (voucher) electronically by first registering on the website www.kmu-scheck.at. Then the applicant receives electronically an application form, which has to be submitted to Kommunalkredit Public Consulting (KPC). In general all SMEs are eligible, however there are upper limits for the number grants per sector. One the application is approved the applicant receives a grant agreement plus a symbolic "voucher". The the SME has to contract an energy consultant from a list of pre-approved consultants. The programme provides standardises template contracts, each for initial consulting and implementation support. After the implementation of the consultancy and the submission of the (standardised) final report to KPC, KPC directly disburses the funds to the energy consultants.

Available Programme Documents

- Scope of Work for Initial Consulting
- Scope of Work for Implementation Support
- Contract Template Initial Consulting
- Contract Template Implementation Support
- Grant Regulations

Results as per 31.03.2010

Federal State	No of Vouchers	Completed Initial Consultancies	Completed Implementation Supports
Vienna	101	28	1
Lower-Austria	107	45	1
Burgenland	12	3	
Upper-Austria	133	74	
Salzburg	74	31	3
Styria	238	74	3
Carinthia	45	15	1
Tyrol	34	12	
Vorarlberg	4	1	
TOTAL	**748**	**238**	**9**

Federal State	Savings in kWh/a	Savings in t CO^2/a
Vienna	943.620	242,27
Lower-Austria	3.578.472	921,42
Burgenland	334.992	75,16
Upper-Austria	5.370.004	1.277,02
Salzburg	2.739.635	718,85
Styria	3.379.563	797,34
Carinthia	1.620.055	546,90
Tyrol	348.049	90,58
Vorarlberg	118.400	29,15
TOTAL	**18.432.790**	**4.698,7**

Energy Savings according to Measures

Measures	Savings kWh/a	t CO^2/a
Lighting	1.560.710	492,6
Electricity	157.409	50,4
Electric usage without power train	570.837	164,5
Power trains	850.984	259,8
Compressed air system	225.615	66,2
Air conditioner	225.022	67,0
Heating system	4.842.264	1.170,3
Use of other heating sources	1.248.696	253,1

Domestic production	104.100	28,1
Switch of energy sources	461.480	232,3
Usage of waste materials	206.450	41,3
Technological measures	351.161	83,0
Thermal insulation	6.189.675	1.424,2
Mobility	697.737	171,7
Contracting	-	-
Organizational Measures	685.136	190,2

Breakdown of sectors (No of consultancies)

Automobile-Trade, Servicing, Repairing	29
Retailing (non food)	28
Lodging	27
Gastronomy	26
Offices	21
Manufacturing of furniture	20
Personal services (hairdressing, laundry,…)	14
Wholesale Trade (without Automobile Trade)	13
Bakeries	10
Metal production	10
Meat processing	10
Retailing (food)	10