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FINAL REPORT

# Industrial Energy Efficiency in Moldova

Reducing Greenhouse Gas Emissions through improved Energy Efficiency in the industrial Sector in Moldova
Project Component 1; (GF/MOL/11/001)


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# 1 Summary

In Moldova, the industrial sector is the second-largest consumer of energy after the residential sector. In 2005, industry accounted for 18% of national energy consumption and 34% of national electricity consumption. Over the last decade, manufacturing industry energy intensity has remained basically stable, but has been significantly higher than that of other countries in the region and three to four times higher than the energy intensity of Western countries.

There are several barriers against fostering industrial energy efficiency in Moldova, including:

- the inadequacy of existing policies, institutions and regulatory framework,
- the lack of resources to effectively promote and support energy efficiency,
- the lack of understanding among industry decision-makers of their economic potential for energy efficiency improvements, and
- insufficient technical capacity within enterprises and in the market to identify, develop and implement industrial energy efficiency projects and measures.

This project sought to address many of the existing barriers to industrial energy efficiency, to deliver measurable results and to make an impact on how the Moldovan industry manages and uses energy through an integrated approach.

The main outputs of the project are the following four programs:

- Industrial Energy Efficiency Monitoring, Verification and Benchmarking Program
- National Industrial Energy Efficiency Best Practice Information and Dissemination Program
- National Industrial Energy Efficiency Best Practice Recognition Program
- National Industrial Energy Manager Certification Program

The Austrian Energy Agency (AEA) and the Austrian subcontractor Energon supported the Moldovan Agency for Energy Efficiency (MAEE) in establishing and implementing the four programs.

The main challenges for the Austrian team were

- the need for rescheduling the project work according to the actual frame conditions,
- the limited capacity of the MAEE to implement the recommended activities in time / during the project period, and
- the low interest of Moldovan industrial companies to participate in the benchmarking pilot program.

From January 2012 to March 2014, the Austrian team undertook eight missions to Moldova. During these missions, concerned Moldovan stakeholders were invited to round tables, workshops and conferences. Staff members of MAEE were trained with several tools for implementing the programs and representatives of industrial companies were invited to workshops and seminars on energy management and energy efficiency benchmarking. Promotional activities for the UNIDO program and best practice cases were organised.

In February 2013, the "First National Energy Efficiency Action Plan (NEEAP) of the Republic of Moldova for the Period 2013 - 2015" was published. In "Section 2: Measures Aimed at Enhancing Energy Efficiency in the Industrial Sector" of the NEEAP, the UNIDO GEF project stated major measures for

- introduction of Energy Management Systems and best practices in the industrial sector and
- development of an energy service market for the industrial sector

Energy savings gained by these measures need to be calculated following the UNIDO methodology.

Depending on the actual frame conditions in Moldova, the planned activities for establishing the support programs were modified in accordance with UNIDO. Needed updates of planned activities are described in the respective chapters of this report.

The main results of the project are:

- a methodology for monitoring the energy performance of individual companies in Moldova. The methodology will be applied to monitor and verify the success of the Moldovan energy audit program and of the Moldovan "award for energy efficiency projects in industry" within the annual conference "EcoEnergetica".
- a National Industrial Energy Efficiency Monitoring and Verification Program. Within a Swedish-financed project, a system for sector-wide monitoring was developed for supporting the reporting requirements of the Government of Moldova, the Energy Community and in a further perspective also the EU. Within the UNIDO GEF project, a clear vision on M&V on sector and sub-sector level was developed. MAEE has started the process of changing the data collection and development of Energy Performance Indicators (EPI) of the National Bureau of Statistics (NBS). Clear recommendations for the change of the data collection system of NBS were elaborated.
- an Industrial Energy Efficiency Benchmarking Program was established and a pilot project with the Moldovan dairy industry was conducted. A clear vision on the application of Benchmarking within nine different subsectors of the Moldovan industry sector was established.
- a National Industrial Energy Efficiency Best Practice Information and Dissemination Program was developed. Awareness raising for energy efficiency possibilities within industrial enterprises was a very important task of the project. The project team realised that more emphasis should be placed on the promotion of existing results and the promotion of lighthouse projects to attract companies to participate in benchmarking programs and audit programs. In 2013 therefore, the focus of the work was also on supporting MAEE in promoting the UNIDO GEF project results.
- two videos were produced on the implementation of an Energy Management System in Moldovan dairies.
- a National Industrial Energy Efficiency Best Practice Recognition (BPR) Program was developed and established. The Austrian team supported MAEE in implementing an award category for "Industrial Energy Efficiency" projects into the annual Moldovan conference "EcoEnergetica".
- Austrian data collection sheets and energy audit tools for industrial companies have been adapted for the Moldovan industry. For future energy audit programs in Moldova the (same) tools can be applied.

This project delivered many supportive tools and programs to be used by the MAEE for further industrial energy efficiency activities.

During the last mission to Moldova, a seminar on Industrial Energy Policy was organized. The aim of the seminar was to illustrate the status of the Moldovan industrial energy efficiency policy and programs and to analyse and discuss if the policy met the requirements of the industrial energy efficiency policy of the European Union.

For a structured discussion approach, the AEA and Energon developed a table with twelve recommended policies. The different programs were analyzed regarding the following issues:

- Is the program already part of the National Energy Efficiency Action Plan (NEEAP 2013 - 2015)?
- Is the program already part of the National Program for Energy Efficiency (NEE 2013 – 2020)?
- What is the status and timeline of the program?
- Is further support needed for implementation? If yes, what kind of support?
- What are the most important programs for Moldova? The programs were assessed according to their priority.

Discussions about individual policy programs were quite fruitful and highest priority should be given to the following tools:

- energy audits
- energy efficiency benchmarking
- energy service companies (ESCOs)

Results were disseminated to Moldovan stakeholders for further input and support and should be the basis for future instruments. The table provides a good overview on the focus of further UNIDO projects in Moldova (see Annex III, page 501).

In conclusion, it can be said that with the UNIDO GEF project a profound basis for energy efficiency improvements in the industrial sector in the Republic of Moldova was created. But for the concrete implementation of all programs more time is needed and also further specific support from international experts will be required by the MAEE.

# 2 Background of the Project

## 2.1 UNIDO Industrial Energy Efficiency Program

Improving energy efficiency in industry is one of the most cost-effective ways to help supply-constrained developing and emerging countries meet their increased energy demand. The final goal of the UNIDO Industrial Energy Efficiency (IEE) program is to put sustained energy management and efficiency practices in industry to effect in developing countries and emerging economies in order to reduce the environmental pressure of economic growth.

## 2.2 Aim of the Project

In Moldova, the industrial sector is the second-largest consumer of energy after the residential sector. In 2005, industry accounted for 18% of national energy consumption and 34% of national electricity consumption. Over the last decade, manufacturing industry energy intensity has remained basically stable, but has been meaningfully higher than that of other countries in the region and three to four times higher than the energy intensity of modern Western countries.

There are several barriers against fostering industrial energy efficiency in Moldova, including

- the inadequacy of existing policies, institutions and regulatory framework,
- the lack of resources to effectively promote and support energy efficiency,
- the lack of understanding among industry decision-makers of their economic potential for energy efficiency improvements, and
- insufficient technical capacity within enterprises and in the market to identify, develop and implement industrial energy efficiency projects and measures.

This project sought to address many of the existing barriers to industrial energy efficiency, to deliver measurable results and to make an impact on how the Moldovan industry manages and uses energy through an integrated approach.

Primary target groups of the project were decision-makers in manufacturing enterprises (managers and engineers), businesses providing industrial equipment, energy professionals and service providers, as well as energy efficiency policy making and implementing institutions.

The UNIDO GEF project is divided into three project components, the first one representing the project reported.

- Project Component 1 (PC1) deals with the shortcomings of existing policies, institutions and regulatory framework. The scope of this final report is the work completed within PC1
- Project Component 2 (PC2) addresses the insufficient technical capacity within enterprises and works with Moldovan companies. The so-called “Type A” enterprises receive technical support and training for implementing an energy management system (EnMS). The Moldovan Agency of Energy Efficiency (MAEE) will monitor the energy performance of these enterprises
- Project Component 3 (PC3) tackles the enterprises’ lack of funds for the development and preparation of industrial energy efficiency projects

The project was funded by the Global Environment Facility (GEF). The following work streams (WS) were scheduled for the project:

- WS 1: planning and management
- WS 2: development and establishment of an Industrial Energy Efficiency (IEE) Monitoring and Verification Program for the GEF UNIDO project
- WS 3: development and establishment of a National IEE Monitoring and Verification Program
- WS 4: development and establishment of an IEE Benchmarking Program
- WS 5: development and establishment of a national IEE Best Practices Information and Dissemination Program
- WS 6: development and establishment of a national IEE Best Practices Recognition Program
- WS 7: development of a National Industrial Energy Manager Certification Program
- WS 8: reporting

The expected outputs of the project were:

- Output 1.1.: an Industrial Energy Efficiency Monitoring, Verification and Benchmarking Program (IEE M&V&BM)
- Output 1.2.: a National Industrial Energy Efficiency Best Practice Information and Dissemination Program (IEE BPID)
- Output 1.3.: a National Industrial Energy Efficiency Best Practice Recognition Program (IEE BPRP)
- Output 1.4.: a National Industrial Energy Manager Certification Program (IEE EMC)

# 3 Project Period and Scope of the Final Report

According to the contract, the project period was scheduled from January 2012 to December 2013. Due to the limited capacity of the MAEE to implement the recommended activities in time and to the communication with the National Bureau of Statistics (NBS) to adapt the statistical data collection system, the project period was extended by three months until the end of March 2014.

The final report covers the total project period from January 2012 to the end of March 2014. The final report completes the content of the first progress report that illustrated the project results gained within the first 14 months. It described the methodologies and the supportive tools for establishing different programs for industrial energy efficiency in Moldova according to the Work Streams 2 – 7.

From March 2013 until the end of the project in March 2014, the following activities for establishing the four programs were undertaken:

- The 6th mission was from 27th of May to 29th of May 2013. During this mission the workshop with Moldovan companies on benchmarking and energy management systems was organized on 28th of May 2013. Detailed information can be found in the outline of the 6th Mission in chapter 12.7 and in the Minutes of the mission in the Annex.
- Awareness raising for energy efficiency possibilities within industrial enterprises is a very important task of the project. Therefore, the focus of the work in 2013 was to finalize and update the MAEE website (http://aee.md/) in English, including project relevant information, Best Practice Cases and videos.
- A new category on Energy Efficiency in Industry was introduced to the annual conference EcoEnergetica. The application form for industrial enterprises was updated. Based on the experience of the EcoEnergetica in 2013 this application form will be updated to tailor specific means.
- AEA recommended updates of the existing data collection sheets in the building sector to be used for energy audits in industry. Furthermore, MAEE received the Austrian energy audit tool “ProTool” in Romanian.
- MAEE developed a clear vision of M&V on sector and sub-sector level. MAEE started the process of changing the data collection and development of Energy Performance Indicators (EPI) of the National Bureau of Statistics (NBS). AEA established clear recommendations for the change of the data collection system of NBS.
- The seventh mission took place from 10th to 12th of March 2014. During this mission, the seminar on “Industrial Energy Policy” was organized on the 11th of March 2014. Detailed information can be found in the outline of the mission in chapter 12.9.

# 4 Outputs and Work Streams

## 4.1 Output 1.1: Industrial Energy Efficiency Monitoring, Verification and Benchmarking (M&V&BM) Program

One of the major outputs expected from the UNIDO GEF Project "Reducing Greenhouse Gas Emissions through the improved energy efficiency in the industrial sector in Moldova (GF/MOL/11/001)" is an Industrial Energy Efficiency Monitoring, Verification and Benchmarking (M&V&BM) Program.

This program comprises three work streams (WS):

- WS 2: development and establishment of an Industrial Energy Efficiency (IEE) Monitoring and Verification Program for the GEF UNIDO project
- WS 3: development and establishment of a National IEE Monitoring and Verification Program
- WS 4: development and establishment of an IEE Benchmarking Program

WS 1 deals with the planning and management of the whole project.

## 4.2 Output 1.2: Best Practice Information and Dissemination (BPID) Program

Within WS 5, a National Industrial Energy Efficiency Best Practice Information and Dissemination (BPID) Program was developed.

The objectives of the BPID Program were

- to raise awareness of an increasingly broader industrial audience of the best practices, the benefits as well as the costs of energy efficiency (EE) and energy management system in the manufacturing sector in Moldova and elsewhere, and
- to offer a reference point for EE and EnMS practitioners as well as enterprises on where to find information and resources for supporting the establishment of an energy management system and for IEE projects identification, development and implementation.

## 4.3 Output 1.3: Best Practice Recognition (BPR) Program

Within WS 6, a National Industrial Energy Efficiency Best Practice Recognition (BPR) Program was developed and established.

## 4.4 Output 1.4: Industrial Energy Manager Certification (IEMC) Program

Within WS 7, a National Industrial Energy Manager Certification (IEMC) Program should have been developed and established. As the European Energy Manager training (EUREM) was already quite well developed in Moldova, MAEE did not see the need for an additional energy manager certification program. It was agreed that the AEA would support the MAEE in improving and adapting the data collection of energy audits.

# 5 Modification and Focus of Work Streams

The expected outputs as referred to in Chapter 4 have been defined in the Terms of References (ToR) on the 10th of October 2011. The establishment and implementation, however, depends on the outcome of other project components and external conditions. In particular, this includes

- MAEE structures and resources,
- progress of the Project Component 2,
- outputs and progress of further projects in the field of industrial energy efficiency, like the Swedish-financed project "Capacity Building to the Ministry of Economy in the Area of Energy Efficiency and Renewable Energy in Moldova",
- progress of national programs like the "Industrial Energy Manager Certification Program",
- ideas and requirements of MAEE regarding setting up a national award ceremony, and
- cooperation of Moldovan dairies within the benchmarking study.

In order to support MAEE as best as possible, use synergies with other projects and avoid "double work", the project team in accordance with the UNIDO technical expert decided to update Work Streams as follows.

## 5.1 Modification of Work Stream 2

The main influencing factor for developing the Monitoring & Verification (M&V) program for Type A[1] enterprises in Moldova was the progress of work with Type A enterprises in project component 2 (PC2). The idea of Work Stream 2 was to establish an M&V Program for the UNIDO GEF project. The MAEE should have monitored the progress of the energy performance of "TYPE A enterprises" from Project Component 2.

During the fifth mission to Moldova (February 18- 20, 2013), AEA discussed with MAEE and the UNIDO experts if this exercise was still of any use for the MAEE. As the MAEE was established much later than planned, the progress with Type A enterprises is much more developed than expected when composing the ToR. Therefore, it was decided that the M&V of Type A enterprises will be done in Project Component (PC) 2 instead of PC1.

However, AEA developed a methodology for monitoring the energy performance of individual companies in Moldova. The methodology will be applied to monitor and verify the success of the Moldovan energy audit program and of the Moldovan "Award for Energy Efficiency Projects in Industry" within the annual conference "EcoEnergetica".

[1] Type A enterprises receive technical support and training for implementing an energy management system within Project Component 2 of the UNIDO GEF project.

## 5.2 Modification of Work Stream 3

The development of the sector-wide monitoring within Work Stream 3 (National IEE Monitoring and Verification Program) was linked with the work of the Swedish-financed project. Within the Swedish-financed project, a system for sector-wide monitoring will be developed. The system should support the reporting requirements of the Government of Moldova, the Energy Community and in a further perspective, also the EU. The focus of the sector-wide monitoring is to show the progress within the work carried out by the MAEE. As a public-financed authority it is important that the MAEE can deliver results and these results are reported in a transparent way.

Within the UNIDO GEF project, MAEE was supported by the AEA to develop a clear vision on the M&V on sector and sub-sector level. MAEE started the process of changing the data collection and development of Energy Performance Indicators (EPI) of the National Bureau of Statistics (NBS). Clear recommendations for the change of the data collection system of NBS were elaborated.

## 5.3 Focus of Work Stream 4 in 2013

Within the UNIDO GEF project MAEE was supported by the AEA to develop a clear vision on the application of Benchmarking within the Moldovan industry sector. In addition to the planned tasks for this Work Stream 4, the Austrian project team supported the MAEE in organizing a benchmarking awareness raising workshop. This information workshop on benchmarking was organized on 28th May 2013.

AEA was also leading a UNDIDO GEF project for benchmarking in food and drink industry in Ukraine. The results of the benchmarking studies for nine sectors of the Ukrainian food and drink industry were also presented during the workshop in Moldova. Moldovan companies from the food and drink industry were able to compare their energy efficiency with Ukrainian companies.

## 5.4 Focus of Work Stream 5 in 2013

Awareness raising for energy efficiency possibilities within industrial enterprises was a very important task of the project. The project team realised that more emphasis should be given to the promotion of existing results and the promotion of lighthouse projects to attract companies to participate in benchmarking programs and audit programs. In 2013, the focus of the work was also on supporting MAEE in promoting the UNIDO GEF project results.

During the fifth mission to Moldova on 20th February 2013, the Austrian team worked with the MAEE on improving the structure of the website.

Best practice examples were developed and published on the MAEE website, two videos of Type A companies were developed and promoted and two half-day promotional events were organized: The first half day seminar on “Energy Management Systems” on the 28th of May 2013 and, the second half day seminar on “Industrial Energy Policy” on the 11th of March 2014.

## 5.5 Modification of Work Stream 6

On December 7th, 2012 the Moldovan conference "EcoEnergetica" was carried out for the first time. MAEE stated in the beginning of the UNIDO GEF project that the Best Practice Recognition Program should be part of this annual conference. As the planning of the event was already in a final phase, MAEE suggested that the Austrian team should support them in 2013 in adjusting the application regulations in order to get information on energy efficiency projects in industry.

During the fifth mission to Moldova in February 2013, the project team analysed the application regulations for the "EcoEnergetica 2012". As there was no category for "Industrial Energy Efficiency" projects, the UNIDO GEF project supported MAEE in improving the regulations for the "EcoEnergetica 2013". MAEE integrated a new category on Energy Efficiency in Industry in the EcoEnergetica and adapted the application form for industrial enterprises in order to be used for M&V of industrial energy efficiency.

## 5.6 Modification of Work Stream 7

During the fifth mission to Moldova in February 2013, AEA discussed with MAEE the kind of support that is needed in this field. As the European Energy Manager training (EUREM) was already quite well developed in Moldova, MAEE did not see the need for an additional energy manager certification program.

It was agreed that the AEA would support the MAEE in improving and adapting the data collection of energy audits.

# 6 Setting up a National M&V Program for the UNIDO GEF Project

## 6.1 Objective

The objective of this work stream was to provide MAEE with technical assistance, training guidance and supervision needed to develop and operate a program to monitor and verify energy efficiency performance of 8-10 enterprises (Type A Enterprises of Project Component 2) participating in and receiving technical assistance from the UNIDO GEF project.

AEA developed a methodology for monitoring the energy performance of individual companies in Moldova. The methodology will be applied to monitor and verify the success of the Moldovan energy audit program and of the energy efficiency award within the annual conference “EcoEnergetica”.

## 6.2 Bottom-up Method

In order to demonstrate the results of energy efficiency support programs for industrial companies, like energy audit programs or energy management system programs, it is important to monitor the energy performance of the participating companies. This monitoring system should demonstrate the results of all companies broken down into individual energy efficiency measures of each company.

The coordinator of the support program needs to define the minimum information that is required to monitor the energy performance. In most cases the information will be collected by energy auditors or energy experts who support the companies in implementing an energy management system. Additionally, the application form of industrial companies for the annual energy award (EcoEnergetica) can be used for M&V purposes of MAEE.

According to the experience of the AEA at least the following data has to be collected from companies in order to monitor their energy efficiency improvement and to establish EPIs:

- general information about the company:
    - branch (NACE Code 3-4 digits)
    - number of employees
    - annual turnover
    - production area
    - annual production time (operating hours)
    - main products
    - etc.
- total annual energy consumption of the company:
    - electricity consumption (incl. own production)
    - thermal energy consumption (gas, oil, district heat, biomass etc.)
    - fuel consumption for transport
- total annual production or raw material input (depends on the sector)
- planned or implemented measures per year (status “planned” or “implemented” should be indicated)

Information on each measure:

- short description of measure
- energy sources before and after the measure
- annual energy savings (electricity, thermal)
- annual $CO_2$ emission reductions
- investment costs
- simple payback period
- internal rate of return (IRR)
- net present value (optional)
- lifetime of measures (optional)

AEA supported the MAEE in setting up the database for energy audits in industry. The database will be used for M&V energy performance on a sub-sector level and for establishing energy efficiency benchmarks.

AEA recommended updates of the existing data collection sheets in the building sector to be used for energy audits in industry and sent the Austrian energy audit tool "ProTool" in Romanian language to MAEE.

Currently there is no energy audit program for industry in Moldova. The Austrian team recommended the following implementation steps:

- establish data collection sheet (audit template/ProTool and audit report)
- train the energy auditors (organized by MAEE)
- conduct pilot audits

Objectives of pilot audits:

- auditors get experience with conducting industrial energy audits
- MAEE gets experience in using the data for M&V and organizing the trainings of the auditors
- industrial companies get experience with energy audits and they can see the advantage of such audits

Financial support for establishing an energy audit program for industry with focus on quality control is needed.

During the first UNIDO GEF project year, it turned out that the progress of the Project Component 2 was already quite advanced when the MAEE was established. Type A enterprises have already analysed their energy consumption in detail, supported by international experts. By applying correlation analysis, the main drivers for energy consumption were identified and the best EPI for the companies were defined. First energy savings were realized mainly through implementing organizational and low-cost measures. Best practice videos show this success in the Best Practice Information and Dissemination Program (WS 5).

During the fifth mission to Moldova it was agreed that the M&V of Type A enterprises will be done in PC2. Within PC2, Moldovan experts underwent trainings on the energy management system standard ISO 50001. These experts also supported the Type A enterprises in carrying out the correlation analysis for finding the "best suitable EPI" of the enterprises. MAEE can use these EPIs for setting up BM&M&V systems on subsector level (Work Stream 3).

## 6.3 Supportive Tools

### 6.3.1 Set of Benchmarking Documents for Defining the EPI

AEA developed a set of benchmarking documents for defining EPI (see Annex I) according to the European Benchmarking Standard EN 16231 for seven sectors of Type A enterprises

- meat processing
- milk processing
- sugar industry
- fruit and vegetables processing
- bakeries
- manufacture of other non-metallic mineral products
- textile industry

and additionally for

- breweries
- wineries

### 6.3.2 Content of Template for Describing Implemented IEE Measures

The AEA manages the Austrian climate protection program for enterprises. Within this program an annual energy efficiency award is organized. During the second mission to Moldova AEA presented the application forms and results of this industrial energy efficiency award. Since 2008, more than 170 companies were awarded. For each company the AEA compiled a "best practice example" that describes on two pages the implemented measures, pay back periods and savings in kWh and $CO_2$. The collection of all best practice examples is available on the website of the climate protection program www.klimaaktiv.at/eebetriebe/bestpractice.

A template with minimum requirements for describing the implemented industrial energy efficiency measures serves as a basis for verifying the energy efficiency improvements.

**Categories of Measures**

- cross-sectional-technologies
    - hot water, steam
    - pumps, ventilation systems, compressed air system, cooling and chilling systems and other electrical motors
- heat recovery
- process optimization
- renewable energies in production process
- information communication technology (ICT) and lighting
    - IT and office equipment, lighting
- buildings
    - new buildings
    - retrofit
- notably innovative measures

The application form was initially, from 2008 to 2012, a word document asking for:

- information about the enterprise (contact, staff number, NACE code etc.)
- profile of enterprise (description of their production, service etc.)
- external energy audit – yes / no
- subsidy for investment – yes / no
- title of efficiency measure
- description of initial situation (before measure)
- category or categories

**Information per category**

- total annual energy consumption per company (kWh electricity and thermal – divided into energy sources)
- planned or implemented measures per year (status “planned” or “implemented” should be indicated)
- per described measure:
    - energy Savings in MWh/a (electricity, thermal)
    - emission reductions per year
    - investment costs
    - lifetime of measures (according to NEEAP, mostly 8 years for industrial measures)
- optional
    - internal rate of return (IRR)
    - net present value (NPV)

Since 2013, the application for the Austrian energy efficiency award is organized as an online platform on www.effizienzprojekt.at, which requires the same data as in the former word document.

### 6.3.3 Austrian Audit Data Collection Sheet – ProTool

The AEA presented the Austrian Audit Data Collection sheet to MAEE. This tool is also available in English and Romanian since the beginning of March 2013, as it was part of a European project within the "Intelligent Energy Europe" Program.

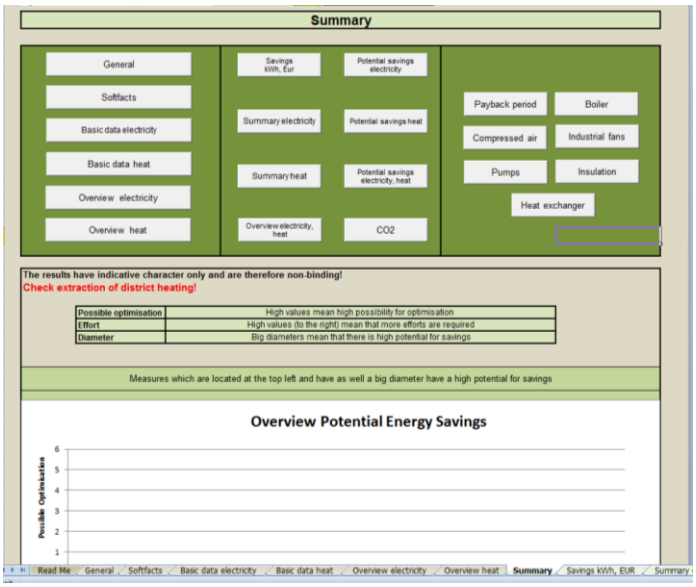




Figure 1: Screenshot of the Austrian Tool (Source: AEA)

## 6.4 Final Results

The final results of this work stream that are used and will be used by the MAEE are:

- detailed information for setting up a data base for energy audits in industry.
- this database can be applied for M&V of energy performance on a sub-sector level and for establishing energy efficiency benchmarks.
- detailed information on necessary update of the Moldovan data collection sheets in the building sector to be used for energy audits in industry.
- Austrian energy audit tool in Romanian language, ready to be used.

According to the Moldovan law no. 1173 as of 21.12.2010, the MAEE was assigned a staff-limit of eleven persons, structured in three departments, two of them being in charge of monitoring and energy auditing system issues. At the beginning of UNIDO Project the MAEE had seven staff members with engineering background – six in the mentioned two engineering services, as well as MAEE Deputy Director. Due to a very limited number of staff members compared to the number of responsibilities and tasks, there was no staff member dedicated for the industrial sector.

Therefore, it was not feasible to implement energy efficiency programs for all sectors at the same time. The MAEE started with the public sector and focused on the buildings. It will take some time to implement all of the industrial energy efficiency programs. But the tools established within the UNIDO GEF project are used and will be used for the implementation period. And the knowledge to use these tools and set up the M&V program is available in the MAEE.

The MAEE estimated the learning benefits for the M&V program according to Table 1.

Table 1: Estimated learning benefits for MAEE staff

| Learning goals | Baseline Score | Ex-post Score |
|---|---|---|
| 1. Knowledge of best practices for IEE M&V, especially relevant to the EU | 1 | 4 |
| 2. Understanding of development and operating aspects of IEE M&V programs and frameworks | 1 | 4 |
| 3. Understanding of the institutional aspects associated with successful IEE M&V programs and frameworks | 1 | 5 |
| 4. Ability to provide advice to policy-makers on development and implementation of best practice M&V programs for IEE | 1 | 4 |
| 5. Ability to develop and operate best practice M&V programs for IEE | 1 | 3 |
| 6. Other | | |

***Note:*** *The score is from 0 to 5. 0 means very poor marks, 5 full marks.*

According to MAEE, the impact of the UNIDO project and the Swedish financed project for the M&V program is that at least four engineers within the MAEE gained necessary skills and learned how correctly to calculate and analyse eleven out of those eighteen minimum necessary energy performance indicators. Due to this fact, MAEE now is able to calculate the energy savings for each sector of the Moldovan economy, including the industrial sector.

The accessible and reliable sources of information and data and the necessary actions for their collection and calculation of respective EPIs, both preferable and alternative, were identified.

# 7 Setting up a National M&V Program for Industry

## 7.1 Objective

The aim of this work stream was to establish a clear and transparent methodology for monitoring and verifying energy efficiency performance at sector and sub-sector level in line with international best practices and

- to establish the required legal and institutional framework to ensure sustainable and sound operation of the national IEE M&V Program,
- to better design and measure the impact of short- and medium-term policies and programs aimed to support IEE in Moldovan industry, and
- to contribute to the establishment of the national IEE M&V Program to support the Moldovan National Energy Efficiency Action Plan (NEEAP) implementation and relevant requirements.

### 7.1.1 Modification of Work

It was essential to start a process for improving the data collection of the National Bureau of Statistics (NBS). As result of synergetic effect of UNIDO Project and the Swedish TA Project, accessible and reliable sources of information and data were identified. Necessary actions for collecting the data and for finally calculating the respective energy performance indicators (EPIs) were identified as well.

## 7.2 Method

For M&V of industrial energy consumption most countries of the European Union prefer to calculate the energy performance with top-down methods. This is the minimum requirement from the European Commission (EC). It is important that the top-down indicators are normalized.

Calculation methods for top-down indicators deal with energy efficiency indicators on aggregated (e.g. sectorial) level. The top-down indicators do not provide exact measurement of energy consumption and do not demonstrate the cause and effect of measures. This method is simpler and less costly than bottom-up calculation methods. Top-down indicators are the minimum and preferred indicators defined by EC.

Calculation methods for bottom-up indicators show savings from specific energy efficiency measures. All the savings from different measures in individual companies are added up. Double counting has to be avoided.

In order to meet the objectives of Work Stream 3 it was necessary that MAEE worked closely with the NBS in Moldova in order to improve the data collection of industrial enterprises.

For setting up the M&V program on sector and subsector level in Moldova, it was also crucial to cooperate with the Swedish-funded project “Capacity Building to the Ministry of Economy in the Area of Energy Efficiency and Renewable Energy in Moldova”.

### 7.2.1 Synergies and Cooperation with Swedish Project

Within the Swedish-financed project a system for sector-wide monitoring was developed. The aim of this task was to elaborate a system, including routines and work schemes, for monitoring and reporting the developments within the energy sector. The system was developed to support the reporting requirements of the Government of Moldova, the Energy Community and also the EU. The focus of the sector-wide monitoring was to show the progress within the work carried out by the MAEE.

The key task was to verify the development of energy performance, energy efficiency and use of renewable energy sources. This means that several indicators needed to be established together with a method of how to measure them in a reliable way over time. The following graph drawn by the Swedish project team shows the sectors where monitoring will be implemented.

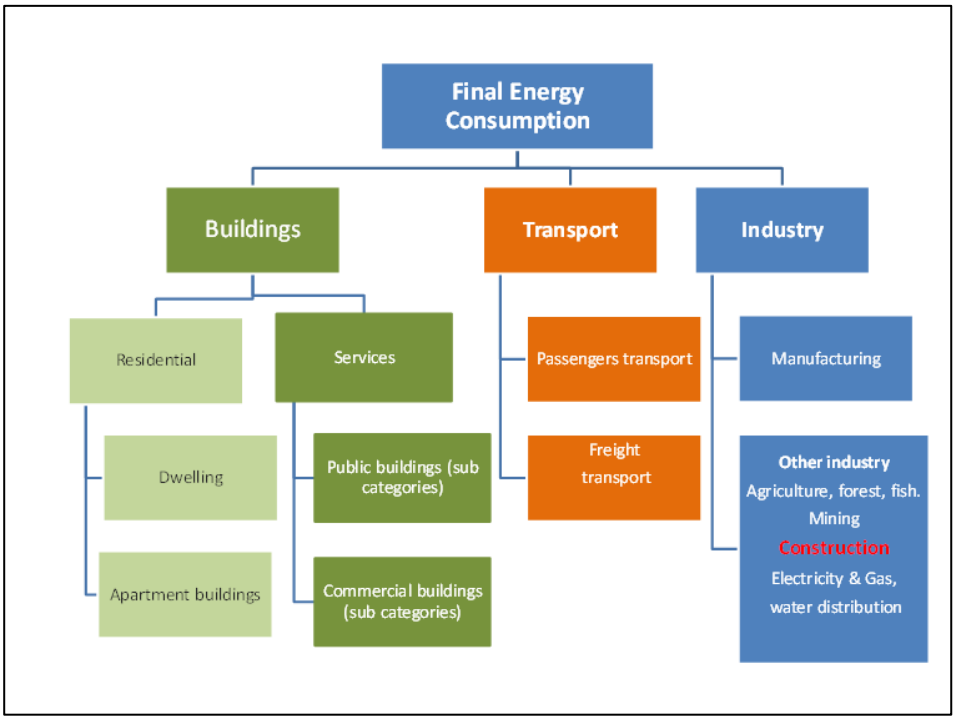



Figure 2: IEA / OECD Methodology

The UNIDO GEF project focuses on the "manufacturing part" of the industrial sector: the following graph (see Figure 3) shows the overlapping part of the Swedish and the UNIDO GEF project.

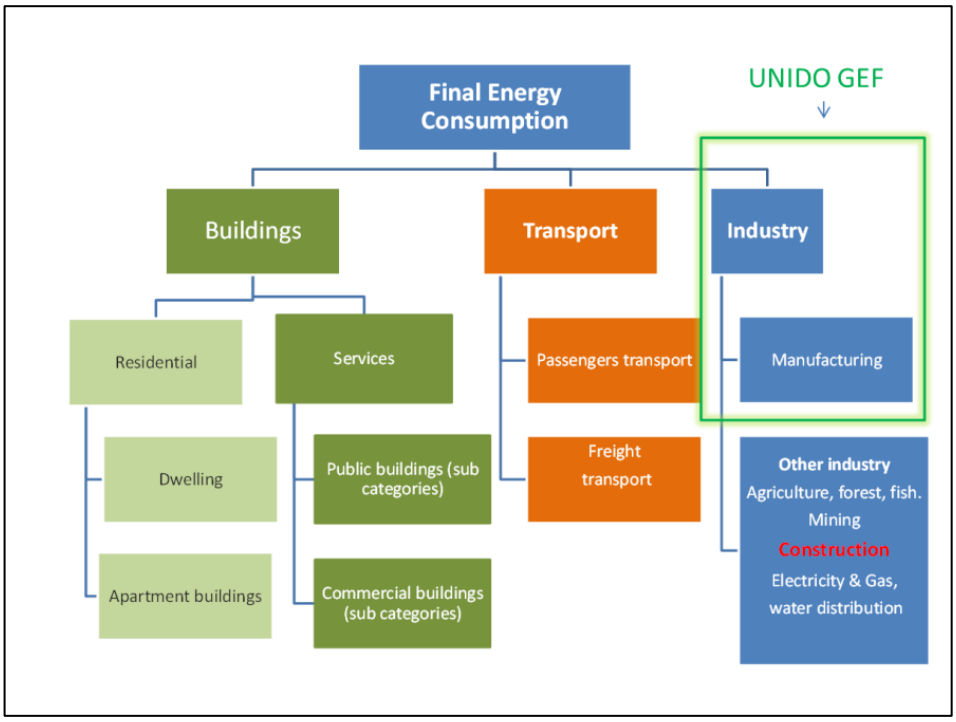



Figure 3: Overlapping Area of the Swedish project and the UNIDO GEF project

The Swedish consultants also have to establish a monitoring system for industry. The highest aggregation level of an indicator for industry is the "Final Energy Consumption of the Entire Industry / GDP of Entire industry". This indicator is already available in Moldova. The ratio of this indicator describes how much energy is required in the economy per added value, the energy intensity. Reversely, it defines how much value is gained by each energy unit.

Sector-wide indicators can be defined as the energy intensity of an individual sector, as measured by **energy use per unit of activity in each sector.** The main sectors in the IEA OECD data, however, are different from the ones used in Moldova. The main difference is that with IEA OECD the construction sector falls within industry, whereas in Moldova it falls within residential energy use.

The UNIDO GEF project offered support to the Swedish team and the MAEE in setting-up schemes for collecting additional data to establish a sector or sub-sector specific monitoring system on a less aggregated level. This can be organized in different ways including:

- adapting energy audits data collection and reporting
- collecting additional data through statistics (NBS)
- implementing benchmarking schemes for further sub-sectors

The following graph has been provided by the Swedish project leader ÅF-Infrastruktur AB.

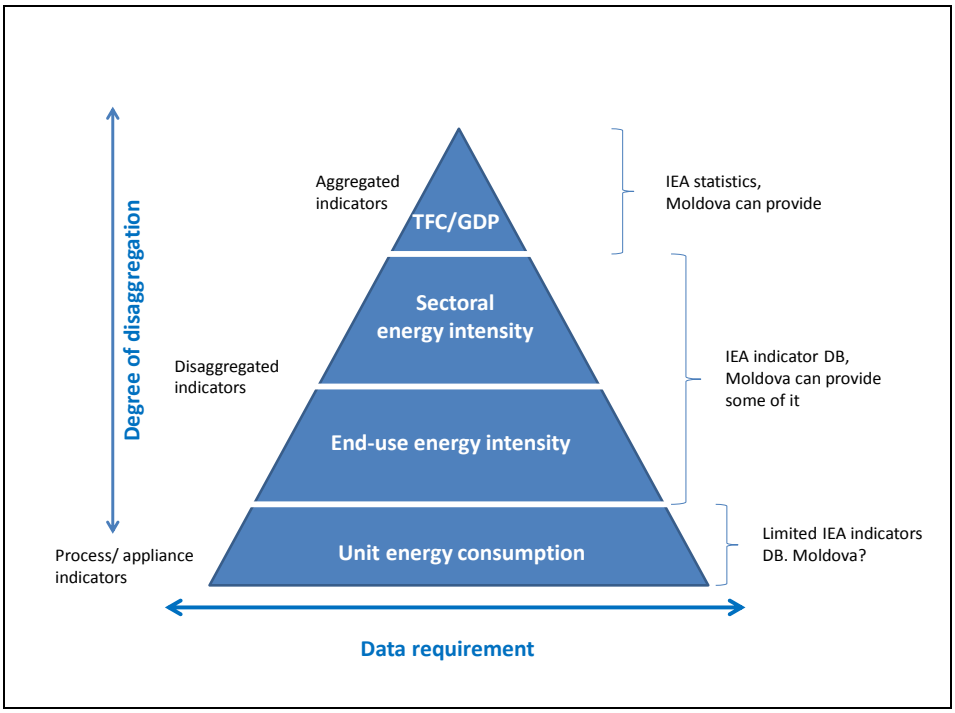



Figure 4: Aggregation level of indicators (Source: ÅF-Infrastruktur AB)

For the indicator hierarchy used in the OECD IEA approach, it is important that the indicators are developed based on the prevailing situation and current policy in the country.

Moldova can already provide the "Total Final Energy Consumption/GDP" as an indicator for industry. Disaggregated indicators on sector level can be provided for the following nine sectors:

- mining and quarrying
- manufacture of food products and beverages; tobacco products
- manufacture of textiles, of wearing apparel; dressing and dyeing of furs; manufacture of leather, leather products and manufacture of footwear
- manufacture of wood and wood products; manufacture of furniture
- publishing, printing and reproduction of informational materials
- chemical industry
- manufacture of other non-metallic mineral products
- electricity and heat, gas and water supply
- other industrial activities

The UNIDO GEF project supported the MAEE in improving the development of indicators on sector and sub-sector level and in compiling recommendations for the NBS in order to change and improve the statistical data collection system.

### 7.2.2 Indicators Suggested for M&V on Sector Level

The Swedish team suggests establishing **two industry indicators,** which are based on rather well-structured existing statistics for **nine major industry branches**.

1) Energy consumption of industrial sub-sectors per **value added**: This can be determined based on existing data, but with minor estimations or assumptions. Energy consumption in industry per type of fuel and energy is available in NBS Energy Balance. Electricity and heating consumption for 9 subsectors of industry is available in NBS Energy Balance. Value of industrial production for industry subsectors is available in NBS Statistical Yearbook.
2) Energy consumption of industrial sub-sectors **per unit of production:** This can be determined based on existing data but with minor estimations or assumptions. Energy consumption in industry per type of fuel and energy available in NBS Energy Balance. Electricity and heating consumption for nine sub-sectors of industry available in NBS Energy Balance. Production of main industrial products available per industry subsector in NBS statistical yearbook.

AEA cooperated with the Swedish team in order to avoid double work and to optimize the synergies of both projects. The Swedish team carried out interviews with industrial associations in order to find out the best indicators for each sector. AEA supported the Swedish team in this process.

In addition to the top-down energy efficiency indicators for industrial sectors, MAEE should implement a bottom-up method for monitoring and verifying the energy performance of industry according to the approach described in chapter 6.2.

## 7.3 Supportive Tools

### 7.3.1 European Standard on Energy Efficiency Saving Calculations EN 16212

In 2012, the CEN/CENELEC standard EN 16212 “Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods” was released. This standard provides a general approach for energy efficiency and energy savings calculations with top-down (TD) and bottom-up (BU) methods. The general approach is applicable to energy savings in buildings, cars, appliances, industrial processes, etc.

The formulation of policies and targets has led to the need for harmonized monitoring and evaluation methods on energy savings at the international and European level. In addition, many countries that want to monitor the energy savings achieved, or the impact of implemented policies and measures, need these calculation methods as well.

This European standard covers the following topics:

- methodology and general rules of calculation
- terminology and definitions
- parameters and data, including data quality and data sources

This standard includes both top-down and bottom-up calculation methods. The top-down method is based on energy indicators (e.g. mean gas consumption per dwelling), which are often calculated from statistical data.

The bottom-up method considers end-user actions and facilitating measures to enhance energy efficiency. For top-down, the standard uses the results of earlier indicator work in the Odyssey project and in the framework of the Energy Services Directive (ESD).

For bottom-up, the standard builds on the results of the Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services (EMEEES) project, initially done in the framework of the ESD implementation. These results are the starting point for this standard, which is general in nature and applicable to a larger category of purposes and users than the EU-driven ESD.

### 7.3.2 AEA’s Experience as Austrian Monitoring Body for ESD

During the second and third mission to Moldova, the Austrian Energy Agency presented its experience with establishing the Austrian National Energy Efficiency Action Plans (NEEAP) and with its role as the “Austrian Monitoring Body”, which was responsible for monitoring the national ESD targets.

Generally, three types of efficiency indicators are in use:

- economic indicators: Energy intensity, carbon intensity [kWh/EUR, $CO_2$/EUR]
- technical indicators: energy consumed per unit physically produced [kWh/ton, liter etc. (Production index)] resp. specific consumption [kWh/application, kWh/residential unit, liters/km etc.
- diffusion indicators: market share of energy-efficient appliances, of renewable energy sources, of efficient procedures [e.g. degree of market diffusion of energy-efficient lamps, A++ appliances, solar thermal systems, modal split in (freight) transportation, etc.]

The choice of the energy efficiency indicators is crucial for each country. The analysis of indicators is important. The following table was established by AEA for MAEE in order to find out if data for different indicators is available in Moldova:

Table 2: Checking Data Availability for Calculation of Energy Efficiency Indicators

| **Energy Indicator** | **Data for calculation of this indicator needed** |
|---|---|
| **Economic indicators** | |
| Energy intensity (kWh/EUR) | **Value added (EUR) by**<br>• minimum whole industry<br>• preferably branch or sector<br>**Final energy consumption**<br>• minimum whole industry<br>• preferably branch or sector |
| Carbon intensity ($CO_2$/EUR) | **Value added (EUR) by**<br>• minimum whole industry<br>• preferably branch or sector<br>**$CO_2$ emissions (direct and indirect)**<br>• minimum whole industry<br>• preferably branch or sector |
| **Technical indicator** | |
| Energy consumed per production index | **Production index by**<br>• minimum whole industry<br>• preferably branch or sector<br>**Final energy consumption**<br>• minimum whole industry<br>• preferably branch or sector |
| **Diffusion indicators** | |
| (Mainly for households and service sector.<br>In Austria we do not use them for industry) | Market share of energy-efficient appliances<br>You can only report it if you have a measure behind it. E.g. subsidies or awareness raising campaigns<br><br>**Possible indicators for industry:**<br>• companies implemented ISO 50001 or similar systems<br>• share of efficient electric motors<br>• number of VSD<br>• use of reactive energy compensators<br>• use of CHP<br>• efficiency of steam boilers<br>• etc. |

### 7.3.3 Recommendation for Data Collection to Establish Benchmarks for Nine Selected Industrial Subsectors in Moldova

AEA prepared a set of benchmarking documents according to the European Benchmarking Standard EN 16231 for subsectors of TYPE A enterprises:

- meat processing
- milk processing
- sugar industry
- fruit and vegetables processing
- bakeries
- manufacture of other non-metallic mineral products
- textile industry
- wineries
- breweries

With these documents, MAEE will be able to set up a benchmarking program according to the European Benchmarking Standard EN 16231. These documents can also be applied to defining suitable Energy Performance Indicators (EPI) for sectors.

### 7.3.4 Data Collection by Energy Auditors

During the third mission to Moldova, AEA presented two energy audit tools. The Excel tools are used in Austria for collecting data in the course of energy audits. MAEE was very interested in both tools.

Energy Audit Tool (ProTool)

- calculation of energy consumption of different processes and equipment
- calculation of saving potentials of different processes and equipment

The ProTool is now available in English and also in Romanian language and will be used in future for industrial audits in Moldova.

Excel Tool for Energy Audit Database (SME Tool)

- recommendations for 1-3 Energy Performance Indicators per branch
- recommendations for energy efficiency measures (list of measures; auditor selects preferred measures)

## 7.4 Final Results

The AEA supported the MAEE in improving the data collection sheet for industrial energy audits and the audit data base. However, due to lack of staff resources in the MAEE, energy audits were not carried out during the project period.

For future steps the AEA recommended the following:

- establish the data collection sheet (audit template and report) according to the EU standard on energy audits EN 16247
- train the auditors (organized by MAEE)
- conduct pilot audits

The objectives of pilot audits are:

- auditors get experience with conducting industrial energy audits
- MAEE gets experience in using the data for M&V and organizing the trainings of the auditors
- industrial companies get experience with energy audits and they can see the advantage of such audits

The AEA recommends further support for establishing an energy audit program for industry with focus on quality control.

A plausible, comprehensive energy efficiency (EE) and renewable energies (RE) Monitoring and Verification System remains a very important tool for the MAEE to perform its monitoring duties and to correct estimation of energy saving potential, as well as to provide assistance in adjusting its policies aiming at improving the competitiveness of the national economy and enhancing its energy independence.

The MAEE stated that they would still need support in the field of consolidation of capacities and strengthening of UNIDO Project results, especially in the following topics:

- development of respective industrial sector data sheets and layers as part of MAEE data-base for the purpose of M&V programme
- provision of support to MAEE staff on establishing efficient procedures for collection of reliable data, both for top-down and bottom-up monitoring and verification of EPIs
- provision of support to MAEE in its communication and cooperation with the National Bureau of Statistics aiming at development and adaptation of data collection sheets and their processing for ensuring data reliability and comprehensiveness and
- provision of support to MAEE in development of a high-quality and plausible reporting system on energy efficiency monitoring and verification etc.

# 8 Setting up a National IEE Benchmarking Program

## 8.1 Objective

The objective of this work stream was to develop an energy benchmarking methodology tailored to the Moldovan manufacturing sector/sub-sector, in order to compare the energy performance of enterprises within Moldovan industrial sub-sectors as well as between Moldovan enterprises and foreign enterprises. The developed energy benchmarking methodology had to be tested in a pilot study with Moldovan dairies.

### 8.1.1 Modification of Work

The MAEE developed a clear vision of a Moldovan benchmarking system within the Moldovan industry. In addition to the tasks planned for this Work Stream 4, the project team together with the MAEE organized a workshop with dairies and further interested companies from the meat processing and sugar industry. The results of benchmarking studies for nine Ukrainian sectors of the food and drink industry were also presented at this workshop.

## 8.2 Method

The Moldovan IEE Benchmarking Program was established according to the 2012 European Standard on Energy Efficiency Benchmarking (EN 16231).The main steps according to the standard are:


The benchmarking pilot study with Moldovan dairies was set-up according to the standard and was based on the experiences of the European Project “BESS – Benchmarking and Energy Management Schemes for SMEs”.

### 8.2.1 Purpose & Planning

The first step for setting up a benchmarking system is to define its specific objectives. The motivation for setting up a benchmarking program in Moldova came about from the UNIDO GEF project. The benchmarking program should

- offer individual enterprises of different industrial sectors and subsectors in Moldova the possibility to compare their specific energy consumption with other companies of the same sector or subsector in anonymized form,
- deliver the information on optimal energy performance indicators (EPI) for different sectors and subsectors,
- allow the estimation of energy saving potentials,
- learn from the best in Moldova and in other countries and
- get a better understanding of their specific energy consumption.

The AEA prepared templates for nine industrial subsectors, which in the future can be used for setting up benchmarking systems in these sectors (see Annex I). The MAEE should develop a project plan that contains the method for

- data collection, e.g. by sending out questionnaires or conducting walk-through audits
- data processing and storage
- data control and verification
- confidentiality requirements
- database ownership
- result distribution criteria
- reporting rules

The MAEE can benefit from the experience gained within the benchmarking pilot study with dairies for setting up such project plans.

The AEA recommended implementing the necessary data collection for benchmarking into the audit data collection sheets. This was done in an Austrian audit program for SME, where more than 2000 audits had been conducted since 2009 in Austrian SMEs. The results of the audits were then integrated into a database. The AEA utilized this information in order to develop benchmark curves of different branches.

For the pilot benchmarking system with Moldovan dairies the AEA supported the MAEE in defining the scope and purpose of the benchmarking program.

#### 8.2.2 Data Collection & Verification

The MAEE, as the coordinator of further benchmarking studies, shall draw up a data collection template in which the type, format and accuracy of the required input data is described in detail. MAEE can use the EPI templates prepared by AEA for this purpose.

#### 8.2.3 Analysis & Results

To ensure that the benchmark study and the results are relevant, the findings shall be analysed in respect of homogeneity of the characteristics of the participants. According to the benchmarking standard, the difference between the worst EPI and the best EPI within a benchmark curve should not be higher than 300% (factor 3). If the difference is much higher, the benchmarking group may be too diverse. By building clusters, e.g. according to the production size or turnover, this problem could be solved.

#### 8.2.4 Reporting

The benchmark study report shall contain the objectives and system boundaries of the benchmark study. The correction factors need to be explained.

The benchmarking results can be presented in different ways, e.g. in the form of tables, graphs, benchmark curves or charts. A very useful form of presenting the results is to establish a benchmark curve that gives the graphical representation of the specific energy consumptions of all participating companies.

The UNIDO working paper “Global Industrial Energy Efficiency Benchmarking – An Energy Policy Tool” illustrates a way to calculate the energy efficiency potential of a sector as follows:

"The most efficient plants are represented to the left and lower part of the curve, and the least efficient plants to the right and higher part of the curve. The shape of benchmark curves would vary for different sectors and regions. However, typically a few plants are very efficient and a few plants are very inefficient. This is generally represented by the steep slopes of the benchmark curve before the 1st decile and after the last decile respectively. Between these two deciles, benchmark curves tend to display a broadly linear relationship between energy efficiency and the share of cumulative production. This relationship can be used to support a rough assessment of the energy efficiency potential for an industrial process, which is defined as 50% of the difference between the efficiencies observed at the first and last deciles."

FIGURE 2:
Illustrative energy benchmark curve for the manufacturing industry

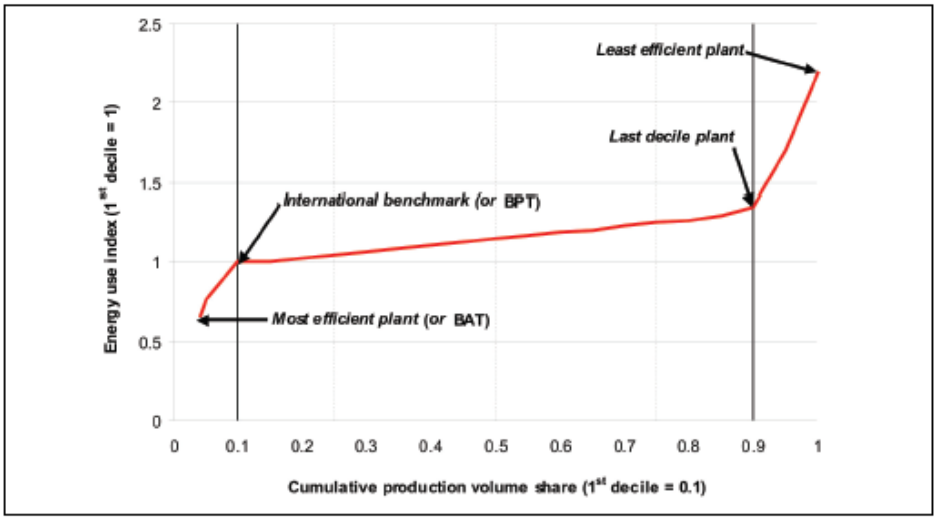



Figure 5: Benchmark Curve (UNIDO Working Paper on Benchmarking)

## 8.3 Supportive Tools

### 8.3.1 Set of Benchmarking (BM) Documents According to EN 16231

AEA prepared a set of Benchmarking Documents according to the European Benchmarking Standard EN 16231 for branches of Type A enterprises (see paragraph 2.2):

- meat processing
- milk processing
- sugar industry
- fruit and vegetables processing
- bakeries
- manufacture of other non-metallic mineral products
- textile industry
- wineries
- breweries

With these documents, MAEE will be able to set up a benchmarking program according to the European Benchmarking Standard EN 16231.

In order to establish an energy benchmarking system for an industrial sector it is important to define the target group and the participants of the benchmarking system.

In October 2012, the European Standard on Energy Efficiency Benchmarking (EN 16231) was published. The overall aim of this European standard is to provide organizations with a methodology for collecting and analysing energy data with the purpose of establishing and comparing energy efficiency between or within entities.

Benchmarking may lead to reductions in total energy use and consequently, to reductions in costs and emissions of carbon dioxide. This standard addresses the general aspects of benchmarking and does not include the definition of and establishment of sector specific benchmarks.

Benchmarking systems work best if the participants (companies) are comparable according to their size (like annual production) and according to their product mixes. Therefore, the target group for the benchmarking systems will be defined by the "Moldovan Classification of the Types of Economic Activities" (comparable to the NACE Code in EU countries).

After the data collection, the benchmarks should be ranked in ascending order. A benchmark curve starts with the minimum EPI and ends with the maximum EPI. The following checks are suggested:

- check the ratio between maximum and minimum value. As a rule of thumb this ratio should not exceed three without explanation
- check the shape of the curve: a normal benchmark curve is smooth without jumps or interruptions. If not, the coordinator must investigate or be able to explain the reason for this non-standard shape: possibly the questionnaire was not consistently filled in by all data providers, e.g. in some data inputs CHP is included, in others it is not
- check the best point of the curve: do the first points of the curve follow each other with normal intervals? In case there are a few points far ahead of the others, the coordinator should explain the reason for this phenomenon
- check the worst point of the curve: are the energy efficiency figures of the last points of the curve realistic ones or do they seem impossible?
- check the numerical value of potential correction factors: in general, corrections should be small and reasonable. If they are too big, either the input for correction factors is wrongly applied, or the calculation method is not suitable

Within the UNIDO GEF project, a pilot benchmarking study for the milk processing sector in Moldova was established. As dairies have a large range of products with quite different energy intensities (e.g. producing hard cheese requires much more energy than producing yoghurt or fresh milk), adjustment factors for different product classes were applied to this benchmarking system.

This pilot study is an exercise for the Moldovan Agency of Energy Efficiency to set up a benchmarking system and to act as the coordinator of a benchmarking system.

For setting up benchmarking systems in further sectors, templates with basic information were compiled within the UNIDO GEF project for the following sectors:

**C Food industry**

- C10.1 production, processing and preserving of meat and meat products
- C10.3 processing and preserving of fruits and vegetables
- C10.5 manufacture of dairy products
- C10.7 manufacture of bread and pastry products
- C10.81 manufacture of sugar
- C11.01 manufacture of distilled alcoholic drinks
- C11.02 manufacture of wine

The templates for individual sectors contain the following points:

- benchmarking target group and benchmarking participants: the target group should be chosen according to the "Moldovan Classification of the Types of Economic Activities"
- benchmarking boundary: the benchmarking boundary should cover the whole plant. Many companies have their own fleet of cars. It has to be decided whether the transport shall come within the boundary. If yes, than the fuel consumption has to be collected separately, and an EPI showing the specific fuel consumption has to be implemented
- recommendations of Energy Performance Indicators: The Austrian Energy Agency recommended EPI for the individual sectors according to its experience with national and European benchmarking studies
- existing Energy Performance Indicators from European Projects: Where available, the AEA provided the MAEE with information on existing EPI for the different sectors
- specific information to collect: In order to be sure to collect the same data from all benchmarking participants, the data which has to be collected to establish the EPI has to be defined

### 8.3.2 US Energy Star EPI

In the course of the 3rd mission to Moldova, AEA presented different international best practices for benchmarking studies. One of them was the US Energy Star EPI Program. ENERGY STAR® is a voluntary program operated by the U.S. Environmental Protection Agency (EPA). The primary purpose of the ENERGY STAR program for industry is to help U.S. manufacturers improve their competitiveness through increased energy efficiency and reduced environmental impact.

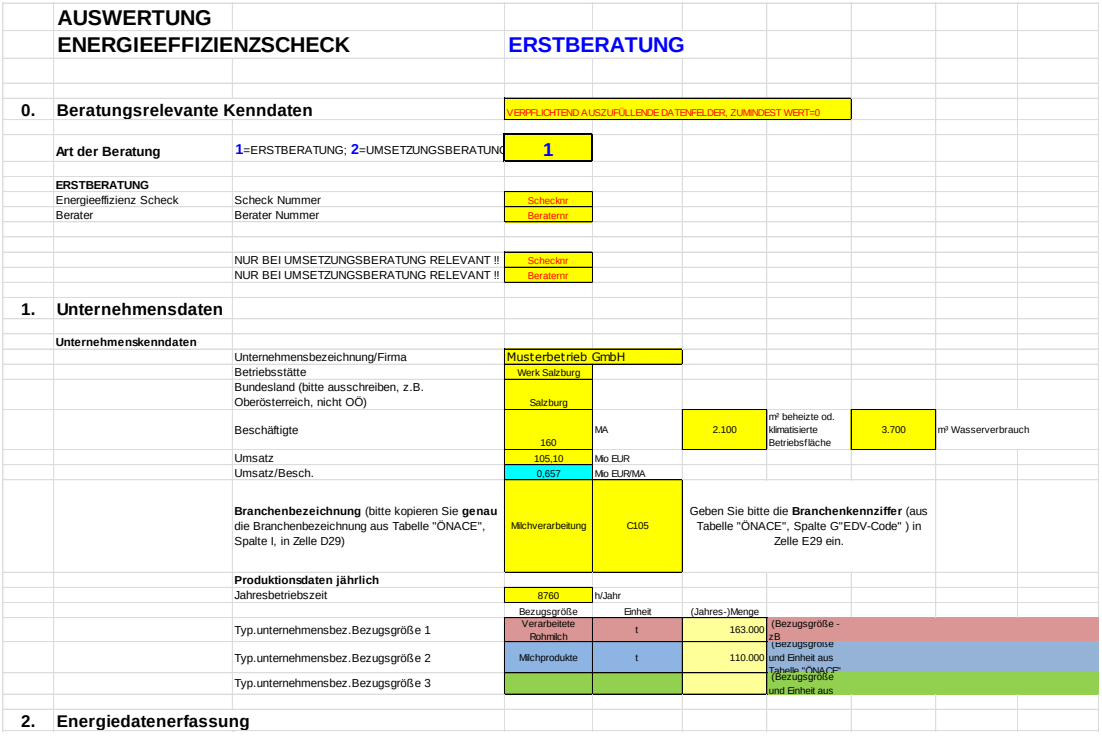
The EPI is an energy management tool, designed to support companies and plants that seek to improve the energy efficiency of their operations. EPI supports benchmarking, which is a critical component of the comprehensive energy management approach embodied in ENERGY STAR's Guidelines for Energy Management (www.energystar.gov).

### 8.3.3 Austrian Audit Program for SMEs

In 2009, a national audit program for SMEs was established in Austria. Within this program, companies were offered a one-day energy consultancy and they only had to pay 10% of the total costs for the audits (90% was supported by the program).

Energy auditors have to fill in the results of the audits in a standardized data collection sheet. This sheet enables the establishment of various benchmarks for different sectors. The AEA utilized the results of some sectors for setting up a benchmarking scheme and actualizing the content of its online benchmarking tool with current benchmarks from Austrian companies.

The audit data collection sheet offers a list of recommended energy performance indicators for all sectors according to the NACE code. This enables the energy auditor to collect the branch specific data for establishing benchmarks.



**AUSWERTUNG**
**ENERGIEEFFIZIENZSCHECK** **ERSTBERATUNG**

**0. Beratungsrelevante Kenndaten**

VERPFLICHTEND AUSZUFÜLLENDE DATENFELDER, ZUMINDEST WERT=0

**Art der Beratung** 1=ERSTBERATUNG; 2=UMSETZUNGSBERATUNG: 1

**ERSTBERATUNG**
Energieeffizienz Scheck — Scheck Nummer: Scheck nr
Berater — Berater Nummer: Beraternr

NUR BEI UMSETZUNGSBERATUNG RELEVANT !! Scheck nr
NUR BEI UMSETZUNGSBERATUNG RELEVANT !! Beraternr

**1. Unternehmensdaten**

**Unternehmenskenndaten**

| | | | | | | |
|---|---|---|---|---|---|---|
| Unternehmensbezeichnung/Firma | Musterbetrieb GmbH | | | | | |
| Betriebsstätte | Werk Salzburg | | | | | |
| Bundesland (bitte ausschreiben, z.B. Oberösterreich, nicht OÖ) | Salzburg | | | | | |
| Beschäftigte | 160 | MA | 2.100 | m² beheizte od. klimatisierte Betriebsfläche | 3.700 | m³ Wasserverbrauch |
| Umsatz | 105,10 | Mio EUR | | | | |
| Umsatz/Besch. | 0,657 | Mio EUR/MA | | | | |
| **Branchenbezeichnung** (bitte kopieren Sie **genau** die Branchenbezeichnung aus Tabelle "ÖNACE", Spalte I, in Zelle D29) | Milchverarbeitung | C105 | Geben Sie bitte die **Branchenkennziffer** (aus Tabelle "ÖNACE", Spalte G"EDV-Code" ) in Zelle E29 ein. | | | |
| **Produktionsdaten jährlich** | | | | | | |
| Jahresbetriebszeit | 8760 | h/Jahr | | | | |

| | Bezugsgröße | Einheit | (Jahres-)Menge | |
|---|---|---|---|---|
| Typ.unternehmensbez.Bezugsgröße 1 | Verarbeitete Rohmilch | t | 163.000 | (Bezugsgröße - z.B. |
| Typ.unternehmensbez.Bezugsgröße 2 | Milchprodukte | t | 110.000 | (Bezugsgröse und Einheit aus Tabelle "ÖNACE" |
| Typ.unternehmensbez.Bezugsgröße 3 | | | | (Bezugsgröße und Einheit aus |

**2. Energiedatenerfassung**

Figure 6: Screenshot of Austrian Data Collection Tool for Audits in SMEs

| EDV-Code | Code | Titel (Nace 2008) | Branchenspezifische Bezugsgröße 1 (bei Produktionsbetrieben inputbezogen) | Einh | Branchenspezifische Bezugsgröße 2 (bei Produktionsbetrieben outputbezogen) | Einh | Andere Branchenspezifische produktionsrelevante Bezugsgröße | Einh |
|---|---|---|---|---|---|---|---|---|
| **A** | **A** | **LAND- UND FORSTWIRTSCHAFT, FISCHEREI** | | | | | | |
| **A01** | **A 01** | **Landwirtschaft, Jagd und damit verbundene Tätigkeiten** | | | | | | |
| A0113 | **A01.13 u** | Gärtnereien | Bewirtschaftete Fläche | ha | Produkt | t | Gewächshausfläche | m² |
| **A02** | **A 02** | **Forstwirtschaft und Holzeinschlag** | **Holzeinschlag** | **FM** | **Verkaufsfertiges Holz** | **fm** | **Bewirtsch. Fläche** | **ha** |
| **A03** | **A 03** | **Fischerei und Aquakultur** | **Fisch** | **t** | **Verkaufsfertiger Fisch** | **t** | | |
| **B** | **B** | **BERGBAU UND GEWINNUNG VON STEINEN UND ERDEN** | | | | | | |
| **B05** | **B 05** | **Kohlenbergbau** | **geförderte Kohle** | **t** | | | | |
| **B06** | **B 06** | **Gewinnung von Erdöl und Erdgas** | | | | | | |
| B061 | B 06.1 | Gewinnung von Erdöl | Erdöl | t | | | | |
| B062 | B 06.2 | Gewinnung von Erdgas | Erdgas | m³ | | | | |
| **B07** | **B 07** | **Erzbergbau** | **Erzabbau** | **t** | zerkleinertes Erz; | **t** | | |
| **B08** | **B 08** | **Gewinnung von Steinen und Erden, sonstiger Bergbau** | **abgebaute Steine und Erden** | **t** | | | | |
| **B09** | **B 09** | **Erbringung von Dienstleistungen für den Bergbau und für die Gewinnung von Steinen und Erden** | | | | | | |
| **C** | **C** | **HERSTELLUNG VON WAREN** | | | | | | |
| **C10** | **C 10** | **Herstellung von Nahrungs- und Futtermitteln** | | | | | | |
| C101 | C 10.1 | Schlachten und Fleischverarbeitung | Schlachtung (Input) | t | Produkte | t | | |
| C102 | C 10.2 | Fischverarbeitung | Fisch zu verarbeiten | t | Produkt | t | | |
| C103 | C 10.3 | Obst- und Gemüseverarbeitung | Obst zu verarbeiten | t | Produkt | t | | |
| C104 | C 10.4 | Herstellung von pflanzlichen und tierischen Ölen und Fetten | Rohmaterialeinsatz | t | produzierte Öle/Fette | t | | |
| C105 | C 10.5 | Milchverarbeitung | verarbeitete Rohmilch | t | Milchprodukte | t | | |
| C106 | C 10.6 | Mahl- und Schälmühlen, Herstellung von Stärke und Stärkeerzeugnissen | Rohmaterialeinsatz | t | Produkt | kg | | |
| C107 | C 10.7 | Herstellung von Back- und Teigwaren | verarbeitetes Mehl | t | Back- und Teigwaren | t | Backfläche | m² |

Figure 7: Screenshot of Austrian Data Collection Tool for Audits in SMEs – List of EPIs

The audit data collection sheet offers a list of recommended energy performance indicators for all sectors according to the NACE code. This enables the energy auditor to collect the branch specific data for establishing benchmarks.

AEA recommended that MAEE should implement a similar approach for the energy audit programs in Moldova.

## 8.4 Benchmarking Pilot Study with Moldovan Dairies

A benchmarking study with Moldovan dairies was carried out as a pilot project for the Benchmarking Program. It was decided to apply the benchmarking approach developed within the European project "BESS – Benchmarking and Energy Management in SMEs". The national expert and MAEE adapted the data collection sheet to Moldovan requirements. The MAEE also integrated a benchmark for the fuel consumption of transport of raw milk and milk products.

### 8.4.1 First Workshop about Benchmarking Study

On November 27th, 2012 the first workshop on the benchmarking study with 29 participants from the pilot dairies, energy experts, energy efficiency fund, and the Swedish project team took place. Apart from the benchmark focus of this workshop, other possible topics for further workshops with the dairies were discussed in order to establish an energy efficiency peer-to-peer network for dairies in Moldova.

AEA and the national expert presented during the first workshop:

- results of the data collection sheets filled in by the pilot dairies
- benchmark graphs and benchmark curves for the dairy sector in Moldova
- comparison of the results of Moldovan dairies with benchmarks from Austrian dairies

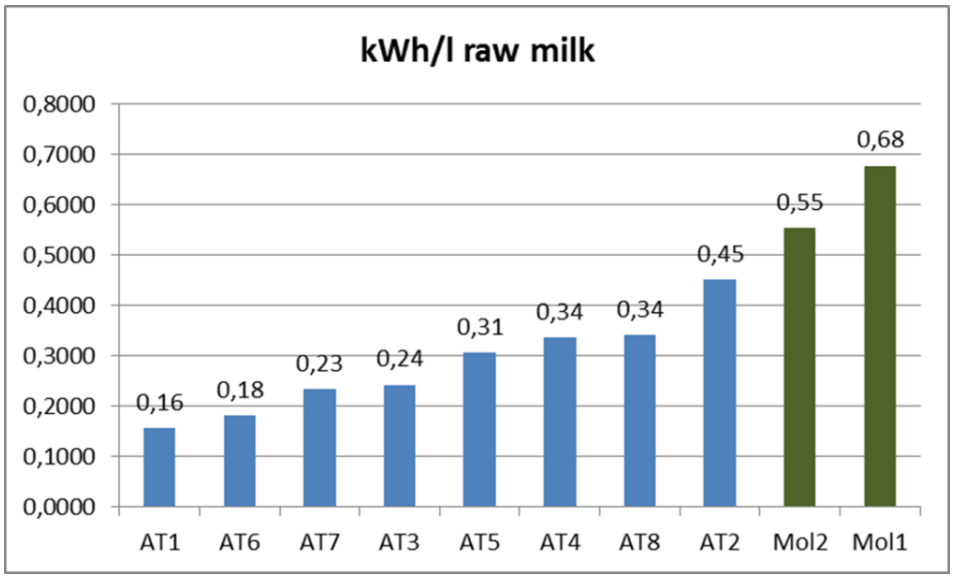



Figure 8: Comparison of Austrian and Moldovan Dairies per Raw Milk Processed

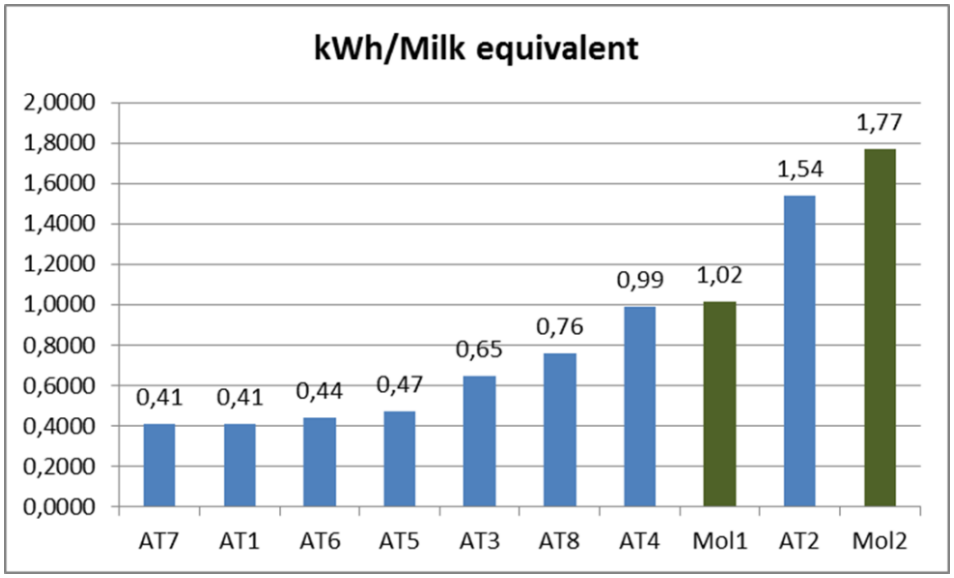



Figure 9: Comparison of Austrian and Moldovan dairies per milk equivalent

Two pilot dairies (and Type A) presented their experiences and results with implementing an Energy Management System according to the ISO 50001.

### 8.4.2 Energy Efficiency Peer-to-Peer Network for Moldovan Dairies

In addition to the pilot benchmark study with Moldovan dairies, a first attempt to set up a peer-to-peer energy efficiency network in Moldova was made within the UNIDO/GEF project. In the beginning, the network will consist of representatives from the pilot dairies, especially energy related and technical staff. During the fifth mission it was agreed that there is a need to organize an “awareness raising workshop on benchmarking” before starting with peer-to-peer network meetings.

### 8.4.3 Main Figures of the Sector

According to the National Classifier of Moldovan economic activities CAEM rev. 2 (transposed NACE rev. 2, in the implementation stage), the sector C 10.5 “Manufacture of dairy products” includes two sub-categories:

- C10.51 Manufacture of dairy products and cheese products
- C10.52 Manufacture of ice-cream

According to NBS data, there were 46 enterprises registered in the sector in the year 2010. The energy consumption and total production of the sector for the years 2010 – 2012 can be seen in the following table.

Table 3: Overview Energy Consumption and Production of Dairy Sector, 2010 – 2012, Source National Bureau of Statistics

| Type of energy/energy resourses | Consumption | | |
|---|---|---|---|
| | 2010 | 2011 | 2012 |
| A | 1 | 4 | 7 |
| Natural gas, ths. c.m. | 6.565 | 5.874 | 5.744 |
| Natural gas, MWh | 61.081 | 54.652 | 53.442 |
| Electricity, MWh | 23.414 | 21.329 | 23.940 |
| Total energy | 84.495 | 75.981 | 77.382 |
| **Dairy products, tonnes** | **32.875** | **33.967** | **35.618** |

### 8.4.4 Participants of Benchmark Pilot Study

The MAEE invited fifteen dairies to participate in the benchmarking study. For this purpose, four documents were elaborated and sent to the participating companies:

- invitation letter signed by the director of the Moldovan Energy Efficiency Agency
- questionnaire on milk products
- questionnaire on energy resources and
- confidentiality agreement

All these documents were compiled in Romanian language.

Only two companies participated in the benchmarking pilot study. The companies were recruited by invitation letters submitted directly to companies, then through phone conversations, and preparation and submission of confidentiality contracts, as well as through site visits.

There are no plans to find more participants, because the enterprises do not accept to share information on collected raw milk and manufactured products.

### 8.4.5 Data Source Reliability

There were two questionnaires elaborated – the first one on dairy products and raw milk processed, and the second one on energy and energy resources consumption. During data processing, some mistakes were identified that could be traced back to an inaccurate notification of measurement units and classification of products into the required groups.

### 8.4.6 Benchmark Cluster

There are three categories in this sector: producers of dairy products only, producers of dairy products and ice-cream, and producers of ice-cream only. While building benchmark clusters, one should take into consideration all above-mentioned factors and the tonnes of processed raw milk. The producers of only dairy products could be divided into two clusters according to the amount of raw milk processed: up to 5 Mio. liters/year and more than 5 Mio. liters/year, respectively.

### 8.4.7 Energy Performance Indicator (EPI)

For sub-category C10.51 Manufacture of dairy products and cheese products, the following EPIs were established:

- total energy consumption / total raw milk processed
- total energy consumption / adjusted production (equivalent factors)
- total fuel consumption / tkm (tonnes kilometer of products and raw milk transported by the companies own fleet)
- total water consumption / total raw milk processed
- total water consumption / adjusted production (equivalent factors)

### 8.4.8 Adjustment Factors

Adjustment factors of dairy products allow comparing the energy efficiency of dairies with different product lines. By applying adjustment factors, the energy intensity of different products is taken into consideration. For example the production of cheese requires much more energy than the production of yoghurt. The following adjustment factors shown in Table 4 were implemented:

Table 4: Overview adjustment factors for dairy products, established by MAEE

| Products | Measurement Units | Equivalent factor |
|---|---|---|
| Processed milk | liter | 0,000 |
| Sweet milk products | liter | 0,209 |
| Sour milk products | liter | 0,657 |
| Cup products | liter | 0,966 |
| Hard cheese | kg | 1,925 |
| Brown cheese | kg | 3,663 |
| Other cheese | kg | 2,854 |
| Casein | kg | 1,952 |
| Dried products | kg | 3,812 |
| Butter /butter oil | kg | 0,800 |
| Preserves | kg | 0,787 |
| Supplemental milk delivered | liter | 0,076 |

The following table shows the results of a dairy that participated on the benchmarking study and on project component 2. The specific energy consumption could be reduced by 15.4%:

Table 5: Specific energy consumption of the dairy LACTIS S.A. before and after the implementation of low-cost measures within the ISO 50001

| Natural gas consumption, $m^3$/t of raw milk | | Natural gas consumption, kWh/t of raw milk | | Electricity consumption, kWh/t of raw milk | | Energy consumption, kWh/t of raw milk | |
|---|---|---|---|---|---|---|---|
| Before | After | Before | After | Before | After | Before | After |
| 24 | 19 | 223.2 | 176.7 | 87.5 | 86.1 | 310.7 | 262.8 |

The energy consumption of Moldovan dairies versus the amount of processed milk and final product is presented in the following table:

Table 6: Total Energy Consumption and Total Production of all Moldovan Dairies in 2010, 2011 and 2012. Raw milk Processed in 2011 and 2012 and Specific Energy Consumption per Raw Milk Processed. Source: National Bureau of Statistics

| **Type of energy/energy recourses** | **Energy Consumption/Dairy products** | | |
|---|---|---|---|
| | **2010** | **2011** | **2012** |
| Natural gas, thousand c.m. | 6,565 | 5,874 | 5,744 |
| Natural gas, MWh | 61,081 | 54,652 | 53,442 |
| Electricity, MWh | 23,414 | 21,329 | 23,940 |
| **Total energy, MWh** | **84,495** | **75,981** | **77,382** |
| Raw milk processed thousand litres | | 86,439 | 106,100 |
| **Specific energy consumption per raw milk processed, MWh/th. liters** | | **0.88** | **0.73** |
| **Dairy products, tonnes** | **97,910** | **96,804** | **97,956** |

The average figure of the indicator for specific energy consumption per 1000 liters of processed milk in the country was 0.88 MWh/1000 liters in 2011 and 0.73 MWh/1000 liters in 2012.

In order to calculate the potential energy savings to be attained for the whole country, **two scenarios** are proposed.

**Scenario I** provides for implementation of no-cost or low-cost measures, which would reduce specific energy consumption by 10% compared to current state of the art or more specifically – attainment of an average figure for the whole country of 0,66 MWh/1000 liters and achievement of a total annual energy saving of about 7,400 MWh.

**Scenario II** could be defined as "achievement of specific energy consumption level of most energy intensive Austrian company, i.e. 0.45 kWh/liter". In this case, the total annual energy savings of Moldovan dairies would reach 21,650 MWh. This result requires an investment in the range of 300,000 – 500,000 EUR for a medium-sized enterprise and would essentially reduce the energy costs related to thermal processes aiming at production of technological steam and cold.

## 8.5 Final Results

The MAEE expects that not many Moldovan companies will be willing to participate on benchmarking studies because of confidentiality reasons. It may be necessary to change the methodology, perhaps by using seminars/trainings of business representatives to perform their own benchmarking studies based on specific energy performance indicators and templates. In this case MAEE, with AEA support, will create a data base on EPIs of the best European companies from manufacturing industry.

The branches selected for further benchmarking studies are:

- meat processing
- bakeries
- fruits and vegetables

The final results of the benchmarking pilot study with dairies are the "identified best practice technologies", an "estimated saving potential for the whole sector" and "conclusions and recommendations".

### 8.5.1 Best Practice Technologies (BPT) for Moldovan Dairies

The identified BPT for the Moldovan dairies are:

- daily monitoring the steam consumption for production
- modification of roof windows to avoid the use of artificial light instead of natural light
- leak detection in the compressed air system
- hot water and steam pipes insulation
- planning of production processes, organized in shifts, for ensuring constant steam supply and avoiding peak loads. As a result the second steam boiler was stopped.
- adjustment of the air / natural gas quantities in gas burner of steam boiler depending on the amount of required quantity of steam
- setting and regulation of maximum necessary steam temperature
- setting the maximum hot water temperature and hot water supply schedule according to the demand
- implementation of two additional pumps into the hot water preparation system for using specifically one pump for the required hot water flow
- implementation of staff motivation system, based on monitoring of specific energy consumption per unit of product

### 8.5.2 Saving Potential in Moldovan dairies

The estimation of the energy saving potential of dairies in the Republic of Moldova is based on the benchmarking analysis performed within the UNIDO GEF project.

The following results were obtained:

- The Moldovan companies have a specific energy consumption per liter of processed milk (average data of two companies) of 0.62 kWh/liter within the range of 0.55 - 0.68 kWh/liter. The same indicator for the Austrian companies (an average figure for eight companies) is 0.24 kWh/liter, corresponding to the data range 0.16 - 0.45 kWh/liter.
- The experience of LACTIS S.A. related to the implementation of standard SM ISO 50001:2012 „Energy Management Systems. Requirements with Guidance for Use" has clearly demonstrated that specific energy consumption can be reduced by 8.5% solely through zero-cost or low-cost measures. These measures included only some technological processes along the whole processing line and do not take into consideration the energy consumption of all technological processes, including raw material and final products transportation.

### 8.5.3 Conclusions and Recommendations

Taking into consideration the reticence of Moldovan companies to share data related to their products and used raw materials, successful benchmarking in the above-mentioned sub-sectors of C 10 Food Industry should use the following approach:

- Prepare templates in Excel format on EPIs calculation separately for each sub-sector, and respectively benchmark EPIs for comparison based on European experience and best practices.
- Invite companies separated into sub-sectors to participate in the workshops on training their representatives to calculate EPIs.
- Subsequently, the MAEE could request those companies to present the calculated EPIs, based on which MAEE could calculate energy savings potential per each sub-sector.

The MAEE estimates the learning benefits for their staff according Table 7.

Table 7: Estimated Learning Benefits for MAEE Staff

| Learning goals | Baseline Score | Ex-post Score |
|---|---|---|
| 1. knowledge of best practices for IEE Benchmarking, especially relevant to the EU | 1 | 4 |
| 2. understanding of development and operating aspects of IEE Benchmarking programs | 1 | 4 |
| 3. understanding of the institutional aspects associated with successful IEE Benchmarking programs | 1 | 4 |
| 4. ability to provide advice to policy-makers on development and implementation of best practice IEE Benchmarking programs | 1 | 4 |
| 5. ability to develop and operate best practice IEE Benchmarking programs | 1 | 4 |

***Note:*** *The score is from 0 to 5. 0 means very poor marks, 5 full marks.*

# 9 Setting up a National Best Practice Information and Dissemination (BPID) Program

The basic structure of the BPID Program shall include:

- the development of IEE case studies. These case studies shall be produced in different ways: translating international case studies; based on results and case studies generated by the GEF project and other UNIDO relevant projects (e.g. Moldovan Sustainable Energy Financing Facility (MoSEFF)
- the development, creation and maintenance of an Industrial energy Efficiency Benchmarking Program (IEE BP) Information and Dissemination Website
- the development and production of IEE information and promotional material such as: articles for industry and other relevant magazines or newsletters; brochures, fliers, press releases, short videos etc.
- an energy management system (EnMS) implementation Guide (by UNIDO)
- an organization of half-day awareness / outreach seminars on the importance of energy efficiency in industry and IEE best practices at the margin of major events

## 9.1 Objective

The objective of this programme is to provide MAEE with technical assistance, training guidance and supervision needed to set up a national best practice information and dissemination program.

## 9.2 Method

During the first meetings, the team elaborated potential MAEE's services to industries and private costumers. A list of stakeholders was developed to target promotional materials and information.

The project team developed draft documents including case studies, website text and story boards for best practice videos. Case studies for JLC and Lactis [2] were provided in a basic version by the national consultants. The following was developed:

- several case studies were delivered to MAEE, including case studies from the Austrian Energy Agency and international case studies
- general website contents as well as website information on industrial energy efficiency were developed in English and provided to MAEE
- story boards for best practice videos were developed for Lactis and JLC
- MS power point presentations to be used during promotional events and workshops to promote the project and motivate companies to participate in the benchmarking program.
- a yearly event list was developed to schedule promotional events in time

[2] JLC and Lactis are Moldovan dairies participating in the benchmarking study.

During the 5th mission to Moldova the topics, target groups and potential promotion activities during the two awareness raising workshops were discussed. MAEE organized two half-day awareness raising workshops on

- Energy Management System (28th May 2013)
- Industrial Energy Policy (11th of March 2014)

## 9.3 Supportive Tools

Supportive tools mainly consist of templates and documents, which will be customized by MAEE and translated into Romanian. This includes:

- MSpower point presentations for the UNIDO GEF project
    - A powerpoint presentation was developed to be used in national language to promote the project to Moldovan companies. Main intention is to win new dairies for a benchmarking program and to out roll the approach to bakeries.
- website contents for http://aee.md/
    - The structure of the website was developed within the project financed by the Swedish International Development Cooperation Agency (SIDA). However, as there were no contents available at all, the team provided English content descriptions about MAEE's activities, the UNIDO project, energy management systems and industrial energy efficiency system optimization. These contents are available online.
- best practice case studies
    - Written case studies were already prepared by the national experts who supported Lactis and JLC. These case studies were updated and will be translated by the local expert to promote industrial energy efficiency and Energy Management.
- story boards for best practice videos (see Annex II)
    - The work on several videos was not foreseen in the original work plan but included to develop additional tools to be used to promote industrial energy efficiency and Energy Management Systems in Moldova. This work was carried out by the Energon team. This included the selection of a professional film team (Panorama), on site visits to verify technical achievements and a working Energy Management System, the development of a storyboard to be used by Panorama, the translation of the storyboard by the national expert and the development of English subtitles. Videos are available today for the dairies Lactis and JLC.

## 9.4 Final Results

Due to a very limited number of staff members compared to the number of responsibilities and tasks, there was no staff member dedicated for the industrial sector. Therefore, AEA and the national consultant, Igor Zanoaga, collaborated with all engineering staff members towards achieving the project outputs and outcomes. Also, depending on the availability of time, almost all engineering staff members of MAEE participated in IEE Best Practices Information and Dissemination activities within the UNIDO Project.

The estimated learning benefits for MAEE staff are presented in the following table.

Table 8: Estimated Learning Benefits for MAEE Staff

| Learning goals | Baseline Score | Ex-post Score |
|---|---|---|
| 1. knowledge of best practices for IEE BPID | 1 | 4 |
| 2. understanding of development and operating aspects of IEE BPID programs | 1 | 4 |
| 3. understanding of the institutional aspects associated with successful IEE BPID programs | 1 | 4 |
| 4. ability to provide advice to policy-makers on development and implementation of best practice IEE BPID programs | 1 | 4 |
| 5. ability to develop and operate best practice IEE BPID programs | 1 | 4 |

***Note:*** *The score is from 0 to 5. 0 means very poor marks, 5 full marks.*

As result of this work stream implementation at least three engineers within the MAEE gained necessary skills for organization of awareness raising campaigns on IEE, how to perform case studies and disseminate the results, as well as organize workshops and seminars on industrial energy efficiency.

Currently, the Energy Efficiency Agency of the Republic of Moldova has enough capacity to develop and extend the UNIDO Project outputs, by its own or using the synergetic effect of other technical assistance projects.

Nevertheless, the objectives were attained, taking into account the MAEE still needs support aiming at consolidation of capacities and strengthening of UNIDO Project results.

Based on further recommendations for the support related to further development and improvement of Monitoring & Verification & Benchmarking activities, MAEE would also need support for dissemination and awareness raising on IEE local and international best practices not only from technical, but also from the financial point of view. Special support in developing MAEEs capacities for dissemination of best practices related organization of financing the implementation of energy efficiency measures in industry, e.g. ESCO and voluntary agreements is needed.

# 10 Setting up a National Best Practice Recognition (BPR) Program

In the beginning of 2012, MAEE had already prepared a draft concept of an annual award ceremony for energy efficiency and renewable energy projects. When the UNIDO GEF project team discussed the ways to support MAEE in this field, MAEE declared that they did not want to change the concept for the event in 2012, but that AEA should analyse the award regulations and support MAEE in improving it in 2013. On 7th of December, 2012, the Moldovan award event "EcoEnergetica" was organized for the first time.

## 10.1 Objective

The objective of the Best Practice Recognition program was to offer enterprises an incentive for engaging and doing well in the UNIDO GEF project in further national industrial energy efficiency programs.

## 10.2 Method

During the fifth mission to Moldova in February 2013, the project team analysed the specifications for the "EcoEnergetica 2012". As there was no category for "Industrial Energy Efficiency" projects, the UNIDO GEF project supported MAEE in improving the specifications for the "EcoEnergetica 2013".

MAEE added a new category on Energy Efficiency in Industry to the EcoEnergetica and adapted the application form for industrial enterprises in order to be used for M&V of industrial energy efficiency.

## 10.3 Supportive Tools

During the fifth mission to Moldova a meeting with MAEE and the responsible person for promoting the EcoEnergetica took place. The specifications for the EcoEnergetica and the application forms to submit the projects for the award were analysed. AEA presented the application form of the Austrian industrial energy efficiency award and the Excel table with the information on the individual projects. This table was translated into English and sent to MAEE for their M&V purposes.

## 10.4 Final Results

As result of work stream 6 implementation at least five engineers within the MAEE gained necessary skills for organization of energy efficiency best practice recognition activities. Currently, the Energy Efficiency Agency of the Republic of Moldova has enough capacity to develop and extend the UNIDO Project outputs for the IEE BPRP, by its own or using the synergetic effect of other technical assistance projects. The estimated learning benefits for MAEE staff are presented in the following table.

Table 9: Estimated Learning benefits for MAEE Staff.

| Learning goals | Baseline Score | Ex-post Score |
|---|---|---|
| 1. knowledge of best practices for IEE BPRP programs | 1 | 5 |
| 2. understanding of development and operating aspects of IEE BPRP programs | 1 | 5 |
| 3. understanding of the institutional aspects associated with successful IEE BPRP programs | 1 | 5 |
| 4. ability to provide advice to policy-makers on development and implementation of BPRP programs for IEE | 1 | 5 |
| 5. ability to develop and operate IEE BPRP programs | 1 | 5 |

***Note:*** *The score is from 0 to 5. 0 means very poor marks, 5 full marks.*

MAEE is planning to continue organizing the "Moldova Eco-Energetica" event and award ceremony in the period 2014-2016 and also is considering to permanently improve the categorization aiming at enhancing the competition among participants.

The "Moldova Eco-Energetica" is probably the best example of energy efficiency best practice recognition program in the country and region. It should further evolve and develop to maintain its status of unique and sole Best Practice Recognition Programme in the country.

Referring to work stream 6 objectives, UNIDO and MAEE future work could be focused on:

- UNIDO should further assist MAEE in developing a method for finding out the most interesting and efficient companies through the M&V program.
- UNIDO should further assist MAEE in developing and introducing a more detailed application form for IEE in 2014 in order to monitor the energy savings and establish Best Practice cases.
- Apart from the UNIDO GEF project, MAEE should be assisted to make best practice examples of the awarded companies and put them on its website.

# 11 Setting up a National Industrial Energy Manager Certification (IEMC) Program

## 11.1 Objective

The objective of the national industrial energy manager certification program was to provide a policy and normative market-based instrument for supporting industrial energy efficiency and to contribute to the creation of a national market for energy services and products for industry and other sectors.

### 11.1.1 Modification of Work

During the fifth mission to Moldova in February 2013, AEA discussed with MAEE the kind of support that is needed in this field. As the EUREM course is already quite well developed in Moldova, MAEE did not see the need for an additional energy manager certification program.

It has been agreed that the AEA supports the MAEE in improving and adapting the data collection of energy audits.

## 11.2 Method

The certified energy auditors have to report the results of their audits to MAEE and insert the data in a database. This database is the basis for Monitoring and Verification (M&V) of energy efficiency. So far the results of energy audits in the building sector are finalized and included in the database. AEA analysed the database for energy audits in the building sector and advised MAEE in adapting the database in order to enable an M&V of industrial energy efficiency on sector and subsector level.

In order to meet the objective of creating a market for energy services and products, AEA suggested to MAEE to use the awareness raising workshop for benchmarking to invite manufacturers and ESCOs. Events organized by MAEE shall be a platform for different players of the energy efficiency market.

## 11.3 Supportive Tools

### 11.3.1 Austrian Energy Audit Tool "ProTool"

Within the Austrian climate protection program "klima**aktiv** energy efficient enterprises" an energy audit tool on excel basis was developed. This tool is used by energy auditors for initial audits. It calculates the energy consumption of different processes and equipment and estimates the saving potentials for processes and equipment.

Since 2006 more than 400 Austrian energy auditors have been trained using this audit tool. In 2012 the Austrian tool was taken for a European project on energy audits and was translated in March 2013 into eight languages including Romanian.

During the 3$^{rd}$ mission to Moldova, the Austrian Energy Agency presented this tool to the Moldovan Agency on Energy Efficiency (MAEE). In March 2013 the MAEE received the audit tool in Romanian language.

The following figures show the results of the Austrian energy audit tool. The energy auditor fills in the required data in the Excel sheet and the tool then generates different graphs. One important graph is the detailed overview of the electricity consumption (Figure 10) and the thermal energy consumption. The tool also generates a graph that shows the expected saving potentials of different technologies applied in the audited company (Figure 11).

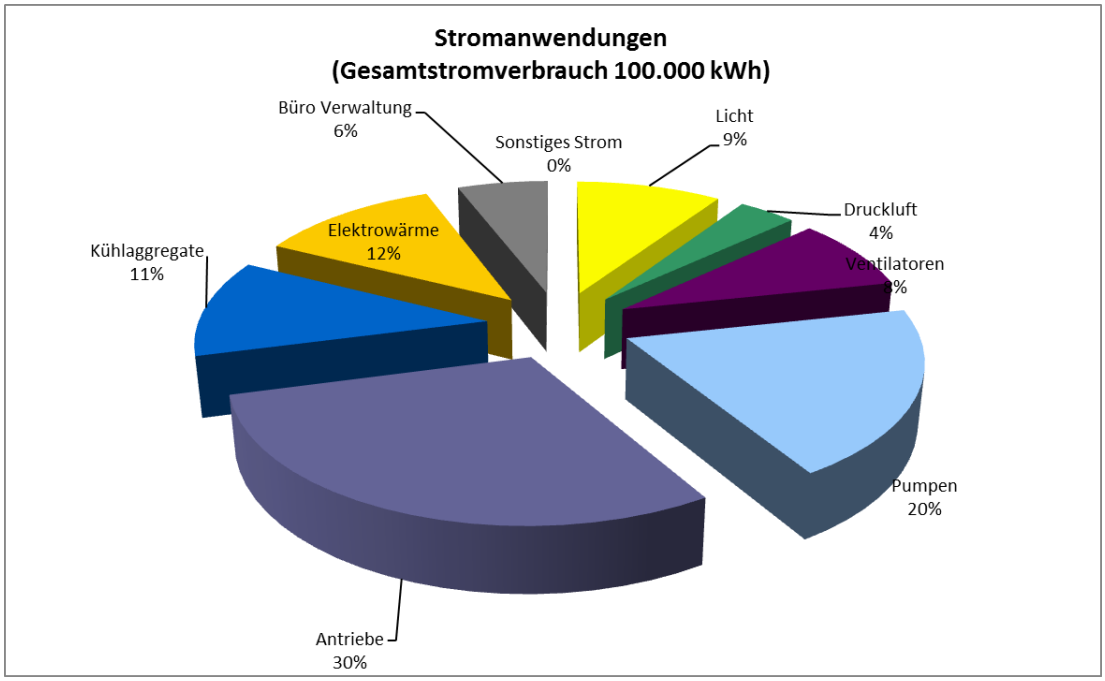



Figure 10: Screenshot of Austrian energy audit tool: overview electricity consumption

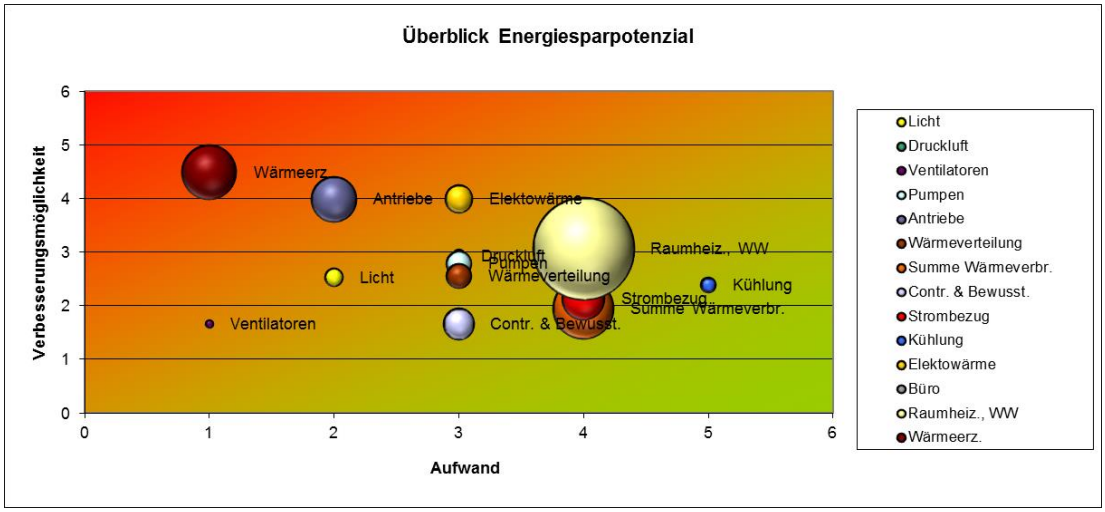



Figure 11: Screenshot of Austrian energy audit tool: overview saving potentials

## 11.4 Final Results

The estimated learning benefits for MAEE staff within the scope of mentioned above activities are presented in the following table.

Table 10: Estimated Learning Benefits for MAEE Staff.

| Learning goals | Baseline Score | Ex-post Score |
|---|---|---|
| 1. elaboration of the draft template Energy Audit Report for public buildings | 2 | 5 |
| 2. elaboration of energy performance indicators for all sectors of the Moldovan economy and calculation of respective energy savings | 2 | 5 |
| 3. development of EE BPRP Regulation | 1 | 5 |
| 4. elaboration of questionnaires for the public buildings survey in Moldova | 1 | 5 |

***Note**: The score is from 0 to 5. 0 means very poor marks, 5 full marks.*

Further planned activities of MAEE for setting up energy audit programs for industry in Moldova are:

- continue to develop energy audit report templates for other type of facilities and systems, e.g. internal and external lighting systems, including public lighting, heat only boiler plants, CHPs, typical industrial technological processes, transportation (road and railway), etc.;
- development of National Bureau of Statistics data collection forms to adapt them to MAEE needs for monitoring and verification of energy efficiency and use of renewable energy sources per each sector and sub-sector of the national economy, by maximizing the level of data detailing in order to enable the application of Bottom-Up approach for the monitoring purposes;
- continuously improving the National Energy Efficiency and Renewable Energy Best Practice Recognition Program and further development of incentive schemes for the participants to it;
- continue the development of other modules of MAEE Database

# 12 Missions to Moldova

Within the first three project meetings in February, April and July 2012, the Austrian Energy Agency (AEA), Energon and the Moldovan Agency for Energy Efficiency (MAEE) discussed with various Moldovan stakeholders the possibilities for setting up the Industrial Energy Efficiency Monitoring, Verification and Benchmarking (M&V&BM) program.

On 4th of October 2012, Rainer Stifter presented the UNIDO GEF project at the International Conference MoldEnergy, targeting mainly public stakeholders from Universities and ministries.

During the fourth mission to Moldova from 26th to 29th November 2012, the first benchmarking workshop for dairies took place with participants from pilot dairies, consultants and other stakeholders. For the dairy sector the benchmarking program is already established. The benchmark study with dairies can be seen as an exercise for MAEE on setting up a benchmarking program for different branches. During this mission AEA also met the Swedish project team that works on:

- specifying follow-up indicators for the different activities stated in the draft National Energy Efficiency Action Plan (NEEAP), and the Draft Renewable Energy Action Plan (NREAP)
- providing national performance indicators for reporting on the generally accepted OECD/IEA format

AEA and the Swedish team agreed on establishing the indicators for industry in close cooperation to ensure a harmonized monitoring methodology for Moldova.

The minutes and presentations of all missions are shown in Annex III.

## 12.1 Outline of First Mission

During the initial meeting, the partners got to know each other and presented their expertise for the project. The work plan was discussed in detail and results and goals of project component 1 of the UNIDO-GEF project were presented.

Resources, roles and responsibilities within the project team were clarified and the roadmap was discussed. An additional goal was to meet relevant stakeholders to create confidence and form the basis for a successful co-operation.

Team members of further relevant projects, especially the “Swedish-financed project”, were also invited to discuss possible synergies on an early stage.

## 12.2 Outline of the Second Mission

The second meeting focused on the **methodologies for each work stream deliverable** and on the local frame conditions influencing the various programs to be developed.

AEA presented to the Moldovan stakeholders its experience with establishing the NEEAP and voluntary agreements for energy efficiency with Austrian enterprises. Furthermore, AEA gave an overview of the energy data collected from enterprises by “Statistics Austria”.

AEA prepared a concept and templates for each methodology and discussed the concepts with local MAEE staff and steps to implement the methodologies. The aim was to identify the framework conditions and to customise the methodologies.

MAEE was responsible for identifying stakeholders at national level and to invite key personnel for the meetings. In addition, team members of PC2 were invited as they are working with "Type A" enterprises (see paragraph 2.2) from which the data should be put into the M&V program.

## 12.3 Outline of the Third Mission

The third mission to Moldova focused on establishing various tools and methodologies for the Monitoring & Verification Program, the Benchmarking Program and the Best Practice Information and Dissemination Program. Reports that can be generated (in the best case, automatically) by these tools and methodologies were identified and described in detail.

- the Austrian team elaborated in working groups with MAEE staff tools for the different programs and discussed the methodologies
- a Moldovan software company presented its program for cadastral maps as this company could be assigned to develop a database for the M&V program

## 12.4 Outline of the Fourth Mission

The fourth mission to Moldova focused on the Benchmarking Program and on implementing peer-to-peer networks with Moldovan industrial companies.

During this mission on 27th of November 2012 a workshop with representatives from the pilot dairies was organized.

Apart from the benchmark focus of this workshop possible interesting topics for further workshops with the dairies were discussed in order to establish an energy efficiency peer-to-peer network for dairies in Moldova.

Before and during this mission, Petra Lackner, MAEE staff and Igor Zanoaga:

- analysed the results of the data collection sheets filled in by the pilot dairies,
- established benchmark graphs and benchmark curves for the dairy sector in Moldova,
- compared the results of Moldovan dairies with benchmarks from Austrian dairies,
- drafted schedules and topics of further peer-to-peer network meetings and
- finalized the benchmark data collection sheets for all sectors of Type A enterprises.

**Energy Efficiency Peer-to-Peer Network for Moldovan Dairies**
In addition to the pilot benchmark study with Moldovan dairies within the UNIDO/GEF project, a first attempt to set up a peer-to-peer energy efficiency network in Moldova was made. During these meetings enterprises should report on their activities, present case studies and exchange ideas and experiences. External experts should manage the meeting and provided the technical expertise on the subject of the meeting.

In the beginning the network consisted of representatives from the pilot dairies, especially energy related and technical staff. If other dairies were interested to join the network they were invited to the meetings in 2013. The 1st meeting was on 27th of November 2012, but during the fifth mission it was agreed that there is a need to organize an "awareness raising workshop on benchmarking" before starting with peer-to-peer network meetings.

## 12.5 Participation on International Conference “Moldova Energy 2012”

From 4th to 6th of October 2012, the international conference "Moldova Energy - 2012" took place in Chisinau. The event was organized with the support of the public authorities, institutions and energy companies from Moldova under the leadership of the Academy of Science.

Representatives from the energy sector, companies and research institutions from Romania, Ukraine, Russia, Byelorussia and other regional countries participated in this conference. Rainer Stifter presented the UNIDO GEF project and its expected results.

## 12.6 Outline of the Fifth Mission

The focus of the fifth mission to Moldova from 18th to 20th February 2013 was on discussing and organizing the project work plan for 2013. On this occasion, all parties got a clear picture of the expected final project results and agreed on the working topics for 2013.

MAEE agreed on elaborating a clear vision on the Monitorig & Verification & Benchmarking program until 15th of March 2013. The next mission was already fixed for the 27th to 29th of May 2013. On 28th of May 2013 the Workshop with Moldovan companies on benchmarking and energy management systems was organized.

## 12.7 Outline of the Sixth Mission

The sixth mission to Moldova focused on finalizing the benchmarking program and organizing the dissemination workshops on benchmarking and energy management systems on 28th of May 2014. The mission took place from 27th to 29th of May 2013.

The focus of the workshop was to inform the companies about the ongoing benchmarking project, to win new partners, to extend the benchmarking project to other branches and to raise interest for industrial energy efficiency and energy management systems

Beside the project team Mr. Pavlo Rozen from UKRAINE was invited to present the results of a UNIDO project in Ukraine where a benchmark system was established in nine agro-food sectors.

The main results of the Moldovan project were presented as well as experiences with industrial energy efficiency within Lactis and JLC.

Stakeholders from the sugar and meat processing industry participated in this workshop and expressed their willingness to participate in future data collection and benchmarking initiatives.

## 12.8 Virtual Presentation on 4th October 2013

During a workshop on industrial energy efficiency, organised by MAEE in their premises, a virtual presentation on Skype was held by Rainer Stifter about energy management system and ISO 50001 implementation in municipalities. Participants were mainly regional energy managers and the idea was to share experiences about this approach, but to save travel costs by presenting these topics in a virtual way.

## 12.9 Outline of the Seventh Mission

During the seventh mission a workshop was conducted for public stakeholders to present and discuss future policies and strategies to anchor energy efficiency in Moldovan industries. MAEE invited stakeholders from ministries and public agencies but response was very low and only representatives from the ministry of economy participated. However, a list of policies was developed and their importance on existing initiatives and legal requirements discussed. This overview was sent out to stakeholders to collect input and to identify a common strategy.