How to develop an energy efficiency program?

7 steps to an energy efficient municipality

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INTRODUCTION

Municipalities play a vital role in the efforts undertaken at an international, national and local level towards improving energy efficiency and use of renewable energy sources. Energy efficiency is one of the safest investments of a municipality if one considers that financial savings and investment payback are almost always guaranteed. Creating and implementing a municipal energy efficiency program is an effective and key first step in that direction.

This guide gives an answer to the question how to develop an energy efficiency program, and it is intended at guiding the municipal administration (mayor, municipal council, EE manager, EE administrator etc.) step by step through the process of creating an efficient and attainable energy efficiency program and its implementation. The guide has been drafted by the Strategic Development Consulting within World Bank-funded project "Promoting Energy Efficiency in Macedonian Municipalities", through the Energy Sector Management Assistance Program (ESMAP). The project is implemented for a period of 18 months (2014-2016) and aims at increasing the efficiency of energy use in Macedonian municipalities by enhancing the capacity of local authorities in identifying and implementing energy efficient opportunities in the municipal sector. The project's realization includes the support provided to 8 municipalities (Radovis, Staro Nagoricane, Novaci, Kavadarci, Pehcevo, Brvenica, Lozovo and Rosoman) in drafting documents that are important for EE of the municipality (municipal EE programs, municipal EE action plans, pre-feasibility study etc.) and experience sharing with all municipalities throughout the country.

The development of a municipal energy efficiency program is an obligation arising from the Law on Energy, referring to a three-year period. The program is implemented through annual action plans and reporting on completed actions during the previous year, which contain specific measures that need to be undertaken towards achieving the projected goals.

LIST OF ABBREVIATIONS AND ACRONYMS

EE – Energy Efficiency

MEEP – Municipal Energy Efficiency Program

EE Manager – Energy Efficiency Manager

EE Administrator – Energy Efficiency Administrator

EU – European Union

RM – Republic of Macedonia

MEM – Municipal Energy Manager

RES – Renewable Energy Sources

AP – Action Plan

ktoe – kilo-ton equivalent

MWh – megawatt hour

kWh – kilowatt hour

CONTENTS

WHY IS ENERGY EFFICIENCY IMPORTANT FOR MUNICIPALITIES?

Energy efficiency (EE) is a way of managing energy consumption and stopping unproductive energy spending, in other words, intelligent use of energy resources at disposal.

Energy efficiency does not mean simplified energy savings at the expense of living quality, but production or achievement of proper living and working environment (even their improvement) with less energy consumption!

Energy efficiency is very important for the economy of the municipality and the country in general. It aims at reducing the energy costs and producing financial savings in the municipal budget by way of spent energy. This will result in a possibility to reallocate saved funds for other priority needs or new EE projects, contribute to the development of local entrepreneurship and opening of new jobs, as well as reduce the effects on environment.

Energy efficiency implementation represents a source of income and increased fiscal ***accountability of the municipality.***

In addition, municipalities can also improve their services through the introduction of EE measures. Therefore, energy efficiency implementation should not be seen exclusively as a legal obligation, but an opportunity for long-term economic and sustainable development.

Municipalities play a significant role in the promotion of energy efficiency through development and implementation of strategies that improve energy efficiency in buildings and activities in their jurisdiction (administrative buildings, schools, kindergartens, street lighting etc.) and/or through stimulating improvements regarding energy efficiency in housing buildings, commercial facilities or the industrial sector. They can serve as heralds in the enhancement of EE, models for motivation of the private sector and other stakeholders.
The proper and efficient creation of the energy system requires a combi-

It is desirable that local authorities include energy efficiency and renewable energy sources in the local development plans and strategic documents. The commitment to energy efficiency can be expressed in the municipality's mission and vision.

nation
of several measures,
such as: reducing the need for energy, use of renewable energy sources, application of new technologies in construction, application of heat insulation etc.

EE OBLIGATIONS: MUNICIPALITY – REPUBLIC OF MACEDONIA – EU

EU Roadmaps

The European Union has developed a strong strategic, but also legislative framework, which provides the prerequisites and ensures the utilization of a vast potential of energy savings. In line with **Stabilization and Association Agreement with the EU[1],** the Republic of Macedonia needs to harmonize its legislation with the EU Acquis. Improvement of the energy efficiency, use of renewable energy sources, as well as analysis and review of the effect of energy production and consumption on the environment are some of the requirements contained in Article 99 of the Agreement.

Significant international treaties and protocols aiming to stimulate energy efficiency are: the Energy Charter Treaty, the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects and the Energy Community Treaty (Detailed information about these documents is provided in Annex 1).

The complete regulations on EU energy efficiency in the EU are available at http://europa.eu/legislation_summaries/energy/european_energy_policy/index_en.htm

The **Covenant of Mayors** is significant on a municipal level, initiated by the European Commission in 2008. It represents a voluntary treaty by which mayors oblige themselves to apply specific energy efficiency measures that lead to reduction of CO_2 emissions in their cities/municipalities by more than 20% up to 2020, in line with the 2007 draft- Energy Policy for Europe.

1 Official Gazette of RM No.28/01

The Covenant of Mayors has been signed by three[2] municipalities in the Republic of Macedonia: City of Skopje, Tetovo and Kocani.

Legal framework on energy efficiency in the Republic of Macedonia

The legal framework on energy efficiency in the Republic of Macedonia is presented in:

- Law on Energy[3];
- Energy Development Strategy[4]; and
- Energy Efficiency Promotion Strategy[5].

The objective of the **Law on Energy** is to provide:

1) Safe, secure and quality supply of energy and energy sources to consumers;
2) Creating an efficient, competitive and financially sustainable energy sector;
3) Promoting competition at energy markets by respecting the principles of non-discrimination, objectivity and transparency;
4) Integrating the energy markets of the Republic of Macedonia into the regional and international energy markets in compliance with commitments undertaken through the ratified international treaties;
5) **Increasing energy efficiency and promoting the use of renewable energy sources;** and
6) Protecting the environment from the negative effects when conducting certain activities in the energy field.

According to the law, the Government of RM adopts an **Energy Development Strategy** for a period of 20 years, revising it every 5 years, as well as a **Program for implementation of the Energy Development Strategy.**

The policy on efficient energy use is established by the **Energy Efficiency Strategy**, which is adopted by the Government upon the proposal of the competent ministry (Ministry of Economy), referring to a ten-year period, in compliance with the Energy Development Strategy.

The Energy Efficiency Promotion Strategy in the Republic of Macedonia up to 2020 was adopted in September 2010. The strategy establishes the framework for improvement of the situation of sustainable energy use through adoption and implementation of legal and regulatory measures, institutional enhancement and recruiting, social and financial measures, as well as a number of technical programs and initiatives intended for consumers.

2 http://www.covenantofmayors.eu [acceded on 15.01.2016]-
3 Official Gazette of RM No.16/11, 79/13 and 164/13
4 Available at http://www.ea.gov.mk
5 Official Gazette of RM No.143/10

The Strategy envisages energy savings exceeding 9% by 2018, compared to the average consumption in the five-year period 2002-2006 (147ktoe), in parallel with the promotion of energy efficiency, as well as monitoring and verification by 2020.

energy efficiency. They are available at the website of the Energy Agency http://www.ea.gov.mk/.

As a signatory of the United National Framework Convention on Climate Change (UNFCCC), the Republic of

National annual indicative targets for energy savings 2018 (ktoe)	147.2
Sector	**Projected annual energy savings by the end of 2018**
Housing	40.51
Business sector and utilities	**24.19**
Industry	90.45
Transport	44.63
Total projected energy savings	**199.78**

Picture 1: *National indicative energy savings targets in ktoe*

For the purpose of implementing the Energy Efficiency Strategy of the Republic of Macedonia, the Government adopts an **Energy Efficiency Action Plan**[6] every three years, upon the ministry's proposal.

The Republic of Macedonia has adopted a number of bylaws (rulebooks, regulations) that encompass

Macedonia is voluntarily providing its contribution to the global efforts for reduction of greenhouse gas emissions (INDC)[7]. In compliance with the document[8], the Republic of Macedonia will make efforts **towards reducing the carbon dioxide emissions from fossil fuels by 30%, i.e. 36% in a higher level of ambition, by 2030 with regards to**

6 First EE Action Plan of RM by 2018, available at http://www.ea.gov.mk/images/stories/E_Izdanija/11.Prv_Akcionen_Plan_za_EE_na_RM_do_2018_MK.pdf

7 Intended Nationally Determined Contribution (INDC)

8 http://www.klimatskipromeni.mk/content/Documents/mk%20final.pdf

the reference scenario. The carbon dioxide emissions from fossil fuels cover almost 80% of total greenhouse gas emissions, with a dominant share of sectors energy supply, buildings and transport.

Municipalities' tasks

According to the Law on Energy, municipalities are obliged to develop three-year energy efficiency programs, as well as annual action plans for the program's implementation. The programs have to comply with the Energy Efficiency Strategy of RM and the Energy Efficiency Action Plan. They are adopted by the municipal council, upon the mayor's proposal and prior opinion provided by the Energy Agency[9].

In addition, the law obliges persons from the public sector (including municipalities) to monitor and manage the energy consumption in buildings or building units where they work in a manner that would result in energy efficiency and energy savings. Moreover, municipalities are obliged to monitor and manage the energy consumption in the field of public lighting in a manner that results in energy efficiency and energy savings[10].

9 Official Gazette of RM No.16/11, 79/13 and 164/13, (Article 132)

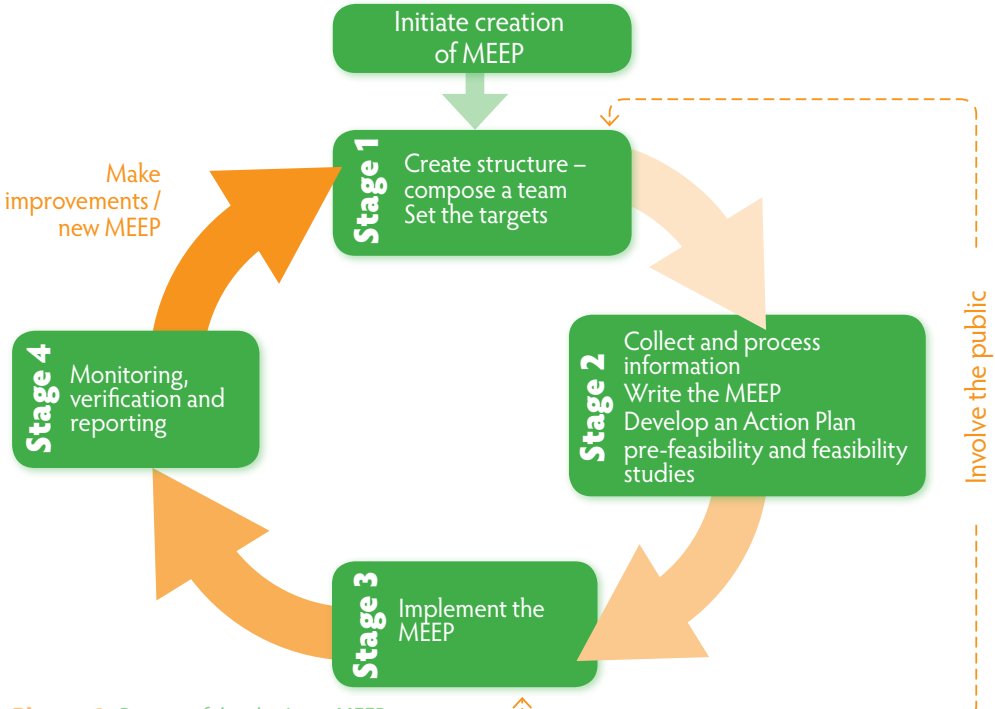
10 Amendments to Law on Energy (Official Gazette of RM No.79/13)

MUNICIPAL ENERGY EFFICIENCY PROGRAM

The creation of a municipal energy efficiency program develops in four stages: I - preparatory stage, II - program creation stage, III - implementation stage, and IV - monitoring and reporting stage.

The process involves decision-making on three occasions: at the beginning of the process – a decision passed by the mayor along with the municipal council, referring to the initiation of a municipal energy efficiency program; after the stage of the program's development – the municipal council passes the decision over its adoption; and at the end of the process – upon conducting the monitoring and evaluation, when the municipal council adopts the results and recommendations for future planning.

The Energy Agency is involved in the entire process, based on legal competences, providing opinions over the program's acceptability and guidelines for its improvement, acceptance and control of compliance with strategic documents at national level, and collection of information over the degree of the program's implementation.



Picture 2: *Process of developing a MEEP*

HOW TO BEGIN?

The mayor should put forward the initiative for launching the development of a municipal energy efficiency program (MEEP) to the municipal council.

Like any other planning process prior to the beginning of activities, it is very important to make a real assessment of the situation and anticipate the possible challenges. The planning process should be preceded by answers to the following questions:

- What is the goal of creating an energy efficiency program and what should be the outcome?
- What is the timeframe for completion of the process?
- Who will be involved in the program development and implementation?
- How will this program correspond to other plans and programs of the municipality?
- Which resources will be required during the process and how many are there at disposal?
- What will the program encompass?
- What has been achieved by the previous three-year program and the action plans (if the municipality has implemented this before)?

The answer to these questions should serve as guidelines that will help municipal council members to perceive the necessity, significance and potentials at disposal for the process to begin.

Advice for the mayor: *When presenting the needs to launch a process of developing a MEEP, use examples of success stories from other municipalities. They will help you highlight the program's significance.*

!!! Set up the required infrastructure

Set up an information system

Setting up an information system is an important prerequisite for timely and efficient flow of information. The system includes technical preparation and information collection protocol. This means that persons involved in the process have valid and active official e-mails, the sources of information have been identified, the persons to collect the information have been identified, the way in which they are collected, the manner of communication has been established (channels, tools) etc.

Appoint a Municipal Energy Manager (MEM)

The mayor (supported by the municipal council) appoints a responsible person (municipal energy manager) who will focus on the entire process of creating and implementing energy efficiency at the municipal level. This person should lead the energy efficiency team towards achieving the EE goals.

The MEM should receive appropriate training (the Energy Agency carries out a comprehensive training program of all appointed managers) and act as point of contact among the Energy Agency, the mayor, the municipal sector managers, the responsible persons in municipal buildings and the contractors.

Appoint Energy Managers for each institution (EE Administrators)

The municipal energy manager appoints energy manager of an institution (EE administrator in each of the institutions in the jurisdiction or funded by the municipality / school, kindergarten, pumping station etc). This person can be the manager/director of the institution, his/her assistant, accountant, technician or any other person having access to specific documents. His/her role is to manage energy data of the institutions and send the collected information to the municipal energy manager.

Create an Energy Efficiency Team

After initiating the process of developing a MEEP, the next activity is to create an energy efficiency team.

MEEP development is a process that requires the involvement of experts possessing knowledge and experience in diverse fields, such as energy, economy, finance, management, data processing etc. In addition, members should be well-acquainted with the regulations and the way in which local self-government and administration operate. In this regard, one should take into account that the people responsible for the program's implementation must be also involved in its development.

*Some larger municipalities, such as the City of Skopje, have an entire department on **energy, energy efficiency and renewable energy sources** within the Local Economic Development Sector. Karpos municipality has an **Energy Efficiency Department** within the Environment Sector.*

Responsibilities of EE team members

- *Implement the energy policy*
- *Draft a municipal inventory (list of all buildings and institutions owned or managed by the local authorities)*
- *Cooperate and communicate with all sources of information from every energy beneficiary*
- *Collect information and regularly update the database*
- *Identify potential financing sources*
- *Take part in the development of the municipal budget*
- *Develop the MEEP and action plans*
- *Monitor and report on the implementation of the program and the action plan*
- *Serve as consultants to the mayor and the municipal council over the MEEP and AP development, MEEP implementation and reporting on achieved results*
- *Recommend corrective measures for future MEEP and AP*
- *Organize and initiate required pre-feasibility studies and energy controls*
- *Organize the process of certifying municipal capacities and install instruments measuring the heat energy consumption*
- *Cooperate with the public procurement department in the municipality during the EE public procurement process*
- *Cooperate in the establishment of public-private partnership in the EE field*
- *Cooperate with other municipalities and regions towards EE improvement*
- *Work on raising the awareness over the potentials of energy efficiency at a municipal level*

Incorporate representatives of the civil society active in the energy, EE or environment fields into the EE team. They can be your partner in the entire process, offering technical and even financial assistance, and can surely be used as sources of information.

Checklist - are you ready?

1. *Identify and clearly determine the objectives to be achieved with MEEP*
2. *Talk with all parties concerned over the mission and be sure that everyone is on board*
3. *Gather as much success stories from other municipalities as possible to help you in elaborating the necessity and significance of the program*
4. *Identify all parties concerned that will be required in the team for an efficient program. Identify the potential consultants or other experts who can assist you in the process.*
5. *Create a plan for approaching and recruiting the team members*
6. *Make a detailed timeframe followed over the course of the entire planning process*
7. *Make a draft of the program content*
8. *Get to work!*

STEP 1:
MAKE A RECORD OF THE CURRENT STATE

Proper and timely data is the foundation in creating any strategy, it is essential in the preparation of analyses and assessments and one of the crucial factors in the decision-making process. A well-developed database contributes to the monitoring of parameters (ex. energy consumption in buildings, spent funds for street lighting etc.) and enables easy and efficient analyses and monitoring of changes.

Prior to the start of the data collection process, the energy efficiency team should create a so-called municipal inventory list. This list should involve all building and architectonic plans of buildings, along with the interior installations and equipment for each facility.
The inventory should also contain a list of industrial capacities in the municipalities, by type and size of consumers.

In order to record the existing state and have insight into the pending change as a result of the MEEP and AP implementation, it is necessary to collect information on:

- consumption of electricity and heat energy
- water consumption
- area of buildings
- number of persons using the buildings
- building use regime etc.

Data collection needs to encompass all administrative buildings, elementary and secondary schools, kindergartens, libraries and local institutions, street lighting etc, under municipal jurisdiction.

Data is collected in cooperation with the responsible persons (EE administrators) of each facility, whose energy consumption is funded from the municipal budget. The collected data should be classified and put into the electronic database, which will be further updated. The database needs to contain information on all consumers, by sectors, and include the basic information: elements on consumption of any type of energy source per month and per year, as well as information over the equipment causing that consumption. This will help the MEM in doing the analy-

sis and putting forward proposals for reduction of energy consumption.

In general, data can be divided in two groups:

1. Standard data - referring to state of facilities, building performance, manner of energy supply, installed power etc. Most of this data is permanent.
2. Variable data - referring to energy consumption, spent energy costs etc. This data require timely updating (ex. in every three months).

The database will enable the municipality to keep data, have insight in the costs, in creating statistics and analyses. It is used for analyses and estimates of the efficiency in energy use, but also for assessments of the profitability of investments in energy efficiency measures compared to the energy savings.

In which sectors should you collect information?

- *Main (mandatory) sectors*
  - *Buildings (facilities owned or under the jurisdiction of the municipality)*
  - *Street lighting*
  - *Water*

- *Other sectors (if required)*
  - *Buildings (private buildings)*
  - *Transport*
  - *Waste*
  - *Energy and heating*
  - *Industry*

Basic information about the municipality		
1	Municipality	(name of the municipality)
2	Name of Municipal Energy Manager	Name and surname of Municipal Energy Manager
3	Number of team members	e.g. 5

Energy Efficiency Indicators						
4	Basic information	unit	Year 1	Year 2	Year 3	
5	Area	km^2	100	100	100	
6	Population	number	20000	20500	20100	
7	Employed	number	10000	10500	9100	
8	Households	number	5000	4900	5100	
9	Floor area					
10	Municipal buildings	m^2				
11	Households	m^2				
12	Industry	m^2				
Total						
13	Other important information					
14	Streets length	km^2				
15	Street lights length	km^2				
16	Energy consumption	MWh				
17	Coal	MWh				
18	Oil and oil derivates	MWh				
19	Electricity	MWh				
20	Firewood	MWh				
Total						
21	Municipality budget					%
22	Heating costs				12000000	69.36
23	Costs for energy consumed in the municipal buildings				3000000	17.34
24	Costs for energy consumed for street lights				500000	2.89
25	Other costs				1800000	10.4
Total					**17300000**	**100**

Picture 3: *Example of a data collection table*

STEP 2:
ANALYZE THE POTENTIALS FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY SOURCES

In order to undertake specific measures and activities towards enhancing energy efficiency, municipalities need to have exact information over the potential at their disposal (through proper records). Based on this data, they should select a priority sector, accompanied by an appropriate project and measures to be undertaken. In the analysis of data in the appropriate sectors and projects, indicators should be set up for comparison among municipalities in RM, as well as municipalities and cities in neighboring countries by using certain benchmarks.

Collected data should be analyzed in the context of other indicators, such as consumption in the previous year, population growth projections, expected development of consumption per capita etc. In this way, projections for a period of 10-20 years can be made. These projections represent an important part of the required input data if the municipality wants to use software tools for a scenario.

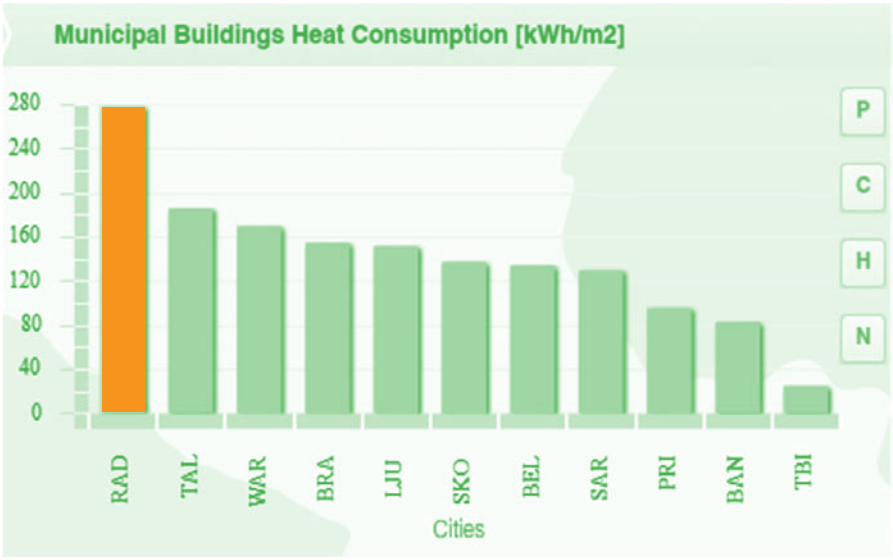
The available statistical data can be of great help in the process of analyzing data and creating projections. Consult different sources, such as the State Statistical Office website http://www.stat.gov.mk/

Analyses on the energy efficiency potential of the municipality can use diverse available tools. One of the tools that offer comparison of the energy consumption with other counterpart cities is the *Tool for Rapid Assessment of City Energy (TRACE)* [11], developed by the World Bank's Energy Sector Management Assistance Program (ECMAP). This tool helps in setting up priorities among sectors, taking into consideration other relevant factors.

The tool is comprised of three modules: energy benchmarking module for comparison of key performance indicators (KPIs) among counterpart cities, sector prioritization module for identification of sectors that offer largest potential regarding en-

11 Available for use and free download at http://esmap.org/TRACE

ergy savings, and intervention selection module for testing of EE measures and assistance in selecting the most appropriate measures at a local level.



Picture 4: *Heat consumption in administrative municipal buildings in Radovis municipality compared to other municipalities (excerpts from TRACE database)*[12]

It is important to note that many municipalities in Macedonia can show low level of energy consumption not because they are efficient but because their level of services is low (lack of lighting, lack of heating etc.)

12 RAD – Radovis, Republic of Macedonia; TAL - Tallinn, Estonia, WAR - Warsaw, Poland; BRA - Bratislava, Slovakia; LJU - Ljubljana, Slovenia; SKO - Skopje, Republic of Macedonia; BEL - Belgrade, Serbia; SAR – Sarajevo, Bosnia-Herzegovina; PRI - Pristina, Kosovo; BAN - Banja Luka, Bosnia-Herzegovina; TBI -Tbilisi, Georgia.

Picture 5: *Sector prioritization using TRACE tool*

Use of renewable energy sources can be of great assistance - do not forget to make an analysis of the energy potentials and record the infrastructure potentials for linking renewable energy sources to consumers.

Street lighting sector

The street lighting sector is one of the more attractive sectors for EE implementation. Savings are estimated at 15-30%, somewhere even up to 50%, depending on the size, type and intensity of lighting.

Why do municipalities most often begin with this sector?
The following contributes to putting this sector on the top of the list when it comes to EE in municipalities:

- It has a relatively short investment return period (financial gains are felt by the following month);

Radovis municipality
When developing MEEP[13] for Radovis municipality, the overview of energy consumption ranks street lighting as the second-largest consumer with 1.148.964 kWh/year (for reference year 2012), i.e. street lighting uses 26.6% of total energy costs of municipality.
Implementation of a complete program for rehabilitation of street lighting will result in annual savings of 251,090kWh, i.e. total energy consumption will amount to 38.2%.

13 Изработена во рамки на проектот финансиран од Светска банка: Промовирање и поттикнување на енергетската ефикасност на општината

Rosoman municipality
According to the pre-feasibility study within the street lighting project in Rosoman municipality, the replacement of the existing light bulbs with LED lights and mounting of new switchboards will contribute not only to energy savings, but the improvement and harmonization of lighting standards, as well as enlargement of lighting coverage.
It is estimated that the municipality will annually save at least MKD 1,000,000, while the investment return period is 10 years.

- Quality of municipal services improves;
- Citizens immediately feel the visual change;
- Environmental effects are reduced through the focused dispersion of lighting;
- Interventions and energy efficiency activities are easy in this sector.

EE measures that can be undertaken in the public lighting sector encompass:

- replacement of the existing (most often mercury light bulbs) with energy-saving light bulbs;
- separation of the street lighting measuring points from the existing EVN substations into separate cabinets;
- introduction of automatic control of ignition and extinction of lighting, depending on the daylight intensity;
- monitoring of street lighting depending on the size of the investment;
- setting up autonomous solar lights etc.

Public lighting has a significant gender trait. A scoping study on gender-based violence against women and girls in urban public spaces in two municipalities (Centar and Cair) showed that perceptions of women over their safety is influenced by the physical appearance of the urban environment, with a properly maintained, broad and well-lit environment makes them feel safer. In this regard, women are prepared to use the longer path to reach their destination if it is lit compared to the dark shortcut.[14]

14 Scoping study on gender-based violence and discrimination against women and girls in urban public spaces of the City of Skopje, Reactor-Research in Action and Strategic Development Consulting, 2012, Skopje.

Karpos municipality

In compliance with the 2008-2012 EE program, series of projects in the street lighting sector have been undertaken in Karpos municipality. The projects involved lighting of new pedestrian tracks, access paths to facilities, new squares and dark accesses. New lines have been built, along with new lighting poles. The number of existing poles has increased by 643 since 2007. The existing, most commonly 125W and 150W mercury light bulbs have been replaced by 70W sodium light bulbs, 55W neon lights, 30W LED lights and autonomous solar lights for park lighting.

The undertaken energy efficiency measures have reduced the annual electricity consumption by 533MWh, i.e. 20.2%.[15]

Kocani municipality

An EE project implemented in Kocani municipality in 2015 resulted in the replacement of all mercury light bulbs of 125W and 140W with 41W-capacity LED lights, achieving increased lighting by 40% and more than three-fold energy savings. In addition, mercury light bulbs of 250W and 270W have been replaced by LED lights of 102W, achieving increased average lighting by 60% and 2.5-fold energy savings.

The EE measures undertaken by the municipality in this sector will result in annual savings of 1,600,000kWh, i.e. annual financial savings of MKD 10.69 million (EUR 173.400).[16]

Administrative buildings sector

Buildings owned by the municipalities or funded by municipalities - administrative facilities (municipal buildings, kindergartens, schools, cultural institutions etc.) - spend more than 30% of the total energy consumption. Implementation of EE measures can result in significant savings in electricity consumption and increase of financial savings.

Savings in these facilities can be achieved in a number of ways:

- Use of EE measures in existing facilities (setting up insulation in walls, floors and ceilings, replacement of windows and doors etc.);
- Replacement of existing lighting with energy-saving light bulbs and reducing the lighting in the room to the standard level (meeting the standards for such type of room);
- Installing contemporary electrical wiring, water supply and sewerage installations, as well as procurement and installing of proper equipment.

15 2013-2015 energy efficiency program of Karpos municipality, available at http://karpos.gov.mk/page/energetska-efikasnost

16 Success model - Kocani municipality, World Bank project, 2015

Kavadarci municipality
The municipality insulated the walls and the roof, replaced the windows, the doors and the light bulbs in elementary school "Dimkata Angelov Gaberot" in village Sopot.
The EE measures resulted in 22% of annual electricity consumption savings, i.e. reduction of energy consumption by 22kWh/m².[17]

According to one research, the comfort in schools is closely related to pupils' educational achievements. The way in which the classroom is designed has a 50% influence on results by pupils during instruction. This includes aspects such as heating, accordingly the energy efficiency measures in schools[18].

Kisela Voda municipality
In 2011-2012, EE measures were undertaken in three municipal facilities in Kisela Voda, including wall insulation, installation of new windows and entry doors, replacement of the heater masks and thermostatic valves, automatic control of the central heating system and replacement of light bulbs.
The benefits of these projects are seen in the total annual energy savings of 63%, i.e. financial savings of USD 48.500.5.[19]

Water sector

The water sector is one of the most poorly treated sectors regarding EE in the Republic of Macedonia thus far. Municipalities have paid very little attention to this sector. Therefore, enhancement of energy efficiency in water supply and water treatment systems in municipalities will result in significant benefits, such as: improvement of conditions and services, lowering of costs for end users, contribution to long-term financial stability of the municipality, along with reduction of the environmental effects.

One of the priority tasks of the municipality is to compile an inventory for each pumping station at the municipal level and record leakages in existing water supply systems (exceeding 50%).

17 The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis, Building and Environment (2015)- Barrett P, Davies F, Zhang Y, Barrett L, doi:10.1016/j.buildenv.2015.02.013

18 The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis, Building and Environment (2015)- Barrett P, Davies F, Zhang Y, Barrett L, doi:10.1016/j.buildenv.2015.02.013

19 GEF sustainable energy project, Republic of Macedonia, 2013

The municipality can undertake diverse measures that will result in reduced energy consumption up to 30%, such as:

- Upgrading of pumping stations (installation of energy-efficient motors);
- Application of appropriate water storage tanks;
- Introduction of frequent regulation of existing electric motors;
- Modernization of existing systems for waste water treatment;
- Use of aerobic water treatment systems as one of the most efficient systems; etc.

Use of renewable energy sources (RES)

Increase of EE can be easily achieved by introducing RES in facilities. RES are used for generation of heat or electricity.

Kavadarci municipality

Application of EE measures at the Kavadarci pumping station is to be implemented in several steps:

- *Repair of the water distribution system in order to reduce leakage by 30%. This will result in savings of 1.463 kWh/year in electricity, i.e. 9.29%*
- *Enlargement of the volume of the two existing tanks*
- *Replacement of the existing pump with one of proper size and increased efficiency, leading to energy savings of 25%, with investment return period of 10,5 years*
- *Installing sensors for pressure control and pump exit speed, resulting in energy savings of 45.3%, investment in the amount of MKD 372,000 and investment return period of 7,6 years*
- *Mounting a solar photovoltaic system for recovery of annual energy consumption, resulting in energy savings of 97.8%.*

Novaci municipality

Calculations have been made for the three pumping stations in Novaci municipality, along with recommended EE measures. According to recommendations, the EE measures for the Bac pumping stations include investments of ***about MKD 120,000, resulting in energy savings of 3.452 kWh/year*** *and investment return period of 3,4 years.*

Recommendations for the Brod pumping station are the following: pipe optimization, detection of leakages, valve control, increase of capacity by 20м³ and setting automated control. These measures will result in ***savings of about MKD 26,000 and investment return period of 4,2 years.***

EE measures for the Zivojno pumping station should result in annual savings of 9.649 kWh/year,i.e.financial savings of about MKD 84,000 MKD/year and investment return period of 4,3 years.

Municipalities need to assess the possibilities for use of energy from renewable sources, such as geothermal energy, biomass, biogas, natural gas and solar energy, for own uses. Furthermore, they must conduct an analysis on the infrastructure opportunities for networking of facilities to RES.

For example, municipalities can apply renewable energy sources as:

- Installation of roof and facade solar panels for water heating;
- Use of street lighting installations operating on accumulated solar energy; etc.

Staro Nagoricane municipality
When developing the MEEP for Staro Nagoricane municipality, an assessment of the RES capacities at disposal has been carried out. The assessment and earlier studies showed that the municipality has one geothermal source (near Strnovec), possessing a big potential for use as renewable energy source. The potential heat energy from the source has been estimated at 207,6MW, i.e. 830,400kWh per year.
The use of this potential can replace the annual use of 159.400 tons of coal and 288.000 tons of wood. Lowering of CO_2 emissions is estimated at 296.5 tons/year. The total investment is estimated at EUR 166 million.

Detailed information on tariffs and bylaws on use of RES can be found at the website of the Energy Regulatory Commission of the Republic of Macedonia http://erc.org.mk/pages.aspx?id=53.

20 Developed within World Bank-funded project: Promoting and Stimulating Energy Efficiency of the Municipality

STEP 3:
DEFINE ENERGY EFFICIENCY GOALS

The defining of energy efficiency goals is a very significant step in the creation of an energy efficiency program of municipalities. Depending on the potentials at disposal or challenges it most commonly faces, the municipality can set different goals that will have to be achieved upon completion of the program's implementation.

The goals set by the municipality need to be measurable, in order to identify the progress achieved in their implementation. The goals are formulated in a statement that describes what needs to be achieved. In fact, they give an answer to the question ***what do we want to achieve?*** One of the ways to formulate goals is the use of the so-called SMART formula. The use of this acronym provides conditions for setting up properly thought-out goals.

When setting up goals, a reference year is the year where no disruptions of the system occurred (or the year with the fewest disruptions) and provides complete consumption data for all energy forms. Based on the collected data for the past 3-5 years, one year that fulfills this condition is selected. Afterwards, the change indicators are determined in comparison to it. Ex. Energy spending in 2017 to be maintained at the same level as 2014, while the greenhouse gas emissions to reduce by 30% compared to 2014.

S **(specific) –** provides for sufficient details that adequately focus on the goal.

M **(measurable) –** provides for traits that clearly show the change that needs to be achieved.

A **(ambitious) –** provides an opportunity to challenge the municipality to come out of its status-quo.

R **(realistic) –** seeks for the goal to be attainable in a certain timeframe while using the available resources of the municipality.

T **(time-bound) –** seeks for a timeframe for achievement of the goal.

The defined goals can respond to different EE benefits.

Financial savings and energy savings – taking into consideration the fact that the most difficult problem of municipalities is to secure funds for servicing of costs, it is expected that the goals of the energy efficiency program address financial savings.

Examples of EE goals of municipalities:

- *To reduce electricity consumption in facilities funded by the municipality by 20% up to 2017.*
- *To reduce the share on spent energy in the municipal budget by 15% for each year in the next three years.*
- *To reduce the share on energy in municipal investments by 20% up to 2020.*
- *To reduce the average energy consumption (kWh/m2) by 10% up to 2018.*
- *To achieve a 20-percent investment return for each new capital project that supports energy efficiency starting from 2016 (each MKD invested in an energy efficiency project to have a 20% annual return of lower operative costs).*

Reducing environmental effects – according to the Strategy for Energy Development in the Republic of Macedonia 2008-2020, nearly 90% of primary energy in the country is obtained from fossil fuels, mainly lignite and heavy crude oil. Most of it is transformed into electricity or heat in thermal-energy capacities. Environmental components affected by the thermal-energy capacities are grouped in three aspects – air, water and soil – and through them they affect the flora and fauna, especially the health and living quality of people. The most environmentally-burdened component by the thermal-energy capacities in the Republic of Macedonia is air. Thermal-energy capacities pollute the air with particles and gasses (SO_2, NOx, CO) that have direct negative effect on living creatures and materials in their vicinity, but also with gasses (CO_2, CH_4, N_2O) that have a global negative influence through the greenhouse effect.

Implementation of the energy efficiency program has an indirect effect on the reduction of use of primary energy, emissions of harmful gasses in the atmosphere, thus acting towards protection of the environment.

Examples of goals referring to the protection of the environment:

- *To reduce the level of CO2 emissions in the atmosphere by 30% in the coming two years.*
- *To reduce the total annual fuel consumption (gasoline/diesel) for the needs of vehicles in the municipality by 3.000 liters up to 2017.*
- *To increase by 30% the share of renewable energy sources in the total balance of spent energy in municipal facilities in the following year.*

Goals can be long-term, mid-term and short-term. They should result in success of the program's implementation.

STEP 4:
ANTICIPATE CHALLENGES AND CONSIDER POSSIBLE ALTERNATIVE SOLUTIONS

In general, municipalities have a large potential for savings and energy efficiency. However, when planning measures to be undertaken, one should take into account the possible challenges (barriers). The awareness over the existence of challenges in the planning stage enables the consideration of alternative solutions that will be used towards achievement of the goal.

The main challenges that can appear when implementing the program can be divided in several groups:

Financial challenges

The implementation of plans and program depends on the funds secured for realization of projected activities. Municipalities most often do not have sufficient funds from their own sources at disposal (municipal budget) in order to implement projected energy efficiency activities.

In order to overcome the challenge by securing funds for realization of the activities, municipalities need to consider the following alternatives:

- Creation of an EE fund;
- Private-public partnership;
- Grants by international and domestic institutions and organizations that invest in energy efficient projects;
- Indebtedness of the municipality through a so-called soft loan;
- Indebtedness of municipalities with commercial banks;
- Use of other financial modalities (equipment leasing);
- Investment in stages and realization of projects over the course of several fiscal years; etc.

Create a revolving fund for EE in the municipality. This will enable the investment of savings obtained as a result of EE into other new projects, thus reducing the dependence of implementation of EE projects from the funds at disposal in the municipal budget.

Institutional barriers

The most common institutional barriers in the municipalities are the following:

- Lack of legally prescribed/recommended systematization structure in municipalities, resulting in different systematization and distribution of

Kavadarci municipality

For the purpose of quality and quantity improvement of lighting, Kavadarci municipality has concluded a public-private partnership for a period of 15 years with a company operating in the sector of rehabilitation, modernization and maintenance of street lighting. This has contributed to the increase in the number of light bulbs and their replacement with EE (LED) lights, rising percentage of functional light bulbs, reduction of electricity consumption for lighting, and elimination of annual maintenance costs. Following calculations of the revenues and expenditures for street lighting, it was perceived that the income of funds from the utility fee for street lighting is sufficient to cover the liabilities for street lighting and invest funds for a new low-voltage network.

tasks among employees in municipalities;
- Municipalities do not have a proper information network;
- Municipalities did not show any concern about consumers at local level in the past, resulting in no inventory by sectors;
- There is a difference in the ratio energy consumption/ subsidies from Ministry of Finance, which municipalities have to cover;
- Municipalities do not file the financial records on total energy consumption by individual sectors;
- There is no proper training of responsible persons who collect EE data; etc.

Municipalities (especially the smaller ones) come across a lack of human potential that can be engaged in the implementation of activities. In most cases, the people responsible for energy efficiency in the municipality are in charge of other tasks and do not always have sufficient time to complete their commitments. In addition, employees are not sufficiently informed about the implementation of energy efficiency projects.

In general, these institutional barriers can be overcome through:

- Engagement of external consultants who will help the municipal staff during the process;
- Proper training of employees;
- Inter-municipal cooperation and exchange of good practices and experiences;
- Dissemination of project results and informing the public (both internally and the broad public) with the EE benefits.

The municipality needs to put financial and human resources at disposal towards implementing EE activities.

The centers for development of planning regions can be beneficial in overcoming of some barriers, through technical assistance, experiences, information. Make them your ally.

In this regard, efforts are required for establishment of the required organizational structure and introduction of a software solution for implementation of the energy management system as minimum prerequisites for the program's realization.

STEP 5:
CREATE A TIMEFRAME AND AN IMPLEMENTATION PLAN

The energy efficiency program represents a legal obligation of municipalities and it is drafted for a **three-year timeframe.** Upon expiry of this period, the municipality is obliged to prepare a new program.

The MEEP implementation is carried out through **annual plans (action plans),** which are adopted by the municipal council upon the mayor's proposal. The annual plans are delivered to the Energy Agency by the end of February at the latest, for the current year, as well as information on the program implementation for the previous year (implementation report).

Regarding priority sectors, it is good if the municipality develops a pre-feasibility study, followed by a feasibility study and detailed technical documentation in order to successfully implement the public call process towards achieving tasks defined in the action plan.

Review once again the projected measures and list them by priority. Make an assessment on the time you will require for realization of each measure. Take into consideration the opportunities and resources (human and financial). Create a timeframe and realization plan based on this.

Project / activity	Quarter										
	2016				2017				2018		
Public street lighting reconstruction			x	x		x	x	x	x	x	x
Drafting a proposal for fitting energy saving lights in the municipal administrative buildings				x		x	x	x		x	x
Replacing the existing hot water heating installation in the Primary School Kliment Ohridski				x	x	x	x				
Installing solar collectors on the municipal buildings						x	x	x	x		
Implementing EE measures in the kindergartens									x	x	x
Preparing the Rulebook on EE in public procurements		x	x	x							
Preparing a study for establishing the possibilities for using Renewable Energy Sources					x	x	x	x	x	x	
Placing thermal facades on kindergartens							x	x	x	x	x

Picture 6: *Example of a timeframe for the program's realization*

Project/ activity	Objective	Financed by	Beneficiary	Investment's Value	Implementation Period	Expected results
Reconstruction of public street lighting	Saving on the electricity and day to day maintenance, better lighting, environment protection	Municipality / World Bank	Municipality	334,500.00 €	2016-2018	Public lighting reconstruction, better services provided to the citizens, lower costs
Preparation of a proposal for fitting energy saving lights in the municipal buildings	Replacing the old and non-economic lights, cutting down on electricity consumption, improving the lighting standards	Municipality / World Bank / other donors	Local educational institutions	110,000	2016-2017	Cutting down on energy and maintenance costs, better conditions for the students

Picture 7: *Example of a plan for program's realization*

STEP 6:
PREPARE PROGRAM AND PUT IT FORWARD FOR ADOPTION

The MEEP must be developed in line with the Energy Efficiency Strategy of the Republic of Macedonia and the energy efficiency action plan. Based on the Law on Energy[21], the program needs to contain a description and assessment of the state and the municipal energy needs, list the goals for energy savings at local level, obligations and opportunities for implementation of energy efficiency activities and initiatives, and define measures that need to be realized towards securing energy efficiency. Furthermore, the program should list the financing sources, activities and timeframes for implementation of measures, holders of activities etc.

MEEP content

Introduction

This part of the program sets the goals of the municipality and the volume of measures to be applied for achievement of the goals. This involves the legislative framework in order to ensure that the implementation of the measures fully corresponds to the legislative requirements.

General data about municipality

This chapter contains the basic information about the municipality and its traits, both environmental and geographic. Moreover, a review of the EE potential is required, along with assessment of the municipality's potential for use of renewable energy sources.

Overview of the existing energy consumption

This includes data on the existing energy consumption in the municipality, by sectors. This information will be used as grounds for comparison and evaluation of savings.

Effect on environment

This chapter should contain a summary on the energy required for each of the sectors and the equivalent for greenhouse gas emissions (CO2, SO2).

21 Official Gazette of RM No. 16/11, 79/13 and 164/13, Article 132

Set benchmarks for diverse sectors

This section encompasses the data of the given benchmarks for all sectors, for which information has been provided in previous chapters.

EE policies and projects

Based on the analysis and benchmarks, this chapter should present the selected sectors, recommendations and causes for the selections.
The goal of setting priorities in sectors is to rank them based on the EE potential.
The recommendations on priority sectors should be identified on the grounds of the following data:
- potential for energy and financial savings
- initial implementation costs
- implementation timeframe.

Goals to be achieved through realization of EE measures

This section should sum up the projected annual energy savings from the implementation of the measures presented in the previous chapter. This data will be used for future evaluation and comparison with the real savings.

Financial sources for MEEP implementation

The opportunities for financing of the program implementation should be analyzed and described in detail. One should take into account there are a number of financing sources (municipal budget, external organizations and institutions etc.) that can contribute to the program's implementation.

Timeframe for implementation of program and responsibilities

The projected measures should be realized within a three-year timeframe, i.e. during the program's validity. This information will produce implementing action plans for each individual year. The non-implemented projected measures from the previous three-year program can be transferred to the program for the coming period.

Monitoring and implementation of MEEP

This section should contain the activities to be undertaken for monitoring of the program's implementation, measurements of energy savings and plan on briefing stakeholders.

The Municipal Energy Manager should prepare the Program.

Upon determining the priority sector, projects and measures, the program is submitted for **approval to the municipal council** by the mayor**, upon a prior opinion from the Energy Agency**[22]. The program, which is to be adopted by the municipality within 30 days, is then forwarded to the Energy Agency, which is obliged to submit a report to the Ministry of Economy (within 30 days) over the program's harmonization with the Energy Efficiency Strategy of RM and the action plan.[23]

22 Official Gazette of RM, No.16/11, 79/13 and 164/13, Article 132

23 Ibid.

STEP 7:
MONITOR IMPLEMENTATION AND REPORT ON IT

A very important part of the entire process of the MEEP implementation is monitoring and verification of the energy savings, which represents the foundation for initiating continual improvements of the process, accompanied by proper and timely changes.

The monitoring and evaluation should begin in the earliest stage of the process and be continually practiced throughout the program's implementation. Effects should be monitored even upon completion of the program's timeframe, in order to establish the long-term effect on local entrepreneurship, the energy sector, the environment, and consumer behavior.

The monitoring and the evaluation of the program's implementation can be carried out internally (by the municipal administration) or externally (by engaging independent consultants or a company). In both cases, the process should be led by the municipal energy manager.

The process of implementing energy efficiency measures and the monitoring and verification process should produce clearly visible results for citizens, the mayor and the municipal council, so that the process is continual and achieving the projected goals of the Action Plan, the Strategy and some of the goals imposed by the EU. The obtained information should be continually submitted to the municipality, as well as annually to the Energy Agency.

The acquired monitoring data should be taken into consideration when developing annual action plans and the municipal budget, as well as adapting and improving the program.

Communicate the results of undertaken EE measures with the public and other stakeholders. The municipality can represent a good model for other entities to start thinking about applying EE measures. Use articulate language and be certain that the others comprehend the importance and the benefits. You have done a great job.

PUBLIC COMMUNICATION AND INVOLVEMENT

Communication with the public and its involvement in the process of creating the municipal energy efficiency program is the foundation for creation of successful policies in the field of energy efficiency and protecting the environment. Communication is especially important for raising the awareness over the significance of problems, improving the level of knowledge and contributing to changes in the people's behavior. **The public's involvement aims at ensuring increased transparency of the entire process and inclusive creation of municipal policies.**

Therefore, it is of paramount important to create a plan for communication and involvement of stakeholders, both in regards to internal communication (among members of the energy efficiency team and the decision-makers) and the communication with the broader public (informing, education and training, public debates and consultations).

Communication with the local population and the broader public is required because it will contribute to a change in habits and behavior by all concerned groups and individuals over energy efficiency issues.

Types of communication

The process of planning energy efficiency programs requires decision-making at three levels:

- When launching the initiative for development of an energy efficiency program;
- When adopting the energy efficiency program;
- When evaluating results and recommendations for the next planning period.

One should take into consideration that the goals for public communication differ for each stage, leading to differences in the forms of communication.

Take into consideration that communication with the public should be a two-way street. It is not enough only to brief them about the steps and activities that are being undertaken. Ask their opinions and suggestions, and involve them in the process. The public should be your ally in the process.

Stages in the process of developing an EE program	Communication goals
First decision – initiative of mayor for EE program	- *Informing the public* - *Consultations and information exchange* - *Announcement of the process beginning* - *Information exchange on stages in the process*
Second decision – adoption of the EE program by the municipal council	- *Information and training on issues related to energy efficiency* - *Getting support from council members* - *Change of habits and behavior among target public*
Third decision – evaluation of results and recommendations for next planning period	- *Improvement of efficiency of municipal policies* - *Enabling an inclusive decision-making process*

Table: *Examples of communication goals in different stages in the process of creating a municipal energy efficiency program*

Dilemmas in the communication process

Prior to starting a process of communication with the target public, it is necessary to analyze the everyday behavior of the population, habits, how far they are informed etc., as well as make an assessment of the readiness to embrace changes by the public concerned.

The results of the analysis and the assessment should be further used as starting points in the planning of activities.

Several significant factors should be taken into consideration when developing a plan for communication and involvement of the public:

- Collective versus individual interest in the process;
- Short-term effects of the plan versus the long-term results;
- Differences in quality of information and degree of knowledge in the matter by individuals in the community;
- The need for a "model" in the process, i.e. a champion that would serve as an example for the community.

In order to achieve the best results, the communication plan should be created in correlation with the remaining tools and messages used by the municipality. At the same time,

Basic steps when creating a communication plan:

- ✓ *Define the general communication goals*
- ✓ *Define the target groups*
- ✓ *Formulate the specific communication goals for each of the target groups*
- ✓ *Define the messages*
- ✓ *Selects communication means and tools*

Have diverse target groups in the process of creating a MEEP: municipal council members, municipal administration staff, employees in facilities where activities are being implemented, service beneficiaries in facilities, their family members, members of civil society organizations, experts in the field, the broad public etc. Create a plan how and when to communicate, as well as the way in which to involve each of the groups in the process. You can do this by using different tools for the citizens' involvement, such as individual meetings with key stakeholders or focus groups over a specific issue or EE measure, or public debates and community forums for involvement of all stakeholders at the same time, for the purpose of general discussions on the EE issue in the municipality and establishing the general problems/guidelines in the field.

the staff responsible for public relations in the municipality and the energy efficiency team members should possess unified, complete and timely information about the goals of the program and the process development.

The involvement of the public can be done in different ways and in different stages of the process of creating an energy efficiency program. It is of great importance to involve the stakeholders in the process of identification and prioritization of projects to be implemented. Other tools for involvement of the public are the following:

- One-on-one meetings;
- Workshops;
- Debates; etc.

The successful communication strategy and involvement of stakeholders requires a complete and timely implementation of the plan upon its development. The success in the plan's implementation correlates with the following aspects:

- Proper coordination of activities;
- Sharing feedback on results;
- Continual monitoring and evaluation;
- Timely response to challenges and flexibility in adjusting to latest developments.

ANNEX 1 - EU ENERGY EFFICIENCY ROADMAPS

Energy Charter Treaty – it establishes the legal framework for countries of Western Europe that refers to the promotion of long-term cooperation in the energy field, based on common benefits that result from these commitments.
The Energy Charter highlights the following key objectives:

- reducing the harmful effects of energy on environment, in order to apply the European environmental standards; and
- increasing energy efficiency.

Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects – aims at stimulating investments in energy efficiency projects and supporting the implementation of energy efficiency policies in signatory-states, such as Macedonia.

Energy Community Treaty – EU and the treaty parties, including Macedonia, have pledged to improving the state of environment from the aspect of natural gas and electricity, energy efficiency and renewable energy sources, taking into account that the achievement of these goals requires the introduction of a comprehensive and integrated regulatory market structure, supported by solid institutions and effective supervision, along with appropriate inclusion of the private sector.

There are several important directives in the energy field listed below:

› Directive on energy performance of buildings 2002/91/EC, 2010/31/EU

› Directive 2006/32/EC on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC

› Directive 2008/1/EC concerning integrated pollution prevention and control

› Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC

› Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC.

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