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## **ENERGY EFFICIENCY OF MUNICIPALITIES IN THE REPUBLIC OF MACEDONIA**

### **Analysis of the progress in the preparation of the Energy Efficiency Program of the Municipalities in the Republic of Macedonia**

#### **Introduction**

**T**he Republic of Macedonia, as a signatory country of the Treaty for establishing of the Energy Community (AERM, 2009) [1] committed to improve the energy efficiency (EE) until 2018 and to achieve national indicative annual savings of 9 % compared to the average consumption in the five-year period between 2002-2006, and with that to contribute towards reducing national dependence on energy imports. For this purpose, a Strategy for Developing Energy Efficiency until 2020 was adopted (Ministry of Economy of the Republic of Macedonia, 2010) [2], alongside Energy Efficiency Action Plan (Ministry of Economy of the Republic of Macedonia, 2011) [3]. According to the art. 132 of the “Energy Law“, Official Gazette 16/2011 (Official Gazette of the Republic of Macedonia, 2011) [4]

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an obligation is given to each local self-government unit to prepare a three-year Energy Efficiency (EE) Program, as well as appropriate annual plans, describing the dynamics of implementation of the measures proposed in the Program.

The “Energy Law“ (Official Gazette of the Republic of Macedonia, 2011) [4] in art.131 and 132, stipulates that:

*“The Energy Agency of the Republic of Macedonia (EARM) participates in the preparation of the Energy efficiency Action plan. The Energy Agency observes the implementation of the measures and the activities from the energy efficiency action plans, as well as the dynamic of achieving the indicative targets given in the Regulation for national indicative targets for final energy savings, and to the Ministry of Economy of the Republic of Macedonia (MERM) submits annual reports not later than March 31 every year“.*

According to the Strategy for Developing Energy Efficiency until 2020 in the Republic of Macedonia (Ministry of Economy of the Republic of Macedonia, 2010) [2], and the Energy Efficiency Action Plan of the Republic of Macedonia (Ministry of Economy of The Republic of Macedonia, 2011) [3], the Council of the municipality, upon a proposal from the Mayor, and based on a previous opinion from EARM, adopts an EE program for the period of the next three years. ”The Program should contain: (1) overview and assessment of current situation and energy needs; (2) list of indicative targets for energy savings at local level; (3) measures for improvement and development of energy efficiency, and targets that need to be reached with these measures; (4) sources for financing the investments needed for implementing the measures, activities and deadlines for implementation of the measures; and (5) carriers of activities and other necessary data”.

*“The local self-government units should submit the EE programs to EARM, no later than 30 days after their adoption. EARM is obliged to submit a report to the Ministry of Economy of the Republic of Macedonia for assessment of the compliance of the EE program with the Strategy for Developing Energy Efficiency and the Action plan, not later than 30 days after the program was submitted by the local self-government units. By the end of February, the local self-government units submits the annual plan to EARM, as well as information for the implementation of the program in the previous year. EARM, nto later than May 31, submits a summary report to MERM based on the annual plans submitted by the local self-government units, and information for the implementation of the programs.”*

## Content of the Energy Efficiency Program of municipalities

The three-year period Energy Efficiency Program of municipalities represents a program document of the municipality which refers to the improvement and development of the energy efficiency in the municipality. The implementation of the program is carried out based on annual action plans.

According to the Strategy for Developing Energy Efficiency until 2020 (Ministry of Economy of the Republic of Macedonia, 2010) [2], the Energy Efficiency Action Plan of the Republic of Macedonia (Ministry of Economy of the Republic of Macedonia, 2011) [3] and the Energy Law (Official Gazette of the Republic of Macedonia, 2011) [4], the program should contain:

*Methodology – The use of two methodologies for data collecting* i.e. collecting data of energy consumption through bills for electrical and/or thermal energy and direct on-site inspection of the measuring instruments in the facilities. In accordance with the first method, the bills for electricity and used fuels in the past three years are collected for every facility individually, which is under the authority of the municipality. An insight is made on the condition of the facilities with records of the condition of the facility, the condition of the cooling, heating and air conditioning systems, lighting systems, etc. The second method, which stipulates collecting data through energy controls of the facilities under the authorities of the municipalities, i.e. field inspection, is recommended only if practically feasible.

### ***1. Overview of the condition of energy consumption within the municipality***

- 1.1 Overview of the current condition of energy consumption in the municipality.
- 1.2 Overview of facilities and electrical and thermal energy consumption.
- 1.3 Overview of the public (street light) lighting energy consumption.
- 1.4 Overview of the means of transport, energy consumption and the adequate infrastructure that belongs to the municipality.
- 1.5 Information for reactive energy in the municipality.

### ***2. Measures for improving and developing energy efficiency***

- 2.1 Proposed measures for increasing the EE of the facilities.
- 2.2 Information for all proposed measures for EE which are foreseen to be realized within the repayment period. In general terms, a suggestion measures can be made that will contribute to reduce the energy

losses of facilities.

- 2.3 Measures for increasing energy efficiency in public lighting.
- 2.4 Measures for increasing energy efficiency in transport.
- 2.5 Total energy efficiency (condition before energy efficiency measures, after the measures and the savings).

### ***3. Dynamic plan for implementation of the energy efficiency program***

- 3.1 List of all planned activities and a timetable for their realization.

### ***4. Overview of indicative targets for energy saving at local level***

- 4.1 Presenting the energy savings considering the predicted measures in MWh/year

### ***5. Overview of the targets to be accomplished with measures for EE improvement***

- 5.1 Accomplished targets with implementation of the energy efficiency measures.
- 5.2 Financial benefits and aggregated data.
- 5.3 Reaching inner ambience – better living conditions for people, reducing fuel consumption, reducing energy consumption, reducing water consumption, reducing negative impact on the environment.

### ***6. Sources of financing investments needed for implementation of the measures***

### ***7. Included parties in the process of program implementation***

### ***8. Other relevant data***

## **EE Programs submitted to EARM for 2011**

Table 1 gives an overview of municipalities that have submitted their EE program to EARM for 2011, an overview of the total energy savings generated by the program and the appropriate opinion given by EARM.

Table 1. Overview of submitted EE programs by municipalities to EARM for 2011, (EARM, 2012) [5]

No.	Municipality	Population	Total energy consumption before the measures (MWh)	Total energy consumption after the measures (MWh)	Total energy savings in %	Status	Action plan
1.	Karposh	59.810	9.819,20	/	/	Old program	/
2.	Bitola	95.385	15.825	12.010	24,1	Old program	/
3.	Kochani	38.092	10.519,45	8.029,15	23,7	Positive opinion	/
4.	Centar	45.412	9.460	5.676	30	Adopted 26.01 2012	2011
5.	Kisela Voda	57.236	9.641,11	5.308,61	45	Adopted 28.10 2010	2011, 2012
6.	Plasnica	4.545	196.1	126	36	Old program	/
7.	Chaska	7.673	1.301,87	In denars	In denars	Adopted 24.10 2010	2012
8.	Dolneni	13.568	1.459,51	1.239,15	15	Adopted 26.01 2012	/

In 2011, 8 municipalities submitted their EE programs to EARM, and only the municipality of Kochani received positive opinion. The municipalities of Karposh, Bitola and Plasnica submitted programs according to the old Energy Law, which proscribed five-year period EE Programs (Official Gazette of the Republic of Macedonia, 2006) [6], therefore these municipalities were requested to adjust and complete their programs. In the municipalities of Centar, Kisela Voda, Chashka and Dolneni the program was only adopted by the Council of the Municipality, without opinion from EARM.

### EE Programs submitted to EARM for 2012

Table 2 gives an overview of municipalities that have submitted their EE program to EARM for 2012, an overview of the total energy savings generated by the program and the appropriate opinion given from EARM.

Table 2. Overview of submitted EE programs by municipalities to EARM for 2012, (EARM 2013) [7]

No.	Municipality	Population	Total energy consumption before the measures (MWh)	Total energy consumption after the measures (MWh)	Total energy savings in %	Status	Action plan
1.	Strumica	54.676	7.158	In denars	In denars	Old program	/
2.	Tearce	22.454	867,53	In denars	In denars	Addition	2012
3.	Butel	36.154	2.093,94	/	/	Addition	/
4.	Krushevo	5.330	1.748,24	In denars	36,3	Positive opinion	/
5.	Radovish	28.244	/	/	/	Addition	2012
6.	Probishtip	16.193	/	/	/	Addition	2011 2012 2013
7.	Resen	16.825	172,215	137,772	20	Addition	/
8.	Krivogashtani	6.150	/	/	/	Addition	/
9.	Konche	/	315,37	233,37	26,2	Addition	/
10.	Mavrovo Rostushe	8.618	1.003,75	/	36	Addition	/
11.	Cheshino Obleshevo	7.490	/	/	/	Addition	/
12.	Ohrid	55.749	9.592	8.450	23	Positive opinion	/
13.	Zhelino	25.000	/	/	/	Addition	/
14.	Gazi Baba	72.222	11.703,23	7.441,62	36,4	Positive opinion	2012
15.	Gjorche Petrov	41.634	4.638,93	3.029,00	34	Positive opinion	2013
16.	Kriva Palanka	20.820	4.086	1.190	28,7	Positive opinion	/
17.	City of Skopje	/	17 212 11	9 205 871	46,5	Positive opinion	2013
18.	Prilep	76.768	8.176,61	5.101	37,6	Positive opinion	/
19.	Kratovo	10.500	2.706,52	1.256,15	46,4	Positive opinion	2012 2013
20.	Veles	55.108	9.844	8.536	13,3	Positive opinion	2011
21.	Gostivar	81.042	8.862	5.613	36,6	Positive opinion	/

As evident from the analysed material, the number of submitted EE programs for 2012 is significantly higher. To be specific, in 2012, twenty

one EE Programs were submitted. Out of them, positive opinion received the following municipalities: Krushevo, Ohrid, Gazi Baba, Gjorche Petrov, Prilep, Kratovo, Veles, Gostivar and the City of Skopje. The municipalities of Tearce, Butel, Radovish, Probishtip, Krivogashtani, Konche, Mavrovo Rostushe, Cheshino – Obleshevo, Zhelino were requested for adjustment of the program. The municipality of Strumica submitted a program according to the old Energy Law for a five-year period (Official Gazette of the Republic of Macedonia (2006) [6].

### EE Programs submitted to EARM for 2013

Table 3 gives an overview of municipalities that have submitted their EE program to EARM for 2013, an overview of the total energy savings generated by the program and the appropriate opinion given from EARM.

Table 3. Overview of submitted EE programs by municipalities to EARM for 2013, (EARM, 2014) [8]

No.	Municipality	Population	Total energy consumption before the measures (MWh)	Total energy consumption after the measures (MWh)	Total energy savings in %	Status	Action plan
1.	Demir Hisar	9.497	680,28	420	38,3	Positive opinion	/
2.	Ilinden	15.894	2.370,20	1.469,23	8,95	Positive opinion	2013
3.	Makedonski Brod	/	/	/	/	In preparation	/
4.	Kumanovo	105.484	25.020,13	17.243,24	31	Positive opinion	/
5.	Gevgelija	22.988	5.121,93	4.256,93	15,1	Positive opinion	2013
6.	Novaci	3.549	336	238	29,21	Positive opinion	/
7.	Delchevo	17.505	2.071	1.076	47	Old program	/
8.	Shtip	48.000	10.228,67	4.944,30	52	Positive opinion	/
9.	Brvenica	15.855	1.735,00	1.492	14	To issue opinion	/
10.	Makedonska Kamenica	8.110	1.037,77	/	/	Addition	/
11.	Aerodrom	72.009	8.774,70	6.022	31,37	Positive opinion	2013
12.	Bogdanci	8.707	1.374,80	1.193,20	13	Positive opinion	2013
13.	Tetovo	86.580	10.496,60	6.881	34,4	Positive opinion	2013

14.	Demir Kapija	4.545	784,31	448	42,8	Positive opinion	2013
15.	Gradsko	3.760	570,1	374	34,5	Positive opinion	2013
16.	Rosoman	4.141	706,76	468	33,8	Positive opinion	2013
17.	Lozovo	2.858	424,85	333	23	Positive opinion	2013
18.	Sopishte	/	547,5	131,4	/	Addition	/
19.	Negotino	19.212	4.030	2.639	34,5	Positive opinion	2013
20.	Karposh	/	1.110	777	30	Positive opinion	/
21.	Kavadarci	38.741	6.195	5.310	14	Positive opinion	2013
22.	Zrnovci	3.264	/	/	/	Addition	/
23.	Rankovce	4.144	671,63	473.63	30	Positive opinion	2014
24.	Berovo	13.941	4.627	3.382	27	Positive opinion	2014
25.	Centar Zhupa	6.519	262,50	210,00	20	Addition	/
26.	Pehchevo	5.517	1.376,00	994,00	28	Addition	2014

In 2013, twenty six energy programs were submitted to EARM. Of all submitted programs positive opinion received the following municipalities: Demir Hisar, Ilinden, Kumanovo, Gevgelija, Novaci, Shtip, Aerodrom, Bogdanci, Tetovo, Demir Kapija, Gradsko, Rosoman, Lozovo, Negotino, Karposh, Kavadarci, Rankovce and Berovo. EARM requested addition to the programs from the municipalities of Makedonska Kamenica, Sopishte, Zrnovci and Centar Zhupa. The program of the Municipality of Makedonski Brod was still in preparation.

Until 2014, out of 80 municipalities in the Republic of Macedonia and the City of Skopje as a distinct unit of local self-government, 27 municipalities have not submitted programs to EARM. These are the municipalities: Novo Selo, Saraj, Dojran, Drugovo, Vevchani, Staro Nagorichane, Arachinovo, Bogovinje, Bosilovo, Valandovo, Vasilevo, Vinica, Debar, Debarca, Zelenikovo, Jegunovce, Karbinci, Lipkovo, Mogila, Petrovec, Sveti Nikole, Struga, Studenichani, Chair, Chucher Sandevo, Shuto Orizari, Vrapchishte.

The Tables 1, 2 and 3 above present the total energy consumption of the municipality before the implementation of the measures in MWh and the total energy consumption after the implementation of the measures in MWh. For better understanding of how the proposed energy efficiency measures affect the energy savings, the difference between the consumption before



and after the measures is expressed in percentage. The savings percentage is between 10 % to 45 %, and basically depends on the type of measures that are implemented. This data is key to understanding the final goal of the EE programs at local level, i.e. the necessary and visible energy savings.

## Results related to the submitted EE programs and discussion

Figure 1 is graphical presentation of a comparison of the programs of their status for the three years (2011, 2012, 2013). The upward trend in both number of submitted EE Programs and the number of positive opinions in 2012 and 2013 year is evident.

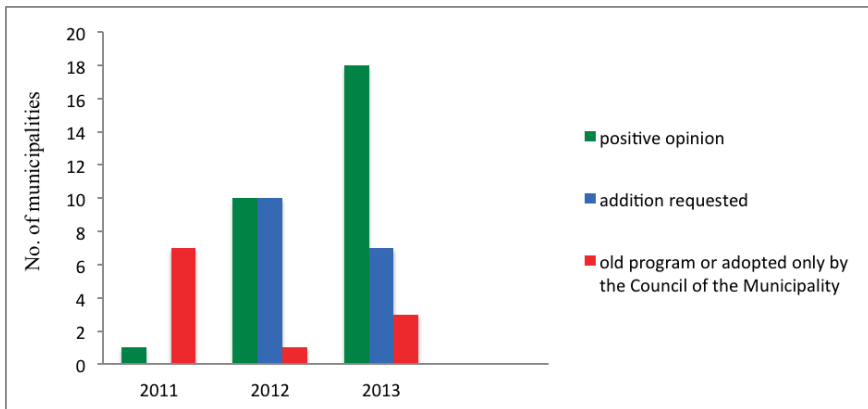


Figure 1. Graphic presentation of submitted EE programs for 2011, 2012 and 2013 and division, according to the obtained opinion (according to data from the Work Report EARM 2011, Work Report EARM 2012, Work Report EARM 2013).

## Assessment for the compliance of the Energy Efficiency Programs

EARM issues opinion for EE programs according to how the program meets the conditions and measures given in the “Energy Law “ Official Gazette 16/2011 (Official Gazette of the Republic of Macedonia, 2011) [4], Strategy for Developing Energy Efficiency until 2020 (Ministry of Economy of The Republic of Macedonia, 2010) [2], as well as the Energy Efficiency Action Plan of the Republic of Macedonia (Ministry of Economy of the Republic of Macedonia, 2011) [3], and based on the confirmed compliance issues a positive opinion for the EE programs. If some measures or part of them are not appropriate for some local self-government units (e.g. transport measures, etc.) then such measures are not taken into account in the evaluation of the program.

In accordance with the established methodology for evaluation of the EE programs of local self-government units in the Republic of Macedonia, the program should comply with the following measures:

**Energy Law** (Official Gazette of the Republic of Macedonia, 2011) [4]

- Overview and assessment of the energy condition and the energy needs on the territory of the local self-government
- Overview on the indicative targets for energy savings on local level
- Measures for EE improvement and development
- Overview of targets to be accomplished with the measures for EE improvement
- Overview of financial sources for investments needed for implementation of the measures
- Overview of included parties in the process of the program implementation

**Strategy for Developing Energy Efficiency until 2020** (Ministry of Economy of the Republic of Macedonia, 2010) [2], and **the Energy Efficiency Action Plan of the Republic of Macedonia** (Ministry of Economy of the Republic of Macedonia, 2011) [3]

- Issuing certificates for energy characteristics of building objects
- Inspection of boiler/systems for airconditioning in the public facilities
- Reconstruction of facilities in the education sector
- Energy control and energy management
- Increasing energy efficiency on public lightning
- Marking and standardization of energy characteristics on electrical appliances and equipment and including the energy efficiency in the public procurement
- Energy savings in hospitals
- Use of solar systems and geothermal heat pumps
- Renewal of ground transportation fleet
- Renewal of public transport busses
- Parking policy
- Promoting bicycle use
- Car-free days
- Promoting railway use for intercity transport

After three-member commission from EARM reviews the programs according to the given measures, the compliance is determined, and the opinion and the explanation is given by the Director of EARM.

## Conclusion

The main analysis presented in this paper refers to the introduction to the Energy Law (Official Gazette of the Republic of Macedonia, 2011) [4] in which the municipalities are obliged to adopt three-year energy efficiency programs, with annual plans and submit information on the implementation of the programs in the previous year to the Energy Agency of the Republic of Macedonia. It also presents the key elements of the program and the procedure for obtaining positive opinion from EARM. In the period of conducting this study, out of 80 municipalities and the City of Skopje, only 54 municipalities have submitted programs (or 66%). Out of the 54 programs submitted, positive opinion was given to 29 programs (53%), negative opinion or a program adopted only by the council of the municipality - 10 (18%), and additions to the program was requested from 17 municipalities (30%). The Municipality of Karposh is an exception because within the past three years, has submitted a program twice. Once in 2011, a program according to the old positive regulation, and then in 2013 a program that has received a positive opinion. The program submitted in 2013 was taken in consideration. The range of achieved savings of the municipalities with the EE programs is between 10 to 45%.

In the first year of the adoption of the Energy Law (Official Gazette of the Republic of Macedonia, 2011) [4] the lowest number of EE programs were submitted, and progress is already noticeable in 2012 and 2013 with twice higher number of submitted programs, and at the same time increase of the number of programs that received positive opinion. The local self-government units benefit to have a confirmation from EARM, because with this kind of reference they stand a better chance when applying for grants or other subsidies, and also the improvement of programs contributes to improved impact on the environment.

The contribution of the municipalities in respecting the legal obligation and creating the programs is recognized, because the implementation of measures at local level directly affects the achievement of the national goals.

Recommendation can be made to the municipalities that do not have EE programs, to analyze in details the already submitted programs, especially the ones with positive opinion, to consult with municipalities that already have programs or with experts from the energy field who can assist in the development of EE programs for those municipalities.

## **Abstract**

The Republic of Macedonia is continuously working on increasing the renewable energy sources and improving the energy efficiency. The purpose of this analysis is to understand the situation related to the advances in implementing the energy efficiency programs at local level. The programs submitted to EARM were analyzed with regards to number of programs submitted for three consecutive years.

The obtained results indicate a trend of improvement in the application of the positive legal regulations, and although the obligation for energy efficiency programs came into force in 2011, three years later 30 % of municipalities have not yet submitted a program.

In the near future, it is suggested that local communities dedicate more attention to this issue, thus to contribute towards successful implementation of the Strategy for Developing Energy Efficiency until 2020 in the Republic of Macedonia, and as a result, to contribute to reducing the consumption of energy resources, which directly and indirectly contributes to overall environmental protection.

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## References

1. Energy Agency of the Republic of Macedonia (EARM) (2009). Treaty for establishing the Energy Community
2. Ministry of Economy of the Republic of Macedonia (2010). Strategy for Developing Energy Efficiency until 2020 was adopted in The Republic of Macedonia available at: [http://archive.economy.gov.mk/ministerstvo/sektori\\_vo\\_ministerstvo/sektor\\_za\\_energetika/3306.html](http://archive.economy.gov.mk/ministerstvo/sektori_vo_ministerstvo/sektor_za_energetika/3306.html), accessed on 20.06.2017
3. Ministry of Economy of the Republic of Macedonia (2011), Energy Efficiency Action Plan of the Republic of Macedonia till 2018, available at : [http://www.ea.gov.mk/images/stories/E\\_Izdanija/11.Prv\\_Akcionen\\_Plan\\_za\\_EE\\_na\\_RM\\_do\\_2018\\_MK.pdf](http://www.ea.gov.mk/images/stories/E_Izdanija/11.Prv_Akcionen_Plan_za_EE_na_RM_do_2018_MK.pdf), accessed on 20.06.2017
4. Official Gazette of the Republic of Macedonia (2011) “Energy Law “ Official Gazette 16/2011 available at: [http://www.ea.gov.mk/images/stories/E\\_Izdanija/Regulativa/SLUZ.VES.BR.16-10.02.2011-ZAKON%20ZA%20ENERGETIKA.pdf](http://www.ea.gov.mk/images/stories/E_Izdanija/Regulativa/SLUZ.VES.BR.16-10.02.2011-ZAKON%20ZA%20ENERGETIKA.pdf) , accessed on 20.06.2017
5. EARM (2012). Work reports of EARM 2011
6. Official Gazette of the Republic of Macedonia (2006) “Energy Law“, available at: [http://www.snabduvanjezapad.mk/toplifikacija%20akti/Zakon\\_za\\_energetika-precisten\\_tekst.pdf](http://www.snabduvanjezapad.mk/toplifikacija%20akti/Zakon_za_energetika-precisten_tekst.pdf), accessed on 20.06.2017
7. EARM (2013). Work reports of EARM 2012
8. EARM (2014). Work reports of EARM 2013