Ministry of Economy

STRATEGY
for Improvement of the Energy Efficiency in the Republic of Macedonia until 2020

Skopje, September 2010

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ACRONYMS

ASE	Alliance to Save Energy
BAT	Best Available Technologies
CDM	Clean development mechanism
CHP	Combined heat and power
CNG	Compressed natural gas
EAF	Electric arc furnaces
EE	Energy efficiency
EEI	Energy efficiency improvement: an increase in energy end-use efficiency as a result of technological, behavioural and/or economic changes
EETF	Energy Efficiency Task Force
EMS	Energy management systems
EPB	Energy Performances of Buildings
EPC	Energy Performance Contracting
ERC	Energy Regulatory Commission
ESCOs	Energy service companies
ESD	Energy End-use Efficiency and Energy Services Directive
ESM	Electric Power Company of Macedonia
EU	European Union
FC	Final Energy Consumption
GHG	Greenhouse gas
IEA	International Energy Agency
IFIs	International financial institutions
IPPC	Integrated Pollution Protection and Control
IRG	International Resources Group
MACEF	Macedonian Centre for Energy Efficiency
MAMNEE	Macedonian Municipal Network for Energy Efficiency
NEAP	National Environment Activities Plans
NEEAP	National Energy Efficiency Action Plans
NGOs	Non-governmental organizations
NSSD	National Strategy for Sustainable Development
OHIS	Organic and chemistry industry
PE	Primary Energy

PEEREA	Protocol on Energy Efficiency and Related Environmental Aspects
PPP	Public-private partnerships
RES	Renewable energy sources
RESMD	Regional Energy Security and Market Development
RM	Republic of Macedonia
SCP	Sustainable Consumption and Production
SEFF	Sustainable Energy Financing Facility
SIEE	Strategy for Improvement of Energy Efficiency in the Republic of Macedonia until 2020
SMEs	Small and medium sized enterprises
UNFCCC	United Nations Framework Convention on Climate Change

Pursuant to Article 123 of the Energy Law (Official Gazette no. 63/2006, 36/2007 and 106/2008), the Government of the Republic of Macedonia at the session held on 21.09.2010 adopted

STRATEGY
for improvement of the energy efficiency in
the Republic of Macedonia until 2020

EXECUTIVE SUMMARY

STRATEGY OBJECTIVE

The objective of the Strategy for improvement of the energy efficiency in the Republic of Macedonia until 2020 (SIEE) is to develop a framework for accelerating adoption of energy efficiency practices in a sustainable fashion through implementation of a series of programs and initiatives that are linked to creating reduction of import dependence, energy intensity, the non-productive use of electricity, preparing a good climate to maximize the involvement of and opportunities for the private sector complementary advocacy, and training activities.
The final result of achieving this objective will be realization of over 9 % energy savings till 2018, comparing to average consumption in the observed 5 years period (2002-2006), with continued promotion of energy efficiency and monitoring and verification until 2020. This is an important task for RM in the way to sustainable development of the country's economy, and to fulfill commitments in the way of EU accession and will serve as the first control point in the realization of the predicted measures.

With the Second NEEAP (2018-2020) the Government of the Republic of Macedonia will develop additional measures to reach 14,5 % savings in 2020, which means that the Republic of Macedonia will approach to the EU target in 2020 to achieve savings of 20 %.

The objective of the elements incorporated into the SIEE is to stimulate a progressive transformation of the market. The development of an adequate policy framework is intended to stimulate the demand for more energy efficient technologies and services. As that demand grows it should encourage the formation of ESCOs and companies that provide more efficient equipment and accompanying maintenance.

Energy efficiency is economically viable under the current circumstances in the country.

The Government of the Republic of Macedonia considers energy efficiency to be very important for its economy. Energy efficiency has the capacity to generate employment, improve the quality of citizens' lives, decrease energy import, and improve chances of EU accession. Moreover, energy efficiency is environment friendly and economically viable under the current circumstances.

"€ 1 invested in EE avoids € 2.2 in supply side investments."[1]

According to the Energy Sector Development Strategy, without integration of energy efficiency, the energy consumption in the Republic of Macedonia will reach the level of 2703 ktoe by the year 2020, while the two scenarios of energy efficiency penetration can bring to either 3 percent (under limited integration of energy efficiency), or over 9 % (strong intervention of energy efficiency scenario) less energy consumption compared to business as usual - BAU). As a signatory of the Energy Community Treaty, the Republic of Macedonia aims to achieve this at least 9 % energy saving target, which is equal to 147 ktoe by 2018, compared to the baseline – measured in average consumption during the

[1] Energy Efficiency in Macedonia: The Need for Speed, Peter Johansen; Senior Energy Specialist, World Bank, Presentation to Roundtable Skopje, December 15, 2009

five-year period 2002-2006, which is equal to 1636 ktoe. The various scenarios and estimated energy saving potentials are summarized below:
2020 energy consumption (as presented in the Energy Sector Development Strategy):

- Under Business as Usual (BAU, no EE): 2,703 ktoe
- Under limited energy efficiency measures: 2,618 ktoe; 83 ktoe (~3%) less than BAU
- Under strong energy efficiency intervention: 2,466 ktoe; 237 ktoe (~9%) less than BAU; or ~14,5% below 2002-06 average consumption

The objective of the present Strategy is to identify the cost-effective energy saving potential for reaching the above target in the following key sectors, which also aggregately comprise 96.5 percent of the State energy balance:

i. Residential Sector,
ii. Commercial and Public Services Sector,
iii. Industry Sector, and
iv. Transportation Sector.

Expected energy savings in 2020 are assumed to be 237,31 ktoe (14,5 percent savings of energy compared to the average consumption in the period 2002-2006).

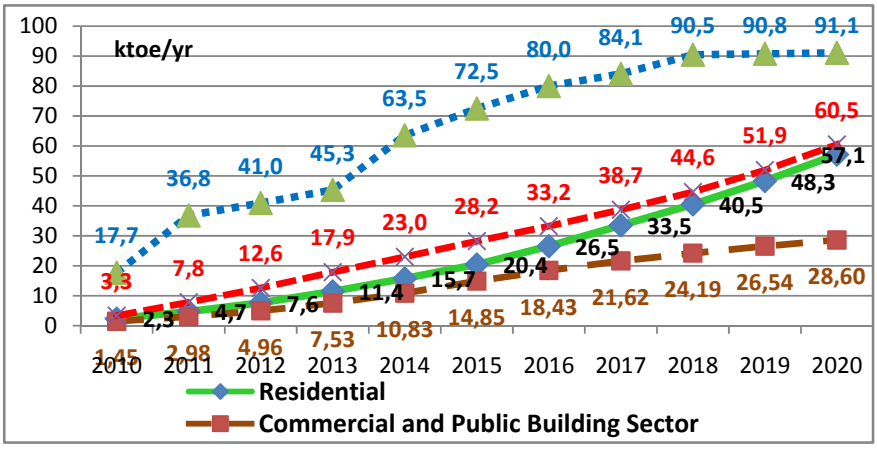
Preparing for accession into the European Union (EU) in the period leading to 2018 will be a strong impetus for the national economy, reflected in the sector of energy efficiency. With technical and financial support from the EU and other donors and international financial institutions, Macedonia will be capable of fulfilling requirements prescribed in the *acquis communautaire*.

Potential Benefits

The cumulative energy saving potentials for 2010-2020 of the above 237.31 ktoe has the following breakdown by sectors:

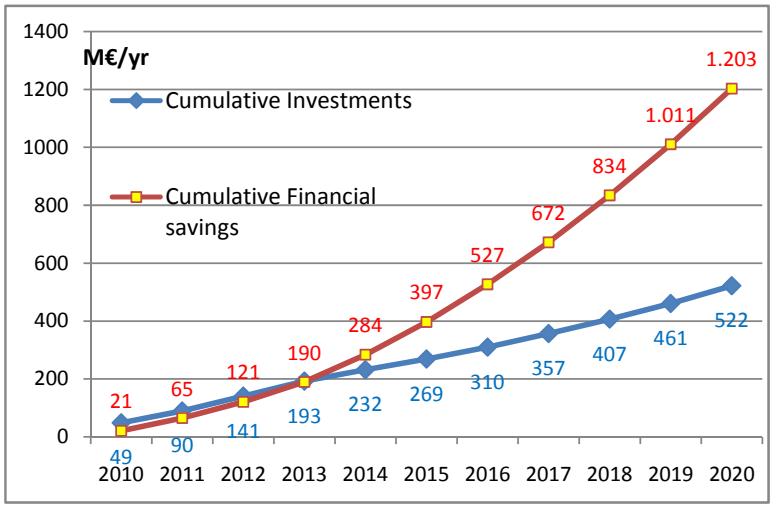
Residential	**57,14 ktoe**
Commercial and Public Building Sector	**28,60 ktoe**
Industry Sector	**91.09 ktoe**
Transport Sector	**60.48 ktoe**

The following figure presents the contribution of each sector to the annual production of savings in ktoe per year up to 2020.



Sectoral Cumulative Annual Energy Saving Potentials for 2010-2020 (ktoe/year)

Necessary estimated investments (in million Euros) and financial savings realized through 2020 (while investments will continue to produce savings for many years) are presented in the table below.



Cumulative economic performance of energy saving investments

Sectoral Breakdown of Estimated Investments, Savings, Social and Environmental Benefits of Proposed Energy Saving Measures
(cumulative for all years and sectoral measures up to 2020)

Sector	**Investments M €**	**Financial savings M €** (current prices)	**Financial savings M €** (liberalized market prices)	**kt CO_2** *	**Social benefit**
Residential	279,56	151,3	311,9	1407	• Living comfort improved • Health improvements • Savings affordability increase • Improved family budget • Energy poverty reduced • Satisfied (happier) citizens
Commercial and Public Building Sector	114,1	124,5	226,03	253	• Product competitiveness increase • Better working conditions • New working places creation
Industry Sector	73,9	612,8	995,1	3130	• Increased corporate responsibility • Product competitiveness increase • New job creation
Transport Sector	54,5	314,2	432	995	• Improved family budget • Health improvements • Traffic safety increased • Improved environmental conditions • Cheaper transportation • More spare time for citizens
Total M €	**522,06**	**1202,8**	**1965,03**	**57,9***	

*Assumed 1tCO_2 reduction = 10 €

** The residential sector investments appear to have no fast repayment on the investments due to the fact that the savings potential and investments required for the summary table bundle a list of individual sub-measures with broad range of capital intensities (solar systems or furnace replacement requiring new investments with long pay back vs. promotional campaigns and legal reform on BEP, which result in no-cost to low-cost weatherization, etc.). Moreover, the residential sector consumes electricity at cross-subsidized tariffs, which slows down the repayment of the investments Nonetheless, even under present energy prices, the EEI measures in residential sector have substantial non-monetary social impact. The approach of the current strategy is to address the lowest cost measures through the awareness raising, legal reform and increasing access to finance, however more cost-intensive measures requiring technological conversion are also presented due to their contribution to energy independence, environmental objectives, and market catalysis. . The expected liberalization of the electricity market in 2015 shall result in higher energy prices, thus leading to better performance (twice shorter SPB periods) of the investments in the residential section, including some cost-intensive measures, such as window replacement and façade insulation. The commercial sector paying higher tariffs for electricity enjoys better repayment even under present energy prices.

The implementation of this strategy will cost the society cca. 522 M Euro, but the benefits which will be reflected on the financial, social and environmental levels are greater.

The proposed measures require a substantial amount of financing, which cannot only be contributed by the national Government. To leverage the Government efforts in the buildings sector, municipalities, donors/IFIs, private consumers shall have to make investments. In the Industry sector all of the investments will be the responsibility of the enterprise owners, while the major EE measures in the transport sector shall be supported by the Government (see below table).

Investment responsibility for energy saving measures, by sectors (€ M)

Sector	Investment till 2020 in € M	Investor		Donors/ International Financing Institutions	Private sector
		Government	Municipality		
Residential	279,56	4	0,7	44,9	229,90
Commercial	114,1	27,43	14,39	18,82	53,48
Industry	73,9				73,9
Transport	54,5	54,50			
Sum	**522,06**	**85,93**	**15,09**	**63,72**	**357,28**

The breakdown of energy and financial saving potential by sectors, the respective investment requirements, gradual penetration of all measures along with their cumulative investment needs, as well as the associated greenhouse gas emission reductions are presented in the below tables.

Energy savings by the sectors (ktoe)

Sectors	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	2,33	4,71	7,63	11,4	15,74	20,42	26,52	33,49	40,51	48,32	57,14
Commercial and Public Building Sector	1,45	2,98	4,96	7,53	10,83	14,85	18,43	21,62	24,19	26,54	28,60
Industry sector	17,7	36,8	40,96	45,32	63,53	72,49	80	84,06	90,45	90,76	91,09
Transport Sector	3,31	7,79	12,55	17,86	22,99	28,21	33,20	38,70	44,63	51,94	60,48
Sum	**24,79**	**52,29**	**66,10**	**82,15**	**113,09**	**135,97**	**158,16**	**177,87**	**199,78**	**217,56**	**237,31**

Penetration of financial investments by the sectors, in million Euro (M €/year)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	11,1	11,6	12,4	17,2	18,9	19,6	26,2	31,8	34,5	43,9	52,4
Commercial and Public Building Sector	6,8	7,8	8,9	10,1	12,3	15,5	14,8	14,8	14,0	14,9	15,0
Industry sector	23,7	3,7	5,8	20,0	7,0	3,0	2,0	3,2	5,5	0	0
Transport Sector	7,0	18,0	24,0	4,5	1,0	0	0	0	0	0	0
Sum	**48,59**	**41,14**	**51,06**	**51,83**	**39,22**	**37,09**	**40,99**	**46,83**	**50,06**	**53,87**	**61,43**

Cumulative financial investments by the sectors, in million Euro (M €/year)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	11,14	22,74	35,15	52,35	71,23	90,81	116,99	148,82	183,28	227,16	279,56
Commercial and Public Building Sector	6,79	14,63	23,49	33,62	45,94	60,43	73,22	85,05	95,11	105,08	114,11
Industry sector	23,7	27,4	33,2	53,2	60,2	63,2	65,2	68,4	73,9	73,9[2]	73,9
Transport Sector	7	25	49	53,5	54,5	54,5[3]	54,5	54,5	54,5	54,5	54,5

Annual penetration of financial savings by sectors (M €/year)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	1,34	2,71	4,34	6,49	8,87	11,43	14,75	18,50	22,55	27,40	33,04
Commercial and Public Building Sector	1,11	2,34	3,90	5,91	8,49	11,63	14,15	16,46	18,41	20,22	21,85
Industry sector	15,21	31,62	35,20	38,94	54,59	62,29	68,74	72,23	77,72	77,99	78,27
Transport Sector	3,23	7,61	12,26	17,45	22,46	27,56	32,43	37,80	43,60	50,74	59,08
Sum	**20,9**	**44,3**	**55,7**	**68,8**	**94,4**	**112,9**	**130,1**	**145,0**	**162,3**	**176,3**	**192,2**

Cumulative financial savings by sectors (M €/year)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	1,34	4,05	8,39	14,87	23,75	35,17	49,93	68,43	90,98	118,38	151,41
Commercial and Public Building Sector	1,11	3,45	7,35	13,26	21,75	33,37	47,53	63,98	82,39	102,61	124,46
Industry sector	15,21	46,83	82,02	120,97	175,56	237,84	306,58	378,81	456,53	534,52	612,79
Transport Sector	3,23	10,85	23,11	40,56	63,02	90,58	123,01	160,82	204,41	255,15	314,23
Sum	**21**	**65**	**121**	**190**	**284**	**397**	**527**	**672**	**834**	**1011**	**1203**

Cumulative Reduction of CO_2 emission in $ktCO_2$

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	15	44	90	154	241	353	490	661	869	1112	1407
Commercial and Public Building Sector	5	13	24	38	60	89	120	152	184	218	253
Industry sector	25	153	303	477	748	1067	1426	1815	2254	2694	3137
Transport Sector	10	34	73	128	200	287	389	509	647	808	995
Sum	**55**	**244**	**491**	**798**	**1249**	**1796**	**2427**	**3137**	**3954**	**4832**	**5792**

[2] This is the final value of investments until current year. In 2019 and 2020 there will not be new investments in the industry sector, in accordance with the table "Annual penetration of financial investments by the sectors".

[3] This is the final value of investments until current year. In the period from 2015 until 2020 there will not be new investments in the transport sector, in accordance with the table "Annual penetration of financial investments by the sectors".

Cumulative financial savings in the residential sector will become greater compared to cumulative investments beyond observed period, but the average simple payback period is 8,3 years. In the Commercial and Public Building Sector – the average simple payback period is 6,2 years; in Industry depending to the observed year 1,34 - 4,6 and Transport – 4,11.

In each of the sectors the wide range of proposed measures has various economic viability features, ranging from very attractive with quick payback to such measures which require over a decade to repay. The above measures will have substantially more attractive payback periods under the higher energy prices expected after 2015 – the date of scheduled energy market liberalization.

APPROACHES TO IMPLEMENTATION:

Implementation of the Strategy will require a combination of institutional and technical activities that are collectively needed to ensure implementation in an economically and environmentally sustainable manner.

Each program or activity will involve a set of actors and actions designed to achieve a focused series of results. The Strategy proposes institutional capacity building of the Energy Department within the Ministry of economy and the Energy Agency of the Republic of Macedonia (hereinafter – EA). This will be carried out through establishment of a separate Unit for Energy Efficiency in the Energy Department of the Ministry of economy and a separate Unit / Sector for Energy Efficiency in the Energy Agency. EA shall have to fulfill these tasks assuming that in all cases will have either a direct program role or a role in identifying and coordinating other actors. The EA will be the government-mandated executing entity that will direct, guide, finance, and support the broad range of potential initiatives and implementers. The EA shall be the responsible entity for oversight and monitoring of energy efficiency strategy and NEEAP enforcement.

STRATEGIC PRIORITIES

The priorities driving the SIEE are linked to the national security and development goals, and include the following:

1. Reliable energy supply
2. Sustainable economic development
3. Competitiveness of the economy

These priorities will be achieved by a series of strategic measures, including the following:

- Reduction of dependence on imported fuels through and electricity consumption for non-productive use.
- Modernization of the energy infrastructure, and diversification of energy supply (the extension of a natural gas network is an important basic element in the realization of all expected energy efficiency measures).
- Enforcement of regional cooperation and fulfillment of Energy Community *acquis.*
- Energy sector management and training, including technology transfer (Best Available Technologies – BAT, clean development mechanism – CDM).
- Building a framework that will allow viability of energy efficiency improvements on a commercial basis.

- Stimulating participation of the private sector to supply services for energy efficiency improvements on a commercial basis. The profit and the competition will motivate the private owners of the industrial and commercial sector to implement individual programs for EE.
- Promoting energy efficiency as the optimal measure to cope with energy poverty.
- Improving the use of renewable energy.
- Investing in the scientific research, education, and promotion of high efficient technologies and appliances.

The identification of priorities is also based on the demand trends and elasticity: electricity represents over 33.7 percent of the commercial energy used in the economy; and has demand elasticity less than for transport fuels. The building sector (residential and commercial) is the largest (more than 42 percent) and most rapidly growing consumer of electricity, representing a particular affordability burden on vulnerable households. Concurrently, private sector action needs to be motivated through incentives to tap into industrial and commercial energy saving potential, given the easier access to capital, economies of scale and smaller administration cost.

STRATEGY ELEMENTS

To promote the achievement of the above savings a series of reform initiatives will be necessary for legal and regulatory improvements, institutional capacity strengthening, a number of financial incentives and technical measures.

A. LEGAL AND REGULATORY

1. Preparation and enforcement of primary and secondary legislation and regulatory framework harmonized with EU ***acquis,*** including development of new legal-regulatory documents, as well as amendments of the existing ones. More specifically, initiatives covered will include the following:

- **Updating of the Energy Law** to define the energy audit procedures for technological processes (informing energy managers on the need for application of high efficiency technologies, collecting energy consumption data, evaluating performance of EE measures and protecting the environment).
- **Amendments to the Building Law** to provide for mandatory preparation of an Energy Efficiency study during the building design phase, as a prerequisite for obtaining a construction permit will ensure implementation of measures determined in the Energy Law and Rule book on Building Energy Performances.
- **Completing the Rulebook on Building Energy Performance** to start the process of buildings certification, hot water boilers and air condition systems control.
- **Building Energy Code development** for new construction will ensure that all new buildings are built as energy efficiently as possible, within a reasonable range of cost-effectiveness.
- **Energy Audit procedures and certification of energy auditors**: Respective secondary legislation will provide minimal requirements and instructions for conduct of energy audits, as well as define the professional certification procedures for energy auditors, thus regulating the quality for future energy audits and laying out the rules and conditions for the energy audit market development.

2. Define the appropriate support mechanisms to boost the number of EE projects in the Republic of Macedonia

Along with the legal-regulatory measures several other capacity strengthening and institutional development measures are necessary to ensure the smooth penetration of energy efficiency measures into the various sectors. These particularly include the following:

- Helping establishment of energy service companies (ESCOs) and performance contracting: The framework for ESCOs and performance contracting will be developed including the necessary of secondary legislation and exemplary performance contract template for adaptation to the conditions of the RM.
- Development of the Energy Efficiency Fund: prior to its establishment, the EE Fund will need to be justified and conceptualized to develop a clear operational framework, bylaws and procedures.
- Public-private partnerships (PPP) can allow municipal energy utilities to get access to private capital, project implementation experience, more progressive management practices, cost-minimization skills, and better service and customer focus.
- Long-term agreement between industry and government on reducing energy consumption (Integrated Pollution Protection and Control (IPPC) working permission**) to promote Best Available Technologies in Macedonian economy.**

3. Regional cooperation

In its efforts to assimilate international best practices and integrate into the regional energy markets, the support shall continue in the following areas:

- Participation in international projects aimed at promotion of energy efficiency
- Regional networking allowing exchange of experiences and knowledge between region's experts on lessons learned in the energy efficiency reform and market acceleration process.

B. INSTITUTIONAL AND CAPACITY BUILDING

The MoE and EA are appropriate institutions which will be responsible for implementation, oversight and monitoring of the SIEE and National EE Action Plan[4].

The MoE will perform the following functions:

- Managing and promoting the national SIEE; coordinating the development of energy efficiency policy and long term scenarios for energy supply/demand for energy activities on state and local levels; coordinating between the government entities that establish policies and those involved in implementation in the respective sectors.
  The Energy Department within the Ministry of Economy would set the priorities, and pass these on to the EA to perform.

The EA will perform the following functions:

- managing and promoting energy efficiency measures such as building energy codes, appliance standards and labels promotion, training and capacity building; collecting and collating energy use information for planning and reporting purposes. This institution would develop specific implementation options based on input from those entities responsible for implementing the specific programmatic initiative. The EA would coordinate activities and report the results of program implementation to the Energy Department within the Ministry of Economy.

[4] Energy Law of the Republic of Macedonia, Article 122

Watch Group – Committee: an interagency group of experts from key stakeholders in the government, academia, public/non-governmental and private sectors, consumer groups, etc. will be established to convene on regular basis and discuss the direction and effectiveness of reform in energy efficiency and recommend actions, thus building a consensus among disparate energy efficiency stakeholders, while providing a platform for public discussion and lobbying of new legal initiatives.

Education and Training Measures:

- **Higher and high education capacity building:** Introducing new programs concerning EE measures into education sector at all vertical levels (primary education, high schools, faculties). Supporting applied scientific investigations (new laboratory equipment, grants for higher education (MSc and PhD preparation) at foreign institutions with high reputation.
- **Education and awareness at all levels:** As the best method for saving energy quickly, public awareness and educational initiatives will be targeted at all consumer groups and launched on national, regional, and local levels. They will include a wide spectrum of awareness-raising initiatives, including a broad range of issues from guided purchasing decisions in home-appliances to decision-making on national and municipal energy efficiency planning issues.
- **Professional trainings - Energy Auditor Certification**: Training and certifying energy auditors can help to ensure that proper energy efficiency improvements are identified and recommended for buildings and industrial facilities and that the suggestions are uniform across the country. Consumers will be more comfortable if the energy auditors that they hire can demonstrate that they have successfully completed the certification program, and are competent in energy auditing techniques and principles.

C. SOCIAL MEASURES

Energy efficiency in social housing: As the most sustainable solution for helping low-income households deal with high utility bills, energy efficiency solutions will be integrated into the new social housing construction, thus helping the vulnerable families not only with shelter, but also with manageable demand for energy.

Block-tariff for electrical energy: Introduction of Block tariffs for electricity will be used to help to the vulnerable families to cope with permanent increasing of electricity price. Experiences with block-tariffs as an appropriate EE measure, shows significant results, too. The end users of electrical energy will be provoked to reduce their monthly electricity consumption, with intention to stay within the lower level block (threshold) of existing tariff. This will be realized with purchasing of more efficient home appliances (labeled as class A), the use efficient lighting, implementation of solar systems for hot water preparation etc. The Government will determine the number and size of tariff blocks.

D. FINANCIAL

Energy Efficiency Fund: An Energy Efficiency Fund will be established to support the establishment of a successful energy efficiency program and promotion of investments. The key principles of Fund will include but not be limited to following:

- The fund will be maintained and operated outside of the government; funds to be operated by commercial banks on on-lending basis. The fund will be utilized as direct loans, or to provide guarantees on loans issued by the commercial banks with their own capital.
- Initial funding will come from several different sources, including program revenues (such as fees for building permits, natural gas applications, etc.), government surcharges on heating fuels and gasoline, as well as individual contributions and possibly donor sources.

- The financial incentives for the use of flexibility mechanisms of the Kyoto Protocol or in reduction of greenhouse gas (GHG) emission. As economically attractive energy saving opportunities decrease, clean development mechanism should be applied in cases where additionality of its application will be deemed additional.
- The Fund shall also exercise promotional programs to promote energy efficiency in various fields. This shall include but not be limited to support program for ESCOs and performance contracting, municipal energy management, etc.

The full scope of the EE Fund's operational principles and rules shall be defined by the Fund's Charter and Operational Manual.

TECHNICAL INITIATIVES

Transposition of EU standards for equipment promotion and control of realization: Energy standards have proven to be an effective measure in instituting energy efficiency into the consumer market. Associated labeling of products will allow the consumers to see the comparative differences in operating cost of the products in addition to the sale price.

The series of technical programs that have been identified and analyzed merit consideration for inclusion in the implementation plan.

These initiatives all lie on the demand-side with particular emphasis on electrical energy use as this is currently the most perturbing end-use issue. The initiatives are grouped by sectors, as follows:

Sector	Summary	Detailed Breakdown of Measures

Residential Buildings	Compulsory and voluntary measures and incentives, as well as promotion and technical support, based on international best practices.	• Skopje District Heating end-use heat metering and consumption-based billing
		• Energy Efficiency in Social Housing
		• Building codes and enforcement/certification
		• Electrical appliance and equipment labeling, and energy performance standards
		• Replacement of fire wood furnaces with high efficiency models
		• Information centers; Information campaigns on energy efficiency
		• Hot water boiler and air conditioner labeling and energy performance standards control
		• Financial support to natural persons for EEI investments
		• Solar systems and geothermal heat pumps in old houses
		• EEI measures in existing multi-apartment residential buildings:
		  o Window and door replacement
		  o Attics insulation
		  o Façade insulation

		○ Introduction of efficient lighting in residential apartments and common space
Commercial and Public Services Building	Public building interventions, proven fairly cost effective, either targeting a single technology improvement (lighting, windows, motors, building envelope) or an integrated facility approach. As the fastest penetration approach, the compulsory measures should be applied in the public buildings. Public buildings are probably the only category of buildings where energy efficiency measures can and must be "imposed."	• Building codes enforcement and certification • Inspections of boilers/air conditioning systems • Education sector -schools renovation • Information centers, campaigns, municipal EE network • Energy management and auditing in the commercial and services sector • Street lighting efficiency upgrades • Electrical appliance and equipment labeling and energy performance standards • Hospital Buildings Refurbishment • Solar systems and geothermal heat pumps • EE and Corporate social responsibility
Industry	The measures are focused on improvement of technologies, equipment, and process control systems. Companies will be required to apply best available technologies in performing their activities. Co-generation is promoted when searching for local energy supply.	• Improvement of process performances ○ Cleaner production (CP) ○ IPPC – permitting • Energy Auditing • Co-generation • Energy performance of non-residential buildings • Improved Lighting • Improved heating systems • Fuel type change • Clean Development Mechanism (CDM) • Waste heat utilization (non CDM) • Smart drives • Compressed air supply • Good house-keeping • EE and Corporate social responsibility
Transport	Create an integrated transportation system. Promote conditions to discourage the use of private cars and encourage the use of public transport and alternative transport modes, including	• Renewal of the national road vehicle fleet ○ *Promotion of sustainable urban transport systems* ○ *Introduction of tramway in Skopje* ○ *Renewal of public transport bus fleet*

	cycling and walking. Establish measures to control the availability of parking in congested areas. Improve traffic management and control. Develop and implement city logistics systems. Encourage financing for market introduction of efficient vehicles Adopt the car fuel efficiency labeling directive. Work towards minimum efficiency requirements for automobile air conditioning systems. Propose a labeling scheme for tires.	○ *Parking policy* ○ *Promotion of greater use of bicycle* • Introduction of integrated traffic management center • Fuel quality and fuel economy standards • Car free days • Promotion of greater use of railway for intercity travel • Tax reduction eco friendly vehicles

STRATEGY TIMELINE

Phase 1: 2010-2012

Given the uncertainty surrounding the economy and the current status of the institutional framework, the first phase of the SIEE is the phase of adoption and partial realization, and will last until the end of 2012.

Harmonization with EU legislation, filling institutional framework gaps that have been addressed, as well as secondary legislation preparation, should be realized in this period.

Prior in-country experience indicates there are financially viable energy efficiency activities that will be in implemented within this time frame. These activities are described into the National Energy Efficiency Action Plans (NEEAP). This time will also allow for the necessary monitoring and evaluation process to be established, which in turn will allow for new activities to be identified, developed, and designed.

Phase 2: 2013- 2018

The activities that are implemented in the first phase will provide source materials and help create the necessary foundation for further implementation during the second phase of the Strategy. In parallel with these activities will be actions that will be used to prepare the ground for sustainable activities in Phase 3.

Updating of the strategy, concerning achieved results and fulfillment of the assumed measures, will also be realized.

Phase 3: "Aim" toward 2019-2020

The ongoing assessment and evaluation initiated in Phase 1 and applied in Phase 2 will lead to a sustainable approach in which "priority" areas will be reconsidered according to the new conditions of the country and Europe.

The strategy will be updated and the Second National Energy Efficiency Action Plan will be prepared.

IMPLEMENTING THE STRATEGY

Implementation, to the extent possible, needs to be done through cooperation between the governmental and private sector.

As many of the selected implementation programs show positive net benefits, it is inappropriate for the government to subsidize their implementation. However, as there is a limited understanding and insufficient availability of trained personnel, it will be appropriate for the Government to play a leading coordinating role in developing outreach and training programs to accelerate the implementation process, which will also require substantial strengthening of the Government institutional capacity.

The Government will play a crucial role in implementing the Strategy, assuming responsibility for the potential for budget implications, elimination of barriers and driving by example for accelerating the utilization of the energy saving opportunities and is convinced of the important benefits that the country will have during and after the implementation.

CONCLUSIONS

The measures that the Government of RM is committed to implement in order to improve the energy efficiency of Macedonian economy and reduce the country's import dependence that are described in this document have been proven successful many times over in other EU countries, and can be successfully implemented in Macedonia. The Government will have to designate an appropriate entity to implement this strategy. This designated institution/entity would need to develop its own list of potential energy efficiency interventions depending to the financial resources and Action Plans of the Municipalities.

Prioritization of the various Technical Programs and the conservative assumptions will result, within the scope of this SIEE, in an overall energy saving equal to **14.51 %** of the average consumption (2002-2006) and 9.5 percent of total national consumption in 2020.

To provide at-a-glance ranking of the proposed measures based on their financial performance and associated social benefits in the buildings sector is provided in the below table.

Program/measure	The specific price of investment M € /ktoe	Social benefit
Cross-sectoral measure		
Energy statistics		Very important
Residential sector:		
Promotional/info campaign	0,267*	Important for the first stage
New buildings (heating, solar systems, new appliances, lighting)- certification, energy codes	3,16	Effective in the later phase
Social housing	4,62	Very important
Allocators for DH	2,561	Important
Buildings refurbishment	7,26	Important, big potential
Commercial and public building sector		
Information campaigns and municipal EE network	1,25*	Very important during whole period of realization, affecting large number of stakeholders
Inspections of boilers/air conditioning systems	0,27*	Appreciably addressing local pollution
Energy management and Corporate social responsibility	0,08*	Important; influencing behavior
Building energy performances improving-certificates	3,80	Important

* Result for the whole period 2010-2020

The situation in the Industry sector differs from others. The ranking in that sector would depend the level of investments, form of energy savings (energy type – electricity, liquid fuel, natural gas), and the amount of saved energy. A comprehensive analysis of all factors proposes the following ranking of the most attractive programs/measures in the Industry and Transport sectors:

Industry:

1. High efficiency CHP
2. Improvement of process performances and Energy Auditing
3. Smart drives
4. Waste heat utilization
5. CDM Projects

Transport:

1. Introduction of integrated traffic management center
2. Promotion of greater use of railway for intercity travel
3. Renewal of the national road vehicle fleet

PREFACE

"Efficiency First" is but one step to bring the world together to agree on meaningful action. It has broad appeal and can be applied immediately in both the developed and developing world.

What's more, it's a step that will achieve significant reductions in greenhouse gas emissions and provide nations with other economic and security benefits.[5]

The Energy Efficiency Strategy of the Republic of Macedonia through 2020 was prepared in December 2003, with USAID support provided through Nexant, Inc. with participation of several Macedonian companies, and accepted as the National Strategy in 2004.

The present document is a set of recommendations for the update of the above Strategy with consideration of new developments that arose since its first development. The Macedonian Centre for Energy Efficiency (MACEF), with support from International Resources Group (IRG) and Alliance to Save Energy (ASE), was tasked to update the Strategy within the framework of the USAID Regional Energy Security and Market Development (RESMD) Program, with support from the USAID mission in Skopje. The recommended updates to the Strategy are aimed at producing a more concise document and refreshing the data on penetration timing for energy efficiency (EE) improvement measures, adding the due focus on social implications of utility affordability. The new areas for the updated Strategy include two additional sectors – Industry and Transportation – which were not adequately covered in the previous version despite their substantive impact on the structure of energy consumption. Moreover, the updates of the Strategy were developed in synergy with the MARKAL Strategy Planning exercise for the Republic of Macedonia.

An effective strategy must not be static. It is anticipated that this is the second in series of iterations and expansions which will later follow leading to a range of activities with positive contributions towards the increased efficiency of energy production, transport, and consumption.

The Republic of Macedonia is a signatory of the Energy Charter Treaty. This agreement, aimed at intensifying energy sector cooperation between Western Europe and the former socialist countries of Eastern Europe. The Republic of Macedonia is also a signatory of the Energy Community Treaty. Both of these Treaties impose an obligation for the country to harmonize its legal framework, especially in the energy sector, with the existing regulation of the European Union (*acquis communautaire*). At the same time, the agreements facilitate the use of all advantages deriving from the development of the regional energy market and the European energy community.

The purpose of the SIEE is to primarily serve as a guide for policy makers considering the approaches for increasing energy efficiency investment in the economy of the Republic of Macedonia. This document builds on a series of experiences and attention given to the subject in the past. It should serve as a summary and a reference point for all decision-makers concerned with the use of energy. The information should not only be useful for officials in the national government, but also for municipal managers, business owners, non-governmental organizations (NGOs), students, and households.

Since the subject of energy efficiency has the potential to impact many areas of civil society, this SIEE tries to balance the engineering and scientific issues with the institutional, legal, financial, economic, and social aspects of initiating a broad set of programs to increase energy efficiency in Macedonia.

Gaps, however, emerged, that must be filled, if the country is to be serious about tapping this resource. Most notable is the lack of clearly appointed leadership and responsibility for managing the introduction of energy efficiency into the economy in a sustainable way. The country must move quickly to rectify this shortcoming through creation/designation of an entity to coordinate activities in

[5] UNF, Improving Energy Efficiency,(www.unfoundation.org/climate-and-energy/improving-energy-efficiency).

this area. Failure to do this in a timely fashion would make it unlikely that energy efficiency could be implemented on a widespread and systematic manner.

Similarly, it will be necessary to increase activity in the energy efficiency business sector. Energy efficiency must be pursued by building partnerships with the private sector, which could implement energy efficiency investments under favorable government policies, capacity building and financial stimulate, as well as other resources needed to educate and train personnel and to stimulate replication throughout the target sectors of the economy.

The energy and social implications of programs suggested by the Strategy are estimated to reach targets set forth in the Directive on Energy End-use Efficiency and Energy Services (2006/32/EC), depending on the economic conditions of the State.

The scale and scope of measures proposed in the strategy are based on their cost-effectiveness, while the their penetration rate will depend on energy pricing and billing practices, marketing of the programs, and other energy policy and program administration considerations including public education and training of specialists.

Using the NEEAP and MARKAL software synergy and IEA/EUROSTAT data, the project team produced a new baseline for technology stock for simulations in four main sectors to develop reduced consumption indicators, which are not based on projected future energy consumption in the State. The benchmark suggested in Directive 2006/32/EC is to reach 9 % national indicative annual energy savings target until 2018, which is equal to 147 ktoe, compared to the baseline – measured in average consumption during the five-year period 2002-2006, which is equal to 1636 ktoe.

The success of the SIEE depends upon the support of a broad range of Macedonian businesses, local and central government offices, and the public at large. The intention of this document is to make a large amount of energy information available to such a broad audience.

1. INTRODUCTION

The direction of energy development in Macedonia has major implications for national economic growth, environmental protection, and human livelihood. For many households in Macedonia, the monthly cost of energy is the largest line item in the family budget after food. Municipalities in Macedonia can no longer rely on national ministries to pay local costs and now have a new and costly responsibility to manage their energy use. Industries in Macedonia consume more energy per unit of output than most other industries in Europe and are therefore at a competitive disadvantage in export markets.

The existing technology stock is not optimal and opportunities exist for technology upgrades. Encouragingly, the technologies needed are not necessarily "high-tech." Prior economic policies and decisions indicate that there are ample opportunities for improvement through adoption of well-proven and readily available technologies such as controls and insulation. By deploying these on a widespread basis new businesses can be set up and jobs created fairly quickly and cost-effectively.

Energy is a public good to which good governments allow fluid access. Because of this social character of energy, which was particularly strong in centrally planned societies, access is often supported by government subsidies. This aspect of perceiving access to plentiful energy as a kind of "right of citizenship" has led to inefficiencies in its use. These inefficiencies exist in all sectors of the economy but are often particularly evident in the selection of energy-consuming products such as lights, space heaters, and motors.

Macedonia has limited supplies of commercial energy resources and will be increasingly dependent on energy imports. Energy efficiency practices can mitigate that dependence, extend domestic reserves, and postpone the need for investing in new energy infrastructures, all at a lower cost than investing in increased supplies and expanded infrastructure.

Energy efficiency is an important component in any energy policy, because it means using less energy to provide the same service or perform the same task. Energy efficiency also contributes to reduced emissions of the by-products of fossil fuel combustion; thereby helping the local and global environment.

1.1 ENERGY EFFICIENCY EXPERIENCE IN MACEDONIA

In order to define the appropriate role for energy efficiency in the economy, this SIEE evaluates the potential for energy efficiency in the context of the current economic, environmental, and social goals of the national government. Energy efficiency investments can offer to government, its businesses, and its citizens high and enduring return compared to investments in increased energy supplies. Creating a more energy-efficient economy will allow Macedonia the opportunity to grow without using as much energy per unit of GDP.

1.2 NATIONAL AND REGIONAL ECONOMIC DEVELOPMENT OBJECTIVES

The following principles are drawn directly from the text of the National Development Strategy:[6]

- "De-stimulate" high energy consumption
- Stimulate economic activities with low specific energy consumption per unit of GDP
- Produce useful forms of energy with a minimum consumption of primary energy

The National Development Strategy[7] also states that "Energy resources available for use in our country and elsewhere are limited and finite. From this aspect, it is necessary to achieve the economic

[6] "National Development Strategy for Macedonia", edited by Macedonian Academy of Sciences and Arts. December 1997.

[7] Ibid, page 259

development of the society with as small a consumption of energy as possible. Reduced energy consumption has an additional, very important effect, which will become even more important in the future, and that is the reduction of pollution of the environment."

In the same document[8] the concept of "development" is broadly defined as "the strengthening of civil society, social progress, the rule of law, political responsiveness and economic growth". This SIEE is prepared and directed in such a way as to complement and support these values and ambitions.

1.3 EUROPEAN UNION ACCESSION/INTEGRATION

Since becoming an independent Republic in 1991, Macedonia has made several efforts towards complying with international, bilateral, and regional energy and environmental agreements. However, many challenges still remain regarding both energy issues and environmental practices that have local and global impacts. Energy efficiency actions present some of the best opportunities to address these concerns (local and global air pollution, for example) in a cost-effective manner.

Regional agreements, which essentially form the basis for collaborative efforts to achieve open, efficient, secure and sustainable energy markets, directly impact Macedonia as one of the regional participants.

During the next decade it is expected that Macedonia will integrate with the European Union. In order to prosper, Macedonia's relatively small domestic economy must remain open and competitive with neighbors in the region. Membership in the EU will provide many new opportunities and markets that will be essential for the export-oriented strategy envisioned in the National Development Strategy. Moving towards EU accession will require that Macedonian industry be managed with increasing resource and environmental efficiency. Energy efficiency is the essential component of any effort to meet more demanding environmental requirements. Increasing energy efficiency will also reduce the energy cost per unit of output, thereby making Macedonian products more competitive in the EU and other export markets.

1.4 INCREASING INDUSTRIAL AND ECONOMIC ACTIVITY

For industrial and economic activity to sustain itself, let alone grow, it must manage the use of all inputs. Energy is one area where Macedonian industries can make significant improvements. Energy has played a key role in Macedonia's energy intensive metallurgical industries. The current debate continues as to which industrial activities may have a comparative advantage in Macedonia and the region in the future. Because of this uncertainty, most projections for future industrial activity and future industrial energy needs will change.

The energy intensity of the Macedonian economy and its industries is considered to be very high. Much of this has to do with the heavy use of energy in the metal processing industries, the inefficiencies of coal-fired electricity generation, and the fact that many economic activities may not be officially measured and accounted for in the GDP statistics. Modernization and improvements in industry and the public and private energy infrastructure that support industry will increase their efficiency and competitiveness.

1.5 ENERGY SECURITY (IMPORT DEPENDENCE)

Macedonia, like other countries worldwide, strives to avoid inordinate dependence on imported fuels. Although Macedonia has indigenous lignite and hydro that serve as the primary energy sources for electricity production, this situation will change as the existing coal resources are depleted.

Being a small economy, Macedonia must remain open to opportunities where its citizens and domestic resources can offer the greatest long-term competitive benefits to the country. Therefore, although implementation of energy efficiency activities will clearly ameliorate risks and vulnerability to energy supply issues, total energy independence is not a strategic objective. There are various

[8] Ibid, page XVII

models for evaluating both the level of diversification and the degree of vulnerability of a power system.

The emphasis is on improving energy utilization on both sides: supply and end-use. Energy supply options will be enhanced if and when a long-term agreement for gas supply through the existing gas pipeline will be established , as well as wider use of RES. The extension of a natural gas network is *inter alia* an important basic element in the realization of all expected energy efficiency measures.

Gasification is put forward by the present document not solely as switching of the fuel –the key measure is the improved efficiency of end-use energy appliance/equipment.

Gasification will ensure significantly increasing of EE on the end-users side. The householders will have opportunity to use appliances with higher performances. Such are:

- condensing boilers with efficiency near to 99%,
- substitution of oil with gas burners into individual boilers for centralized heating of buildings
- simultaneous production of heating energy and hot water on the basis of exhaust gases
- application of small scale cogeneration systems.

The use of natural gas for heating has advantage compared to district heating at least for 8-12% (the heat energy loss in distribution pipelines).

Substitution of electrical energy with gas is important gain economical and environmental. Stressing that 85% of electricity is produced into thermal power plants, where for each kWh produced electricity is spent 3 kWh from fuel, and emitted cca 1kgCO_2 .

1.6 ENERGY SECTOR DEVELOPMENT STRATEGY

The subject of energy efficiency is necessarily a subset of the broader energy supply and demand situation in the country. In 2009, the Ministry of Economy launched preparation of the Strategy for Energy Development in the Republic of Macedonia for the Period 2009-2020 with a Vision to 2030. This document accurately estimates the future energy consumption.

There is still sufficient impetus for an independent Strategy for Improvement of the Energy Efficiency, as it will be beneficial regardless of the size of projected consumption, going into more depth in assessing the potential for cost-effective energy efficiency investments, unveiling the approaches and policy objectives for tapping this potential under current tariff and market conditions. Moreover, to bring the Strategy for Energy Development and the Strategy for Improvement of the Energy Efficiency to implementation, and to comply with the requirements of the Energy Community Treaty, the National Energy Efficiency Action Plan further lays out the programs and plans for implementation of proposed strategic measures towards achievement of a national energy saving target prescribed by the EU Energy Saving Directive 2006/32/EC for the period until 2018.

1.7 CURRENT ECONOMIC, SOCIAL, AND BUSINESS CLIMATE

The social, economic, and political milieu will play a significant role in determining the most realistic approach for implementing the SIEE. Although these important factors are beyond the scope of this Strategy, they will directly affect the ability to achieve implementation of energy efficiency policies and activities.

More difficult than executing existing legislation may be the creation of new or amended legislation – for example, to establish an Energy Efficiency Fund.

Most difficult is the allocation of government budget and resources, or the creation of new jobs at a time when the government is under fiscal constraints. Therefore, the priority should be creating a framework that will allow for energy efficiency improvements on a commercial basis.

Even in difficult economic situations, as is the case for many Macedonians who are without work and income, saving energy can be of value both economically and financially. Traditionally, energy efficiency business activities, involving broad-based deployment of energy efficiency technologies throughout key sectors, are labor-intensive and create employment. In countries where energy efficiency has been largely ignored, the job creation potential can be fairly significant and cost-effective. For the chronically unemployed and poverty-stricken, energy efficiency tends not to be a high priority, especially if it involves investment. In such cases, it may be necessary to provide some form of social assistance, as improving their utilization of energy is often economically justifiable at the national level.

2. INSTITUTIONAL AND ENERGY POLICY FRAMEWORK

2.1 INSTITUTIONAL FRAMEWORK

This Section provides a brief overview and analyses of the Institutional Framework in which EE activities currently take place. The analyses includes a review of existing legislation and international agreements that directly address or potentially influence the organization and execution of energy efficiency activities in Macedonia as well as the organizations who are active and involved in implementing various energy efficiency-related activities.

2.1.1 NATIONAL ENERGY SECTOR INSTITUTIONS

The Department of Energy, within the Ministry of Economy, oversees the entire energy sector and is currently in charge of all energy efficiency-related issues, especially from a policy perspective, including the SIEE. Within the energy efficiency field, the Ministry of Economy cooperates with the Ministry of Environment and Physical Planning, Ministry of Finance, Ministry of Transport and Communications and Energy Agency.

The Ministry of Economy cooperates with the Macedonian Academy of Sciences and Arts, as well as with individual experts from the University of Cyril and Methodius. A growing number of NGOs are involved in aspects of the energy and related environmental problems in Macedonia.

The national government of the Republic of Macedonia has been the only significant promoter of energy efficiency activities in the past. This Strategy expects that the central government will continue to be a lead actor for initiating and promoting the majority of new investment in energy efficiency in Macedonia. The creation of an enabling institutional and regulatory framework is the primary responsibility of government.

The Ministry of Economy also oversees the industrial sector; hence the SIEE implementation in this sector will have to be coordinated with the sectoral development plans. The implementation of the Strategy in parts referring to the public and residential buildings will have to be coordinated with the Ministries of Environment and Physical Planning (regulation of construction norms in new buildings), Ministry of Transport and Communications (work with existing housing and home-owners, energy efficiency in social housing, optimization of transport network and bus fleet, etc.), Ministry of Local Government for municipal energy planning. All aspects of the Strategy requiring public finance, including incentives, establishment of new entities, investments in public buildings, etc. will need coordination and cooperation with the Ministry of Finance. The local government will play a cross-cutting role in all buildings and transport sector initiatives.

Key questions at a national level will focus on the creation of an Energy Efficiency Fund. Legislatively, the government must make decisions about the restructuring of state-owned enterprises, attracting investment, and the need for expanding or replacing infrastructure.

2.1.2 NATIONAL ENERGY POLICY AND REGULATORY ANALYSIS

Macedonia has a significant body of policy and legislation that pertains to and influences actions in the energy sector.

While the existing laws could be improved in terms of their recognition, enforcement, and support of energy efficiency activities, there are already sufficient legal commitments of the national government to promote energy efficiency programs. In other words, an adequate legal framework exists to enable the immediate creation of the institutions necessary to design and manage national energy efficiency programs.

2.1.3 NATIONAL STRATEGY FOR SUSTAINABLE DEVELOPMENT OF THE REPUBLIC OF MACEDONIA[9]

This National Strategy for Sustainable Development (NSSD) of the Republic of Macedonia provides an integral approach for planning, which offers the overall umbrella for all other policies and strategies in various fields. The NSSD already respects a set of strategic directions in different sectors, but also provides strong cross-cutting links essential for sustainable development.

On the other hand, the implementing legislation on energy efficiency and renewable energy (rulebooks, regulations, procedures, standards) is not in place or is in an early stage of development. Considerable efforts for adoption of secondary legislation are yet to be undertaken, including harmonization of the laws and regulations from different sectors (construction/building, transport, environment, etc.) which address sustainable energy issues.

Also, properly accredited training on EE and renewable energy sources (RES) for experts and local energy managers should be organized ensuring that trainees can practice in governmental programs.

One of the components will be a Sustainable Energy Financing Facility (SEFF) consisting of a loan guarantee facility and a loan facility (a revolving fund), on a co-financing basis with commercial institutions and the Macedonian Bank for Development Promotion.

Another component supports the development and start-up of utility-based energy service companies. The ESCOs will help to stimulate the market for energy services by providing turnkey and performance-based contracting for EE and by demonstrating the financial performance of such projects using third-party financing for publicly-owned buildings.

Another key challenge is to invest in technical capacities for identification of projects and preparation of necessary documentation.

2.1.4 NATIONAL STRATEGY FOR ECONOMIC DEVELOPMENT OF THE REPUBLIC OF MACEDONIA[10]

This document, published in December 1997, highlights the need for national policy to be concerned with energy efficiency as a key factor in achieving national development goals. Essentially, this document says that it is necessary to pursue economic development with minimum energy consumption and at the same time points out the positive effect on the environment resulting from more efficient energy utilization.

These recommendations were accepted and implemented into existing Energy Law (Article 124).

2.1.5 NATIONAL STRATEGY FOR CLEAN DEVELOPMENT MECHANIZM

The National Strategy for Clean Development Mechanism (CDM),, passed by the Government of the Republic of Macedonia in February 2007, stimulates the CDM application possibilities within the first commitment period of the Kyoto Protocol 2008 -2012. The document met all needed prerequisites for the Kyoto Protocol functioning.

[9] Preparing as Project financed by SIDA in collaboration with Ministry for environmental protection and Spatial Planning (still in progress)

[10] National Strategy for Economical Development of the Republic of Macedonia, MANU/UNDP, Governments of the Republic of Macedonia and Republic Austria, 1997

2.2 NATIONAL ENERGY POLICY

2.2.1 THE ENERGY LAW (OFFICIAL GAZETTE OF THE RM NO. 3/06, 36/07 AND 106/08)

The Energy Law and its amendments comprise the main legislation for the sector. In process of adoption is a new Energy Law that would means finalization of the legal framework in the energy field.

Providing a legal framework for promotion of increased use of RES and EE, the existing Energy Law is the most important achievement along this line. This law governs the objectives of the energy policy and the manner of its realization, energy activities and the manner of regulating the energy activities, construction of energy facilities, functioning of the Energy Regulatory Commission (ERC), introduction of a markets for electricity, natural gas, oil and oil derivatives, thermal or geothermal energy; and contains a special chapter on EE and RES.

The Energy Law with the Article 124 outlines that the Strategy for improvement of energy efficiency should define the goals and tools for increased energy efficiency and the modalities according to which those aims should be accomplished, namely:

> "….
> - Reduction of energy consumption per unit of GDP;
> - Energy efficiency increase in all sectors of the State Policy;
> - Promotion of new high efficient technologies;
> - Promotion of measures for energy efficiency increase;
> - Analyse of potential for high efficient CHP application;
> - Introduction of the support mechanisms for energy efficiency increase including preferential tariffs for producers of electricity from high-efficiency cogeneration units and other support mechanisms;
> - Public awareness and energy efficiency goals promotion;
> - Reduction of harmful consequences to the environment caused by energy production, transmission, distribution and use."

Special emphasis is made on the building sector with Article 130 that refers to the new and reconstructed old buildings and respective requirements that need to be fulfilled.

2.2.2 POWER SECTOR RESTRUCTURING

The Electric Power Company of Macedonia (ESM) has been restructured into three parts: ELEM – production of electricity; MEPSO – transmission and dispatching and privatization of the distribution grid (EVN Macedonia); and an independent Energy Regulatory Commission, responsible for energy tariffs regulation, and implementing additional incentives that encourage investment in energy efficiency.

2.2.3 THE ENERGY REGULATORY COMMISSION

The ERC of the Republic of Macedonia is a regulatory body which is fully independent from the interests of the energy industry and the governmental bodies. The ERC was established in 2002 with the Energy Lawand it is composed of five Commissioners elected by the Parliament of the Republic of Macedonia. The main competencies of the Energy Regulatory Commission are to ensure:

- Safe, secure, continual and quality energy supply to the final consumers
- Protection of environment
- Protection of consumers
- Promotion and protection of a competitive energy market based upon the principles of objectivity, transparency, and non-discrimination

Specifically, the ERC:

- Approves tariff systems for separate types of energy
- Adopts conditions and protocols for supply of different energy sources
- Approves the decisions for pricing of separate types of energy according to pricing methodologies, tariff systems, and other legal regulations
- Issues and revokes licenses for various energy activities
- Proposes relevant energy legislation
- Prepares decisions on determination of feed-in tariff for purchase/sale of electricity produced and delivered from renewable sources

It is evident that the ERC's mandate does not explicitly address any responsibility to encourage the efficient use of energy, except by stimulating electricity production by renewable and in high efficiency technologies (CHP).

2.2.4 THE ENERGY POLICY IMPLEMENTATION

The SIEE describes in detail the measures and instruments necessary to realize the energy policy of Macedonia, and specifies the required investments and commitments to be made by the Government. The SIEE further estimates the energy saving potential, which can be realized under current economic circumstances.

The projections and simulations of the possible measures and instruments are in accordance with the realization requirements of the energy policy principles laid out in Strategy for energy sector development.

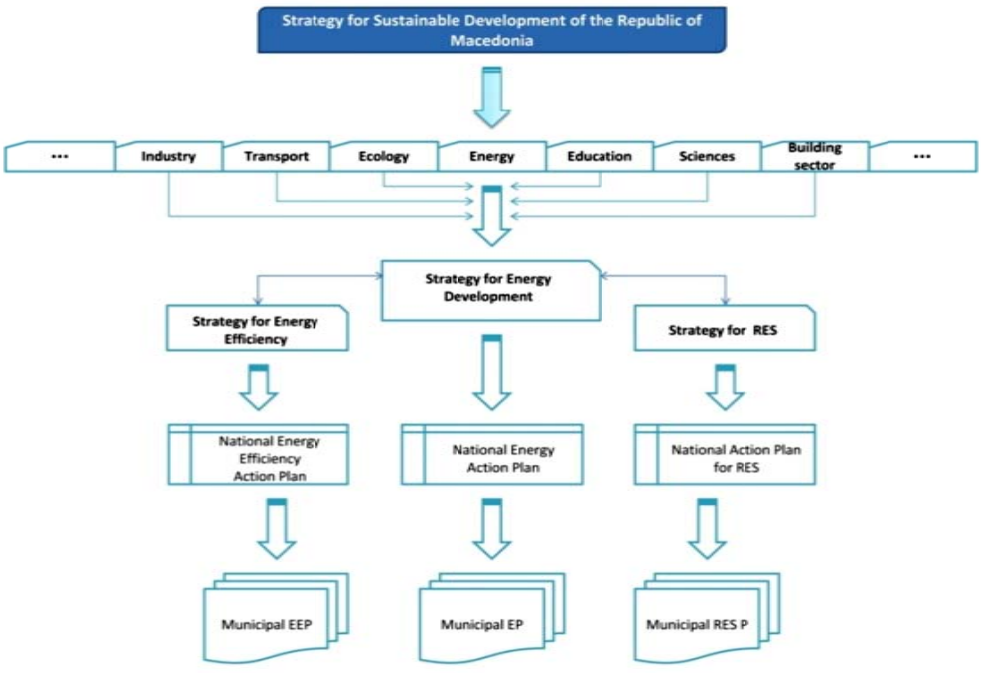


Figure 2.2.1 The energy policy realization interconnections

Thus, these two strategies (Strategy for Development of the Energy Sector in the Republic of Macedonia and SIEE) define the conditions for implementations of the energy sector policy of the Republic of Macedonia. The SIEE further lays out the detailed EE measures and assesses the respective investments and economic benefits of various measures.

Figure 2.2.1 illustrates energy policy implementation, including its EE component.

The SIEE gives directions for dealing with two contradictory tendencies in the energy sector: the need to save energy, while improving the quality of lives of citizens.

The SIEE is being implemented through the National Energy Efficiency Action Plan. This document presents the recommended programs that will achieve the energy savings projected in the SIEE as well as the implementation timeframe. It also features the financial means for implementation as well as the values of the savings achieved.

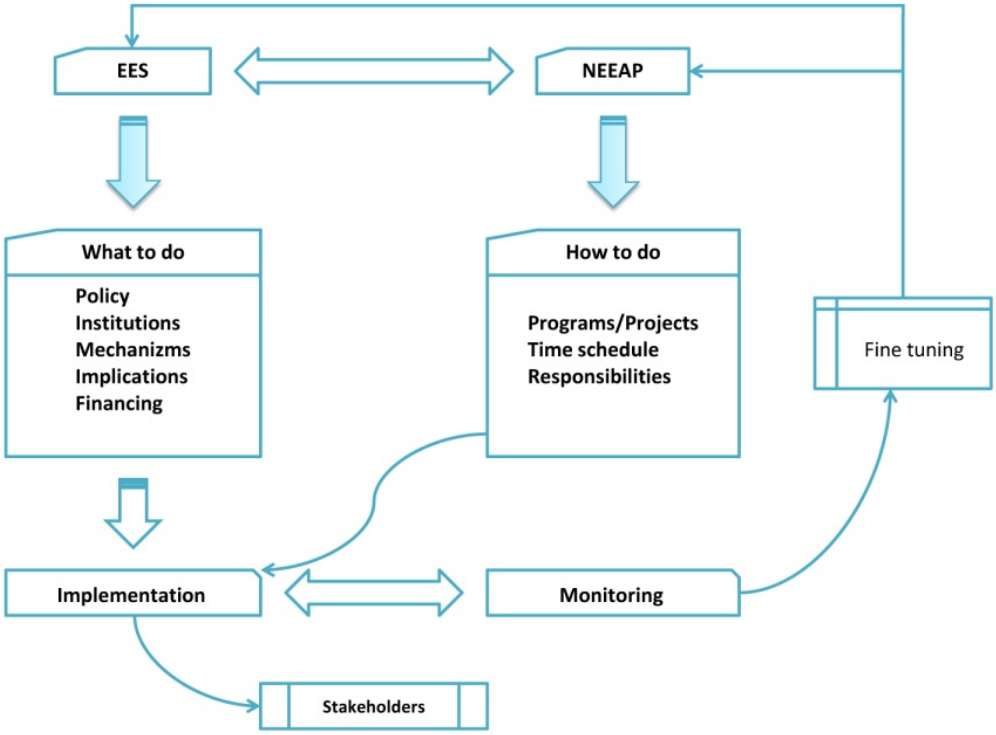


Figure 2.2.2. Responsibilities of SIEE and NEEAP

While a separate document, the NEEAP represents an integral unit of the SIEE and the Macedonia's energy policy (see Figure 2.2.1). Furthermore, it is a part of Macedonia's commitment as a signatory to the Energy Community Treaty upon joining the Energy Community. The Strategy for Energy Development lays out the objectives (what to do); the NEEAP shows how to achieve them (how to do it), as presented in Figure 2.2.2.

2.3 INTERNATIONAL POLICY, TREATIES, AND OBLIGATIONS

The international community has determined the need for encouraging energy efficiency as a component of both environmental protection and economic growth. As a consequence several international agreements and protocols in this area have been created, including the Energy Charter Treaty; Energy Charter Protocol of energy efficiency, and related environmental aspects – Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA), the Stabilization and Association Agreement, and the Energy Community Treaty.

Their short explanation is enclosed in the ANNEX 1.

2.4. RELATED LAWS AND REGULATIONS

2.4.1 ENVIRONMENTAL POLICIES

The only fossil domestic energy resource in Macedonia is lignite and renewable resources are hydropower, biomass, solar, wind, and geothermal. In order for these resources to be more environmentally sustainable, a plan must be put into place to use the best available technologies.

2.4.2 LAW ON ENVIRONMENT

The legislative act that has most clearly established the environmental protection strategy for Macedonia is the Law on Environment and its amendments (Official Gazettes of RM no. 53/05, 81/05, 24/07, 159/08 and 83/09), along with National Environment Activities Plans (NEAP1 and NEAP2), Macedonia's First National Communication (under the UN Framework Convention on Climate Change – 2003) and the Second National Communication (2006).

One important aspect of the Law among others was that it required the preparation of a inventory, map, and registry of the main greenhouse gas emission sources and sinks in Macedonia, as well as with the Ordinance for regulating the procedure for obtaining (the A or B depending to the pollution level) Integrated environmental permit and time schedule for submission of the adjustment plans, which implies the use of energy efficient best available technologies .

2.4.3 LAW ON LOCAL SELF GOVERNMENT

The recent and ongoing devolution of authority to municipal governments, including delegation of a broad range of "competencies" and management responsibilities, presents some enormous opportunities and challenges for the application and adoption of more energy efficient practices. This evolving municipal role, strengthened in the Law on Local Self Government (Official Gazettes of RM No. 5/02), is one of the primary vehicles proposed in this SIEE for both the promotion and the realization of energy efficiency benefits for a large segment of energy consumers in Macedonia.

Among other obligations this law states that the municipality is responsible for:

- Supply of natural gas and thermal energy
- Urban planning and issuing of building permits
- Public lighting;
- Protection of the environment
- Local economic development
- Maintenance of local schools, clinics and government buildings

This law also stipulates an obligation for the municipality to take care of its own property in the manner of a "good household owner." The municipality is the owner of the communal services. The municipality, acting responsibly under its new-delegated authorities could work to increase the energy efficiency in the schools, public health institutions, public offices, and other public enterprises.

The municipalities' energy efficiency policy obligation,[11] including the City of Skopje, will be defined by the Program for Energy Efficiency Promotion to be developed in accordance with the State Strategy for Energy Efficiency Promotion.

Concurrently, each community leader shall prepare an Annual Plan for implementation of the Program as well as an Annual Progress Report. These plans should be controlled by the Ministry of Economy.

2.4.4 THE LAW ON CONSTRUCTION

The existing and amended Laws on Construction, (Official Gazettes of RM no. 51/05, 82/08 and 130/09), include statement for investors or builder to plan and construct new structures in a manner that would be most energy efficient (Article 3). The Law does not include specific reference for investors or builders to plan and construct new structures in a manner that would be most energy efficient.

Among the requirements for technical documentation, the current Law on Construction does not make it compulsory to provide an estimate of the consumption of energy prior to the construction permitting.

In the sections referring to the technical documentation that is required for the construction of a new building, this Law stipulates the documentation for a building project must be made in accordance with the climatic conditions of the site, standards, and norms ensuring consumption of energy during use to be equal or smaller than determined level, ensuring conditions to the consumers for adequate heat protection.

The list of rulebooks is given in ANNEX 2.

2.4.5 IMPROVING THE LEGISLATION RELATED TO ENERGY EFFICIENCY

There are a number of existing laws and legislatives acts that substantially cover the legal framework in this field, nonetheless the process of Macedonian integration in the EU impose the need for improving and developing the existing framework. The present SIEE shows the reasons for this and proposes ways to change and introduce new legislation in this important domain.

2.4.6 EDUCATION SECTOR CAPACITY BUILDING

The educational capacity shall be strengthened by introducing new programs concerning EE measures into education sector at all vertical levels, as well as supporting applied scientific investigations (new laboratory equipment, grants for higher education (MSc, PhD preparation)) at reputable foreign academic institutions.

2.5 PRIVATE SECTOR

The private sector represents every sector and organization that is independent of government budget. Therefore, this sector also includes not-for-profit organizations and non-federal colleges and universities.

The private sector entities have important roles, both as potential implementers and investors in energy efficiency, and as primary consumers of energy. Although the potential for the private sector to both create demand and to supply services for energy efficiency is great, their participation has been limited in the Republic of Macedonia.

Profit and competition will motivate the private owners of the industrial and commercial sector to implement individual programs for EE. In some cases, the implementation of these programs will include radical reconstructions or replacement of inefficient technology, and in other cases organizational and technical measures oriented towards energy saving will be sufficient.

[11] Energy Law of the Republic of Macedonia, Article 128

Engaging certain political instruments, harmonized between the Government and the private sector, the EE and the renewable resources need to be turned into a driving force of the overall economic and development strategy of Macedonia. Some of these instruments relate to issues of general policy, regulatory and legal aspects, institutional framework, as well as fiscal policy, taxes and pricing policy.

As the energy efficiency market evolves, the demand for energy efficiency products shall also increase. This demand creates pressure for two policy actions: firstly, the import procedures of energy efficient products can be simplified; and secondly, the local manufacturing of energy efficiency products can be supported by the Government. Energy efficiency can thus become an industry and a job market, ripping secondary benefits to the GDP and social indicators of the country.

2.5.1 ESCOS

A privately owned or utility-linked ESCO could be created to provide services on a performance contract basis. More broadly, incentives could be offered for ESCOs and market transformation-type activities. The hurdle for ESCOs, in addition to all the institutional and financial constraints, is the present economic climate that currently seeks short-term returns, because of perceived risks in longer-term investments.

The current political, social, and business environment is not very supportive for the formation of an energy services industry. The lack of clarity and political will for an energy efficiency policy with appropriate financial stimulus, coupled with the limited transparency and confidence in contractual arrangements, make it difficult for ESCOs to emerge, let alone survive. The best option for initiating a performance-based contacting experience will be through some sort of government-guaranteed contracts, either with national ministries or agencies or possibly through municipalities.

However, the concept of building management on a contract basis may perform some of the ESCO-type saving arrangements. Essentially, a management firm would be given incentives to improve efficiency as a supplement to its ongoing responsibility of daily operation and maintenance tasks. It will require some training and preparation for building managers to assume these roles, but it is the kind of arrangement that has been effective in other countries to gradually introduce efficiency measures. Nonetheless, this only works in situations where the building is owned or leased by one entity that is also responsible for paying the fuel bills.

It is necessary to establish a framework which will regulate the relations between consumer, bank, and ESCO providers. The framework for ESCOs and performance contracting will be developed, including the necessary secondary legislation and exemplary performance contract template for adaptation to the conditions of the RM.

2.5.2 NGOS

Existing non-governmental organizations could make very effective contributions to the realization of energy efficiency programs by providing training, consumer outreach, and awareness-building services. They could also play an important role in the design and realization of energy efficiency projects, as well as taking a leadership in rolling the national level strategy out for implementation on local government as well as final energy consumer level.

Their ability to concentrate experts in particular short-lasting projects make them capable entities to be involved in development of further legislation, implementation of some of the strategy tasks as well as monitoring the progress of the Strategy and NEEAP.

Some energy efficiency and environmental NGOs have already demonstrated leadership in organizing energy efficiency awareness campaigns, energy efficiency and management trainings for local governments, catalyzed climate-friendly lifestyles, held lectures and seminars on energy efficiency issues thus generating a public dialogue on and stronger perception of the matter. The NGOs can play an instrumental role in the public watch-group/committee responsible for the monitoring of the implementation of the Strategy.

3. ENERGY SUPPLY AND DEMAND ANALYSIS

The SIEE relies extensively on existing data provided in statistical yearbooks and by the Ministry of Economy, Annual Energy Balances, and energy statistics of the International Energy Agency (IEA). Additionally, the database generated by the Strategy for Energy Development research was used per concurrence from the Ministry of Economy. The focus of the SIEE is on end-use or consumption of energy, particularly electricity.

The Republic of Macedonia consumes very little primary energy per capita. The final energy consumption per capita is also small and in 2006 was 33 times lower than the average consumption in the OECD Europe and 35 percent less than the average of the non-OECD Europe. This parameter will remain low in 2020 even if Macedonia achieves a 3 percent growth of the final energy consumption per year. In that case, the final energy consumption per capita in Macedonia in 2020 will be equal to that of the less developed European countries (non-OECD Europe) in 2006 and 2 times less than that of the developed European countries (OECD Europe) in 2006.[12]

The Strategy for Energy Development lays out two scenarios according which energy consumption will be developed. In addition, energy facilities to provide safe energy supply have been projected as well. Due to the unfavorable structure of the available energy resources – limited coal reserves, limited hydro power potential capacity, energy efficiency is being acknowledged as significant energy resource. While EE does not solve the problem of energy supply, it substantially decreases the pressure for construction of new generation facilities and fuel imports.

Both scenarios suggest implementation of EE measures. The implementation of measures is not described in details in the Strategy for Energy Development, has no precise timing outlines and has further no accompanying financial data, because it is the task of the present SIEE.

The second scenario with stronger EE measures suggests relatively higher percentage of energy efficiency measures implementation (Figure 3.1).

The Strategy for energy sector development does not determine the energy quantity needed unless the energy efficiency measures are not implemented.

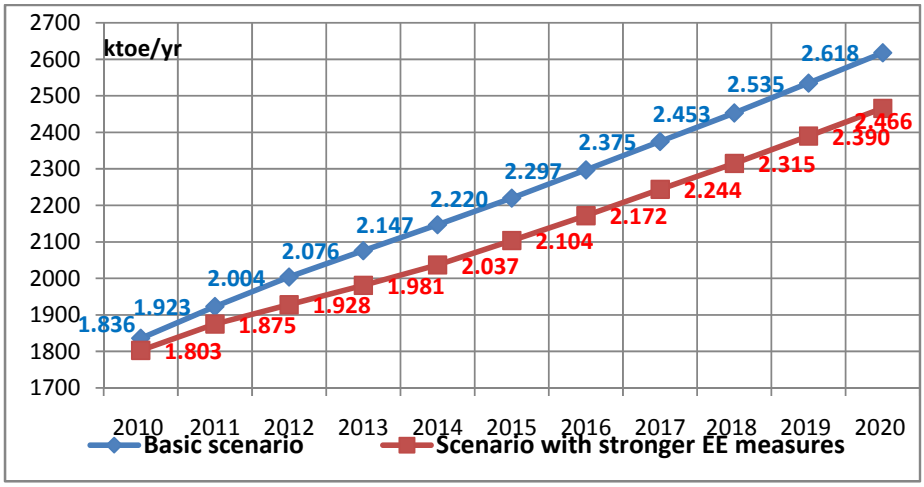


Figure 3.1 Final Energy Needs in accordance with Strategy for Energy Development

[12] Macedonian Academy of Sciences and Arts: Strategy for Energy Development in the Republic of Macedonia till 2030.

NEEAP – MARKAL Synergy

As part of this USAID/RESMD project the regional capacity to perform national energy system modeling and analysis has been created by mentoring the country teams through the process of model development and utilization.

The MACEF' and MARKAL teams harmonized NEEAP and MARKAL software entering data, using 2006 national energy balance data to produce new baseline of the technology stock. The joint effort of both teams were directed to the following:

- Collection and analysis of energy data and determining a national target for energy savings.
- Analysis and forecast of growth in end-use demand by sector and use.
- Available energy technologies and forecast of technological development
  - The operational characteristics and the degree of penetration of the technologies currently employed in the various energy end-uses.
  - A forecast of the development of the above technologies and other technologies which are expected to come on-stream over the planned time scale.
- Determination of economic potential for energy savings and planning of measures to improve energy end-use efficiency
  - Energy savings are calculated as the difference in energy consumption between the Reference Scenario which corresponds to a Business as Usual development and the Energy Savings Scenario.
  - The Energy Savings Scenario incorporates a number of policy actions designed to achieve the potential savings.

The Figure 3.2 indicates the energy quantity Macedonia will need if the energy efficiency measures are not being implemented. Thus it's assumed that the Scenario with stronger energy efficiency measures may be implemented only if the projected measures of the SIEE are in place. The surface "without EE savings" represents the expected energy consumption when assumed EE savings are added to the scenario with stronger EE measures. The difference between surfaces of "EE scenario" and "without EE savings" represents the so-called "***negajules***".

The basic scenario assumes annual increase of the energy demand by 3.3 percent.

The scenario with stronger EE measures assumes annual increase of energy needs by 2.8 percent. Should the projected measures of the Strategy for energy efficiency not get implemented, the energy consumption will rise by 3.77 percent annually, and reach consumption of 2703 ktoe by 2020 instead of the anticipated 2618 (basic scenario) or 2466 ktoe (scenario with stronger EE measures).

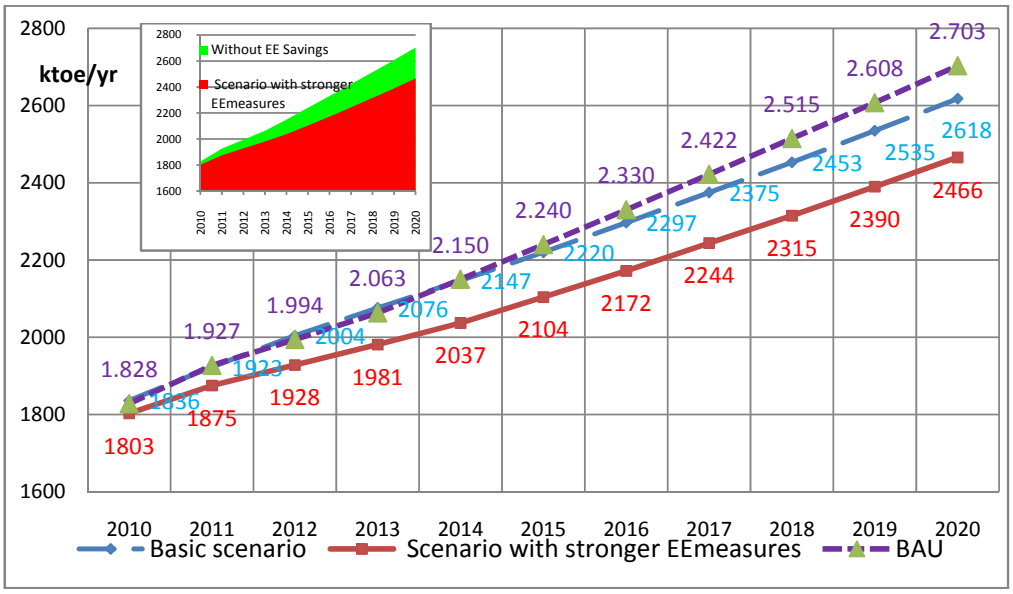


Figure 3.2 Final Energy Needs in accordance with joined Strategy for Energy Development and SIEE

The energy consumption by citizen or household is far lower than in the EU countries (Figures 4.1.1.2 and 4.1.1.3- Annex 3). While about 58 percent of household energy use is for heating, this is substantially less than in other EU countries e.g. twice less than in Slovenia (see Figure 4.1.1.5). This lower energy consumption is not due to efficient energy use but rather due to energy poverty. Home-dwellers consume as much energy as their can afford, thus not meeting optimal comfort conditions. Hence, the energy consumption for households heating will rise on average by 40 percent in order to reach normal comfort conditions.

On the other hand, the anticipated impact of increasing energy prices and fiscal measures on efficient energy utilization needs to be assessed as a controlling/limiting factor for economic growth.

The Republic of Macedonia today has virtually the same energy capacities that it had before 1990, which are now two decades older. The low electricity price greatly contributed to irrational consumption of electricity relative to other energy sources, resulted in inefficient energy and has contributed to the perseverance of the unfavourable structure (from an energy point of view) of the domestic industry and the economy as a whole. The extended delays in construction of new facilities has led to interruption in creation of own cadre of power engineers.

3.1 BASELINE STATISTICS

The energy infrastructure of the Republic of Macedonia is comprised of coal, oil and oil products, natural gas sectors, and firewood as primary energy sources, and the electricity sector and the heat generation sector as sector with transformed energy.

The present analysis especially focuses on determining the Primary Energy (PE) needs of the country thus representing the country‘s economic development input energy as well as the Final Energy Consumption (FC), which is a portion of the primary energy input and of which the gross domestic product is being realized. Table 3.1.1 lists the basic energy sector indicators starting with PE up to FC.

Aggregated and individual data on energy consumption have been used to set the target. These data are provided by Ministry of Economy and Macedonian Centre for Energy Efficiency MACEF and

academic experts from specific fields. The used material balances do not differ from those provided to EUROSTAT.

Table 3.1.1 Basic energy indicators for PE and FE in ktoe

	2000	2001	2002	2003	2004	2005	2006
Primary Energy Generation	1532	1572	1510	1568	1536	1459	1450
Net Imports	1113	1019	1187	1100	1163	1246	1322
Trade/ Exchange	64	17	-141	43	-2	34	-13
Total Primary Energy (PE)	2709	2608	2556	2711	2697	2740	2759
Total Final Consumption (FC)	1601	1436	1504	1653	1624	1691	1708
FC/PE (%)	59.12	55.05	58.83	60.97	60.22	61.72	61.91

Table 3.1.1 clearly indicates the stagnation of both the primary as well as the final energy consumption in recent years. The efficiency of the FC/PE is between the limits of 55 to 62 percent.

Within the Energy Community Treaty and the Community's EETF, in the case of Macedonia as a Contracting Party, this first Action Plan covers the period 2010-2018 and sets intermediate indicative target as benchmark for this period for 9 percent (Directive 2006/32/EC, Article 4) of the final inland energy consumption. The first NEEAP provides a package of measures for the most important final energy demand sectors: industry, transport, residential (households) and commercial and public services.

Official statistics additionally identifies the sectors of agriculture and non energy use. However, due to the small percentage of the overall energy consumption, it was decided not to specify separate measures targeted to these sectors alone. The first NEEAP contains measures which are already being or have been implemented as well as new measures which are planned for implementation in this three-year period (2010-2012) and will, for the most part, continue to be implemented in the next six year period at least until 2018.

The share of the different fuels and sectors in the total final energy consumption for 2006 is given in Figures 3.1.1 and 3.1.2.

The final energy consumption in the Republic of Macedonia in 2006 was equal to 1708 ktoe. Industry has the biggest final energy consumption with 33.8 percent and households with 29.2 percent, followed by transportation with 20.5 percent, commercial and service sector with 13.1 percent, and finally, agriculture and forestry with a modest consumption of 1.8 percent. The consumption for non-energy needs is also small, and its share is 1.7 percent.

Electricity demand grows continuously, and during the five-year period (2002-2007), the total consumption increased at an annual rate of 4.46 percent. The biggest growth in final energy consumption in the period 2003-2007 was noted in the industry, where the growth rate was 7.15 percent. This sector is followed by the commercial and the service sector with an annual rate of almost 4 percent, followed by households with 2.64 percent.

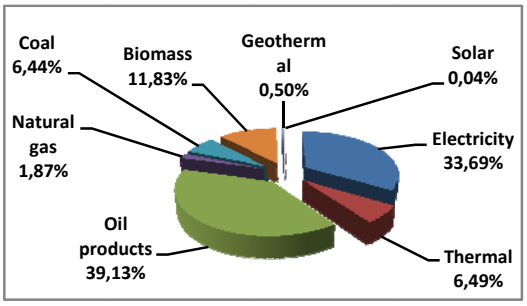


Figure 3.1.1 Energy consumption in 2006

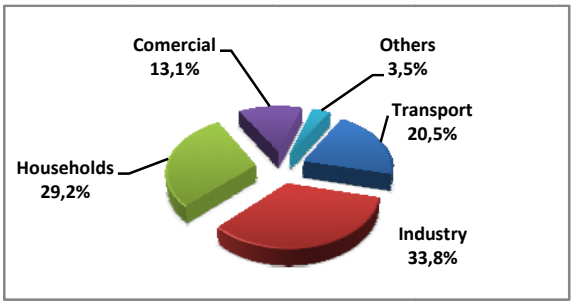


Figure 3.1.2 Energy consumption by sectors, 2006

Based on the analysis of the energy consumption statistics for the period before the financial crisis, four sectors were selected for further in-depth analysis and energy efficiency measures recommendations.

The industry sector is the biggest energy consumer, with metallurgy holding the dominant stake. Worldwide financial conditions dramatically influence this sector, which further reflects on this sector's energy consumption.

According to the structure of officially statistical data, the buildings were broken down into two sectors – (i) residential and (ii) commercial and public services sector. The building energy consumption is most relevant given the huge potential for energy saving.

The social aspect related to energy price increases and utility affordability is in the residential sector, which may serve as an impulse for undertaking saving measures. The State policy shall be directed towards creating an enabling environment for households' home-owner own capital engagement in order to implement the projected energy savings. The new legal obligations of the Housing Law prescribe mandatory establishment of condominiums and their association. Nonetheless, this initiative will have little enforcement without adequate support from the financial institutions, which will help finance the implementation of the EE measures recommended by the Strategy.

The spectrum of measures proposed for the Commercial and Public Services Sector is very diverse. Obligatory measures may be immediately implemented in the Public Services buildings through Government decrees or recommendations (e.g. efficiency requirements as selection criteria in public procurement tenders), whereas in private sector commercial buildings the driving and motivation force are only the market conditions and fiscal measures provided by the State for stimulating energy saving through EE measures.

The Transport Sector may also achieve significant energy savings through of replacement of aged vehicle fleet, encouraging the use of public transportation and etc.

The "Agriculture" sector as well as the "Energy consumption for other purposes" have not been analyzed because of their small shares in the state energy balance with 3.5 percent. However, this does not mean that in the process of preparation of the plans and programs for EE implementation at municipal level these sectors shall be neglected. This especially refers to the possibility of increased and more efficient use of geothermal energy in the regions where it is available.

One of the primary objectives of the SIEE is to slow down/decrease the increase in electricity consumption across all sectors. This particularly refers to electricity use for non-generation processes (especially heating and hot water preparation).

Electricity consumption

Electricity consumption data, broken down by sectors, was obtained from the electric and power entities[13] in Macedonia and is presented on Figure 3.1.3.

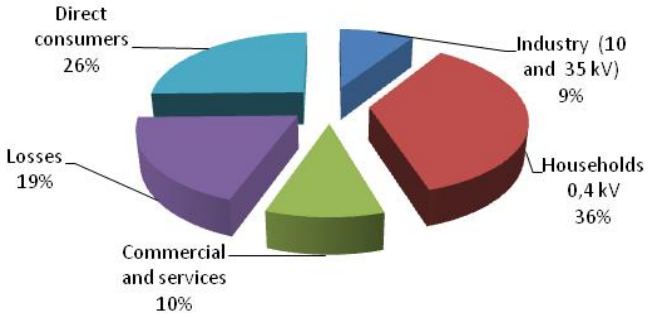


Figure 3.1.3 Structure of electricity consumption by consumer groups (%) for 2006

The implementation of the EE measures set forth by the present Strategy is expected to be accompanied by rapid development of the natural gas transportation and distribution network throughout many Macedonian towns along with financial stimuli for home-owners for solar collector installation, geothermal heat pumps and refurbishment of old buildings.

The fast penetration of the natural gas throughout the Macedonian economy will reduce the consumption of liquid oil products. The consumption of light heating oil (D2) used both in the residential and commercial sectors, partially in the industry and in smaller share in the transportation sector will decrease, based on the projection that the bus fleet will use compressed natural gas (CNG) as fuel. In addition to the reduced energy consumption, this will yield significant environmental protection gains.

Restructuring of the energy (electricity) sector is considered to be the desired approach to more economically efficient energy pricing. In Macedonia this option is under active consideration. The theory assumes that where energy subsidies or cross-subsidies are removed more efficient consumption patterns should result. But while price rationalization is a prerequisite, additional measures are needed to realize that the transition to "more efficient consumption patterns" requires access to information, technological options, market delivery mechanisms, and capital.

More efficient energy pricing will also imply increases in the cost to consumers.

The current price of electricity to distribution consumers is below regional market levels and below long run marginal costs. Residential and a number of commercial customers are thus getting price signals that electricity costs much less than it really does. These misleading price signals need to be corrected in order to encourage energy efficiency and make it more attractive. However, any price increases will need to be accompanied with measures to help vulnerable groups cope with the increases, including through targeted low-income energy efficiency programs which may help reduce the utility bills in the vulnerable households.

The energy prices are regulated by Energy Regulatory Commission. The tariffs are set on a cost calculation basis, including rate of profit. The energy market will be opened and all consumers will

[13] ELEM, MEPSO and EVN Macedonia

become eligible[14] to buy energy according market rules**.** This will be strong impetus for faster implementation of EE measures.

Estimations of financial savings were prepared using the following fuel and energy prices. Depreciation of financial investments and gains was not taken into account. All accounts are made with the value of money in 2009.

Table 3.1.2 Fuel and Energy Prices Used for Estimating Financial Savings

	MKD/kWh	€ /kWh
Natural gas	**2,1618**	**0,035**
Wood	**0,9792**	**0,016**
Electricity	**3,8388**	**0,063**
Light heating oil	**3,7143**	**0,060**
District heating (average)	**2,2673**	**0,037**
ELEM Energetika DHC	**3,2594**	**0,053**
Skopje Sever DHC	**2,5833**	**0,042**
Toplifikacija AD	**2,4413**	**0,040**

The recent changes of the energy (fuel) prices are shown in Figure 3.1.4

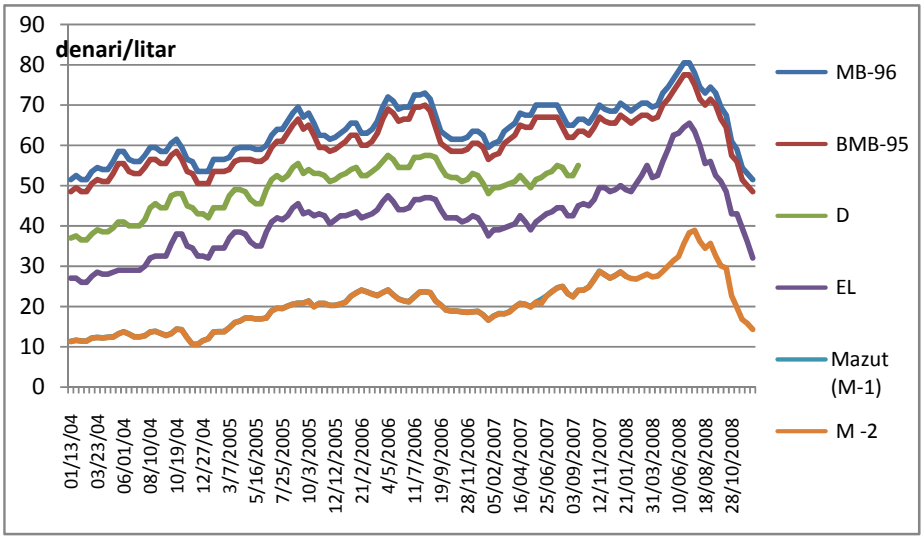


Figure 3.1.4 The history of liquid fuel prices

[14] Large industry is already buying electricity on the market.

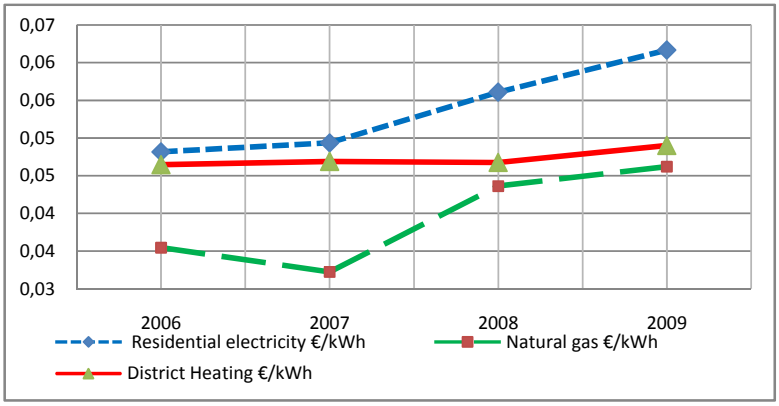


Figure 3.1.5 The history of energy prices

3.2 NATIONAL ENERGY SAVING BENCHMARKS

The expected energy savings of the measures envisaged by the present Strategy and also reflected in the National Energy Efficiency Action Plan for each of the four aforementioned most important sectors of final energy consumption are summarized in Table 3.2.1 below. The expected savings per sector are calculated for the package of measures applied to that sector.

The national target as a benchmark has been calculated on the basis of the average final consumption of energy for the last five years for which data are available and are in harmony with National Strategy for Energy Development till 2030. In the case of the Republic of Macedonia, this period is 2002-2006. The benchmark is expressed in the absolute amount of ktoe. The benchmark calculation is presented in Table 3.2.1.

Table 3.2.1 National Indicative Energy Savings Benchmark in ktoe

ktoe	2002	2003	2004	2005	2006	Average	9% Savings
Total primary energy supply	2555	2711	2698	2739	2759	2692	242
Total final energy consumption	1504	1653	1624	1691	1708	1636	**147**
National indicative annual energy savings benchmark by 2018							**147**
National intermediate indicative annual energy savings benchmark by 2012							**65.4**

In pursuance of the Directive 2006/32/EC, the Republic of Macedonia has adopted a national indicative energy savings target not less than 9 percent of the final inland energy consumption for 9 years by 2018, (a quite high rate for the existing conditions an average 1. percent annually), which means that the country should ensure energy savings to the amount of 147 ktoe.

The annual cumulative energy saving improvements that Macedonia has committed to are more ambitious than those committed to by the most developed G8 countries (Figure 3.2.1). Given the state of the economy, still slow growth, and sub-optimal lifestyle conditions, such a target may be an unfair burden on the society and economy.

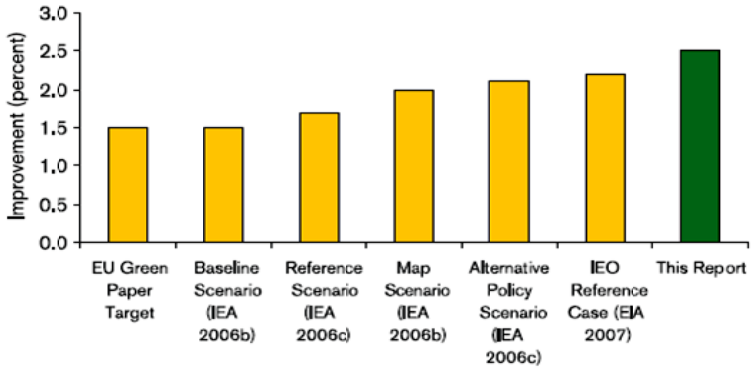


Figure 3.2.1 Assumptions of annual efficiency improvements from selected energy projections[15]

4. ENERGY EFFICIENCY MEASURES

Main Macedonian targets are similar to the European targets.

The objectives proclaimed by the EU in the energy field until 2020 are: decrease of final net energy consumption by 20 percent, provision of energy from renewable energy sources in the amount of 20 percent of final energy consumption, and reduction of the emission of greenhouse gases by 20 percent.

The EU's stated objective is to provide its citizens with "the most energy-efficient buildings, appliances, processes, cars and energy systems" in the world. It identifies 75 specific actions in 10 priority areas to be implemented over a six-year period.

The objectives proclaimed by the Republic of Macedonia in this strategy are based on the EU objectives, taking into account the specificities of the country. Considering the high energy intensity, the Republic of Macedonia plans for greater improvement of energy efficiency in the generation, transmission, and utilization of energy.

In order to achieve this Macedonia will focus on the following:

- *New energy performance standards for **product groups** such as boilers, copiers, TVs and lighting;*
- *New energy standards for **buildings** and promoting low-energy buildings ("passive houses") Making **power generation** and distribution more efficient;*
- *Legislation to limit CO_2 emissions from **cars** to 120g/km by 2012 and strengthened fuel-efficiency labelling;*
- *Facilitate bank **financing** for investments in energy efficiency by SMEs and ESCOs;*
- *Enhance regional cooperation and EU;*
- *Coherent use of **taxation** to increase EE consumption;*
- *Awareness **campaigns**, systematical **education**; and **science** development*

[15] Realizing the Potential of Energy Efficiency: Targets, Policies, and Measures for G8 Countries, United Nations Foundation, Expert Report, 2007

- *Improve energy efficiency in **urban areas** through participation of Macedonian municipalities at the "Covenant of Mayors" which will exchange best practices.*

4.1. RESIDENTIAL SECTOR

The present Strategy identifies the specific aims, elements and context of the energy efficiency policy and programs for residential sector energy efficiency. The aims of the Strategy for the residential sector are as follows:

- Improve housing energy efficiency
- Mitigate fuel poverty and provide affordable heat
- Reduce the incidence of illness and early deaths caused by fuel poverty
- Promote energy saving in households and raise awareness of the benefits of energy conservation
- Use the least environmentally damaging forms of energy and reduce carbon dioxide (CO_2) emissions
- Avoid unnecessary use of energy
- Increase the efficiency of energy conversion

The elements of the Strategy include:

- A review of existing services/activities and current efficiency of energy use in housing.
- Development of an effective Residential Energy Efficiency Action Programme, incorporating awareness-raising, stimulating investments in residential energy efficiency.

The context of the Strategy must:

- Enable co-ordination with all other relevant strategies and policies, and the Government priorities
- Facilitate effective consultation with relevant people and organisations

The residential sector is the second largest energy end-user in Macedonia with 29 percent of total final energy consumption according to data from 2006. Households have the largest consumption of electricity among the sectors.

The patterns of demand, analysis criteria, methodology and future consumption forecast as well as saving potential are presented in ANNEX 3.

In summary, the reviewed energy efficiency improvement programs and their energy savings potential within the Strategy timeline periods are presented in Table 4.1.1:

Table 4.1.1 Estimated Savings Potential of EEI Programs during the Strategy Timeline

	Title of the program/EEI measure	Savings ktoe		
		2012	***2018***	***2020***
1	Individual heat allocators in DH Skopje- Toplifikacija	0,37	1,38	1,56
2	Integrating energy efficiency in Social Housing	0,26	0,93	0,93
3	Building Codes Enforcement and BEP certification	2,98	8,87	10,31
3.1	*Expansion of the DH consumer base (adding new apartments)*	2,12	6,37	7,43

3.2	*Solar systems for new appartments*	0,34	0,80	0,89
3.3	*Lighting in new appartments*	0,24	0,72	0,84
3.4	*Efficient electrical appliances*	0,27	0,96	1,14
4	High-Efficiency wood fuel furnaces	0,486	6,4	7,98
5	Promotional EE campaign	1,080	7,6	10,26
6	Boilers for central heating	0,395	2,0	3,03
7	Solar heaters for domestic hot-water preparation	0,415	2,0	4,02
8	EE Buildings retrofit	1,633	11,4	19,05
	Total for residential sector	**7,630**	**40,515**	**57,139**

Necessary investments to reach targeted savings are assumed to be on the level of 272 M €.

About one-quarter of the investments is expected in the sector of increased renewable energy utilization – new solar systems for hot water preparation, and geothermal heat pumps, and the same for new boilers for individual centralized heating.

Most of the investment will be required in the new building envelops and efficient lighting (11 percent). It is noteworthy that the investments required solely represent the incremental cost to be added to the present construction cost of traditional buildings common nowadays to achieve construction in accordance with the Rulebook for Building Energy Performance (BEP). Significant investments are expected (10 percent) for new, high-efficiency wood furnaces. The simple pay-back period of the building renovation is high, the same as the necessary investment (15,3%), because of additional work to remove old parts (windows, mortar) and later to implement new thicker insulations. Public awareness campaigns, appliance labeling, maintenance and replacement with more efficient ones will require investing about 4 M € in the next 10 years' period.

Table 4.1.2 Investments and produced financial and energy savings until 2020 for Residential Sector.

	Measures	Assumed cumulative energy savings until 2020	Assumed investments until 2020	Cumulative Financial savings until 2020	Simple payback period	Simple payback period (LMP)
		ktoe	M €	M €	years	years
1	Individual heat allocators in DH Skopje-Toplofikacija	9,43	3,99	3,85	6,27	3,3
2	Integrating energy efficiency in Social Housing	6,8	4,32	4,39	7,2	4,77
3	Building Codes Enforcement and BEP certification of new housing	65,6	29,78	32,62	6,42	3,25

4	Wood furnaces	35,7	29,61	6,62	20	Not affected signifcantly with electricity prices changing
5	Promotional campaign	47,3	3,6	28,63		
6	Boilers for individual heating	13,4	28,51	9,74	12,93	9,7
7	Solar systems for domestic hot water preparation	14,9	41,5	10,84	14,21	8,89
8	EE Buildings retrofit	75,1	138,25	54,61	10	6,24
	Sum	**268,23**	**279,56**	**151,4**	8,3	4,1

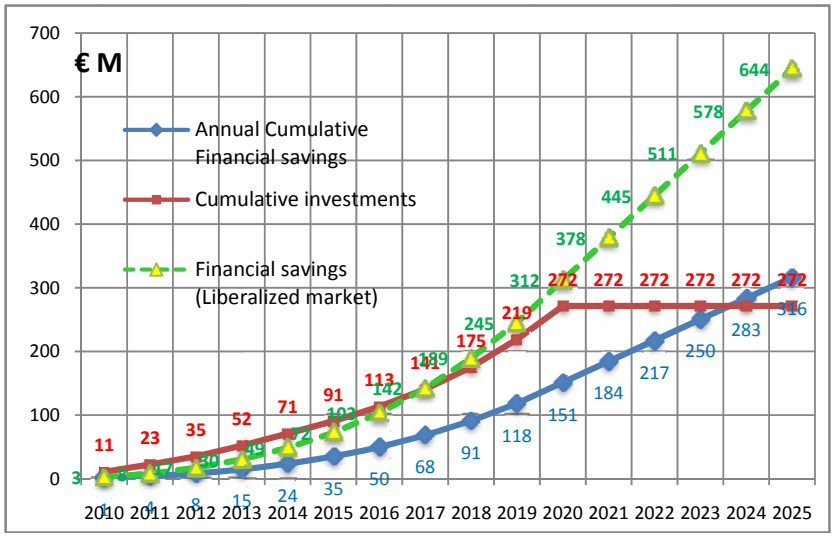


Figure 4.1.1 The difference between investments and financial savings (M €)

The difference between cumulative investments and cumulative financial savings is shown in Figure 4.1.1.

In other countries the price of electricity is at least 50 to 200% higher compared that of Macedonia. This influences Simple Payback Period (SPP) dramatically. The financial condition of consumers is poor, hence they under- consume energy, living in suboptimal comfort. Along with the low prices, the low consumption worsens the SPP. The residential EE does look more attractive in countries with higher tariffs and energy consumption.

Calculations of financial saving were carried out in accordance with existing electricity price (including production, transmission and distribution). Imported electricity as well as feed in tariffs are incorporated into production/transmission part of the price.

After 14 years the savings become greater compared to investments under the present energy prices. Liberalized energy market (expected in 2015) shall provoke fast increaseof energy prices in a short time period reaching at least 100 €/MWh at the end-user side. The dotted curve on Figure **4.1.1** shows a more attractive financial impact on savings in short period, reducing SPB at least 40%.

It is noteworthy that investments were assumed only for new building stock.

Investments for refurbishments are several times higher compared to investments for new buildings.

Steps foreseen:

- Implement the energy performance of buildings directive
- Propose an expanded role for the public sector to demonstrate new technologies and methods
- Change the threshold for minimum performance requirements for major renovations
- Aim for the performance of new buildings to approach the level of "passive" houses
- Consider binding requirements to install passive heating and cooling technologies
- Introduce energy efficiency aspects where relevant under the construction products directive.

4.2. COMMERCIAL AND PUBLIC BUILDING SECTOR

The energy consumption in the commercial and service sector is very variable. This sector consists of small and medium sized enterprises (SMEs) and the public sector.

The registered energy consumption in 2006 was 224 ktoe.[16]

The energy consumption in this sector is mainly comprised of electricity with a 43 percent share in the consumption, and oil products (heating oil, the so-called D2 fuel and LPG) with almost 42 percent of the total energy consumption in the sector in 2006.

In the short-term, the focus of state EE Policy will be on the public sector since it is easier to address through policy measures. It is expected that the public sector's leading-by-example will trigger actions in the commercial sector as well. Activities should be directed towards potentials for large no/low cost energy savings, such as encouraging changes of behavior through education, training and information campaigns.

Certain segments of this sector, such as the public administration, education, and health are not expected to experience high growth rates, but there are still many possibilities for improvement of energy efficiency. Intensive construction of structures in these sub-sectors is not to be expected, neither on central, nor on local (municipal) level. Higher growth can be expected in the hotel industry, wholesale and retail trade, and financial sector, but in this group, only the hotels are significant consumers of energy.

The indicative final energy savings in the Commercial and Public Building Sector within the scope of the Energy Services Directive in the Republic of Macedonia in 2018 is considered to be equal to 24,19 ktoe.

Public buildings are probably the only category of buildings where energy efficiency measures can and must be "imposed." The following points indicate a series of measures that could be applicable:

- ❖ Compulsory establishment of an energy management scheme and appointment of an energy manager among the existing personnel of the building

[16] © IEA Online Database: Energy Balances of Non-OECD and OECD Countries and Energy Statistics of Non-OECD and OECD Countries, OECD/IEA, [2008].

- Specifications of the energy managers' duties
- Training programmes and technical support to energy managers
- Compulsory energy audit execution within a specified time period and elaboration of a concrete action plans for the improvement of the energy performance of the building
- Implementation of the action plan and of the energy efficiency investments within a specified period of time
- Regular reporting

The analysis of consumption patterns, demand growth trends, criteria, methodology and forecast for energy consumption savings are reported in the ANNEX 4.

The investments necessary to achieve the targeted savings are estimated at 114,1 M €.

Most of the investments have to be realized in the new and refurbished building envelops (36,67 M € until 2020).

It is noteworthy that this investment amount is merely the difference between the construction cost of traditional buildings as opposed to new buildings, to be built in compliance with the Rulebook for BEP.

Public awareness campaigns, appliance labelling, and maintenance will reveal the need to replace inefficient appliances with more efficient ones, investing over 11,8 M € in the next 10 years.

The positive financial results (under current energy prices) appear after 9 years (Figure 4.2.1). Calculations show that with financial investment of 114,1 M€ it is possible to realize financial savings (mostly through electrical energy saving) of 226 M € until 2020, assuming electricity price for commercial sector will be 120 €/MWh, as expected to be reached near to 2015 year after market liberalization (LM - dotted curve).

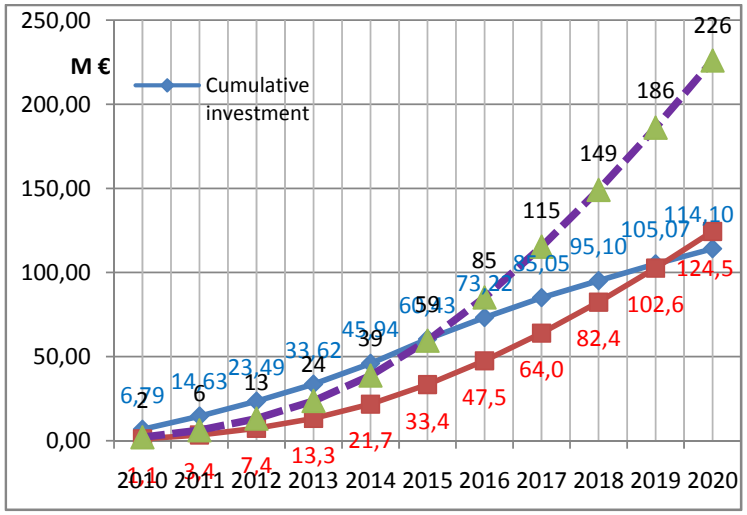


Figure 4.2.1 Difference between investments and financial savings in commercial and public buildings

Table 4.2.1 presents the relation between the investment and savings for different EE measures.

Table 4.2.1 Technical and Economic Features of Energy Saving Measures

	Cumulative investments (M euro)	2018 energy savings	2020 energy savings	Cumulative financial savings until2020 (M euro)	Simple payback period	Simple payback period (LMP)
		%, compared to average consumption during 2002-2006			year	year
BEP Certificates	36,67	0,46%	2,95%	40,56	4,52	2,87
Inspections of boilers/air conditioning systems	0,30	0,07%	0,52%	7,07		
Education sector	11,21	0,18%	1,25%	10,37	6,29	4,27
Information campaigns and Municipal EE network	2,70	0,10%	0,59%	6,98		
Energy management	1,20	0,14%	0,89%	10,61		
Street lighting Project	3,45	0,06%	0,35%	0,873	3,95	2,451
Electrical appliance and equipment labelling and energy performance standards	9,09	0,09%	0,55%	7,93	6,65	4,13
Savings in hospitals	18,29	0,22%	1,74%	24,43	5,59	3,65
Solar systems and geothermal heat pumps	31,20	0,15%	1,08%	15,63	10,49	6,51
Total	114,1	1,48%	9,9%	124,46	6,11	3,37

The average **simple payback period** for the investments in this sector is 6,11 years (taking into account all measures envisaged in the sector). The shorter payback period compared to household sector (8,3 years) is generated because of longer period of use of equipment (lighting, solar systems, etc.) SPB become much more attractive (over 40%) considering expected electricity price on liberalized market.

Simulations show that the Commercial and Public buildings sector has a real, viable potential to implement proposed measures.

Action plan priority:

Due to the high population density and intensive energy consumption, it is particularly important to improve energy efficiency in urban areas. Political commitment by the top decision makers in that sector will be an excellent starting point. Signing the memorandum of understanding on energy efficiency of the network of mayors of Europe's most committed cities "Covenant of mayors"[17] is one of such steps.

Priorities for raising awareness about energy efficiency will include labelling as well as education and training programmes for energy managers in industry and utilities, and teaching aids for primary, secondary, and vocational education. To summarize, the measures and activities necessary for promotion of energy efficiency in the public and commercial buildings sector are as follows:

- Adopt European Commission energy efficiency procurement guidelines
- Promote energy management schemes, and training toolkits for industry, SMEs, and the public sector
- Propose a vocational educational initiative on energy efficiency
- Establish Municipal Network on Energy Efficiency
- Involve and charge the EA in implementation of the action plan
- Strengthen energy efficiency in external relations cooperation frameworks
- Increase international cooperation

4.3. INDUSTRY SECTOR

After 1990, Macedonian industry passed through various stages, some of them with important output reduction when the former Yugoslav market fell apart. However, nowadays it operates in a business environment which is relatively open to international competition and growing more stable in terms of GDP growth, inflation, and employment. During of the period of 2002–2006 the industrial production has grown at a rate of 5.06 percent. This rapid production growth is now seized and the international recession of 2008 will most likely postpone this tendency for some time and 2009 could be a year of discontinuity. Some of the large metallurgical companies plan to suspend their work for at least one year, while others have reduced production.

Efficient use of energy in the industry sector is one of the crucial factors for the country's economic growth and competitiveness. This has been already recognized by both the National Strategy for Energy Development and the Industrial Policy of the Republic of Macedonia.

The energy efficiency policy aims at facilitating industrial growth of the country in an environmentally sound manner.

Among the priority objectives of the SIEE reducing the energy intensity, i.e. reduction of energy consumption per unit of GDP is on the top.

The policy measures will be focused on: *Improvement of technologies, equipment and process control systems.*

[17] City Skopje, will sign it in the first half of 2010, in the frame of CCI Project funded by GTZ

The most effective way of achieving high energy efficiency is to take it into consideration in the earliest possible stage. Therefore, priority will be given to low energy intensive technologies. In addition, measures will be undertaken to ensure that new industrial installations are designed and constructed for efficient use of energy. The following measures are envisioned for early intervention:

- Companies will be required to apply best available technologies (BAT) through specific licensing processes (IPPC and energy audits of the processes) in performing their activities
- As energy saving reduces greenhouse gas emission, CDM should apply whenever possible (additional)
- Co-generation should be given priority when searching for local energy supply
- Auxiliary systems and activities such as HVAC, compressed air supply, electric motors control, lighting etc. should be gradually improved to use energy more efficiently

The indicative target set as benchmark in the industry sector is to realize savings of at least 90,45 ktoe in 2018.

The analysis of consumption patterns, demand growth trends, criteria, methodology and forecast for energy consumption savings are reported in the ANNEX 5.

In summary, the reviewed energy efficiency improvement programs and their energy savings potential within the Strategy timeline for the Industry are presented in Table 4.3.1, depending to the year of monitoring.

Table 4.3.1 Estimated Savings Potential of EEI Programs during the Strategy Timeline in the Industry Sector

	Title of the program/measure	Savings ktoe		
		2012	2018	2020
1.	Improvement of process performances	**6**	**5**	**5**
2.	Energy Auditing	**0,3**	**0,65**	**0,75**
3.	Co-generation	**25,1**	**38,6**	**38,6**
4.	Energy performance of non-residental buildings	**0,15**	**0,35**	**0,42**
5.	Improved Lighting	**0,11**	**0,25**	**0,32**
6.	Improved heating systems	**0,3**	**0,4**	**0,4**
7.	Fuel type change	**0,6**	**0,8**	**0,8**
8.	CDM	**2,8**	**26**	**26**
9.	Waste heat utilization (non CDM)	**2,5**	**8**	**8**
10.	Smart drives	**1**	**3,9**	**4,3**
11.	Compressed air supply	**0,1**	**0,5**	**0,5**
12.	Good house keeping	**2**	**6**	**6**
	Sum	**40,96**	**90,45**	**91,1**

The index of M€ 1,06 saved energy value, consists of three types of energy savings where the electricity takes up to 61,3 %, the heavy fuel oil 21,2% and others 17,5 %.

The investments depend on a fairly wide scope of elements such as producer and quality affecting the cost, the loan interest rate, annual number of working hours producing energy savings, the cost of maintenance, technological replacement rate (keeping few old parts) etc., and it is within a ratio of 0,86-4,59 M€/ktoe.

The sum of investment to realize assumed savings shows that the main field for investment is the sector of metallurgy and energy. Application of CHP and CDM projects opens the way to saving energy as well as protecting environment.[18]

Investment in the field of CHP were accounted for only as a part of the whole investment, the same as the participating ratio in the production of electricity from high efficient cogeneration plant. This ratio comprises 10 percent higher efficiency compared to separate production (in accordance with Rulebook on Preferential Producers of Electricity in CHP and the Rulebook for issuing guarantee of origin of electricity from CHP, on the basis of utilized heat).[19]

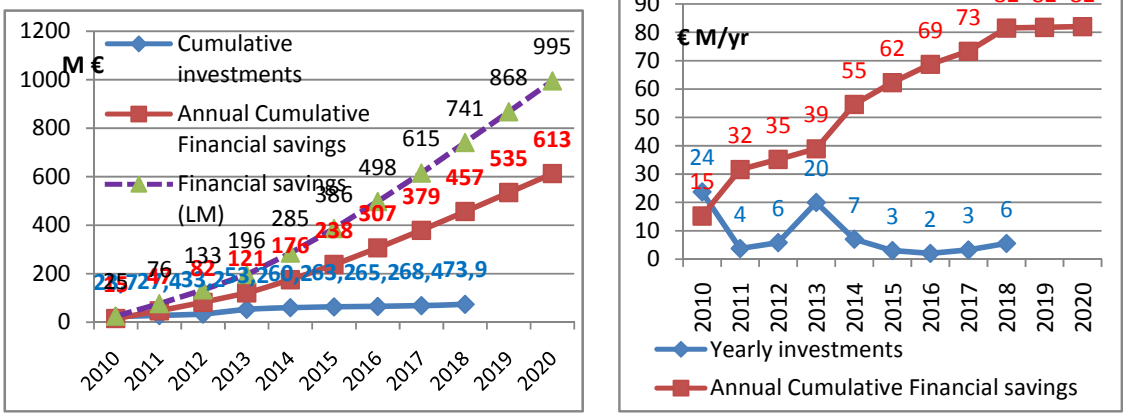


Figure 4.3.1 Difference between investments and financial savings and penetration of financing

By investing 74 M € in the industry sector, 713,2 ktoe can be saved through 2020.

Energy savings are escorted by increasing the competitiveness of Macedonian industry and avoided emissions equivalent to 3137 kt CO_2. This is a direct contribution to reducing the global warming and an opportunity for future pollution trading.

Cumulative investments (CDM, CHP) make this an attractive investment choice (Figure 4.3.1). The energy market liberalization bringing the electrical energy prices at level of 120 €/MWh for industry and commercial sector have a substantive positive impact on the financial viability of these measures, as shown by the dotted curve on Figure 4.3.1.

The average simple payback period for the investments in this sector depends to the monitoring year and are in the frame of 0,67 – 5,34 years.

Steps foreseen to implement EU directives: Directive 2004/8/EC and 2006/32/EC:

❖ Develop efficiency requirements escorted with mandatory energy audit for new electricity, heating and cooling capacity lower than 20 MW

[18] The sum in the field of exhaust energy utilization in Silmak is not calculated with added investment for possible power plant instalment (additional 14 m €).

[19] Rulebooks are adopted and published in the Official Gazette, No. 40/2010 and 56/2010, accordingly.

- ❖ Introduce mandatory energy audit (four-year period) for energy consumer with installed capacity over 4 MW, or consuming over 2 ktoe/year.
- ❖ Draw up guidelines on good operating practices for existing capacity
- ❖ Implement the directive on the promotion of cogeneration (CHP)

4.4. TRANSPORT SECTOR

The transport sector in **M**acedonia is responsible for about 21 percent of the total final consumption of energy.

Within the transport sector, the road transport mode is the most dominant one in Macedonia. In the years 2002 to 2006 over 97 percent of the energy consumed in the transport sector was actually consumed by road transport.

The final energy savings in the *Transport Sector* within the scope of the Energy Services Directive in the Republic of Macedonia in 2018 would have to be equal to 31.3 ktoe or higher.

As far as the transport is concerned, efficient use of energy implies more intensive use of public transport with promotion of environmentally friendly vehicles, improvement of fuel quality, as well as breakthrough of bio-fuels (Sustainable Transport).

According to the Strategy for Energy Sector Development of the Republic of Macedonia, the savings based on EE measures are higher compared to the ESD projected benchmarks. At moderate scale of implementation of the proposed energy saving measures, twice more savings may be achieved (60.5 ktoe), while with larger efforts and societal engagement 93.4 ktoe may be achieved, which is fully corresponding to the projections of the Strategy for Energy Sector Development: 88 ktoe is the difference between the two scenarios. Thus analysis shows that there is potential for savings of up to 140 ktoe though with State financial support (decrease of the purchasing fees for new cars, promotion of public and rail transport).

The analysis of consumption patterns, demand growth trends, criteria, methodology and forecast for energy savings in the Transport sector are reported in the ANNEX 6.

In summary, the reviewed energy efficiency improvement programs and their energy savings potential within the Strategy timeline for the Transport sector are presented in Table 4.4.1, depending to the year of monitoring.

Table 4.4.1 Estimated Savings Potential of EEI Programs during the Strategy Timeline in the Transport Sector

Title of the program/measure	Savings ktoe		
	2012	2018	2020
Renewal of the national road vehicle fleet	2,18	14,11	21,31
Promotion of sustainable urban transport systems o *Introduction of tramway in Skopje* o *Renewal of public transport bus fleet* o *Parking policy*	5,02	14,93	18,83

o *Promotion of greater use of bicycle* o *Introduction of integrated traffic management center*			
Fuel quality and fuel economy standards	2,39	7,54	10,22
Car free days	0,39	1,05	1,32
Promotion of greater use of railway for intercity travel	2,58	6,99	8,80
Sum	**12,55**	**44,63**	**60,48**

Therefore, this National Energy Efficiency Action Plan is entirely in line with the objectives defined in the national transport strategy.

The sum of investment to realize assumed savings shows that the renovation of national road vehicle fleet is engaging/asking very high investments. In the period of 2020 it will be necessary to engage at list 2252,2 Million €, to obtain 160 870 new vehicles. **As it was noted previously, this sum can't be accepted as direct investment into measures for energy efficiency.** Renovation of the road fleet is produced by other tasks, and reduction of spent fuel is only a benefit tanks to the new technology, and world policy for reduction of harmful emission in the transport sector.

The total sum which is necessary to be spent is as follows:

Measure 2: Introduction of sustainable urban transport systems 50 M€

Measure 2 a: Tramway in Skopje[20] (150 Later than 2016?)

Measure 4. Car- free days M€

Measure 5. Promotion of car free days and sustainable urban transport systems, escorted with greater use of railway for intercity travel 4,5 M€

Sum: 54,5 M€

Energy savings till 2020 under moderate scenario: 321,7 ktoe,

Under accepted preconditions, without participation into investment of vehicle fleet, avoiding the influence of introduction of tramway into the calculation, necessary investment basically depends to the new bus fleet in the City of Skopje. Global financial savings, in correlation with fuel savings, can cover investments in the transport sector (Figure 4.4.1).

[20] Investments in the tramway are not taken into account, as the savings which it can produce. In the next phase, if the City and State policy, accompanied with better economical circumstances, this opportunity have to be considered

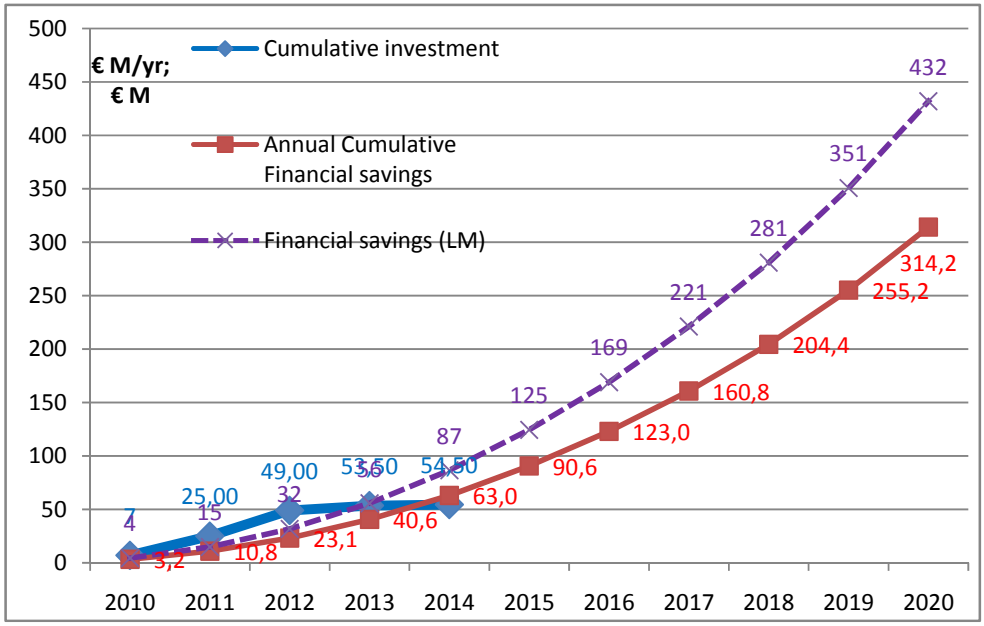


Figure 4.4.1 The difference between investments and financial savings

The average **simple payback period** for the investments in this sector is 4,1 – 5,1 years depending to monitoring year. The payback period is affected by the price-setting approach for the bust fares – the bus tickets are priced below cost-recovery level.

Actions proposed

- Create an integrated transportation system
- Promote conditions to discourage the use of private cars and to encourage the use of public transport and alternative transport modes, including cycling and walking
- Establish measures to control the availability of parking in congested areas
- Improve traffic management and control
- Develop and implement city logistics systems
- Encourage financing for market introduction of efficient vehicles
- Adopt the car fuel efficiency labeling directive
- Work towards minimum efficiency requirements for automobile air conditioning systems
- Propose a labeling scheme for tires

5. FINDINGS OF THE INFLUENCING FACTORS ANALYSIS

5.1 CRITICAL INSTITUTIONAL/POLICY/REGULATORY CONSIDERATIONS

5.1.1 RESPONSIBILITY FOR MANAGING ENERGY EFFICIENCY IN MACEDONIA

Energy efficiency activities are currently occurring in an ad-hoc manner, driven more by political considerations and donor initiatives rather than being inculcated into society. Discussions with all major players in the energy sector: supply and demand-side, public and private entities, academicians and business personnel and institutional, residential, commercial and industrial facility owners and operators led to the conclusion that the resources currently actively involved routinely in energy efficiency are insufficient to even develop, let alone take advantage of the economic benefits that are potentially attainable by tapping the energy efficiency as energy resource for Macedonia.

In 1999, a brief document entitled "Program for Energy Efficiency until 2020," prepared by the Ministry of Economy, made a series of recommendations about the energy efficiency actions that the Government of Macedonia should pursue. The major recommendation was the need for a specialized public entity that would systematically address the importance of energy efficiency for Macedonia, as well as the renewable sources – a designated authority, agency or institution.

In the same direction is one of the basic targets formulated in the Directive 2006/32/EC :
"Member States shall assign to one or more new or existing authorities or agencies the overall control and responsibility for overseeing the framework set up in relation to the target mentioned in paragraph 1. These bodies shall thereafter verify the energy savings as a result of energy services and other energy efficiency improvement measures, including existing national energy efficiency improvement measures, and report the results".

The main tasks of the MoE will be to carry out the following duties:

- *Help promote strategies/propose policies*
- *Propose fiscal policy measures to encourage EE and RES projects, promote technology and related services*
- *Guide the cooperation with local administrative units to help achieve their EE and RES programs*
- *Participate in developing long term scenarios for energy supply/demand for energy activities on state and local levels*

The main tasks of the EA will be to carry out the following duties:

- *Develop and maintain appropriate and transparent data bases on energy efficiency and renewable energy sources (monitoring and reporting services)*
- *Propose internationally harmonized standards for improving equipment efficiency*
- *Organize information dissemination campaigns for EE and RES*
- *Cooperate with non-governmental sector in developing the awareness of the need of EE and RES*
- *Encourage private initiative and cooperation, as well as joint ventures in realization of EE and RES projects*
- *Promote the use of economically and environmentally acceptable EE and RES technologies*
- *Encourage innovative approaches for investment including third party financing or co-financing*
- *Promote the creation of the private or public advisory information dissemination services Support investment in cogeneration systems (CHP)*

- *Undertake measures for increasing the efficiency of urban systems for heating production and distribution to buildings and industries*
- *Verify the energy savings as a result of energy services and other energy efficiency improvement measures and report the results.*

5.1.2 POLICY AND REGULATORY INITIATIVES

5.1.2.1 ECONOMIC AND FISCAL INITIATIVES

A broad range of economic and fiscal initiatives are used in different countries in an attempt to encourage energy efficiency investment. If generalized, such initiatives fall into the following generic categories:

- Rationalized pricing of energy sources and tariff policy
- Taxation policy[21] – lower tax or no tax on energy efficient equipment and household appliances
- Favorable customs duties for energy efficient equipment
- Mobilizing capital for creation of investment funds
- Guarantees for commercial banks
- Regulations and standards on rational energy use
- Public information and awareness campaigns

The range of regulatory and administrative measures encouraging energy efficiency includes:

- Elaboration of guidelines and supporting legislation
- Instructions on the minimal level of acceptable energy efficiency
- Standards and labels

And other policy measures could encourage:

- Standardization of equipment
- Education and training of personnel
- Quality of technical documentation

Fiscal policy is an important way to encourage changes in behaviour and the use of new products that use less energy. Improving taxation to ensure that the polluter really pays without, however, increasing overall tax levels is one of the options how these bottlenecks can be overcome.

Financial incentives rely more and more on tax incentives than on direct subsidies.

The EU could promote tax measures that either encourage or discourage certain forms of behaviour. Macedonian tax policy still remains too often a simple tool at the service of budgets, without much

[21] Potential taxation schemes:
Amortization (enabling companies to amortize investments earlier and to decrease their taxable profit)
Energy consumption tax
Green energy (where the consumer pays a higher price for the renewable generated energy. The increased energy price is compensated by the decrease of the value added tax)
Tax benefits (for investors and fund users)
Green mortgage (increased energy price is compensated by the decrease of the value added tax)

coherence with the aims of other policies, and full of exceptions demanded by Member States for all manners of consideration.

Direct subsidies on energy efficiency investments remain popular. As they have often been considered costly and questionable, they are now better targeted. Subsidies are viewed as a temporary measure to mobilise consumers, prepare for new regulations, or promote energy efficient technologies by creating a larger market than would exist otherwise, with the objective of a cost reduction for the subsidised energy efficient technologies. These subsidies may however have negative impacts on emerging markets if they are applied without real continuity.

Fiscal incentives, such as tax credits, tax reductions and accelerated depreciation, are usually considered cheaper than direct subsidies, especially to households, as they have lower transaction costs. They can work well if the tax collection rate is sufficiently high: such measures usually perform poorly in an economy in recession or in transition.

Packages of measures that combine several instruments are very effective: for instance, direct subsidies plus financing, economic incentives plus quality labels, regulations plus subsidies or financing mechanisms and quality labels, and so on.

Good information is essential, but it should be complemented by financial incentives or with both regulations and financial incentives. These complementary measures should be implemented simultaneously and not one after the other.

Giving incentives to improve the energy efficiency of rented accommodation is a difficult task because the owner of the building does not normally pay the energy bill and thus has no economic interest in investing in energy-efficiency improvements such as insulation or double glazing.

5.1.2.2 ENERGY PRICING POLICY

The fiscal and pricing policies need to be streamlined for efficiently internalising the long-term costs and benefits in the market. The general unpopularity of taxes should not deter the RM government from careful design of new taxation schemes, taking into account international competition and the negative impacts on low-income households. A progressive increase of energy prices even at a low rate, announced publicly, can have, in the long-term, a large impact on technological innovation. Energy efficiency measures, particularly in the residential sector, can be used to reduce the negative impact that energy price rises could have on low income households.

The current unbalanced structure of energy tariffs is not stimulating rational consumption of energy.

The Energy Regulatory Commission is responsible for the price regulation and adopts methodologies for setting the prices of electricity, gas, geothermal energy, central heating and oil. Coal prices are liberalised.

Prices are developed by applying the methodologies are incentive-based regulated by revenue-cap method for electricity, gas, central heating and geothermal energy. The oil prices are set on the basis of cost plus method. This method determines regulated maximum revenue that the companies are allowed to earn annually through collection of charges for their regulated activities. It enables covering all costs and ensures a level of regulated return of capital. The Rulebooks on the methods and conditions for regulating prices are followed by the Tariff system for transport,distribution and the Tariff system for selling energy to tariff customers. Nonetheless, the costs of the energy suppliers will have to rise as the current low level of salaries of workers in this sector has to rise. Moreover, the use of coal results in market distortion as it is state-owned and used at no rent/concession. Moreover, the hydropower plants supply the energy mix with electricity while the no fees are charged for the water they use. This and other factors, including the government desire to maintain the electricity

prices at a below-market level will have to change -- after 2015 the traders can offer electricity at the open market and the prices will become market-oriented.

An environmental fee is incorporated in the price of gasoline.

The Rulebooks were already prepared on the methods and procedures for establishing and approving the use of feed-in tariffs for purchase of electricity produced from small hydropower plants, electricity generated by wind powers which have obtained the position of privileged producer, electricity generated by photovoltaic solar collectors and electricity generated by CHP on biomass.

No subsidies currently exist in any of the tariff methodologies. However, there are cross-subsidies, mainly between commercial and household customers, in the electricity tariffs.

While the cross-subsidy is largely aimed at protecting the vulnerable consumer groups, which could be hurt by prices increase, the more affluent consumers with higher consumption benefit more from this social policy. Hence the cross-subsidy and general pressure on electricity prices have to be eliminated to build energy efficiency incentives into the price methodology, instead being replaced with targeted subsidies/social safety nets exclusively designed for low-income households. . Currently, there is no safety net in place for low-income customers. This is likely to become a problem as tariffs increase to cover investment costs, and as payments discipline is better enforced. The electricity prices are relatively low and do not provide strong incentives for energy efficiency.

A rise in energy prices is unavoidable, as tariffs need to be adjusted to reflect the true cost of service. Introducing a market price of energy will improve the operational condition of domestic energy producers and also will provide significant motivation for energy saving on the consumers side. However, a pricing reform should be promoted well in advance, and should be combined with a social safety net and incentives for the electricity companies to provide energy services to the customers.

Steps foreseen:

- The Government should send a clear message that current energy prices are not sustainable so as to allow the consumers to prepare for future adjustments.
- The energy prices should be cost-reflective.
- Pricing structures should eliminate cross-subsidies and should integrate formulae that promote energy efficiency and take care of vulnerable customers.
- Energy utilities should receive incentives and operate under conditions so as to develop and implement demand-side management (dsm) programmes.

5.2 REGULATIONS, CODES AND STANDARDS

In order for Macedonia to join the EU, the country must continue to strive for compliance with the EU *acquis.* Meeting these EU standards and regulations will become an increasingly important goal for Macedonia in the following years.

The entity eventually charged with overseeing energy efficiency-related policy initiatives will need to be cognizant of where imported appliances come from and understand use patterns of various common equipment (heaters, refrigerators, air conditioners, etc.) in order to work with the Institute for Standardization, and other offices to devise an effective low cost strategy to encourage the purchase of the most energy efficient equipment available.

5.2.1 BUILDING ENERGY CODES

The Rulebook on Building Energy Performances (2008) established the first very important step for building energy audit and certification, determining the maximal values for energy transparency of buildings envelopes. It should be noted that they are voluntary, not obligatory, rules.

High priority is given to preparing the legal basis (preparation and adoption of new Energy Law) to transpose into national bylaws the rest of Directive on Building Energy Performances (2002/91/EC)– preparation of national methodology for performance computing, authorization of independent energy auditors, regular control of water boilers for central heating and air conditioners with capacity over 12 kW.

It is crucial that the implementation of these measures becomes mandatory.

5.2.2 EFFICIENT HEAT AND POWER GENERATION IN COMBINED CYCLE COGENERATION PLANT

In the past few years, there has been an intensive construction of new combined cycle cogeneration plants for electricity and heat production in the city of Skopje. The first one was realized with 10 gas engines, each with 3MW electrical power, delivering useful heat of 13 MW and industrial process heat 12 t/h, using natural gas as fuel. The second facility would provide new electricity generation capacity of 236 MW and up to 160 MW of thermal heat for application in the district heating system (Toplifikacija). The efficiency of the combined cycle system for electricity production would be about 54 percent compared to almost 32 percent in the lignite plants of Bitola.

Introducing new rulebooks on preferential producer of electricity in CHP, as well as origin of electricity, is encouraging the next consumers to become self producers of dispersed production of electricity and heat/cooling energy.

To realize dispersed production of energy, with all benefits escorting it (financial, environmental, etc.) it is necessary to faster distribution of natural gas to the consumers.

5.3 PRIORITY SECTORS

More efficient use of energy means that businesses, households, government offices, schools, and industries can spend less on energy bills. Businesses can be more competitive and profitable, households can buy other needed items, and the government can spend the savings on other public goods.

In many households in Macedonia, where energy bills represent a significant portion of the monthly cost of living, providing access to information and skilled support for the implementation of energy saving measures could be a significant and empowering government action.

This SIEE document is intended to be accessible to a wide audience so that it might increase their understanding of the importance of rational energy use in their lives, while simultaneously outlining the relative priorities for government action (from the need for national legislation to the establishment of municipal energy efficiency programs).

Four main priority sectors were identified based on the estimated potential for energy saving per average participant:

- Residential Sector
- Commercial and Public Services
- Industry Sector
- Transportation Sector

In 2006, these four sectors consumed 96.5 percent of the whole energy in the State (see Figure 3.1.2).

5.4 ECONOMICS OF ENERGY EFFICIENCY IN MACEDONIA

5.4.1 ECONOMIC POTENTIAL OF ENERGY EFFICIENCY

Traditionally, professionals in the energy sector have concentrated on creating new energy supplies, new energy generation and transmission systems, new refineries, and pipelines. Energy efficiency at the end-use was left as a low priority. This has been particularly true in Macedonia where there are significant opportunities to reduce the amount of energy required to perform the same tasks; however, there are no studies that examine what energy efficiency could contribute to the economy.

In Macedonia, there are not even any surveys of the market penetration or distribution of energy-using products, which is a necessary starting point for estimating energy savings potential.

Despite these limitations, it is clear from the few domestic experiences and extensive work in neighboring countries that the energy-saving potential is significant and that energy efficiency at the end-use should justifiably be a priority in the energy sector.

5.4.2 RESOURCES FOR IMPLEMENTING ENERGY EFFICIENCY

INVESTMENT

Funding is one of the critical steps in establishing a successful energy program. Staff costs as well as program costs need to be supported, so that the energy efficiency work can become an essential element in Macedonia.

While identifying energy efficiency opportunities is a technical exercise, tapping this potential requires investment resources, which the energy users do not always have. While the present report preparation coincided with a financial crisis year, even in regular years, obtaining financing for EE investments is a challenge.

Even when commercial financing is available at banks, the terms of commercial loans are often unacceptable for lending for EE purposes: EE projects may have longer payback periods, may not be supported with collateral, may be needed by borrowers who are not competent to develop an adequate technical project and application, etc.

Initial funding could come from several different sources, including program revenues (such as fees for building permits, natural gas applications, etc.), possible government surcharges on heating fuels and gasoline, as well as individual contributions and possibly donor sources.

ENERGY EFFICIENCY FUND

To support the energy efficiency work, a designated financing facility specifically for energy efficiency – an Energy Efficiency Fund – will be needed.

Such a Fund will need to finance energy efficiency projects with terms and conditions (including grant funding for market studies, project development, energy auditing, awareness raising, etc.) matched to the techno-economic features of various EE project categories. The fund could be utilized either through direct lending, or on-lending through commercial banks, or could provide guarantees on loans issued by the commercial banks with their own capital.

Fundraising for the Fund would be an ongoing effort, and this should be a high priority for the Government. The Government can use its own sources and other possible opportunities provided by EU, international financial institutions (IFIs), agencies, etc. These could include the European Bank for Reconstruction and Development, World Bank, The European Commission, and other agencies such as USAID, ADA/ADC, and GTZ, to identify possible sources of funds to support energy efficiency initiatives in the country. In addition, the Government will promote the benefits of energy efficiency investments to the financial community at large to facilitate investment by the private sector.

PUBLIC AWARENESS

The level of awareness on energy efficiency and the opportunities and benefits that energy efficiency can bring to the economy is limited to a small cadre of professionals in the country. It will be necessary to expand this group through outreach programs to all levels to inculcate energy efficiency methodologies and practices within key players in the energy sector.

HUMAN RESOURCES

Macedonia is blessed with a small group of dedicated professionals active in the EE arena, and the challenge will be to expand and increase to a critical mass. To this end, the government must make best use of delivery channels for implementation that provide both the opportunity to develop skills and knowledge within the existing business community as well as providing the chance for professional development and business growth in this area.

Countries that have adopted energy efficiency as an overall objective have found that energy efficiency can be implemented relatively quickly and cost effectively. There is also a corresponding increase in business activity and a simultaneous growth in jobs at all levels of the economy. Although energy efficiency activities imply the deployment of new technologies, the technologies are proven and well established and do not require skill sets beyond those normally found in industrial and commercial activities. It is relatively simple and cost-effective to retrain skilled personnel to apply energy efficiency methodologies and practices.

5.5 APPROACHES TO IMPLEMENTATION

Implementation of the Strategy will require a combination of institutional and technical activities that collectively need to ensure implementation in an economically and environmentally sustainable manner.

5.5.1 INSTITUTIONAL SETTING

STRATEGY MANAGEMENT

The development of an SIEE by itself will have little tangible impact on the people or the economy of Macedonia. The role of different segments of society, discussed above in 5.1, and the commitment of those entities and individuals to making change will give value to the Strategy. It is essential that Macedonia's government maintain its lead in promoting the legislation, institutional strengthening, and promotion of energy efficiency activities.

The Governments of countries neighboring Macedonia have succeeded in bringing together various "players" to sit together and agree to the creation of an executive body with responsibility for energy

EE COUNCIL PURPOSES

The proposed activity envisions a Council whose primary purposes would include the following:

- Disseminating information on Council members' and other organizations' activities among the membership
- Identifying and prioritizing barriers to energy efficiency
- Formulating, preparing and promoting recommendations on legislative reforms to encourage energy efficiency
- Raising awareness among appropriate stakeholder groups - especially the public - on energy efficiency issues and activities

Structure:

A two-tiered structure is proposed. The *Council* at large would comprise influential members of a variety of stakeholder groups in the energy and energy efficiency communities. To the extent possible, the Council should include representatives of ministries, large and small private firms (foreign and domestic), donor organizations and their implementers, academic institutions, municipalities, citizens' groups, and electric, heat and water utilities. This breadth will give the Council greater credibility and its recommendations greater weight, ideally making the Council the voice of authority on energy efficiency issues in Macedonia. It will also enhance dissemination of recommendations beyond the Council.

The Council would steer the activities of task-specific *Working Groups*. The objective of this structure is to attract high- and intermediate-level participants to the Council while also providing a mechanism - the Working Groups - to carry out specific tasks on the Council's behalf.

efficiency issues. Informal discussions along the same lines have taken place in Macedonia but no formal protocol has been signed by key actors and concerned parties in the country.

To enhance the participation of stakeholders in SIEE implementation, and to increase transparency, the Government will establish an independent Energy Efficiency Council (observer committee) that would bring together disparate energy efficiency stakeholders, monitor implementation of EE measures and reform progress, identify the needs for intervention and further reform.

Bylaws should determine the scope of work and prerogatives. The power of decisions should lay on the authority of the members, and their professionalism. Services of EEC can be utilized by different sectors Ministries, Government and Parliament, too.

This Observer Committee/Watch Group should be funded through the State Budget, EE Fund, financing institutions donation (WB, USAID, GTZ), or should exist on voluntary basis. This proposal should be later developed with preparation of bylaws/rulebook on duties and prerogatives of this group, as well as its coordination mechanism/entity. The group need not be established immediately with the Strategy launch, but can be established later, within a certain period after the EE strategy has entered into force. Experiences from other similar groups in the other sectors/countries can be used.

PARTNERSHIP/ADVOCACY

The consensus is that one of the most significant areas for action and the sector that may have the greatest incentive to introduce energy savings is households. Therefore, a lot of attention will be given to the prospects and possible arrangements for municipal and residential energy efficiency activities, including targeted assistance for low income households. As an antecedent to these programs there should be broad efforts directed at **education, awareness building, and consumer advocacy** promoting the importance of, and opportunities for, energy efficiency. Existing non-governmental organizations could make effective contributions in this regard.

5.5.2 LOW-INCOME ASSISTANCE

With energy already constituting the largest expense after food for a large segment of inhabitants, the higher energy prices will cause further hardship for poor families. Both to minimize problems with restructuring and to build a meaningful social safety net for the poor, many countries have established programs that address the impact of high cost of energy on the poor.

The three major types of low-income energy interventions are assistance payments, social block-tariffs and energy-efficiency programs.

Assistance payments are cash payments provided directly to poor families or to their energy suppliers in order to reduce the size of the energy bills. The main advantage of this approach is that it provides immediate tangible relief to households. The main disadvantage is that the payments and the administration of the program are expensive for the government. Another disadvantage is that recipients may have little incentive to conserve energy if payments are seen as going directly to the energy suppliers.

Social block-tariffs allow users of small amounts of energy to pay a low unit price for it. The low price is provided through a cross-subsidy consisting of higher prices for users of a large amount of energy. The main advantage of social tariffs is that they are easy to set up and administer.

Introduction of block tariffs for electricity will be used to help to the vulnerable families to cope with permanent increasing of electricity price. Experiences with block-tariffs as an appropriate EE measure, shows significant results, too. The end users of electrical energy will be provoked to reduce their monthly electricity consumption, with intention to keep lower level of existing tariff. This will be realized with purchasing of more efficient home appliances (labeled as class A), the use efficient

lighting, implementation of solar systems for hot water preparation etc. The Government will determine the number of tariff blocks.
The 2010 State budget anticipates 2,5 M€ dedicated as social support to vulnerable families to cope with energy poverty.

A low-income EE program seeks to lower poor families' energy bills by installing basic low-cost EE measures in their homes. The program should provide free of charge such basic measures as caulking or weather-stripping of window and door frames, installation of radiator (foil) heat reflector shields, thermostatic radiator valves and heat cost allocators or meters for district heat consumers, and compact fluorescent lamps. This kind of energy efficiency improvement can be more cost effective and beneficial than perpetual subsidies.

Of the different legitimate approaches to helping low-income households with their energy costs, EE programs are superior to fuel assistance payment programs because they only need to be provided to a household one time and thus reduce or eliminate the need for fuel assistance payments; they improve comfort as well as energy efficiency; and by reducing energy bills they free up money for low-income families to use on other needs.

Given the high poverty rate in Macedonia, a low-income energy efficiency program cannot be expected to serve all eligible low-income families in a single year. Thus, to work with a manageable social scale, the most vulnerable families will need to be ranked for priority intervention: these could be the families receiving the bulk of the energy efficiency assistance in a given year. Alternatively, the state focus may be targeted to the most vulnerable groups of the society, such as the elderly and families with children. Once a decision is made by the Macedonian Government, a low-income energy efficiency program will need to be designed in coordination with the social authorities.

6. BARRIERS AND RECOMMENDED REMEDIES

Barriers that may prevent individuals and businesses from taking up the energy efficiency opportunities set forth in the present Strategy include but are not limited to the following:

- Behavioral and Organizational Barriers
- Financial Barriers
- Legal-Regulatory and Political Barriers
- Ownership structure in buildings / Split Incentives; and
- Technical Barriers

6.1. Behavioural and Organisational Barriers

Organizational barriers are primarily linked to the potential *lack of institutional capacity among the key implementing partners and stakeholders of the Strategy*. The present institutional capacity responsible for energy efficiency measures development, promotion, monitoring, evaluation and reporting in the Republic of Macedonia is week. The limited personnel of the Department of Energy within the Ministry of Economy, coupled with the limited staff of the Energy Agency do not possess sufficient capacity to duly implement the present Strategy and respective action plan in the proposed timeframe. **To address this barrier the capacity of the responsible institution(s) should be strengthened with people, capacity building and toolkits for implementation of tasks, which should be clearly delegated for implementation to EA/agencies/ministries.**

Another potential threat to the effective utilization of policy and programmatic recommendation is the *lack of coordination between the responsible institutions* (Ministries and Agencies) and stakeholders can postpone or even suspend the realization of energy efficiency programs. Should this mis-coordination undermine the support necessary for the implementation of the strategy, this could produce unexpected administrative constraints in the whole vertical hierarchy system of decisions.

This barrier can be remedied by establishment of a coordination scheme for an effective inter-agency cooperation in design and implementation of strategic actions.

Other threats include the absence of municipal energy efficiency planning framework can stop realization of the energy efficiency policy.

Lack of information, awareness and knowledge: In many cases insufficient awareness and resistance to change slow down the progress in infiltration of high efficiency solutions. Individuals and firms are not always able to make effective decisions involving complex and uncertain outcomes. Indeed, when faced with complexity, uncertainty or risk, the full understanding of which would require significant investments of time and energy, individuals and firms may adopt simple decision rules that lead to satisficing rather than optimising behaviour.

The lack of information and training on the latest technologies and their economic and financial impact on the rate of return from investment, combined in some cases with an aversion to the risk associated with early adoption of new technologies and techniques, can encourage investors such as banks to continue supporting outdated technology even when they are not the most efficient or offering the best return.

Experience shows that the traditional intermediaries, in particular banks, are often reluctant to support energy-efficiency projects due to limited information about the expected cash flows, technical performance and real risks.

Consumers are often unaware of the benefits of energy efficiency and conservation and how to realise them. Adverse selection can also happen under circumstances when goods with the worst characteristics end up dominating the market. It can occur if sellers are better informed than buyers about a product's energy efficiency. If sellers exploit this information asymmetry by promoting their

products as energy efficient when they are not, consumers may discount any energy efficiency claims in purchasing decisions, making it difficult for suppliers to differentiate efficient goods. This can lead to an under-supply of energy efficient goods. This is another barrier which can be eliminated by state-lead appliance labeling program.

Education and awareness-raising programmes, including labelling schemes, are designed to help overcome this. Such programs should be customized to different user groups, as well as financiers and decision-makers.

The opening up of markets has had a positive effect on energy efficiency. There are not enough companies that supply efficiency solutions and that are getting paid by the energy savings ('ESCO'). These companies still need policy support in the form of help for the dissemination of their activities, quality standards, and access to finance, as they are still in their infancy stage.

The market for professional energy audits' and energy services' will be promoted to open access to competent advice on energy efficiency improvements, facilitating optimal decision-making. Sector-specific consumer awareness campaigns, training programs for EE professionals and financiers, and other related programs (e.g. appliance labeling) can help eliminate this barrier.

The level of unemployment and energy poverty in the society will strongly affect the realization of energy efficiency strategy at whole. That is why there is need for **low-income energy efficiency programs, facilitating EE investments in vulnerable households.**

The below table summarizes the key remedies to the common expected behavioural and organizational barriers.

Table 6.1. Key Behavioural and Organization Barriers and Remedies

Barriers	Remedies
Lack of institutional capacity:	Capacity strengthening with tools and staff
Lack of coordination between the responsible institutions:	coordination scheme for an effective inter-agency cooperation
Absence of municipal energy efficiency planning:	capacity strengthening, localization of national strategy
Lack of knowledge on contemporary EE solutions for investment decision-making:	Awareness campaigns, training, promotion of energy efficiency services and professional energy audits' market. Labeling and Awareness programs for financiers, consumers, businesses, etc
Unemployment and energy poverty	Low-income energy efficiency programs

6.2. Financial Barriers

A crucial step for implementation of the national strategy is the localization of the national measures to the community scale with specification of municipal authorities, entities, local consumer groups and financing schemes (national or local).

Failure to create a designated financing facility specifically for energy efficiency may hamper the uptake of the energy efficiency measures by the market/consumers. The unadvertised energy efficiency measures need illustration through designated financing, which will gradually lead to introduction of commercial capital to this economically attractive financial products' market.

Establishment of the Energy Efficiency Fund shall support energy efficiency investments and programs. It is noteworthy, that while the Government of the Republic of Macedonia shall seek ways to catalyze energy efficiency financing, there will also be other lending instruments

launched by the IFIs on the national and regional level, which would supply investment capital for cost-effective energy efficiency measures.

Access to capital – Some consumers struggle to meet the initial costs of energy efficiency measures even though they are cost effective over time. This applies particularly to low income households who might find it difficult to finance the initial higher cost of more efficient appliances and other energy efficiency improvements.

Incentive programmes such as discounted products, and grants and loans can help overcome this. Low-income energy efficiency programs will alleviate investment burden on vulnerable households while mitigating the need for utility subsidies.

Another option would be providing dedicated loans (*The European Investment Bank*, EBRD) where the funds are subsequently redistributed via an intermediary financial institution through on-lending with more technical and economic expertise in the field of energy efficiency, or using technical outsources.

Another opportunity is utilizing the financing models based on shared savings, such as Third-party Financing and Performance Contracting.

Weak price signals – The rising energy prices are a strong incentive for energy efficiency programs. Subsidies in this field are counter-productive.

The energy vouchers (social help for no/low-income persons) may slow down realization of energy efficiency programs.

Energy pricing does not yet fully reflect the environmental and economic cost of energy production and consumption. The current pricing system for energy products does not create incentives for resource conservation and rational energy use. The current pricing system does not guarantee that external costs are included. Instead of an energy efficiency incentive, the current prices have been sending a market signal for wasteful consumption. **A political resolution to this barrier is the remedy to establishing cost-recovery pricing, which, coupled with incentive programmes, can help overcome this barrier.**

Transactions Costs[22] - In the context of energy efficiency, the costs of obtaining and interpreting information can be particularly problematic in sectors where energy is a small part of the overall budget and items are purchased primarily for attributes other than their energy characteristics. For example, when purchasing a TV consumers may be more interested in the quality and size of the picture and the look and features of the appliance rather than in the standby power consumption. **Appliance labeling will help eliminate this barrier facilitating consumer choices.**

Transparent energy billing - There is lack of effort to allow for consumers to understand the true cost of their energy consumption. This barrier is further reinforced by the above barriers triggered by the weak price signals. **–A real-time metering system and consumption-based billing could bring down consumption.**

6.3. Legal-Regulatory and Policy Barriers

A number of legislative hurdles remain slowing down promotion of energy efficiency. These include but are not limited to incomplete reform in standards and labeling field, missing efficiency requirements for public procurement, complicated bureaucracy for import of EE Products, etc.

Faster harmonization of Macedonian laws with EU legislation is necessary for faster transposition of EU Directives for the energy efficiency sector. Realization of foreseen measures depends to necessary amendments of existing, and preparation of new Laws. These will also require amendment of existing

[22] Transactions costs include the costs of obtaining and interpreting information as well as any costs associated with implementing energy efficiency opportunities including the costs of negotiating, implementing and enforcing contracts

bylaws with rules, recommendations and standards compliant with EU Directives addressing energy efficiency.

It would be appropriate to amend the legislation with a mandatory (recommended) precondition for realization of "green" (efficient) procurement giving preference to energy efficient appliances labeled as class "A", new low fuel consumption cars, energy efficient technologies, etc.

Simplifying the paperwork and administrative workload will help the import of EE equipment. If possible, incentives should also be provided for local manufacturing of EE products.

It is necessary to harmonize inter-ministerial acts and necessary documentation, which is slowing realization of energy efficiency programs.

Similarly, the absence of appropriate tax stimulation is delaying realization of proposed measures for high efficient equipment investment and application of other energy efficiency measures.

6.4. Ownership structure in buildings/Split Incentives

Landlords who are responsible for paying for building improvements may not directly get the benefits, such as lower energy bills or increased comfort. Likewise, tenants may not want to invest in improving homes or buildings that they don't own or may not occupy for long periods.

Incentive programmes, such as assistance to landlords to insulate properties and the setting of minimum standards, can help overcome this.

6.5. Technical Barriers

Lack of standardisation of energy-using equipment and components can also make it more difficult for new energy efficient technologies to have a rapid impact on the market.

Audits are not developed in industry, nor in building sector. Their introduction should be made mandatory, particularly for larger energy users. Audit schemes are a practical way of informing consumers about the possible actions to improve energy efficiency.

Energy audits should be partially funded (subsidized) by public agencies or by utilities to encourage participation until the awareness of the benefits of energy audits is adequate to establish a healthy energy auditing market.

Table 6.2. Summary of Other Barriers and Remedies

Barriers	Remedies
Lack of Financing/ Access to capital:	Incentive programs, grants, loans, Low-income EE programs , third-party financing, performance contracting, EE Fund
Pending legal hurdles	Accelerate reform and harmonization (standards, labeling, EE in public procurement, import of EE products, etc)
Ownership structure in building sector/ split incentives	Incentive programs for landlords, minimum EE maintenance standards
Lack of EE standards, energy auditing practices	Temporarily and partially subsidizing energy audits to push the energy services marker
Weak price signals	Cost-recovery energy pricing with built-in EE incentives, elimination of (cross)subsidies
Non-transparent billing	Real-time metering and consumption-based billing to create incentives for conservation
Cost of obtaining and interpreting info	Appliance labeling , facilitating consumer choice

7. PRIORITY INTERVENTIONS IN MAJOR END-USE SECTORS

7.1. STRATEGY OBJECTIVE

The objective of the SIEE is to develop a framework for accelerating adoption of energy efficiency practices in a sustainable fashion through implementation of a series of programs and initiatives that are linked to creating reduction of import dependence, energy intensity, the non-productive use of electricity, preparing a good climate to maximize the involvement of and opportunities for the private sector complementary advocacy, and training activities.

The final result of achieving this objective will be realization of over 9 percent energy savings till 2018, comparing to average consumption in the observed 5 years period (2002-2006), with continued promotion of energy efficiency and monitoring and verification until 2020. This is an important task for RM in the way to sustainable development of the country's economy, and to fulfill commitments in the way of EU accession and will serve as the first control point in the realization of the predicted measures.

With the Second NEEAP (2018-2020) the Macedonian Government will develop additional measures to reach 14,5% savings in 2020, which means that the Republic of Macedonia will approach to the EU target in 2020 to achieve savings of 20%.

The objective of the elements incorporated into the SIEE is to stimulate a progressive transformation of the market. The development of an adequate policy framework is intended to stimulate the demand for more energy efficient technologies and services. As that demand grows it should encourage the formation of ESCOs and companies that provide more efficient equipment and accompanying maintenance.

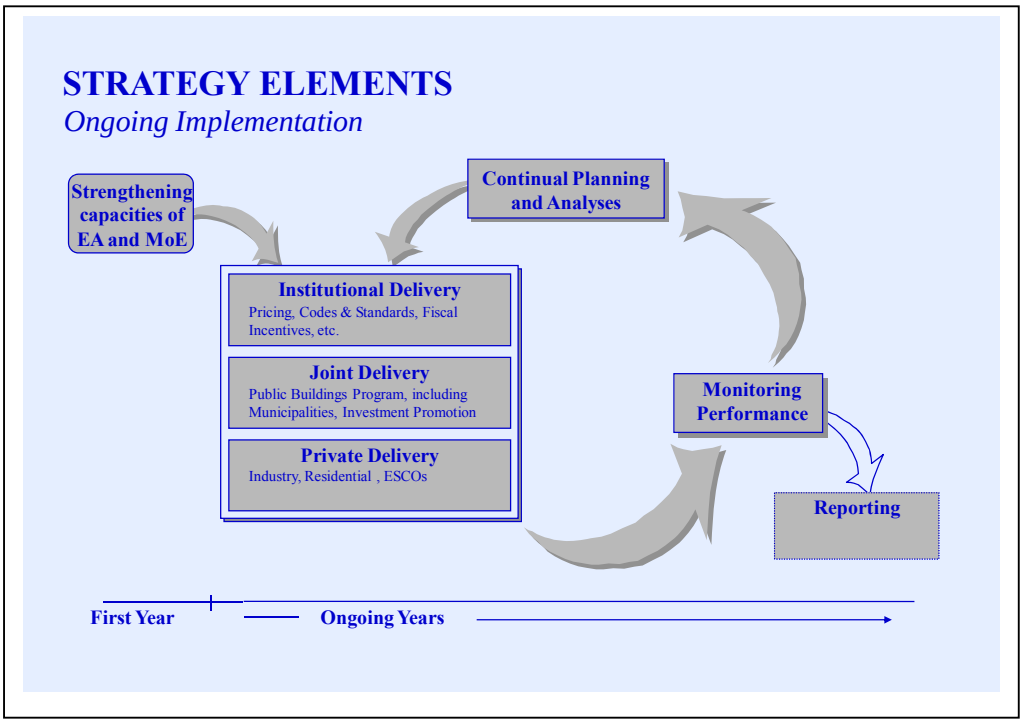
7.2 STRATEGY ELEMENTS

The diagram below illustrates the ongoing and iterative process that will govern the execution of this SIEE. This diagram and this strategy pivot on the establishment of a small but capable DI.

Essentially, once the responsibility for energy management concerns is delegated and organization is mandated and staffed, it will be possible to refine and focus a series of concrete actions. Once an entity (MoE, EA, EE Fund) is established, that office will then collect, collate, and analyze data periodically to help orient the implementation.

The first initiatives presented in this Strategy outline programs and technical interventions that will be applied where they are deemed to be most cost-effective. Subsequent monitoring of performance will provide the feedback for revision and retargeting in order to optimize the limited resources that will be available for energy efficiency initiatives.

This "market conditioning" requires training and capacity building at all levels. All players, from the staff at the DI, to legislators, to municipal and industry managers, bankers, and NGOs, require exposure to new sets of concepts and skills. Effective outreach and awareness campaigns will support the changing consciousness that is necessary for the gradual but essential market transformation processes to start.



7.3 STRATEGY TIMELINE

7.3.1. PHASES OF STRATEGY IMPLEMENTATION

Phase 1: 2010-2012

Given the uncertainty surrounding the economy and the current status of the institutional framework, the first phase of the SIEE is the phase of adoption and partial realization, and will last until the end of 2012.

Harmonization with EU legislation, institutional framework gaps that have been addressed, as well as secondary legislation preparation, should be realized in this period.

Prior in-country experience indicates there are financially viable energy efficiency activities that will be implemented within this time frame. These activities are described in the NEEAP. It will also allow for the necessary monitoring and evaluation process to be established, which in turn will allow for new activities to be identified, developed, and designed.

Phase 2:2013- 2018

The activities that are implemented in the first phase will provide source materials and help create the necessary foundation for further implementation during the second phase of the Strategy. In parallel with these activities will be actions that will be used to prepare the ground for sustainable activities in Phase 3.

During this period the targets for 2012 within the NEEAP shall be realized. Necessary updating of the expected results for this phase 2 will be performed.

Updating of the strategy, concerning achieved results and fulfillment of the assumed measures will also be realized.

Additional estimation of electricity market liberalization influence to fostering of EE measures introduction and economical justification will be prepared.

Phase 3: "Aim" toward 2019-2020

The ongoing assessment and evaluation initiated in Phase 1 and applied in Phase 2 will lead to a sustainable approach in which "priority" areas will be reconsidered according to the new conditions of the Country and Europe.

New Action Plan for the period 2018-2020 will be prepared.

7.3.2. CHALLENGES

For the best implementation of the Strategy, a number of existing challenges have to be overcome. Previous experience showed that the following challenges have to be addressed in priority order:

- Existing institutional settings do not favor planning and implementation of Sustainable Consumption and Production (SCP). Better coordination is needed among the various institutions responsible for environmental protection and the sector's policies. It is essential to improve the institutional capacity to achieve more sustainable production and consumption.
- There is room for dramatic improvement in environmental management in enterprises. It is an imperative that if environmental legislation is tightened and enforcement start getting stricter, improvements in industry will occur.
- Integrating a sector's policies and environmental concerns is still a distant goal. For example, spatial planning and municipal management are still not well coordinated with environmental and SCP considerations, although they could be used to have an effect on energy supply, building, transport, and waste management.
- Some policy tools for SCP are in place but in a piecemeal fashion. Various relevant strategies and programs (e.g. energy efficiency programs, waste strategies, etc.) have been established, but their implementation still has to follow. Policy action should build SCP considerations into these strategies and programs.
- Despite their effectiveness, limited economic incentives and technical tools are in place to stimulate government, businesses, and private consumers to reduce the environmental pressures they exert implementing EE measures. Policy tools already exist in many sectors to promote energy efficiency, public transport, or waste recycling. More effort will be needed to support implementation.
- Consumer behavior is one of the crucial factors for SCP, and more efforts must be made to raise public awareness of the potential economic gains from more SCP. Information should be provided (e.g. labeling) which will enable consumers to make informed choices and to influence governmental policies.

7.4 IMPLEMENTATION

According to Macedonian legislation, the country's government is responsible for approving the SIEE: "The Government of the Republic of Macedonia shall make the policy on energy efficiency and renewable energy resources utilization. The energy efficiency policy shall be determined by the SIEE[23]".

[23] Art. 121 – Draft of Macedonia's Energy Law (January 2010)

The process of implementation has to involve a lot of stakeholders and the coordination of their good or bad actions will affect Strategy's results. Figure 7.4.1 shows the different actors in this play and their roles in implementation process.

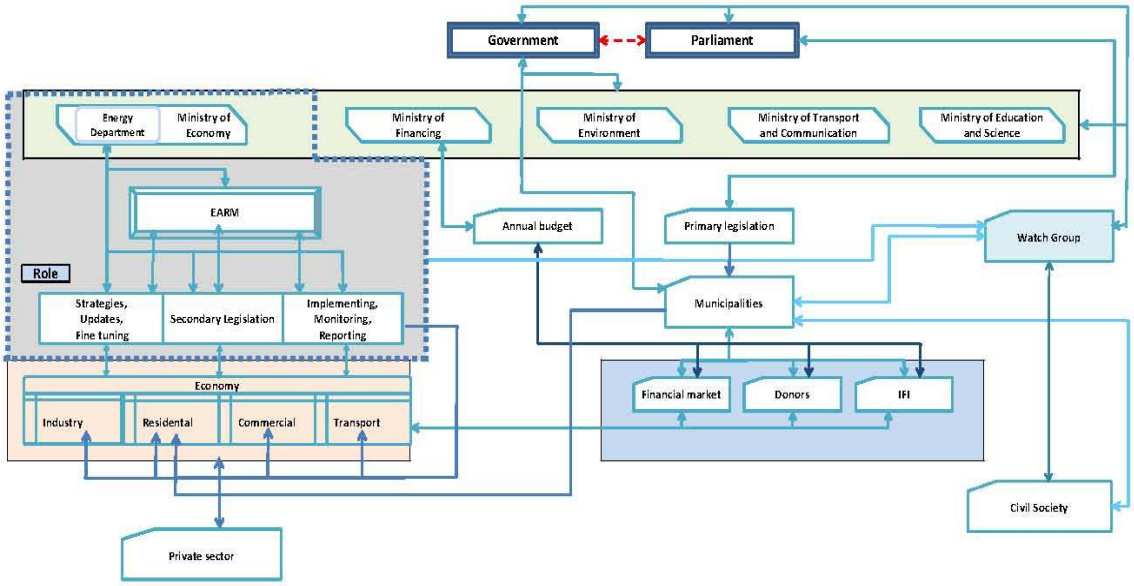


Figure 7.4.1. Actors and their roles in implementation process

The Government – as mentioned above – approves the proposed strategy that was previously discussed publicly. Given the potential impact on all economic sectors, all ministries are interested in the implementation and outcomes of the Strategy. However, for a better coordination and appropriate monitoring, one responsible entity has to be designated. According to the Energy Efficiency Strategy of 2004, this entity was the Energy Efficiency Agency, as part of the Ministry of Economy. After adoption of the Energy Efficiency Strategy by the Government in 2004, the Energy Agency of the Republic of Macedonia was established by adoption of the Law of establishing of the Energy Agency of the Republic of Macedonia in 2005. This entity is envisaged to cooperate, with respect to the Energy Law – especially in data gathering for monitoring – with the Ministry of Economy's Energy Department (which establishes the strategy for energy sector development), and the other ministries. The support mechanisms which involve an appeal to the annual budget managed by the Ministry of Finance play an essential role for the successful implementation of the Strategy.

The Strategy defined a number of legislative initiatives that have to be carried out by the Parliament (for primary legislation). Other agencies such as the Energy Regulatory Commission and Energy Agency will issue specific pieces of secondary legislation.

The local authorities will also play an important role in strategy's implementation, especially in application of residential domain's measures. This important but new role will impose a strengthening of the mayors' offices dealing with new buildings plans approval and energy issues in general.

The **civil society** has three essential roles in this respect: (i) provides input, comments, and suggestions when the document is analyzed prior to its implementation, (ii) participates in its implementation, and (iii) benefits from the results of appropriate application of its provisions.

Even if the actions proposed by the strategy and listed in the National Action Plan have big benefits they could be implemented only with substantial financial efforts. In this respect, the private sector, in cooperation with the financial market, has a key role. The well-known fact is that energy efficiency measures can increase private companies' competitiveness on local and international markets, serving as a normal stimulus for implementation of energy efficiency measures.

Similarly, actions at the Government level need financial resources, too. These could be channeled from annual budget funds directly through ministries or from local budgets. In order to boost the policy directions laid out in the energy strategy, the EE strategy proposes an Energy Efficiency Fund. This Fund will put together resources from central budget and donors contributions. There are good experiences obtained in other Balkan countries, including Bulgaria and Romania, which used IFI's money to lend to implement energy efficiency projects in private sector, which had energy savings and reduced greenhouse gases emissions.

8. OUTCOMES

The Strategy for Energy Development of the Republic of Macedonia until 2030 outcomes show the trend of energy consumption in the State, which have to be provided to the consumers.

The difference between the two scenarios is not significant, but reasonable (see Figure 2.6.1 Final Energy Needs in accordance with the Strategy for Energy Development).

Both scenarios envisaged, more or less, measures for energy efficiency – on energy generation and on end-use side. They are not explicitly determined to provide a clear picture of their influence on final results.

The results of the simulations for the four main sectors provide information on the impact and outcomes of the energy efficiency measures proposed, independent of the future energy consumption in the State. The benchmark suggested in the Directive 2006/32/EC is to reach at least 9 percent national indicative annual energy savings target till 2018 equal to 147 ktoe, compared to the baseline – average consumption in the five-year period 2002-2006 which is equal to 1636 ktoe is overmatched.

Expected savings are 12,21 percent compared to average 5 years period consumption. This result is produced by entering into production of 2 CHP in 2009 and 2010.

Naturally, different sectors participate with different ratios in realization of savings. The industry sector is the most prominent. The sector of transport is very promising, but there is a strong correlation with a huge investment for road fleet renovation.

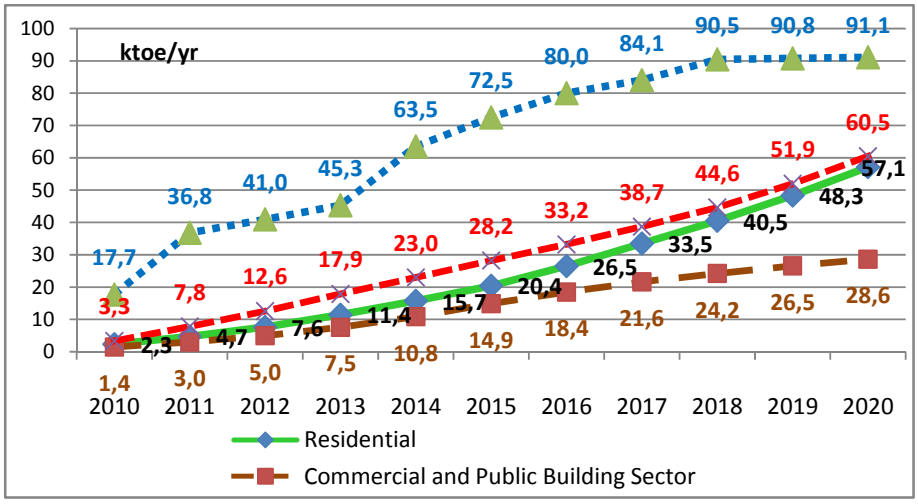


Figure 8.1 Estimated Sectoral Energy Savings (ktoe per year)

The simulations and analysis were conducted in a very cautions and prudent manner, considering the current complicated economic conditions and associated consequences.

Fulfilling all of the proposed measures is a necessity, but the priorities will be determined in accordance with financial capacity of the government and private sector. Implementation of the proposed measures is cost-effective but not always self-enforcing.

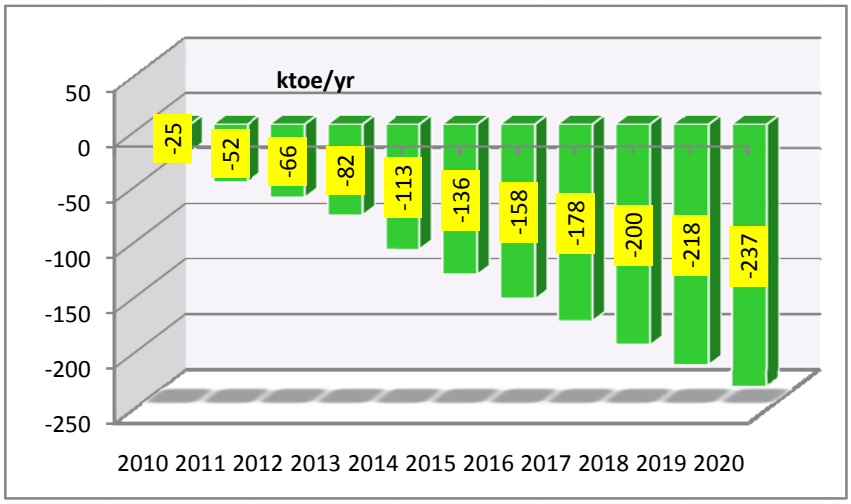


Figure 8.2 Energy savings with targeted scenario, reaching target in 2018

The very first milestone is the year 2012. The penetration rate of the proposed measures must be controlled, as they are reached, and it must be determined if the society has enough power (financial, political, intellectual, technical, willingness) and is moving forward faster, or it is necessary to update existing results and to adapt to the new situation.

Preparing for accession into the EU in the period leading to 2018 will be a strong impetus for the national economy, reflected in the sector of EE. With technical and financial support from EU members, Macedonia will be capable to fulfill all requirements prescribed in the *acquis* and Directives.

The final objective of the SIEE shall be achieved if the country produces over 9 percent energy savings till 2018, compared to the average consumption in the observed five-year period (2002-2006). This is an important task for RM in the way to sustainable development of the country's economy, and to fulfillment of commitments on its way of EU accession. The initiatives will be targeted at areas and measures with highest technical-economic cost-effectiveness and most attractive return on investments.

Tables 8.1, 8.2, 8.3, 8.4 and 8.5 below demonstrate the economic features of the energy savings by sectors.

Table 8.1. Breakdown of Annual Cumulative Energy Savings by Sectors (ktoe/yr)

Savings ktoe/yr	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Residential	2,33	4,71	7,63	11,44	15,74	20,42	26,52	33,49	40,51	48,32	57,14
Commercial and Public Building Sector	1,45	2,98	4,96	7,53	10,83	14,85	18,43	21,62	24,19	26,54	28,60
Industry sector	17,7	36,8	40,96	45,32	63,53	72,49	80	84,06	90,45	90,76	91,09
Transport Sector	3,31	7,79	12,55	17,86	22,99	28,21	33,20	38,70	44,63	51,94	60,48
Total	**24,79**	**52,29**	**66,10**	**82,15**	**113,09**	**135,97**	**158,16**	**177,87**	**199,78**	**217,56**	**237,31**

Table 8.2. Annual penetration of financial investments by the sectors in million Euro (M €/yr)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	11,1	11,6	12,4	17,2	18,9	19,6	26,2	31,8	34,5	43,9	52,4
Commercial and Public Building Sector	6,79	7,84	8,86	10,13	12,32	14,49	12,79	11,83	10,06	9,97	9,03
Industry sector	23,7	3,7	5,8	20	7	3	2	3,2	5,5	0	0
Transport Sector	7	18	24	4,5	1	0	0	0	0	0	0
Sum	**48,6**	**41,1**	**51,1**	**51,8**	**39,2**	**37,1**	**41,0**	**46,9**	**50,0**	**53,8**	**61,4**

Table 8.3. Cumulative financial investments by the sectors in million Euro (M €/yr)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	11,14	22,74	35,15	52,35	71,23	90,81	116,99	148,82	183,28	227,16	279,56
Commercial and Public Building Sector	6,8	14,6	23,5	33,6	45,9	60,4	73,2	85,0	95,1	105,1	114,1
Industry sector	23,7	27,4	33,2	53,2	60,2	63,2	65,2	68,4	73,9	0,0	0,0
Transport Sector	7,0	25,0	49,0	53,5	54,5	0	0	0	0	0	0

Table 8.4. Annual penetration of financial savings by sectors (M €/yr)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	1,34	2,71	4,34	6,49	8,87	11,43	14,75	18,50	22,55	27,40	33,04
Commercial and Public Building Sector	1,11	2,34	3,90	5,91	8,49	11,63	14,15	16,46	18,41	20,22	21,85
Industry sector	15,21	31,62	35,20	38,94	54,59	62,29	68,74	72,23	77,72	77,99	78,27
Transport Sector	3,23	7,61	12,26	17,45	22,46	27,56	32,43	37,80	43,60	50,74	59,08
Sum	20,9	44,3	55,7	68,8	94,4	112,9	130,1	145,0	162,3	176,3	192,2

Table 8.5. Cumulative financial savings by sectors (M €/yr)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential	1,34	4,05	8,39	14,87	23,75	35,17	49,93	68,43	90,98	118,38	151,41
Commercial and Public Building Sector	1,11	3,45	7,35	13,26	21,75	33,37	47,53	63,98	82,39	102,61	124,46
Industry sector	15,21	46,83	82,02	120,97	175,56	237,84	306,58	378,81	456,53	534,52	612,79
Transport Sector	3,23	10,85	23,11	40,56	63,02	90,58	123,01	160,82	204,41	255,15	314,23
Sum	**21**	**65**	**121**	**190**	**284**	**397**	**527**	**672**	**834**	**1011**	**1203**

The average **simple payback period** for the investments in the Residential sector is 8,3 years under current energy prices, but it will only be 4,1 years if taking in to account liberalized electricity market prices after 2015; in the Commercial and Public Building Sector – 6,2 years (taken in account all measures envisaged until 2020) and 3,37 years under LMP conditions; in Industry 0,67 – 5,34 years and Transport –4,1 – 5,1 respectively, both become twice shorter under LMP for electricity.

In each of the sectors the wide range of proposed measures has various economic viability features, ranging from very attractive with quick payback to such measures which require more than a decade to repay. In the transport sector, for example, the bulk of investments will be needed for the new buses fleet where the bus ticket price is not created depending to market principles. The Government is considering subsidizing at least partially the ticket prices, because transport is a viable public service and can be significant environmental polluter.

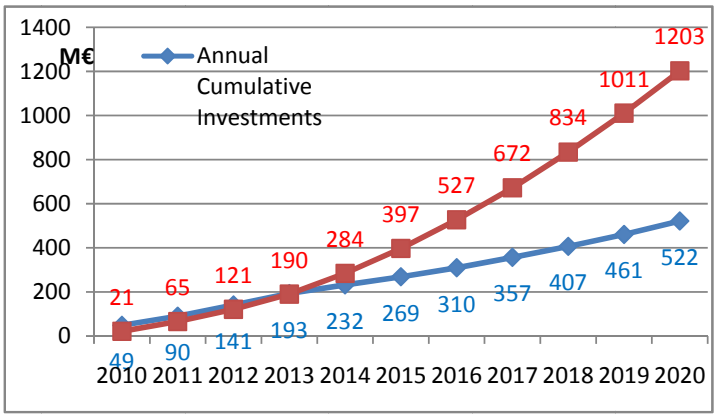


Figure 8.3 Expected financial figures obtained with the Strategy

Predicted measures, with assumed penetration ratio, will ensure financially viable energy efficiency strategy, with additional benefits to environmental protection (**Figure 8.4**).

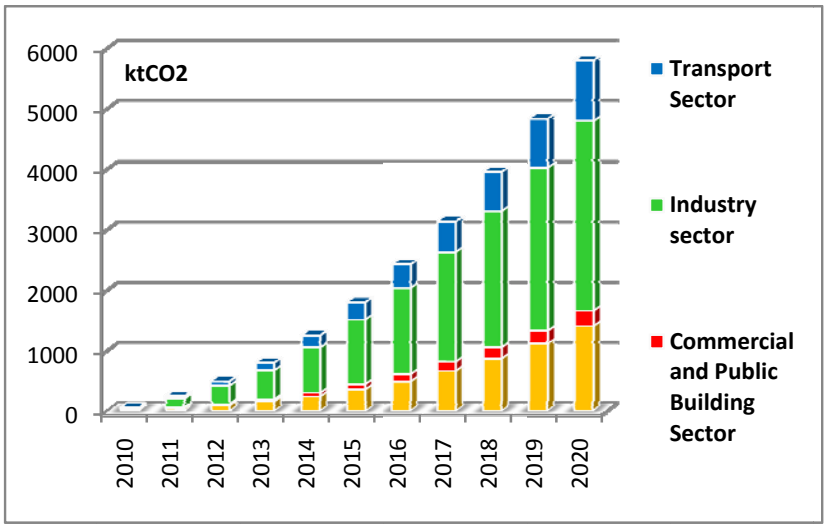


Figure 8.4 Expected reduction of CO_2 equivalent emission

The implementation of the Strategy requires a mixed pool of financing, with the State taking the leading role by financing legal-regulatory reform, design and support of programs, exemplary interventions, capacity building, monitoring and verification, while most of the direct investments will be made by facility owners, such as local governments, businesses and individual households. Donor organizations and international financial institutions, in turn, can substantially facilitate the integration of energy efficiency in the economy through technical assistance, capacity building and training, support in design of programs and policies, knowledge transfer on innovation and success stories, etc. The blend of different financing sources envisaged for the Strategy realization is presented in Tables 8.5 (residential sector) and 8.6. (Commercial and Public services sector).

Table 8.6. Investment responsibility in the residential sector (in € M)

Measure	Investment till 2020 in € M	Investor		Donors/ International Financing Institutions	Private sector
		Government	Municipality		
Heat allocators	3,99				3,99
EE in Social Housing	4,32	2,6		0,9	0,9
EBP certificates	29,78			1,5	28,3
Efficient Woord Furnaces	29,61				29,61
Promotional campaign	3,60	1,44	0,72	1,08	0,36
Boilers for central heating	28,51				28,51
Solar heaters	41,50				41,50
Buildings refurbishment	138,25			41,5	96,8
Total	**279,56**	4,0	0,7	44,9	229,9

Table 8.7. Investment responsibility in the commercial sector (in € M)

Measure	Investment till 2020 in € M	Investor		Donors/ International Financing Institutions	Private sector
		Government	Municipality		
BEP certificates	**36,7**	3,67	3,67	7,34	22,02
Inspections of boilers/air conditioning systems	**0,30**	0,15	0	0	0,15
School Refurbishment	**11,21**	4,48	1,68	3,92	1,12
Information campaigns and Municipal network of EE	**2,70**	1,08	0,81	0,81	0
Energy management	**1,20**	0,12	0,12	0	0,96
Municipal Street lighting	**3,45**	0	2,07	0,34	1,03
Electrical appliance and equipment labelling	**9,09**	1,36	1,36	0,00	6,36
Hospital EE Retrofits	**18,29**	11,89	0,00	6,40	0,00
Solar collectors/GHP	**31,20**	4,68	4,68	0	21,84
Total	**114,13**	**27,43**	**14,39**	**18,82**	**53,48**

The private industry sector will invest 73,9 € M, but in the transport sector most of assumed investments (54,5 € M) will be realized from the State budget and municipalities.

The sectoral breakdown of investment responsibilities for SIEE realization is presented in the Table 8.8.

Table 8.8. Investment responsibility

Sector	Investment till 2020 in € M	Investor		Donors/ International Financing Institutions	Private sector
		Government	Municipality		
Residential	279,56	4	0,7	44,9	229,9
Commercial	114,13	27,43	14,39	18,82	53,48
Industry	73,9				73,9
Transport	54,5	54,5			
Sum	**522,09**	**85,93**	**15,09**	**63,72**	**357,28**

Table 8.9. Sectoral Breakdown of Estimated Investments, Savings, Social and Environmental Benefits of Proposed Energy Saving Measures (cumulative for all years and sectoral measures up to 2020)

Sector	**Investments M €**	**Financial savings M €** (current prices)	**Financial savings M €** (liberalized market prices)	**kt CO_2***	**Social benefit**
Residential	279,56	151,3	311,9	1407	• Living comfort improved • Health improvements • Savings affordability increase • Improved family budget • Energy poverty reduced • Satisfied (happier) citizens
Commercial and Public Building Sector	114,1	124,5	226,03	253	• Product competitiveness increase • Better working conditions • New working places creation
Industry Sector	73,9	612,8	995,1	3130	• Increased corporate responsibility • Product competitiveness increase • New job creation
Transport Sector	54,5	314,2	432	995	• Improved family budget • Health improvements • Traffic safety increased • Improved environmental conditions • Cheaper transportation • More spare time for citizens
Total M €	**522,06**	**1202,8**	**1965,03**	**57,9***	

CONCLUSIONS AND RECOMMENDATIONS

The strategic forecasting of energy development of the Republic of Macedonia is based on the following predefined energy policy objectives with strong correlation with implementation of energy efficiency strategy:

- Adopt secondary legislation prescribed in EU directives to support the implementation of RES and EE projects.
- Ensure sustainable energy utilization with regard to all aspects of environmental protection in line with internal commitments and the country's international obligations.
- Progressively change the energy mix (increasing utilization of natural gas and renewable energy sources for energy production and substitution of electricity).
- Reduce import dependence through investments in research and creation of new energy sources (focusing on utilization of solar, geothermal energy, and waste biomass in rural settlements) and other energy infrastructures.
- Stimulate structural changes in the industry, favoring less energy intensive industries and SMEs.
- Improve EE on the demand side through targeted programs, education, training and awareness-raising.
- Introduce a market price for energy (rationalization of energy prices) which will improve the operational condition of the energy producers and will provide significant motivation for energy savings.
- Enhance the existing and introduce more incentives for EE.
- Promote a sustainable energy financing facility and encourage EE projects to make use of it.
- Support research, development, and promotion of new, clean technologies and efficient energy technologies, and follow energy efficiency policy on professional and scientific bases.
- Host as many as possible CDM projects and identify and promote as many as possible programmatic CDM projects.
- Monitor and assess the climate change vulnerability (particularly health impacts) and undertake appropriate adaptation measures.

The support mechanisms discussed in the SIEE, which can help to reach these objectives, are as follows

1. Developing and generating an Energy Efficiency Fund
2. Adopting rules for enforcement of Building Energy Codes
3. Establishing a system for mandatory Energy Audits for technical designs, buildings, and industrial processes
4. Performing well organized promotional campaigns to aware consumers to possibilities to adopt technical measures
5. Introducing mandatory requirements, for governmental and municipal public procurements of goods, that equipment with label "A" (the most efficient) is an asset.

The most influencing factors in constructing the hierarchy of activities were that electricity represents over 33.7 percent of the commercial energy used in the economy, elasticity for demand for electricity is less than for transport fuels (39 percent oil products), and the building sector (residential and commercial) is the largest (more than 42 percent) and most rapidly growing consumer of electricity.

Electricity, although mostly domestically produced, faces increasing supply constraints: expanded consumption and older equipment in power plants which have to be provided as import. Electricity payments represent a significant burden to poorer and especially unemployed households.

The existing lack of human and financial resources necessitates the creation of an stronger entity (EA) that will assume the role of focusing and coordinating research, programs, and activities. Government and donor funding must be sought.

Other programs to address the commercial and industrial consumers will also require the pricing and fiscal incentives to motivate private sector action.

The measures that the Government of RM is committed to implement in order to improve the energy efficiency of Macedonian economy and reduce the country's import dependence that are described in this document have been proven successful many times over in other EU countries, and can be successfully implemented in Macedonia. The Government will have to designate an appropriate entity to implement this strategy. This EA/entity would need to develop its own list of potential energy efficiency interventions depending to the financial resources and Action Plans of the Municipalities.

Prioritization of the various Technical Programs and the conservative assumptions will result, within the scope of this SIEE, in an overall energy saving equal to 14.5 percent of the average consumption (2002-2006) and 9.52 percent of total national consumption in 2020.

To provide at-a-glance ranking of the proposed measures based on their financial performance and

associated social benefits in the buildings sector is provided in the below table.

Program/measure	The specific price of investment M € /ktoe	Social benefit
Overall measure		
Energy statistic		Very important
Residential sector:		
Promotional/info campaign	0,267*	Important for the first stage
New buildings (heating, solar systems, new appliances, lighting)- certification, energy codes	3,16	Effective in the later phase
Social housing	4,62	Very important
Allocators for DH	2,561	Important
EE Building retrofit	7,26	Important, big potential
Commercial and public building sector		
Information campaigns and municipal EE network	1,25*	Very important during whole period of realization, affecting large number of stakeholders
Inspections of boilers/air conditioning systems	0,27*	Appreciably addressing local pollution
Energy management and Corporate social responsibility	0,08*	Important; influencing behavior
Building energy performances improving-certificates	3,8	Important

* For the whole period 2010-2020

The situation in the Industry sector differs from others. The ranking in that sector would depend the level of investments, form of energy savings (energy type – electricity, liquid fuel, natural gas), and the amount of saved energy. A comprehensive analysis of all factors proposes the following ranking of the most attractive programs/measures in the Industry and Transport sectors:

Industry:

1. High efficiency CHP
2. Improvement of process performances and Energy Auditing
3. Smart drives
4. Waste heat utilization
5. CDM Projects

Transport:

1. Introduction of integrated traffic management center
2. Promotion of greater use of railway for intercity travel
3. Renewal of the national road vehicle fleet

Each program or activity will involve a set of actors and actions designed to achieve a focused series of results. It is assumed in all cases that the EA will have either a direct role in a program or a role in identifying other actors. In most cases it will be the government-mandated executing entity that will direct, guide, finance, and support the broad range of potential initiatives and implementers. Many individuals in Macedonia have good ideas regarding energy efficiency actions the country might pursue. Leadership from the EA and strong involvement of non-governmental and citizen's organizations will be needed in order for successful energy-efficiency programs to materialize and be effective.

Steps foreseen:

- Facilitate public–private partnerships to attract funding for enterprises offering energy services
- Encourage the use of EU financing for SMEs to promote eco-innovation solutions

- Consider costs and benefits of tax credits as incentives for energy-efficient goods
- Review the energy tax directive to incorporate better energy efficiency and environmental considerations

ANNEX 1 International Policy and Treaties

Correspondent with chapter 2.3

2.3.1 THE ENERGY CHARTER TREATY

This Treaty establishes a legal framework among the Western European countries for promoting long-term co-operation in the energy field, based on the mutual benefits that would arise from these efforts.

The energy charter highlights the following core objectives:

- Reduction of the adverse environmental impacts of energy with the intention of applying the European Environmental Standards – for the existing (old) energy facilities, the standards may be less strict than the European standards, but for the new energy facilities there shall be no exception; and
- Increasing energy efficiency.

2.3.2 PEEREA – PROTOCOL ON ENERGY EFFICIENCY AND RELATED ENVIRONMENTAL ASPECTS

PEEREA seeks to encourage investment in energy efficiency projects and support the implementation of energy efficiency policies in participating countries such as Macedonia. This protocol, emanating from the Energy Charter Treaty was initiated in 1994 and fully ratified by the Charter members in April 1998. Macedonia is among the more than 50 countries to have signed it.

2.3.3 ENERGY COMMUNITY TREATY

The EU and contracting parties, including Macedonia, committed to improving the environmental situation in relation to gas and electricity, related energy efficiency and renewable energy sources, and considering that, to achieve these aims, a broad-ranging and integrated market regulatory structure needs to be put in place supported by strong institutions and effective supervision, and with the adequate involvement of the private sector.

The South-East European region needed a framework in which it can cooperate on rebuilding its energy networks, ensure the stability vital for investment, and create the conditions in which its economies can be rebuilt effectively. A regional approach to energy security offers significant advantages both in terms of improved utilization of existing supply and production capacities and optimizing future investments. The raison d'être of the Energy Community is to facilitate this process. Ultimately it will also support the integration of the region into the internal energy market of the European Community.

The Energy Community process contributes to the economic regeneration and improvement of quality of life, giving people better opportunities. Further, it contributes to rebuilding trust and cooperation between governments and industries, and fosters stability across Europe. By working closely with their counterparts, the Energy Community stakeholders learn from each other and improve thereby their performance on the ground of the Energy Community Treaty requirements. Through examples of good practice, the stakeholders benefit from the experiences of others.

At its meeting in June 2007, the Permanent High Level Group agreed to the establishment of as Energy Efficiency Task Force (EETF) to produce a detailed plan for tackling energy efficiency issues in the Contracting Parties of the Energy Community (Conclusion 7, 5th PHLG Meeting, 28th June 2007) and the Ministerial Council approved the recommendation in its meeting of June 29, 2007.

The Work Program 2008-2009 of the EETF foresees under Task No. 2, "Preparation of a generic (non-customized) Action Plan to advance energy efficiency in the Contracting Parties."

The Directive 2006/32/EC of the European Parliament and of the Council on Energy end-use efficiency and energy services (ESD) requires EU Members States to prepare three National Energy Efficiency Action Plans (NEEAP) for the period 2008 – 2016 and report them to the European Commission. The first NEEAP has been already submitted in 2007, for the reporting period of 2008 – 2010, by most of the Member States.

The reporting period for achievement of the indicative target under the Directive is 2010 through 2018. The primary aim is that all Member States achieve an energy savings target of 9 percent of the average final inland energy consumption for the period 2001–2005 for the ninth year of application of this Directive. The above-mentioned target does not apply to energy consumers covered by Directive 2003/87/EC of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community as well to the final consumers, which energy consumption is classified into sectors of air and water inland transport.

2.3.4 STABILIZATION AND ASSOCIATION AGREEMENT BETWEEN REPUBLIC OF MACEDONIA AND THE EU

Approved in April 2001, this Agreement supports the harmonization of Macedonia's legislation with that of the EU and creates the institutional infrastructure necessary to enable closer cooperation with the EU member states, institutions, and companies. Clause 99 of the Agreement refers to the cooperation policy between the Republic of Macedonia and the EU in the energy area, and states that the principles of the Energy Charter Treaty will gradually be integrated into Macedonian energy markets and energy policy as Macedonia moves towards greater cooperation with the EU and progressively integration into European energy market.

Specifically, Article 99 of the Agreement calls for:

- Modernization of the energy infrastructure, diversification of energy supply, and more efficient approaches to energy transmission and marketing
- Energy sector management and training, including technology transfer
- Improving energy efficiency, the use of renewable energy, and the analysis and consideration of the influence of the energy production and consumption on the environment
- Defining the framework for restructuring the energy sector and for improving the cooperation of energy sector companies

OTHER INTERNATIONAL AGREEMENTS

Macedonia is a non-Annex B Party to the Protocol and can potentially benefit from the Clean Development Mechanism in its efforts to increase energy efficiency.[24]

As Macedonia initiates measurable improvements in energy efficiency, these could achieve simultaneous reductions in greenhouse gas emissions that can be monitored, measured, and monetized.

Various studies indicated that CDM has potential to reduce up to 4 million t CO_2 equivalent in Macedonia, which, under market price of 8-15 EUR can result in carbon certificate sales with 30-60

[24] Macedonia is a party of the UNFCCC since 1998 (Law on ratification of the UNFCCC – Official Gazette 6/1997) and in 2004 Macedonia ratified the Kyoto protocol (Law on ratification of the Kyoto Protocol to the UNFCCC – Official gazette 49/2004). In March 2007 Macedonia established the Designated National Authority (DNA) within the Ministry of Environment and Physical Planning. With the adoption of the National Strategy for Clean Development Mechanism 2008-2012 by the Macedonian Government the institutional framework for hosting CDM projects in Macedonia was ready.

million EUR per year, of which about 64 percent – from energy sector emission reduction, excluding renewable energy (15 percent).[25]

ANNEX 2 Related Laws and Regulations

Correspondent with chapter 2.4.

2.4.1 THE RULEBOOK FOR BUILDING ENERGY PERFORMANCES

The Rulebook for Building Energy Performance has been published in the Official Gazette Nº 143/08, governing the standards related to heating techniques and thermal insulation issues. This regulation refers to minimum insulation requirements and, in any case, according to the Energy Law, their application is not obligatory.

The enforcement entry of this Rulebook was postponed to the end of 2010, because of need to form legal basis for complete implementations of the Directive 2002/91/EC on the Energy Performances of Buildings (EPB). This period will be used to develop national methodology for EPB calculation, the rules for energy auditor's authorization, their training, pilot project realization and preparation of Macedonian Climatic Atlas, as an important part of the Methodology. Meanwhile, future auditors,[26] designers, and academic institutions will be trained to implement prescribed rules into life.

2.4.2 RULEBOOK FOR PRODUCTION OF ELECTRICITY FROM RENEWABLE ENERGY RESOURCES

The Rulebook for production of electricity from renewable energy resources (Official Gazette of RM, No. 127/08), prescribes the types and respective features of plants utilizing renewable energy resources for electricity production.

2.4.3 RULEBOOK FOR ACQUIRING PREFERENTIAL PRODUCER STATUS FOR ELECTRICITY PRODUCED FROM RENEWABLE ENERGY RESOURCES

The Rulebook for acquiring preferential producer status for electricity produced from renewable energy resources (Official Gazette of RM, 29/09), stimulates the electricity production from RES given the opportunity for take advantage of the preferential tariffs.

2.4.5 RULEBOOK FOR HOME APPLIANCES ENERGY EFFICIENCY LABELLING

The Rulebook for home appliances energy efficiency labeling, (Official Gazette of RM, 63/07), prescribes the mandatory energy efficiency labeling of home appliances such as refrigerators, deep freezers and combos, washing machines, drum laundry dryers and washer dryer combos, dishwashers, ovens and cook tops, air-conditioning units, and light bulbs.

2.4.6 RULEBOOK FOR EFFICIENCY REQUIREMENTS OF THE HOT WATER BOILERS COMBUSTING LIQUID AND GASEOUS FUELS

The Rulebook for efficiency requirements of the hot water boilers combusting liquid and gaseous fuels (Official Gazette of RM, 13/07), prescribes the requirements for efficiency that are applicable for new hot water boilers that combust liquid and gaseous fuels with nominal capacity from 4 kW and not higher than 400 kW.

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[25] *Z. Kapor* Co-financing renewable energy and energy efficiency projects through Kyoto mechanisms. GFA ENVEST GmbH. Available at" http://www.gfa-group.de/envest/publications/webdownloads/534788/EEC_Skopje_paper_Zoran_Kapor.pdf

[26] Donation of Austrian Government to the Government of the Republic of Macedonia. Realization in 2010/11, Project leaded by Austrian Energy Agency

ANNEX 3 Residential Sector

Correspondent with chapter 4.1

4.1.1 PATTERNS OF DEMAND

The dominant forms of energy in household consumption are electricity (especially for appliances, but with substantive share still used for heating purposes) (52.6 percent) (Figure 4.1.1.1) and biomass (firewood) (33.3 percent). Liquid fuels and thermal energy (district heating) are participating with similar percentages (6.7 and 6.9 percent, respectively). There is still no use of natural gas in the residential sector.

The household energy consumption in Macedonia, expressed per capita is very low. This type of consumption usually remains relatively constant for very long periods of time, not only in Macedonia but in the other European countries as well (Figure 4.1.1.2). The developed European countries have 2.6 times greater household consumption per capita than Macedonia, and the less developed European countries have a 50 percent higher consumption than Macedonia.

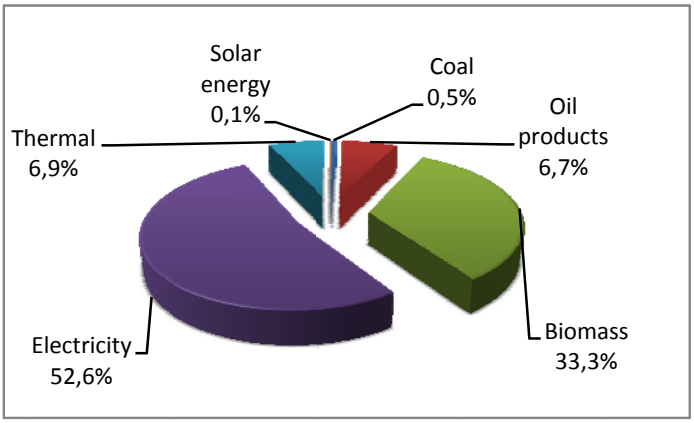


Figure 4.1.1.1- Structure of household fuel consumption in Macedonia, 2006[27]

The actual energy consumption in Macedonia is 10-15 percent higher than official estimates, if the unregistered consumption of fire wood, estimated at 25-35 percent of the registered consumption, and the unregistered electricity consumption, estimated at 8 percent of the registered electricity consumption, are introduced into the calculation.

[27] © OECD/IEA, [2008], IEA Online Database: Energy Balances of Non-OECD and OECD Countries and Energy Statistics of Non-OECD and OECD Countries

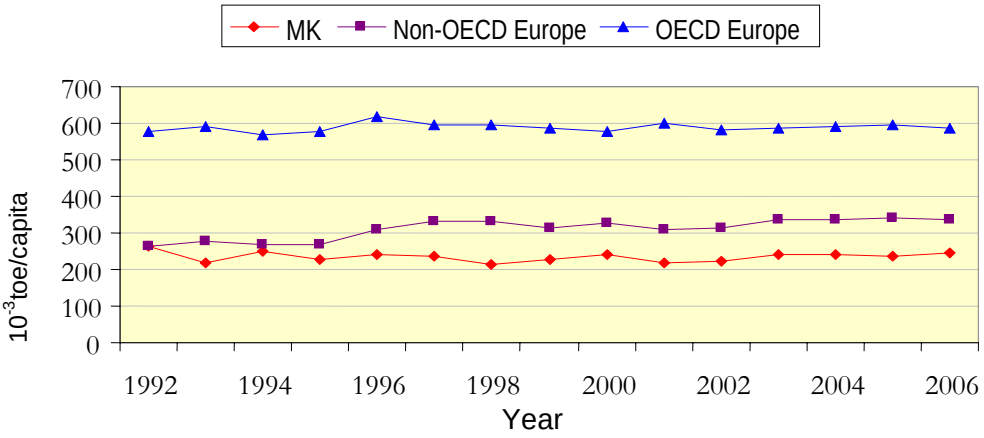


Figure 4.1.1.2 Household energy consumption per capita[28]

The analysis of household energy consumption for various purposes is analyzed in terms of assessing the future demand in the upcoming period. To obtain realistic data for energy consumption, a conventional family was taken as a unit for analysis. That is because – in this sector – the consumption of energy per capita is less representative, taking into account that the consumption mostly depends to the apartment (heating, lighting, appliances – hot water excluded); the number of persons inside is not very important.

The number of apartments/houses is not taken as a number of units spending energy. Only the number of families in the State are counted, without inclusion of empty residences (as weekend houses etc.) which are not consuming energy continuously. That means there are more apartments compared to families.

- Observed unit: household
- Number of households: 564 296[29]
- Number of dwellings 697 529
- Average members of household: 3,6
- Household average surface: 70,6 m^2
- Average number of rooms in the urban settlement: 3 rooms
- Ages of building residential stock
  - before 1919 1,11 %
  - 1919 – 1945 3,95 %
  - 1946 – 1970 30,12 %
  - 1971 – 1989 47,80 %
  - after 1991 17,02
- Average consumption of energy for one household: 0,96 toe/year = 11,13 MWh/ year

- Heating: 0,55 toe/year
- Hot water preparation: 0,12 toe/year
- Lighting: 0,07 toe/year
- All other electrical appliances: 0,21 toe/year

[28] © OECD/IEA, [2008], IEA Online Database: Energy Balances of Non-OECD and OECD Countries and Energy Statistics of Non-OECD and OECD Countries

[29] Strategy for housing of the Republic of Macedonia (2007-2012), May 2007

Because of energy poverty the difference in household consumption compared with several countries in the region (Figure 4.1.1.3) shows that the consumption in Macedonian households is very low.

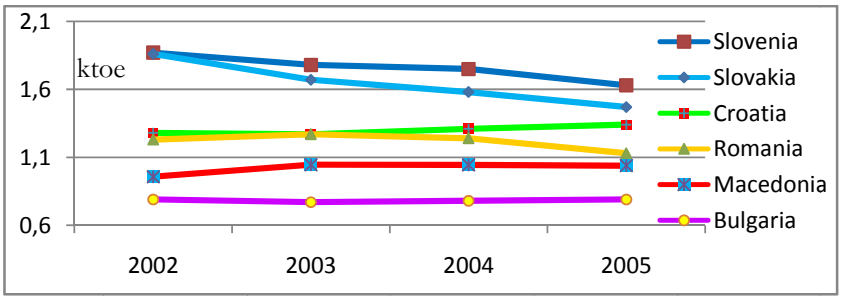


Figure 4.1.1.3 Households energy consumption per dwelling in ktoe[30]

An average family consumes 57 percent of the energy for heating, 22 percent for the home appliances (stove, refrigerator, vacuum cleaner, washing machines, air conditioning, ventilators, TV-set, computer, etc.) as well as part for street lighting, 12.7 percent for hot water preparation and 8 percent for lighting. Energy for heating is the largest share of consumption (Figure 4.1.1.4).

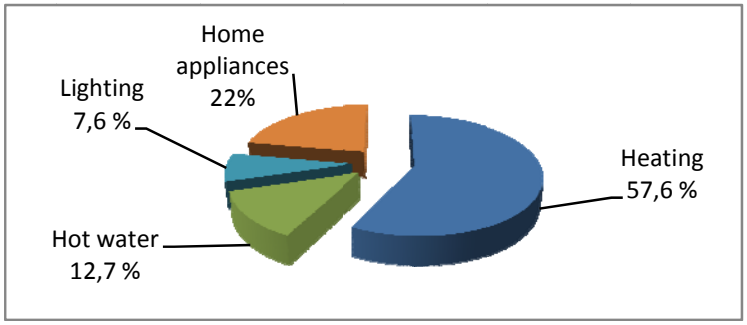
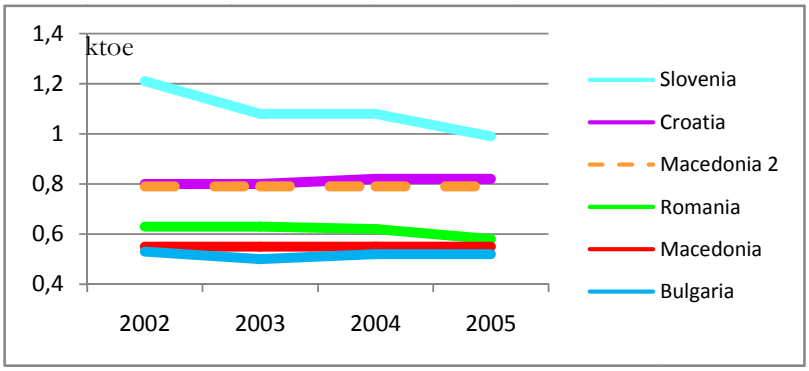


Figure 4.1.1.4 Breakdown of household energy consumption

To ensure comfortable living conditions it is necessary to spend 43 percent more energy for heating: 0.79 toe/year = 9,18 MWh/year.[31] Figure 4.1.1.5 shows the position of Macedonia in regards to consumed energy for heating (line Macedonia) and the second one (Macedonia 2) assuming that in all of the dwellings normal living conditions are ensured.



[30] Odyssee-Energy Efficiency Indicators in Europe, Update date: April 2008

[31] MACEF's data collected from realized energy audits of 40 buildings; Interview with DHC Toplifikacija's experts and director d-r Dimitar Hadzi Misev

Figure 4.1.1.5 Consumption per dwelling for space heating (for average family)

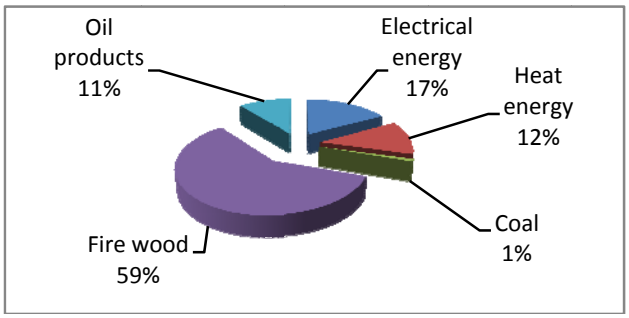


Figure 4.1.1.6 Share of energy carrier for heating in the residential sector in 2002

As Figure 4.1.1.6 indicates, the households primarily use biomass (59 percent) for heat energy, followed by electricity (17 percent), thermal energy and oil products (12 percent each) and coal (1 percent).

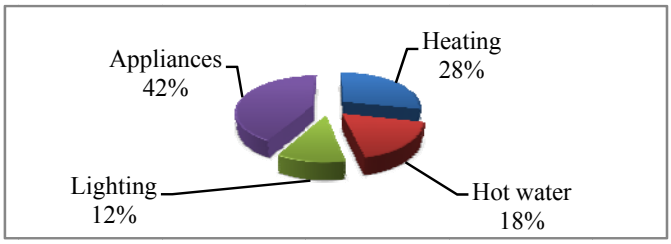


Figure 4.1.1.7 Use of electrical energy in the residential sector

The average family consumes 42 percent of the electrical energy for all electrical home appliances (Figure 4.1.1.7); 28 percent of electricity is used for heating, with 18 percent hot water preparation and lighting with 12 percent.

The analysis considers that the net salary in recent years, on average, grows by 4.95 percent annually and the cost of living grows by 3.41 percent (See Figure 4.1.1.8). According to the statistical data for recent years, one conventional family, after covering the costs of average shopping basket, has only 15-25 percent of the average salary to cover all other costs.

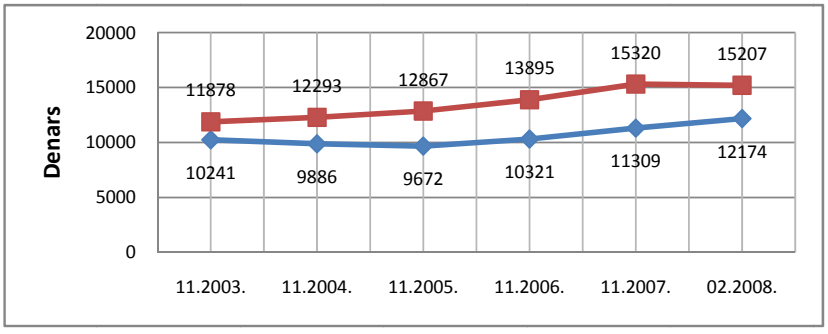


Figure 4.1.1.8 Net salary and consumer basket history

The average annual population growth rate in the period between 1994 and 2002 is 0.48 percent. However, in recent years, the population growth rate has been decreasing due to the consistent drop in net births (Figure 4.1.1.9). According to the United Nations demographic research,[32] the Macedonian population will decrease from 2.036 million in 2006 to 2.025 million in 2020 and 1.966 million in 2030.

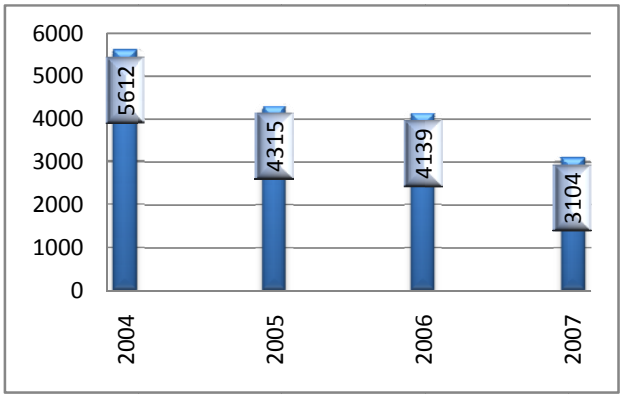


Figure 4.1.1.9 The yearly difference births/deaths

The Republic of Macedonia needs a highly publicized Action Plan for Energy Efficiency Improvements including thermal retrofit of buildings, with public sector playing an exemplary role; assessment of heating alternatives; developing incentives for switching to alternative heat sources, supporting low-income and vulnerable groups of the population to switch from electricity to other types of heating and to implement retrofit measures.

4.1.2 CRITERIA AND METHODOLOGY

The analysis of measures for reduction of energy consumption of the households takes into account the following factors:

- living standards,
- number of constructed homes,
- population and number of families,
- measures (laws and bylaws, training, propaganda) for improvement of the energy efficiency, especially of the home appliances and homes,
- automatic control of the energy consumption.

[32] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: 2005 Revision, http://esa.un.org/unpp

Table 4.1.2.1 Calculation of the indicative saving target in the Residential sector

ktoe	2002	2003	2004	2005	2006	Average	9% Savings
Total final energy consumption in the Residential sector	449	491	487	483	498	482	**43,3**

The target in the Residential sector is to obtain energy savings of **43.3** ktoe in 2018.

Experiences and surveys from neighboring countries indicate the comparable inefficiency of energy use for space heating in buildings.

To start efficiently introducing energy efficiency measures, it is necessary to accept cheap measures, which can be applied voluntarily by wide circle of consumers without big financial involvements, but showing immediately results. Basic measures, that can be immediately realized in residential homes include:

- For windows, advanced low-energy techniques are needed for multi-layer glazing, coating and vacuum sealing.
- Main entrance doors weather-stripping.
- Improve passive ventilation systems. Air infiltration into apartments often significantly exceeds western norms for ventilation, and reducing air infiltration can result in significant energy savings without reducing indoor air quality.
- Improve staircase windows. Losses in common staircases can be significant because of the high infiltration of outside air.
- Thermal insulation of exterior walls (facade).
- Thermal insulation of the internal roof slab.
- Additional loft insulation.
- Basement ceiling insulation.
- Installation of thermostatic valves on radiators.
- System balancing.
- Insulation of heating pipes.
- Installation of reflecting screens behind radiators.
- Automation of the substations and heat-meters installation.
- Energy efficient appliances.
- Efficient lighting
- Buying energy-efficient appliances.

4.1.3 SIMULATION AND FORECAST OF ENERGY CONSUMPTION SAVINGS

The formulation of an energy efficiency strategy for the buildings sector has proved to be a rather difficult task for governments and other competent institutions worldwide. The most important reasons are that the sector consists of a very large number of independent decision-makers (including households, local authorities, organizations) whose objectives are very difficult to harmonize, and the decision making –especially in the housing sector – is heavily influenced by behavioral patterns which are equally difficult to change.

The main policy tools applied worldwide include compulsory and voluntary measures and incentives, as well as promotion and technical support. In the compulsory measures could be included, for example, compulsory insulation standards, compulsory energy certification of existing buildings, compulsory energy audits, emission limits for CO_2, CO, minimum efficiency limits for space heating boilers, etc.

Voluntary measures can include tax reductions for solar system installations, grants for energy efficiency investments by large energy consumers, etc. Promotional programs can also include public outreach campaigns (including through mass media), free or subsidized energy audits, establishment of consumers information centers, etc.

The success of an energy policy depends on the mixture of measures that are selected for each case. The main problem is that enforcement in practice of compulsory measures is very difficult, especially in the private sector. Therefore, any measure of this category should be accompanied by information dissemination campaigns and other promotional activities.

Energy performance is not only the concern of the building owners and designers, but also of the national government and the eventual users. Implicit in the concept is the assumption that those concerned will wish to improve the energy performance of the buildings. Since design requires the active participation of a large number of professionals, including the client, all the contributors need to understand the concepts of energy economy.

The benchmark in the Residential sector is to obtain energy savings of **43.3** ktoe in 2018.

Energy policy for the residential sector is characterized by a set of instruments targeted at various aspects of residential energy use.

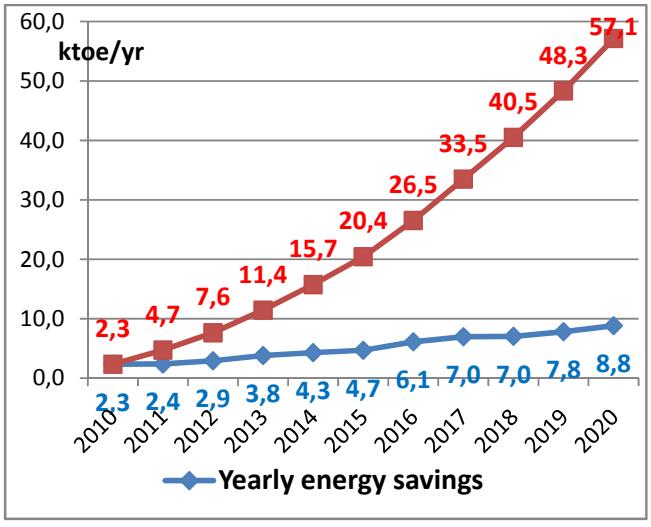


Figure 4.1.3.1 Expected savings in the residential sector

They are:

- Metering and Informative Billing – Heating Allocators
- Mandatory application of Building Codes in the sector of Social Housing
- Implementation of Building Codes for new buildings
- Efficient firewood furnaces
- Promotional campaign; Information centers
- Hot water boilers for individual centralized heating and air conditioners energy performance standards control
- Solar systems for existing buildings
- Financial support to natural persons for investing in energy efficiency improvements investments
- Buildings renovation.

This package of instruments aims to increase awareness on energy use and energy savings, to provide incentives to home owners to take measures to improve the efficiency of their houses and addresses regulations for new building construction and renovation of houses.

This scenario envisages realization of the above-mentioned energy efficiency policy in the households. The scenario envisages wide application of solar systems and natural gas which means stronger measures for stimulation of the introduction of solar energy in the households and of the natural gas in several cities in Macedonia. It is envisaged[33] that Skopje and Kumanovo will have rapid development of the distribution network. Connection of Tetovo and Gostivar to the gas pipeline is expected along with a certain expansion of the secondary network in 2020. The construction of the pipeline to Veles and Stip is also envisaged.

Similarly to formerly realized financial incentives for solar systems (donation of 300 Euros for installation), the Government should consider extending it to geothermal heat pumps as potential systems for heating of individual housing structures, due to low consumption of energy.

The consumption of energy in the new construction structures, according to the Rulebook on Energy Performances of Buildings, will be halved compared to today's values.

All these measures would lead to reduction of the share of the electricity in the household energy use, as well as the energy at whole.

[33] Realization of the Study work concerning implementation of natural gas transport pipelines in the Republic of Macedonia. Financing – Russian debt of cca 60 million US$.

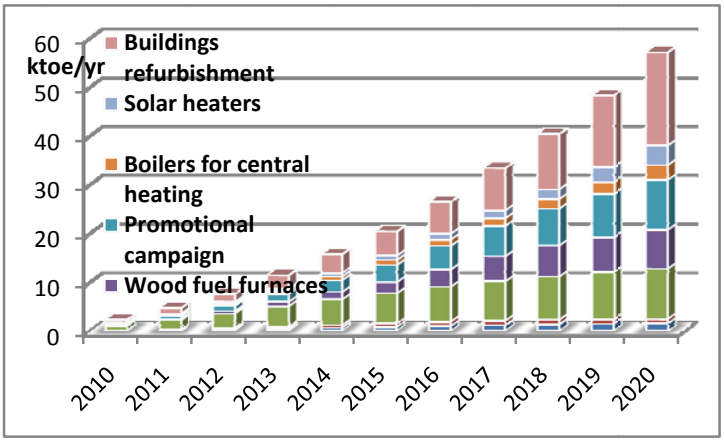


Figure 4.1.3.2 The share of different measures for energy savings

It is envisaged that the activities for efficient energy usage in the households shall be directed towards:

- Enlarging the existing and building new heating systems, primary in the larger urban areas, with economically justified heating density
- Creating conditions for more rapid and intensive including of the households in the gas line system (realization of transport system to main cities in the State, development of distributive gas networks in the cities, attractive conditions for concessions for foreign investors, soft loans for householders for furnishing their dwellings with new equipment working on natural gas, training of specialized assemblers of installations etc.)
- Using the geothermal waters for the household needs in the regions where this energy is exploited; intensive usage of solar energy, intensive usage of geothermal heat pumps etc.
- Weatherization of older houses and multi apartment buildings
- Developing regulation, standards, and other acts
- Intensifying promotional activities: informational and educational activities, publications and brochures, etc.
- Encouraging and publicizing introduction of low-cost or no-cost energy efficiency measures, which can be applied voluntary by wide circle of consumers without large financial involvements, but yielding immediate results.

Implementing assumed measures, energy savings will reduce CO2 emission for 1400 $ktCO_2$ equivalent (Figure 4.1.3.3).

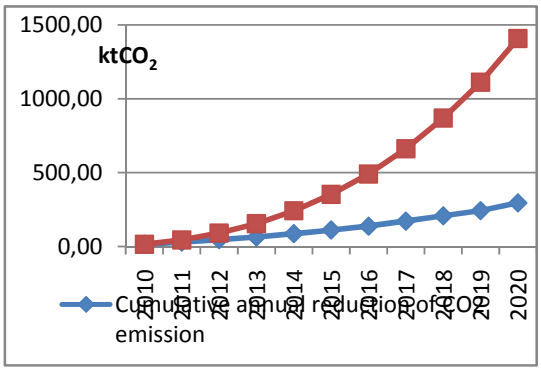


Figure 4.1.3.3 Emission reduction

Review of the regulatory framework for energy efficiency in buildings revealed the complexity of the issue and the interrelations between the different components. The success of an energy efficiency policy for buildings requires a blend of voluntary, compulsory and promotional measures that have to be carefully selected for the specific conditions of the country.

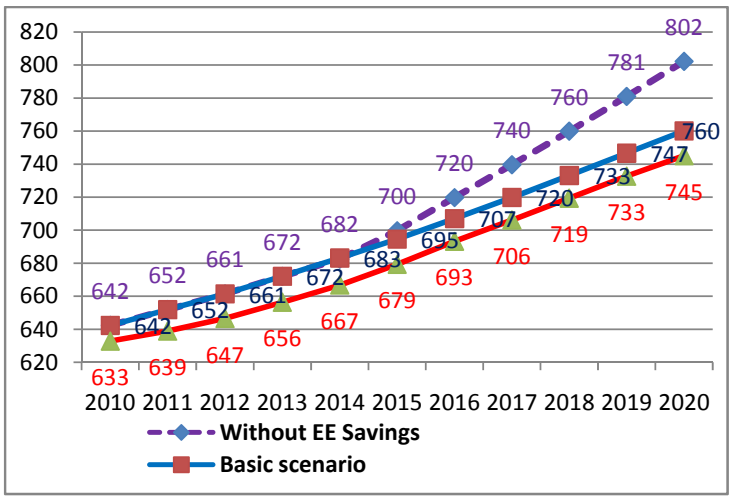


Figure 4.1.3.4 Final energy needs in accordance with joined Strategy for Energy Development and SIEE in the residential sector

Figure 4.1.3.4 indicates the energy quantity Macedonia will need if the projected energy efficiency measures are not implemented. Thus, it's assumed that the Scenario with stronger energy efficiency measures of the SIEE for energy sector development may be implemented only if the projected measures of the NEEAP are in place.

The basic scenario assumes annual increase of the energy needs by 1.68 percent.

The scenario with stronger EE measures assumes annual increase of energy needs by 1.65percent. Unless the projected measures of the Strategy for energy efficiency are not implemented, an annual increase of energy consumption by 2.25 percent may be expected, thus reach consumption of 802 ktoe by 2020 instead of the anticipated 760 or 745 ktoe.

ANNEX 4 Commercial and Public Services Sector

Correspondent with chapter 4.2

4.2.1 PATTERNS OF DEMAND

Expressed per capita, the energy consumption in this sector is very small (Figure 4.2.1.1). The energy consumption per capita is similar to that in the European non-OECD countries and 2.5 times smaller than that of the developed European countries.

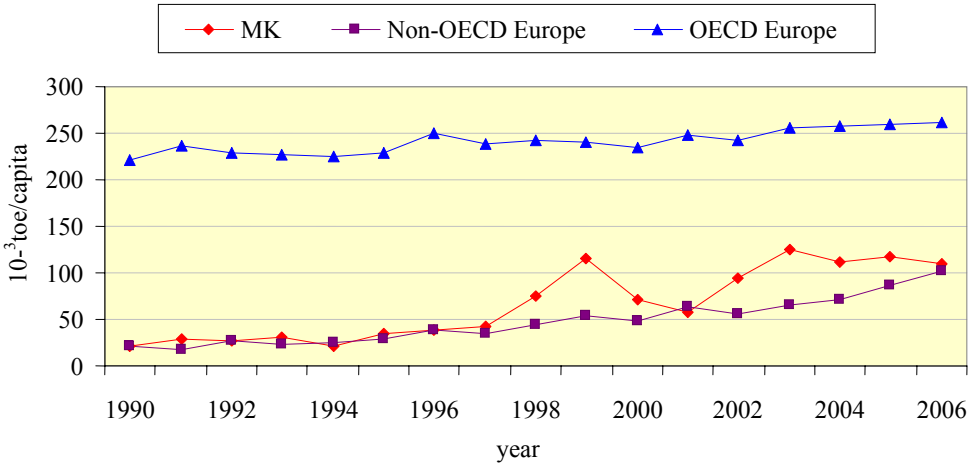


Figure 4.2.1.1 Energy consumption in the commercial and service sector[34]

According to the installed economic power, Macedonia has very high energy consumption in this sector (Figure 4.2.1.2). The decline of the consumption registered in the last years is encouraging.

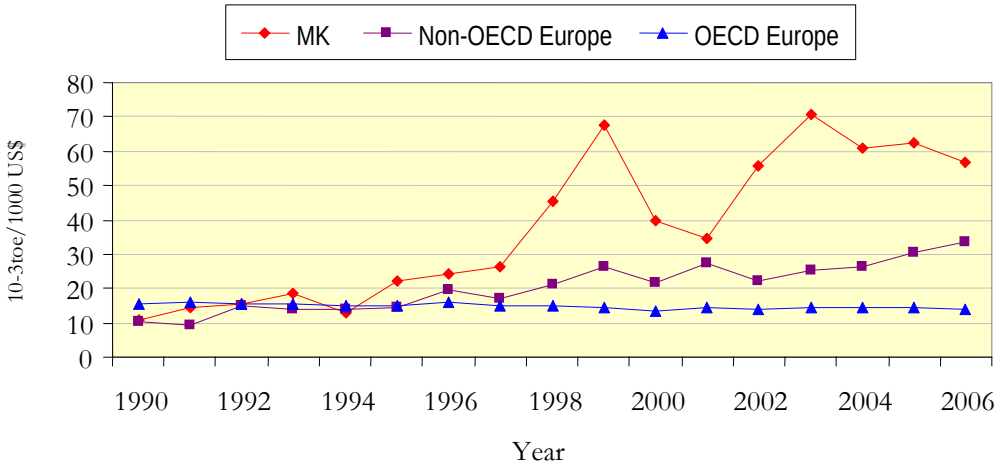


Figure 4.2.1.2 Energy consumption commercial and services sector[27]

[34] © OECD/IEA, [2008], IEA Online Database: Energy Balances of Non-OECD and OECD Countries and Energy Statistics of Non-OECD and OECD Countries

The Strategy for Energy Sector Development in the Republic of Macedonia for the period 2008-2020 with a vision to 2030 presented two scenarios: the basic scenario and the scenario with stronger energy efficiency measures.

The energy consumption in this sector is mainly comprised of electricity with a 43 percent share in the consumption, and oil products (heating oil, the so-called D2 fuel and LPG) with almost 42 percent of the total energy consumption in the sector in 2006 (Figure 4.2.1.3). The electricity consumption in this sector has been growing continuously during the analyzed period. The consumption of thermal energy is relatively constant both in absolute and in relative quantities and remained at 9 percent in 2006. The share of other fuels is small; wood contributed 3.7 percent, coal – 1.8 percent, geothermal energy – 0.6 percent, and natural gas – 0.2 percent.

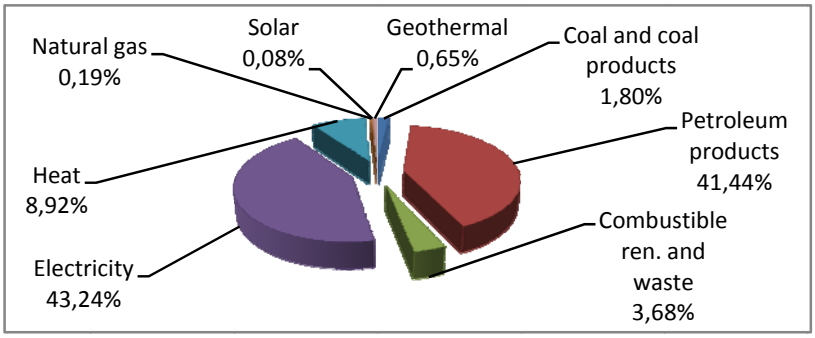


Figure 4.2.1.3 Consumption of energy in the commercial and service sectors by fuels[27]

Additionally, energy management systems (EMS) will be introduced supported by monitoring and targeting tools. This will take place within the local administration (project in the stage of establishment – MAMNEE (Macedonian Municipal Network for Energy Efficiency). Finally, energy efficiency criteria in public procurement will enable the faster penetration of energy efficient products and technologies into the market, which will eventually lower their prices and trigger utilization on a much wider scale.

Based on the degree of construction of the structures in the commercial sector, as well as based on the expectations for investments in the upcoming period, it is realistic to expect slower growth of energy consumption in this sector. The increase in the electricity tariffs will also influence energy consumption, mostly through more intensive energy efficiency measures (improvement of the insulation of the existing structures and new structures, illumination with lower electricity consumption, development of the awareness that the energy saving is a new energy source and that the state and local budget institutions should make an example of energy savings). The private sector will realize them more rapidly due to clearly economic reasons.

The indicative final energy savings in the Commercial and Public Building Sector within the scope of the Energy Services Directive in the Republic of Macedonia in 2018 is considered to be equal to 20.4 ktoe.

Table 4.2.1.1 Calculation of the indicative saving target in the commercial and public building sector

Ktoe	2002	2003	2004	2005	2006	Average	9% Savings
Total final energy consumption in the Commercial and Public services sector	192	252	225	239	224	226	20.4

The basic scenario sets the growth rate of the energy consumption in the commercial and service sector at 2.4 percent per year. With this growth rate, the energy consumption until 2020 will be 39 percent higher. The energy consumption growth of the commercial and service sector is presented in Figure 4.2.1.4. The composition of the projected energy consumption by individual fuels is variable, as the different fuels' demands have different dynamics. The growth of certain fuels is in line with gradual shift of their share towards the one in the more developed European countries.

The electricity consumption, depending on the scenario, will grow at the rate of 2.94 percent per year (and 2.36 percent for EE scenario) or total of 37.6 percent (29.27 percent for EE scenario) for the 2009-2020 period, totalling 148 (138) ktoe in 2020.

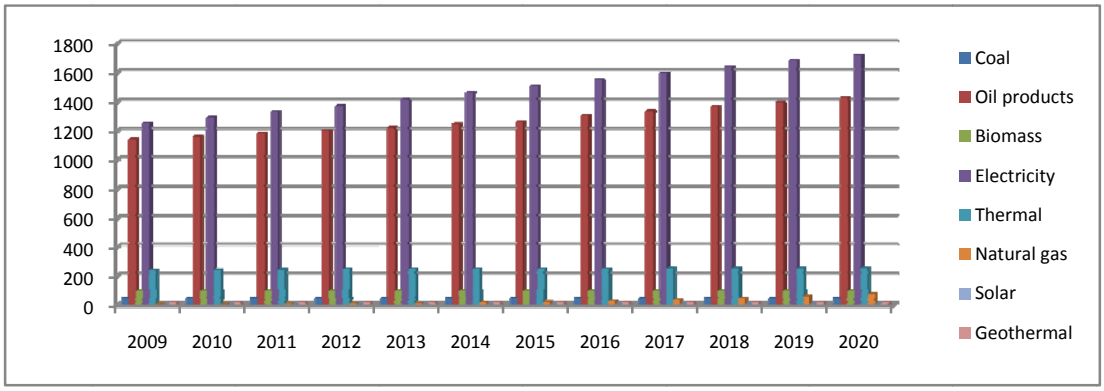


Figure 4.2.1.4 Forecast of the energy consumption in the commercial and service sector according to the basic scenario

The consumption of oil products will grow at average rate of nearly 2 percent (basic scenario) and by 1425 GWh (122.6 ktoe), and it will be 25 percent higher than the oil products' consumption in 2009.

In the Strategy for Energy Development the analyzed scenario with stronger energy efficiency measures predicted average annual growth rate of energy consumption of 1.9 percent as feasible. The Strategy further states "…And also in this case the share of the individual fuels is projected in direction of the more developed European countries, excluding the natural gas. We cannot expect high share of the natural gas in this sector until 2020 because lack of infrastructure and habits to use gas."

The development of the energy consumption in the commercial and service sector until 2020 according to this scenario is given in Figure 4.2.1.5.

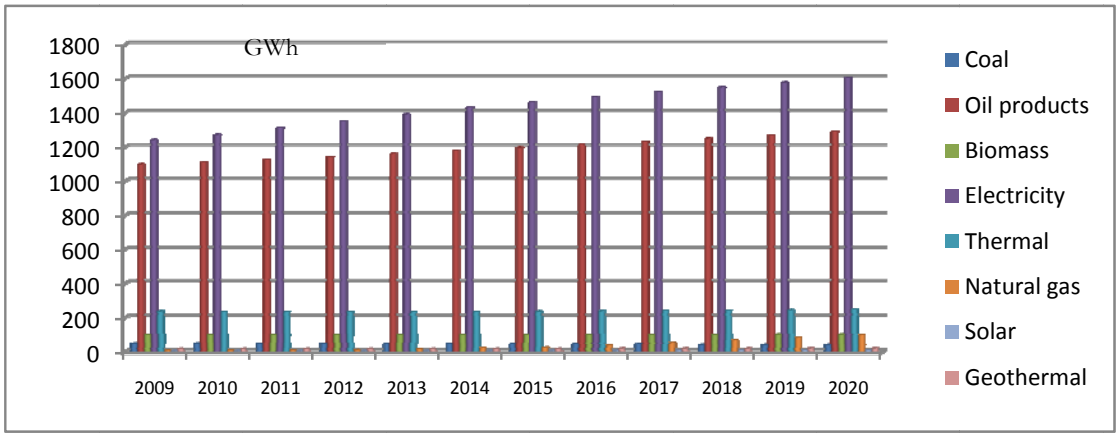


Figure 4.2.1.5 Energy consumption of the commercial and service sector – scenario with stronger energy efficiency measures (GWh)

The difference between the two scenarios is 7.15 percent, or in absolute values 21 ktoe (243 GWh; Figure 4.2.1.6).

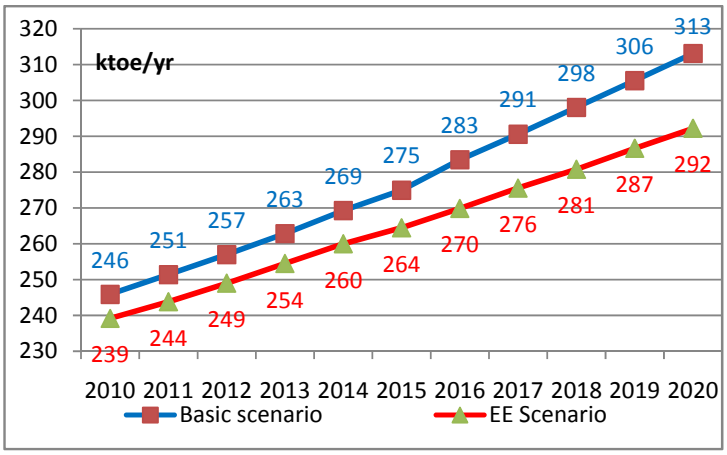


Figure 4.2.1.6 Energy consumption of the commercial and service sector – both scenarios

4.2.2 SIMULATION AND FORECAST OF ENERGY CONSUMPTION SAVINGS

Office buildings are consuming – and wasting – an increasing amount of energy. The energy wasted in these buildings is mainly electricity, the most expensive and most valuable form of energy, and one which is produced pollution.

Public building interventions have proven to be fairly cost-effective, whether they have targeted a single technology improvement (lighting, windows, motors, building envelope) or an integrated facility approach. Such options can be framed around changes in procurement practices and/or operating and maintenance investments and often involve opening up the market to private sector energy service companies. National programs using public-private partnerships to deliver the intervention(s) have proven successful and have stimulated economic activity and created new industries as well as new employment opportunities.

The fastest means of application of compulsory measures is in the public buildings. The energy consumption in commercial buildings has been growing steadily.

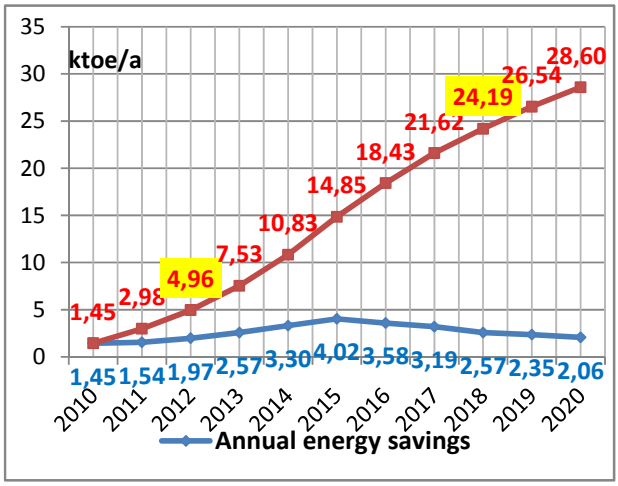


Figure 4.2.2.1 Expected savings in the commercial and public buildings sector

The benchmark in the commercial and service sector till 2018 is at least 20.1 ktoe in accordance with the Directive 2006/32/EC of the European Parliament and of the Council on energy end-use efficiency and energy services. Estimated values show that it is achievable savings of 24.19 ktoe with modest penetration intensity of assumed measures. The expected energy savings as a result of the projected energy efficiency measures is shown in Figure 4.2.2.1.

Energy policy for the commercial and public buildings sector is characterized by a set of instruments targeted at various aspects of residential energy use, as follows (Figure 4.2.2.2):

- ❖ Application of Building Codes and Building Energy Certificates
- ❖ Inspections of boilers/air conditioning systems
- ❖ Education sector
- ❖ Information campaigns and municipal network
- ❖ Introduction and implementation of Energy Management System
- ❖ Public Street-Lighting Project in Skopje
- ❖ Electrical appliance and equipment labelling
- ❖ Energy saving measures in hospitals
- ❖ Solar systems and geothermal heat pumps

Recent experience in EU countries has shown that energy consumption in office buildings can be reduced by 50 to 80 percent, while maintaining a similar level of quality for the user. The Directive 2002/32/ EEC and Directive 2002/91/EEC represent the EU framework for improving end-use efficiency and energy services and energy efficiency in new and existing buildings in EU Member States. In brief, the Directives provides for the following:

- ❖ Thermal insulation of new buildings
- ❖ Energy certification of buildings,
- ❖ Billing of heating, air-conditioning and hot water costs on the basis of actual consumption
- ❖ Third-party financing for energy efficiency investments in the public sector

- ❖ Regular inspection of boilers
- ❖ Energy audits of undertakings with high-energy consumption.

Many of the above concepts can be utilized in Macedonia, due to the similarity in building construction and materials used.

The costs of the program will depend upon the magnitude of improvements needed, and the number of targeted buildings. A conservative estimate suggests 15 to 20 percent savings in building electricity use with typical payback periods that range of 2 to 4 years.

Basic regulatory measures *inter alia*, that will establish incentives to reach assumed savings targets, are as follows:

- Transpose the missing EU directives in the EE field into national legislation.
- Add Legislative Regulation for control mechanisms for implementation of these rules and standards.
- Prepare legislative regulation concerning quality and responsibilities of design preparation, realization and supervision of erection of buildings (licensing).
- Prepare an Act on Rational Use of Energy in Public Buildings, foreseeing preparation of studies and designs for weatherization/rehabilitation of older public buildings escorted with Action plan and priorities (hospitals, schools, courts, administrative buildings and so far).
- Build capacity of SMEs in the field of application of building energy efficiency measures (thermal insulation, weatherization etc) (even licensing them), to ensure proper conduction of proposed measures. To ensure proper audit of their work by appointed persons or institution.
- Prepare technical guides to constructors and engineers on thermal insulation and installation design of energy efficient buildings.
- Launch an information campaign to the general public on thermal insulation and the use of efficient lighting and electrical appliances.

An important characteristic of energy consumption in Institutional Buildings is that energy efficiency can be dictated by state or local government while they can only be encouraged in other building categories. This allows the possibility of a much faster and uniform implementation.

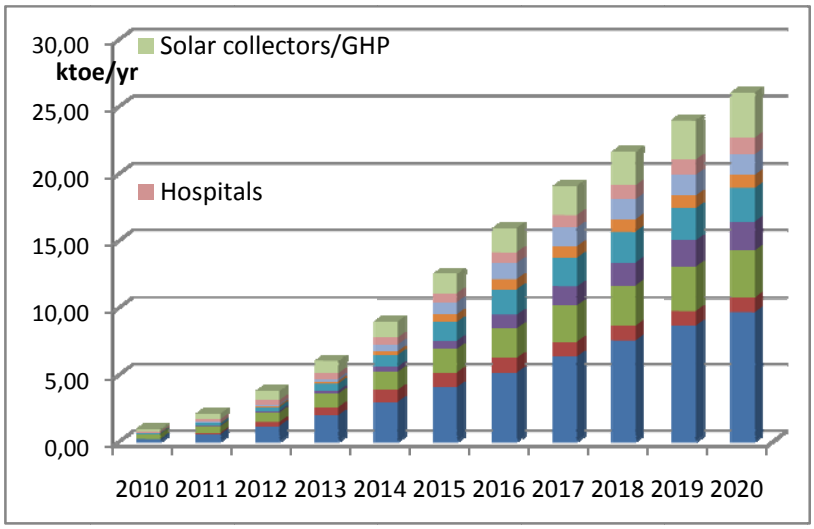


Figure 4.2.2.2 The energy saving contribution of various measures in public buildings

Reduction of the CO_2 emission is equal to 1157 $ktCO_2$ equivalent until 2020 (**Figure 4.2.2.3).**

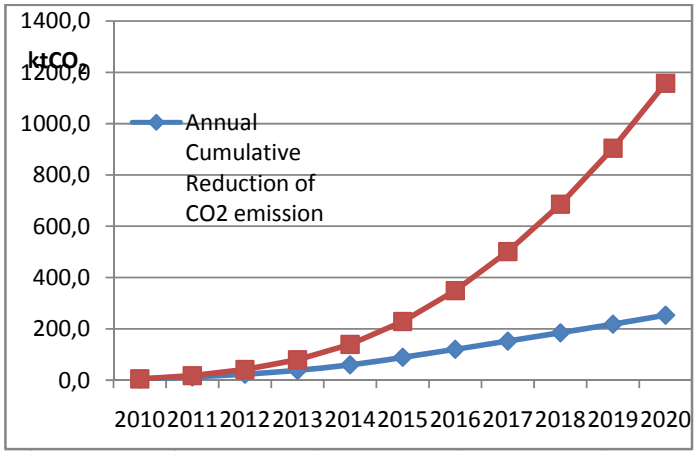


Figure 4.2.2.3 Reduction of CO_2 emission

The financing aspect of the implementation could also present a less complicated situation than the case of privately owned buildings: the government could finance directly from its own budget, or obtain loans from IFIs or private commercial banks at better terms and conditions than those offered to the general public.

Other sources of financing may include third party financing through ESCOs and/or the Energy Efficiency Fund. Finally, the high public visibility of energy efficiency applications implemented in these buildings will certainly encourage replication.

All these reasons make Institutional Buildings a primary target for energy efficiency interventions.

Energy efficiency interventions in Institutional Buildings can be grouped into some categories as:

- Interventions on the building envelope
- Interventions on the heating system, including building controls and substation improvements
- Interventions on specific building services

- Interventions on the lighting System
- Interventions on the Air Conditioning System

The Building Services, and therefore the kind of appropriate energy efficiency interventions, in a specific Institutional Building are determined by the function of the building itself. Hospitals, retirement homes, nurseries, etc. present the most comprehensive cases. Their services include laundry, kitchen, sterilization, and domestic hot water. Equipment and components employed in these services, as well as process methods, are many and varied, therefore the appropriate interventions are to be determined on case-by-case basis.

Hot water preparation is one of the largest consumers of energy, reaching 20-25 percent of the total energy consumption in the building. Metering and constant monitoring will discourage waste, tank and piping insulation will help to reduce losses, solar techniques where economically applicable are to be encouraged, and water temperature requirements for hygiene must be balanced with energy efficiency ones.

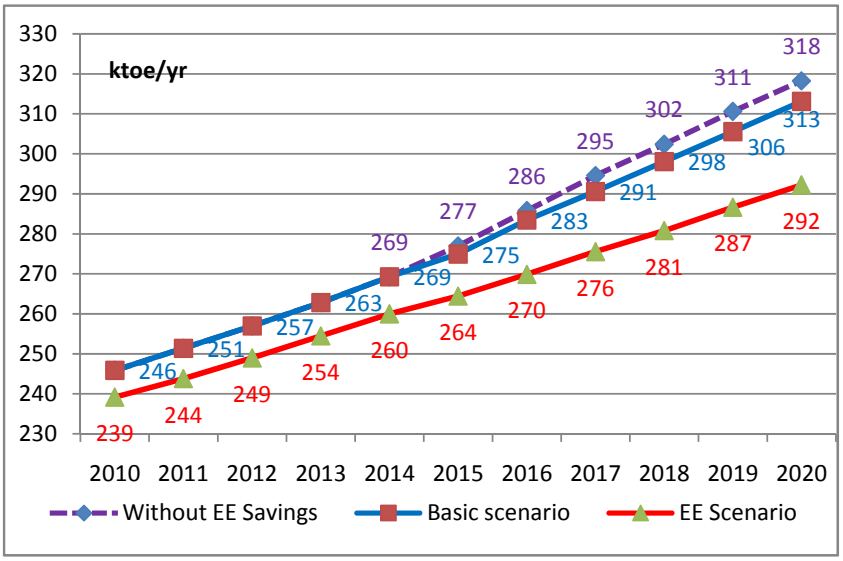


Figure 4.2.2.4 Final energy needs in accordance with joint Strategy for Energy Development and SIEE in the Commercial and Public Building sector

Figure 4.2.2.4 shows the energy quantity Macedonia will need if the energy efficiency measures are not implemented. Thus it is assumed that the scenario with stronger energy efficiency measures of the Strategy for energy sector development may be implemented only if the projected energy efficiency measures are in place.

The basic scenario assumes annual increase of the energy needs by 2.43 percent.

The scenario with stronger EE measures assumes annual increase of energy needs by 1.97 percent. If the measures proposed by the Strategy for energy efficiency are not implemented, an annual increase of energy consumption by 2.61 percent may be expected, thus reaching consumption of 318 ktoe by 2020 instead of the anticipated 313 or 292 ktoe.

ANNEX 5 Industry Sector

Correspondent with chapter 4.3

4.3.1. PATTERNS OF DEMAND

4.3.1.1 MACEDONIAN INDUSTRY SECTOR STRUCTURE

In 2007 the Industrial sector accounted for more than 20 percent of GDP (the contribution in MKD is shown in Figure 4.3.1.1 and engaged over 30 percent of total occupied labor force. Textiles, iron and steel, cement, food, and tobacco are the important manufacturing industries of Macedonia.

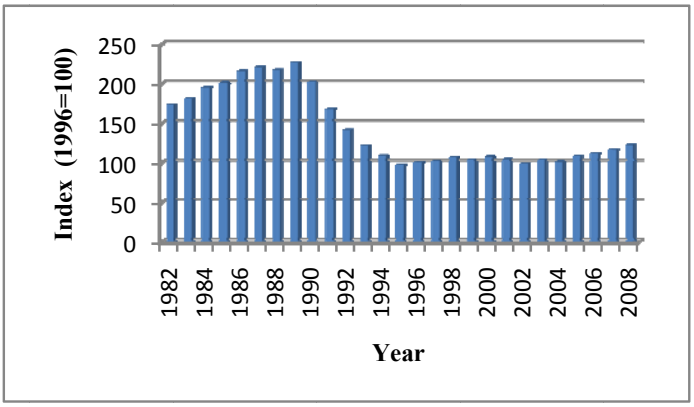


Figure 4.3.1.1 Macedonian industry production indices (1996=100) [35]

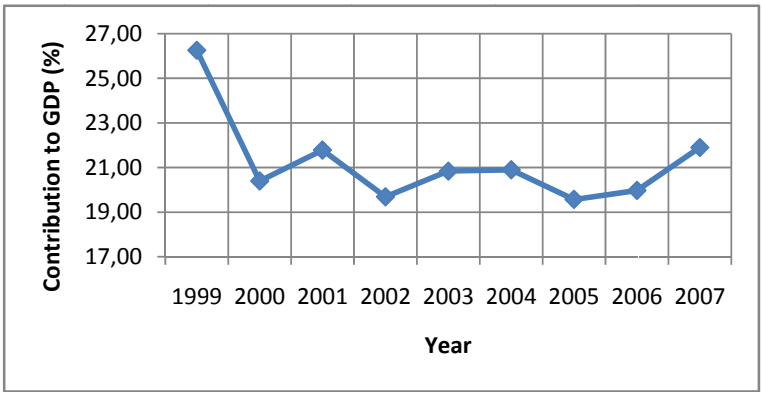


Figure 4.3.1.2 Contribution of Macedonian industry to GDP[36]

Steel and chemical production, along with buses manufacturing, textiles, food processing, tobacco, furniture, and ceramics are important industries.[37]

A) IRON AND STEEL INDUSTRY

Steel and ferroalloys production and processing are the most energy demanding industry in Macedonia.

Most of the metallurgical installations are based on electric arc furnaces (EAF). Some of the EAFs operate batch wise in short cycles thus creating substantial variations in power consumption. The largest metallurgical companies in Macedonia are:

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[35] Source: Energy Balances of Macedonia (Annual publications + Publications No.6.1.8.09, No. 6.1.9.10)
[36] Source: State Statistical Office Annual of the Republic of Macedonia - GDP Reports
[37] Encyclopedia of the Nations, Europe, Macedonia: at http://www.nationsencyclopedia.com/Europe/Macedonia-INDUSTRY.html

- Silmak, a ferrosilicon producing company
- Makstil, steel production and hot rolling
- Skopski Leguri, ferroalloys production
- FENI, ferronickel production
- Archelor – Mittal, cold rolling mill
- Metalski Zavod, foundry

Due to the privatization process and economic factors, the production rate of the Macedonian metallurgical companies varies and some of them are often out of operation. The global economic crisis led to temporary closure of some of the companies (Skopski Leguri, Archelor – Mittal, Silmak) and to significant reduction of production activities in others (FENI, Makstil).

B) MINERAL INDUSTRY

A number of brick manufacturing installations, a cement factory, several white ceramic manufacturing units, bentonite production, limestone, and dolomite roasting facilities make the mineral industry sector in Macedonia.

C) FOOD AND TOBACCO

Approximately 5,100 companies deal with food production and processing. However, most of them are covered by the agricultural sector. Some 40 fruit and vegetable processing companies in Macedonia are privately owned and undertake different activities, for example: 10 facilities for canning, 14 drying facilities, 11 deep freezing installations. In addition, there are several hundred medium- and small-sized mills and bakeries. Their installed capacities are rather big (about 260,000 t), however, their utilization rate is only 24 percent or about 63,000 t.

Production of 20,000 t fermented tobacco and 3600 t of cigarettes was reported in 2006.

D) MINING AND QUARRYING

Mining activities in Macedonia are focused on extraction of lignite, copper, lead, zinc, and nickel ores. Lead and zinc ores are mined underground, while copper, nickel, and lignite are extracted from open pit mines.

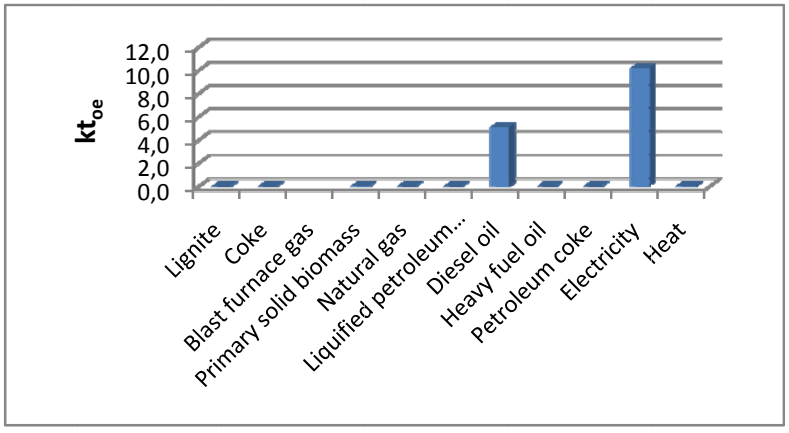

Figure 4.3.1.3 Mining and quarrying energy consumption by type

An analysis made in the course of preparing the Macedonian Strategy for Energy Development showed that only diesel oil and electricity are significantly consumed by mining and quarrying industry (figure Figure 4.3.1.3).

E) TEXTILE AND LEATHER

Textile industry generates and contributes the highest revenue to the economy of Macedonia and it is followed by the leather goods industry.[38]

4.3.1.2 ENERGY CONSUMPTION IN INDUSTRY

Figure 4.3.1.4 clearly indicates that, from the point of view of energy consumption, only steel and ferroalloys, minerals, and food and tobacco industries are significant energy consumers. In addition, mining and quarrying and textile and leather are also industries of concern. As expected, industries branches generating the biggest revenue have less important energy consumption.

Industry is responsible for 33.8 percent of the country's final energy consumption, while only contributing 20 percent to the country's GDP. This shows that this sector's energy intensity is higher than average, so a coherent plan to improve its energy efficiency can have an important impact on the whole country's energy performances.

In addition, the biggest growth in the final energy consumption in 2006 and 2007 was noted in the industry, and the growth rates were 7.15 and 7.59 percent respectively, which can be attributed to the reactivation of the biggest metallurgical capacities in Macedonia (FENI, SILMAK, and Zhelezara).

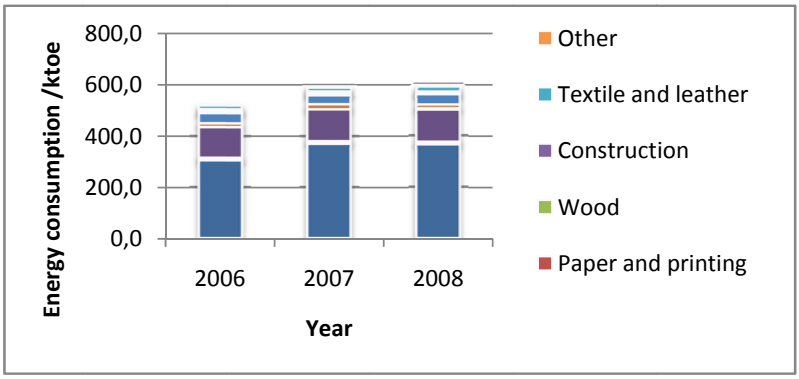

Figure 4.3.1.4 Energy consumption by different industry sectors for the last three years

A comparison between the Macedonian industry situation and other European countries reveals energy intensity of this sector and the fact that Macedonia performs slightly better than the average non-OECD countries (Figure 4.3.1.5) in this respect.

[38] According to http://www.mapsofworld.com/macedonia/economy-and-business/industry.html

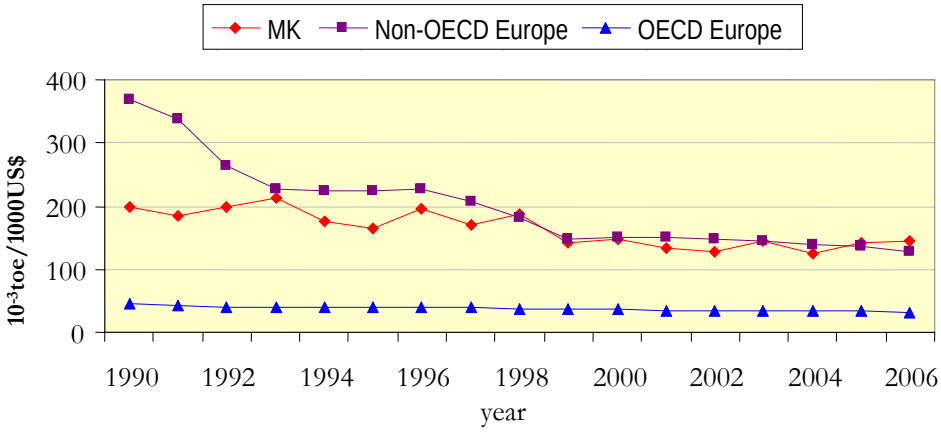

Figure 4.3.1.5 Energy consumption in the industry sector per unit of GDP5 compared with OECD Europe and non-OECD Europe countries average

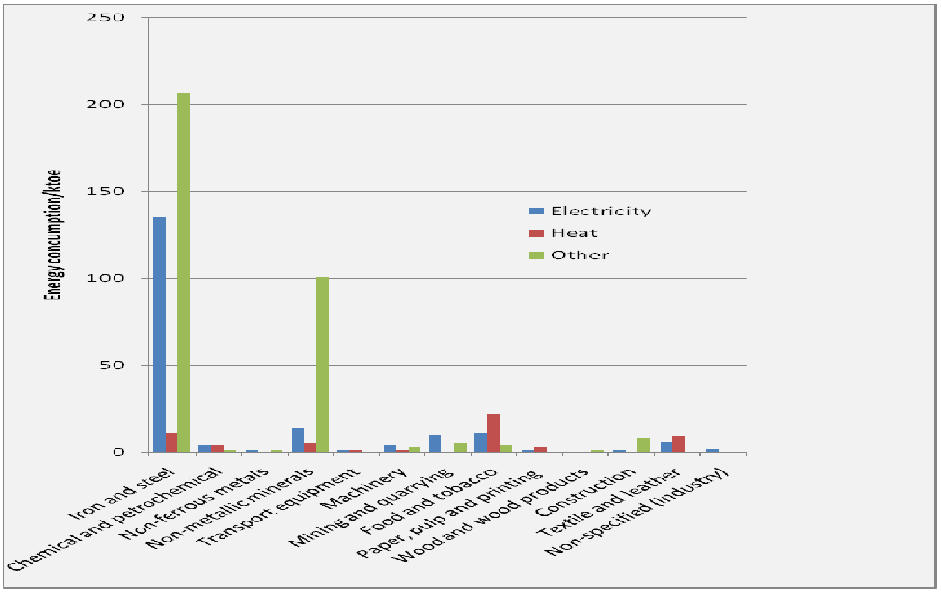

Figure 4.3.1.6 Total consumption of energy in the industry by sub-sectors

The industry sector uses mostly electricity and oil products with 33 percent and 32 percent respectively according to data on 2006, followed by coal with 19 percent, thermal energy with 10 percent, and natural gas with almost 6 percent and wood with less than 1 percent.

The steel and ferroalloy industry is by far the most intensive consumer of practically every kind of energy. Figures 4.3.1.6 and 4.3.1.7 provides the structure of the consumption by sub-sectors for 2006.[39]

[39] Macedonian Academy of Sciences and Arts: Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030.

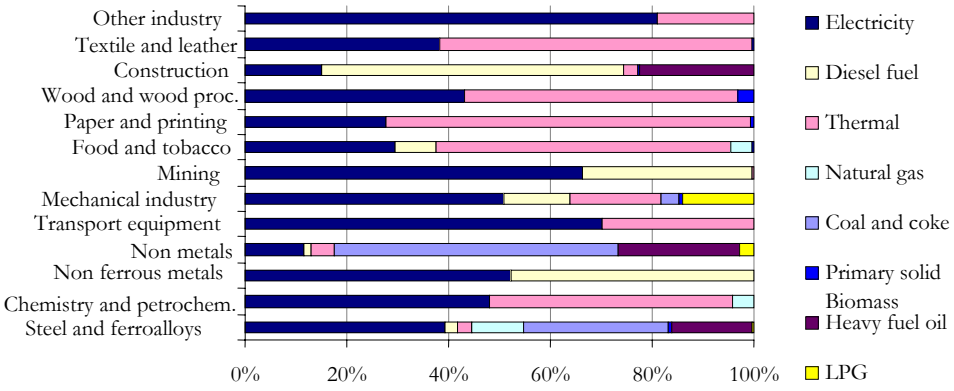

Figure 4.3.1.7 Structure of the energy consumption in industry by sub-sectors

Electricity consumption closely follows steel and ferroalloy domestic and international markets. In 2006, this industrial branch participated with more than 70 percent (1.534 GWh) in the total electricity consumption in the industry sector. The non-ferrous metallurgy is practically insignificant after the smelter for zinc and led ceased to operate. In addition, the chemical industry significantly reduced its production after some of the facilities in the organic and chemistry industry (OHIS) stopped working. The electricity consumption in the industry – excluding the sub-sectors of steel and ferroalloys – decreased until few years ago when a slight increase can be noted. Most of the industrial installations, including those mentioned above, have been shut down due to commercial reasons. However, their possible relaunch includes local environmental issues entailing significant investment costs. Some of the plants have been so deteriorated that their reopening is practically impossible (e.g. Chloral alkali).

Thermal energy is present in almost all industrial sectors in different degrees. Some industries (steel, chemical, mechanical, textile, and leather) use heat received from external suppliers for both their production processes and for heating the working premises and some hot water. Most of the thermal energy delivered to the industry is generated in thermal plants primarily based on fossil fuel combustion. The contribution of thermal energy produced by using waste, by-products or furnace gasses is negligible. Some of the biggest Macedonian metallurgical companies report heat losses as high as 1 percent of the national yearly electricity consumption equivalent.

Almost the entire consumption of **lignite** in the Republic of Macedonia was in the ferroalloy industry (ferronickel and ferrosilicon). The fact that two facilities in this field stopped working in 2000 reduced the lignite consumption in Macedonia to very low values. Of the other industrial branches only the textile and leather industry has a small demand of lignite. According to the Macedonian Academy, several studies have been made for these customers, looking for ways to replace lignite with another type of fuel because of the problems regarding waste management and elimination of emissions in the air. However, even with the investments in systems for environmental protection and waste management, lignite still remains the cheapest fuel in the areas where there is no natural gas supply.

Traditionally, the non-ferrous metallurgy and steel and iron metallurgy (including foundries) were the biggest **coke** consumers. However, after the zinc and lead smelter in Veles stopped working, coke has practically been eliminated as a source of energy. The ferronickel metallurgy uses some quantities of coke and this sub-sector remained the most important consumer.

Petrol coke in Macedonia, due to the composition of the combustion products, is used exclusively for cement production. The cyclone system for heating the batch acts as an absorber for SO_2 and thus its emission is significantly below the maximal allowed, environmentally safe values.

Consequently, since 2004, only two industrial branches are relevant for the solid fossil fuel consumption – the steel and ferroalloy metallurgy and the non-metal industry, particularly the cement industry. These industries, in the last few years, used an average of 170 ktoe/year of solid fossil fuels.

While from 1990 to 1996, heavy fuel oil was present in practically all industry sectors, after this period, it was used only in the steel and ferroalloys industry and the non-metal industry. In 2006, the total consumption of heavy fuel oil in the industry in Macedonia was about 85 ktoe/year. Consumption of this energy source was limited – at least theoretically – by the rule book[40] on maximal allowed concentrations and quantities of harmful matters that can be emitted by industrial facilities.

Petrol and diesel fuels consumption also had strong variations, but, after 2002, the consumption trend levelled out and ranges between 20 and 30 ktoe. This trend continues beyond 2006 (25.4 ktoe in 2007 and 25.8 ktoe in 2008)[41] 2007 and 2008 showed a notable increase of consumption in the steel and ferroalloys metallurgy and in the mining industry.

LPG use in the Macedonian industry was constantly declining from 1996 to 2003, especially because this type of fuel was partially replaced with natural gas. Consumption grew in the last few years, although the total quantity is marginal at about 5 kt (5.5 ktoe) per year. Macedonia still does not have a developed gas distribution network that will enable efficient use of **natural gas** in the industry. Therefore, the use of natural gas depends more on the geographic location than actual need. Natural gas is used exclusively in some industrial facilities in Skopje. The current consumption of natural gas in the industry is annually about 37 ktoe.

Biomass (wood chips and other wood waste) is the only renewable energy source that is used in the industry in Macedonia. The production of ferroalloys (ferrosilicon) is by far the most important consumer of this type of energy.

The Strategy for Energy Development prepared two scenarios of the annual growth rate of energy consumption in the industry: a basic scenario (business as usual) and a scenario with stronger integration of energy efficiency measures:

The basic scenario has an average annual growth rate of energy consumption of 3 percent, which approximately corresponds to the growth rate in the interval of 2002-2006 in the industry, excluding steel and ferroalloys. Considering the problems the sector is presently facing, the steel and ferroalloys industry cannot develop as planned without additional energy efficiency measures. So, even this basic scenario relies on energy efficiency measures for these specific industries. The system of integrated pollution prevention and control which has been implemented through the so-called integrated licenses is based on applying best available technologies . One of the key elements of BAT is the efficient use of energy. Larger industrial installations have already submitted their applications for an Adjustment Permit with an Adjustment Plan which precedes the integrated permit for the existing installations. The Adjustment Plan, among others, has to include measures for improvement of the installations' energy efficiency.

The strategy of cleaner production is not unknown in Macedonia. Starting from 2000, with a brief interruption between 2004 and 2007 when the National Centre for Cleaner Production was established, around 50 small projects were prepared and around 10 of them have been implemented. Part of them relate to efficient energy use.

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[40] Official Gazette of SRM no. 3/90 from 31.1.1990

[41] Macedonian Academy of Sciences and Arts: Strategy for Energy Development in the Republic of Macedonia until 2030

However, all industries and especially the steel and ferroalloys industry will have to include additional energy efficiency measures in order to maintain the competitive position on the world market with moderate steel and ferroalloy prices.

The above elements may significantly reduce the energy consumption per unit product, but its growth will be in correlation with the industrial production growth.

National Strategy for Energy Development of Macedonia defines a **second scenario** with stronger energy efficiency measures. This scenario has been developed assuming that:

- New installations will be designed and constructed for efficient use of energy
- Modifications of existing installations will be carried out to reduce energy losses
- Wasted energy will be recovered

However, no justification has been given in the Strategy for Energy Development and no evaluation of the energy saving potential and practical capabilities has been done. It is most important that CDM projects have not been taken into account for the second scenario.

Table 4.3.1.1 Calculation of the saving benchmark in the Industry Sector

ktoe	**2002**	**2003**	**2004**	**2005**	**2006**	Average	9% Savings
Total final energy consumption in the Industry sector	438	509	464	549	577	507	**45,63**

The indicative target set as benchmark in the industry sector is to realize savings of at least 45.63 ktoe in 2018.

4.3.2. POLICY PRIORITIES AND MEASURES

4.3.2.1 OBJECTIVES

Efficient use of energy in the industry sector is one of the crucial factors for the country's economic growth and competitiveness. This has been already recognized by both the National Strategy for Energy Development and the Industrial Policy of the Republic of Macedonia.

The energy efficiency policy aims at facilitating industrial growth of the country in an environmentally sound manner.

Among the priority objectives of the SIEE reducing the energy intensity, i.e. reduction of energy consumption per unit of GDP is on the top.

4.3.2.2 ENERGY EFFICIENCY POLICY RELATED TO MACEDONIAN INDUSTRY

The policy measures will be focused on: *Improvement of technologies, equipment and process control systems.*

Due to the fact that obsolete technologies, equipment, and process control systems are significant reasons for low energy efficiency, there is a need for making new technologies, equipment, and control systems easily accessible to Macedonian industry. In addition, applied research activities should be encouraged and supported thus increasing the overall effect.

The most effective way of achieving high energy efficiency is to take it into consideration in the earliest possible stage. Therefore, priority will be given to low energy demanding technologies. In addition, measures will be undertaken to ensure that new industrial installations are designed and constructed for efficient use of energy. In this respect:

- Companies will be required to apply best available technologies through specific licensing processes (IPPC and energy audits of the processes) in performing their activities
- As energy saving reduces greenhouse gas emission, CDM should apply whenever it is possible
- Co-generation should be given priority when searching for local energy supply
- Auxiliary systems and activities such as HVAC, compressed air supply, electric motors control, lighting etc. should be gradually improved to use energy more efficiently

Upgrading existing technologies has a significant energy saving potential. Those companies that will be legally bonded to change production techniques (technology, equipment, process control system, etc.) should be able to access such techniques with no import barriers and possibly with a suitable technical and financial assistance.

Although mandatory, approaching BAT is an expensive process and therefore an application of some financial support will be required. Continuation of initiatives like offering low interest rates credit for small and medium sized enterprises will stir up industrial modernization.[42]

The Draft Industrial Policy[43] dealing with applied research and development is also related to the energy efficiency policy.

4.3.2.3 SETTING UP THE TARGET

Based on the data on energy consumption provided in permit applications, technical conditions of the installations in Macedonia, BREF documents, the Industrial Developing Strategy and the Strategy for Energy Development, an indicative target has been set up to reach 9 percent savings in the year 2018 of the average energy consumption, which according to IEA is 507.4 ktoe per year (in the period 2002-2006).

This is translating in an amount of savings of 45.63 ktoe.

Regardless of the extent of energy savings potential, country wide industry savings of over 9 percent in 2018 is a rather high figure and an effective way of implementing the policy must be established in order to achieve these figures. Realistically, high figures are only expected towards the end of the period of consideration due to implementation of major projects encouraged by the energy efficiency policy.

4.3.3. SIMULATION AND FORECAST OF ENERGY CONSUMPTION SAVINGS

Planning of the energy needs of the industry in the period until 2020 was based primarily on the projections of the economic growth and on the growth of the industrial production. In addition, it must also be considered the weaknesses that need to be removed as well as the opportunities that need to be used. These included the following in particular:

- ❖ Increase of the efficient use of energy
- ❖ Improvement of technologies, equipment and process control systems
- ❖ Reduction of the dependence on fossil fuels and minerals
- ❖ Reduction of the use of electricity in the thermal processes

[42] European Investment Bank credit line for Small and Medium sized Enterprises, supported by Government of Macedonia

[43] Subchapter 6.2.3 of the Final Draft of Industrial Policy of Republic of Macedonia:

❖ Technology transfer stimulation. Government will stimulate transfer of new technology by elimination of import barriers and co-financing of costs for technology which will enhance introduction of new higher value added products and services.

The penetration rate and yearly cumulative savings are shown in Figure 4.3.3.1.

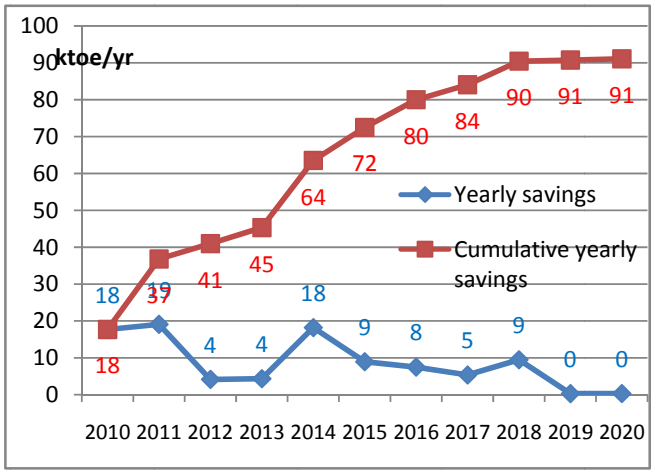

Figure 4.3.3.1 Industry sector savings and penetration rate during the observed period

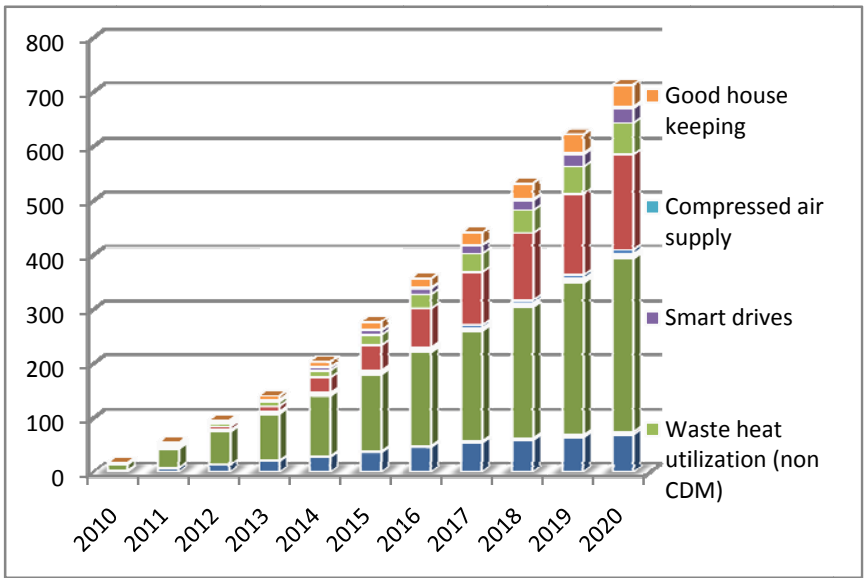

Figure 4.3.3.2 Industry sector – the share of different measures for energy savings

The influence of cogeneration is very high (Figure 4.3.3.2) followed by CDM projects and waste heat utilization.

Figure 4.3.3.3 indicates the amount of energy Macedonia will need if the projected energy efficiency measures are not being implemented in the industry sector. Thus it is assumed that the Scenario with stronger energy efficiency measures of the Strategy for energy sector development may be implemented only if the projected measures of the SIEE are in place.

The basic scenario assumes annual increase of the energy needs by 4,38 percent.

The scenario with stronger EE measures assumes annual increase of energy needs by 3,91 percent. If the projected measures of the Strategy for energy efficiency are not implemented, an annual increase

of energy consumption by 4.34 percent may be expected, thus reach consumption of 849 ktoe by 2020 instead of the anticipated 794 or 758 ktoe.

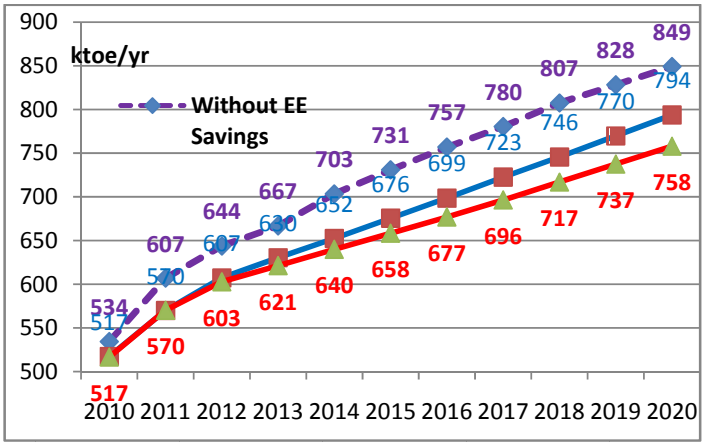

Figure 4.3.3.3 Final energy needs in accordance with Strategy for Energy Development and SIEE in the industry sector

The increased energy savings, not clearly indicated in the Strategy for energy sector development, is based on the ESD decreased primary energy consumption facts at the CHP which is considered as energy saving in the industrial sector. The two new plants significantly affect the steep energy savings increase. Thus, it is agreed that 15 percent of the generated energy will be considered as savings. (PES>10 percent).

Reduced CO_2 emission is 3137 $ktCO_2$ equivalent (Figure 4.3.3.4):

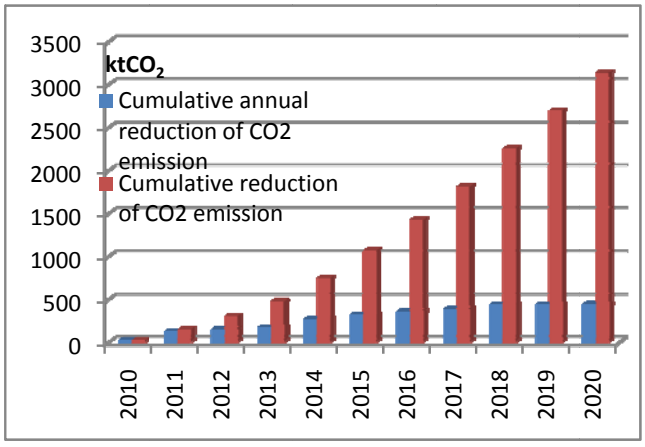

Figure 4.3.3.4 Reduction of CO_2 emission

4.3.3.1 LEGAL MEASURES

Reliable data on energy consumption and energy efficiency. It will be practically impossible to evaluate the implementation of the energy efficiency policy if reliable data are missing on energy consumption and on the efficiency at which the energy has been used. The Energy Lawshould make reporting on energy efficiency compulsory for most of the industry sectors.

Legal mandate to energy efficiency. The legislation will ensure that all new industrial plants and facilities will be designed, constructed, operated, and maintained so that energy is used efficiently. There is a provision in the Law on the environment for efficient use of energy by installations operated under IPPC and a sub chapter in the Integrated Permit template. However, the enquiry for energy efficient design, construction, operation and maintenance can only be deduced from the definition of Best Available Technologies. Therefore, the new Energy Law should be adopted and the Law on Environment should be updated as soon as possible. Based on the updated Laws suitable pieces of sub-legislation are to be provided indicating or setting up standards for energy efficiency in the industry sector escorted with mandatory energy audit.

Energy saving plans. Industrial companies will be required to prepare and implement energy saving plans as part of their energy management plans. The Energy Lawshould provide for target agreements between the government and the companies thus linking the national action plan to companies own plans.

Sub-chapter 2.7 of the Integrated Permit requires that the operator prepare and submit an energy management plan to the competent authority for approval. Guidelines are to be provided for the operators and the regulator on preparation and evaluation of energy management plans in which the energy saving plans should be incorporated.

Energy auditing is mentioned only in the IPPC guidelines and is required for IPPC installations. Otherwise, it is only part of the environmental audit which is mandatory in case of change of ownership. Regular energy audits with defined scope and frequency have to be provided by the new Energy Law.

Training. *An efficient training program should be developed and implemented aimed at training the trainers (experts that will further train industry staff to conduct assessments, develop, and finance energy efficiency projects and select and participate in carrying out pilot projects). An information campaign should be organised to introduce companies to energy management and system optimisation.*

Non-residential buildings, especially those in production facilities are significant consumers of energy for heating. In a number of cases such buildings are heated with steam leading to overheating, but also to substantial losses of heat due to losses of condensed steam and the overall efficiency of the steam plant. In addition, non residential buildings are generally poorly insulated relying on the availability of energy.

Policy measures will be established to encourage use of alternative and more effective fuels while reducing volume of exhaust gasses.

4.3.3.2 FINANCIAL MEASURES

The Policy will provide suitable forms to help industry in building its capacity for more efficient use of energy. These will include:

Subsidies for energy audits for SMEs. For a number of small and medium-sized enterprises financial barriers for initiating energy efficiency are an important issue. Most often they have a shortage of funds or consider their energy costs as a small portion of overall expenditures and therefore neglect them. In order to promote energy auditing as a suitable tool and opportunity indicator it is necessary to subsidize SMEs for this important part of energy efficiency activities. The TAM-BAS program has already been active in this field and it should be supported to help more SMEs.[44]

[44] The EBRD's TurnAround Management (TAM) and Business Advisory Services (BAS) Programme helps private enterprises adapt to the demands of a market economy. These complementary programmes develop the micro, small and medium-sized enterprises (MSMEs) through a multi-tiered approach. TAM/BAS is fully integrated into the EBRD's activities, alongside banking and investment. TAM focuses on substantial managerial and structural changes within companies, providing the advisory services of experienced senior executives from economically developed countries. BAS supports short-term projects with narrowly defined objectives and develops a sustainable infrastructure for business advisory services in the countries of operation.

Soft loans for investments in energy efficiency. Although generally profitable, energy efficiency measures may require substantial investment and companies usually do not take such a risk in doubt that the savings will be materialized. To encourage investment in this field, mechanisms will be developed to offer low interest rate and long grace period loans to enterprises, SMEs in particular.

Energy Efficiency Fund. Due to lack of financial means and technical knowledge Macedonian companies are not able to use most of their potential for cost-effective energy efficiency improvements. There is a need for an organisation collecting funds and allocating them to the most cost-effective programmes. In addition it will help (finance) small and medium enterprises in performing energy audits and preparing feasibility studies for energy efficiency projects.

Establishing Energy Efficiency funds has been explicitly mentioned in paragraph 11 of the Directive 206/32/EC as one way to subsidise energy efficiency improvement programs and other energy efficiency improvement measures.

Reduction of taxes. Reduced taxes will be applied for investments in energy efficiency projects. In addition, reduced VAT should be applied to energy efficient products.

Statement

Although the targets of the SIEE in industry are by far ahead the requirements of the Directive 2006/32/EC, they are feasible – if a good action plan is prepared and all the institutional, legislative, technical, and financial prerequisites are in place and timely.

ANNEX 6 Transport Sector

Correspondent with chapter 4.4

4.4.1 PATTERNS OF DEMAND

The development of any strategy, as a long-term action, requires a "good sense" or a "good vision" of the future for the sector of concern.

What is the future of transport in Europe? The report to the DG Energy and Transport prepared by the Focus Groups[45] produces valuable findings that could also help to define the expected future environment in Republic of Macedonia.

In this sectoral report, seven factors are identified as the most basic drivers of future transport activity:

- ageing
- migration and internal mobility
- urbanization
- regional integration
- globalization
- climate change
- technology (in particular energy and information technology).

The Directorate General for Transport and Energy (DG TREN) report predicted greater demand for mobility and stronger relations with neighboring countries.

The transport sector in this scenario will have to satisfy a greater demand for mobility.

Over the past decades, transport activities in the EU have increased substantially. From 1995 to 2006, intra-EU freight transport, measured in tonne-kilometres, has increased by 2.8 percent per year on average,[46] while the average annual growth of intra-passenger transport, measured in passenger-kilometers was 1.7 percent.[11] This compares with average GDP growth over the same period of 2.4 percent.[11]

This trend is expected to continue, and it will result in a growth of energy consumption in the transport sector at a rate not matched by any other sector. This can be explained by the strong growth of transport activity which overrides the effects of the improved vehicle energy efficiency.

The general picture of the trends of energy consumption in the transport sector in EU27, as well as its relation with the GDP and population, can be obtained by means of the data in the Table 4.4.1.1.

45 THE FUTURE OF TRANSPORT, Focus Groups' Report, EC DG Energy and Transport, 20.02.2009

46 DG TREN (2008) EU Energy and transport in statistical figures. Statistical pocketbook 2007/2008

Table 4.4.1.1 Trends of GDP, population and energy consumption in the transport sector in EU 27[47]

EU 27 YEAR	2001	2002	2003	2004	2005	2006
GDP (in million 1995 Euros)	8208568	8300717	8397626	8599411	8753634	9015573
Population (in 1000)	483782	484613	486618	488757	491023	492976
Total energy consumption in transport sector (1000 toe)	343056	345986	351323	359780	362392	370304
Gasoline	129300	127692	123736	120567	114297	110207
Diesel	157306	162133	169287	177672	182885	190201
Kerosene	44312	43595	44977	47672	49703	51719
Electrical power	6128	6160	6219	6294	6370	6236
	337046	339580	344219	352205	353255	358363
Other	6010	6406	7104	7575	9137	11941
Consumption of natural gas in transport sector (1000 toe)	559.568	504.776	507.523	512.658	562.482	648.514
Renewable energy (biofuels, biogas, hydrogen) – 1000 toe	755	986	1351	1977	3131	5376

The intensity of energy consumption in transport sector in EU 27, over the same period from 2001 to 2006 is shown on Figure 4.4.1.1.

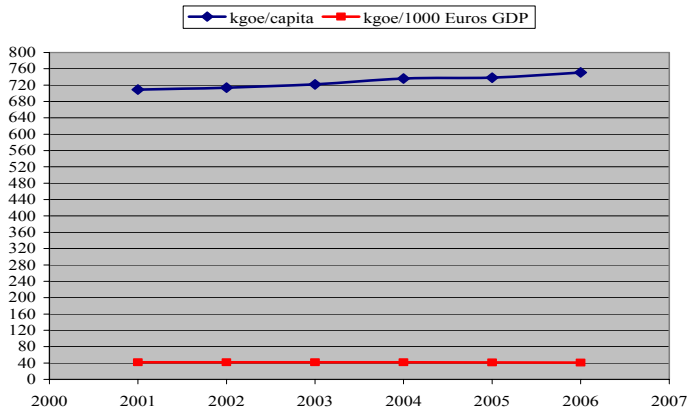

Figure 4.4.1.1 Intensity of energy consumption in transport sector in EU 27[48]

[47] Source: EUROSTAT - Energy - yearly statistics 2006, EUROPEAN COMISSION - 2008 edition

[48] Ibid

The comparison of energy consumption per capita in the transport sector, between Macedonia and EU 27, shows that every citizen in Macedonia spends about four times less energy in the transport, compared with average values in EU27. Moreover, while the intensity of energy consumption in the transport sector in EU 27 has been increasing over the period from 2001 to 2006, the same variable seems to have remained steady in Macedonia, over the same period. This can be seen in Figure 4.4.1.2.

The transport sector in Macedonia consumes about 21 percent of the total final consumption of energy. The distribution of energy consumption by sectors in Macedonia, as well as the portion of energy consumption in the transport sector is shown in Table 4.4.1.2.

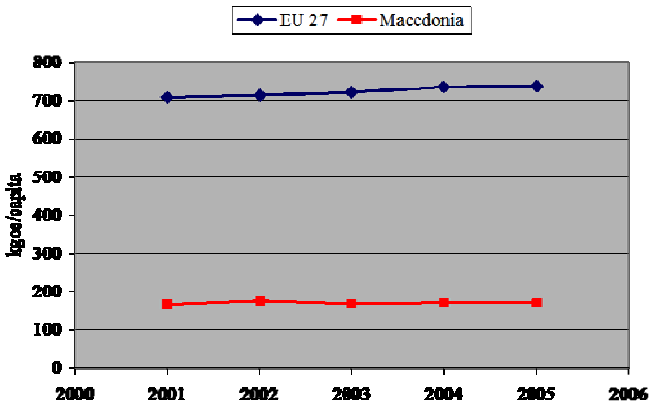

Figure 4.4.1.2 Intensity of energy consumption in transport sector in Macedonia and EU 27[49]

Table 4.4.1.2 Energy consumption per sector in Macedonia in ktoe per year

Year	1992	1995	2000	2001	2002	2003	2004	2005
Housing	508	447	481	441	450	492	488	485
Industry	686	511	531	457	437	467	462	547
Commercial and public services	53	69	143	119	231	253	226	244
TRANSPORT	274	336	363	345	360	347	352	352
Agriculture/ forestry	61	142	56	57	33	28	61	37
Other	73	46	35	24	38	34	43	36
Total final consumption	**1655**	**1551**	**1609**	**1443**	**1549**	**1621**	**1632**	**1701**
% transport	16.56	21.66	22.56	23.91	23.24	21.41	21.57	20.69

Within the transport sector, the road transport mode is the most dominant one in Macedonia. In the years 2002 to 2006, over 97 percent of the energy consumed in the transport sector, was actually consumed by road transport.

The trend of energy consumption in Macedonia by mode of transport is shown in the Figure 4.4.1.3.

[49] Source: EUROSTAT - Energy - yearly statistics 2006, European Commission – 2008 edition

The distribution of number of vehicles in road transport sector in Macedonia, by type of energy is shown in Figure 4.4.1.4. As can be seen from the graph, gasoline is the dominant type of fuel, followed by diesel and LPG. It is noteworthy that there has been a trend of decreasing use of gasoline and growth in consumption of diesel and LPG over the last six years. This trend comes from the increasing number of vehicles in road transport with diesel engines, as well as due to the increase of number of gasoline engine vehicles that have been converted to LPG.

Detailed data on the trends of energy consumption in the transport sector in Macedonia for the period from 1990 to 2006, by type of fuel and mode of transport, is given in Table 4.4.1.3.

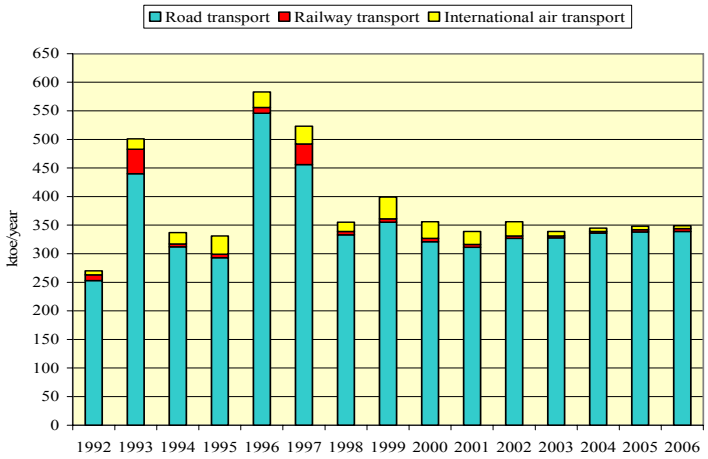

Figure 4.4.1.3 Energy consumption in Macedonia by mode of transport[50]

The consumption of electrical power in the transport sector comes from the rail transport mode, and the rail sections that are electrified. Since some parts of the railway network are not electrified, diesel locomotives have also been use. There is no significant water transport in Macedonia. During the summer months, there is lake transport, mostly on Lake Ohrid, but the consumption of energy by this type of transport mode is only symbolic, and is not considered in this analysis.

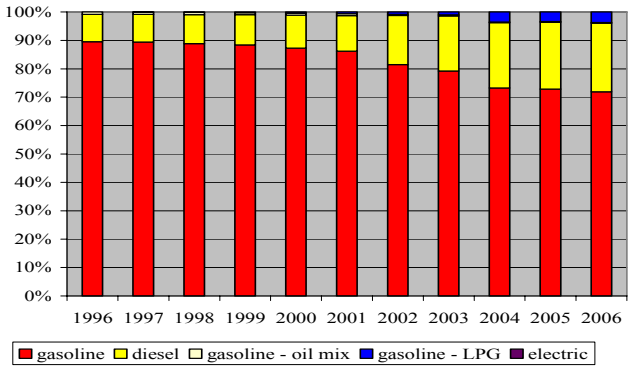

Figure 4.4.1.4 Distribution of road vehicles in Macedonia by type of fuel[51]

[50] Source: EIA ENERGY STATISTICS, Electronic version 2007

[51] Source: EIA ENERGY STATISTICS, Electronic version 2007

Table 4.4.1.3 Consumption of energy in transport sector in Macedonia by type of energy and mode of transport (in ktoe/year)[52]

	gasoline			diesel			LPG	electricity	Total transport
year	total	road	rail	total	road	rail	total	total	(without air transport)
2000	150	150	0	173	169	4	2	2	327
2001	137	137	0	174	171	3	3	1	315
2002	142	142	0	176	174	2	13	2	333
2003	132	132	0	178	176	2	21	2	333
2004	128	128	0	184	182	2	26	3	341
2005	123	123	0	187	185	2	30	2	342
2006	112	112	0	192	189	3	37	4	345

It is important to forecast the structure and trends of energy consumption in transport sector that could be expected in Macedonia.

The Strategy for Energy Development of the Republic of Macedonia until 2030 offers a forecast of the energy consumption in the transport sector in Macedonia by 2020. The forecasted results have been based on the definition of two scenarios: "scenario of moderate economic development," and "scenario of slow economic development." The projected energy consumption for the scenario of moderate economic development is presented in Table 4.4.1.4.

Table 4.4.1.4 Forecasted energy consumption in transport sector in Macedonia (without air transport) in ktoe/year[53]

ktoe	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
gasoline	125	129	136	142	149	156	162	169	175	182	188
diesel	208	221	239	259	279	299	319	340	361	382	403
LPG	16	18	20	23	26	29	32	35	38	42	45
TOTAL	**349**	**368**	**395**	**424**	**454**	**484**	**513**	**544**	**574**	**606**	**636**

In view of recent global developments regarding the economic crisis and recession, it seems that the "scenario of slow economic growth" provides better estimates for the period until 2018.

However, in the long run, regardless of the timing of the periods with low or high rate of growth of the Macedonian economy, Macedonia can also expect growth of activities in the transport sector, and consequently a growth of energy consumption in the transport industry. Therefore, the development of an SIEE is essential, if Macedonia is to address problems of energy consumption and supply, as well as environmental problems.

Table 4.4.1.5 Calculation of the indicative saving target in the Transport Sector

ktoe	2002	2003	2004	2005	2006	Average	9% Savings
Total final energy consumption in the Transport sector	356	340	346	348	350	348	**31.3**

[52] Source: EIA ENERGY STATISTICS, Electronic version 2007

[53] Source: Strategy for Energy Development of the Republic of Macedonia until 2030, Skopje, 2010

The final energy savings in the *Transport Sector* within the scope of the Energy Services Directive in the Republic of Macedonia in 2018 would have to be equal to 31.3 ktoe or higher.

As far as the transport is concerned, efficient use of energy implies more intensive use of public transport with promotion of environmentally friendly vehicles, improvement of fuel quality, as well as breakthrough of bio-fuels (Sustainable Transport).

The implementation of these technical measures should be supported by launching targeted public awareness raising programs as well as by developing appropriate curricula for each educational level.

Identification of policy measures for increased energy efficiency in transport sector

(The approach of the European Union to the problem on energy consumption and CO_2 emissions from transport sector)

The transport sector is probably the most unsustainable activity of human civilization today. The transport sector is travelling in the "wrong direction" environmentally, according to a new European Environment Agency report. The Agency report "Transport at a Crossroads" finds that the sector contributes disproportionately to greenhouse gas emissions, poor air quality, and noise and still uses the least efficient modes to move people and goods.

The European Environment Agency says the technology is available to tackle the impact of transport on Europe's environment but points worrying statistics, including that:

- *Transport emissions of greenhouse gases, excluding international aviation and marine transport increased by 26 percent between 1990 and 2006*
- *Total freight volume for EU member states increased by 35 percent between 1996 and 2006 while rail freight and inland waterways market share fell*
- *Car ownership levels rose between 1995 and 2006 by 22 percent or 52 million cars – equivalent to the entire UK and Spain fleets put together. Meanwhile, the number of kilometers travelled by EEA member country passengers grew by 65 million kilometers in 2006.*

In 1998 the Commission of the European Communities issued a Communication (COM (1998) 204 final) on transport and CO_2 that contained policy approaches which were expected to contribute to curbing the growth of fuel consumption and in CO_2 emissions from transport. In addition, the emission reduction potential of a certain number of promising measures was assessed. The list of measures given in this Communication is briefly presented in the following text.

4.4.2 CRITERIA, METHODOLOGY AND ENERGY SAVINGS POTENTIAL

IMPROVING THE EFFICIENCY OF ALL MODES OF TRANSPORT

Road Freight. The potential for better and more efficient logistics is substantial. Road haulers can increase the utilization of vehicles and reduce the empty running. Using information systems and better management practices, efficiency can be increased. According to some estimates, improved logistics and more efficient freight operation could achieve a reduction in truck operations and vehicle-km in the order of 10 to 40 percent. The development of city logistics can also make a significant contribution.

Passenger car. Passenger car energy consumption has exhibited a strong growth trend in the past and is expected to grow significantly in the future. The average fuel economy of passenger cars has improved significantly over the last 20 years, but the effects of this have been eliminated due to increase in vehicle ownership and increases in vehicle-km travelled.

The EU has adopted a strategy to increase energy efficiency from passenger cars by improving the fuel economy (COM (95) 689 final 20.12.1995) with the objective to achieve a 30 percent improvement of average fuel economy of new cars.

The objective is to be achieved by a package of complementary measures: (1) an environmental agreement with the automotive industry under which the industry would commit itself to reducing the average CO_2 emissions of new cars; (2) fiscal measures in the context of vehicle taxation; and (3) a consumer information scheme to influence the market.

Rail freight. Unlocking the potential of railways to carry a larger part of freight transport is a crucial dimension of the Common Transport Policy. The railways are seen as significant potential for cutting of energy consumption. In order to ensure conditions for efficient rail market, the Commission has issued three policy packages in 1998. The first contained guidelines for the use, management, and pricing of rail infrastructure; the second comprised the rules on the financial relationship between States and railways, whilst the third set out an approach to further technical harmonization and interoperability in conventional rail.

Assuming a cross-price elasticity of 0.5 between rail freight and road freight, a decrease of 25 percent in railway freight tariffs, would allow a reduction of energy consumption from road transport of about 4.5 percent.

Public passenger transport. A well-planned public transport system that offers high-quality service has also great potential to reduce passenger car travel in urban areas. This has been recognized in several documents issued by the EU (1996 Green Paper "The Citizens' network" and Communication "Sustainable Urban development in the European Union: A framework for Action – COM (1998) 605 Final)

According to some estimates made by the Commission, a 5 percent shift of passenger car transport to public transport by bus and rail would reduce energy consumption by 2 percent. However, it is emphasized that these results depend greatly on the occupancy rates of public transport vehicles, which points out the need for improving the public transport operations and services.

Air transport. Air transport has the highest energy consumption per passenger-km and per ton of freight shipped. Moreover, the growth in aviation is two to three times higher than the average growth in transport.

Although the share in transport emissions is still relatively small (12 percent), this clearly implies that the action in aviation is required. Options that are available are promoting the efficiency of the air transport system, including the taxation and charging, and the policies to develop alternatives to aviation, where appropriate.

Efforts are being made to integrate Air Traffic Management System (ATMS) at a European level, which would also make an important contribution. Studies made by EUROCONTROL suggest that optimization of ATM operations could contribute to energy consumption of about 7 percent.

4.4.3. ASSUMPTIONS AND FORECAST OF ENERGY CONSUMPTION SAVINGS

Macedonian goals in this sector are similar to the European.

The realized savings are over the target determined under ESD equal to the benchmark of 31.3 ktoe (Figure 4.4.3.1):

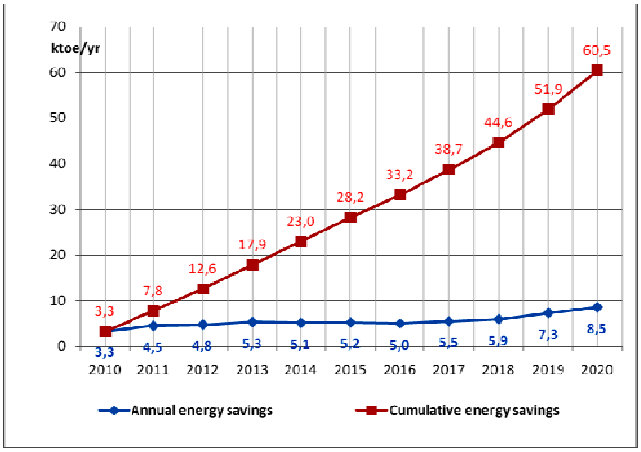

Figure 4.4.3.1 Expected savings in the transport sector

In accordance with the expected measures realization of the Strategy for Energy Sector Development of the Republic of Macedonia, the savings based on EE measures are higher compared to the ESD projected benchmarks. At moderate scale implementation of the proposed energy saving measures, double savings may be obtained (60.5 ktoe). At higher efforts and society engagement 93.4 ktoe may be achieved, which are fully compliant with the projections of the Strategy for Energy Sector Development. Thus the simulation shows that there is potential for savings of up to 140 ktoe though with State financial support (decrease of the purchasing fees for new cars, public transport stimulations and subventions, rail transport stimulations).

Realization of the analyzed scenario depends to different elaborated measures and policies. Participation of these measures into final savings is shown on the Figure 4.4.3.2.

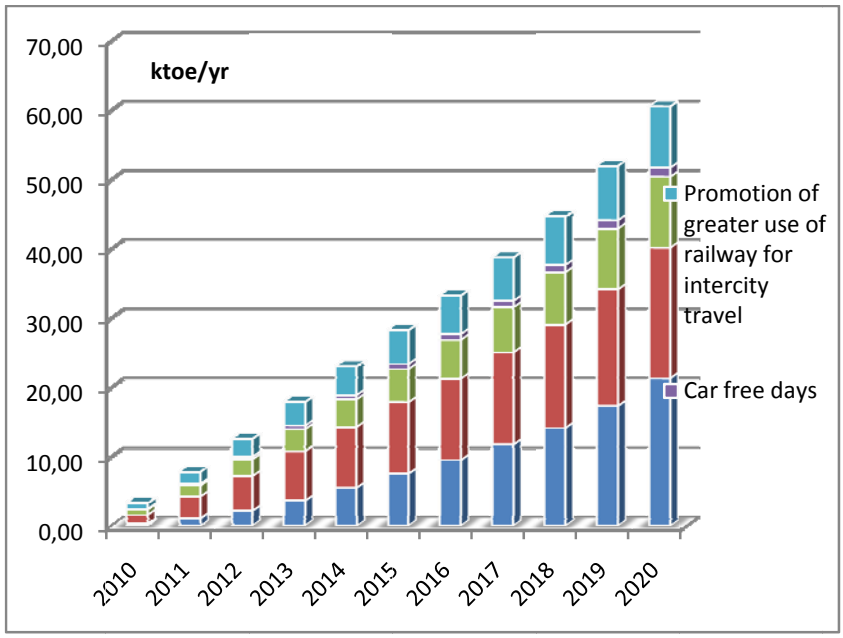

Figure 4.4.3.2 Expected energy savings share by different measures

Figure 4.4.3.3 indicates the energy quantity Macedonia will need if the projected energy efficiency measures are not being implemented. Thus it is assumed that the Scenario with stronger energy

efficiency measures of the Strategy for energy sector development may be implemented only if the projected measures of the NEEAP are in place.

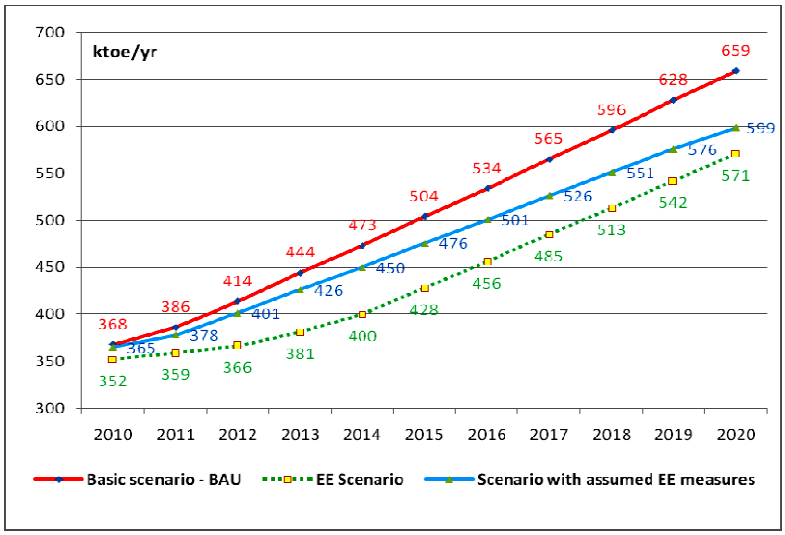

Figure 4.4.3.3 Final energy needs in accordance with joined Strategy for Energy Development and SIEE in the Transport sector

The basic scenario of the Strategy for Energy Development (red curve on Figure 4.4.3.3) assumes annual increase of the energy needs by 6 percent during the period 2010-2020. The scenario with stronger EE measures (green dotted curve) assumes annual increase of energy needs by 4.96 percent. In case if the projected measures of the Strategy for energy efficiency are implemented (blue curve), an annual increase of energy consumption by 5.08 percent may be expected, thus reach consumption of 589 ktoe by 2020 instead of the anticipated 659 (red curve).

During the outcomes simulations, a conservative saving measures penetration analysis was conducted. The analysis indicates that this sector should employ great effort in society in order to achieve the projected energy savings of the high-level EE measures implementation scenario from the Strategy for energy sector development.

Reduced CO_2 emission is 995 $ktCO_2$ equivalent (Figure 4.4.3.4):

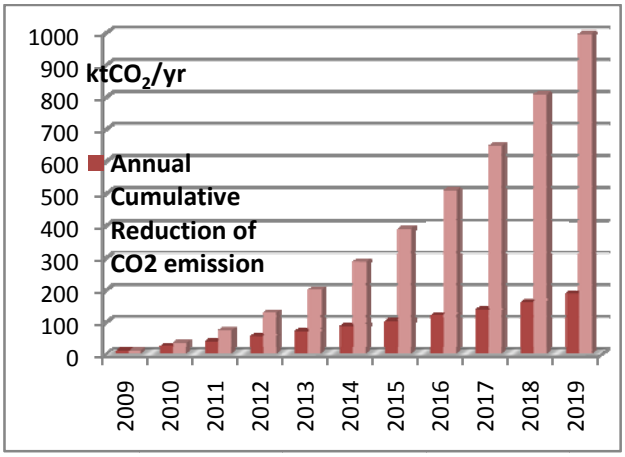

Figure 4.4.3.4 Reduction of CO_2 emission

4.4.3.1 CREATING AN INTEGRATED EU TRANSPORTATION SYSTEM

Intermodality, combined transport and logistics. Putting forward a new systems approach, the 1997 Communication on Intermodality and Intermodal Freight Transport in EU promotes intermodality as a tool whereby transport services are offered as mode-dependant door-to-door connections, based on a variety of modal transport alternatives.

Combined transport that uses the road, railway, maritime transport, and inland waterway modes have consistently better energy efficiency performance than road transport. An important element of such intermodal systems is the availability of network of terminals to tranship goods from one mode to another. The EU expects that the combined transport can reduce energy consumption by 2–3 percent.

Moreover, the EU has invested considerable resources into research and development of information systems for road transport. The progressive implementation of these systems will significantly improve the information flow to car users, allowing them to avoid congested areas and thus increase fuel economy.

Traffic management measures improving the flow of vehicles in urban areas can reduce fuel consumption by 5 percent to 15 percent depending on the situation. Since the urban traffic represents about 30 percent of all vehicle traffic, this could produce an overall fuel consumption reduction from transport of 3 percent.

Fuel taxation. Community Directives on the excise duty of mineral oils lay down minimum rates of duty that must be applied in Member States. The Commission believes that increase in the Community's minimum fuel taxes constitute and important element in a strategy for reducing fuel consumption from transport. This policy is still being discussed. Many measures like differential treatment favoring public transport over private cars or introducing tax on kerosene could be implemented.

Fair and efficient pricing. The EU objective of ensuring sustainable transport requires that prices reflect underlying costs to society, which would otherwise not be taken into account by transport users. These costs include the damage caused to transport infrastructure, air and water pollution from transport CO2, emissions, the costs of time delays caused by congestion, transport related accidents and the noise "pollution" from transport.

At the community level, it is estimated that the policy of internalizing all external costs of transport would reduce fuel consumption and CO2 emissions on average by 11.5 percent.

4.4.3.2 COMPLEMENTARY MEASURES FOR REDUCING FUEL CONSUMPTION FROM TRANSPORT

Measures by national, regional, and local authorities. Within the framework of better traffic management, national and local authorities can play an important role by contributing to the development of traffic plans. They are ideally placed to deploy measures to discourage the use of private cars and to encourage the use of public transport and alternative transport modes including cycling and walking.

Measures to control the availability of parking in congested areas can be best implemented by local authorities. Authorities can restrict certain lanes to high occupancy vehicles, can apply number of traffic management schemes that would lead to better efficiency of the transport.

The circulation of trucks in cities creates specific problems. City logistics systems have been able to reduce the distances driven in cities by some 60 percent as demonstrated the THERMIE program.

According to some estimates of the Commission the possible impacts of various local measures on total fuel consumption from transport are:

- Promotion of cycling: 4 percent reduction

- ❖ Speed limit and better speed control: 5 percent reduction
- ❖ Information campaigns: 3 percent reduction
- ❖ Higher parking charges: 1 percent reduction
- ❖ Restriction of cars and lorries in cities: 1 percent reduction

Land-use planning and transport. Good cooperation between those who are responsible for traffic management and land-use planners is important for the long-term efficiency of transport systems. By considering where people live and where their professional activities take place, land-use planners can make a useful contribution to more efficient mobility in terms of trips made, distance travelled, and the type of transport mode used. As land-use policies have a direct effect on fuel consumption, effective long-term land-use planning can influence fuel consumption from transport by minimizing the need for travel.

4.4.3.3 LONG-TERM SOLUTIONS

There are obviously limits to fuel efficiency improvements that can be gained by further improving the internal combustion engine. For the future, the technical answer lies in the development of alternative propulsion technologies, notably hybrid car technology and fuel cell.

Hybrid cars that use a combination of a battery and conventional engine could provide 20 to 50 percent fuel savings in urban driving conditions compared with the existing vehicles.

The strategy recognizes the positive results of certain measures already taken at EU level, but underlines that further progress is required in the following areas:

- ❖ Avoidance and/or elimination of the negative effects of traffic growth, particularly through land use measures and infrastructure charging
- ❖ Promotion of public transport, inter modal and combined transport and environmentally less harmful modes (e.g. railways and inland waterway)
- ❖ Further research and technological development, in particular to reduce CO2 emissions and noise
- ❖ Raising of awareness among the public, vehicle drivers and the industry of how to reduce the environmental impact of transport, e.g. through indicators and vehicle standardization.

4.4.3.4 POLICIES ON TRANSPORT AND ENERGY IN REPUBLIC OF MACEDONIA

The national strategy for transport, energy and environmental protection is yet to be defined and developed in Macedonia.

Partially, some of the relevant issues have been raised in several documents published during the last 10 years.

- The second NEAP – The Second National Environmental Action Plan[54] has raised the problem of pollution from the transport sector and its contribution to the pollution of air, soil, water, and noise.
- Macedonia's first national communication on climate change[55] has included the estimates of greenhouse emissions from the transport sector and has given general recommendations on the ways to reduce those emissions:
  - To reduce the increase of vehicle-kilometers

54 The Second National Environmental Action Plan, NEAP II, Ministry for Environment and Physical Planning, 2006.

55 Macedonia's First National Communication under UN framework convention on climate change, Ministry of Environment and Physical Planning, Skopje, 2003

- To promote public transport and cycling
- Greater use of electric transport modes (railway, tramway in Skopje)
- Improvement of traffic management and control
- Development and implementation of city logistics systems

- The Spatial Plan of Republic of Macedonia[56] contains the plan for development of national transport infrastructure. This plan emphasizes the need to apply the concept of sustainable development. In this direction, the improvement of the railway infrastructure and intermodal transport has been recommended
- The National Transport Strategy[57] has defined the objectives of the development of the Macedonian transport system. This document underlines the main directions in developing transport policies and actions:
  - The need to upgrade the transport infrastructure
  - The need to improve transport safety
  - The need to improve the accessibility and mobility
  - The need for sustainable transport system and protection of the environment (protection of water, air, biodiversity, soil, decreasing of climate change effects, landscape etc.)
  - The need to substantially improve the urban transport (public transport and other environmentally friendly modes)
  - The need to develop and improve the intermodal and integrated transport

The National Strategy for Upgrading of Road Transport Safety[58] does not specifically address problems related to the energy consumption and environmental protection. It does define actions for reduction of the number of traffic accidents in general, as well as actions to protect specific vulnerable groups, such as pupils and students, elderly people, handicapped, etc.

Therefore, this National Energy Efficiency Action Plan is entirely in line with the objectives defined in the national transport strategy.

4.4.4 COST ESTIMATE

The proposed measures for greater energy efficiency in the transport sector in Macedonia, involve certain costs for their implementation. The financial issues of the implementation of these measures have been discussed.

Renewal of the national road vehicle fleet. The promotion and support of this measure should be achieved through regulatory and fiscal measures implemented by the national government. The possible policy measures can be aimed at achieving:

1.1 Incentives for purchase of clean and energy efficient vehicles

1.2 Incentives for use of clean and energy efficient vehicles

56 Spatial Plan of Republic of Macedonia56, Ministry for Transport and Communication, 2004.
57 National Transport Strategy, Ministry for Transport and Communications, 2007.

58 National Strategy of Republic Macedonia for Upgrading of Road Transport Safety 2009 - 2014, National Council for Road Transport Safety, November 2008.

The first group of policy measures may include various schemes, such as:

1.1.a. Reduction of taxes for purchase of new clean and energy efficient vehicle and keeping the same existing costs for the other vehicles

1.1.b. Reduction of taxes for purchase of new clean and energy efficient vehicle and increasing the taxes for other vehicles

1.1.c. Provision of bank credits with lower interest rates, if a new clean and energy efficient vehicle is purchased. The difference from commercial rates can be covered by the government, but also other financial arrangements can be made between the government and the commercial banks.

The second group of policy measures include schemes such as:

1.2.a. Lower costs for vehicle registration for clean and energy efficient vehicles

1.2.b. Lower costs for parking in the centre of the city for the clean and energy efficient vehicles

1.2.c. Lower ecological tax (if there is any) for clean and energy efficient vehicles

1.2 d. Lower tax on property (for passenger vehicles over 2000 sm^3) for clean and energy efficient vehicles

The financial impact of implementation of these measures will depend on the policy scheme applied. The impact on the national budget can be negative, if only reduction of the existing taxes is implemented. But, if the fiscal measures include redistribution of taxes between energy efficient and energy non-efficient vehicles, the financial effects could be even positive. This would be the case if the income from higher taxes for old vehicles is higher than the loss because of lower taxes for new energy efficient vehicles.

The current taxes for purchase of new passenger vehicles are given in the table below:

Type of vehicles	Customs	VAT	Accise	
			Denars	Wuros
below 1500 cm^3	5%	18%	72000	1176
1500 - 2000 cm^3	4%	18%	160000	2614
2000 - 2500 cm^3	4%	18%	330000	5392
2500 - 3000 cm^3	2%	18%	550000	8987

In the worst case scenario (the existing taxes are lowered for clean and energy efficient vehicles – no higher taxes for the other vehicles), the loss of income for the national budget would be estimate at:

Regular income – reduced income = 56 622 549 – 23 061 275 = **33 261 274 euros/year**

Assumptions:

15 000 new vehicles per year

VAT lowered to 5 percent

Average price of new vehicle 14 000 EUROS

Accise 50 percent of existing values

Structure of new vehicles

80 percent - below 1500 cm^3

15 percent - 1500 to 2000 cm^3

3 percent - 2000 to 2500 cm^3

2 percent - 2500 to 3000 cm^3

The fiscal measures from the second group can be easily implemented through the approach of redistribution of costs, so the net result for the resulting income, after measure implementation could be zero. In order to estimate the possible investments from this measure, the data and forecasts from the National Strategy for Energy Development of Republic of Macedonia[59] is being used. The forecast takes into account:

	New road vehicles	**Cumulative**
2009	4281	4281
2010	2245	6526
2011	1923	8449
2012	1921	10370
2013	8035	18405
2014	13775	32180
2015	20365	52545
2016	20630	73175
2017	21149	94324
2018	21667	115991
2019	22182	138173
2020	22696	**160869**

Assuming the average price of a new vehicle is 14,000 EUROs, the amount invested in new vehicles is 2252.2 M€. This amount cannot be directly considered an energy efficiency investment as the efficiency is not the only purpose of the fleet replacement, the primary reason being the phase-out of depreciated vehicles. Energy saved is a by-product of the fleet modernization.

Influence of the new vehicle fuel consumption to the consumer is a large, but not determining factor. It can be taken into account that this can influence the final decision with 15 percent and with the same ratio to determine investment into new fleet, directed to more efficient engine.

Promotion of sustainable urban transport systems. This measure includes more actions aimed at promotion of more sustainable modes of transport and travel behavior. The common feature of all these actions is that the benefits of their implementation by far exceed the transport system energy efficiency problem. They involve much greater variety of issues such the quality of life, the quality of transport service, the quality of environment, etc. Consequently, the implementation of some of these measures requires big investments and must be part of greater national projects.

Introduction of tramway in Skopje. The city of Skopje plans to build a tram network that would greatly help to alleviate the transport problems. A network of three lines is planned with total of 60 km of tracks, and a fleet of about 60 trams. Recent experience from European cities shows that the approximate cost for building a tram track is around 1,200,000 Euros per km. A cost of 6 axes articulated tram is about 200,000 per tram. Therefore, the estimate of the cost of the total tram system is around 150,000,000 Euros. This amount includes two rail yards, tracks, and the fleet.

Renewal of public transport bus fleet. The Government of Macedonia has already made a decision to provide money to purchase 300 public transport vehicles for the city of Skopje. There have been already two public tenders. The estimated value of the 300 buses is about 40,000,000 Euros.

[59] National Energy Strategy of the Republic of Macedonia, 2010

The benefits of new public transport fleet for the city of Skopje and its citizens are numerous and valuable. The greater energy efficiency and the lower pollution of the environment are just a small part of the total benefits, the detailed analysis of which is out of scope of this report.

Introduction of integrated traffic management centre. This measure is to be implemented as part of the FP 7 "RENAISSANCE" project in which city of Skopje is one of the five EU cities partner. The cost of this measure is about 700 000 Euros. It includes the traffic management within the centre city of Skopje (the small and the big ring)

Promotion of greater use of bicycle. This measure includes investments in the bicycle network infrastructure, as well as a public campaign for greater use of bicycle. The development of the bicycle infrastructure has been included into the Plan for a sustainable transport system in Skopje that has also been part of the FP 7 "RENAISSANCE" project. It will also be part of the transport study for the city of Skopje that is due by September 2010.

The costs for the public campaign may be estimated at 40,000 to 60,000 Euros.

Parking policy. The aim of this measure is to discourage the use of automobiles in the cities. Therefore, the implementation of this measure (paid parking) should result in positive financial effects for both: the cities (increased local budget) and for the government (reduced fuel consumption). The city of Skopje has already introduced the concept of zonal parking in the centre city. It is implemented by the local public company for parking.

Fuel quality. The implementation of this measure does not include any direct costs. The regulation of the higher quality of fuels should be enforced and implemented by the oil producers and oil sale companies.

Carfree days. The costs for implementation of this measure include the public campaign through media (TV, radio, posters, etc.) Depending on the type of the campaign and ability to provide sponsors, the costs will range from 50,000 to 100,000 Euros per year for three carfree days per year.

Promotion of greater use of railway for intercity travel. The improvement of railway infrastructure in Macedonia is a capital undertaking that include huge investments. However, within this measure, it is expected to increase the railway intercity passenger ridership by improvement of rail timetables – better service suited to the passenger needs, and by public campaign.

Recently, the ex-company Macedonian railway has split into two companies: operations and infrastructure. Currently, the railway operator has been offering very poor passenger services (very limited number of departures and connection between major cities). This situation must be changed. The poor financial condition and the very old rail fleet and infrastructure of the Macedonian railway are now its major problem. The problem is complex and certainly requires help from the state.

However, in the first phase the Macedonian railways-operations must improve their service offer and stop the downward spiral of passenger ridership. This should be followed by media campaign for the advantages of railway transport.