**Technical Assistance to the Ministry of Economy and EPCG**

**An EU – funded project managed by the European Agency for Reconstruction**

# ENERGY EFFICIENCY STRATEGY FOR MONTENEGRO
## Final Report –
## (Unofficial translation)

**Podgorica, December 2005**

**The Government of Montenegro adopted the Energy Efficiency Strategy for Montenegro as part of the energy sector development policy proposed by the Ministry of Economy and in accordance with its obligations defined in the Energy Law, energy policy documents, Economic Reform Agenda, Athens Memorandum of Understanding and in accordance with the related European regulations.**

**The Energy Efficiency Strategy was prepared by IIPA Energy Consulting[1] with EU technical assistance to the Ministry of Economy and to the EPCG.**

**The Energy Efficiency Strategy is underlining that efficient use of energy contributes to a more reliable energy supply, market competitiveness and environmental protection. It also confirms the significant role that energy efficiency has in creating new business opportunities and increasing employment, as well as other benefits at the local and global level.**

**The Energy Efficiency Strategy presents the framework initiatives needed for the promotion of energy efficiency in all energy sectors in Montenegro, especially in the final energy consumption sector, including initiatives for increased use of alternative and renewable resources.**

[1] The Report was prepared by Ilija Vujosevic, PhD, Igor Vusanovic, Assistant PhD, Dejan Vojinovic, graduated engineer and local consultant and Mr. Franck Daganaud – international IPA Team consultant

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# Summary

The main objective of the Energy Efficiency Strategy of the Republic of Montenegro is to emphasize on the impact of the rational use of energy on security of supply, market competitiveness and the environment. It confirms that energy efficiency (EE) has a significant impact on new jobs' creation, increased employment and improved living standards, as well as indicates other benefits on a regional and global level.

The influence that the energy sector has on social prosperity and economic stability in developed countries relies on long-term planned activities for the rational use of natural and technological resources. Permanent care on EE increase is a fundamental component of the sustainable development and national strategic goal. Implementation of the EU standards and norms related to EE and in accordance to the Athens Memorandum of Understanding (2003) will have an influence on Montenegro's integration into the EU.

Specific energy consumption in Montenegro (assessed to be 1.08 toe/per capita in 2003) is relatively low when comparing to the worldwide average, but approximately five times higher than the average in developed countries. However, a further increase in energy consumption is expected with the increase of GDP and the living standard. On the other side, the energy sector in Montenegro is characterized by high-energy intensity in comparison to EU and other developed countries, which is basically caused by high consumption in the heavy industry. The energy intensity factor in 2003 totalled 0.432 kgoe/ €, which was 3.3 times higher than the one in the EU, indicating significant potential for energy rationalization.

These currently unfavourable circumstances in the energy sector can be attributed to the long social-economic developments in all levels in the previous period, especially to the deep political and economic crisis after 1990. The significance of EE and renewable energy (RE) sources is highlighted by the fact that over 55% of the final energy (i.e the total needs for liquid and gas fuels and 1/3 of electricity) is imported. This means that EE and increased use of the RE sources are key issues for Montenegro from both, political and economic point of view, especially in respect to the external trade balancing.

Due to the lack of reliable estimations, a rough assessment of future trends shows that energy consumption will present an average annual growth rate of at least 3%. This means that the final energy consumption will increase from 32000 TJ in 2004 to 39000 TJ in 2010 followed by a significant increase of the dependence on imports. At the same time, the annual electric energy deficit will increase from the current 30% to 42% (at about 2400 GWh), which equals about €90 million at the current import prices.

Accordingly, decisive energy policy in all sectors, with intensive measures in the building sector (households and services) and in the transport sector, is necessary in order to balance or diminish the effects of the expected growth in energy consumption. From the EE point of view, the most significant problem is the very high share of the electric energy use for space heating (over 50%), which is primarily caused by the low electric energy prices for a long period.

There is significant unexploited potential of RE sources in Montenegro, especially high-quality hydro-power potential. Excluding the hydro power potential of storage, large capacity Hydroelectric Power Plant (HE), it is economically justified for Montenegro to double the current use of RE sources (small HE, solar and wind energy, biomass). However, only a very small percentage of the economic potential of RE sources is expected to be realized without special measures.

Increase of EE is considered as the least expensive and the most productive energy alternative, with practically unlimited possibilities. Rationalization of energy use could significantly stimulate innovations, employment and economic growth. Significant energy and financial saving could be obtained with relatively small investments, better choices for more efficient energy technologies, and better organization and improved quality.

Considerable EE improvement and higher RE use is connected to a high degree with overall economic and social policy. There is a real potential to contribute to sustainable development and economic growth, which could influence all economic activities. In order to achieve its energy objectives, Montenegro has to meet internationally determined obligations with institutional, legislation and legal changes. Implementation of the EU norms and standards regarding the EE will also influence EU integration of Montenegro.

Preconditions for the realization of the above defined objectives are to identify barriers and provide assistance to stakeholders regarding removal of barriers for implementation of the program and EE measures. A review of the main EE barriers brings the conclusion that a lack of financial resources and information on existing technologies and good practice are the most significant barriers, while fundamental changes are necessary to the institutional and regulatory frameworks. Analysis of the previous support programs show that domestic funds are severely limited and that access to international funds targeting this sector is not available.

Keeping in mind the absence of a long term EE policy there is no doubt that significant economic EE potential (of at least 20%) exists in Montenegro, without direct assistance to the end users. Significant EE potential exists in the power production and distribution sector (especially in the distribution), as well as in industry, tourism, public and household sectors. According to the recent research [1], achievable energy saving in Montenegro, without significant investments, is estimated at 13% or about 4400 TJ, which equals to 1200 GWh or about 100000 tons of liquid fuels.

Current and future owners of the privatized industrial and commercial sector enterprises will be motivated by competition and profit to implement their own EE programs. In some cases programs to be implemented will include major reconstruction of facilities or replacement of inefficient technologies, while in other cases, organizational and technical measures aiming energy savings will be sufficient.

In order to increase the currently low share of utilisation of RE sources, which is 5-10% of the total energy balance, it is necessary to start an extensive program based on the assessment of existing sources and other legal and technological preconditions. As emphasized, besides the significant, unused potential for large scale HEs, there is a significant, unused hydropower potential of small water streams. Up to today, about 70 locations are explored for small HE at the Morača, Zeta, Lim, Piva and Ibar rivers, with the total installed capacity of 226 MW and annual production of 660 GWh. There are also very favourable estimations for the use of solar and wind energy, as well as for biomass energy (especially for burning wood – about 200000 $m^3$ per year) for space heating, cooking and sanitary water heating. On the other hand, exploitation of RE as “green energy” has a strong positive impact on the environment.

According to research, about 66% of necessary heating energy in households (space heating, water and for cooking) is electric energy, 18% is wood energy and 11% is coal energy. The dominant share of electric heating could be a real field for implementation of various EE measures, or for substitution and energy savings. Among other measures, such as insulation to prevent thermal loses through walls and windows, heat pumps are among the most efficient technical solutions for electricity savings for heat production as final energy output. For example, in the case that only 10% of the heat-accumulators and pump heaters are replaced, about 75 GWh energy could be saved. In addition, some previous estimation indicates that the existing installed solar collectors meet only 5% of the total sanitary heating water needs. However, the above-mentioned figure should be verified through “market studies” for each sector.

The EE Strategy for Montenegro is to be implemented through annual action plans, which will include priority activities with the necessary financial resources. A prerequisite is that the Ministry of Economy establishes the Montenegrin Energy Efficiency Unit (MEEU) with adequate financial resources from the budget and other contributions. The main mission the MEEU is to identify, analyze and propose the cost-efficient and technically feasible policies and measures for EE improvement on both the production and consumption side, including the reduction of negative environmental impacts caused by energy transformations. The MEEU also promotes cooperation, and knowledge and information exchange among similar bodies in Montenegro, international institutions and associations active in the EE field of work.

Preconditions for the achievement of EE goals are planning and gradual implementation of institutional, legal, structural-organizational and financial-economic reforms in all energy related sectors in Montenegro. Energy **and economy incentive regulations, as well as several financial initiatives (supported by especially established funds), would create a good climate for successful realization of Programmes for rational use of energy.**

Adequate policy instruments should turn EE and RE sources into an impulse for the overall economic and development strategy for Montenegro. Some of those instruments refer to general regulatory and legal issues, institutional framework, as well as fiscal, tax and pricing policy. A limited number of instruments should create motivation and demonstrate best practices from other countries applicable in Montenegro. Other instruments should be directed to specific sectors and should be addressed to identify barriers for each aspect within the energy sector.

This EE Strategy for Montenegro is an open evolving document. Deviations from the target objectives can be corrected and new activities that appear necessary for achieving the objectives can be added following monitoring of the implementation effects.

# Abbreviations and Acronyms

| | |
|---|---|
| AC | Automatic Control |
| AMR&B | Automated Meter Reading & Billing |
| BOT | Build, Operate and Transfer |
| CDM | Clean Development Mechanism |
| CFLs | Compact Fluorescent Lamp |
| CHP | Combined heat and power production (co-generation) |
| DSM | Demand Side Management |
| EAR | European Agency for Reconstruction |
| EBRD | The European Bank for Reconstruction and Development |
| EC | European Commission |
| EE | Energy Efficiency |
| EPCG | Electric Power Industry of Montenegro |
| ERA | Energy Regulatory Agency |
| ESCO | Energy Service Company |
| EU | European Union |
| GoM | Government of Montenegro |
| GDP | Gross Domestic Product |
| HE | Hydroelectric Power Plant |
| IEA | International Energy Agency |
| IFI | International Financial Institution |
| KAP | Aluminum Plant Podgorica |
| KfW | Kreditanstalt für Wiederaufbau |
| LPG | Liquefied Petroleum Gas |
| MEEU | Montenegrin Energy Efficiency Unit |
| MoA | Ministry of Agriculture |
| MoE | Ministry of Economy |
| MoEP | Ministry of Environmental Protection and Physical planning |
| MoES | Ministry of Education and Science |
| MoEUI | Ministry of International Economic Relations and EU Integrations |
| MoF | Ministry of Finance |
| Monstat | State Institution for Statistic |
| MoT | Ministry of Maritime Affairs and Transportation |
| NGO's | Non-Governmental Organizations |
| OC | Other Consumption |
| PPT | Private and Public transport |
| RE | Renewable energy |
| RUE | Rational use of energy |
| RTD | Research and Technological Development |
| R&D | Research and Development |
| SD | Secretary of Development |
| SDU | Remote controlling system |
| S&M | Serbia and Montenegro |
| SME's | Small and Medium Enterprises |
| TA | Technical Assistance |
| TAF | Thermal Accumulation Furnace |
| TE | Thermal Power Plant |
| UCTE | Union for Coordination of Transmission of Electricity |
| UNDP | United Nation Development Program |
| UNFCCC | UN Framework Convention of Climate Change negotiation |
| UPT | Urban Public Transport |
| USAID | United States Agency for International Development |
| VT/MT | Higher/Lower Tariff |
| WB | World Bank |

# INTRODUCTION

This preliminary EE Strategy for Montenegro has been prepared in coordination with IPA Energy Consulting, according to the Program assignment and in line with the Program of technical assistance to the Ministry of Economy and the Electricity Utility of Montenegro (EPCG), sponsored by the European Union (managed by EAR). EE Strategy presents a framework for initiatives necessary for promotion of EE in all energy sectors in Montenegro, especially in the field of final energy consumption, including initiatives for increased use of alternative and renewable resources.

Within the overall economy reforms in Montenegro in recent years, the basic system, institutional and other preconditions for reforms in the energy sector has been created. After introducing the Energy Law (2003), Energy Policy for Montenegro (2005) and other legislative and sub-law regulations, the Energy Efficiency Strategy (EE Strategy) generally focuses on the authorized institutions at national and local levels. It indicates to the energy parties and R&D sector the existing opportunities and their role in energy efficiency improvement in Montenegro.

The Energy Law defines the responsibilities of the Ministry of Economy regarding energy efficiency (EE) and renewable energy (RE) sources in Montenegro. The EE Strategy guides the implementation of EE policy as defined in Article 3 of the Energy Law.

Article 3

2. For the purpose of fulfilling its obligations under this Law and other applicable regulations, the Government shall, through the Ministry:
   a) Realize EE policies and encourage the conservation of energy resources;
   b) Encourage and advise on EE and the rational use of energy;
   c) Develop and promote incentives for the efficient use of energy and renewable resources;
   d) Promote the increased use of RE Sources and alternative energy sources for generation in the internal market; and
   e) Manage funds contributed for the purpose of energy conservation and EE.

In addition, the document entitled “Energy Policy for the Republic of Montenegro” obliges the Government of Montenegro and other authorized institutions in Montenegro to accomplish two additional goals directly related to EE:

- Providing institutional and financial incentives for EE improvement and energy intensity reduction in all sectors, including all energy chain, from generation to energy consumption;
- Providing support for research, development and promotion related to new, clean and efficient energy technologies and related to conducting of the energy policy on an expert and scientific basis.

Within the systematic, legal, institutional and socio-economic instruments for accomplishing the above-mentioned goals, the following activities were defined in the Energy Policy document:

- providing incentive measures for implementation of the EE programs, new, renewable resources and clean technologies, including energy-efficient devices environmentally acceptable;
- reconsideration of existing legislation and adoption of new legislation, technical standards and regulations related to energy, in construction of buildings and other premises, especially aiming at EE increase;

- facilitating the Montenegrin Energy Efficiency Unit (MEEU) to successfully promote and conduct the Governmental EE Program, including proposals for regulations that would adequately support it;
- introducing subvention programs for the socially most vulnerable groups, aiming to meet their minimal needs for the electricity and heat energy.

The EE Strategy covers all the actions that must be taken by the Government and energy actors – producers, suppliers and consumers of energy – in order to promote and develop the efficient use of energy, RE and related technologies.

Worldwide experience shows that energy inefficiency should be attacked on the whole front, from the supply side to the end-user efficiency. Given the complexity of the project for the preparation of the EE Strategy, it is necessary to engage the available R&D potentials from the University and industry, in order to precisely identify EE potentials, also through international expertise and financial support, and to promote modern, efficient and ecologically acceptable energy technologies for energy generation and use in Montenegro.

What mostly interferes with the preparation of the EE Strategy is the absence of a National Energy Strategy as a basic document, which would answer the following dilemmas:

- Mid-term and long-term forecasts of the energy balances;
- Development scenario, especially in the field of the selection of new electric energy capacities;
- Rationally useable potential of the alternative and renewable resources;
- Optimal heating models, adjusted to the climate characteristics, social status of the residential sector and energy alternatives of the specific regions.

In that context, this Strategy presents an initial step towards an all-inclusive National Energy Strategy. It should be reconsidered after completing the National Strategy.

Also, concerning the identification of essential energy trends in Montenegro, there is a lack of appropriate statistics on the consumption of solid, liquid and gas fuels in non-industrial activities and of a large number of other data on the number and structure of consumers in all sectors, that are required for the design of specific measures. In the short available timeframe for the preparation of this Strategy, it was not possible to conduct any additional detailed research on the field that could compensate for the missing information on the energy system.

Under the given circumstances, numerous analyses and conclusions from this document are based on data from:

- Study on saving possibilities, rational consumption and substitution of certain fuels in Montenegro (with a special view toward electric energy) prepared for the Government of the Republic of Montenegro by the Electric Engineering Faculty in Podgorica in 2000 (hereafter: EE Study);
- IPA Draft Initial Report on EE Strategy, prepared by IPA team in June 2004;
- The A Book on Expert Basis for the Energy Development Strategy for Montenegro up to 2025 – Realized energy balances (working material) and
- Other relevant sources reported in Annex E.

This EE Strategy shortly identifies the origins of energy inefficiency across the whole energy chain, especially in the final consumption (end-use efficiency). Annual action plans would define the priority activities that fall within the authority of the Montenegrin Energy Efficiency Unit (MEEU). These activities will target improvement for existing legislation, establishing EE funds and conducting studies and demo projects as well as starting a campaign related to the EE issues.

This EE Strategy is an open document. In the frame of implementation and monitoring of the results, deviations from the target objectives can be corrected and new activities that are considered necessary for the achievement of objectives can be added.

# 1. EE AND RE USE POLICY AND OBJECTIVES

## 1.1 Significance and general access to improved EE

The influence of the energy sector on social prosperity and economic stability for developed countries is based on long-term planned activities for the rational utilization of natural and technological resources. Permanent concern about how to increase EE is one of the basic components for the sustainable development and strategic goal on the state level. Implementation of the EU EE regulations and standards, according to the Athens Memorandum of Understanding (2003) will influence the Montenegrin integration into the EU.

The benefits of EE increase for the community are demonstrated through:

- the rational utilization of natural resources,
- lower energy dependency,
- less need for construction of new energy facilities and lower harmful impact on the environment.

Benefits for the individual consumer are:

- lower cost for the energy consumed and
- optimal use of the energy devices.

It is considered that increase of EE can be the least expensive and most productive energy alternative, with practically unlimited opportunities. In addition, energy savings contribute significantly to the stimulation of innovations, employment and economic growth. With relatively small investments, more rational selection of the technological equipment, better organization and improved quality, significant energy and financial savings could be achieved.

General definitions and prerequisites of rational use of energy, energy savings and substitution of energy forms, as basic methods for achieving both short-term and long-term EE Strategy goals, are presented in Annex A.

Preconditions for the achievement of EE goals are planning and gradual implementation of institutional, legal, structural-organizational and financial-economic reforms in all energy related sectors in Montenegro. Energy **and economy incentive regulations, as well as several financial initiatives (supported by especially established funds), would create a good climate for successful realization of Programme for rational use of energy.**

More rational energy use of energy and development of RE resources are closely connected with the implementation of the general economic and social policy and have significant potential for contributing to sustainable development and economic growth and also have positive impact in all areas of economy. Additionally, considering the international obligations, significant institutional and legal changes, as well as changes in overall behaviour would be required.

## 1.2. General EE Strategy objectives

According to the positive experience and good practice in developed countries over the last 30 years, the general goal of the EE Strategy is to emphasize on the contribution of the efficient use of energy on the following:

- Security of supply,
- Market competitiveness and
- Environmental protection,

and to confirm the significant role of EE in creating new business opportunities and increasing employment, as well as its other benefits at the regional and global level.

Based on the above, the specific objectives of the EE Strategy are as follows:

- Significant reduction of non-rational energy consumption in all energy sectors;
- Reduction of the negative environmental impact of energy use;
- Reduction of energy imports dependency and the associated costs, and reduction of the trade balance deficit;
- Reduction of energy costs for households, increasing the living comfort, health and safety, and playing a significant role in the improvement of the situation of the poorest population;
- Reduction of energy costs for the commercial sector and industry, therefore increasing their competitiveness;
- Reduction of energy cost in the public sector, therefore reducing the public expense;
- Improvement of the reliability of the power system; reduction of the outages and distribution losses;
- Reduction of the costs for power generation and transmission, and for distribution;
- Launching of activities and creation of employment at local level by developing local energy resources and local business in the production, installation and maintenance of EE equipment, and in the provision of EE related services;
- Improvement of international relations through contributing in the goal of reduction of CO2 emissions.

Additionally, an essential objective of the EE Strategy is dissemination of knowledge, experience and social awareness regarding EE. Development and implementation of specific legal and other measures is also important, including even minimum mandatory standards where necessary, in order to achieve the above-listed specific objectives for rational use of energy in all areas of its generation, distribution and final consumption.

# 2. PREVIOUS AND FUTURE ENERGY CONSUMPTION TRENDS

## 2.1 Brief review of the utilization level of the natural energy resources

The basis of the energy system of Montenegro, which is is mostly related to power generation, are the exploited hydro potentials of the Piva and Zeta rivers (around 1860 GWh per year) and coal potential from the Pljevlja Basin (around 1,300,000 tons per year). Total demand for the oil derivatives (app. 300,000 t) and one-third of the electricity needs (about 1,300 GWh) are imported.

Quite the opposite of a high-energy deficit, Montenegro possesses very high-quality hydro-energy potentials, suitable for the construction of peak load power-plants of large capacity. That potential has been utilized for about only 27% of natural water flows, or for about 17% considering integrated utilization of water flows. In addition to this, according to the latest estimate, the technically usable potential of small hydro flows is about 680 GWh per year.

Another primary energy resource in Montenegro is coal. The total geological reserves lignite brown coal in the entire Pljevlja Basin totals approximately 360 million tons, while the exploitable reserves are estimated at approximately 190 million tons. Geological brown coal reserves in the Berane Basin are estimated at 160 million tons, while the balance reserves are app. 30 million tons. Coal in Montenegro is characterized by a low sulphur content, as well as low ash quantity, which is especially important for environmental protection.

So far, geological research conducted for a long-period for oil and gas, both in the ground and under the sea in Montenegro, indicates significant findings of energy resources. Although the level of exploration is not sufficient for a definitive conclusion, total potential of oil and gas reserves are estimated to 470 Mtoe,, out of this 295 Mtoe under the sea and 175 Mtoe under the ground.

New and renewable types of energy worldwide (except firewood) are still in the stage of intensive development and industrial research. Special attention is given in their use in autonomous and local purposes and for meeting the demands of so-called small energy systems, particularly indicating their increasing importance for security of supply and environmental protection.

Energy of direct solar radiation, wind energy and biomass energy are the main renewable energy forms in the area of Montenegro. However, except from the traditional use of firewood and some initial results in application of solar collectors installed in tourist facilities at the coastal area, these types of energy are not significantly in use in Montenegro. In order to provide reliable estimations of this potential and the real possibility for its use for generating electricity and thermal energy, comprehensive studies and researches should be conducted by using methodology and criteria applied and developed in European countries.

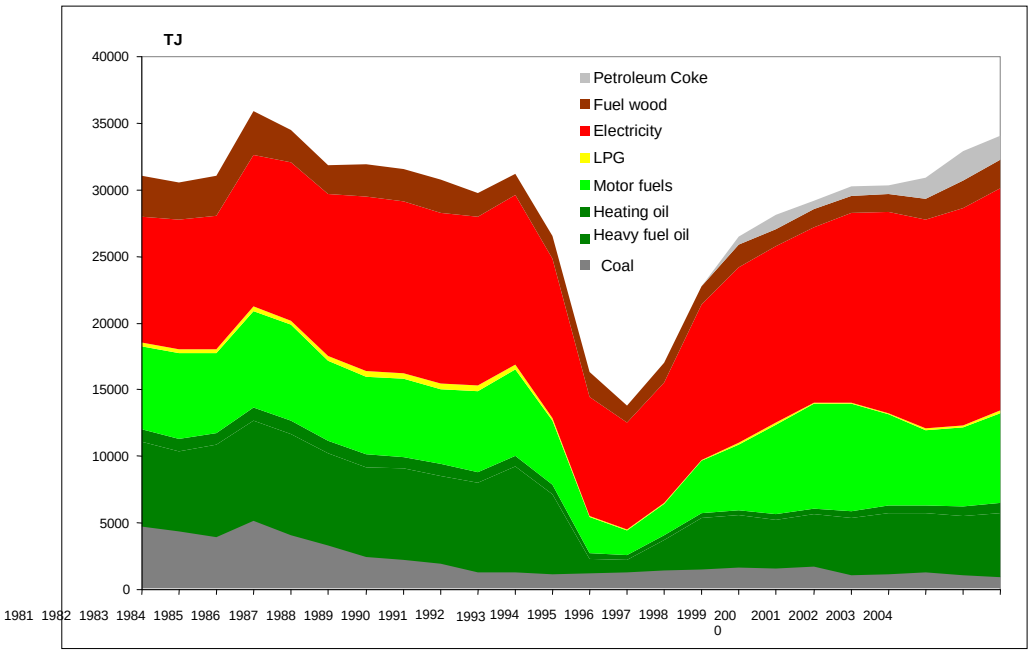
## 2.2. Energy consumption trends in the past

An overview of the energy consumption in Montenegro by the energy form in natural units and TJ, for the period 1981-2004, is given in the Tables B.1 and B.2 – Annex B.
Picture 2.2.1 shows a graphic overview of the energy consumption in Montenegro by energy forms.
An overview of the energy consumption by sectors (categories) is given in the Table B.3 – Annex B and on Picture 2.2.2.

From the cited pictures and tables, three characteristic periods are noticed:

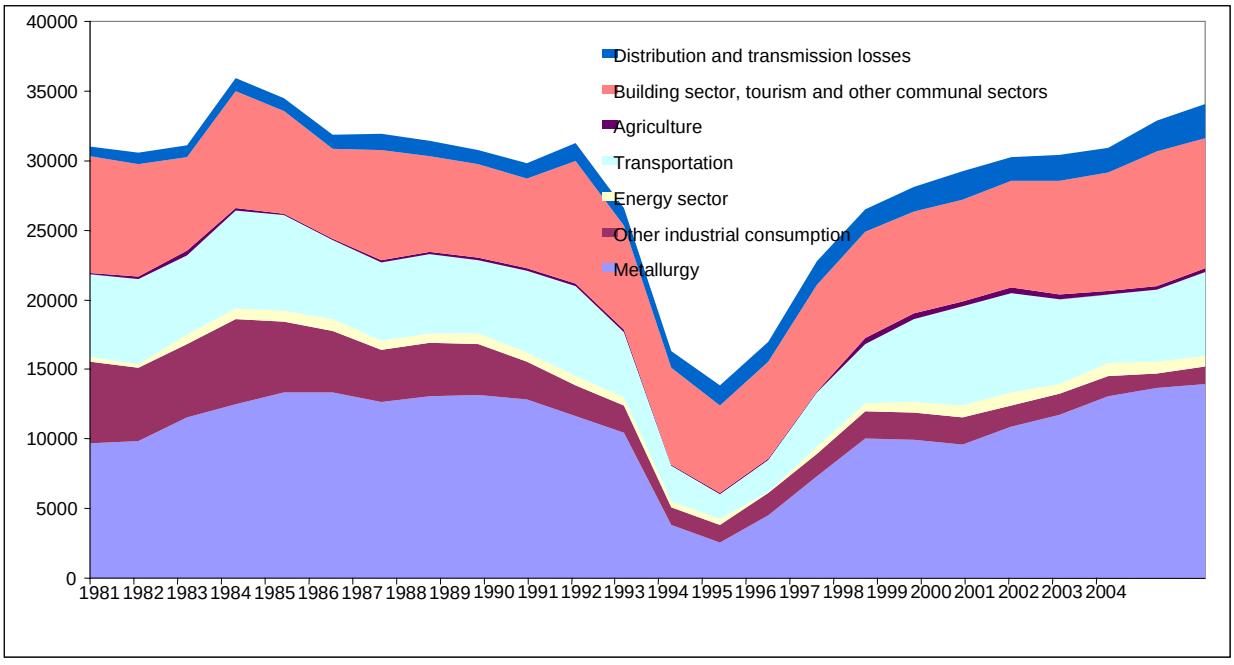
- Period 1981-1991 – stagnating consumption, with the recorded increase of about 15% in 1984 and 1985,
- Period 1991- 1994 – steep decrease of consumption by about 65% due to the war crisis and international sanctions,

- Period after 1995 – rapid growth of consumption, especially of electric energy and motor fuels.




**Picture 2.2.1** Energy consumption in Montenegro, by energy forms

It is also obvious that the consumption of electricity, heavy fuel oil and motor fuels are dominantly shaping the overall consumption chart, which is relevant for the estimation of future consumption after 2004.

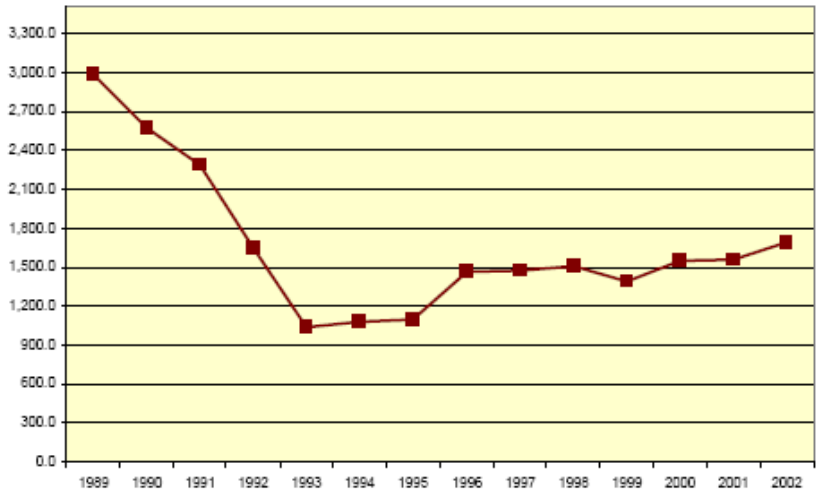



2.2.2. Energy Consumption in Montenegro, by sectors (TJ) for the period 1981 – 2004

The steep decrease shown in the energy charts is the direct consequence of the deep socio-economic crisis during 90's. During that period the Montenegrin economy operated at 20-30% of the total capacity, which resulted to a decrease of the gross domestic product for more than 60%. (Picture 2.2.3)

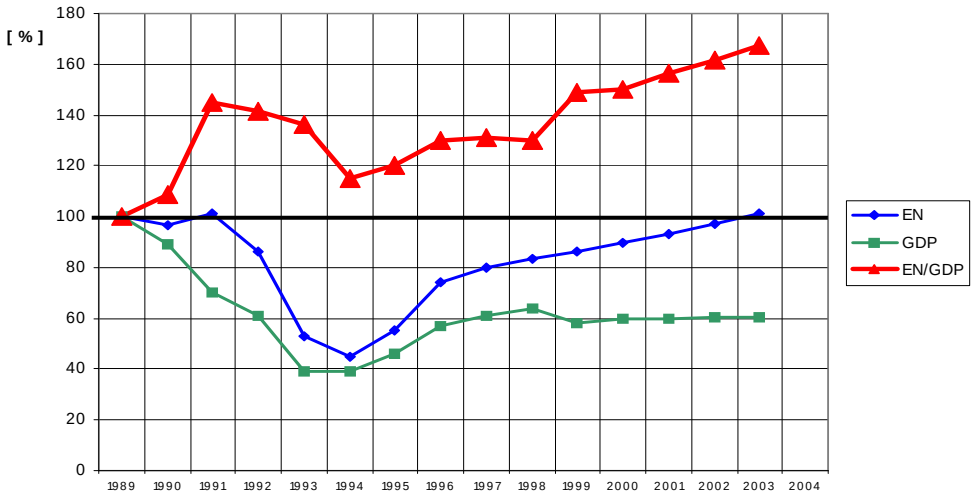
A combined picture of the GDP variations and energy consumption for the period from 1989 - 2003 (1989 - base year) is given in Picture 2.2.3. In the previous period, the displayed relation between final energy consumption and GDP recorded a growth trend, up to 45% until 1991. From 1991 to 1994, this energy inefficiency index falls down to 15% and after 1995 showed a permanent increase, so for 2003 it becomes higher by 67% compared to the base year, 1989. This means that energy consumption per unit of the gross product has been decreased by 67% in the recorded period. Completely the opposite process occurs in developed countries, which illustrates an alarming situation in this field and the risk that the energy sector in Montenegro will become unsustainable.

An overview of all the energy forms taking part in the energy balances from the primary through the end-use of energy is given in the energy flows for the year 2004 (Picture B.1 – Annex B). This energy overview should be updated through additional research based on data for the last few years.




Source: Institute for Strategic Studies and Prognoses (ISSP)

**Picture 2.2.3** GDP/ per capita in Montenegro (US$/p.c)

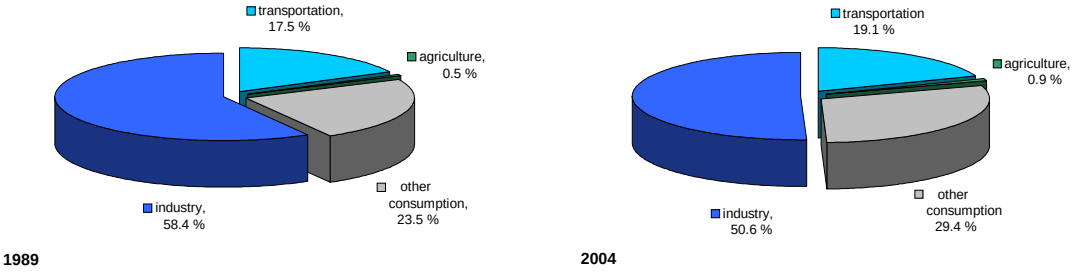



**Picture 2.2.4** EE Indicators in Montenegro

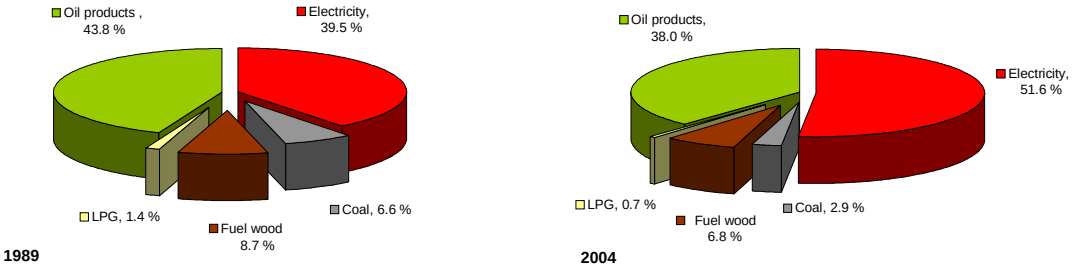
The final consumption structure is presented on the right side of the graph in two forms: by sector (industry, traffic, agriculture and other consumption) and by types of end-use energy (heat, mechanical operations, chemical transformations and other).

Pictures 2.2.5 – 2.2.7 show the characteristic relations in the field of final energy distributed to consumers, with the records from 1989 and 2004.

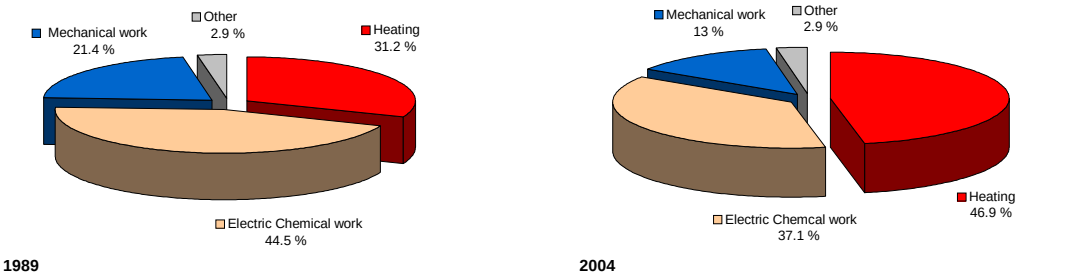
Clearly, according to the given pictures the consumption structure changed in the period 1989-2004. This is mostly expressed through a decrease of industrial consumption from 58.4% to 50.6%, with the parallel "other consumption" increasing from 23.5% up to 29.4%.




**Picture 2.2.5** Shares of sectors in final energy consumption




**Picture 2.2.6** Energy forms shares in the total final energy consumption




**Picture 2.2.7** Electricity supplied to consumers by type of the useful energy

Taking into account that in the meantime, significant changes in the participation of certain energy forms was recorded, as the electricity share increased from 39.5% in 1989 up to 51.6% in 2004 (Picture 2.2.6), it can be concluded that the recorded structural changes are moving to an unfavourable direction. Actually, there is an increased participation of electricity in heat generation. Based on the fact that in this case there is an unfavourable coefficient of the primary energy transformation into useful energy, we conclude that this trend leads to a lower rationality of the total energy system. This is being confirmed by the data that in 1989, 31.2% of the total available electric energy has been transferred into heat, since this percentage in 2004 was 46.9% (Picture 2.2.7).

## 2.3 Estimate of the future trends in energy consumption, by 2010

A rather reliable estimation of future consumption trends for certain energy resources, can be conducted through a factor analysis, which would include economy development estimates, demographic increases, structural reforms towards open markets, the development dynamics of conventional and alternative energy and other natural resources and of energy rationalization. In principle, that is the task for the Energy Strategy of Montenegro, which is not available at the moment.

Due to lack of a more reliable forecast, the following assumptions are considered for the period of 2010:

- The following period will also be characterized by the economy's recovery, with economic growth and GDP growth,
- The current industrial structure, with KAP (Aluminum Factory) and Steel Plant as energy-intensive facilities, will remain the same in the period of 2010,
- With the living standard growth and the development of small and medium enterprises, there will be a growth in energy consumption, but with slightly moderate trends. Tables 2.3.1 and 2.3.2 and Picture 2.3.1 show the estimated energy quantities with estimated annual growth rate of 4% by 2005 and 3% by 2010,
- Increased participation of renewable and alternative resources until 2010, at a rate of 4-5%.

**Table 2.3.1** Energy consumption in Montenegro in 1997 and forecast for 2005 and 2010 (TJ)

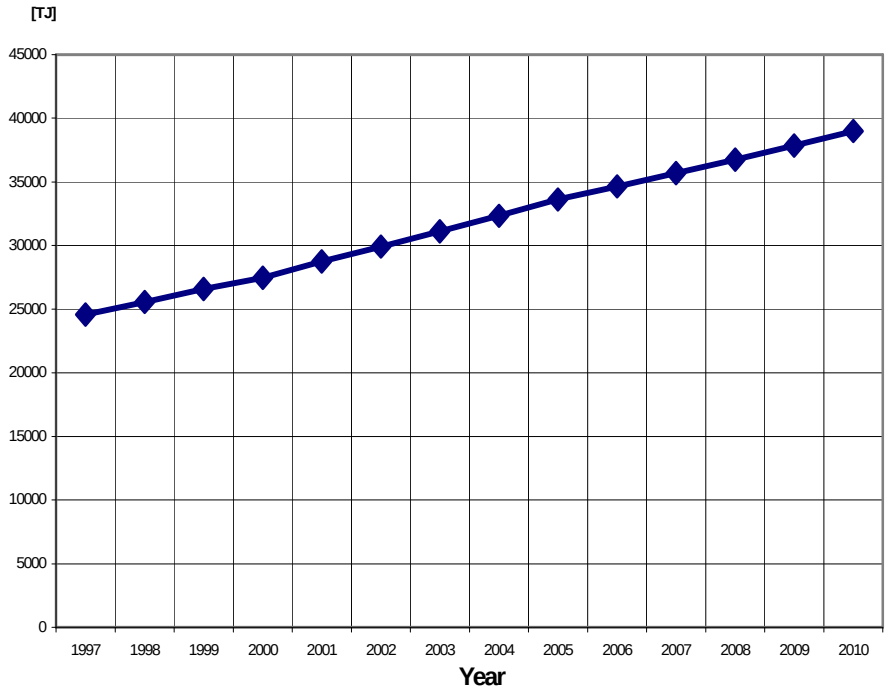
| Fuel | | Year | | |
|---|---|---|---|---|
| | | 1997 | 2005 | 2010 |
| Coal | TPP | 10242 | 12528 | 14616 |
| | Other | 1321 | 1252 | 1451 |
| Heavy fuel oil | | 3868 | 4013 | 4414 |
| Heating oil | | 361 | 682 | 750 |
| Motor fuels | | 4370 | 6824 | 8317 |
| Liquid petrol gas | | 129 | 152 | 191 |
| Electricity * | | 13129 | 17288 | 20041 |
| Firewood | | 1398 | 1905 | 2156 |
| Alternative resources | | - | 840 | 1700 |
| Total energy | | 24575 | 33630 | 38990 |

* Losses in distribution included

**Table 2.3.2** Energy consumption in Montenegro in 1997 and forecast for 2005 and 2010 (in natural units)

| Fuel | | Year | | |
|---|---|---|---|---|
| | | 1997 | 2005 | 2010 |
| Coal (1000t) | TPP | 981 | 1200 | 1400 |
| | Other | 126.5 | 120 | 139 |
| Heavy fuel oil (1000t) | | 96.4 | 100 | 110 |
| Heating oil (1000t) | | 9 | 16 | 17.6 |
| Motor fuels (1000t) | | 102.5 | 160 | 195 |
| Liquid gas (1000t) | | 3.4 | 4 | 5 |
| Electricity * (GWh) | | 3646.9 | 4802 | 5567 |
| Firewood (1000m3) | | 146.7 | 200 | 223 |
| Alternative resources (%) | | - | 2.5 | 4.3 |

* Losses in distribution included




**Picture 2.3.1** Final energy forecast in Montenegro for 2010

Estimates of the future energy demands show that the import dependency will be significantly higher. For example, the electric energy deficit will grow from the current 30% up to 42% (2360 GWh). Based on this, the cost for importing electricity (with a price of 37 €/MWh) will amount to €87 million per year. In other words, the trade balance deficit will further increase and one option is urgently exploiting the economically feasible EE potential wherever possible. Many analyses and estimations show that the energy sector of Montenegro has a significant number of possibilities for more rational energy use in all its domains.

# 3. EE AND RE SOURCES POTENTIALS

## 3.1 EE indicators

The energy system of Montenegro, throughout the supply chain and including the use of primary resources, production facilities, energy transmission and distribution, energy transformation and utilization by end users, presents a number of non-rational characteristics, primarily attributed to:

- Long absence of an energy strategy;
- Extensive use on energy-intensive and often obsolete technologies and equipment;
- Non-optimal use and operation and inadequate maintenance of facilities;
- Insufficient awareness and knowledge in use of energy by the end users;
- Inadequate skills and competences of employees in energy facilities;
- Insufficient knowledge about the possibilities for rational energy use;
- Wrong pricing policy for energy.

Disproportional high and non-optimal consumption of energy is best illustrated by the following indicators: energy consumption per capita, energy consumption per unit of production (intensity factor), energy cost as a share of GDP in total and by sector, especially in energy intensive industries.

Due to KAP consumption, Montenegro is a huge electricity consumer, with the gross consumption of 6,500 KWh per capita per year, which strongly indicates the weakness of the electricity system, especially in generation side. This weakness is increased by the fact that KAP is responsible for ~44% of the total consumption and requires a secure and continuous supply. However, the specific consumption of total energy is relatively low and it is estimated at 1.08 toe in 2003. According to IEA, this figure is at the level of the world average, but about 5 times less than in developed countries.

Also, in 2003 the energy intensity factor in Montenegro was 0.432 kgoe/€, compared to 0.205 kgoe/€ in developed countries. In the EU, according to IEA, it was 0.13 kgoe/€ in 2001. This means that Montenegro was spending ~2.1 times more energy per unit of production compared to developed countries in average, or 3.3 times more than the EU, which indicates significant room for optimizing energy use.

The multi-leveled impacts of the long-term socio-economic developments of the recent past and inter-dependent influences of traditional and modern ways of life are responsible for the current, unfavorable energy characteristics. Particularly detrimental is the heritage of state, economical and social crisis over the recent few years.

Indicators of energy use deteriorated to such an extent since 1990 that macro- and micro-economic analyses indicate that the future recovery of Montenegrin economy by 2010 can be realized only if the above indicators are improved to a level, at least equal to the 1990 level.

The above mentioned facts indicate an urgent need for undertaking all the necessary measures, first towards concrete activities related to the rational use and conservation of electricity and thermal energy, in the residential, public and commercial sectors.

## 3.2 EE potential in the energy sectors

In order to develop an adequate framework for activities, it is necessary to estimate the potential for more rational energy use. This potential could be analyzed from three following points of view:

- technical potential,
- economic potential and
- market potential.

If economic criteria is excluded from consideration, the technical EE potential and RE potential could almost be unlimited. However, EE and RE technologies create costs, sometimes higher than standard solutions. Even so-called "solutions for free", such as the better use of existing equipment (manual lighting control, manual temperature control, etc.), involve some costs for campaigns to raise awareness and knowledge, etc.

The definition of "economic potential" is not simple. In general, sustainable development of the EE and RE technologies must be integrated into the market economy and costs should be recovered by the benefits. If energy prices are accurate and reflect all "externalities", they would reflect real costs. Under this assumption, the economic potential could be defined as follows:

- For EE: the end user could afford the cost of an efficient solution based on energy savings and within an acceptable payback period. The acceptable payback period depends on the type of user and a number of other criteria.
- For RE: the investment for energy generation could be paid back from the produced energy value (avoided costs for purchasing energy or additional revenue from energy sales) within an acceptable payback period.

Therefore, economic EE potential represents a part of the technical EE potential, which is attractive from the macroeconomics point of view, under perfect conditions, assuming absence of any other barriers. Market potential is estimated taking into account the investors micro-economic point of view including payback periods and existing barriers.

The potential for more rational use of energy presents the basis for defining EE policy objectives and the energy policy in general. Technical potential cannot be the objective in itself, but serves as an EE indicator. The difference between the economic and market potential shows the level of required interventions that the Government should undertake to promote EE improvement.

However, achieving EE and RE goals create certain benefits for the state. Those benefits could not always be reflected in the microeconomic terms: reduced investments in energy production, transmission or distribution instead of electricity import, stimulation of local employment, increased national energy independence, improved energy balance structure, environmental protection, increased competitiveness for enterprises, improved living standards for the population etc. Those are all good reasons for public support to EE and RE. In EU countries, the public support in favor of EE and RE includes direct incentives, fiscal subsidies, soft loans, electricity market regulations with preference to RE solutions, etc., which obviously directly influence the "economic" EE and RE potentials.

Unfortunately, most of the available data regarding the EE and RE potential in Montenegro are not useable without additional evaluation; therefore the figures mentioned below should be revised through "market studies" for each sector. There is no doubt, taking into consideration the absence of an EE policy lately, that there is a huge economic EE potential in Montenegro without any direct incentives for end users. Exploitation of this potential should be the priority of the EE Strategy in the next few years. Absence of incentives doesn't mean that the Government would not have any costs. The following chapters will show the various barriers that influence market and could prevent from the achievement of this potential. Removal or at least reduction of these barriers requires the coordination of governmental activities and a minimum of financial resources necessary for implementation.

A significant potential for increased energy efficiency also exists in the area of generation and transmission (especially in distribution) and in industry. However, power production sector (EPCG and Coal Mine) as well as the industrial sector will soon be privatized, which will create competition and profit motives for the future owners to implement their own EE programmes. In some cases, programmes to be implemented may include drastic rehabilitation or the replacement of non-optimal existing technologies, and in other cases organizational and technical measures oriented towards energy savings.

On the other hand, Montenegro has significant RE potential (small HEs, wind power, solar energy, biomass etc.).

According to the Study [1] findings, small investments in industry can lead to significant EE improvements, specifically savings in the non-ferrous industry up to 13%, in the ferrous industry up to 30%. Possible savings in the rest of the industry are estimated at 7%, and in transport 10%. In residential-communal sector including tourism there is a savings potential of 20% - 30%. However, given the lack of interest rational energy use in these sectors, savings of 10% can be realistically expected. In the energy sector (energy consumption in generation and transmission) it is realistic to expect savings of ~7%, while the transmission and distribution losses can be decreased by ~30%.

Therefore according to the Study [1], possible total energy savings without significant investments in all sectors in Montenegro were estimated at 13-13.5%, or 4100 - 4300 TJ based on the expected 2005 consumption level. These savings equal 1140 - 1180 GWh of electricity (which was the deficit in 1997) or 400,000 - 410,000 tons of coal (~40% of coal consumption in TE Pljevlja) or 96,000 - 98,000 tons of motor fuels. The annual economic effect of rationalization of energy use, at a price of 3.7 c€/kWh, is ~ € 41 million.

### 3.2.1 Energy production sector - Cogeneration and RE sources

According to the existing conceptual project in the power generation sector, the main EE potential is the cogeneration potential of TE Pljevlja of 78 MW of thermal energy that can be used for heating the Pljevlja Municipality. The condition for releasing this potential is the implementation of the Program of Reconstruction and Modernization of TE, in order to transform it to CHP and to build an appropriate district heating infrastructure in the city. For this highly profitable and ecologically acceptable program, significant investments are necessary from EPCG (or future TE owner) and Pljevlja municipality. The energy, environmental and investment aspects of this EE potential should be included in the TE and the Coal mine Pljevlja privatization strategy.

**Small HEs**

Besides large Hydro-Power Plants at the Piva and Zeta rivers, seven small HEs are active within the EPCG system and their total installed power is 9 MW, with an average annual production of 21.4 GWh. In addition to the unexploited HE potential for large HEs, the main unexploited renewable potential for electricity production is the HE potential of small water streams. It is based on the analyses (studies or conceptual designs) performed on 70 sites in tributaries of Moraca, Zeta, Lim, Piva and Ibar rivers. The technically feasible potential for small HEs is 680 GWh with total installed power of 226 MW. It is necessary to conduct research for all potential small HEs and include them into the Master Plan, and afterwards conduct research for specific Power plants and develop conceptual designs.

**Wind energy**

Although the analyses of the wind energy potential in Montenegro are not complete, there are very favorable estimates, which is favored by a combination of mountainous terrain and Mediterranean influences. Based on meteorological measurements, potential areas that could have “good” wind power are located in the vicinity of Nikšić, then in south western region of Montenegro, in the mountains over the sea, and in Coastal region. To illustrate this potential, measurements taken by the Meteorological Station in Niksic have shown that during March 2002 the wind power was 30 W/m$^2$, while on a 1000 m higher location of the ski-center “Vucje” near Niksic during the same month the wind power totaled 225 W/m$^2$. Measured wind parameters at the “Vucje” location during 74 days (between Feb. 23 and May 8, 2002) total duration of active velocities over 4 m/s was 60%. A wind generator with a 500 kW power (three blades with 42-m radius) would produce over that period 230 MWh of electricity or 3100 kWh per day.

At the end of 2001, the Government of the Netherlands approved a donation for implementing a Pilot project constructing the first wind generator in Montenegro, with the total power of 500 kW. Based on the results of the measurements, Holland "Main Wind" Company and the donation beneficiary, the "Mezon" Company from Podgorica, selected the Ilino Brdo location for this windmill. For implementing this Pilot Project, EPCG provides the land for the windmill's location, build access roads and electric network needed for connecting the plant and for later purchase of the generated electricity.

**Solar energy**

Solar energy is a significant RE potential in Montenegro. The area of Montenegro is exposed to direct sunlight for about 1500-2500 hours per year, which is approximately 17-18% of overall year time. Especially, the Montenegro coast is highly exposed to direct sunlight, with an average solar flux of 4.45 kWh/$m^2$ (the area of Bar and Ulcinj municipalities). In the previous period (before 1990), solar energy was used in many hotels and landlords' facilities for sanitary hot water production and was also used in some residential and military buildings. The total of installed area for solar collectors is about 11,000$m^2$, with installed capacity of around 5,500 kW. Some preliminary estimation shows that existing solar collectors' installations cover only 5% of all demands for hot, sanitary water.

In order to identify the solar potential in Montenegro more precisely , it is necessary,(on the basis of available data), to conduct detailed spatial and seasonal planning of all important parameters that define available solar energy.

**Biomass**

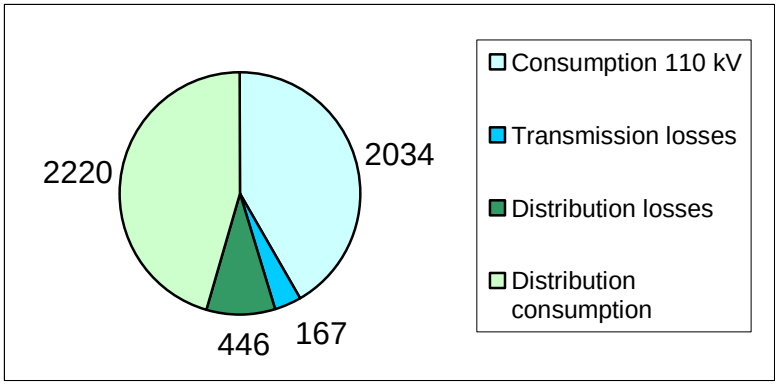
Out of all the available biomass types used as an energy resource, firewood is mostly used (~150-220000 $m^3$ per year), especially in households and partly in the public and commercial sector. A certain quantity of wood waste is used in wood processing industry for generating the technological steam used for own production process. An area of 6,750 $km^2$ is covered by forest, which is about 42% of the total area of Montenegro. Except traditional use of firewood, other biomass forms are not utilized in Montenegro.

**Communal Waste**

Solid Communal waste of about 200-250000 tons annually produced in Montenegro, is causing significant problems of its disposal in most communal centers (especially in the coastal area). The modern approach considers solid waste as a communal-energy problem, to be solved by its burning in order to produce electricity and heating energy. Estimated communal waste quantities in Montenegro are the basis for constructing 3-5 industrial facilities for its burning and for generating 7-15 MW of electricity and 10-20 MW of heating energy.

3.2.2 Electrical energy Transmission and Distribution sector

The reduction of Power system's transmission and distribution losses represents the main EE potential. Total EPCG's technical and commercial losses in 2003 were (Picture 3.2.1) 446 GWh in the distribution and 167 GWh in the transmission network . Total losses were 613 GWh, i.e. 14.4 % of gross consumption. Compared to the distribution gross consumption, distribution losses were 18%.




**Picture 3.2.1** EPCG electricity consumption and losses (GWh) 2003

A realistic EE potential is reflected in reducing distribution losses to the level of 7% - 7.5%, although the potential in transmission losses reduction should not be neglected, in spite of limited possibilities in this sector. For example, total savings in 2003 would amount to 260 - 270 GWh, or about 19% of the deficit.

Evaluated with the low price of Montenegro electricity of €0.03 per kWh, excluding taxes, the total energy savings based on the reduction of energy losses in 2003 amounted to about €8 million per year.

EPCG is keeping records on distribution losses and collection rates on a monthly and annual basis. It is also organizing special teams for implementing the losses reduction programs and is analyzing the needs for conducting a study on implementation reactive power and energy compensation in the energy system of Montenegro.

### 3.2.3 Industrial sector

The industrial sector participates in the energy balance of Montenegro with 50% of the energy consumption over the last two decades, out of which 35% is allocated to non-ferrous and steel industry, and therefore industry is the biggest energy consuming sector. At the same time, it is the area where significant energy savings can be realized.

A major part of the Montenegrin industrial facilities was built during the period over which technology selection criteria were based on minimizing investments, but with little heed to energy and ecological efficiency. The coefficient of efficiency, calculated as a ratio of useful and final energy, is 0.65 for ferrous metals industry, 0.60 for non-ferrous metals industry, 0.50 for non-metals industry, 0.85 for chemical industry, 0.71 for other industries, and for overall industry 0.62.

**Steel Works Plant in Niksic**

In the steel industry, as represented by Zeljezara Niksic, from 1981 – 1989 the average consumption was 10.65 GJ/ton, while between 1990 – 1997 with a production decrease of 46%, specific consumption was 13.1 GJ/ton, or 23% more than in the first period. The situation is more unfavorable when taking into account that the level of raw steel processing in the second period was significantly lower.

Research showed that using the “waste” heat of industrial water and exhaust gasses of the heating furnaces in Zeljezara represents the biggest potential for optimizing consumption and increasing efficiency of use of industrial fuels.

Potential savings are estimated in the EE Study:

*Electric energy:*

- ETA 9% i.e. 17.6 GWh/year
- Electro-resistant furnaces 7 % i.e. 3 GWh/year
- Electro-motor drives, lighting and other 5 % i.e. 5.6 GWh/year

*Heavy fuel oil:*
Energy of exhaust gasses from different kinds of furnaces is ~41 TJ/year. By using this heat, the need for heavy fuel oil could be reduced by 3.5%, i.e. ~1000 t.

*Coal:*
Using heat pumps would allow the use of waste heat that could satisfy all the needs for heating premises and preparing water supplies, and reduce coal consumption by 60%, i.e. by 30.000 t.

Total estimated EE potential of the Steel Works Plant in Niksic is ~450 TJ, i.e. 14.5% of total consumption in 1989.

**Aluminum Plant Podgorica – KAP**

A representative of the non-ferrous metals industry is KAP, which is the largest single user of electricity in Montenegro. Its production process consists of a number of technologies and organizational units. In its annual energy consumption, electricity participates with ~60% of the total, heavy fuel oil with ~40%, while other sources of energy (heating oil and liquid petrol gas) represent less than 0,5%. The biggest consumer of electricity is the Aluminum Electrolysis Unit (series A and B) with 92,5%, while the biggest consumer of heavy fuel oil is the Alumina Plant with 85%.

Production in the Electrolysis Unit in 1997 was 21% lower than the capacity, while the specific consumption of electricity was 12,7% higher than projected. At the same time, production of alumina was 58% of the projected, and specific consumption of heavy fuel oil was 17.7% higher than projected.

The main opportunity for reducing electricity consumption, in the absence of significant technological breakthroughs, is to maintain the voltage of cells at the norm-prescribed value and to decrease the anode effect. It is also necessary to provide technical solution for electricity generator to be connected to 10 kV network and to work in co-generational mode.

Potential for energy savings in KAP according to the previous EE Study is:

- Electrictricity 6.2 % i.e. 86.2 GWh/year
- Heavy fuel oil 20 % i.e. 18 000 t/year

Total estimated EE potential for KAP is ~1000 TJ, i.e. 10% of the total 1989 consumption.

3.2.4 Transportation sector

The transportation sector is a large consumer of imported energy, which calls for special measures for energy savings and optimization. Transportation participates with ~20% in the total consumption of energy in Montenegro. Imported resources (motor gasoline and kerosene, diesel and heavy fuel oil) represent 98% of consumption.

The development of the transportation system in Montenegro is not at a satisfactory level in respect to the density of the transportation network and services' quality. The density of major and regional networks is 13 km/100 $km^{2,}$ with an average travel speed of 48 km/h. The density of the railway network is only 1.8 km/100 $km^2$, with low commercial prices and poor equipment. The railway between Niksic and Podgorica is not electrified and requires an urgent overhaul, while the railway Podgorica – Božaj – Skadar stopped operating in 1992 and it is unlikely that the traffic will be re-

established any time soon. Local public transportation is not organized in most cities, and public transportation is insufficient, especially in the north of Montenegro. In terms of transportation for people and goods to and from the surrounding regions, insufficiently developed road transportation represents a limiting factor.

The efficiency coefficient of transportation is low and in 1997 was 0.31.

Given that road transportation is participating with 88% of energy consumption (excluding maritime transportation) and it is based on imported energy resources, the main area for optimization and savings is road transportation. Individual consumers' consumption represents 60% - 80% of consumption. Motor gasoline is the main source of energy for individual consumers (personal consumption) and over the most recent years, motor gasoline consumption grew at a 7.4% rate.

Compared to maritime cargo transportation, with the lowest specific consumption per unit of work, the consumption of railways with an electricity drives is 2.4 times higher, that of diesel fueled railways is 14,1 times higher and that of road cargo transportation is 21.2 times higher. This clearly illustrates the advantages of railway transportation over road cargo and personal transportation.

Potential for energy savings in transportation, according to EE Study, is 10%, i.e. ~50TJ.

#### 3.2.5 Tourism sector

In tourism, until 1990, Montenegro had a dynamic growth and turnover. Location distribution of capacities is uneven, with the following breakdown: seaside – 95% of all tourism capacities; Central Montenegro - 2%; Northern Montenegro - 3%. Therefore, energy savings and optimization should be primarily focused on seaside tourism, i.e. summer tourism.

Energy sources used in tourism are electricity, coal, heavy fuel oil, petroleum gas, firewood, solar energy (solar collectors), etc. There is no official statistics on energy consumption in tourism. This consumption is accounted for within the total communal consumption, which makes quantitative analyses difficult. The primary energy requirements in tourism are for heating, cooling and the preparation of hot water and food, which is sourced from thermal energy.

Possible energy-saving measures in tourism include conserving all available energy sources and the substitution of certain non-renewable or imported resources with renewable or non-conventional resources, primarily with solar energy in the coastal region.

Potential for energy savings in tourism is estimated at ~20%, which represents 420 TJ.

#### 3.2.6 Residential and communal sector

The contribution of the residential and communal sector is a significant amount of the total energy consumption of every country. It depends on the level of development, living standard, climate etc. Some analyses show that in the OECD countries this sector is responsible for 1/3 of total energy consumption. This is a cause for a detailed overview of the EE potential in this sector, since very low investments in this sector can lead to significant savings in electricity consumption.

Based on research in the EE Study in Montenegro, participation of households and other communal consumption (tourism included) varied from 27% in 1981 to slightly above 20% in 1990, and after that, due to the decrease in industrial consumption in 1991. and 1992., went back to the percentage levels of the 1980s. In that period, total energy consumption started to decline and its composition was restructured; as a result, in 1994 households and communal consumption reached the level of 46% of total energy consumption. In recent years, with an economic revival, that participation decreased again to ~30%. The structure of consumption is such, that most of the consumed energy in the residential

sector is allocated to heating, preparation of sanitary hot water, cooking, food refrigeration and recently air conditioning, which is new compared to the situation 15 years ago.

Table 3.2.1 shows the structure of electric energy consumption in the residential sector which use electricity for heating,..The data has been taken from the research conducted by the Electric Utility company from Belgrade during the 1990's, which have shown that an average household uses 65% of electricity for heating purposes and 11% for water heating of its total consumed energy. There is the primary EE potential for substitution and the reduction of energy consumption.

In order to perceive the actual potentials for electric energy savings, Table 3.2.2 presents the data of electric energy delivered to the distribution consumers in years 1996 and 2001. The emphasized years are presented in order to show the growth of energy consumption in the distribution sector for a specific time period, because its beginning represents the recovery from the UN sanctions, and the records from the year 2001 are quite closely representing the current consumption.

**Table 3.2.1** Structure of the energy consumption in apartments* with electric heating

| Purpose | Share (%) |
|---|---|
| Heating | 61.2 |
| Preparation of sanitary water | 11.5 |
| Lighting | 2 |
| Food preparation | 10 |
| Refrigerators | 2.5 |
| Deep freezing | 3.6 |
| Laundry and dish washing | 6.6 |
| Other | 2.6 |

*In Belgrade area

The table shows a significant proportional increase in the electricity consumption for heating in the Municipalities Bijelo Polje and Niksic, which are the second and third biggest municipalities in Montenegro. Podgorica is below the Republic average in percentages, but far ahead in absolute value and presents one-third of the total consumption in the Republic. The data that should be considered as problematic is that in the instance of Niksic and Bijelo Polje we talk about Northern municipalities, which are characterized by low winter temperatures and a fairly long heating season.

Therefore, total energy saving potential is ~1100 GWh, taking into account heat as a useful energy. For the purchase or generation of this quantities of electricity (taking into account the estimated tariffs of electricity in the future of 37 €/MWh), it is necessary to provide circa €40.7 million, which is 80% of the funds Montenegro earmarks for imported electricity purchase each year. Naturally, the demand for heat as a final energy form will not decrease, rather it will increase, but it is necessary to recognize all energy savings measures and necessary substitutions; so as to meet the current heating needs, it is necessary to decrease the specific energy consumption.

**Table 3.2.2** Overview of the electricity consumption used for heating by Montenegrin municipalities

| Electric energy consumption for heating (GWh) | | | |
|---|---|---|---|
| Municipality | 1996 | 2001 | Increased Consumption (%) |
| Bar | 72.3 | 88.476 | 22.3 |
| Berane | 44.2 | 53.184 | 20.3 |

| | | | |
|---|---|---|---|
| Bijelo Polje | 39.2 | 56.849 | 45 |
| Budva | 40.6 | 55.386 | 36.4 |
| Cetinje | 36.2 | 39.827 | 10 |
| Herceg Novi | 71.2 | 87.696 | 23.2 |
| Kolašin | 10.4 | 13.063 | 25.6 |
| Kotor | 47.5 | 57.155 | 20.3 |
| Mojkovac | 8.1 | 9.546 | 17.8 |
| Nikšić | 94.6 | 134.221 | 41.9 |
| Pljevlja | 35 | 41.448 | 18.4 |
| Podgorica | 333.5 | 364.571 | 9.3 |
| Rožaje | 13.6 | 20.572 | 52.6 |
| Tivat | 29 | 31.403 | 8.3 |
| Ulcinj | 32.5 | 39.977 | 23 |
| Žabljak | 5.8 | 7.576 | 30.6 |
| Total: | 913.7 | 1101.30 | 20.5 |

In addition to space heating, heat as a final energy form is significantly used for sanitary hot water production, which is particularly expressed in the south part of the Republic during the tourist season. For a better understanding of consumption, the pictures in Annex C contain the consumption of electricity by regions in Montenegro in 1996. There is a characteristic rise in the coastal region during the summertime caused by the tourist season and an increased need for sanitary hot water, while in the other regions there is a summer minimum when there is no need for heating. However, recently this relation may be changed by the widespread use of air conditioners in the Central part of the Republic where the biggest centers, Niksic and Podgorica, are located.

Figure C4 in Annex C shows a summary chart for Montenegro which form is similar to the chart for the central region (C2). The participation of electric heating was 22.1%, which is also close to the percentage for the central region. This is reasonable, taking into account that the participation in the total household consumption for the central region of Montenegro was 50.5%. Analyzing this data, it can be concluded that usage of electric heating for this sector in Montenegro is relatively high and that the volume twice exceeds the average registered in former Yugoslavia.

**Implementation of insulation in improving EE of the buildings**

By improvements to the existing insulation characteristics of the buildings (window and door sealing, replacement of standard windows by double-vacuum windows, by installation of thermal insulation in the roofs and other areas where possible) it is possible to achieve significant heating energy savings. These measures, by their structure, represent measures of low investment with high savings that are primarily estimated at a minimum of 10%. Installation of insulation layers reflects on wall surface temperature as well, which is a significant comfort factor inside the building. As for the new buildings, it is necessary to point out that a separate law is needed to set out standards in this sector (building code), so that loss values limits throughout the building shall be exactly defined.

Therefore, estimated energy saving potential, based on building insulation improvement is 110 GWh, i.e. €4 million.

**Heat pumps**

The heating pump represents one of the most efficient technical solutions for electricity savings for the generation of heat as a final energy type. In addition to heat generation in heating season, heat pumps represent cooling devices during the summer months when it is necessary to carry out space cooling. There are several technological systems for heat generation by using a heat pump. It varies mostly in the source of low temperature heat, its temperature level, user type (industry, household, trade), etc.

The ratio of heat delivered by the heat pump and the electricity supplied to the compressor, is defined as coefficient of performance, , which is a benchmark for heat pump operation efficiency. The usual value of this coefficient is in the order of a magnitude of 3 to 4, and recently exceeds values over 4. Also, it is necessary to say that heat pumps are more effective in the areas with mild winters, where the air temperature does not go below -5ºC. In the areas with more severe winters, a heat pump can be applied, but must be combined with some system that provides a higher temperature for the primary heat source (e.g. solar collectors, geothermal source, soil, etc.)

If an potential of ~1100 GWh is observed (as it is mentioned above), it can be calculated that this volume of heat can be generated by heat pumps consuming only 300 – 350 GWh at an annual level. Year by year the price is becoming more acceptable, even for the majority of the population. The problem with promoting these devices for heating mostly concerns the prejudices that these devices should be used only for cooling, not for heating, as well as a habit of using electricity storage heaters. These attitudes are difficult to change.

During summertime operation, heat pumps are used for the generation of cooling energy, in which high volumes of heat are directed through the condenser. This heat represents a pure loss which could be used for sanitary water generation by the means of a so-called ”de super heater“ on the ”hot“ side of the condenser. Heat pumps with so-called “de super heaters” have already been produced serially and represent an extraordinary solution for sanitary water generation in the summer months for big buildings, such as hotels, institutions, hospitals etc.

Accordingly, in cases where only 10% storage heaters and other types of electrical heaters are replaced with heat pumps, it is possible to obtain energy savings of approximately 74 GWh, or €2.7 million in a heating regime.

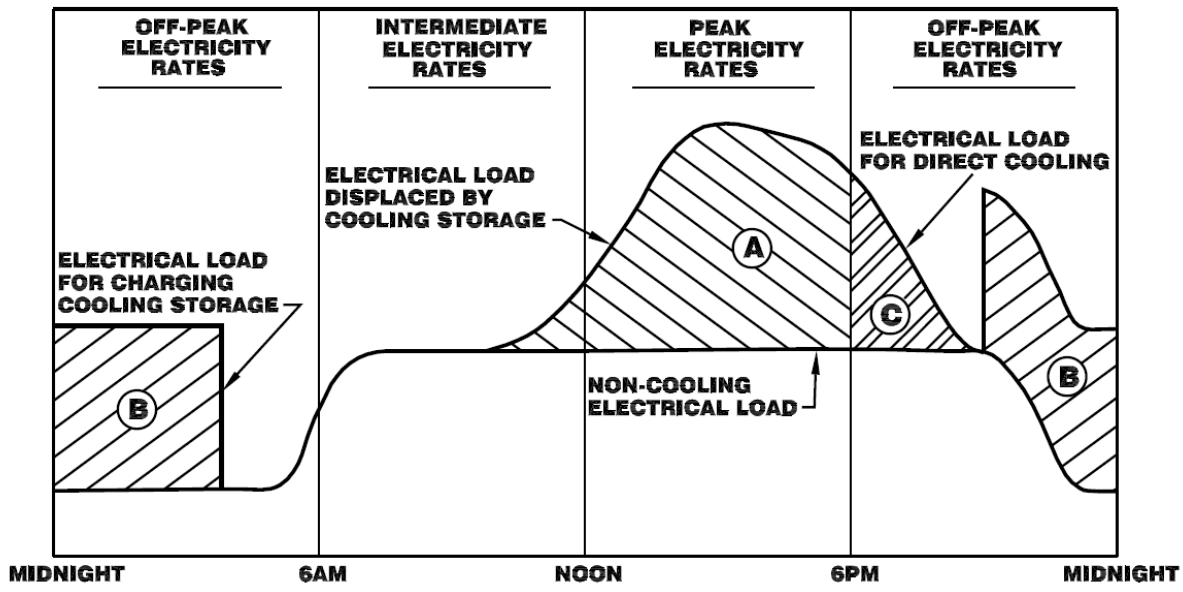
**Cooling energy accumulators**

A measure, by which it is possible to obtain significant energy savings and to provide load shedding of distribution system during the summer months and daily consumption, is the application of “cooling” energy accumulators together with a cooling machine. During nighttime, when the lower rate for electricity is active, it is possible by the means of a cooling device to accumulate a large quantity of energy in a relatively small volume on account of the ice-melting heat (10 kg of ice = 0.922 kWh). This energy captured in ice can be used in the daily operation regime of cooling installation and as a supplement for covering the peak load or for covering the total daily consumption. Figure 3.2.2 shows a typical chart of electricity consumption for cooling a hypothetical building during the daytime. It can be clearly seen from the chart that period with highest energy consumption, between noon and 6 p.m., can be covered from the accumulated energy generated during the nighttime. Also, in addition to cover the peak load, there are solutions when it is possible to cover the total daily consumption by the night accumulated energy, but this is less rational because it requires the installation of equipment of a higher installed capacity.

By using cooling energy (ice) accumulators, certain effects are achieved that can be recapitulated in several items, as follows:

- Decrease of installed capacity for cooling facility which is dimensioned not according to the maximum load ( peak load) but according to its mean value, as it is indicated in the Figure 3.2.2,
- Energy consumption during lower night rate by which significant financial savings is achieved (lower bills),
- Usage energy during the night hours, is useful for electrical network system to get through period of minimum load when energy consumption is significantly decreased,
- A cooling machine operates with a higher degree of cooling due to decreased outside air temperature which is usually used as a heat “abyss”,

- When ice accumulates on the surface of evaporators, the temperature in the evaporator is gradually decreased, which to a certain degree, spoils the cooling factor of the machine, but there is some compensation in the decrease of outside air temperatures.




**Picture 3.2.2** Typical chart of the consumption and accumulation of cooling energy during the day

Application of the cooling energy accumulators provides significant financial results in electric energy cost reduction (bills are reduced by half of the amount) on one side, and on the other side it provides a lower peak load during the summer months, when cooling is needed.

**Solar collectors**

Energy from direct solar radiation can be converted into thermal energy and be used as a final energy for preparation of sanitary hot water, for industrial purposes, for space heating during the wintertime, but also in any other area where applicable. Solar energy usage has been actualized during the last couple of decades, and will help solve the earth's energy problems by reducing waste and environment pollution.

So far, research in the field of solar energy for heating water and space, shows that using solar energy is economically justified on the level of its 60% participation in the total energy consumption necessary for those purposes. In some cases we would need additional heating in solar system, in the amount of 40%.

Ideal areas for the implementation of solar heating systems are the open spaces on the Montenegrin Coast, where significant tourism facilities are located and where we have significant sanitary water consumption during the summer months, which is presented in Chart C1. Also, those facilities mainly use electricity for preparation of sanitary hot water, as well as for cooling and food preparation.

According to the data from 2001, the estimated electricity consumption used for the preparation of sanitary hot water in the residential sector was 187 GWh. Employment of the solar collectors' , which would substitute, for example, , only 15% of the electricity consumption for this purposes, would result in saving 22 GWh per year, that is €850,000.

**Use of underground water capacities as an addition to or a replacement of the cooling systems**

Electricity is being used lately not only for heating and sanitary hot water preparation, but also for cooling during the summer months. This form of consumption will be even higher in the future, considering the increased needs for a better living standard during the summer months, and the relatively affordable prices of those devices. It should also be considered that the electric energy in cooling devices could not be substituted by some other energy type, which is in direct dependence on today's level of technology development.

In numerous public buildings with a high concentration of people, such as hospitals, schools, sport halls, and public institutions, cooling is usually centralized, therefore the preparation of the conditioned air or cooling water is being done in one central unit, which usually has very high installed power (over 100kW). Since the Podgorica area has significant quantities of underground waters with a relatively constant temperature during the whole year (app. 12 - 14$^{o}$C), it could be used as cooling reservoirs during the summer months. Namely, this water can be directly transferred through pumping facilities into stations where it can be used to supplement the existing cooling installation or as the main cooling source.

An example of this installation type operates in the Public institution Sports Center "Moraca" in Podgorica, where the low temperature of underground waters is used for sports hall air-conditioning. This could be used all throughout Podgorica, because there is almost a subterranean lake under the town. The savings on the existing installations could be up to 60%, and on the installations in the newly constructed buildings it would be up to 50%.

**Influence of the automatic control on rational consumption of thermal energy**

Modern heating and cooling of the residential and working spaces demands systems for automatic temperature control (AC) that provide the following:

- Pleasant thermal feeling and
- Energy savings.

Some developed countries are currently installing integral systems for heating, cooling and lightning in big residential, public and commercial buildings, which are based on microcomputers technologies with compatible software. This approach enables huge energy savings through system automation, which were completely inconceivable with the classical approaches.

In Montenegro, practically , there is no any automated control installed for thermal energy consumers. In best case, manual water temperature regulation could be found in boiler rooms, but not automatically controlled heat release , based on a given set of ambient parameters.

Due to present architectural, location, ecological and many other conditions, many consumers don't have any alternative choice, especially in the residential sector, and therefore will have to use electric heating as the only available choice for a long period of time. Under those conditions, except for improvements to the insulation, significant energy savings could only be realized with properly automatic control of storage heaters, which could regulate the temperature level in the room.

Through additional thermal insulation and a temperature level maintained at 18-20°C, savings of 10% could be achieved by using storage heaters .

Because of the huge storage heaters participation for heating, Electric Utility Company of Montenegro faces a significant problem with uneven daily load curve and that they have to be managed from command (dispatcher) centers.

**Other household appliances**

Other appliances for cooking, clothes and dish washing, freezing, etc., are widely present in the residential and tourism sectors. Some of these (such as cookers) have installed power up to 10kW. Depending on the maintenance quality and appliances' handling, the following savings could be achieved:

- electric cooker app. 10 %
- electric boiler app. 8 %
- refrigerator -freezer app. 8 %
- laundry wash machine app. 4 %
- dishwasher app. 2.5 %
- ironing app. 10 %.

**Lighting**

Electricity consumption used for lighting is relatively low compared to the other consumption sectors (~2% in the residential sector and ~0.8% for public lighting). However, keeping in mind that a lot of energy is consumed for lighting in other consumption sectors (industry, handicrafts, trade, transportation) and that a lot more intensive lighting of the streets and traffic arteries could be expected, special attention should be paid to rational energy consumption in this field. Besides the organizational-technical measures that can contribute to more rational consumption, modern technological solutions for light bulbs should be implemented in order to increase lighting efficiency and longer lasting bulbs.

Incandescent light bulbs are not an economical light source, because over 95% of the generated energy is heat and only a small percentage is for lighting. Compact fluorescent light bulbs are much more efficient, and especially the new generation of miniature so-called saving tubes that with the power of 25 W provide the same lighting effect as a 100W incandescent light bulb, and are still lasting 4-5 times longer. The resultant savings are the same by using sodium bulbs instead of mercury bulbs for outside lighting.

Provision of proper selection of the bulbs and implementation of automatic control for lighting, provides a possibility to have an energy savings of 20-25% in this field.

**Compensation of the reactive energy at 0.4 kV**

Compensation of the reactive power and energy in distribution networks results in multiplied positive energy, technical and economic effects, and especially the following:

- reduction of active energy losses on each section of electrical energy system network from the point of generation to the end users;
- reduction of the peak load;
- reduction of the voltage drops and improvement the voltage situation on the network during the peak load periods;
- reduction of bills for reactive energy consumption over prescribed limit;
- an increase of capacity in the existing transformers, power cables and overhead lines on distribution network etc..

Selection of reactive energy compensation system should be conducted based on a rational procedure for each concrete distribution network. The criteria should take into consideration the minimal actual investment costs for compensation system (capacitor banks or some thiristors controlled reactor or capacity), with respecting savings caused by reduced value of the peak load and reduced energy losses.

# 4. BARRIERS TO EE AND TO RE RESOURCES DEVELOPMENT

## 4.1. Target groups and parties involved

The general objective for this Strategy is to improve EE in Montenegro, according to the EU best practices. In order to realize this objective, one of the Strategy's assignments is to assist stakeholders in recognizing and removing identified barriers to implementation of EE programs and measures in all energy sectors, especially on the demand side. Table 4.1.1 gives a list of the target groups and relevant participants in the process of defining and implementing the EE policy, from the governmental institutions to certain groups in the consumption sector. Participants are grouped in three categories:

- Policy makers,
- Intermediaries,
- Consumer groups.

The table shows the roles that different participants can take, from being actors or developers of EE effects on one side or beneficiaries on the other. In that context, the main governmental institution role is undertaken by the Ministry of Economy (MoE), and especially by its Unit for EE (MEEU). MEEU's role is to promote and improve EE in the demand side, by setting up the motivation, targeted and integrated mechanisms for cooperation between relevant institutions and participants in this complex and long-term process.

**Table 4.1.1 List of beneficiaries and parties according to their relevance**

| Institution or group | Activities | Role of ACTORS in EE Strategy | Role of BENEFICIARIES in EE Strategy |
|---|---|---|---|
| **Policy makers** | | | |
| Ministry of Economy (MoE) | •□□National energy policy<br>•□□Coordination and supervision of implementation.<br>•Preparation of annual energy balances<br>•□□Preparation and approval energy legislation, secondary legislation and regulation<br>•□□Support the various branches of the Montenegrin economy<br>•□□Provision of contacts<br>•□□Development of industrial cooperation<br>•□□Harmonization of Montenegrin legislation with EU *acquis*, e.g. in EE labeling | •Support MEEU to undertake the key role in the implementation of the EE Strategy<br>•□□Financial contribution to EE Strategy implementation<br>•□□Provision of Information<br>•□□Promotion of EE as an integrated part of energy policy objectives<br>•□□Stimulation of domestic production of EE equipment<br>•□□Support of promotion and training<br>•□□Support know -how transfer through industrial cooperation<br>•□□Technical/financial assistance to small and medium-sized enterprises (SME's) for EE increase | •□□Support to sustainable energy policy development<br>•□□Evaluation of effects of governmental EE program and investments<br>•□□Energy saving in own premises/ public buildings<br>•□□Support to labeling of EE products and services<br>•□□Know-how transfer on EE equipment<br>•□□Promotion of locally produced EE equipment<br>•□□Well defined industrial development plan |
| Ministry of Maritime Affairs and Transportation (MoT) | •□□Planning of all transport modes in Montenegro<br>•□□Preparation of the Transport Master Plan | •□□Support to the EE Strategy with the elements of the Transport Master Plan | •□□Harmonization the transport policy to EE aims<br>•□□Outputs from demonstration projects<br>•□□Guidelines for advising MPT companies on EE aspects<br>•□□Energy saving in own premises/public buildings |

| | | | |
|---|---|---|---|
| Ministry of Environmental Protection and Physical planning (MoEP) | •□□Supervision of implementation of building insulation / construction standards<br>•□□Cooperation in improving domestic codes for allowable heat losses in buildings<br>•Construction and supervision of Governmental Buildings<br>•□□Cooperation on environmentally friendly EE projects;<br>•Improvement of legislation for environmental protection<br>•□□Emission control of boiler rooms and power plants. | •□□Provision of expertise on building and infrastructure reconstruction<br>•□□Support the implementation of the standards for heat insulation regulation<br>•□□Implementation of legislative and regulatory measures to reduce emissions<br>•□□Ensuring the development and implementation of EE policy in line with EU environmental standards | •□□Improved building insulation standards and methodologies for its implementation<br>•□□Increased know -how transfer at expert level<br>•□□Outputs from demonstration projects<br>•□□Technical advice on effective implementation of secondary legislation for implementation of EE in construction<br>•□□Energy saving in own premises/ public buildings<br>•□□Reduction of emissions caused by energy production in all sectors and in transport<br>•□□Combination of efforts on environmental and energy control<br>•□□Improved position in UN Framework Convention of Climate Change negotiations (UNFCCC)<br>•□□Ensuring environmental policy reconciles with the sustainable development. |
| Ministry of Finance (MoF) | •□□Approving non investment related budget allocations of related ministries and/or public administrations to EE measures/ programs.<br>•□□Formulating and carrying out debt management policies<br>•□□Policy making and implementation regarding investment initiatives for domestic and foreign capital | •□□Approval of investment related governmental budget allocations to EE measures/ programs<br>•□□Assistance in development of financial stimulation measures to implement EE measures (tax relief for EE equipment production and import)<br>•□□Approval for the provision of and guarantees for loans<br>•□□Channeling loans and grants for EE projects | •□□Energy saving in own premises/ public buildings<br>•□□Reduction of budget spending for energy supply in public services |
| Secretary of Development (SD) | •□□Coordination and approval of development and investment plans<br>•□□Coordination of external technical assistance in investment related projects. | •□□Expert contribution<br>•□□Coordination of TA projects and development in EE sector<br>•□□Approval of investment related governmental budget allocations to EE measures/ programs | •□□Well prepared project and investment proposals in line with 5-yr-plan and with integrated approach |

| | | | |
|---|---|---|---|
| Montenegrin EE Unit (MEEU) | •□□Development or providing advice on development of secondary legislation and regulation in cooperation with the related ministries.<br>•□□Dialogue with consumer groups on monitoring and implementation of EE programs. | •□□Financial contribution to EE Strategy implementation<br>•□□Provision and dissemination of information<br>•□□Active role in EE Strategy implementation<br>•□□Coordination of integrated/targeted EE projects (EU, …)<br>•□□Participation with own MEEU staff in project implementation | •□□Support to EE policy development<br>•□□Evaluation of effects of governmental EE programs and investments<br>•□□Energy saving in own premises/ public buildings<br>•□□Know-how on concrete project implementation procedures<br>•□□Wide scale implementation of EE measures |
| Ministry of Education and Science (MoES) | •□□Coordination of research and development activities<br>•□□Implementation of EE Strategy, R&D programs and support of EE demonstration projects<br>•□□Training and auditing in the industrial sector | •□□Support research activities/ projects<br>•□□Support interaction and cooperation with other EE initiatives<br>•□□Development of public-private cooperation / research in EE technology implementation | •□□Efficient and integrated implementation of EE programs, projects and initiatives<br>•□□Efficient and coordinated spending for R&D related to EE projects / research |
| Energy Regulatory Agency (ERA) | •□□Implementation of the Energy Law<br>•□□Approving instructions and regulations, grid codes, distribution codes, customer services codes, and balancing and settlement codes<br>•□□Monitoring the activities and practices of legal entities operating in the market, as well as their compliance with the terms and conditions of their respective licenses, in order to ensure compliance with non-discrimination and transparency standards;<br>•□□Setting up the pricing principles to be employed for electricity sale to non-authorized consumers according to the market conditions<br>•□□Development of financially sound and transparent electricity market operating in a competitive environment under provisions and the delivery of sufficient, good quality, low cost and environment-friendly electricity to consumers and ensuring the autonomous regulation and supervision of this market. | •□□In approving the tariffs, taking into account the companies efficiency and setting the initiatives targeting the efficient management.<br>•□□Application of cost reflective prices and employment of measures aimed at minimizing technical and non-technical losses in accordance with related regulations,<br>•□□Monitoring market performance; drafting, amending, enforcing and control of the performance standards and codes related to distribution and customer services<br>•□□Expertise contribution to the development of targeted energy efficiency programs | •□□Energy saving in own premises<br>•□□The Energy law sets the framework of an effective and efficient operating market environment that would cause enormous efficiency gains in the electricity sector as a whole. |
| Standards Institutions | •□□Certification of EE related equipment in line with EU directives<br>•□□Issuing standards | •□□Product and Process Certification for manufacturers for applying the standards | •□□More efficient standard implementation |
| **Intermediaries** | | | |

| | | | |
|---|---|---|---|
| Ministry of International Economic Relations and EU Integrations (MoEUI) | •□□Coordination of the support to the Montenegrin energy sector<br>•□□Attraction of investors and donors | •□□Channeling loans and grants for EE projects | •□□Proposals for high quality donations<br>•□□Energy saving in own premises/ public buildings |
| Ministry of Agriculture (MoA) | •□□Ensure efficient energy supply in agricultural industry<br>•□□Promotion of efficient use of local resources (biomass, biogas) | •□□Determination of the potential of local energy resources (biomass)<br>•□□Support in RE projects development<br>•□□Assistance in the costs analysis and setting prices for agricultural products to be used for energy generation | •□□Concept for the efficient energy supply in agriculture industry and rural / distant areas<br>•□□Demonstration projects<br>•□□Developing market for using biomass for energy production |
| Municipalities | •□□Decision making on municipal infrastructure, public and administrative buildings<br>•EE □□planning and implementation in municipal supply structures<br>•□□Supervision and implementation of building insulation/energy performance standards<br>•□□Improving the MPT rate<br>•□□Increasing the rate of public awareness | •□□ EE projects development and support<br>•□□Development of local political consensus for larger infrastructure EE investments and local EE policy<br>•□□Planning/supervision of traffic flow and public transport<br>•□□Increasing the MPT rate<br>•□□Studies on public awareness promoting | •□□Advice on development and implementation of efficient local energy supply strategy (gas)<br>•□□Assistance on local EE initiatives<br>•□□Demonstration projects<br>•□□Supporting energy saving and environment protection<br>•□□Increase of the capacity of the municipalities for the observation duty (financial and administrative)<br>•□□Energy saving in own premises/public buildings |
| Industrial Branch Associations | •□□Representation of certain industries<br>•□□Information on quality standards and increased efficiency of production in industries<br>•□□Support marketing of products<br>•□□Conducting debates with the Government on promoting more favorable conditions for their groups | •□□Provision of data on certain industries<br>•□□Dissemination of best practice on EE and technological processes<br>•□□Support to organization of events<br>•□□Commitments of top management members to decrease production costs<br>•□□Expert contribution for the EE potential analysis and the development of sub- sector EE programs/strategies in industry<br>•□□Support development and fund raising for low - interest credit lines for target industries<br>•□□Voluntary agreements | •□□Information on best practice projects for replication<br>•□□Strategies to implement EE in the main industries<br>•□□Demonstration projects<br>•□□Information on international and national quality standards<br>•□□Availability of the qualified energy auditors |
| Chambers of Commerce | •□□Support certain sectors of the Montenegrin economy<br>•□□Provision of contacts<br>•□□Development of industrial and commercial cooperation | •□□Stimulation the local production of EE equipment<br>•□□Support events and training<br>•□□Support know -how transfer via industrial cooperation<br>•□□Assistance of SME's in promoting EE<br>•□□Top management commitments of members to decrease production costs | •Support members for know –how transfer through;<br>•□□Support to labeling of EE products and services<br>•□□Know-how transfer on EE equipment in Montenegro<br>•□□Promotion of locally produced EE equipment |

| | | | |
|---|---|---|---|
| University | •□□Fundamental and applied research<br>•□□Support equipment producers<br>•□□Education and training<br>•□□Lectures on energy management | •□□Expert provision for specific measuring, diagnostics and certification measures<br>•Provision of expert know - how on evaluation of effects of specific technologies implementation | •□□Assistance in targeting research and services to practical project application according to demand of economy, GoM and MEEU |
| State Statistic Bureau (Monstat) | •□□Comparable energy and economy structured statistics related to end-user industries | •□□Provision of relevant data on economy sectors<br>•□□Publishing and dissemination of statistics<br>•□□Evaluation support on effects of EE Strategy implementation | •□□Statistically comparable data<br>•□□Completion of EUROSTAT project for determining EE indicators |
| Consumers' Associations | •□□Informing consumers on advanced and efficient technologies and devices<br>•□□Information on traders<br>•□□Protection of consumers' Rights | •□□Promotion of EE actions<br>•□□Distribution of results<br>•□□Evaluation of the information demand on final energy consumer groups and assisting MEEU in adjusting information measures accordingly | •□□Use of information and promotion materials and advices from MEEU<br>•□□Dissemination of energy efficient equipment and devices (labeling actions, etc.) |
| Environmental groups and associations | •□□Promotion and initiatives of environmental protection, reduction of pollution | •□□Support to the initiation of local activities and cooperation<br>•□□Assistance of local informative events on EE and environmental protection<br>•□□Motivating authorities to become active in energy saving and protecting the environment (emissions reduction) | •□□Use of information and promotion materials and advice |
| Electric UtilityCompany of Montenegro (EPCG) | •□□Ensure stable power supply<br>•□□Diversification of resources<br>•□□Increasing efficiency of power generation, transformation and distribution sectors | •□□Optimization of energy supply to consumers<br>•□□Provision of the technical conditions for connection of CHP plants to the network<br>•□□Improvement of efficiency in production and distribution | •□□Providing detailed data on electricity consumption and trade<br>•□□Stable power supply<br>•□□Imports reduction<br>•□□Rational use of electricity in all sectors |
| International Donors and Foreigner EE Agencies | •□□Developing DSM and other programs jointly with EPCG | •□□Promotion of relations and exchange of knowledge and information on EE | •□□Establishing bilateral/ international financial support programs |
| **Consumer groups** | | | |
| Industrial Enterprises (especially KAP and Steel Works Plant Niksic) | •□□Maximizing the production process efficiency<br>•□□Production of the EE products | •Implementation of EE and rehabilitation measures<br>•□□Coordinate activities with MEEU via establishment of energy management systems at their premises | •□□Information on quality standards<br>•□□Best practice information on EE measures and CHP<br>•□□Performing energy audits<br>•□□Demonstration projects<br>•□□Reduction of the energy bills |

| | | | |
|---|---|---|---|
| Buildings (residential and commercial) | •□□Energy consumption<br>•□□Responsible for rehabilitation measures in dwellings, office and service buildings | •□□Development of own EE initiatives<br>•□□Preference for purchasing EE equipment | •□□Living standards improvement<br>•□□Stable energy supply<br>•□□Reduction of the energy bills |
| Commercial Services | •□□Energy consumption<br>•□□Rehabilitation measures | •□□Development of own initiatives for EE<br>•□□Preference for purchasing EE equipment<br>•□□Stimulate EE at own premises | •□□Improvement of working process quality<br>•□□Stable energy supply<br>•□□Reduction of the energy bills |
| Private and Public transport (MPT) | •□□Passenger transport<br>•□□Freight transport | •□□Choice of less costly and more efficient transport modes<br>•□□Preference for more EE vehicles | •□□Reduction of fuel bills<br>•□□Improved transport quality in terms of time and convenience |
| Public Sector | •□□Energy consumption mainly for space heating and cooling<br>•Energy consumption for office appliances<br>•□□Energy consumption of transportation vehicles | •□□Application of building management system<br>•□□Purchase of more efficient appliances and cars | •□□Reduction of energy bills in offices and guest houses.<br>•□□Improved climate conditions in buildings<br>•□□Better working conditions |

## 4.2 EE barriers, problems and reasons identified

The previous short analysis of the Montenegrin energy sector has shown that in all areas there is a significant EE potential and a wide range of effective and low-cost measures with short investment returns. Also, the primary RE resources that would contribute to sustainable energy and ecological development., were mentioned. On the other hand, there is also a significant number of identified barriers to the successful implementation of any program of activities. Barriers could be classified in many ways; the most suitable is as follows:

Barriers caused by:

- the political, legal and regulatory frameworks;
- Institutional framework;
- Fiscal, taxation and pricing policies;
- Access to financial funds;
- Information and publicity.
- Barriers for RE resources development.

### 4.2.1 Barriers caused by the political, legal and regulatory frameworks

- Not well elaborated Energy Law:
  - The role of the Regulatory Agency in the EE fields is not specified,
  - EU directives related to the energy savings, which are the part of the *Acquis communautaire* are/are not clearly mentioned in the Law and adopted,
  - Obligations of the energy supplier and consumer should be stated in the official document.
- Law on Public Supplies
  - Integration of the energy costs within the tenders' evaluation criteria,
  - The life cycle cost analysis would encourage procurement of EE equipment. Its price could be higher but the saving would be recorded in the long run (e.g. diesel and gasoline cars).
- Lack of regulations related to the specific technologies (CHP, heat pumps, RES),
- Complicated procedures for EE technologies import,

- Lack of organization within the energy sector.

4.2.2 Institutional Framework

- Lack of coordination among various institutions,
- Absence of monitoring and evaluation of programs (policies) and projects,
- Absence of special EE teams within the relevant bodies,
- Absence of Governmental support for MEEU,
- Absence of local and regional EE planning.

4.2.3 Fiscal, taxation and pricing policies

- Energy price,
- Unbalanced structure of energy tariffs and discouraging prices (for EE),
- Lack of direct and indirect incentives,
- Discouraging taxation system (for EE),
- In consideration of the costs in a wider (international) context,
    - Effects of $CO_2$ and other emissions,
    - Security of supply,
    - Industry competitiveness,
    - Employment.

4.2.4 Access to financial funds

- Absence of public funds for EE and RE support,
    - Budget limitations, influence of the IMF and relations of other donors and IFI,
- Low interest from banks (fro EE projects),
- Absence of ESCOs.

4.2.5 Information and publicity

- Insufficiently informed consumers,
    - Insufficient information on EE and RE technologies,
- Insufficient awareness of the additional benefits,
    - Consumption and cost control,
    - Improved comfort,
    - Improved property value,
- Uninformed about the financing opportunities.

4.2.6 Barriers for RE resources development

- Unreliability of future RE resources' prices,
- Conditions for connecting into the network,
- Risk estimation,
- Insufficient know-how,
- Absence of organized marketing and lobbying,
- Environmental impact,
- Long-lasting and complicated administrative procedures.

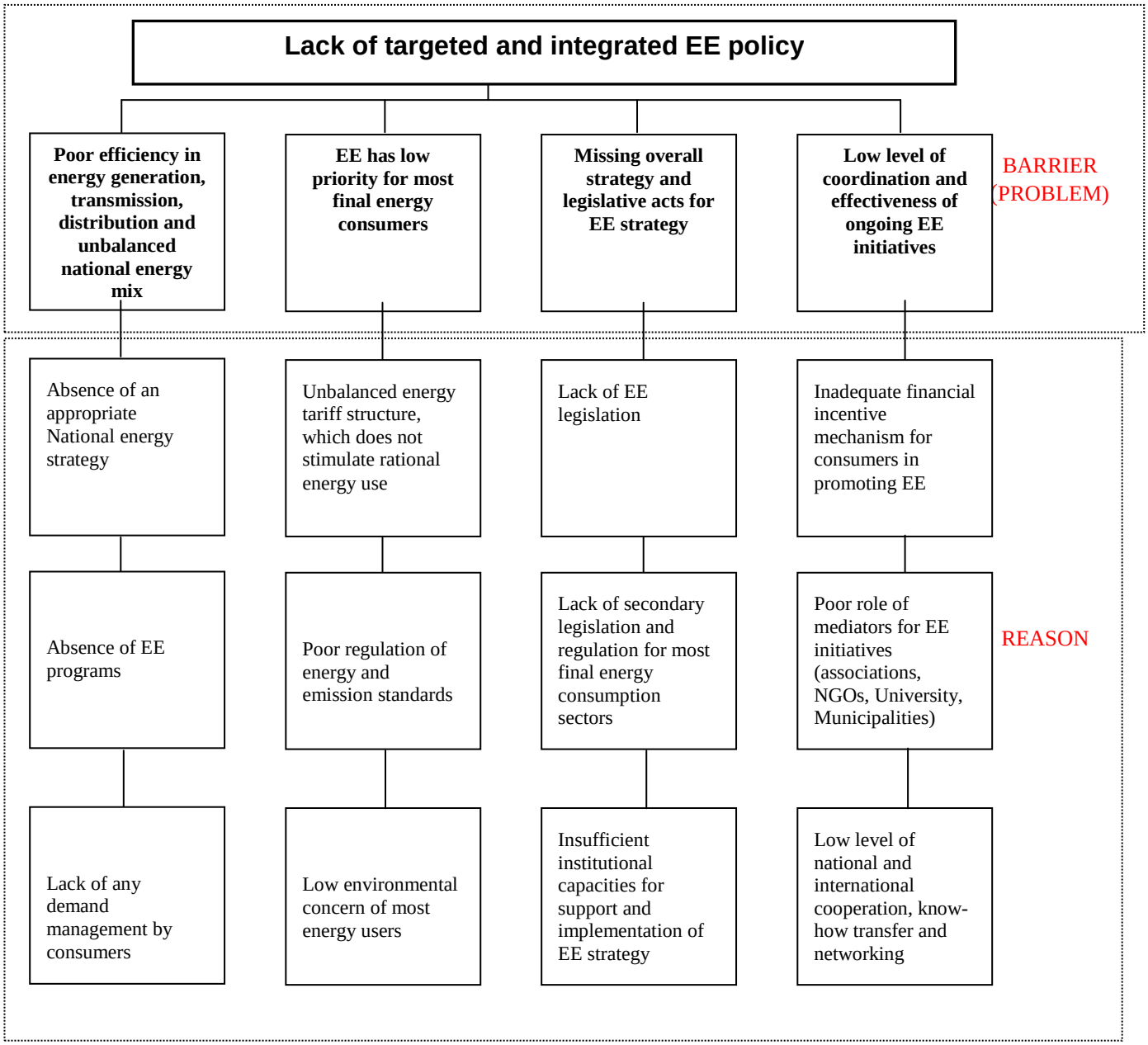
The aforementioned EE barriers are presented in block-diagrams 4.1-4.4. They presented four main areas specified on the basis of the energy balance characteristics, the specific characteristics of each sector and Government's involvement in this area:

- EE policy system

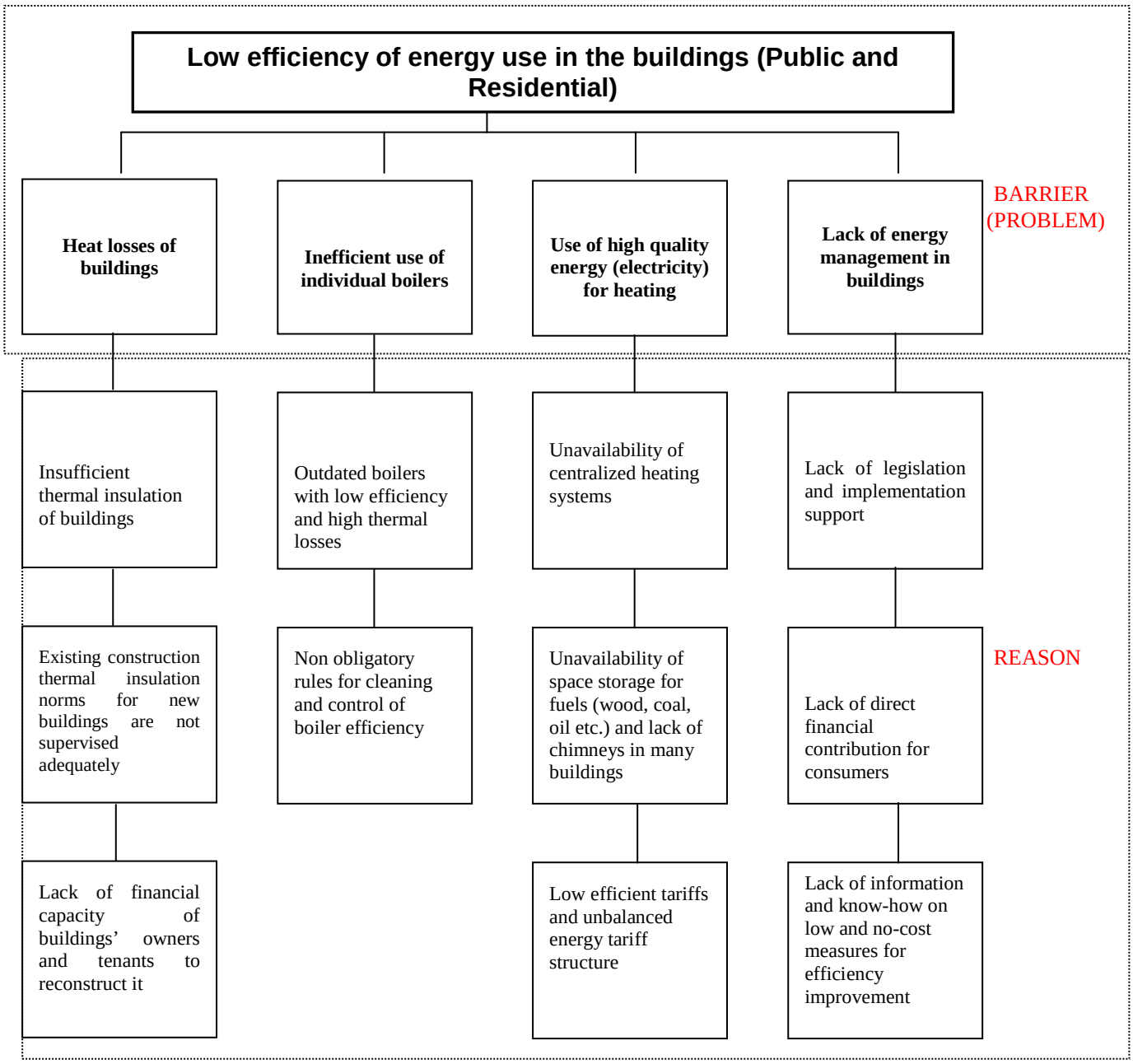
- EE in buildings
- EE in industry
- EE in transport.

The objectives and actions necessary for overcoming the existing barriers are defined in the corresponding block-diagrams in pictures 6.1.1-6.1.4 in Section 6. Reviews in this Section (Table 4.1.1 and Pictures 4.2.1-4.2.4) briefly present the important institutional, legislative and other elements needed for a comprehensive EE Strategy, which would be implemented though specific mid-term agendas in stages. Some questions will be discussed in more detail in the following sections, while in this section the special attention should be given to the current low level of MEEU activation, which should have an irreplaceable role in the initial, as well as in all following phases of this process.

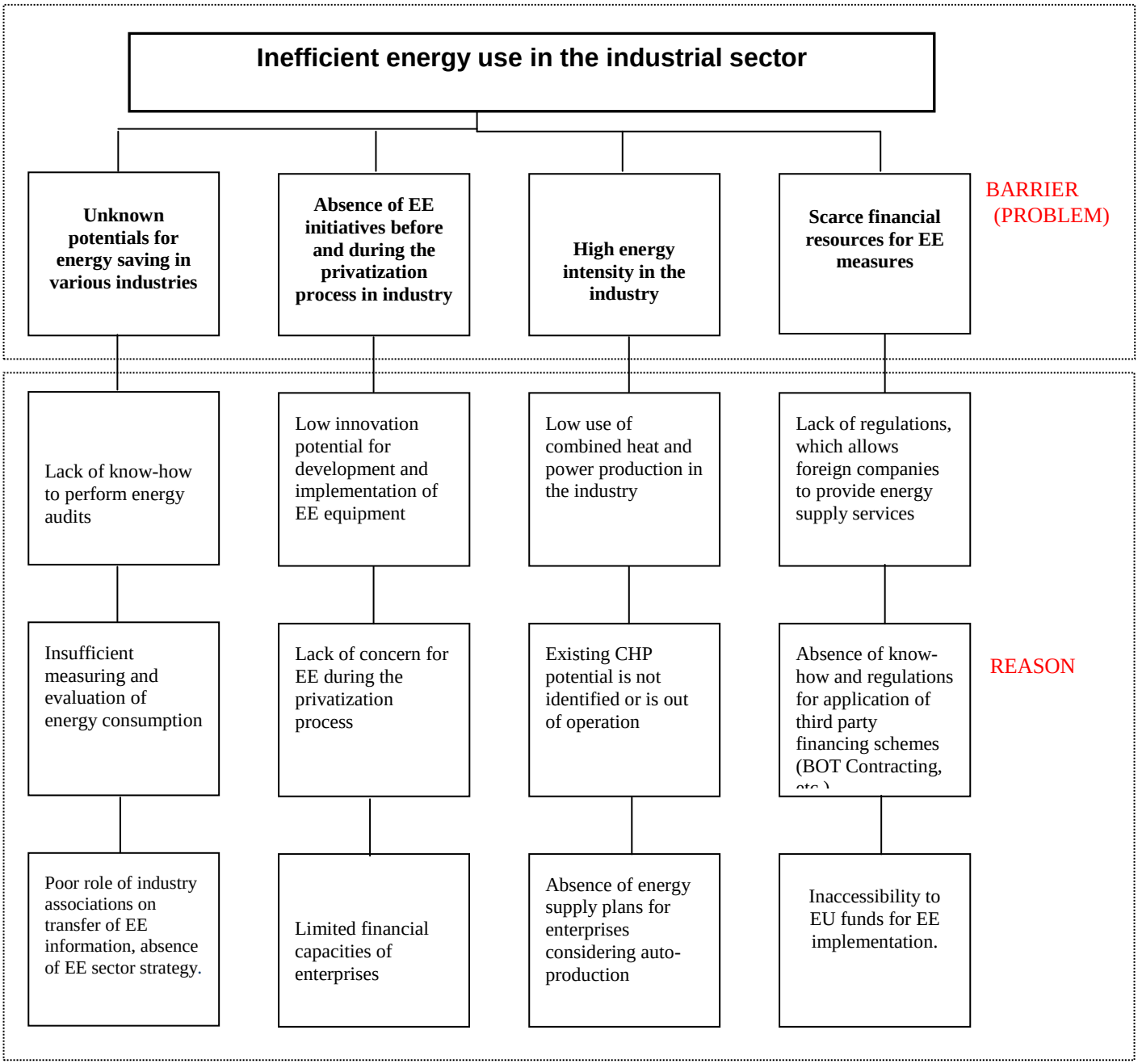
**Picture 4.2.1 EE policy**
Barriers (problems)/reasons identified



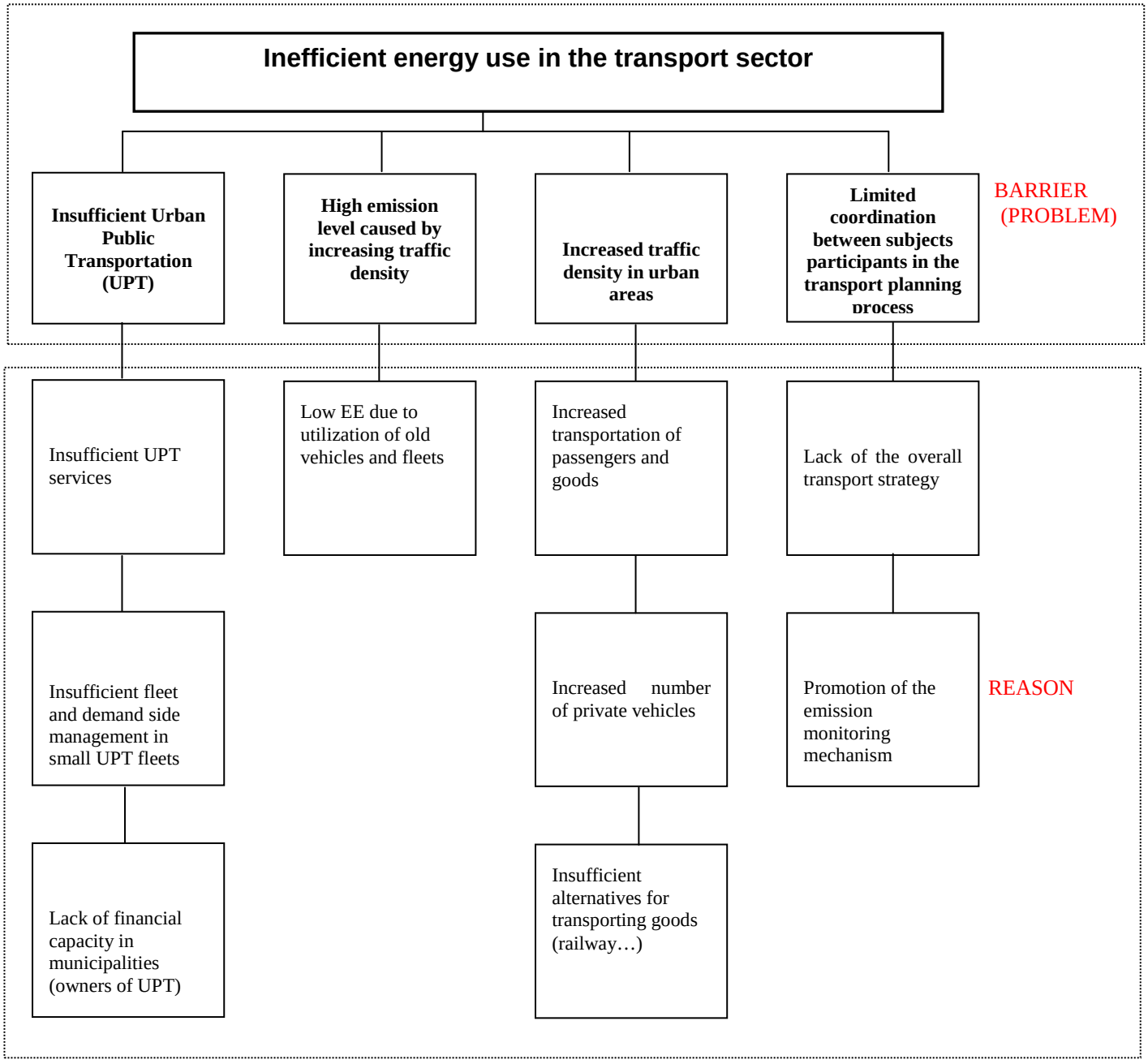
**Picture 4.2.2 EE in the buildings**
Barriers (problems)/reasons identified



**Picture 4.2.3 EE in industry**
Barriers (problems)/reasons identified



**Picture 4.2.4 EE in transport**
Barriers (problems)/reasons identified



# 5. REVIEW OF THE PREVIOUS AND EXISTING EE PROGRAMS AND PROJECTS IN MONTENEGRO

Worldwide experience in optimizing energy use so far indicates that the results depend significantly on how much motivated the energy users are. It is difficult to achieve good results in EE improvement and high level of engagement of all participants in the process, unless they are strongly motivated by the lack of energy supply, most often accompanied by high prices, as was in cases like during the "oil crises" in the 1970's. Optimization effects cannot be realized in the short term – over a few months or a year. As a rule, the process is long and requires continuous reviewing and evaluations of methodologies, as testified by 30-years experience in the EU countries.

Montenegro reacted inadequately to the "oil crises" because the steel industry as well as the energy-intensive aluminium industry were developing in the 1970's. With the improvements of the living standards and the economic development in the mid-80's, the energy deficit problem became pronounced, coupled by the decelerated development of new sources of energy. However, in such an economic environment and a complete social system of non-optimal solutions, awareness of optimal energy use did not increase significantly. Rare cases of energy use optimization in economy were motivated by the need to substitute imported oil derivatives with some other energy sources, cheaper and more accessible at the time.

The first systematic program of measures for energy sector optimization was presented by the Montenegrin Parliament in 1987. It was entitled: *Program for Measures for Rationalization, Savings and Substitution of Energy*. A similar program was presented on the federal level of SFRY. Among other regulatory measures, the Montenegrin Program offered fiscal stimuli (decrease in taxes and tariffs) and the establishment of special funds for the research and development of energy optimization. Despite the generally good concept, the program in reality was never implemented because already in 1988 there were significant political upheavals, with consequences that affected the energy sector as well and led to further deterioration of the sector's efficiency.

The second relevant program entitled *Program for efficient energy use in FRY with the Plan for Implementation in 1997* was adopted by the government of FRY in 1997. In the same year and prior to this program, the federal government adopted the Strategy for Energy Sector Development until 2020 with a vision for the period up to 2050. This program's goals were ambitious and they essentially included the following:

- decreasing expenditures for imported energy by 7.5% per year,
- decreasing energy consumption in transportation by 15% and by 10% in households and
- increasing participation of alternative sources of energy in total consumption to the level of 5%.

This Program also stipulated stimulatory measures in the domain of regulatory, development and economic policies. With the transformation of FRY into SCG (Serbia and Montenegro) in 2002, it was abandoned as it was a program from 1987. EE issues became of responsibility of member states.

The Government of Montenegro, through its Ministry of Industry, Energy and Mining, in 1997 contracted the Electrotechnical Faculty of Podgorica University to prepare the *Study with the Program of Potential Measures for Savings, Rationalization and Substitution of certain Energy Sources in Montenegro*, with a particular focus on electric energy. Based on 2-years research and addressing all energy sectors, a Program has been prepared containing 60 development, regulatory and simulative measures, among which 6 concrete measures referred to the domain of economic policy (tax and tariff decreases for products, equipment and materials that optimize energy use). It has also been proposed that an Agency for Efficient Use of Energy to be established. The principle participants for program implementation were identified, including government agencies. However, the government did not formally adopt this program and EE improvements are up to the individual consumers.

In 2002, EPCG received a grant by the World Bank (US$ 2.8 million) for implementation of the Pilot Project on ”Reduction of losses and payment increase in power distribution sectors in Montenegro” within the *Program on Emerging Stabilization of the Electricity Supply in Montenegro*. The Pilot Project was to demonstrate the capabilities of an automated meter reading & billing system (AMR&B) for precise, technical monitoring of electric energy losses, consumption, DSM capabilities, and improvements to the billing system through remote disconnection of non-paying consumers, etc. The Pilot Project will include ~3000 households (~1% of total) in Podgorica, Niksic, Bijelo Polje and Herceg Novi. Expected effects of this program include a decrease of total losses in the pilot areas to 5-7% and increased payment rates at close to 100%. The Pilot Project provides for monitoring of the complete energy, financial, educational, social and other effects and reactions by consumers as well as monitoring of those EPCG’s services that are included in the Pilot Project, for at least a year. According to the analysis of experiences and data gathered through the Pilot Project and based on the detailed techno-economic analysis, if the AMR&B system proves worthwhile, it will define further strategy for expanding this modern measuring-controlling system, especially for Montenegrin urban centres.

Data were not available in regard to funding models and possible incentives for other implemented projects in the field of energy consumption optimization.

# 6. NEW EE POLICY IN MONTENEGRO

## 6.1 Basis for a new EE policy

As stated above, the Government of the Republic of Montenegro, the competent Ministry, authorized institutions (ERA, MEEU, and others) are directly responsible for EE improvement and realization of RE potential in Montenegro, according to the Energy Law, Energy Policy, Economic Reform Agenda, Athens Memorandum of Understanding and the appropriate European regulations.

The above documents stress that efficient energy use contributes to a more reliable supply, higher market competitiveness and better environmental protection. This confirms the significant role that EE and RE have for creating new business opportunities and for increased employment, as well as for other benefits at the regional and global level. From that aspect, the EE Policy is basically part of the energy policy and the complete economic policy of the Government of Montenegro in the next period. Successful implementation of the EE policy and programmes would create strong support and lay the groundwork for sustainable development in Montenegro and for its strategic orientation toward European integration.

The document Energy Policy of the Republic of Montenegro, as well as this EE Strategy, clearly identifies key energy problems. It especially points to deceleration in the implementation of policies and programs related to EE improvement and increased use of RE resources. Chapter 2 identifies the trend of increasing energy intensity and unfavourable structuring of the final energy consumption balance, with the reduced level of industrial and other commercial and economic activities. If those trends continue, there would be a risk that the energy sector might become unsustainable in the near future. Chapter 4 states the basic systematic, institutional, legal, economic-financial and other barriers to improvements in this sector. However, institutional prerequisite for EE policy implementation are the authorization of MEEU and the provision of financial support (National budget and/or donations, international funds, credit lines, etc.) for its initial activities, in addition to other market, economic and social reforms, including reforms in the energy sector and in its role.

The main systematic (regulatory-institutional) activities for successful implementation of the EE Strategy include the urgent need for preparation of the National Energy Strategy, which would, among other issues, constitute a basis for clarifying the definition of the EE policies. It also provides for the preparation of adequate legislation and a complete energy statistical system, which would be compatible with the EU legislation and statistical standards. Finally, the need was also emphasized for defining economic incentives for EE, RE and environmental protection.

European experience indicates that any EE Strategy cannot be successfully implemented without the cooperation and support of a wide range of participants (governmental institutions, energy producers and suppliers, energy equipment producers, universities, R&D centres, consumers' associations and NGOs). Therefore, it is often necessary to connect certain policies and activities defined for one with those defined for another sector (e.g. ecology, construction, tourism, agriculture and wood industry, education, etc.). In addition to setting up the market principles and mechanisms, modern European and global regulations in this area (e.g. EU Council Resolution on EE 1998 98/C 394/01) also provides mandatory measures and standards for all participants, as well as sanctions for those interfering in and avoiding programs and coordinated activities for achieving the defined EE Policy objectives.

Concerning the harmonization of National legislation with EU legislation, adoption of new EE regulations and standards will be necessary. Preparation of new legislation will be a very serious task for MEEU and the competent Ministry. Keeping in mind the significance deceleration about the rational use of energy and its importance for the economic and social development of Montenegro, quick preparation and adoption of a separate **Energy Efficiency Law** should be seriously considered, as many countries did in the initial phase. This Law would define goals, priority areas, administrative

and operational responsibility for the governmental institutions, as well as the obligations of producers, suppliers and energy users regarding the EE Strategy implementation.

The experience from many countries, including EU members and member candidates, indicates the fact that EE Strategy implementation is the most successful when the administration structure and measure are created to meet the various target groups' requirements and capabilities. In order for EE Policy to reach the end users, it is necessary to provide access to integral measures and programs through the following:

- Promoting concerning the conditions and consequences of irrational energy consumption,
- Demonstration of results and benefits from practical projects,
- Providing technology information, implementation support and financial incentives,
- Effective supervision and evaluation,
- Creating and implementing adequate instruments for income-generating,
- Providing the availability of an extensive choice of EE equipment and devices in the market.

Authoritative, executive institutions should be authorized and become capable of realizing their roles and responsibilities in the EE programs' implementation. In addition to various activities related to general EE Policy (information dissemination, awareness campaigns, education, etc.), those institutions, especially MEEU, would manage special EE projects, which could be supported in many ways, such as technical assistance for preparation of the feasibility studies and business plans. This requires to consider provision of sustainable financing from different sources (national budget, international donations, a share in financial savings sourced from implemented EE programs, self-financed revolving renewable EE fund, etc.). When Montenegro becomes qualified for access to EU support programs for EE, possibilities for participation in special EU funds and membership in the European network OPET (Organization for Promotion of the Energy Technologies), EnR (Network of National European Energy Agencies) and others would open.

As it could be concluded from the previous facts, the EE Strategy's success would be expected only if EE is treated as one of the key segments of the National Energy Policy. One of the recommendations given by the World Commission for Environment and Development (WCED) is that the "low-energy way" is the best path toward sustainable development. Decisive and consistent respect to this global experience in Montenegro is a necessary condition for better living standards and higher employment, productivity and competitiveness, as well as for preserving employment, and the environment.

## 6.2 EE Policy by sectors

### 6.2.1 Priority sectors

As can be concluded from the data and analysis on energy consumption given in Chapters 2 and 3, heating is the dominant consumption need, and at the same time the main area for savings, fuel substitution and other ways of energy use rationalization. It is clearly shown in Table 3.2.1 that the consumption of energy allocated to heating exceeds 60%, while the direct need for heating and preparation of hot sanitary water is ~70% of consumption in households. In the public sector (which includes public facilities, such as hospitals, schools, hotels, sports arenas, etc.), heating is also the dominant type of energy use and thus deserves attention as a priority in the first years of EE Strategy implementation. It is particularly worrying that this sector mostly uses electric energy for heating, which represents one of the worst solutions from the point of view of energy transformation.

One possibility for electricity substitution with some of RE resources is solar energy use for heating, both for heating premises and preparing hot sanitary water. Another possibility is in the field of cooling, where energy used for cooling could be replaced with the use of underground waters as a "cold water" reservoir. Previous IPA studies presented some possibilities for energy savings in the public sector. Some practical projects based on this concept are already in place (JU Sportski Centar

Morača, Institut Igalo). Concrete analysis was also conducted for Mljekara Podgorica, A.D. Plantaže Podgorica, Budvanska Rivijera, Department of Public Revenue and Water Supply System Mareza.

The total energy cost in the public sector (excluding state companies such as hotels and industry) amounts to around €10 million per year, and will increase as the electricity prices increase. This includes the following offices and buildings:

- The administration sector
- The education sector (schools, colleges, universities)
- The health sector (hospitals, health centres)
- Street lighting
- Water supply works

It is well known that wastage occurs where there is no control. The public sector is particularly vulnerable to that, because users don't feel responsible for the costs, as is the case in the commercial and residential sectors.

The main responsibility and motives for EE in the industrial sector (soon-to-be-privatized) will be of the new owners, since they are driven by market competitiveness and profit maximization. The same refers to the tourism and transportation sectors. However, the responsibility and authority of the Government and competent bodies is related to energy flows monitoring and the improvement of a systematic framework for EE projects implementation in these sectors. The government also bears responsibility for protecting the public and private sectors from negative effects caused by the energy processes in energy production and application.

Therefore, the priority sectors for the Governmental EE measures are households and the public sector, as well as the tourism, transportation, agriculture and industry sectors.

### 6.2.2 Objectives and activities by sectors

In Chapter 4 (bloc-diagrams at pictures 4.2.1-4.2.4), barriers and reasons for inefficiencies are identified in the main energy sectors: industry, households and communal sectors, and transportation. In the pictures 6.1.1-6.1.4 of this Chapter are given the corresponding goals and the main activities of policies necessary for EE improvement in these sectors.

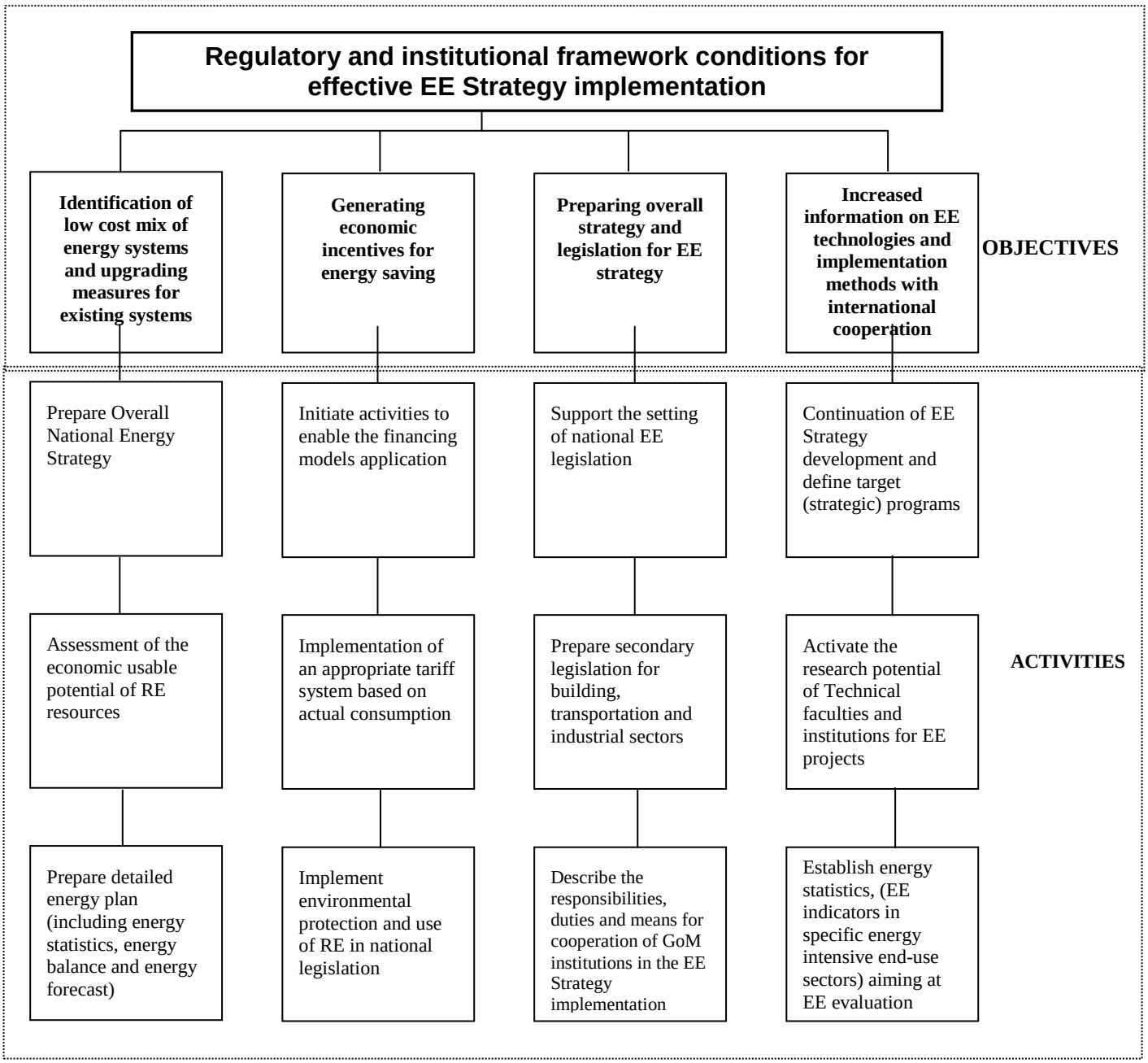
Establishing MEEU with the responsibilities and necessary financial capacities will represent the main incentive necessary for a systematic approach to removing persistent barriers to EE increase. In addition to MEEU, it would also be useful to establish a special forum (e.g. National EE Advisory Council), which would discuss strategically important issues relating to EE improvement on a periodic basis..

Objectives and adequate activities targeting EE increase in buildings are related to increased living comfort, followed by reduced heating costs with improved insulation in existing and future buildings, financial savings, alternate heating that would substitute electricity and by improved energy management in buildings.

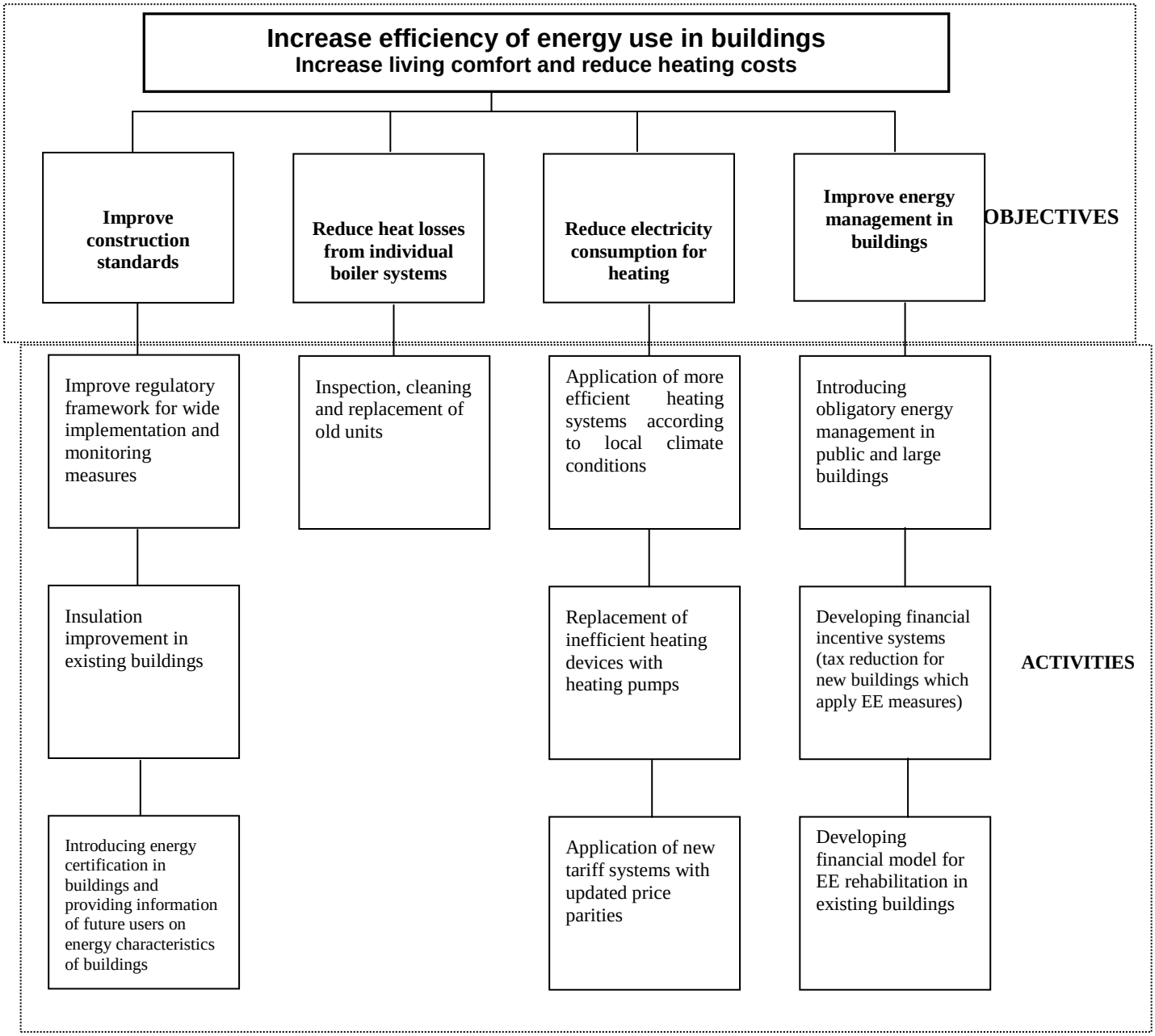
EE programs in the industrial sector focus on the reduction of energy intensity and increased competitiveness for certain industries. The range of measures and programs vary for different industries and requires previous techno-economic analysis.

EE in the transportation sector should generally contribute to reducing imported energy consumption, increasing profitability of transportation companies and reducing gas emissions pollution and other environmentally negative influences.

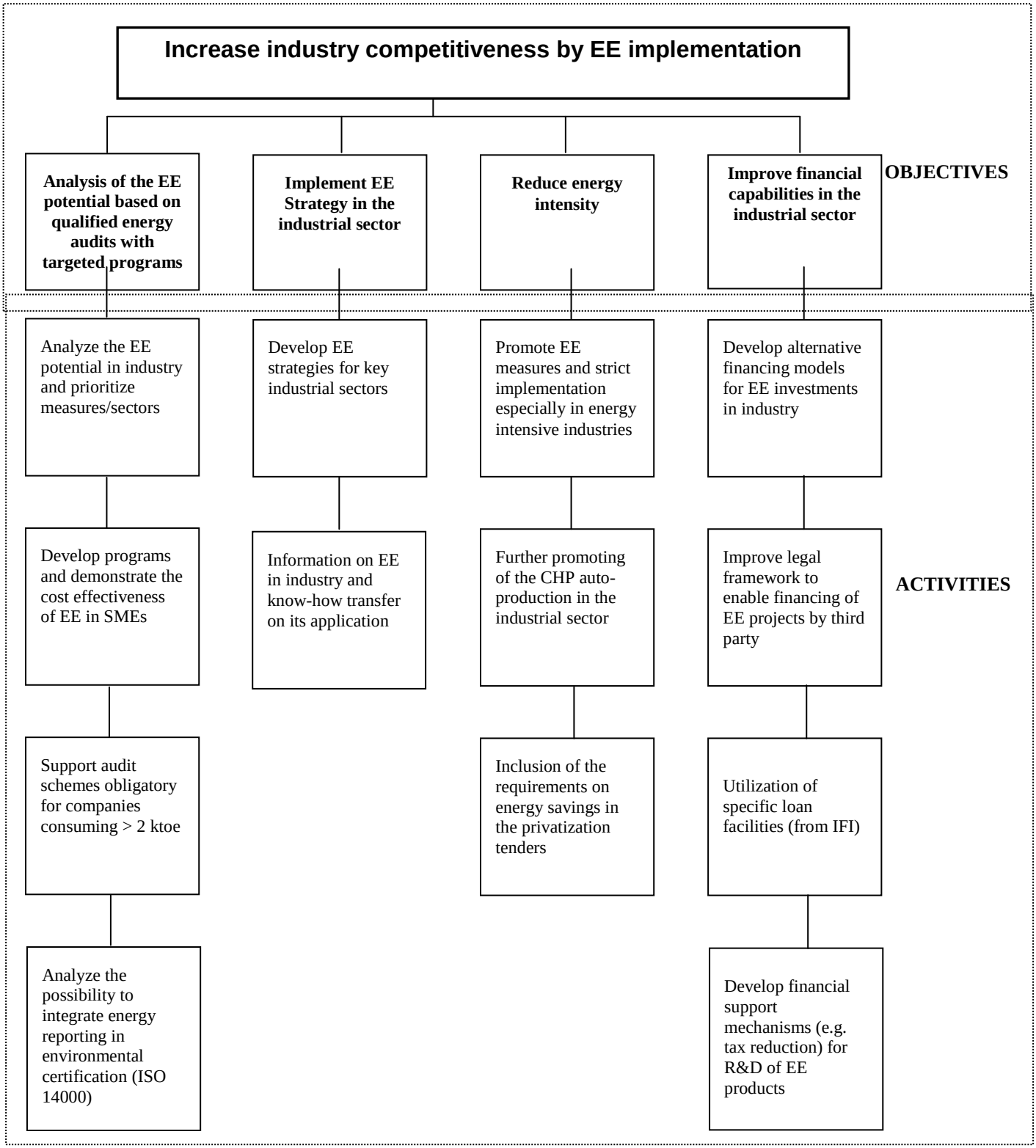
**Picture 6.1.1 EE policy**
Objectives/activities



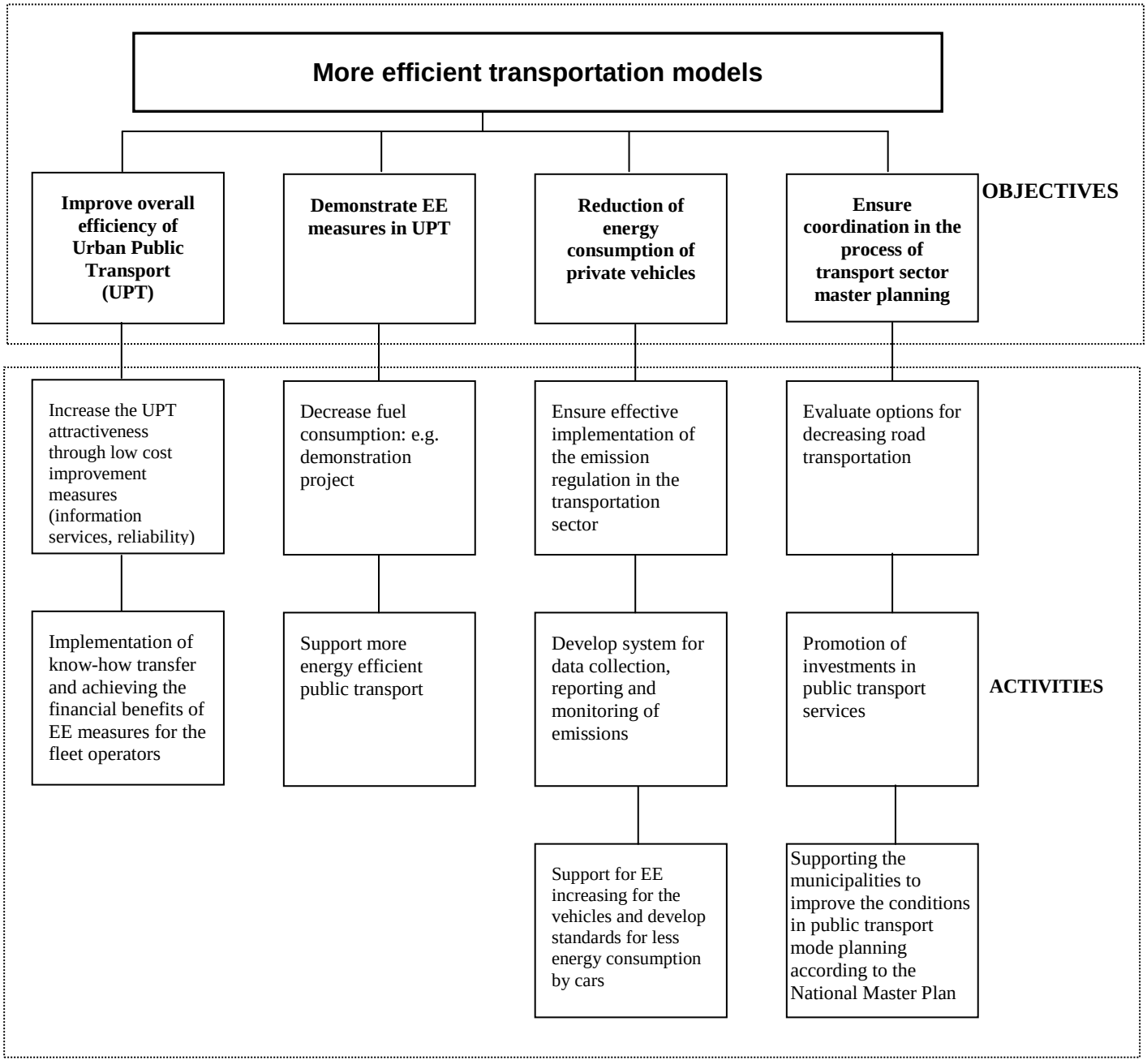
**Picture 6.1.2 EE in the buildings**
Objectives/actions



**Picture 6.1.3 EE in the industrial sector**
Objectives/actions



**Picture 6.1.4 EE in transportation sector**
Objectives/actions



## 6.3 Establishing the Montenegrin EE Unit (MEEU)

### 6.3.1 MEEU Objectives

The main MEEU objectives and mission are sourced from the authorities that the Ministry of Economy has in front of the Government regarding the EE and according to the best EU practice, consist of the following:

i. Identification, analysis and proposition of possible technical and cost effective policies and measures for EE improvements regarding the generation as well as energy consumption side,
ii. Encouraging and promoting activities targeting savings and other EE activities, as well as reducing negative environmental impacts caused by energy conversions in the energy generation and consumption processes,
iii. Promotion of RE use and use of other non traditional sources with low environmental impact,
iv. Promotion and participation in sharing know-how and information with related bodies in other countries and with international institutions and associations active in the EE field (IEA, WEEA, COGEN, etc.).

### 6.3.2 MEEU Activities

The Energy Law, Energy Policy and other relevant documents generally define MEEU activities. Its establishment and strengthening presents the initial measure of the Energy Law implementation regarding EE obligations for the GoM.

MEEU activities are elaborated in the annual Action Plans proposed by the MEEU to the competent Ministry. Action Plans would primarily include the following activities:

- Developing an energy database and appropriate indicators for monitoring, analysis, forecasts and planning:
  - relationships with bodies in charge of statistics (Monstat, Eurostat, etc.),
  - relationship with the energy sector stakeholders,
  - undertaking certain statistical surveys;

  The EE database is a segment of the wider energy statistical system and should be compatible with the EU statistics standards. Regarding this base, MEEU should closely cooperate with the ERA, which is authorized by the Energy Law to collect the necessary data on the energy participants' business operations, excluding those representing the business secret.
  The list of the basic EE indicators is given in Annex D.

- Conducting market research on EE and RE technologies in order to improve the knowledge about energy use and in order to define how to improve it;

- Assisting the Ministry in charge of energy in the elaboration of the EE Strategy, EE Action Plan, and in drafting the appropriate legislation, codes and standards;

- Lobbying ministries and competent administrations to conduct common activities designed to promote EE improvement, especially the following:
  - Ministry of Economy (tariffs, taxes, excises);
  - Ministry of Environmental Protection and Physical Planning (construction programs, construction regulations, ecology standards, climate changes policy);
  - Ministry of Maritime Affairs and Transportation (transportation policy and programs);
  - Ministry of Agriculture, Forestry and Water Management (in charge of forests);

- EE Action Plan implementation and coordination of all activities;
- Creating and preparing information and awareness campaigns for the consumers;
- Publishing the technical documentation for the consumers and all participants in the EE activities;
- Developing activities and materials for the education of professional groups, schools, universities, etc.;
- Organizing demonstration projects;
- Coordinating the EE policy and strategy with neighbouring countries, the EC, and the international agencies involved in EE and RE;
- Participating in the international programs, funds collection;
- Developing and promoting financing schemes and funds for EE and RE investments;
- Establishment and management of the EE Fund;
- Creating and updating the MEEU web site.

### 6.3.3 MEEU Organization

MEEU will be established within the Ministry of Economy. If appropriate, MEEU could become an independent public agency in the future. In that case, the referred Ministry would transfer its authorities and obligations related to the EE Policy creation and implementation to this agency, and its financing would change.

MEEU will have a Director and 2 Departments:

- Department in charge of the following:
  - social-economic analysis, researches, data base,
  - market analysis and barriers assessment,
  - information and campaigns, website, etc.,
  - organization of training, conferences,
  - relations with final consumers and representative organizations (associations of consumers, associations of industrials, etc.).
- Technical Department, in charge of the following:
  - defining and implementing the demonstration projects,
  - elaborating the technical content of all information and training materials.

For the first 2 years, MEEU's staff will include (at least)[2] 3 persons:

- Director,
- Specialist in social-economic issues and researches,
- Technical specialist.

The Director will report to the Deputy Minister in charge of energy.

The MEEU will have an authority to subcontract outsourcing services for the Action Plan implementation.

[2] Considering the very comprehensive activities, the number of employees provided by the Systematization is insufficient. Additional employment and/or external expert support would be necessary.

### 6.3.4 MEEU Action Plan and Financing

MEEU activities would be defined in the annual Action Plans and its results should be demonstrated in public, as well as the benefits that the government has from establishing such a body.

The MEEU Director would annually propose to the Ministry an Action Plan consisting of several projects and an implementation budget.

It is expected that the MEEU will receive a grant from EAR for the first 2 years, to cover the initial establishment costs and the initial activities' implementation. The MEEU staff salaries will be covered by the Ministry of Economy.

In the future, the MEEU will seek international support from multilateral and bilateral donors and foreign agencies involved in EE, environmental protection and the so-called Clean Development Market. MEEU will seek to establish the EE Fund, which would be used for financing the EE projects. Without providing financial resources for MEEU and the appropriate financial support, it is not realistic to expect that the objectives defined in this EE Strategy will be achieved. Under the current conditions, the negative economic effects of irrational and inefficient resources and energy use, are enormously higher than the resources required for MEEU's successful work. Therefore, transferring part of the financial benefits obtained by conducting EE measures into the MEEU's budget for new programs' implementation is reasonable.

## 6.4 Priority sector activities

In addition to the general activities and policies for removing EE barriers by sector, as mentioned in Section 6.2, activities in some sectors, important for EE Strategy are further indicated.

### 6.4.1 RE Sources

It is necessary to undertake activities on conducting a comprehensive development program for RE sources in Montenegro, in order to evaluate the existing potential for small water-flows, wind, solar, biomass and geothermal energy and other RE resources. It is also necessary to introduce and support existing organizational, study and project initiatives in the commercial and non-commercial sector (EPCG, University, especially Electrotehnical and Mechanical Faculty, Montenegrin Academy for Art and Science, some private companies and NGOs) regarding the exchange of knowledge and additional research on potential sources, creating the preconditions for implementation of advanced technologies and proved solutions in this domain. Finally, according to the Energy Law and Energy Policy, it is necessary to create conditions for increased use of RE sources by the introduction of regulations with simplified procedures for obtaining concessions and licenses for constructing small HEs and other RE facilities, granting licenses for network access and licenses for doing business in energy generating and supply from those sources.

Considering the significant current and expected role of biomass energy, it is necessary to prepare the Study on heating and waste wood use, including the complete chain, from planting through cutting, transportation, industrial processing and storage to the end users. This study should encompass the improvement of technical devices used in wood heating, including architectural and building requirements such as storage space, chimneys, etc.

### 6.4.2 Buildings

a) EE role in construction regulations

Construction auditors indicate the fact that considerable energy losses in buildings are caused by poor construction: low levels of insulation, poor openings (doors and windows). The studies on improving the conditions in buildings show that improved insulation in buildings is hardly profitable (several years for return), while a high standard of insulation is possible with small additional costs if installed during construction.

The existing market mechanisms in the building sector are not in accordance with the EE principles for the following reasons: the construction investor is not the final user who pays the energy bills. The investor has neither incentives nor obligations to increase the construction quality from the EE aspect.

In order to make up for this market failure, there are two main EE policy approaches that could be implemented:

- EE labelling development for every building, providing information on the EE standards applied or alternatively giving the expected energy consumption and cost under the standard climate conditions. The final users with that information could consider the EE effects when buying or renting residential or business premises. Therefore, the investor would have an interest in developing EE solutions when it is not excessively expensive or during the design and construction phases, since the level of applied EE standards could become a parameter in defining the final price. This approach is under elaboration in the EU countries, but it should be noted that it is difficult to introduce and implement it. There is no doubt that it will be developed in the future, and that the MEEU should actively be informed about the evolution of the EU legislation. However this option is not considered for the short term.
- Introduction of the minimum EE requirements in the construction standards.

The regulation concerning new buildings is under the competence of the Ministry of Environmental Protection and Physical Planning. The construction regulatory regime is based on the Law enforced in former Yugoslavia (SFRJ), but it is insufficiently implemented regarding the EE.

EE must be introduced more strongly in the secondary legislation of the Construction Law. It will require assistance from international technical and legal experts. It should mostly be based on the EU approach or on harmonization with the EU Directive on energy performance of buildings (2002/91/EC), with the introduction of integrated energy performance features, instead of the former component-based regulation.

Among others, the Directive 2002/91/EC defines the requirements, obligations and procedures for auditing and certification of energy characteristics in new and existing buildings. Thus, e.g. Article 5 of the Directive for new buildings with total useful floor area over 1,000 $m^2$ requires from the EU member states to ensure that minimum energy heating and/or cooling requirements are met considering the following ways:

- Decentralized supplying system from the RE sources,
- CHP,
- Remote heating or cooling system, if available,
- Heating pumps under certain conditions.

During the project design these alternatives should be studied and if proven cost effective are implemented.

The introduction of this approach in Montenegro would have advantages and disadvantages. The experience in neighbouring countries with economic and climate conditions similar to those prevailing in Montenegro should be considered. Such a standard would be favourable not only for EE, but also for RE. For instance solar energy could be strongly preferred. The standard would also include the

obligatory chimney construction, even when electric heaters or heat pumps are supposed to be installed. That would present a competitive point among different energy sources in the future.

The introduction of new EE regulation should be followed by:

- intensive training for professionals, architects, engineering companies, installation companies,
- technical manual for professionals,
- an awareness campaign for all participants.

Such a regulation would motivate companies for more intensive EE inclusion in its operations (e.g. insulation or solar energy systems) and would improve EE business development.

The limitation of the construction standard is that the new regulation could only be applied in new buildings, or at the occasion of significant reconstruction work. It means that it would not significantly impact on existing buildings. Considering that the reconstruction rate is in the range of 1 – 2%, the impact could only be expected in the long term. If more immediate results are expected, activities applied to the existing structures must be designed and implemented.

b) Other activities

According to the specifications for activities to increase energy use efficiency in buildings (Picture 6.1.2), increase living comfort and reduce heating costs, it is necessary to conduct activities designed to improve energy consumption management in public and private buildings. This includes introducing of obligatory energy management in public and large buildings (auditing, planning and monitoring), followed by the implementation of several demonstration projects in the public, private and commercial sector.

Demonstration pilot projects would also provide multiple benefits in verifying the efficiency of alternative heating solutions (solar collectors, heat pumps, heaters that use wood or other solid energy source, etc.) under various climate conditions.

It is also necessary to initiate well-designed EE awareness campaigns related to buildings, including educational and informative popular material targeting different population groups and the commercial sector.

Regarding financial incentives, it is necessary to create tax-deduction mechanisms for new buildings with applied EE measures, or for the construction materials used for energy rehabilitation in existing buildings.

As in other sectors, monitoring of EE in this sector requires establishment of an adequate statistics system with a database on the physical, energy and other characteristics of buildings.

c) Rationalization of electricity consumption for space heating and cooling

In order to discourage electricity consumption for heating, and the optimal use of electricity generation and distribution, it is necessary to analyze electricity prices parity and the current tariff system (for the VT&MT functioning). By a new, well-designed tariff system (based on long term marginal costs) and the appropriate remote-control and management techniques (SDU) for TAF and accumulative boilers from control centres, it is possible to “equalize” the daily consumption curves and other effects in the Distribution Management System (DMS).

In order to achieve energy and economic savings on both the electricity supply and user sides, it is necessary to modernize the existing management, measurement and billing systems. This concerns the gradual development of Technical and Information System (TIS), whose key segments are SDU and Automated Meter Reading & Billing (AMR&B), integrated with the business information system. The Distributive AMR&B Pilot Project currently underway in four distribution sectors (Podgorica, Niksic,

Herceg Novi and Bijelo Polje), has initiated the introduction of the DMS functions in EPCG, targeting the integration of the remotely controllable resources. After monitoring the project, it is necessary to conduct a detailed techno-economic analysis of the SDU profitability and the strategy on its introduction and widespread use over the entire or certain EDS areas.

In recent years, an increased number of heat pumps was recorded for air conditioning, especially in the Central and Southern region of Montenegro. This application represents significant problems during peak load periods, with declining power factor and other technical and economic consequences. According to the EU Directive 2002/91/EC, increasing the thermo-insulation characteristics in buildings during the summertime is prioritized, as well as the further development of passive cooling techniques; especially those for improving indoor climate conditions and microclimate conditions around buildings.

It is necessary to start this study preparation, focusing on this problem, as soon as possible.

#### 6.4.3 Industry

In order to exploit the EE potentials and reduce specific energy consumption in industry, the preparation of a programmes for the rational use of energy (RUE) would achieve significant economic effects for industry and for Montenegro. These programs would also analyze the potential uses of industrial wastewater and exhaust gasses from electro-arc and other furnaces. This waste-heat potential would be used for space heating, combined with the use of heat pumps and for water heating for high-temperature steam generation for technological processes.

In some industries (Aluminium Plant and Steel Works Plant primarily), the RUE programs would include Combined Heat and Power (CHP) production analysis, as well as application of the variable speed drives in electricity motors in various processes. It is also necessary to enable systems for compensation of reactive power energy and filtering of harmonics, to achieve a high power factor, improve voltage and reduce losses in the electricity systems of the Aluminium Plant and the Steel Works Plant.

Achieving of overall worldwide standards on specific energy consumption and energy intensity, as well as on environmental impact (power factor, harmonics, etc.) should be key requirements and conditions determined for industrial companies, privatization strategy and tender procedures. Compatibility conditions with the supply system should be met also in the construction period and while connecting new industrial facilities with the power system.

Large, as well as small- and medium- sized companies in the industrial sector should develop an integrated energy management system, including training of staff in energy management, and preparation and dissemination of manuals for savings and other EE measures. Each participant should establish a system of obligatory monitoring on energy indicators, which should be periodically reported to the MEEU, Monstat and other official institutions authorized for the collection and analysis of energy data.

According to worldwide practice, it is necessary to define energy auditing as an obligation for companies consuming over 2 Ktoe. At the same time, these companies should establish an energy management system.

#### 6.4.4 Transport sector

Considering that almost 90% of energy consumption in the transportation sector is consumed in road transportation[3], with the dominant participation of private vehicles, the main EE potential for rational energy use is related to road transportation. Additional reasons for including the transportation sector

[3] The balance does not include consumption in maritime transportation

in the EE programs are that all of the energy used in this sector is imported and pollution from exhaust gas emissions is negatively impacting the environment in urban areas.

Realization of the EE potential in the transportation sector is quite complex and it would be necessary to initiate an urgent potential improvement analysis by conducting special studies, which would include analysis of the EE problem and the gas emissions problem. This research would also include assessment of the impact of limited road infrastructure, potential for rationalization of the traffic flows from EE perspective, especially by shifting the road transportation of people and goods towards railway transportation, and the necessity for a larger share of public urban and sub-urban transport. The electrification and general reconstruction of the railway from Podgorica to Niksic is a high priority and of special importance for EE.

As for the other consumption sectors, an adequate statistical system should also be developed for the transportation sector that would provide the main energy indicators. Regulations and standards should also be developed for an efficient emission monitoring system. It is also necessary to conduct an awareness campaign on EE and the environmental effects in this sector.

## 6.5 The needs for additional research, studies, data collection and market analysis

a) Research, pilot and demonstration projects

The absence of EE general policy and concrete programs causes a gradual decrease in the EE indicators, with serious consequences for energy, economy, ecology and other developing preconditions in Montenegro. The Energy Policy for Montenegro includes the obligation of establishing funds for research and technology development, which would provide support for research, development and promotion of new, clean and efficient energy technologies and for managing expert- and scientific-based energy policy. The instruments for the Energy Policy implementation also define the following EE-related obligation for the GoM:

- introduction of the incentive measures for scientific-technology development in the energy sector and cooperation with the international energy programs;
- providing incentive measures for implementation of the EE programs, new RE sources and clean technologies, including the use of EE devices, friendly to environment;
- promotion of technological achievements and infrastructure development targeting negative gas greenhouse impacts.

Although direct support programs are of high cost, they are necessary since successful results on the best EE practice should take into account the following:

- innovativeness,
- modern technology application,
- replicability.

It is important to select projects with maximum results and visibility (e.g. administration, school or hospital buildings, apartment buildings, etc.), as well as projects that would be included in international research programs.

Pilot and demonstration projects represent an important EE Policy mechanism, especially when they generate results that can be widely published. These projects, carefully selected, should cover various regions and areas.

b) Market studies

As previously mentioned, the EE Strategy is based on the final users approach. The EE Strategy elaboration requires in-depth knowledge on the energy demand and market structure. The global data on energy consumption in Montenegro are useful but not sufficient. The total consumption figures should be structured as follows:

- by sector,
- by type of use.

In a first approach, the main sectors to be considered are:

- Households
- Public sector
- Commercial buildings
- Industry
- Agriculture
- Transport

For detailed activities targeting a certain sector, the need for sub-categories would appear. Considering the available data from this first EE approach in Montenegro, in the next 2 years it would be necessary to conduct market studies on the following:

- all household types (see more details further);
- the public sector with the following sub-sectors:
  - administrative and office buildings
  - buildings in the education sector (schools, high schools, University),
  - buildings in the health sector (hospitals, health centres),
  - water pumping and water supply systems,
  - street lighting;
- commercial buildings: in this initial approach, only the tourism sector (mainly hotels) should be considered as the target for specific activities in the next 2 years.

It is not enough to be aware of a certain sector's consumption, but it is also necessary to be aware of the following:

- consumption distribution according to the different types of use (heating, cooling, lighting, motors, etc.);
- type of equipment, technology, age, efficiency;
- consumers' behaviour regarding EE;
- consumers' expectations and selection criteria.

It is also necessary to clearly understand how the following markets are functioning:

- technologies available at the market, costs and benefits,
- attitude of providers, retailers, engineering companies, architects, etc.

In order to collect the required data, the MEEU is to:

- define the type of information requested for properly addressing every sector,
- define the data that could be collected by other bodies (Monstat, Institute for Strategic Studies and Prognoses, Hydrometeorology Institute of Montenegro, etc.) For instance, data on heating and cooling equipment as well as on appliances could be included in the official population census,
- maintain contacts with energy suppliers, consumer associations, professional federations, etc., in order to obtain additional data,
- conduct market surveys by own means (the priority would be the survey on energy use in the residential sector).

All larger consumers should respond to the annual survey on energy consumption and equipment type (with respect to the required procedures for ensuring information confidentiality). In order to avoid

redundant questions, which would inconvenience large consumers, this must be organized with the Ministry of Environmental Protection and Physical Planning and the Ministry of Economy, Chamber of Commerce, and with the administration in charge for the energy equipment inspections (steam boilers, etc.).

The Energy Law, or a specific EE Law, should authorize the MEEU to request information, to process and to publish it in an appropriate way. For instance, MEEU should be authorized to request data on electricity consumption from EPCG or from any other energy supplier.

# 7. FUNDING FOR EE POLICY AND STRATEGY IMPLEMENTATION, INCLUDING OPTIONS FOR MEEU FUNDING

## 7.1 Sector potential for EE financing

Lack of financial resources is a typical barrier for EE in most emerging economies. Interest rates are high and commercial organizations and industry may be reluctant to use their scarce self-financing capacity for EE projects. They may prefer to invest in more profitable investments. This is why an EE Fund establishment was proposed for the EE projects development.

The public sector may also be unable to finance EE. According to the public accounting rules, the government and other public institutions cannot amortize the project investment costs and must include the total expenses into their regular own budget. In a period of budget reduction, it may be easier for the administration to pay a higher energy bill. For the public sector, ESCO may be an appropriate response to this problem, provided that the legal framework provides sufficient security for foreign investors.

Individual consumers may also be unable to finance EE solutions, such as heat pumps, or even compact fluorescent lamps (CFLs). In some countries the electric power company provides CFLs to its users and reimburses the cost through their energy bills, which is a successful scheme.

The future implementation of the Kyoto Protocol, and the Carbon Market development, would create additional financing opportunities.

MEEU should require and develop the capacity for providing financial resources for EE projects through the following:

- EE Fund,
- connections with international donors and development banks,
- connections with other EE agencies who may provide support,
- connections with projects or funds not specifically dedicated to EE, but where a synergy is possible (funds for housing rehabilitation, funds for the SME development such as the fund managed by KfW, etc.).

## 7.2 EE Fund

a) Fund operations

Establishing an institutional mechanism through a EE Fund for financing EE projects and programs is strategically important for the EE Strategy implementation. In some cases, a dedicated law establishes the Fund.

The Fund concept foresees establishing *sui generis* financial institution whose operations targets the collection of financial sources for financing EE programs, projects and measures and increased use of RE sources in Montenegro.

The Fund's operations would include the following:

- non-repayable sources (grants),
- commercial loans under the market interest rates,
- soft loans with favourable interest rates, longer repayment period and grace period for repayment,
- provision of guarantees.

The fields for EE and RE sources, which would be financed from the Fund, include the following:

- domestic small entrepreneurs, producers of equipment characterized by significant energy and cost savings in general, and equipment which would ensure environmental protection,
- construction of the energy generation facilities characterized by more efficient energy use,
- construction of facilities using the RE sources, such as wind energy plants, small HPP solar energy systems and other facilities,
- supply and installation of equipment and other appliances and materials for increasing EE, conducted by legal and physical persons,
- conducting special studies and analyses, and projects for preparation of laws and secondary legislation.

b) Strategic framework for the Fund's operations

The Fund for financing EE and RE use activities, as an integral and important part of the energy sector reform, should be clearly structured due to the following:

- Mobilization of the development capital primarily from domestic commercial banks for the EE and RE resources use. The starting point for financing is that the user receives economic benefits from the project. This way, one of the main preconditions for economic development is achieved.
- Attracting interest of specialized foreign investment funds which invest capital in projects, including financing of developing energy markets, energy sector reforms, as well as investments in the field of EE and RE resources and benefit from their experiences, interests and strategies

The Fund should consider a revolving component for its higher efficiency. This component would not necessarily determine its business strategy, but is important for its economic-financial specific character as a specific purpose Fund. Therefore, the Fund would be set up from institution point view with a double structure:

- profit oriented and
- non-commercial.

The projects and distribution of resources would be conducted in the same way.

c) The Fund's tasks

The tasks of the Fund are as follows:

- EE Policy implementation,
- National EE programs' implementation,
- Collection of the financial and other incentive resources for the EE programs, projects and measures and for the use of RE resources,
- Managing those resources,
- Partly self-financing,
- Preparation of the annual budget and the working program,
- Defining the criteria for distribution of allocated resources,
- Identification of potential projects,
- Announcing tenders for distribution of the allocated resources,
- Evaluation, processing and selection of submitted proposals,
- Distribution of allocated resources,
- Administrating of loans,
- Monitoring and control of meeting the objectives of expenditures allocated for specific purposes.

d) Operation priorities

The priorities in the Fund's operations are as follows:

- EE/RE Strategy and Policy implementation,
- Mediation in financing EE/RE projects, programs and initiatives within international programs for bilateral and multilateral cooperation,
- Mobilization of sources for financing the national EE/RE programs and projects,
- Supporting domestic EE equipment production,
- Supporting and financing construction and installation of the EE equipment and technological solutions.

e) Financing the Fund

The budget of the Fund would be financed from several capital sources, such as:

- National budget and budget of local governments,
- Loans from commercial banks,
- Interest from loans provided by the Fund,
- Share (fee) included in the price of certain fuel types,
- Cost savings achieved by the EE programs implementation,
- International financing sources.

f) Financing distribution

The Fund's resources would be distributed according to defined criteria for project evaluation and selection, as well as in accordance to the defined operating control mechanisms:

- criteria and priorities for financing
- system for verifying the beneficiary's solvency,
- criteria for project identification, profitability evaluation and selection,
- system for planning and controlling the operation and financing.

Note:
Typical financing conditions in EU are:

- interest rate of 5%;
- repayment period:
    - 4 years for households,
    - 5 years for industry and the private sector,
    - 7 years for district heating and the public sector.

Establishing such a Fund with an initial capital approximately of €1-2 million would generate strong initiatives for EE improvements and a higher penetration of RE resources in the Montenegrin energy sector.

# 8. IMPACT OF ENERGY PRICES AND COLLECTION RATES ON EE POLICY IMPLEMENTATION

## 8.1 Energy tariffs

Besides the set of other factors which influence EE and energy intensity, the energy price factor is very important, especially for electricity. Only real energy prices, which cover all expenses including environmental costs, could guarantee sustainable energy sector development. Ignoring this principle in many countries, especially in developing countries such as Montenegro, results to energy prices that only cover 50-60% of actual costs.

Among all activities for the deregulation in the energy sector, a comprehensive tariff reform that would reflect the real costs would be the greatest incentive for end users to implement EE initiatives, while an improved billing collection rate and enforcement also might help. Based on the cost analysis of the EPCG's and current tariff structure, it was estimated that the electricity tariffs for households should be at least double the current level of 0.049 €/kWh. Such a step would initiate energy savings, particularly regarding small investments in EE measures, such as lighting and insulation. Indeed, based on household surveys, it was estimated that the price elasticity for electricity in S&M amounted to 0.25, which indicates that each 10% rise of prices would accordingly decrease consumption by 2.5%.

As shown in the Electricity Distribution and Billing Losses Report elaborated by IPA in April 2004, EPCG tariffs are low and do not motivate consumers for energy saving. Prices applied for the residential sector are particularly low, which causes increased energy use. However, the over-consumption due to low tariffs must not be overestimated, taking into consideration that energy prices are much higher than in the EU countries if compared to the average income. Even if subsidized, the energy bill still represents a significant share in the household budget with monthly income of around €200.

A more important impact on the current electricity prices is that the majority of buildings use electricity for heating. Imported fuels such as heating oil or LPG are more expensive. The AC development could be a good solution for the present, but if the price of electricity for the residential sector is doubled or tripled, the space heating market could change completely. The Government should be aware of this potential impact, because it could force the population to adopt non-desirable solutions, such as low-efficiency oil heaters, or wood use as an energy source in an uncontrolled way. Conducting a market study on space heating and cooling is recommended.

If the Government is to support the poorest population groups, it should be done through direct social programs instead of through energy prices. In principle, energy tariffs should not be subsidized but should reflect actual costs (as required in the Energy Law, Article 18). Consequently, the development of 2-level tariffs should be encouraged. Shifting of energy use from peak periods to low demand periods, even if it is not necessarily accompanied by reduced energy consumption, helps the EPCG to become more efficient.

## 8.2 Non-payment reduction

The non-payment issue is likely to be a higher EE barrier than the low prices. When energy is free, there are no incentives for energy savings, and particularly for investments in EE equipment. EPCG is the main responsible for this issue, since it received from IPA (April 2004) a comprehensive study of the billing losses and on how to reduce the commercial losses. Commercial losses are estimated at 226 GWh/year, corresponding to an economical loss for EPCG of about €6.8 million per year.

The Government, through appropriate regulations and law enforcement, must support the EPCG. Out of 890 cases of meter stealing reported by the EPCG, the courts resolved only a 10%, imposing small penalties of only €50 to €75. This is likely to be an encouragement for stealing rather than a deterrent measure. The relevant penalty for meter stealing is up to 5 years imprisonment, therefore the real problem is enforcement of the law.

EPCG is currently not authorized to bill illegal consumption of around 3,000 or more consumers. EPCG would reduce the commercial losses, were they able to bill them.

It is understood that many consumers cannot afford part or even the total bill amount. However, the tolerance for stealing or for non-payment is a negative incentive for all consumers. It is well known that the poorest population groups are not always those who take advantage of the stealing or non-payment tolerance. The Government should find a more suitable way to protect the poor population groups, through direct protection programs focused on those who actually need it. For instance, the Government could pay the bills for the most vulnerable population groups.

### 8.3 DSM and electricity tariffs structure

Consumption reduction during the peak load period, even if not combined with reduction in total energy consumption, should be included in the EE Strategy. It is expected, under fair energy tariffs, that reduction of the maximum demand by 1 MW would be less expensive than the construction and operating of 1 MW during the peak load period. Besides, reduction of the peak demand would reduce the technical losses in the distribution network. The shift of electricity loads from peak periods to low demand periods, even if not necessarily followed by a reduction of the energy consumption, helps EPCG to be more efficient. EPCG might be especially interested in this particular EE potential and be involved in this strategy as an active partner.

MEEU will advise ERA on an appropriate tariff structure for promoting DSM (measures that take into account the ability and acceptability by the final users): i.e 2 or 3-tariff rates (peak, high and low demand), and 2 or 3 seasonal rates (in compliance with the Energy Law).

It will be a part of the MEEU's activities to inform and to promote solutions that assist consumers to make better use of electricity tariffs. Implementation of a demonstration project is proposed for selected households, which would apply automatic load shifting so that some electric appliances are used only in the low tariff period (TAFs, hot water heaters, washing machines etc.).

# 9. ECONOMIC AND MARKET POTENTIALS

In line with the MEEU establishment for the administrative EE Strategy aspects, investments in EE might be conducted from a variety of multilateral and public financing sources.

Considering the financing possibilities from foreign sources, it is foreseen that the announced financial sources by KfW would be intended for small- and medium-sized enterprises. Yet, much of the EE potential is in public buildings and households. It is necessary to stimulate the investment climate for EE projects in the commercial sectors. That prerequisites an initial screening of companies' interest and of appropriate EE projects (focus on the privatized enterprises or those in the privatization process), which may require "soft" loan agreements from local or foreigner banks (KfW, WB, etc).

As mentioned, given Montenegro's relatively abundant RE sources, the potential for activating financing mechanisms such as the Clean Development Mechanism (CDM) exists. By ratifying the Kyoto protocol, Montenegro would create a framework for implementing such mechanisms. Alternative financing sources include the EBRD, World Bank, UNDP (GEF) and other donors.

# 10. ACCOMPANYING IMPACTS ASSESSMENT

## 10.1 Macroeconomics impacts

Generally speaking, the primary macro economic effect of the EE strategy implementation is GDP increase, a decrease in energy imports and the external trade deficit, national budget savings, implementation of new technologies, establishment of the new industry sectors with increased employment and economic competitiveness.

## 10.2 Social impacts

Promotion of EE measures in the demand side would contribute to reduced consumption and thus compensation of the impact of increases in prices, especially in the still undervalued electricity prices. EE improvement in the residential sector would enable reduced direct subsidies (to cover the gap between tariffs and actual production costs). This, in turn, allows shifting of saved subsidies for utilities to targeted subsidies for the poorest population groups. For vulnerable groups with low incomes (such as pensioners, the unemployed, etc.), the share of heating costs in the total household income may be in the order of 50% or even more.

It is recommended that the Government, through the ERA, define the appropriate protective measures for the poorest population groups. However, EPCG should understand its role in this issue by introducing rules for more favorable payment terms for vulnerable groups, and introducing suitable tariffs or metering (pre-payment, appropriate tariffs, etc.). In parallel with the introduction of low tariffs, the vulnerable population groups could receive education on how to use the available amount of energy in the best possible way.

In addition, it must be stressed that the public sector does not give a good example by paying most of its bills through barter. This issue should be addressed by activities targeting the reduction of energy consumption and public sector expenses. The MEEU will elaborate data by demonstrating the negative impact that non-payment cause for EE, and lobby the relevant authorities for the implementation of the above recommendations.

## 10.3 Environmental impacts

The main objective of this EE Strategy as well as the MEEU mission will be to encourage and promote activities focusing on the rational use of energy and the reduction of negative environmental impacts in energy conversion and consumption. The operative instruments to achieve this MEEU mission would be legislation and its accompanying measures (monitoring, informative and educational campaigns, training for professionals).

EE measures are usually environmentally friendly measures “per se,” as long as they reduce the fuel consumption or when replacing it with a cleaner fuel (such as replacing heavy fuel oil with natural gas). This is emphasized when the traditional fuels (coal, oils, etc.) are substituted by RE sources (“green energy”).

However, due to the need for an increased reliance on domestic energy resources and reduction as much as possible of the dependence on energy imports, substitution of cleaner fuel (such as heavy fuel oil in KAP and district heating plants) with locally produced coal cannot be excluded. This could make sense if a coal-fired co-generation plant would replace a heat-only plant. In such cases, it must be ensured that the emission balance of the new system is – at least – not worse than that of the replaced one.

Finally, apart from a few individual, special cases, the MEEU activities will contribute considerably to the reduction of harmful emissions in the energy sector. The MEEU activities should align the future participation of Montenegro or municipalities to the Kyoto Protocol mechanisms.

# 11. LEGAL AND REGULATORY FRAMEWORK IN THE EU AND THE REPUBLIC OF MONTENEGRO

## 11.1 Harmonization with EU legislation

With respect to future EU accession, all new measures should be consistent with the EU legislation and its directives. Regarding the EE, this mainly includes the following:

- Directives about labeling (declarations on EE characteristics) for numerous appliances,
- EE standards for construction,
- Minimum EE standards for a limited number of appliances (mainly hot-water boilers),
- Implementation of the environmental management system and ISO-14000 standards,
- Requirement for each Member State to conduct active policy on EE and RE promotion. Design and implementation are the responsibility of each Member State.

Quantitative objectives have been fixed for each Member State regarding the following:

- Kyoto Protocol (carbon and other greenhouse gases effect);
- A minimum RE share in the energy balance.

However, Montenegro has accepted in addition to other conditions, the next commitment from the Athens Memorandum of Understanding:

> 2.1 REGIONAL MARKET ASPECTS
>
> 2.1 Electricity and Natural Gas market action plan
>
> The participants would endeavor to establish a compatible state and regional level for the electricity and natural gas market action plans, to be coordinated by the Permanent High Level Group, for:
>
> - comprehensive tariff reform,
> - the reduction of non -technical losses,
> - coordinated anti-corruption measures and an anti-corruption monitoring mechanism,
> - the increase in EE necessary to abate demand, and
> - the facilitation of sensible energy substitution, while maintaining a free market framework.

The Government should formulate objectives and targets through an Energy Strategy. The measures to be implemented for achieving the objectives would then be elaborated in the EE Strategy, including the role and obligations of other stakeholders.

Absence of the Energy Strategy is a barrier to EE and RE objectives formulation, and to appropriate measures.

## 11.2 Energy Law of Montenegro

The Energy Law adopted in June 2003 establishes the responsibility of the Government for promoting EE and RE in Montenegro. It defines the status and the role of the ERA.

Article 23 defines that the competent Ministry should supervise through its inspection department if technical regulations and quality standards for products and services relevant for the rational and economic use of electricity, heat and other energy types are applied.

According to Article 32, the Government is obliged to provide information on RE sources to potential investors. The same Article also defines the obligations for ERA to define simplified procedures for small power plants, including RE and cogeneration. However, the tariff level is not yet fixed. Tariffs should be calculated in order to attract investors for achieving the objectives of the Government.

### 11.3 New EE legislation

In order to provide long term EE integration in the Montenegrin policy and economy, there is a need for defining the specific EE legislation, which could be implemented by either including specific paragraphs in the Energy Law, or adopting a separate EE Law, with the following issues:

- More precise definitions for what are the EE and RE objectives,
- Establishing the EE Strategy as a part of the Energy Policy, which defines obligations to the relevant Ministries,
- Defining the MEEU role,
- Defining the budget sources and ensuring the permanent MEEU funding,
- Establishing the MEEU with the appropriate status, and connections with relevant Ministries (its establishment as an independent agency in the future is recommended),
- Defining the MEEU authorities:
    - to monitor policies and legislation, as well as to check whether the EE and RE have been considered,
    - to propose models and to lobby the competent governmental authorities to promote EE and RE,
    - to request information on consumption, data, etc.,
    - to represent Montenegro at the international meetings related to EE and RE,
    - to participate in the international projects, to coordinate regional cooperation,
    - to conduct activities contracted with the Ministries and international donors.

In the future and after conducting the appropriate researches, other issues could be introduced within the EE legislation, such as:

- obligation for energy suppliers to provide EE solutions to final users,
- EE-related obligations for final users,
- EE Fund establishment including incentives or low interest rates, procedures, etc.,
- EE label introduction for all appliances listed according to market analysis , data on how to measure and verify the label information, and coordination with relevant authorities,
- EE introduction in the Construction Law
- introduction of the EE certificates for existing buildings.

EE should also be included in other laws and regulations or through the Construction Law, Spatial Plans, codes and standards on environmental regulations. The MEEU would monitor if EE and RE is properly addressed in the legislation, regulations and standards. The MEEU would lobby the competent authorities for introducing new measures or improving existing ones.

**ANNEX A**

## Definitions and preconditions for Rationalization, Savings and Energy Substitution

### a) Rationalization

Generally, rationalization represents planned, long-term and systematic operations targeting the initiation of structural changes in all spheres of energy generation, distribution and use for the better exploitation of the resources and the lower specific energy consumption. It is mostly followed by other objectives, such as: improved quality of the technology processes and products, increased comfort use, lower harmful influence on the environment, higher reliability, etc.

Rationalization assumes the need for a combination of the following preconditions:

- Higher awareness on resources, technologies, organization and various types of energy use, which could be achieved by research or by the implementation of the modern world's accomplishments;
- Create economic preconditions followed by pricing policies on energy, goods and service, which would provide economic interest for rational energy consumption;
- Create economy-systematic preconditions for the introduction and selection of technological processes using less energy and possibly adapted to the domestic energy resources;
- Create a legal framework for governmental and authorized institutions' activities, targeting all spheres of energy generation and rational consumption;
- Research and implementation of energy macro projects supported by the Government, aiming at infrastructure construction and development facilitating complete, more rational and more efficient energy consumption (heating systems, gas systems, small HE plants, introduction and supply of the alternative energy resources and technologies, etc.);
- Introduction and support of the necessary research, development, controlling, expertise and similar institutions and organizations capable of individual operations or in cooperation with the acknowledged international institutions and organizations for monitoring, research, projecting, control, conducting, exploring and testing in all fields of energy;
- Encourage producers and buyers of materials, products and services adjusted to the necessary EE increase (solar collectors, ceramic fibers, thermal-insulation materials, energy rational carpentry, energy rational devices, energy rational buildings etc.);
- Introduction of energy control and tax and custom subventions for the products, services, research, buildings, urban plans/designs, etc., with improved energy characteristics in comparison to "classic" solutions, considering their actual contribution in energy consumption decrease.

### b) Saving

Saving is the prevention of unnecessary and worthless energy "waste" under the existing technical-technological capabilities for its generation, distribution and consumption. Energy savings mostly depend on the awareness level of the various participants about the saving possibilities during operations and energy consumption; depending on the benefits as well as on how motivated they are to accomplish those results. Accordingly, stimulation could be based on the economic benefits, but also on other measures – such as control and compulsion in the case of excessive wasting – should not be neglected. One of the most significant saving measures is the efficient utilization of the devices, installations and complete energy production systems according to their technical characteristics, which brings the issue of optimal capacity utilization and creating the preconditions necessary for optimal use. In any case, energy saving should not be conceived as a deprivation and shouldn't be viewed negatively. Energy should be economically treated as very significant limited resource, which satisfies certain living conditions.

Conditions for effective savings are as following:

- Education,
- Economic incentives,
- Control,
- Enforcement.

### c) Substitution

Rationalization of consumption through substitution of various types of energy forms by other energy types, which contribute to more rational consumption than the previous, or from the imported to the domestic types. Mostly, it is the replacement of conventional energy resources by renewable energy, or the replacement of imported by domestic resources, etc.

Conditions for substitution are the same as for the other rationalization types.

**Table B.1** – Overview of the energy consumption by energy types in Montenegro * for the period 1981-2004 (natural units)

| Energy type | | Measur. units | Year | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Coal | TPP | x1000 t | 0 | 111.6 | 921.1 | 1234 | 1290 | 1129.5 | 1335 | 1111 | 1173 | 1185 | 1205.9 | 996 | 930 | 739.02 | 36.1 | 1053.6 | 970.3 | 1302.0 | 1258.0 | 1381.4 | 1000.8 | 1598.4 | 1479.9 | 1394.0 |
| | Other | x1000 t | 449 | 420.66 | 373.8 | 495 | 390 | 316.5 | 231.4 | 215 | 186.7 | 120.68 | 120.93 | 107.51 | 115.95 | 120.91 | 135.59 | 140.58 | 148.2 | 167.2 | 172.1 | 119.1 | 109.3 | 124 | 111 | 95.9 |
| Heavy fuel oil | | x1000 t | 159.56 | 149 | 174 | 187 | 190 | 172.38 | 168.73 | 170 | 163.4 | 168.1 | 198.24 | 150.04 | 26.59 | 23.744 | 57.374 | 97.863 | 98.8 | 92.3 | 97.5 | 106.8 | 114.8 | 110.4 | 109.6 | 119 |
| Heating oil | | x1000 t | 22.884 | 23 | 22 | 24 | 25 | 22.815 | 23.864 | 22.4 | 23.4 | 20.298 | 20.697 | 18.146 | 11.619 | 9.33 | 9.383 | 9 | 8.6 | 9.4 | 10.2 | 11.1 | 13.1 | 12.9 | 17 | 19 |
| Motor fuels | | x1000 t | 146.17 | 150.7 | 141 | 171 | 168 | 142.06 | 136.92 | 137.3 | 130.4 | 142.42 | 151.99 | 112.93 | 62.514 | 44.152 | 54.255 | 91.345 | 113.3 | 154.3 | 181 | 186 | 157.8 | 131.4 | 137.4 | 153.7 |
| Liquid gas | | x1000 t | 6.892 | 7.267 | 6.548 | 7.575 | 8.548 | 8.801 | 9.776 | 10.485 | 11.337 | 10.664 | 9.02 | 5.13 | 1.939 | 1.804 | 1.839 | 2.718 | 2.8 | 3.4 | 1.7 | 1.3 | 1.7 | 2.5 | 3.1 | 4.8 |
| Electricity | | GWh | 2636.2 | 2721 | 2783.4 | 3160.3 | 3296 | 3384.3 | 3648.8 | 3574.3 | 3558.8 | 3517 | 3548.2 | 3321.7 | 2494.6 | 2212.9 | 2513.5 | 3227.9 | 3661.6 | 3661.3 | 3642.1 | 3949.1 | 4189.1 | 4362.4 | 4523.7 | 4631.8 |
| Fire-woods | | x1000m$^3$ | 319 | 290 | 319 | 352 | 256 | 223 | 253 | 257 | 264 | 192 | 164 | 178 | 196.5 | 135.9 | 155.3 | 146.7 | 172.0 | 130.0 | 131.0 | 126.0 | 137.0 | 159.0 | 220.0 | 230.0 |

**Table B.2** - Overview of the energy consumption by energy types in Montenegro * for the period 1981-2004 (equivalent units)

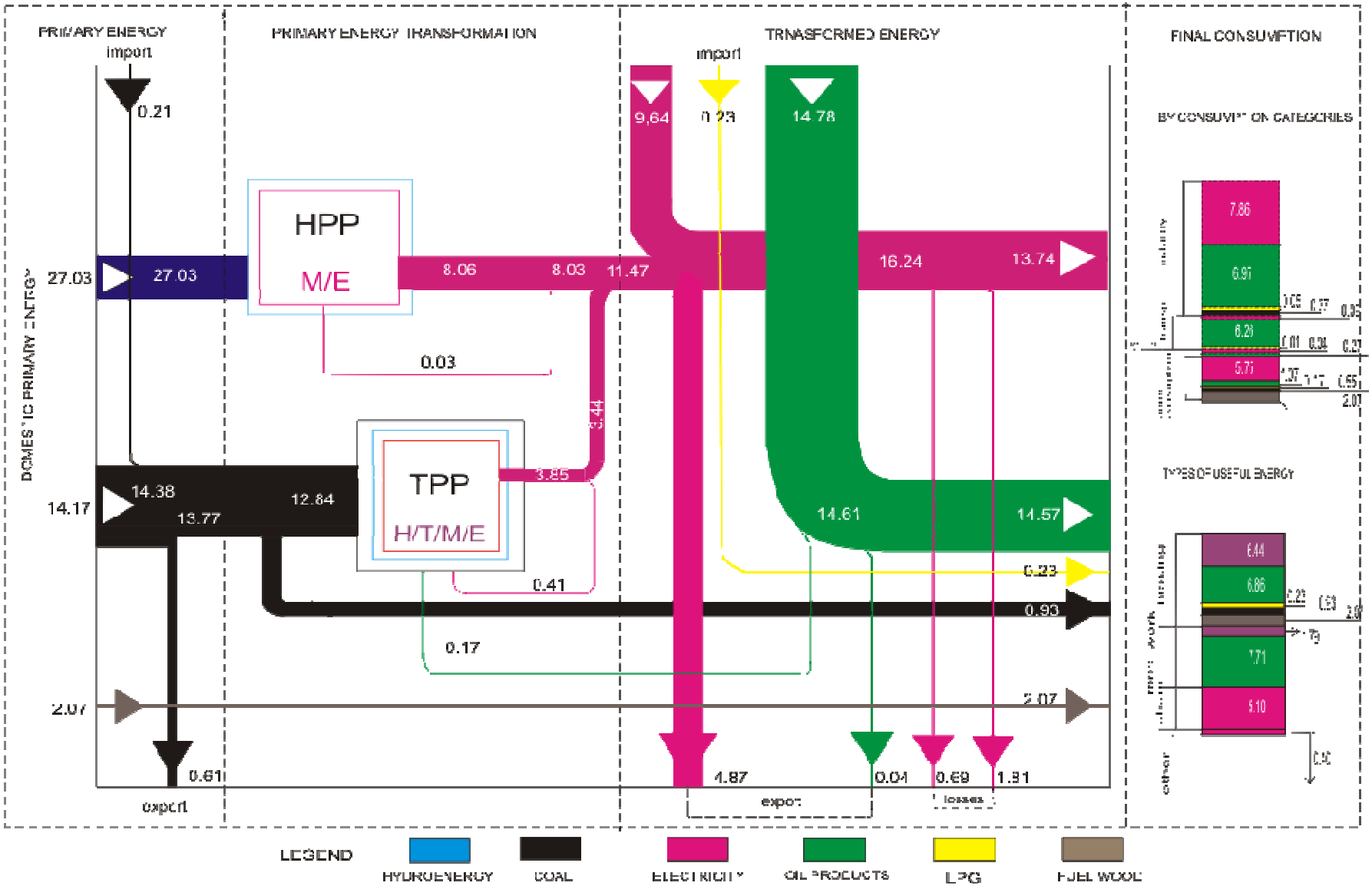
| Energy type | | Measur. units | Year | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Coal | TPP | TJ | 0 | 1165 | 9616 | 12883 | 13468 | 11792 | 13937 | 11599 | 12246 | 12371 | 12590 | 10398 | 9709 | 7715 | 377 | 11000 | 8936 | 11991 | 11586 | 12723 | 9217 | 14721 | 13630 | 12838.7 |
| | Other | TJ | 4688 | 4392 | 3902 | 5168 | 4072 | 3304 | 2416 | 2245 | 1949 | 1260 | 1263 | 1122 | 1210 | 1262 | 1416 | 1468 | 1365 | 1540 | 1585 | 1097 | 1007 | 1142 | 1022 | 883.2 |
| Heavy fuel oil | | TJ | 6403 | 5979 | 6982 | 7504 | 7624 | 6917 | 6771 | 6822 | 6557 | 6746 | 7955 | 6021 | 1067 | 953 | 2302 | 3927 | 3971 | 3710 | 3919 | 4292 | 4614 | 4437 | 4405 | 4782.6 |
| Heating oil | | TJ | 918 | 923 | 883 | 963 | 1003 | 916 | 958 | 899 | 939 | 815 | 831 | 728 | 466 | 374 | 377 | 361 | 367 | 401 | 436 | 474 | 560 | 551 | 726 | 811.5 |
| Motor fuels | | TJ | 6234 | 6427 | 6014 | 7293 | 7165 | 6059 | 5840 | 5856 | 5562 | 6074 | 6483 | 4816 | 2666 | 1883 | 2314 | 3896 | 4929 | 6712 | 7874 | 8091 | 6864 | 5716 | 5977 | 6686.0 |
| Liquid gas | | TJ | 263 | 277 | 250 | 289 | 326 | 336 | 373 | 400 | 433 | 407 | 344 | 196 | 74 | 69 | 70 | 104 | 131 | 159 | 80 | 61 | 80 | 117 | 145 | 225.1 |
| Electricity | | TJ | 9490 | 9796 | 10020 | 11377 | 11866 | 12183 | 13136 | 12867 | 12812 | 12661 | 12774 | 11958 | 8981 | 7966 | 9049 | 11620 | 13182 | 13181 | 13112 | 14217 | 15081 | 15705 | 16285 | 16674.5 |
| Fire-woods | | TJ | 3040 | 2764 | 3040 | 3355 | 2440 | 2125 | 2411 | 2449 | 2516 | 1830 | 1563 | 1696 | 1873 | 1295 | 1480 | 1398 | 1548 | 1170 | 1179 | 1134 | 1233 | 1431 | 1980 | 2070 |
| Total | | TJ | 31036 | 30558 | 31091 | 35949 | 34496 | 31840 | 31905 | 31538 | 30768 | 29793 | 31213 | 26537 | 16337 | 13802 | 17008 | 22774 | 25493 | 26873 | 28183 | 29366 | 29438 | 29099 | 30541 | 32132.8 |

**Table B.3** – Energy consumption by the consumption sectors in Montenegro (TJ) for the period 1981-2004

| Consumption sector | | Year | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
| Industry | Metallurgy | 9662.7 | 9814.6 | 11580.7 | 12474.2 | 13330.3 | 13359.9 | 12695.9 | 13061.3 | 13141.6 | 12851.5 | 11605.7 | 10405.2 | 3802.0 | 2575.0 | 4514.2 | 7277.6 | 11950.3 | 11614.0 | 11620.3 | 13074.0 | 14017.5 | 15352.0 | 16011.4 | 16346.1 |
| | Other ind. consum. | 5906.9 | 5306.0 | 5201.3 | 6166.5 | 5108.6 | 4413.7 | 3725.8 | 3877.7 | 3664.0 | 2718.0 | 2213.2 | 2014.5 | 1291.0 | 1238.9 | 1581.1 | 1620.9 | 2539.1 | 2443.1 | 2443.8 | 1734.5 | 1929.7 | 1589.1 | 1436.7 | 1550.3 |
| | Total | 15569.6 | 15120.6 | 16782.0 | 18640.7 | 18438.9 | 17773.6 | 16421.7 | 16939.0 | 16805.6 | 15569.5 | 13818.9 | 12419.7 | 5093.0 | 3813.9 | 6095.3 | 8898.5 | 14788.8 | 14458.1 | 14392.3 | 15225.7 | 16244.3 | 17358.6 | 17870.1 | 18193.5 |
| Energy sector | | 270.4 | 257.3 | 752.2 | 711.3 | 773.6 | 789.5 | 676.2 | 678.4 | 735.2 | 651.2 | 721.3 | 580.7 | 447.2 | 425.7 | 130.0 | 559.2 | 476.4 | 621.6 | 715.6 | 757.9 | 523.7 | 793.8 | 791.9 | 671.9 |
| Transportation | | 5943.7 | 6102.3 | 5631.3 | 7069.2 | 6826.7 | 5726.1 | 5564.9 | 5656.1 | 5314.2 | 5872.5 | 6421.6 | 4705.1 | 2512.4 | 1760.5 | 2259.9 | 3880.0 | 4314.1 | 6178.8 | 7196.4 | 7737.8 | 6863.4 | 5574.8 | 5725.4 | 6359.6 |
| Agriculture | | 103.4 | 142.9 | 336.6 | 141.9 | 122.8 | 95.7 | 144.4 | 155.8 | 155.0 | 147.9 | 155.6 | 107.4 | 71.0 | 76.3 | 98.6 | 87.9 | 382.3 | 373.0 | 347.0 | 350.0 | 313.3 | 324.5 | 296.0 | 304.3 |
| Resident, tourism and other sec. | | 8422.6 | 8137.0 | 6714.7 | 8394.7 | 7395.9 | 6402.7 | 7966.7 | 6925.5 | 6686.1 | 6437.7 | 8859.9 | 7504.0 | 6959.9 | 6312.2 | 6975.4 | 7643.5 | 7658.3 | 7335.4 | 7295.5 | 7696.1 | 8178.8 | 8449.1 | 9308.5 | 9305.9 |
| Distribution losses | | 729.5 | 797.3 | 877.3 | 987.1 | 937.1 | 1053.0 | 1135.4 | 1072.1 | 1074.2 | 1113.5 | 1240.2 | 1222.9 | 1253.5 | 1414.8 | 1447.6 | 1705.3 | 1661.4 | 1805.8 | 2035.1 | 1695.6 | 1805.8 | 1834.6 | 2226.2 | 2500.2 |
| Total | | 31039.2 | 30557.4 | 31094.1 | 35944.9 | 34495.0 | 31840.6 | 31909.3 | 31426.9 | 30770.3 | 29792.3 | 31217.5 | 26539.8 | 16337.0 | 13803.4 | 17006.8 | 22774.4 | 29281.3 | 30772.6 | 31981.8 | 33463.1 | 33929.3 | 34335.4 | 36218.2 | 37335.4 |

"-Petrol coke

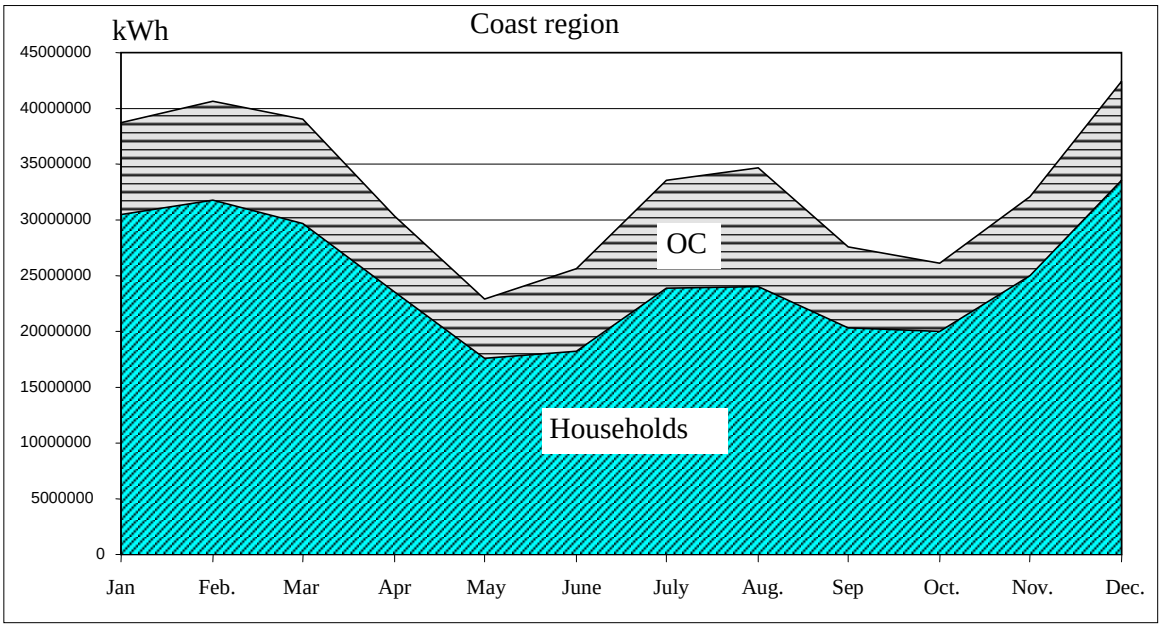
## ANNEX B



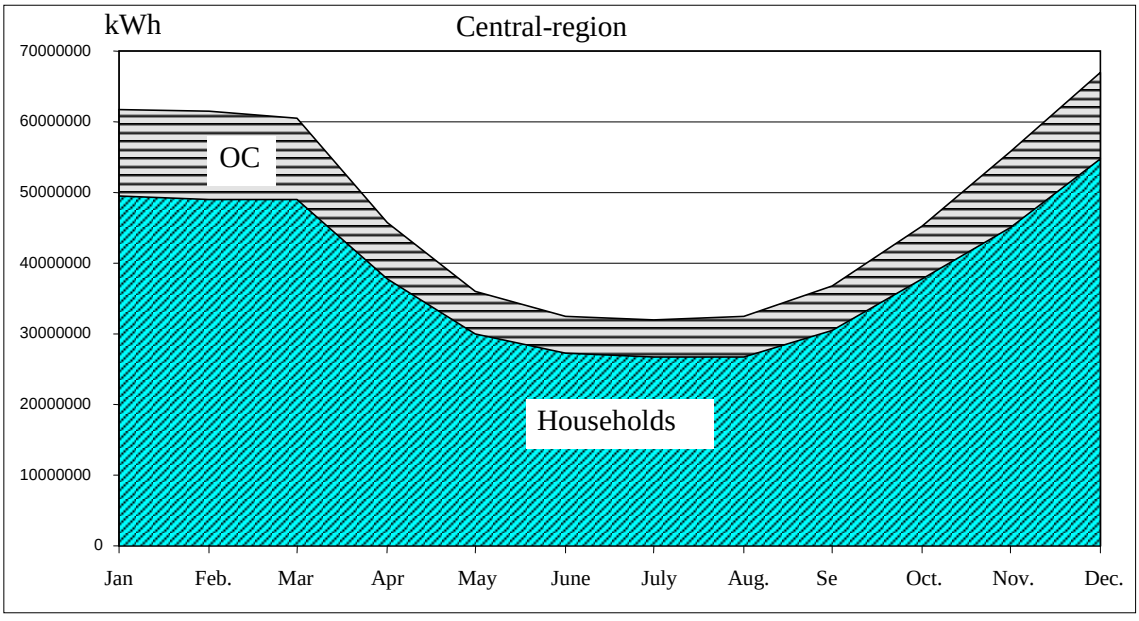

**Picture B2** Energy balance of Montenegro in 2004 (TJ)

**ANNEX C**

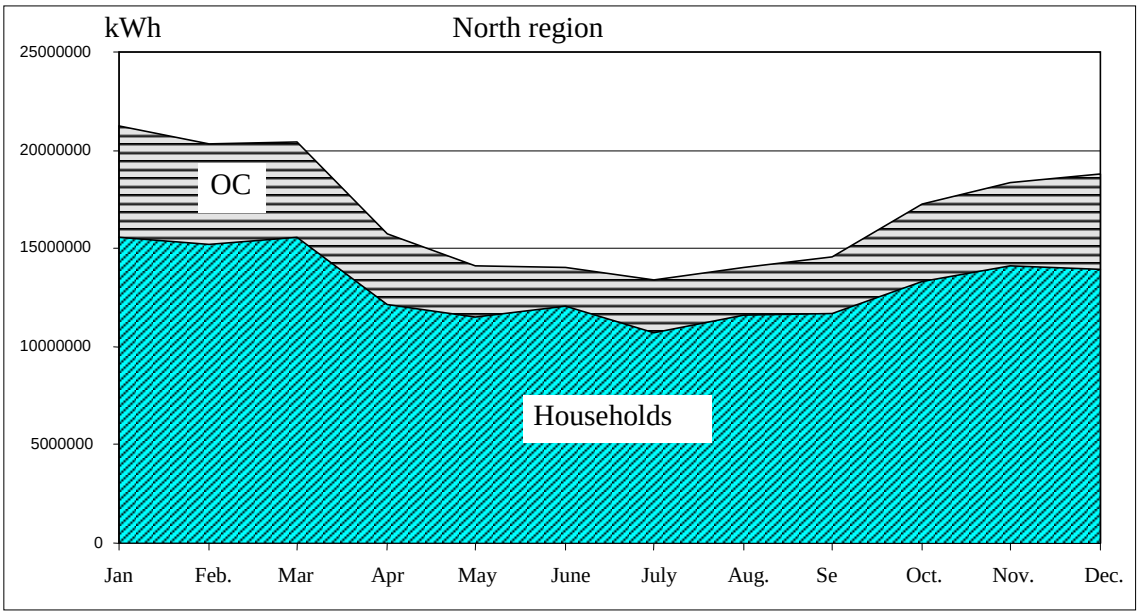
**Electricity consumption for households and "other consumption" sector - by regions**



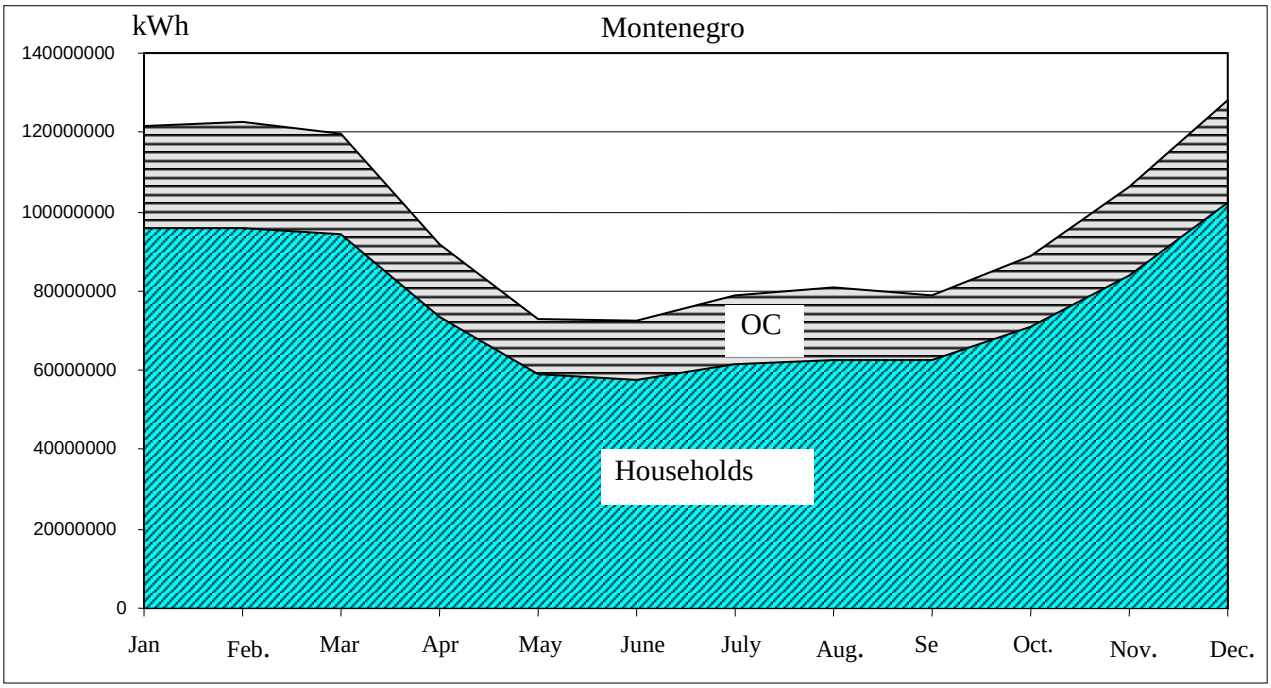

**Picture C1**. Electricity consumption for households and "other consumption" sector in 1996 (South region)




**Picture C2.** Electricity consumption for households and "other consumption" sector in 1996 (Central region)




**Picture C3**. Electricity consumption for households and "other consumption" sector in 1996 (North region)




**Picture C4.** Electricity consumption for households and "other consumption" sector in Montenegro, year 1996

**ANNEX D**

## The basic energy indicators

### Reliable energy supply

1. Energy consumption (energy intensity).
2. Coal generation.
3. Production capacities for energy generation, with an average load factor and maximum load.
4. Trade and consumption.
5. Variety of primary fuel supplies.
6. Percentage of the electricity produced by using different fuels.
7. Percentage and variety of fuels used for electricity generation.
8. Electricity generation from renewable resources.
9. Variety of the oil import.

### Energy in the industry: investments and productivity

1. Energy companies' share in the GDP and total number of employees in the energy companies.
2. Fuel imports and export value as a percentage of the total import and export.
3. Investments in energy companies.
4. R&D in energy companies.
5. Productivity changes in energy companies.
6. Percentage of the gross value added as energy costs.
7. Electricity companies' share in the GDP.
8. Investments of the electricity companies.
9. Productivity changes in electricity companies.
10. Coal sector's share in the GDP.
11. Productivity changes in the coal sector.

### Comparison to foreign companies regarding energy generation and use

1. Primary energy generation and consumption ratio.
2. Variety in primary energy supplies.
3. Dependence on fossil fuels.
4. Final and primary energy consumption ratio.
5. Energy consumption in households, per person.

**Fuel price**

1. Index on fuel price for industrial sector.
2. Index on fuel price for residential sector.
3. Electricity price for industrial consumers.
4. Electricity price for residential consumers.
5. Gasoline and diesel prices.
6. Share of the taxes and customs in the selling price for diesel fuel.
7. Share of the taxes and customs in the selling price for motor oil.

**Service standards**

1. Number of guaranteed standard payments at 100,000 tariff electricity consumers.
2. Reliability and availability of the electricity supply for the average consumer.
3. Compliance numbers for the electricity supply received by the Regulator.

**Social aspects**

1. Number of households facing unaffordable bills.
2. Share of the fuel expense in total expenses for certain income level groups.
3. Fuel expenses as a percentage of total income for the lowest income group.
4. Weekly household expenses for fuel, food and accommodation as a percentage of its total expenses.
5. Energy efficiency for the groups of consumers facing unaffordable bills.

**Environment**

1. Fuel use for the electricity generation and electricity consumption of the final user's ratio.
2. Carbon dioxide emission.
3. Carbon dioxide emission by the GDP unit.
4. An average new $CO_2$ emission.

**Energy consumption indicators**

1. Energy intensity.
2. Final energy consumption by sectors.
3. Energy consumption in industry and its effects.

4. Energy intensity in the iron and steel industry.
5. Energy intensity in the chemical industry.
6. Energy intensity in the food, beverage and tobacco industries.
7. Energy intensity in the non-ferrous industry.
8. Energy consumption in the transportation sector, by transportation mode.
9. Energy intensity in passenger and goods transportation.
10. Energy consumption in road transportation per km.
11. An average CO2 emission by new cars.
12. Car use per capita.
13. Electricity consumption in households.
14. Final energy consumption in households.
15. Central heating ownership, by type.
16. Thermal efficiency in residential buildings.
17. Specific energy consumption in households.
18. Installed insulation and roof size.
19. Energy consumption by household appliance types.
20. Percentage of households using air conditioners.
21. Percentage of households using devices / laundry and drying machines.
22. Energy efficiency of new cooling devices.
23. Energy consumption and effects in servicing sector.
24. Final energy consumption and value added in public administration.
25. Final energy consumption and value added in commercial and other services.

**ANNEX E**

**EU directives and resolutions on energy efficiency**

| | | |
|---|---|---|
| **1.** | Directive **2004/8/EC** | **cogeneration** (amending Directive 92/42/EEC) |
| 2. | Directive 2002/91/EC | energy performance of buildings |
| 3. | Directive 2000/84/EC | summer-time |
| 4. | Council Resolution 1998 | EE |
| 5. | Council Resolution 1997 | combined heat |
| 6. | Directive 96/57/EC | household appliance |
| 7. | Directive 93/76/EEC | carbon dioxide emissions (SAVE) |
| 8. | Resolution of the Consultative Committee of the European Coal and Steel Community concerning the Commission communication to the Council on a Community strategy to limit carbon dioxide emissions and to improve energy efficiency (CO2/energy tax) | |
| 9. | Resolution of 15 September 1986 | industrial firms |
| 10. | Resolution of 15 March 1985 | building sector |
| **11.** | Resolution of 15 January 1985 | energy-saving programs |
| **12.** | 82/604/EEC | encouragement of investment |
| 13. | Resolution of 9 June 1980 | **new lines of action** |
| **14.** | 79/639/EEC: Decision | detailed rules for the implementation of Council 77/706/EEC |
| **15.** | 79/167/ECSC, EEC, Euratom: | energy requirements for buildings |
| 16. | Directive 78/170/EEC | performance of heat generators |
| **17.** | 77/713/EEC: | industrial undertakings |
| **18.** | 76/495/EEC: | urban passenger transport |
| 19. | 76/492/EEC: | promoting the thermal insulation of buildings |
| **20.** | Resolution of 9 December 1975 | **short- term target 1976/77** |
| **21.** | Resolution of 13 February 1975 policy | **measures** - to be implemented to Community energy - Council on 17 December 1974 |
| 22. | Resolution of 17 December 1974 | **action program** |
| 23. | Resolution 17 Dec 1974 | energy policy objectives for 1985 |

24. Resolution 17 Sep 1974 new energy policy strategy

Europa EUR-Lex

**12.10.20 - Rational utilization and conservation of energy**

**32004L0008**
Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC (more info) (Skip this document [32004L0008])
*Document formats available:* HTML PDF
*Publication references:* OJ L 052 21.02.2004 p.50

**32002L0091**
Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings (more info) (Skip this document [32002L0091])
*Document formats available:* HTML PDF
*Publication references:* OJ L 001 04.01.2003 p.65

**32000L0084**
Directive 2000/84/EC of the European Parliament and of the Council of 19 January 2001 on summer-time arrangements (more info) (Skip this document [32000L0084])
*Document formats available:* HTML PDF
*Publication references:* OJ L 031 02.02.2001 p.21

**31998Y1217(01)**
Council Resolution of 7 December 1998 on energy efficiency in the European Community (more info)
(Skip this document [31998Y1217(01)])
*Document formats available:* HTML PDF
*Publication references:* OJ C 394 17.12.1998 p.1

**31998Y0108(01)**
Council Resolution of 18 December 1997 on a Community strategy to promote combined heat and power (more info) (Skip this document [31998Y0108(01)])
*Document formats available:* HTML PDF
*Publication references:* OJ C 004 08.01.1998 p.1

**31996L0057**
Directive 96/57/EC of the European Parliament and of the Council of 3 September 1996 on energy efficiency requirements for household electric refrigerators, freezers and combinations thereof (more info)
(Skip this document [31996L0057])
*Document formats available:* HTML
*Publication references:* OJ L 236 18.09.1996 p.36

**21994A0103(54)**
Agreement on the European Economic Area - Annex IV - Energy - List provided for in Article 24 (more info) (Skip this document [21994A0103(54)])
*Document formats available:* HTML
*Publication references:* OJ L 001 03.01.1994 p.322

**21994A0103(52)**
Agreement on the European Economic Area - Annex II - Technical Regulations, standards, testing and certification - List provided for in Article 23 (more info) (Skip this document [21994A0103(52)])
*Document formats available:* HTML
*Publication references:* OJ L 001 03.01.1994 p.263

**31993L0076**
Council Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE) (more info) (Skip this document [31993L0076])
*Document formats available:* HTML
*Publication references:* OJ L 237 22.09.1993 p.28

**31992Y0519(01)**
Resolution of the Consultative Committee of the European Coal and Steel Community concerning the Commission communication to the Council on a Community strategy to limit carbon dioxide emissions and to improve energy efficiency (CO2/energy tax) (more info) (Skip this document [31992Y0519(01)])
*Document formats available:* HTML
*Publication references:* OJ C 127 19.05.1992 p.2

**31986Y0924(01)**
Council Resolution of 15 September 1986 on improving energy efficiency in industrial firms in the Member States (more info) (Skip this document [31986Y0924(01)])
*Document formats available:* HTML
*Publication references:* OJ C 240 24.09.1986 p.1

**31985Y0326(01)**
Council Resolution of 15 March 1985 on the rational use of energy in the building sector (more info) (Skip this document [31985Y0326(01)])
*Document formats available:* HTML
*Publication references:* OJ C 078 26.03.1985 p.1

**31985Y0122(01)**
Council Resolution of 15 January 1985 on the improvement of energy-saving programs in the Member States (more info) (Skip this document [31985Y0122(01)])
*Document formats available:* HTML
*Publication references:* OJ C 020 22.01.1985 p.1

**31982H0604**
82/604/EEC: Council Recommendation of 28 July 1982 concerning the encouragement of investment in the rational use of energy (more info) (Skip this document [31982H0604])
*Document formats available:* HTML
*Publication references:* OJ L 247 23.08.1982 p.9

**31980Y0618(02)**
Council Resolution of 9 June 1980 concerning new lines of action by the Community in the field of energy conservation (more info) (Skip this document [31980Y0618(02)])
*Document formats available:* HTML
*Publication references:* OJ C 149 18.06.1980 p.3

**31979D0639**
79/639/EEC: Commission Decision of 15 June 1979 laying down detailed rules for the implementation of Council Decision 77/706/EEC (more info) (Skip this document [31979D0639])
*Document formats available:* HTML
*Publication references:* OJ L 183 19.07.1979 p.1

**31979H0167**
79/167/ECSC, EEC, Euratom: Council recommendation of 5 February 1979 on the reduction of energy requirements for buildings in the Community (more info) (Skip this document [31979H0167])
*Document formats available:* HTML
*Publication references:* OJ L 037 13.02.1979 p.25

**31978L0170**
Council Directive 78/170/EEC of 13 February 1978 on the performance of heat generators for space heating and the production of hot water in new or existing non- industrial buildings and on the insulation of heat and domestic hot-water distribution in new non-industrial buildings (more info) (Skip this document [31978L0170])
*Document formats available:* HTML
*Publication references:* OJ L 052 23.02.1978 p.32
*Consolidated text available:* 1978L0170 Disclaimer
*Document associations:*
Incorporated by **21994A0103(52)** (OJ L 001 03.01.1994 p.263
Incorporated by **21994A0103(54)** (OJ L 001 03.01.1994 p.322)
Amended by **31982L0885** (OJ L 378 31.12.1982 p.19)

**31977H0713**
77/713/EEC: Council recommendation of 25 October 1977 on the rational use of energy in industrial undertakings (more info) (Skip this document [31977H0713])
*Document formats available:* HTML
*Publication references:* OJ L 295 18.11.1977 p.3

**31976H0495**
76/495/EEC: Council recommendation of 4 May 1976 on the rational use of energy in urban passenger transports (more info) (Skip this document [31976H0495])
*Document formats available:* HTML
*Publication references:* OJ L 140 28.05.1976 p.16

**31976H0492**
76/492/EEC: Council recommendation of 4 May 1976 on the rational use of energy by promoting the thermal insulation of buildings (more info) (Skip this document [31976H0492])
*Document formats available:* HTML
*Publication references:* OJ L 140 28.05.1976 p.11

**31975Y1217(01)**
Council Resolution of 9 December 1975 setting a short- term target for energy saving 1976/77 (more info)
(Skip this document [31975Y1217(01)])
*Document formats available:* HTML
*Publication references:* OJ C 289 17.12.1975 p.1

**31975Y0709(04)**
Council Resolution of 13 February 1975 concerning measures to be implemented to achieve the Community energy policy objectives adopted by the Council on 17 December 1974 (more info) (Skip this document [31975Y0709(04)])
*Document formats available:* HTML
*Publication references:* OJ C 153 09.07.1975 p.6

**31975Y0709(03)**
Council Resolution of 17 December 1974 on a Community action program on the rational utilization of energy (more info) (Skip this document [31975Y0709(03)])
*Document formats available:* HTML
*Publication references:* OJ C 153 09.07.1975 p.5

**31975Y0709(02)**
Council Resolution of 17 December 1974 concerning Community energy policy objectives for 1985 (more info) (Skip this document [31975Y0709(02)])
*Document formats available:* HTML
*Publication references:* OJ C 153 09.07.1975 p.2

**31975Y0709(01)**
Council Resolution of 17 September 1974 concerning a new energy policy strategy for the Community (more info) (Skip this document [31975Y0709(01)])
*Document formats available:* HTML
*Publication references:* OJ C 153 09.07.1975 p.1

COUNCIL RESOLUTION

December 7th 1998

**On energy efficiency in the European Community**

COUNCIL OF THE EUROPEAN UNION

Considering the following:

1. Internal documents, Energy Policy of the European Union OJ C 224 1.8.1996 p.l.
2. Council Decision on Renewable Energy Sources OJ C 198 24.06.1998. p.l.
   Council Decision on the Strategy of the Community on Promoting Combined Energy Production OJ C 4 8.01.1998 p.l.
3. Council Conclusion from May 11th and 16th and 17th June 1998 on climate changes,
4. Implementation of the Kyoto Protocol for the Framework UN Convention on Climate Changes,
5. Energy Declaration
   - Protocol on energy efficiency and relating environmental aspects and
   - Pan-European Initiative on energy saving,
   - Presidential Conclusion of the Cardiff European Council regarding the integration of the issues related to the environment and sustainable development in all relevant policies,
6. SAVE II Program and discussion on following:
   - Framework program on energy as well as
   - Fifth framework EU program for researches, technology development and demonstration,

1. WELCOMES the trust given and shown in the correspondence of the EU Energy Efficiency Commission, **"Toward the Strategy on rational energy use"**, which is to represent the basis for conducting activities at the Community level accompanied by activities conducted by the Member States.

2. INDICATES contribution of the efficient use of energy for providing:
   - Reliable supply,
   - Economic competitiveness and
   - Environmental protection.

CONFIRMS significant role of the energy efficiency in creating:
   - Business opportunities and
   - Employment, as well as
   - Global and regional benefits.

3. REAFFIRMS three key Energy Policy principles
   - Reliable supply,
   - Competitiveness,
   - Environmental protection.

5. INDICATES Communication results, and estimated economic potential of available energy saving at the complete Community's territory by the end of 2010 at an annual rate of 18%, accompanied by the level of energy consumption as in 1995.

6. UNDERSTANDS that the Communication is aiming to improve final consumption intensity by the end of 2010 at the Community level by adding one percent to total annual average level and after that the final objective is to provide useful instruction for increasing efforts at the Community level in the

Member States, having in mind need for reflecting different situations in each country as they have different energy prices.

9. INDICATES the existence of various barriers preventing potential energy saving implementation, which is the challenge for authorities in charge for creating policies targeting introduction of the framework for initiatives on achieving energy efficiency maximum. States that measures were either already available or could be designed for reduction or removing those barriers, keeping in mind the principle on subsidiary regulations implementation (subsidiary principle).

11. CONFIRMS that the desirable development of further activities of the Community in cooperation with member States, e.g. regarding CCPMs, as stated in the Article (3). Calls upon the Conclusion made on May 11th 1998 (energy) and 16th and 17th of June 1998 (environment) on Energy Efficiency.It is stated that the activities according to the subsidiary principle implementation could include the following:

1. increased use of the combined heat and power production (CHP), including heating or cooling in urban areas, where possible;
2. increased use in the building sector, but also regarding the energy use in the industrial and residential sectors;
3. increased and extended use of labeling, certification and standardization;
4. increased information-sharing on best practice regarding applied technologies and techniques in energy efficiency;
5. increased application of the negotiations and long-term contracting of energy efficiency on voluntary basis;
6. review of the existing regulations and preparation of new legal instruments, including introduction of the minimal energy efficiency standard as an obligation if other measures are unacceptable;
7. implementation of instruments such as cooperative technology supply according the Competition Law, taking into consideration energy efficiency in the public sector, as well as an energy audit if possible;
8. wider implementation of new financial instruments, including third parties financing and results guarantee.

12. UNDERSTANDS the importance of the knowledge and experiences transfer among the entire Community regarding the energy efficiency, preparation and supporting special measures and regulations, where possible and importance of the continuous development of new and efficient measures and technologies;

13. BELIEVES that it is desirable to incorporate energy efficiency in the Community's policy, where possible, by respecting its main objectives;
UNDERSTANDS that other Community's policy, including regional, research and technology, transportation, industry, foreign affairs and state aid, could significantly contribute to the promotion of energy efficiency.

14. UNDERSTANDS the concern in the working documentation of the Commission (Œ), list of potential policy measures that include adequate energy fiscal measures, economic incentives and similar economic measures targeting emission reduction;

15. UNDERSTANDS that potential changes regarding energy efficiency during a review of the Community's instructions on state aid should not have undesirable effects on competition.

16. INVITES the Commission to propose a priority action plan on energy efficiency as soon as possible, starting with the above points, especially those included as an examples in point (11). An action plan should also consider the contribution that the other Community's policies might provide in the promotion of energy efficiency. It could indicate to the Community and the Member States their responsibilities and especially indicate financing and dynamics.

**ANNEX F**

## List of documents referenced in this report: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2. Draft Initial Report on EE Strategy, IPA team, June, 2004.
3. Establishment of the Montenegrin Energy Efficiency Unit, final version IPA, June 2003.
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11. Energy Prices & Taxes, IEA statistics, second quarter, 2004.
12. Statistic Yearbook 2003, Monstat, Podgorica 2003.
13. Statistic Yearbook 2004, Monstat, Podgorica 2004.
14. Montenegro Economic Trends (MONET), ISSP, July 2004
15. Stuck in the Past – Energy, Environment and Poverty –Serbia and Montenegro, UNDP, 2004.
16. M&E Plan of Distribution Pilot Project, Final Report, WB consultants, 2003.
17. Energy Information Administration / International Energy Outlook 2003.
18. Other official documentation given by MoE, EPCG and others.
19. Book A Expert basis for the Strategy on the Energy Development of Montenegro by 2025 – Realized Energy Balances (working material)