

COUNTRY REPORT MOLDOVA



ENERGY SECTOR IN THE REPUBLIC OF MOLDOVA

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2014



This Country Report has been developed and The Review has been developed and funded within the FP7 project ENER2I - "ENERgy Research to Innovation: Reinforcing cooperation with ENP countries on bridging the gap between energy research and energy innovation" supported by the European Commission under the grant agreement № 609532.

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ABBREVIATIONS

CIS = Commonwealth of Independent States

EBRD = European Bank for Reconstruction and Development

EE = Energy Efficiency

GWh = Gigawatt Hour

KTOE = Kilotonne of Oil Equivalent

NEEAP = National Energy Efficiency Action Plan

NGOs = Non-Governmental Organizations

OECD = Organization for Economic Co-operation and Development

PNEE = National program for energy efficiency

PPP = Purchasing Power Parity

RES = renewable energy sources

SMEs = Small and medium enterprises

INTRODUCTION

As part of a wider Ener2i research, the Moldova Country Report will consist of two parts, analysis of local energy sectors, and stakeholder identification. The Report will analyze the local energy sectors of the Republic of Moldova and will describe the current energy and technology resources. The paper will identify the local strengths and weaknesses with regards to the application of energy efficiency and RES in the business and enterprise sector. It will provide an overview of available technologies and technology providers, of social innovations achieved, and address the relevant local policies and energy strategies. Another important focus of analysis will be the national innovation systems, including funding possibilities and innovation support services concerning EE/RES. Linkages between research and business in the energy field will be investigated and existing bottlenecks highlighted. Cooperation opportunities between EU and ENP partners on innovations in EE/RES will be outlined. On the basis of these current snapshots of the local energy innovation systems, potentials and opportunities for EE/RES applications will be outlined and outlooks for future developments in the sector provided. The country report will identify the relevant stakeholders in EE/RES (research institutes, manufacturers, technology providers, start-ups, innovation support providers, incubators, funding agencies, etc.). The identification of stakeholders is a necessary precondition for fostering research-business collaboration.

GEOGRAPHY AND DEMOGRAPHICS

Moldova is located in southeastern Europe, at the junction of Eastern, Central and Southern Europe. The territory is crossed, in the middle by 28° 50' long. E and 47° latitude N.. Moldova is a country located in the Black Sea and in the Danube River Basins. Danube is the second largest river in Europe, but the first by its role in trade between European countries. The potential of this river is not yet exploited by Moldova.

Moldova is bordered by Ukraine and Romania. The border with Romania follows the river Prut and a small area of about 900 meters, on the Danube. At the North, East and Southeast, Moldova borders with Ukraine. The total area of the Republic of Moldova is approximately 33,800 square kilometers.

Total population of the Republic of Moldova on January 1, 2012 was 3.5595 million people. About 2 million people live in rural areas, and a million and a half - in urban areas. The population is divided in the following way: in the capital city Chisinau live 794.800 people, in the northern districts of the country - 1.0026 million people, in the central districts - 1.062 million people and in the southern districts - 538 900 people. These numbers do not include the population living in the Transnistria region which in 2013 consisted of 506 900 inhabitants.

Most of the eastern territory of Moldova is occupied by an integral relief unit, the Moldavian Plateau, which extends from the piedmont of Bukovina and the Moldavian Subcarpathian mountains in the west to the Dniester River in the east. On the left branches of the river Dniester we have the Southwest Podolia Plateau. Within these major units, in addition to the relief of the plateau, there are hills and plains. In the Prut-Dniester interfluvium, Moldova Plateau is between 429 m (Hill Bălănești) and 4 m high in the meadow Dniester (Palanca).

The Republic of Moldova has a moderate continental climate that is characterized by short and mild winters, with little snow and warm summer, with a low amount of precipitation. These conditions also have a negative effect as they are responsible for long dry periods and the changing nature of weather. Basic features of the climate of Moldova are formed under the influence of the influx of solar radiation, atmospheric circulation and the character of the active surface.

Due to its position in the South-East of Europe, atmospheric circulation in Moldova is characterized by the action of specific priority centers of air pressure, specific to south and south-eastern Europe. Air masses that move between the main centers of air pressure over the country arrive over Moldova with modified physical characteristics due to their transformation, determining the sequence of weather conditions in the country. In conclusion, most air masses arriving on the country are largely dry. This explains the frequency of drought in almost all seasons.

Insolation during the course of the year ranges from 1940 to 2180 hours, 60-70% in summer and 20-30% during the winter. Solar energy reserves expressed by the size of the radiation balance, constitutes about 2100 MDj/m² a year. It is the basic energy source which provides the heating of the soil, evaporation, and the average temperature of the air.

Moldova's climate is moderately continental: The summers are warm and long, with temperatures averaging about 20 °C (68 °F), and the winters are relatively mild and dry, with January temperatures averaging -4 °C (25 °F). The annual average air temperature is 8-10°C and 10-12°C on the surface of the soil. The frost-free period averages 170 days in the north and 190 in south, but in some years its duration can reach 200-230 days. Moldova belongs to an area of insufficient humidity. Rainfall decreases from northwest to southeast, from 620 to 490 mm per year. Precipitation are falling primarily during the warm season as rain showers and only about 10% of yearly precipitations are in the form of snow.

Wind regime is characterized by the winds coming from northwest and southeast, in terms of frequency (12 to 35% and 15 to 25% respectively). Average wind speed varies from 2.5 to 4.5 m/s.

CHAPTER 1: CURRENT ENERGY SITUATION IN THE REPUBLIC OF MOLDOVA

The Republic of Moldova almost entirely depends on imported fuels; dependence on imports is estimated to be around 96%. This dependence leads to high energy prices and large debts to foreign suppliers. Shortage of internal capacities to generate energy, increasing energy intensity of the economy, and a low level of RES usage (solar, wind, hydropower, and biomass) are other significant challenges for the Moldovan energy sector. In this situation it is necessary for national and local public authorities to undertake concrete actions for increasing energy efficiency and the energy supply through RES, as an essential condition for the sustainable development of the economy. Moldova has indeed great potential to produce energy from its own renewable sources (e.g. biomass), which have not yet been exploited. In recent years, the Moldovan Parliament adopted a series of legislative acts in the energy field, including the Energy Strategy of the Republic of Moldova 2030, the law on the use of renewable energy (2007), and the law on energy efficiency (2010). In 2009, Moldova became a member of the Energy Community, which extends the EU internal energy market to South East Europe and beyond through a legally

binding framework. In the period 2010-2014, the EU allocates €14 million for the production of renewable energy from local biomass (e.g. straw) as part of a EuropeAid project, helping to reduce dependence on imported natural gas.

1.1 Main energy sources and energy suppliers in the Republic of Moldova

The main sources of the energy sector can be observed in the table 1 and are: supply of natural gas, electricity, and thermal energy and oil products.

Resources	2005	2006	2007	2008	2009	2010	2011	2012
Total	2463	2430	2358	22410	22312	2401	2442	2358
Internal Sources	87	92	88	110	124	104	116	123
Liquid fuel	10	7	16	26	38	31	31	29
Solid fuel	70	78	69	77	81	66	78	91
Hydroelectricity	7	7	3	7	5	7	7	3
Import	2185	2157	2115	2104	1973	2071	2150	2041
Liquid fuel	622	603	643	668	659	666	740	675
Natural gas	1205	1201	1110	1057	977	1033	1015	971
Solid fuel	103	105	110	124	84	112	125	113
Electricity	255	248	252	255	253	260	270	282
Stocks of fuel beginning of the year	191	181	155	196	215	226	176	194
Distribution – total	2463	2430	2358	2410	2312	2401	2442	2358
Internal consumption	2278	2271	2160	2191	2071	2209	2237	2145
transformation in other types of	842	817	767	764	716	737	717	704

energy								
production- technological needs of which:	1 436	1 454	1 393	1 427	1 355	1 472	1 520	1 441
industry and construction	1 61	1 63	1 56	1 42	8 5	1 07	1 18	1 25
Agriculture	6 1	5 9	5 2	5 1	4 6	4 8	4 5	4 4
Transport	2 67	2 85	3 25	3 36	2 91	3 58	3 83	3 69
trade and communal facilities	1 20	1 23	1 19	1 20	1 72	1 57	1 57	1 56
sold to population	7 04	6 91	5 98	6 32	6 60	6 89	7 08	6 39
Other	1 23	1 33	1 43	1 46	1 01	1 13	1 09	1 08
Export	3	4	7	5	1 5	1 8	1 4	2 7
Stocks of fuel end-year	1 82	1 55	1 91	2 14	2 26	1 74	1 91	1 86

Table 1. ENERGY BALANCE (thousand tons of oil equivalent)¹

Electricity: The main normative act regulating internal electricity sector today is the Law on electricity adopted in 2009. In Moldova there are 4 big electricity producers, 1 state enterprise for electricity transport and 3 electricity providers. Beside the 3 providers with regulated tariffs, Moldova also has 9 companies with unregulated tariffs. Electricity production in the Republic of Moldova covers about 25% of its consumption, with a decreasing trend. Thus, in 2012, electricity generation decreased by about 9% compared to 2011 and decreased by 14% in the period 2008-2012. We can also observe an increase in the amount of energy imported from Ukraine and purchased from MGRES. In 2012 this indicator was 4.3% higher than in 2011 and about 10.7% higher than in 2008. Generally, the dependence on energy imports is rising.

Indices	2001	2005	2009	2010	2011	2012	2013
Electricity production	1042, 9	999,8	856,8	888,1	854,3	776,1	747, 9

¹ Source: National agency of statistics

Indices	2001	2005	2009	2010	2011	2012	2013
(delivered from the outgoing power lines) total mil.kWh							
Incl: CET-1	115,4	128,9	116,7	82,0	59,8	47,7	53,3
CET-2	812,8	724,7	639,2	665,4	655,9	636,6	594,0
CET – Nord	31,5	55,5	53,5	57,1	57,8	54,5	49,4
NHE Costești	72,2	83,8	54,0	78,3	75,5	33,5	44,6
Other internal producers	11,2	6,9	2,4	5,3	5,3	4,0	6,6
Purchases of electricity - total, million kWh	3194,8	3465,1	3799,6	3915,6	3993,7	4050,3	4071,9
Incl. RED Nord	569,7	588,1	638,6	651	662,9	663,9	662,0
RED Nord-Vest	314,9	287,1	330,6	342,4	344,1	353,0	355,8
RED Union Fenosa	2310,2	2484,3	2749,2	2842,2	2902,5	2949,2	2941,9
Eligible consumers		105,6	81,1	80,0	84,2	84,2	112,2

Table 2: Structure of electricity generation by producers and breakdown of consumption by supplier

The data presented in table 3 indicate a decrease of 28.2 million kWh (3.6%) in the volume of electricity produced in 2013 compared to the previous year, representing the lowest level since 2001 with 747.9 million kWh.

In this context, it is worth mentioning that the amount of electricity generation is far below the level of consumption and domestic production covers only 18.3% of the needs, and its share is declining for several years in a row. While the production has decreased by 3.6%, in the consumption we observe an increase of 2.1%. The situation described here reveals a state of increased vulnerability of the national energy sector, which is worsening over a number of years.

Natural Gas: In Moldova there are 24 gas providers and one gas transporter “Moldovatransgas”. Over half of the imported gas comes from Russia – 61.0%, while the remaining is being imported from Kazakhstan – 24.2%, Romania – 8.5%, Belarus – 2.7% and Ukraine –1.6%.

Moldova is dependent on natural gas imported from abroad. This dependence increases the vulnerability of the economy and increases the price of the purchased natural gas. The volume of gas purchased by Moldova and delivered to the final consumer shows general decreasing trends. The amount of gas purchased in 2012 was 1095.5 million m³, a decline by about 4.93% compared to 2011. However, purchases of gas, in terms of amount paid increased in 2012 compared to 2011 by 12.4%, due to the increase in the average import price of natural gas. Higher prices of natural gas induced a decreased household consumption.

Thermal Energy: The market of thermal energy is covered by three thermoelectric centrals and the main provider is “Termocom”. Production of thermal energy in the Republic of Moldova has a decreasing trend. Thus, according to the energy balance, in 2011 generation of thermal energy decreased by 5.3% compared to 2010 and by 11.5% compared to 2008. This trend is mainly due to massive disconnections by consumers from the district heating network and to the reduction of the thermal load contracted by operators, resulting in a negative effect on the country's energy security.

District heating is provided through centralized systems and during 2013 were provided by 14 operators carrying out activities to provide thermic energy in cities and towns. Service tariffs are regulated by ANRE.

Oil and Liquefied gas: Currently, there are 9 importers of liquefied gas and 18 importers of gasoline and diesel. There are 67 companies operating as distributors of liquefied gas and 81 companies as distributors of gasoline and diesel.

During 2013, there were some 119 oil companies operating in the country. 22 of them was engaged in import and wholesale of gasoline and diesel, and 11 was specializing in import and wholesale of liquefied gas. 88 firms, including including 12 importers were active in the field of retail trade of gasoline and diesel. Petrol and diesel were sold through 610 certified filling stations. Retail sale of liquefied gas was made by 69 firms including nine importers authorized to sell retail LPG. Liquefied gas was delivered through 420 certified filling stations. The largest companies in the oil market are "Lukoil-Moldova" SRL, "Petrom Moldova" and "Romp petrol Moldova".

The volume of all petroleum products imported in 2013 increased was 640 843 tons, showing an increase of 10.9%, compared to the volume imported in 2012. The largest increase in imports was experienced in the fields of diesel (17.6%), liquefied gas (1.4%) and gasoline (0.4%) compared to 2012. In addition to imported fuel, oil products processed from oil extracted in

Moldova were also marketed in the domestic market. The "Arnaut-Oil" company has produced 1 231 tons of diesel, which is 724.4 tons less than in 2012. For the first time, the same company produced gasoline, in a total amount of 159 tons.

1.2 Legislation and institutional framework in energy sector

Energy institutions of the Republic of Moldova have been undergone a substantial restructuring process during the period from 2000 to 2010. In the energy sector, consequently, the Ministry of economy is responsible for:

- Participation in the development and implementation of measures concerning energy security;
- Development of technical requirements;
- Organization and coordination of drafting legislative and normative acts;
- Developing programs on medium and long term and investment projects for the development of the energy sector and its segments, in cooperation with energy companies and other interested parties;
- Developing and monitoring concepts and strategies, and the implementation of the program in the energy sector at national and regional levels;
- Development policy of gas pipelines;
- Defining the general rules concerning the import, export and transit of electric energy, gas, petroleum products and other fuels;
- Coordinating the activities on the field of energy efficiency and renewable energy and supervision of responsible authorities;
- Promoting international cooperation in the energy sector.

In accordance with the obligations for transposition imposed to Moldova as part of receiving full status as a Contracting Party to the energy community, law of 2009 on natural gas has transposed Directive 2003/55/EC concerning common rules for the internal market in natural gas, into the internal legal order of the Republic of Moldova. This law lays down the rules and general conditions of the functioning of the internal market of natural gas, which fully comply with the Directive. It also specifies the responsibilities of public institutions, types of licenses needed to conduct commercial activities and the procedures for issuing, renewal and revocation of licenses. In addition, the law defines the requirements and conditions for the construction and operation of the gas infrastructure and storage facilities.

Moldova has not adopted any specific legislation to govern the exploration and production of crude oil. This is partially due to the fact that the country has negligible deposits of oil and imports virtually all petroleum products consumed domestically. In addition, in the present territory of Moldova there are no exploration activities and no oil pipeline crosses the Republic of Moldova.

In addition, there isn't any specific legislation dealing with processing activities. The primary legislation governing the oil sector (petrol and diesel) is the law of 2001 on oil market, which sets up the basic legal, economic and organizational framework for regulating the importation, transportation, storage and sale of petroleum products.

Of significant importance are the Ministry of agriculture and food industry and the Ministry of environment, playing a supporting role in conducting activities related to energy. Furthermore, a National Energy Council was also established in the form of an auto-financed non-governmental organization for consulting Moldovan Government on energy policies and those related to

energy efficiency. In the field of renewable energies, a Coordination Council was created for the use of renewable energy through a prime ministerial decree.

The National Agency for energy regulation (ANRE), which was established in the year 1997, regulates and supervises primarily the sectors of electricity, oil, natural gas and urban heating. The AGENCY was established as an independent regulatory body, which is responsible for the issue of licenses, for carrying out activities in the field of energy and for monitoring compliance with the licensing conditions.

Another mechanism of regulation of the energy sector is the establishment of the energy efficiency Agency (EEA), founded on the basis of law No. 160 of 12 July 2007 on renewable energy, to replace the National Agency for energy conservation, founded in 1994 with the aim of the promotion of energy efficiency and use of renewable energy in the country. In December 2006, the old agency ceased to operate. However, on July 2, 2010, the Moldovan Parliament adopted the law on energy efficiency in that it stipulates that it has implemented the institutional framework and the organizational energy efficiency.

The legislation of the Republic of Moldova in energy sector is based on the following laws:

Currently the main policy document is the Energy Strategy 2030 approved by Government Decision no. 102 of 05th of February 2013.

The objective of the Strategy is to provide a practical guidance for the development of the energy sector in the Republic of Moldova in order to support economic growth and social welfare. Thus, the Strategy has identified strategic vision and strategic opportunities in the country's rapidly changing energy environment, in the Central, Eastern and Southern regions.

Priority strategy aims are directed to overcoming the country's energy problems that require quick solutions and rescheduling/resizing objectives, with prudent reconciliation between: resources currently available, the EU aims/objectives of the Energy Community and national agreements, international obligations and programs (including also towards neighboring countries), and emergency needs of the country.

The strategy is based on three objectives: energy security; creating competitive markets with regional and European integration; environmental sustainability and combating climate change.

Integration of electricity and gas in Moldova into the EU internal energy market, and of the energy system of the country and the economy in general, is a lengthy process, and people will have to live under current conditions in the transition period. Moldova's energy strategy is targeting 2020 as a year of full integration into the EU internal energy market. In line with this objective, the country's legislation will be harmonized with Energy Community acquis and approximation of laws to the EU acquis will be implemented, thus ensuring compatibility with the legal and regulatory markets.

The period of 2012-2020 will be the first phase in implementing measures for expected results of less expensive energy efficiency and use of renewable energy sources closer to the cost of conventional energy. Despite these measures, this sector will be still vulnerable to gas and electricity, because of the limited number of alternative sources of supply.

Moldova's energy sector development in the decade of 2020-2030 will be based on the successful implementation of measures and actions planned for the previous period of 2012-2020. At the beginning of this new phase, the energy sector will benefit from planned

improvements to achieve the energy mix, reduce consumption and greater efficiency in generation, transmission, distribution and consumption. It will also benefit from stronger connections, more diversified sources of supply, effective competition in the supply of energy, and lower market concentration. Another set of advantages will come from the definition of the mechanisms of a competitive and transparent market price, responsible, honest management, and a high level of professionalism and increased social accessibility. All these achievements will form a sustainable platform to begin a new stage in the development of Moldova, characterized by an energy-efficient control and effective integration into the network of small generating sources. These are the essential characteristics of the concept of smart grid, both based on the introduction of more sophisticated technology, once arrived at the competitive level of implementation costs. By 2020, the most expensive current generation technologies using renewable energy sources will have time to mature and become accessible and new production technologies, energy storage and possibly carbon capture technologies, which are now only in an experimental stage, will gain an economy of scale size.

Other legislation related to energy sector is:

- a. ***On 7th of February 2014, at the initiative of the Ministry of Economy of the Republic of Moldova, the Government approved the draft law on the promotion of renewable energy sources (RES).***

This normative act aims at diversification of primary energy sources; achieve at least a 17% share of energy from renewable sources in gross final consumption of energy by 2020 and achieve at least a 10% share of renewable energy in final energy consumption in the transport sector by 2020.

The main purpose of the law is to encourage and protect investors, to ensure the continued development of technologies, which generate energy from renewable sources, to provide free and non-discriminatory access for manufacturers to the energy grids, access for producers of biogas to the natural gas network, ensuring mandatory purchase of electricity produced from renewable sources, biogas and biofuels.

In the context of Moldova's dependence on imported energy sources up to 95% of the country's energy consumption and an energy intensity of about 3 times higher than in developed countries, capitalizing RES will enhance the energy security of the country. The project also aims to promote technological development and innovation, providing opportunities for employment and regional development, especially in rural areas.

Using renewable resources such as solar, wind, biomass, and other debris and waste to produce electricity, biofuel and biogas provides significant environmental benefits, given the strong potential for achieving greenhouse gas reduction, both in the production of energy and in the their use as biofuel.

The law creates the framework for attracting foreign investments in the production of electricity from renewable sources as well as a mechanism to protect the consumer in order to obtain fair prices for electricity from renewable energy sources.

The elaboration of the draft law on the promotion of renewable energy, is driven by the need to harmonize the legislation of the Republic of Moldova with the principles of the legal system of the European Union.

- b. **Law no. 142 of 2nd of July 2010 on energy efficiency**

This law regulates the activities aimed at reducing the energy intensity of the national economy and the negative impact of the energy sector on the environment.

c. Law Nr. 123 of 23rd of December 2009 on natural gas

The purpose of this Act is to establish a legal framework for the effective functioning of the gas market and gas sector activities, in terms of accessibility, availability, reliability, continuity, competitiveness, transparency, compliance with quality standards, safety and protection of the environment.

d. Law Nr. 124 of 23rd of December 2009 on energy

The purpose of this Act is to establish a legal framework for the efficient operation of the electricity market. Establish measures to ensure security of electricity supply in order to ensure the proper functioning of the electricity market, an adequate level of generation capacity, an appropriate balance between supply and demand, and an appropriate level of interconnection systems with neighboring countries for the development of electric power market.

e. Law No. 117-XVIII of December 23, 2009 for Moldova's accession to the Treaty establishing the Energy Community.

This law refers to Moldova's accession to the Treaty establishing the Energy Community. As a consequence, Moldova enjoys all rights guaranteed to the parties and is subject to all the obligations imposed by the treaty, by all procedural decisions and acts adopted in the context of the treaty after its entry into force.

f. Law Nr. 160 of 12 of July 2007 on renewable energy

The purpose of this law is the legal operation of the renewable energy sector, economic and social relations that constitute the process of exploitation of renewable energy sources, ways of organizing production and bringing renewable fuel and energy sources to the market.

g. Law Nr. 461 of 30th of July 2001 on the petroleum products market

The purpose of this law is to form an organizational, legal and economic framework, in order to ensure the economic security of the country and regulate the import, transport, storage and marketing of petroleum products on the domestic market, considered as strategic products, with a special regime of activities.

h. Law Nr. 1525 of 19th of February 1998 on Energy

The purpose of this law is to create a legal framework to ensure energy efficiency, reliable supply of the national economy and the population with energy resources.

i. Government Decision no. 141 of 24th of February 2014 on the establishment of an energy statistical system

This decision provides for the establishment of an action plan on creating and implementing an efficient energy statistical system in accordance with European Directives. It provides for the introduction of specific indicators of energy efficiency and renewable energy, as well as the production of energy statistics for reporting to stakeholders and international organizations.

j. Government Decision no. 1073 of 27th of December 2013 on the approval of the National Action Plan in the energy sector from RES for the period 2013 – 2020.

The purpose of this Decision is to develop an action plan to promote the use of renewable energy.

Other relevant laws are:

- Government Decision no. 113 of 2nd of July 2013 on the approval of the National Action Plan for Energy Efficiency for 2013-2015;
- Government Decision no. 833 of 10th of November 2011 "National Program on Energy Efficiency 2011-2020";
- Government Decision no. 117 of 10th of February 2009 on approval of the electronic industry development program until 2015.
- Decision of the National Agency for Energy Regulation Nr. 321 of 22nd of January 2009 on approval of the Methodology of determination, approval and application of tariffs for electricity produced from renewable energy and biofuel.
- Government Decision no. 1226 of 19th of September 2002 on the approval of the regulation on organization and execution of the designing works, installing and reception of gas supply systems.

CHAPTER 2: Current situation with energy efficiency and renewable energy sources

The Republic of Moldova almost entirely depends on imported fuels; dependence on imports is estimated to be around 96%. This dependence leads to high energy prices and large debts to foreign suppliers. Shortage of internal capacities to generate energy, increasing energy intensity of the economy, and a low level of RES usage (solar, wind, hydropower, and biomass) are other significant challenges for the Moldovan energy sector. In this situation, it is necessary for national and local public authorities to undertake concrete actions for increasing energy efficiency and the energy supply through RES, as an essential condition for the sustainable development of the economy. Moldova has indeed great potential to produce energy from its own renewable sources (e.g. biomass), which have not yet been exploited. In recent years, the Moldovan Parliament adopted a series of legislative acts in the energy field, including the Energy Strategy of the Republic of Moldova 2020, the law on the use of renewable energy (2007), and the law on energy efficiency (2010). In 2009, Moldova became a member of the Energy Community, which extends the EU internal energy market to South East Europe and beyond through a legally binding framework. In the period 2010-2014, the EU allocates €14 million for the production of renewable energy from local biomass (e.g. straw) as part of a EuropeAid project, helping to reduce dependency on imported natural gas. Dependence on foreign sources of energy led to the increase of energy prices and to large debts to external suppliers. The energy sector is vital for the economic development of the country. The Government of the Republic of Moldova has undertaken many actions to optimize and streamline the energy sector, by creating prerequisites for strengthening energy security, diversification of energy sources and attracting investments in the sector. According to the energy strategy of Moldova for 2020, the amount of energy produced from renewable sources should increase to 20%. Moldova has a large potential for energy production from renewable sources. Studies have shown that the most reliable and affordable are alternative sources of energy such as those obtained from straw and other waste. Each year, our country produces on average over 700 tons of straw. This volume rises to about 250 million cubic meters of natural gas, which is about 25% of the annual consumption in the

Republic of Moldova. This quantity of straw is sufficient to warm the 9 million square meters or 100 thousand houses with an average area of about 80 square meters.

2.1 Electricity production from renewable sources

Tariffs for the electricity produced from renewable sources were approved in 2013 for 3 manufacturers: SRL "Tasotilex" (Decision no. 510 of 02.27.2013), LLC "Elteprod" (Decision no. 511 of 27.02.2013) and SRL "Teva's Group" (Decision no. 519 of 30.05.2013). Rates approved for already existing producers, installed capacity of power plants, the type of sources and volumes of electricity produced from RES in the previous year are shown in table 3.

Name of the company	Type of RES	Capacity, kW	Approved tariff, MDL/k	No. of guarantees of origin issued by the network in	Total electricity produced and delivered to the electrical
G.T. "Morari	Biogaz	85	1,73	11	324 362
SRL "Solotrans Agro"	Energie solara	95	1,92	10	89 894
SRL "Tasotilex"	Energie	10	1,92	10	11 324
SRL "Elteprod"	Energie	1100	1,24	9	979 807
SRL "Tevas Grup"	Biogaz (gaz de depozit)	320	1,73	7	502 481
Total				47	1 907 868

Table 3: Electricity production from renewable sources in 2013

During 2013, a total of 47 guarantees of origin were issued for a total volume of electricity produced from renewable sources of 1.9 GWh. The volume of electricity increased significantly with respect to 2012 when only 0.3 GWh of total volume of electricity from renewable sources was delivered to the electricity grid.

2.1.1 Renewable energy sources (RES) and biofuel

In the field of biofuels and other renewable fuels, efforts have been made in the past by now defunct the Ministry of energy, to adopt specific legislation on the use of biofuels and their use in the transport sector, as well as promoting energy generation from biomass. However, although some projects have been prepared for this purpose, these efforts have not been successful no law of this kind has been approved by the Moldovan Parliament yet.

Currently, main primary legislation that supports the use of biofuels is the 2007 Law on renewable energy, in which is expressly stipulated that one of the main objectives of the State policy in the field of renewable energy is to increase the yearly share of renewable fuels produced and consumed in Moldova. It also puts emphasis on the creation of a system of production, distribution, marketing and rational consumption of such fuel. This law also provides for the confirmation of the origin and authenticity of such fuels by means of a certificate of

compliance to be issued in accordance with the law and for the establishment of a certification system as with regards to equipment and technical devices, which operate on the basis of renewable fuel.

The Republic of Moldova disposes the following forms of Renewable Resources: wind, solar, biomass and hydraulic.

RES used in Moldova in 2007 was 60 thousand toe, 5.5% of the total energy consumption, which increased annually by a rate of 9.8%, in 2010 reaching approximately 10% of the country's total energy consumption, a value in complete agreement with the National Energy Conservation Strategy. Thus, Energy Conservation Programme has the potential to save over 500 thousand toe from RES, structured as follows:

- Wind Energy, 25 thousand toe, 5.0% of RES;
- Solar Energy, 50 thousand toe, 10.0% of RES;
- Biomass Energy, 352 thousand toe, 70.5% of RES;
- Hydro Energy, 73 thousand toe, 14.5% of RES;

2.2.2 Wind Energy: Current Status and Potential

Today, Moldova does not dispose of any modern wind installations, and there is only some small power wind equipment (with capacity from 1 to 2.5 kW), designed and exploited by amateurs. Unextensive studies developed at the beginning of the 1990s concluded that Moldovan geography is not favorable for the use of wind installations. Negative appraisals were based on meteorological data of the Chisinau Weather Station. These studies did not take into account the poor geographic positioning of the Weather Station (obstacles and rugged terrain). In fact, further scientific researches and measurements revealed that Moldova has some favorable zones for wind installations. Thus, measurements taken between years 1990 and 1999 at a weather station located in the south of the country showed that, at 10m above ground, average wind currents are 3-7 m/s. This speed allows efficient operation of modern wind installations. Moreover, wind speed increases with height and would make more efficient the use of wind installations, at a typical construction height of 60-70 m above ground.

In 2001, Technical University started a research project having the goal to prepare a Wind Atlas of the Republic of Moldova. Financed by the Supreme Council for Research and Technological Development and the Technical University, the project was estimated to take 3 years. However, due to the limited number of measurement systems available, the schedule for calculations over 50 m above ground required 2 additional years. Partial available results show that there are favorable zones for wind installations, with wind speeds equal to or exceeding 7 m/s at 50 m and more above ground.

2.2.3 Solar Energy Current Status and Potential

In Moldova, solar energy is used for:

- **Drying medicinal plants and tobacco.** According to the Ministry of Agriculture and Food Processing Industry, approximately 80% of annual tobacco harvest is dried traditionally, using solar heat. Taking tobacco production in 2002, i.e. 14,000 t as reference, the annual quantity of substituted fuel is estimated at 7,400 toe. In addition, approximately 1,500 t/year fruits and medicinal plants are dried using solar energy. In fact, estimated potential for this procedure is ten times higher. Primary energy sources used to dry fruits and medicinal plants are wooden biomass and solar energy (no data on the consumed quantities);

- **Heating water for domestic use.** First Moldovan research on solar energy used to heat water was carried out in the middle of the last century. But low energy prices at that time and lack of policy to promote renewable resources stopped implementation of this kind of equipment. Later, in the ninth decade of the last century, three Moldovan institutions designed and built solar installations to heat water. Fifteen houses, public institutions and companies were equipped with their solar equipment. At present, due to the components' bad quality and lack of maintenance, solar equipments installed between 1982 and 1990 are not functional. Continuing the tradition, two other Moldovan companies have designed solar installations since 1993 to heat water. It has to be noted that in 2006-2007, several solar batteries were installed with the support of the World Bank for heating and hot water supply in certain Moldovan hotel complexes;
- **Producing electricity by photovoltaic installations.** There are a few existing experimental installations to supply water pumps and weather station communication systems. The As electrical supply network is available to all consumers, PV development is limited to certain sectors, like small power irrigation or supply-isolated consumers.

The quantity of solar energy reaching the Earth depends on several factors, among others on the Sun's brightness and current distance from our planet. For the Republic of Moldova, theoretical (maximum) sun brightness period is 4450 h/year. In fact, the real value is 2100-2300 h/year, approximately 50% of the maximum theoretical value. The brightest Moldovan period is from April to September, representing more than 75% of the total annual brightness period. Solar radiation is 3.5% more significant in the central than in northern region, and 2.6% in the southern than in the central region. In order to achieve the Energy Strategy's aim concerning Solar Energy, it is necessary to install through 2010 one million m² of solar installations for water heating and 80 thousand m² of solar installations for drying agricultural products.

The potential of PV Solar Energy utilization was investigated as well. It was estimated that 5850 isolated consumers might be supplied by PV Solar.

2.2.4 Biomass Energy: Current Status and Potential

In the Republic of Moldova biomass – fuel wood, wooden wastes and agricultural residues - is burned mainly for heating and cooking purposes. To be noted that in the Republic of Moldova, the areas covered with forests varied considerably over time but in 2005 we were close to the level of 150 years ago: from 366.2 thousand ha in 1848 to 362.7 thousand ha in 2005 or circa 10.7 percent of the country's territory.

The total volume of standing wood mass in the forests of the Republic of Moldova is circa 45 million m³, on average 124 m³ per hectare. The average forest increment is 3.3 m³/yr/ha, and the total average increment is circa 1085 thousand m³/yr. The structure by age in the case of all forest species are misbalanced, in particular in those of low productivity.

The volume of commercial timber, as well as the quantity of fuel wood gathered in Moldova, were identified based on statistical data and reports on commercial deforestation in managed forest land, provided by the Forestry Agency "Moldsilva", and the State Ecological Inspectorate, on authorized fellings and illegal logging in forests and other woody vegetation areas managed by local public authorities. Data on the volume of fuel wood gathered also include the volume of twigs, boughs, branches, etc., which are also used as fuel.

Within the last 10 years, the Forestry State Agency 'Moldsilva' provides circa 300-400 thousand m³ of fuel wood annually. The price of one m³ of fuel wood, including transport, is approximately US \$15. According to available statistical data, in 2005, a conventional family living in the rural sector used approximately 2.3 m³ of fuel wood. In reality, average family consumption is much more significant, but no coherent data are available because of the lack of detailed studies.

A certain amount of biomass is harvested also from protected forest strips and other types of forest vegetation. Local public authorities manage 95 percent of these resources but this data not statistically confirmed either, as the available national records for this type of vegetation are insufficient. Biomass is harvested from orchards and vineyards too, in particular during the cleaning cuttings, as well as from the trees growing in private rural orchards (the traditionally used average was 10 trees per household).

In order to achieve the Energy Strategy's aim concerning combustion of fuel wood, wooden wastes and agricultural residues as resources, it is necessary to increase the consumption of respective RES to 300 thousand tons.

It has to be mentioned, that early in 1999, Moldova implemented his first experimental installation producing briquettes from agricultural residues, like sunflower and corn stalk and straw. The installation, financed by the Netherlands Government and managed by 'AGROBIOENERGIA' Company, produces 250 kg briquettes per hour, for US \$20-25 per briquettes ton operation cost. In 2012, in Moldova we had more than 40 producers of pellets and briquettes. The branch is evolving and is characterized by sporadic strong motivation of producers to learn production technologies and assess the profitability of the activity. The branch is characterized by a lack of homogeneity in terms of technologies used by manufacturers, geographical distribution, and biomass used in the production process.

Another specific domain is Biogas obtained by fermentation from animal and poultry manure. In the early 2000s, two projects were developed with the assistance of the Netherlands:

In 2000, Dutch NGO Novib and Moldovan NGO Agroeco developed an individual anaerobic fermentation installation with 10 m³ installed capacity, for the Grigoras family farm in Soroca district.

In 2002, within the framework of the Netherlands Programme for cooperation with Central and Eastern Europe, an installation was put into service intended for the fermentation of 700 m³ of waste from a poultry farm. Located in the Vadul-lui-Voda region, the installation produces biogas for a cogeneration engine with an installed capacity of 87 kWe and 116 kWt;

In 2005, with technical assistance from the Netherlands, a project to construct a power plant in Colonita village was launched, which was based on the consumption of biogas obtained from manure coming from a cattle breeding farm (the generator capacity is 100 kW, which is sufficient to cover the farm's in-house needs in electricity).

The potential for biogas production in the Republic of Moldova is estimated at 3700 thousand m³. In order to achieve the Energy Strategy's aim concerning Biogas Resources, it is necessary to increase the fermentation installation capacity to 7100 m³.

In the Republic of Moldova there are five wastewater treatment plants provided with anaerobic treatment tanks and biogas collecting equipment. However, the respective installations, built more than 20 years ago, are not operational because of their degraded status, lack of use,

reparation and maintenance. Limited financial resources and unrewarded competence and legislation in this field, also contribute to the poor condition of respective equipment for biogas production.

2.2.5 Hydro Power Energy: Current Status and Potential

Hydro Power Plants are generally associated with electricity production. Generally, size is the factor that assigns a Hydro Power Plant to the category of Renewable Energy Sources. In somewhat simplified terms, RES includes small power Hydro Power Plants, but this is a rather aleatory classification.

The Republic of Moldova has two small Hydro Power Plants: one at Dubasari (48 MW installed capacity and 30 MW available) and another at Costesti (16 MW installed capacity and 10 MW available). There are 6 micro Hydro Power Plants, built by individuals or economic agencies and placed on already existing accumulation systems of lakes and drainage. Their total installed power is 141 kW. Hydro potential in Moldova is estimated at 3 billion kWh/year, including potential of large rivers (1.9 billion kWh/yr) and small rivers (1.1 billion kWh/yr).

2.2 Energy Efficiency

The 2010 Law concerning energy efficiency partially transposes Directive 2006/32/EC on energy efficiency and services to final consumers. The Law has also created the institutional framework for energy efficiency, introduced the concept of energy audit and imposed energy management obligations on local public authorities. In addition, it provides for the establishment of energy service companies (ESCO) and allows financing third parties (TPF) and contracting energy efficiency projects.

National program for energy efficiency (PNEE) and energy labeling have been addressed as part of the assistance offered by the project "support for the implementation of the agreements between the Republic of Moldova — EU". The programme was elaborated by the Government, with the support of the project of draft proposals on the formulation of PNEE and energy labeling, awaiting adoption.

The national program for energy conservation for the period 2003-2010 stated a low level of energy efficiency in the Republic of Moldova and aimed at reducing energy intensity by 2-3% annually. However, at the practical level, there were no measurements for monitoring its implementation.

This program is expected to be replaced by the above mentioned 2020 PNEE, which proposes the national goal of 20% saving by the year 2020, with an intermediate target of 9% by the year 2016. PNEE 2020 project, to be formally adopted in the very near future, also lists the activities in each sector on the basis of EU directives, suggests a national communication strategy in sensitizing public opinion and identifies the measures, funding sources and institutions responsible for implementation, as well as specific terms to be respected in its action plan.

Despite this large decrease, Moldova's economy still has a high level of primary energy consumption per unit of GDP compared to averages for countries in the OECD. According to IEA, in 2005, the energy intensity of Moldova (energy use compared to GDP at purchasing power parity (PPP)) is 0.45 toe/US\$ 1000 at PPP, nearly three times higher than the EU-27 average.

The residential sector is the greatest energy consumer (40% of total final consumption), followed by industry (21%) and transport (15%). Agriculture, although dominating the economy of the country, has a small share in the final consumption of commercial energies (4%).

The economic and structural reforms implemented in the country resulted in substantial reduction of industrial production, which in turn resulted in reduced energy consumption. However, the energy efficiency of the industrial sector is low. The specific energy consumption of industrial processes is high and energy loss is substantial. Energy audits and implemented energy efficiency projects demonstrate high energy efficiency potential in all sub-sectors of industry. Nonetheless, energy efficiency is still not a matter of great concern in industry. For instance, in 2007 the energy intensity of industrial production was 0.118 t.c.e./thousand MDL, almost twice lower than in 2001.

Energy Losses from Electricity, Gas Transmission and Distribution Grid

During 2008, electricity purchased by distribution enterprises, excluding eligible consumers, shows 1.2% growth (3737.4 million kWh), but electricity supplied to consumers shows 2.7% growth (3106.0 million kWh) over the previous year. Thus, confirming the benefit tendencies of the precedent years, the share of technological consumption and commercial losses at electricity distribution decreased by 1.2%, i.e. from 15.7% in 2007 to 14.5% in 2008.

It is noteworthy that the tendency of decline in the technological consumption and commercial losses of electricity was persistent in 2008, including distribution enterprises. For example, the losses incurred by RED North JSC last year decreased by 0.5%, the losses of RED North-West - by 0.2%, the losses of RED Union Fenosa – by 1.5%, this being the most significant decrease (34.8 million kWh). However, the latter still fails to meet the limits of losses, admitted by ANRE for 2008, exceeding it by 1.38%.

Specific Objectives in the Field of Energy Saving and Increasing Energy Efficiency

The Energy Strategy of the Republic of Moldova until the year 2020 was adopted in 2007. . The Strategy acknowledges energy efficiency as one of the priorities for the national economy and for the energy sector. Energy Efficiency has also been declared as a key objective under the EU-Moldova Action Plan (Objective 66).

Currently the energy intensity in the country is about three times higher than in the European Union.

It is estimated that a well-planned and concerted implementation of an energy efficiency program in Moldova could have reduced the financial impact of the energy sector on the GDP by 1.6-1.7% per year, starting from 2008. The pursuit of higher energy efficiency does not concern only the energy sector but is relevant to all sectors of the economy and energy consumption and, therefore, has a highly multifaceted character. As a result, it requires a variety of approaches and types of measures, which generally differ from one sector to another.

CHAPTER 3: INNOVATION SITUATION IN THE ENERGY SECTOR

3.1 Describing the situation with EE/RES, in particular to what extent these are currently relevant and applied in the business sector

The Republic of Moldova depends heavily on energy imports; thus, 95 % of its energy needs are covered by imports. The dependence on external energy sources has led to constant price increases and accumulation of huge debts towards foreign suppliers. The energy sector is vital for the country's economic development. The Moldovan Government committed itself to reform the energy sector through enhancing the energy security, diversifying the energy sources and attracting investments to this area. By 2020, the authorities opt to increase the share of renewable energy up to 20% of the country's total energy consumption – an objective stated in the Energy Strategy of the Republic of Moldova.

The Moldovan Sustainable Energy Financing Facility provides a unique opportunity to realize energy savings potential. It provides not only loan financing and grants for this kind of projects, but also technical assistance by international experts who help to optimize the project.

Among the well-known Moldovan companies who implemented projects with the assistance of MoSEFF are Orheit Vit, Macon, Covoare Ungheni and others. But also a range of small companies implemented projects from loans ranging from EUR 10,000 to 2 million.

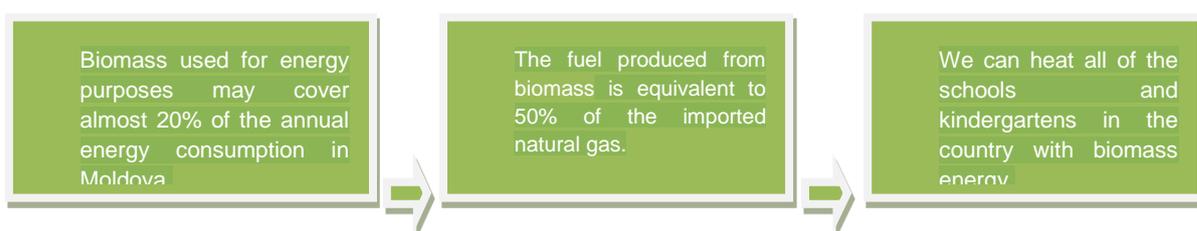
The Moldovan Sustainable Energy Financing Facility (MoSEFF) was launched by the European Bank for Reconstruction and Development (EBRD) in order to support energy efficiency investments of Moldovan enterprises. Under MoSEFF, the EBRD made a total of € 42 million available for on-lending through local partner banks. To make investments into energy efficiency projects even more attractive, MoSEFF contains a grant component for eligible projects. Depending on the energy savings and CO2 emission reductions achieved, the grant may reach 5% to 20% of the loan amount.

To facilitate and speed-up investments in energy efficiency, MoSEFF provides technical assistance and advice on the optimization of energy consumption and supply. MoSEFF's technical assistance is financed by the European Union and is available free of charge for eligible projects.

Also the country has a pretty high potential for the production of renewable energy, which is so far unexploited. Biomass is the most abundant alternative energy source in the Republic of Moldova. In general, we can say that biomass covers a wide range of materials, such as: agricultural and technical crops, agricultural and forestry residues, etc.

According to the definition provided in the European Directive 2003/30/EC, biomass is the biodegradable fraction of products, waste and residues from agriculture, forestry, and industrial and municipal waste. In this context, biomass is the main fuel used in rural areas. As an agricultural country, the Republic of Moldova faces a major challenge - the use of its existing potential of biomass.

Three figures in favor of biomass energy:



The energy produced from own sources are beneficial for several reasons: it reduces the dependence on imports, enhances the country's energy security, has lower costs, and enables the development of new businesses and creation of new jobs. Moreover, it reduces the GHG emissions and air pollution.

The Moldova Energy and Biomass Project provides support to public institutions from rural communities to have access to renewable energy sources, ensure energy independence, and community development. With the help of the financial support, modern biomass-fired heating systems – an alternative to the ones currently in place – will be installed by 2014 in more than 130 rural schools, kindergartens, and community centers across the country. The Energy and Biomass Project will cover the majority of costs related to the installation of alternative heating systems, while the villages are expected to contribute with at least 15% of the total investment value.

The Energy and Biomass Project Beneficiaries:

- District Councils;
- Local Public Authorities;
- Local public institutions;
- NGOs and community centers;
- Local and regional entrepreneurs, biofuel producers.

The expected impact resulting from the implementation of biomass processing is the possibility to enhance energy safety of rural communities throughout the country, to foster the development of enterprises for processing locally available biomass, and to set up sustainable partnerships, that contribute to the economic development of villages and regions.

3.2 Are there relevant (EE/RES-specific) strategies available?

The Republic of Moldova adopted multiple strategies and policies, which influenced, directly or indirectly, the energy sector's performance. The evolution of energy consumption and forecasts concerning the energy and energy resources consumption have been used as a basis for the current political decisions of the Republic of Moldova oriented towards providing the users with energy under safe conditions, for minimal prices and in compliance of the environment protection requirements.

The Energy Complex is one of the main branches of the national economy and plays an important role in successful implementation of economy development programmes and maintaining social stability. Thus, the Moldovan Energy Complex, pursuant to the National Development Strategy "Moldova 2020", approved by the Law No, 166 dated 11 July 2012, has got the basic objective to provide high-quality energy at affordable prices to all consumers and support the implementation of the sustainable development of the national economy. This target is attainable on the basis of competitiveness and liberalised energy market.

The aforementioned analysis of energy resources and energy consumption was and is useful to forecast and devise energy sector plans and development strategies. The most relevant plan is: "**The National Energy Efficiency Action Plan for 2013-2015**" (NEEAP) developed by the Agency for Energy Efficiency in co-operation with the Central and Local Public Administration Authorities,

intended to provide assistance as per its functional competences. The NEEAP has been developed in compliance with the national legislation in this area, with the commitments of the Republic of Moldova as a Member of the Energy Community Treaty, the provisions of the Law on Adherence of the Republic of Moldova to the Treaty establishing the Energy Community No. 117-XVIII dated 23.12.2009.

The purpose of the NEEAP relates exclusively to efficient energy consumption and reduction of greenhouse gas emissions. The objective of the NEEAP is to reduce the energy end-use in all sectors of the national economy by 428 ktoe, and cut the emissions of CO₂ by 962 848 tons during 2013-2015. Similar to the EU Member States aiming to achieve an overall national indicative energy savings target of 9% during 2008-2016, the Republic of Moldova also has set up an intermediary energy savings target of 9%, to be reached by 2016, compared to 2009.

Most savings would be achieved through the establishment of development conditions and the introduction of energy services on the market, the allocation of additional earmarked funds and credit lines to those sectors. Thus, domestic and foreign financial efforts have been consolidated in order to implement the present NEEAP, including:

- credit line for small and medium-sized enterprises and the Moldovan Sustainable Energy Financing Facility (MoSEEF) II in the total amount of 352 million MDL (22 MEUR);
- credit line for the residential sector (MoREEF) in the total amount of 560 million MDL (35 MEUR);
- Energy Efficiency Fund in the total amount of 520,107.6 thousand MDL for the NEEAP timeframe, with resources coming from the direct budget support provided to the energy sector;
- energy sector budget support provided by the EU Delegation in the amount of circa 640 million MDL (40 MEUR);
- technical assistance in the total amount of 35.2 million MDL (2.2 MEUR) provided by the EU Delegation for the implementation of the Energy Sector Budget Support Policy Matrix;
- technical assistance provided by the Global Environment Fund to support the energy efficiency growth in the industrial sector in the total amount of 12.8 million MDL (0.8 MEUR), etc.

3.3 Is it a priority in the country concerned?

In order to diminish dependency on imported energy resources and the energy sector's impact on climate changes, the National Energy Efficiency Programme 2011-2020, which serves as a starting point for this NEEAP, pursues the accomplishment of the following objectives, relative to 2009 baseline:

- Increase the efficient use of overall primary energy by 20% by 2020;
- Cut the greenhouse gas emissions by at least 25% by 2020, relative to the 1990 baseline.

By improving the energy efficiency in different national economy sectors, it would be possible to exploit the energy savings potential in a cost-efficient manner. The set of measures outlined in the national policies pursue the goal to create significant benefits for each sector of the national economy, including:

- Energy transformation sector, including all related activities: production of electricity and heat, transportation and distribution of electricity, heat and natural gases, and the final use of all types of energy resources;

- Industry sector;
- Construction sector;
- Transport sector;
- Public sector.

The main document dealing with the issues in question is the National Energy Efficiency Programme for 2011-2020, approved by the Government Decision No. 833 dated 10 November 2011;

Moldova's strategic objectives for 2013-2020 are as follows:

- Safety of natural gas supply, by diversifying the supply routes and sources, carrier types (conventional, non-conventional gas, LNG) and storage facilities, together with strengthening Moldova's role as a natural gas transmission corridor;
- To strengthen Moldova's role as a power transmission corridor, by building new interconnectors, connected to the ENTSO-E system, and by consolidating the internal power transmission network;
- To create a strong power and heat generation platform, through retrofitting, efficient district heating and advanced marketing;
- To improve the energy efficiency and increase the use of renewable energy sources (RES);
- To provide legal, institutional and operational framework for a real competition, to effectively open the market, set up energy prices in a transparent and fair way, integrate the Moldovan energy market into the EU internal market;
- To provide a modern and competitive institutional framework for the energy industry's development.

3.3.1 Institutional Framework for the EE and RES sector implementation

During 2001-2010, the institutional framework responsible for the energy sector was subject to essential amendments. The Ministry of Energy was dissolved, while the competence in energy policy was assigned to the Ministry of Industry and Infrastructure. Subsequently, the latter was also dissolved, and the energy sector divisions were assigned to the Ministry of Economy.

The National Agency for Energy Conservation, which is a body charged with the energy conservation tasks, being a self-financed body, failed to cope with financial challenges, and was subject to reorganisation in late 2006 as per the Government Decision No. 1452 dated 21 December 2006 on the activity performed by the National Agency for Energy Conservation.

Since energy efficiency is not a separate sector, the Government of the Republic of Moldova established the Agency for Energy Efficiency (AEE) through the reorganisation of the National Agency for Energy Conservation to promote and implement energy efficiency policies and implement the use of renewable energy sources in all sectors of the national economy. AEE is first mentioned in the Renewable Energy Law No. 160-XVI dated 12th of July 2007, although it was established only in 2010 by the Government Decision No. 1173 dated 21st of December 2010 on the Agency for Energy Efficiency, based on Article 8 of the Energy Efficiency Law No. 142 dated 02 July 2010.

3.4 Energy Efficiency – is it an issue among businesses?

The aspect of sustainable development should not be a secondary one in Moldova, especially considering the great potential that the country has for developing some sectors of the "green economy".

An important indicator is the level of the country's overall energy-efficiency, which is very low but similar to the CIS countries. The objective of Moldova is to get closer to the energy efficiency levels of the Central and Eastern European Countries that show a 40% higher EE.

Another specific indicator that reflects the reduced concern of Moldovan companies to capitalize strategic opportunities offered by the "green economy" is the very low penetration of ISO 14001 certificates (only 0.3 certificates / 1 billion of GDP, compared to 0.4 in CIS and 8.4 in CEE countries).

Energy efficiency is not at the top of the priority list of Moldovan enterprises. Most people and enterprises use old equipment and technologies resulting in energy intensity about 3 times higher than in EU. Since 2010, when the AEE was founded, things are gradually changing because the Agency, through its activities, aims at drawing attention to this fact and involve both public and private companies and institutions.

Another reason that raised the level of attention to EE in Moldovan enterprises is the considerable increase in the price of natural gas and oil. In the first quarter of 2010, the estimated price for gas imported by Moldova was 231.71 dollars per thousand cubic meters and the price gradually increased until it reached the level of 374.38 dollars per 1000 cubic meters in the first quarter of 2014². With the skyrocketing heating bill in winter, the number of those who replace gas heating with biomass boilers is growing. Many entrepreneurs have found that EE offers excellent earning potential, and today it is a growing industry, so even if EE does not have a major impact within companies, there is an increasing number of companies that produce biogas, fuel pellets and solar energy.

What hampers investment in EE is the insecurity of entrepreneurs, who often purchase equipment based solely on their price, usually choosing the most economic option and neglecting their ability to use energy more efficiently. This attitude is partly due to the lack of knowledge in energy management, the lack of capital in businesses and the reduced availability of loans, but also an administrative command of Soviet type that persists even today.

3.5 How far energy innovations have been implemented in the country?

Renewable energy and energy efficiency became a topic of national importance only in the last few years as the price of the usual energy sources rapidly increased and started to menace Moldova's energy security. Under the pressure and urging of the government, some innovations in the energy sector were introduced by small enterprises and also at an industrial scale. Innovations are intended as elements of novelty at country level, as the solar batteries, windmills and some biogas equipment, already present for some time in most developed countries.

There is always a greater emphasis on energy efficiency of households and public buildings as it is the sector that consumes the most of the energy introduced in the grid. Because of rising

² Source: <http://www.moldovagaz.md/menu/ro/about-company/transportation>

housing prices, this sector is very active, and materials of latest generation that can greatly enhance the energy efficiency of buildings have recently become available on the market.

Today the share of energy production from solar, wind and biomass energy is insignificant. The potential of these energy sources is much higher and it is estimated that if we use these resources to their full potential, we can easily cover the 20% of our energy needs, reaching and far exceeding the objective introduced by the Energy Strategy 2020. Getting to these levels of energy production and efficiency will require a lot of attention by the institutions involved in the energy sector, starting with the Government and ending with the individual citizens of the country.

3.6 Are there any relevant renewable energy sources installed or companies active in RES?

Considering the willingness of the Moldovan government and the help from the European community, solar energy as well as other renewable resources, like biomass or wind turbines, probably will be part of the daily life of the Moldovan citizens in the next decade.

According to the radiation levels studied by the Technical University, solar energy has a great potential in the Republic of Moldova. The energy needs of the country and the rising energy price provide the push to make renewable energy production units grow within the next years. Solar energy production is very limited, as the price of solar energy is higher than that of generated from traditional resources. In 2013, the amount of solar energy delivered to the grid was 101218 kWh, and its use is rather limited. It is mainly used by households, but the first Solar Farm in Moldova is already built, which generates 350 kW of power, based on amorphous panel technology. In 2009, the Institute of Oncology started a project aimed at generating photovoltaic solar energy, with a significant financial support from the Government of Japan (5 million USD). The phase of installation of the equipment was finalized in September 2013, and the solar energy plant, which covers an area of 8000 m², generates savings that are directed to enhance the quality of medical care.

Other relevant solar installations are placed on commercial buildings like Bucuria factory, the roof of the office building of Porsche, and some institutional buildings. There are several companies which provide the equipment and installation services, but there are no companies producing solar energy for commercial use. There are some programs (Green House, MOSEFF) that support the purchase of photovoltaic systems by covering part of the costs, and this makes the solar energy more competitive, but these contributions are not sufficient to switch to a solar energy production at national scale.

Wind installations producing energy in Moldova reach a total capacity of 979807 kWh³. In Moldova, there are over 25 wind mills and turbines, 20 of them with a small installed capacity and in the ownership of Mr. Nicolai Constantinov, president of the Wind Energy Association. These turbines are installed at small farms, vineyards and sheep farms. Another important institution that installed 10 units of wind turbines, is the Technical University of Moldova. These installations are part of a an experimental project supported by Ion Bostan, the rector of UTM. Some of these units were installed in Chisinau, and Cahul.

³ Source: <http://aee.md/energie/energia-eoliana/analiza/254-statistic-energie-eolian>

The amount of energy delivered to the grid by biomass power producers is 826843 kWh⁴. It appears that the energy produced from biomass is less than the wind energy but this can be explained by the fact that biomass is used primarily for the production of thermal energy. "Energy and Biomass" project, which should be implemented in 2011-2014 and has a budget of 14.56 million euros, granted by the EU (14 million) and UNDP (560000 EURO), plays a very important role in the formation of a local market for biomass energy. This project aims to:

- Improve quality assurance of heating energy of public buildings in beneficiary villages, using wheat straw and other grain waste supplied by local agricultural businesses;
- Stimulate the development of production market of heating energy for individual households, production of biomass briquettes and creation of industrial CHP plants;
- Increase the capacity of key stakeholders in the biomass sector, ensuring durability and further replication of technologies based on biomass;

Another important project in this area was announced by the Ministry of Agriculture and Food Industry. It will be funded by the Government of Japan and implemented during 2012-2014. The project provides for the procurement and installation of the social institutions of rural settlements and agricultural enterprises that require thermal heating boilers that work on biomass (straw and other crop residues).

In 2013, the first biogas plant at industrial level in Moldova was built by the German company Südzucker in Drochia. Sudzucher Moldova S. A. processes about 300 tons of sugar beet. As a result of the technological process, it produces 80 thousand tons of dehydrated pulp. This amount of pulp is not requested on the market and therefore accumulates at the factory in the form of waste, which in turn creates problems for the environment. The company invested 7.5 million euros in the construction of the biogas factory. The projected annual processing capacity of the plant is around 7.3 million cubic meters of biogas, containing 51% methane, produced from 55 000 tons of pressed sugar beet, the main waste resulting from the process of obtaining sugar beet., Compressed sugar beet waste will be processed only in the first two years, and after this period the factory will use all organic waste resulting from the processing of sugar beet.

MolFarm Group plans to build its own biogas factory in 2014, that will process animal manure. The company has a farm with around 1000 head of cattle, which translates in 60 tons of biomass daily. The total capacity of the factory will be of 1000 kWh.

Moldova does not possess deposits of fossil fuels, but rivers such as Nistru and Prut, and a number of smaller rivers are of interest. We cannot talk about the erection of large hydroelectric power plants, but it is possible to build smaller power generating units, even on streams with low flow. They are a local use and importance, but if we are able to strengthen this network, the cumulative effect will improve the energy security of the country.

Currently, hydropower is produced by two hydroelectric plants in Moldova: CHE Dubosari, with an installed capacity of 48 MW, and HPP Costești - 16 MW. There are several micro hydro power plants built by individual producers and operators. All generating units are built on the basis of existing dams on small reservoirs. Statistics show that the total amount of energy produced from this source reached almost 80000 kWh in 2000-2011, being by far the most important source of renewable energy in the Republic of Moldova.

⁴ Source: <http://aee.md/energie/biocombustibil/analiza/255-statistic-bioenergie>

CHAPTER 4: OVERVIEW OF CRITICAL STAKEHOLDERS

We can consider the stakeholders of the energy sector in Moldova on 5 different levels:

1st - Political or legislative level

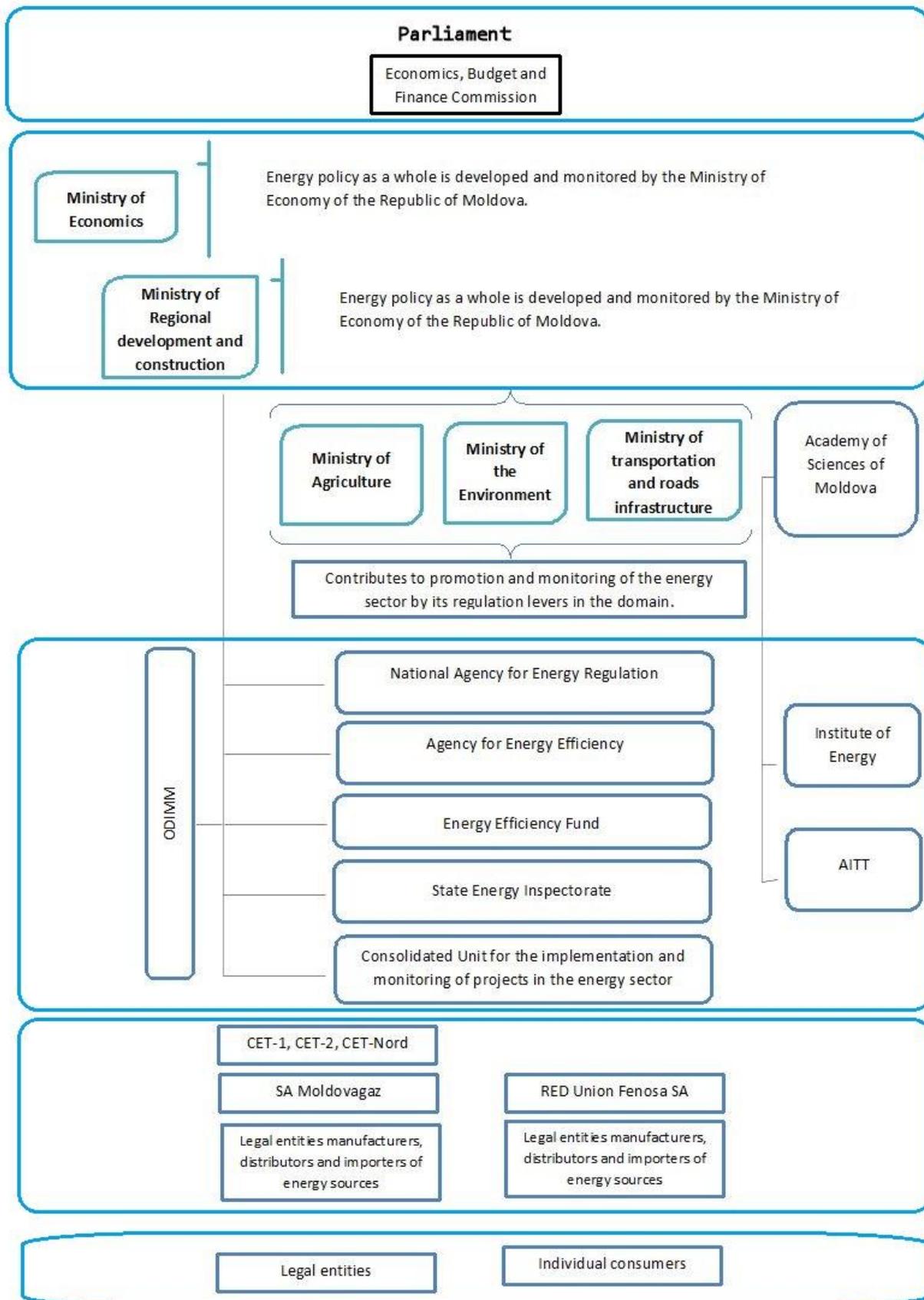


Figure 1: Political or legislative level

The Parliament and the Parliamentary Standing Committee "**Committee on Economy, Budget and Finance**" discusses and approves the draft laws and other legal documents related to the energy sector.

2nd - The operational level

The Ministry of Economy of the Republic of Moldova is the main regulatory body in the field of energy. It contributes to the development and promotion of energy policy based on principles ensuring energy security of the state, and increasing energy efficiency, by diversifying energy sources and the use of renewable energy. As a result, it helps to create a competitive and efficient energy complex to provide consumers with quality energy resources that are affordable and reliable.

The Ministry of Regional Development and Construction creates the legal framework and mechanisms to encourage improvements in the energy performance of buildings in the country. Taking into consideration the fact, that buildings currently consume 45% of total energy, this occupies a special place in the policy of the Republic of Moldova.

The Ministry of Agriculture and food industry develops policies to promote the use and exploitation of the energy potential of biomass. It aims at gradually substituting fossil fuel consumption by processing the plant biomass into briquettes and pellets, in terms of durability, efficiency and competitiveness.

The Ministry of Environment promotes the state policy to assure ecological security by reducing greenhouse gas emissions. However, the Ministry of Environment contributes through its policies to expanding access to clean energy, improving energy efficiency and promoting green industry as an integral component of the transition to a green economy.

The Ministry of Transport and Road Infrastructure regulates and mitigates the emissions of greenhouse gases in the transport sector and promote the use of biofuels.

The Academy of Sciences promotes the state policy in the field of research and development. ASM performs a series of activities in the field of CD and innovation, including funding and implementation of projects in the energy sector.

3rd - "Execution and monitoring of public policy"

The National Agency for Energy Regulation regulates economic and commercial activities in electricity sectors, natural gas and oil products through licensing, promotion of adequate tariff policy and consumer rights protection.

The Energy Efficiency Agency's mission is to oversee developments in energy efficiency and renewable energy sources, ensuring the preparation and submission of program summaries, evaluation of investment projects, drafting of legislation and the creation of an information base in its areas of activity.

The Energy Efficiency Fund: The primary activity of the fund is to attract and manage financial resources for funding and implementing projects in the field of energy efficiency

and renewable energy recovery in accordance with the strategies and programs developed by the Government. This objective will be provided by:

- promotion of investment projects in energy efficiency and exploitation of renewable energy sources;
- technical assistance for projects development in energy efficiency and renewable energy;
- providing financial assistance to projects;
- direct financial contributions;
- acting as the agent or mediator for other sources of financing;
- providing full or partial guarantees for bank financing;
- assistance in identifying the optimal combination of project financing.

The State Energy Inspectorate monitors the power system development in Moldova and has the following functions:

- Control for the rational use of electricity and thermal energy in all spheres of the national economy and implementing measures to achieve energy saving;
- monitoring consumers' compliance to the discipline and regime of consumption limit of electricity and thermal energy;
- organization and optimization of the quality of the flow of electricity and thermal energy delivered to consumers;
- enhancing consumer requirements for the exploitation of technical and safety operation of electrical installations, identify wasteful, inefficient and unsatisfactory processes in the context of reliability and safety of operation of electrical installations;
- increase control while reducing the costs of electricity consumption used for heating supply, thermal and energy-technological processes, public lighting and advertising panels in all spheres of the economy and in the context of household needs.

The Consolidated Unit for the implementation and monitoring of projects in the energy field was created by Government Decision no. 1276 of 21st of December 2000 in order to improve efficiency of investment projects, financial and technical assistance in the energy sector provided by the World Bank and other donors.

The Organization for Development of Small and Medium (ODIMM) - contributes to enhancing the competitiveness of the national economy by supporting the development of SMEs sector. Elaborates and implements programs and projects including in energy development.

The Institute of Power Engineering of the Academy of Sciences is an institution working in the field of research and aims to promote the following strategic directions:

- energy security and efficient functioning of the energy complex
- innovative solutions to build power lines, equipment adjustment for the realization of the concept of intelligent energy networks;
- new methods of calculation and analysis of transient processes and stationary circuits (lines) with heterogeneous distributed and focus parameters;
- rational use of electricity and thermal energy;

- conversion plants and systems for renewable energy sources in the conditions of the Republic of Moldova.

The Agency for Innovation and Technology Transfer - was created to coordinate, stimulate and implementing mechanisms for innovation and technology transfer activities. One of the strategic direction it supports is the optimization of the energy complex and assurance of energy security by financing projects that aim at improving the use of renewable energy sources.

4th - "production, import and distribution of energy resources"

Moldovan-Russian Joint Stock Company "Moldovagaz" is a distributor of natural gas. As of 1st of January 2009, it exploits approximately 1800 km of gas pipelines and gas pipelines connections, 92 gas distribution stations, five compressor stations, one gas measuring station and other accessories, which form the country's gas transportation system. The organization also operates more than 17000 km of gas distribution network, 20475 plants and installations for the regulation of the gas pressure of all types and categories (from single ones up to those located in separate buildings), 290 gas measuring points and other accessories that work in a single gas distribution system of the country. In the country there are 552 790 gasified apartments and houses, including 388 130 in the cities and 164 660 in rural areas.

RED Union Fenosa SA is the largest private distributor of electricity in Moldova. RED Union Fenosa SA serves over 835,000 clients, individuals and legal entities, it distributes electricity in 21 out of the 37 districts, including in the capital, Chisinau, which overall constitutes two-thirds of the country.

S.A. Termocom is a production company in Chisinau, under the control of the mayor's office and the City Council. The activity of the company aims at the production, transportation and distribution of thermal energy (hot water and heating) to consumers: municipal housing organizations, state institutions, budgetary and socio-cultural organizations, economic agents, the private sector and individuals.

Other legal entities that are producers and distributors of energy are energy companies in all sub-sectors of the energy sector - holders of licenses for regulated activities of generation, transmission, distribution and supply of electricity at regulated tariffs.

5th - "Consumers"

Legal entities and individual consumers of energy resources in Moldova.

CHAPTER 5: Analysis

Promoting energy efficiency in the Republic of Moldova is a must but also proves to be a challenge. However, since 2010, with the approval of the primary regulatory framework for energy efficiency, a number of actions/activities have been launched based on an intention to improve efficient energy consumption and at the same time educating Moldovan society to the importance of energy efficiency.

The first law drafted under the Law no. 142 of 2nd of July 2010 on energy efficiency is the National Energy Efficiency Programme 2011-2020, approved by Government Decision no. 833 of 10th of November 2011. The program comes with a strategic vision, especially in terms of energy efficiency, aiming to take a stand in the following sectors:

- Energy transformation sector (electricity, thermal energy, natural gas, etc.).
- Industry sector;
- Construction sector;
- Transport sector;
- Public sector.

The program comes with a set of objectives and specific measures for each of the aforementioned sectors, to ensure energy savings of about 14.2 PJ and a volume reduction of greenhouse gas emissions of around 760 kt of CO₂ by 2020. To achieve the program goals, several measures and activities were formulated. Some of them have already started by being placed on the agenda of the authorities in the field, and also on the agenda of the local government.

To support the program, the National Action Plan for Energy Efficiency for 2013-2015 was developed and approved. This action plan sets intermediate targets, intended to be achieved through making a list of measures. Some of them are:

- Promoting energy auditing;
- Promoting voluntary agreements;
- Creating necessary conditions for market development of energy services;
- Develop and implement various incentive instruments for both the private and the public sectors, etc..

However, the National Action Plan for Energy Efficiency sets an intermediate target of 9% for energy savings by 2016. The action plan sets the objective to save energy of a total of 428 ktoe in absolute value cumulatively for the period 2013-2015. The realization of the objectives stated in the law have to be treated in other reports, prepared in accordance with the terms and conditions predetermined by the law. With the same purpose, the Agency will report progress summaries on the base of action plans and will create a knowledge base in the field of energy efficiency. These materials will contain information about the implementation of the actions included in the plans developed by all relevant actors.

The estimated energy economy target for 2020 compared to actual consumption of primary energy resources is very ambitious. Setting such targets requires the development of a list of measures/activities, with the setting of responsibilities and identifying the sources of financial coverage. To achieve the values specified in the objectives, a monitoring mechanism should be applied.

OBJECTIVES OF RENEWABLE ENERGY - National Targets for 2030

According to the decision D/2012/04/MC-EnC of the Ministerial Council of the Energy Community, the Republic of Moldova has committed to achieve a share of renewable energy sources in the gross final energy consumption of 17% by 2030.

Implementing the above mentioned decision takes place through several policy documents, among them:

- Energy Strategy of the Republic of Moldova until 2030;
- Renewable Energy Law Nr. 160-XVI of 12th July 2007;
- Draft law on the promotion of renewable energy, approved on February 27th, 2014 in Government meeting;
- National Development Strategy of the Republic of Moldova 2012-2020;
- National Action Plan on energy from renewable sources for the years 2013-2020 (NAPERS), approved by Government Decision no. 1073 on 27th of December 2013.

Sectorial targets and trajectories related to renewable energy sources

In accordance with the aforementioned primary and secondary legislation, Moldova is committed, to achieve the following sector objectives up to the 2020 time horizon: The share of biofuels in the total consumption of fuels used in the transport sector is expected to be at about 10%. Simultaneously, the National Development Strategy 2012-2020 reiterates Moldova's overall national target for renewable energy use of 20%, and supplements it by a midterm objective - 10% renewable energy in gross final energy consumption by 2015. The strategy also sets a target sector for producing electricity from RES to 10% by 2020. It needs to be mentioned that the national target for the consumption of electricity produced from RES can be achieved without "green" energy imports.

Consequently, the share of RES in total thermal energy consumption has to be very huge in order to achieve the global target of 17%. Thus, the contribution of the "thermal energy from RES" should be about 28% by 2020.

Objectives for energy efficiency

Promoting energy efficiency and setting goals for the efficiency of energy consumption are addressed in the following regulations:

- Energy Strategy of the Republic of Moldova until 2030;
- National Energy Efficiency Programme 2011-2020;
- Government Decision no. 102 of 05.02.2013 on the Energy Strategy of the Republic of Moldova until 2030, Official Gazette no. 27-30 of 08/02/2013, Article number: 146
- Government Decision no. 833 of 10.11.2011 on the approval of the National Energy Efficiency Programme 2011-2020 Official Gazette. 197-202 of 18.11.2011, Article number: 914
- National Action Plan on energy efficiency for the years 2013 - 2015 (NAP);
- National Development Strategy "Moldova 2020".

Therefore, the overall objective for energy efficiency is set out in the NPEE and states an improvement of efficient global primary energy consumption of 20% by 2020. The National Action Plan in this field, as mentioned above, comes with an intermediate target fixed for the year 2016, and at the same time traces the trend of primary energy consumption optimization. In this sense, the goal is to reduce the annual consumption by 1.8%.

With regards to the Strategy “Moldova 2020”, it establishes a number of sectorial targets for the horizons 2015 and 2020, for the electricity sector, thermal, natural gas, construction, public sector, etc.. The final and the intermediate targets are shown in the table below.

Monitoring indicators	2015	2020
Energy intensity reduction		by 10%
Reduction of electricity losses in the transmission and distribution on electricity grid	up to 13%	up to 11%
Reduction of losses in the gas distribution grid	by 20%	by 39%
Reduction of losses in the distribution of thermal energy	by 2%	by 5%
Reduction of the proportion of natural gas in the energy mix	by 53%	by 45%
Reduction of greenhouse gas emissions (compared with 1990)		by 25%
Reduction of the buildings energy consumption		by 10%
Increase of the share of renovated public buildings		by 10%

Table 3: Final and the intermediate Targets

Energy-consumption optimization

As a general approach to energy consumption optimization, we can mention that Moldova is an energy intensive country with efficiency three times below the average of EU member countries. Large domestic consumption, characteristic to the subjects operating on the internal market, appears on the background of using old technology and obsolete equipment. This occurs due to the fact that energy conservation is a subject ignored at all levels. In addition to the reasons stated above, we may add the lack of information or simply the poor information that flows to the society and the private sector pertaining to the benefits gained from the implementation of energy efficiency measures.

Today we may observe an insistent demand made by the society for the demonstration of good practice in the field of energy consumption, which in tandem with financial instruments, special funds, credit lines available on the market today, are able to make an important shift towards the implementation of measures that would optimize

consumption efficiency. The first steps in this direction have already been taken, including the support of the administrative body in the energy efficiency and renewable energy domain - the Energy Efficiency Agency.

SWOT Analysis:

Strengths	Weaknesses
<p>Long term energy sector strategy (2030)</p> <p>Harmonization of Moldovan legislation with EU standards</p> <p>Implementation of projects for the assistance of the development of the energy sector</p> <p>High potential for the use of renewable energy sources</p> <p>Implementation of investment programs to promote energy efficiency</p>	<p>Low rates on energy delivered in the grid</p> <p>Lack of information about the benefits deriving from EE and RES</p> <p>Incomplete and incoherent legislative framework</p> <p>Financing concentrated on projects</p> <p>Weak interaction between the research and the business sector</p> <p>Poorly developed infrastructure in the energy sector</p> <p>Low public and private expenditures in R&D</p> <p>Poor valorisation of RES</p> <p>The lack of an attractive investment climate for foreign and local investors in the energy sector</p> <p>Low energy efficiency in the production-distribution-transportation chain</p> <p>Inefficient banking system in the investment field</p> <p>Lack of qualified human resources</p>
Opportunities	Threats
<p>Association agreement with the EU</p> <p>Unexplored capacity</p> <p>Different and diversified EE funding sources and support structures (FEE, MoSEFF, AITT, AEE...)</p> <p>Strengthening the role of the Moldovan electricity transit corridor through the construction of new interconnection lines, ENTSO-E connection to the internal network and strengthen the electricity transmission</p> <p>Gradual internationalization of companies in the energy sector</p> <p>Investments in cross-border energy infrastructure</p>	<p>Political instability in the region</p> <p>Excessive bureaucracy</p> <p>Government underfunding in research, innovation and technology</p> <p>The high degree of dependence on energy imports</p> <p>The rising costs of energy resources</p>

Table 4: SWOT Analysis

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