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1.1. Energy Supply

1.1.1. Electricity Production Technologies

The energy system of the Republic of Moldova includes one large Thermal Power Plant (TPP) located in the Transnistrian Region (Administrative Territorial Units on the Left Bank of Dniester River); 3 municipal Combined Heat Power Plants (CHP); 9 CHP plants beside sugar factories; and 2 Hydroelectric Power Plants (HPP). Table 1 shows the installed capacities of the power plants in the Republic of Moldova.

As per information above, the country has the following power generating sources: CHP-1 and CHP-2 Chisinau; CHP-North Balti; Moldovan Thermal Power Plant in Dnestrovsc (MTPP); and two HPP in Dubasari and Costesti. The total installed capacity of the country's power stations are about 3000 MW, but there are used only about 1600 MW. The available capacity of hydroelectric power plants constitutes around 40 MW. Sugar factories power plants have an installed capacity of 97.5 MW and are operated mostly seasonally to cover energy needs at the stage of processing sugar beet.

Table 1: Characteristics of Power Plants in the Republic of Moldova

Power Generation Unit	Installed electric capacity, MW	Installed thermal capacity, Gcal/h	Fuel	Year of construction
CHP-1 Chisinau	66	254	gas, HFO	1951-1961
CHP-2 Chisinau	240	1200	gas, HFO	1976-1980
CHP-North, Balti	28.5	200	gas, HFO	1956-1970
9 CHP of sugar factories	97.5		gas, HFO	1956-1981
HPP Costesti	16	0	(hydro power)	1978
HPP Dubasari*	48	0	(hydro power)	1954-1966
Moldovan Thermal Power Plant (MTPP)*	2520	0	Gas, coal, HFO	1964-1982

Source: * - left bank of Dniester River

CHP-1 from Chişinău was built during 1951-1961. It has an installed capacity of 66 MW, the available being about 40 MW. The main fuel is natural gas, and the reserve one is heavy oil. The wear degree of the equipment is about 60%.

CHP-2 Chişinău has an installed capacity of 240 MW, and available one being of 210 MW; it was built between 1976 and1980. The main fuel is natural gas, and the reserve one is heavy oil. The wear degree is of about 50%.

The CHP North-Bălți, with an installed capacity of 28.5 MW and an available power of 24 MW was built between 1956 and 1970. The main fuel is natural gas, and the reserve one is heavy oil. The wear degree of the equipment is about 60%.

Technological process at CHPs is based on the classical cycle of steam turbines. At the CHPs are used steam and hot water boilers of Russian production: steam boilers made at the factories from Barnaul and Taganrog during 1951-1993, type TC-35GM-50, TGM-96B, DKBR-6.5/13, BKZ-75/39-GM and BKZ-120-100GM; hot water boilers made during 1971-1988 at the factories from Barnaul and Belgorod, type PTVM-100 and KVGM-180, and steam turbines made at the factories from Kaluga, Breansk and Saint-Petersburg during 1957-1995, type R-12-35/5M, PT-12/15-35/10M, PT-80/100-130/13, R-6-90-37, R-27-90-1.2 and R-10-35-1.2.

According to the specific fuel consumption level, technologies used in the Republic of Moldova are not as efficient as the similar world ones (e.g., the nominal efficiency of the local CHPs is twice less than the modern installations). Additionally, as a result of the energy consumption reduction in the last years, the functioning regimes of the energy production enterprises, especially of CHPs, in the Republic of Moldova are far from the nominal ones. Respectively, their real efficiency is much lower than the nominal one.

Box 1. Brief Description of the Technologies Used at Local CHPs

The fuels used at all domestic CHPs are natural gas and residual fuel oil. Natural gas is delivered to Chişinău and Bălţi cities through main pipes of 75 bars, and the gas distribution system is provided for 12 and 3 bar, CHPs being connected to the distribution system of 3 bar by 75-mm pipes. Gas from the pipes comes to the pressure reducing stations and is counted, filtered and reduced to the 0.5 bar pressure. Having no tanks, the gas cannot be stored at the plants and it is impossible to make reserves.

Residual fuel oil is delivered to the plants by railroad and it is stored in tanks. For example, storage capacity at each CHP-1 and CHP-2 Chisinau represents about 1,600 m³, and at CHP-North from Bălţi – about 2,000 m³, and these quantities are sufficient to function one month at a 30-40% productivity. Residual fuel oil is heated up to the temperature of 50-75°C, when transporting through the pipes. After that, it is heated up to 100-140°C to be pulverized in the boilers' combustion chambers. The heating process foresees the steam use, which increases the residual fuel oil humidity up to 3-5%, later being strained and evacuated. According to the technological process, it is foreseen to clean the water from the oil and to introduce it into the technological cycle. But, in practice, the water is poured out into the sewerage.

The fuel burns in the boilers' combustion chambers, where the fuel and oxidant – usually air, heated up to 150-300°C, are introduced through the burners. The burning process in the boilers' combustion chambers of the CHP is occurring at 1,700-2,000°C. The burning gases are cooled in the heat exchange surfaces of the boiler, giving the heat to the water, steam and air. The gases cooled to the temperature of 138-245°C are discharged through the flue. In the process of oil burning a certain quantity of ash (about 50 mg/ m³) is eliminated into the atmosphere in the form of dust. Boilers for gas and liquid fuel currently used are not equipped with evacuated gas-cleaning installations.

Electrical energy generating process consists of water heating in the boiler up to the boiling temperature and its transformation into steam. After overheating up to 400-560°C, the steam is directed to the turbine, where the thermal energy is transformed into mechanical work and after that, through an electric generator, the mechanical work is converted into electricity.

At the CHPs of the sugar-beet factories and CHP-1 Chişinău, the steam is expanded to the pressure of 0.7-4 bar (temperature of 90-140°C), after that it is delivered to the consumers. High pressure steam (7-13 bar) for technological consumption is obtained through adjustable plugs of the intermediate steps of the turbines. At CHP-2 Chişinău, CHP-North Bălţi and one turbine of CHP-1 the steam is expanded to a pressure of about 5 kPa, and after that is directed to the condenser. In the condenser it is transformed into liquid. The evaporated water in the cooling tower is almost equal to the steam debit through the condenser.

The condensed obtained in the condenser and network heating is pumped into the gas cleaning installation to be cleaned from the gases that may produce corrosion of boiler surfaces. In the gas cleaning installation is introduced the additional water to substitute the losses of water and steam in the cycle, and also the steam consumed in the industrial technological processes without condensed returning. From the gas cleaning installation the water gets into the supply pump and is directed into the boiler.

In the network heating the water is heated up to 105-115°C, which corresponds to the exterior air temperature of 5°C. To heat the water to higher temperatures than the shown ones (top tasks), hot water boilers (HWB) are available at the municipal CHP with a high productivity (50-200 MW).

The CHPs of the sugar factories with a total capacity of about 97.5 MW serve as seasonal energy sources (e.g., Alexandreni – 12 MW, Briceni – 12 MW, Cupcini – 12 MW, Donduşeni – 10 MW,

Drochia – 10 MW, Făleşti – 7,5 MW, Gârbova – 12 MW, Ghindeşti – 6 MW, Glodeni – 10 MW). These CHPs were put into operation between the years of 1956-1985, so that their degree of wear differs from one station to another. These plants usually function only during the sugar-beet processing season (3-4 months per year), consuming for self use about 60-90% of electricity produced.

The hydro-electrical station from Dubăsari was put into operation in 1954, having an installed capacity of 48 MW, an available capacity of 30 MW and a wear degree of about 75%.

The hydro-electrical station from Costeşti has an installed capacity of 16 MW, the available capacity being of about 10 MW and the wear degree of 67%. It was put into operation in 1978.

It should be mentioned that the majority of energy generating capacities have an advanced rate of wear. With small exceptions, all the sources of electric and thermal energy production in the country have the age of more than 20-45 years. Considering the specific fuel consumption, the technologies used at the domestic CHPs are not as efficient as those of the similar installations in the world. The efficiency of the CHPs from the country is twice lower comparing to up-to-date technologies.

Table 2: Electricity Production on the Right Bank of Dniester River in the Republic of Moldova within the 1994-2007 time series, million kWh

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Electricity Production – Total	1883	1697	1591	1452	1236	1176	1398	1450	1246
Combined Heat Power Plants	1815	1577	1518	1384	1189	1089	1309	1360	1160
Hydroelectric Power Plants	37	71	60	66	46	85	87	87	84
Other Production Units	31	49	13	2	1	2	2	3	2
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Electricity Production – Total	1134	931	1263	1179	1046	1022	1229	1192	1100
Combined Heat Power Plants	1039	843	1188	1057	977	958	1137	1108	1061
Hydroelectric Power Plants	91	85	73	121	64	59	85	77	33
Other Production Units	4	3	2	1	5	5	7	7	6

The energy production capacities have a non-uniform territorial repartition, the majority (more than 80%) being concentrated on the left side of Dniester River: Moldovan Thermal Power Plant in Dnestrovsc and Hydroelectric Power Plants in Dubasari (Table 3).

Table 3: Electricity Production on the Left Bank of the Dniester River (Transnistrian Region) within 1990-2006 time series, million kWh

	1990	**1991**	**1992**	**1993**	**1995**	**1996**	**1997**	**1998**
Electricity production	13789	11449	9666	8934	4986.6	4839.8	3923.5	3593.4
HPP Dubasari	220	227	198	308	239.7	279.4	295.0	224.0
MTPP in Dnestrovsk	13569	11222	9468	8626	4746.9	4560.4	3628.5	3369.4
Electricity imported	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity consumption	NA	NA	NA	NA	2878.0	2589.4	2363.6	1928.8
Electricity exported	NA	NA	NA	NA	2108.6	2250.4	1559.9	1664.6
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Electricity production	2973.1	2720.0	3649.9	3228.5	3016.1	3156.6	2995.9	1674.8
HPP Dubasari	285.6	256.7	284.1	286.5	223.0	266.1	295.0	275.0
MTPP in Dnestrovsk	2687.5	2463.3	3365.8	2942.0	2793.1	2890.5	2700.9	1399.8
Electricity imported	2.8	0.0	0.0	285.4	921.3	812.0	659.2	275.8
Electricity consumption	2098.4	2100.0	2183.1	1899.2	2111.6	2124.3	2107.9	1898.9
Electricity exported	877.5	620.0	1466.8	1614.7	1825.8	1844.3	1547.2	51.7

By the end of 2003, the separatist administration (ATULBD) sold the MTPP to a Russian-Belgian Company *Saint Guidon Invest NV* for USD 29.5 millions. In March 2005, the affiliated company of the *Inter RAO EES*, and namely *RAO Nordic Oy* (Finland) bought 51 percent of the MTPP shares at USD 50 millions from the *Saint Guidon Invest NV*, and later in August the remaining 49 percent at USD 35 milions. In November 2005, *RAO Nordic Oy* sold 49 percent of the shares for USD 39.2 millions to *Freecom Trading Ltd*. (Cyprus). Finally, in July 2008, *Inter RAO EES* bought 100% of the shares of *Freecom Trading Ltd.* from the Hungarian *EMFESZ* for a total amount of USD 163 millions, thus acquiring 100 percent of shares of the MTPP.

The MTPP has an installed capacity of 2520 MW, and has eight energy condensation units with an electric power of 200 MW each on coal (set into operation in 1964-1971 with only five energy groups currently operational), two energy condensation units with an electric power of 210 MW each on residual fuel oil and natural gases (set into operation in 1973 and 1974, both operational), and two energy groups operation in a mixed gas-steam cycle on natural gas, with an installed power of 245 MW each (set into operation in 1980, both operational).

The technological processes employed at the MTPP are based on the classic cycle of the condensed steam turbines and imply fossil fuel combustion for electric power production, while thermal power production is just a secondary process. In conformity with the specific fuel consumption, the energy units of the MTPP of 200-210 MW (380-440 g c.e./kWh) are less efficient than the analogous plants in the world (e.g., the condensing energy units manufactured by Siemens, with an installed power of 450 MW, has a specific fuel consumption of as little as 254 g c.e./kWh).

It should be noted that employment of a combined cycle of the gas-steam turbine installation (GSTI) type, in comparison with the regular condensation units, assure a circa 20 percent fuel economy in the total fuel consumed for the unit, and can be rapidly put into operation at the maximal load time. The rated capacity of the gas-steam type plant used at the MTPP is 24.8 per cent, which is much less than the 42 percent in the modern gas turbines.

The electricity production at the MTPP has decreased by five times during 1990-2005 time series. Respectively, the MTPP's efficiency in the past years also dropped considerably. If in 1970-1980 the average specific fuel consumption was less than 340 g c.e./kWh, then further, in particular in 1990-1997, this indicator varied between 370-470 g c.e./kWh. Following the conservation in 1999 of energy condensation units on coal and use of only energy condensation units on residual fuel oil and natural gas, and of the two energy units working in a mixed gas-steam cycle on natural gases, the specific fuel consumption has reduced to circa 360 g c.e./kWh in the past years.

After the increase of the price of natural gas supplied by Russian Federation from 80 USD to 110 USD on 01.01.2006, and from 110 USD to 160 USD on 01.07.2006[1], the MTPP changed its tariff policy, increasing the price for the supplied electricity from 3.05 US ¢ to 4.08 US ¢. Under the circumstances, starting November 2005 the Republic of Moldova stopped buying electricity from the MTPP, switching over to a cheaper option to buy from Ukraine, at a price which varied in November 2005 – June 2007 between 2.5-2.8 US ¢ for 1 kWh (as per the contract dated 20.05.2006 between the Moldovan Company „ENERGOCOM" and the Ukrainian Company „UCRINTERENERGO", the average buying price for the electric power from Ukraine starting 01.07.2006 had to be no less than 3,1 US ¢ for 1 kWh, with further monthly increase with 0.1 US ¢ until it reaches the average sales price on the internal market of Ukraine[2]). Under the circumstances when there is no demand for load, during the period from 09.11.2005 until 11.01.2007 the MTPP employed only one energy unit with a mixed gas-steam cycle on natural gases.

To be noted that, the annual electricity consumption of the residential sector of the administrative-territorial units on the left bank of the Dniester River is circa 350 million kWh, another circa 1.4 billion kWh is the annual consumption of the Combined Metal Works in Ribnita (ATULBD). Over the period of time from 1995 to 2006, the annual production of electricity on the left bank of the Dniester River varied between 1.7-5.0 billion kWh, of which circa 40-60 percent was supplied to the Republic of Moldova and/or exported to southern regions of Ukraine (see Table 3).

[1] The average annual sales price of natural gas in 2007 was 172 USD/1000 m^3, and in 2008 respectively, circa 238 USD/1000 m^3, including: 190.86 USD/1000 m^3 in the I quarter of the year, 216.6 USD/1000 m^3 in the II quarter, 253.0 USD/1000 m^3 in the III quarter, and 287.6 USD/1000 m^3 in the IV quarter.

[2] It should be noted that in conformity with recently concluded agreements between the Governments of the Republic of Moldova and Ukraine in May 2008 in Kiev, the average price for the electric power supplied from Ukraine starting 01.06.2008 was increased to 4.4 US ¢ for one kWh, with further increase to 7.5 US ¢ for one kWh by 01.07.2009. The price proposed to the Republic of Moldova by the MTPP in 2008 was 5.5 US ¢ for one kWh, however with no guarantees to ensure long term supplies at a stable price, in particular reasoning from the increasingly growing selling prices for natural gas supplied by the Russian Federation.

In January-March 2007, the MTPP exported circa 211 million kWh of electricity in Belarus and Russian Federation, however, due to fact that Ukraine introducing increased fees for transit of electricity on its territory, export was re-oriented towards Romania. In July –December 2007, the MTPP exported circa 554 million kWh at an average price of 5.0 Euro ¢. Circa 900 million kWh of electricity were contracted and supplied to Romania in 2008.

In 2009 it is planned to increase supply of electricity to Romania by three times and with this in view, a scheme to exclude several energy units of the MTPP from the energy system of the Republic of Moldova and connecting them to the energy system of Romania, is being currently implemented (Moldovan and Romanian energy systems are in different synchronisation zones; integral synchronization of the MTPP to the energy system of Romania requires a change of the plant generator rotation frequency). Energy export will be done through the interconnection electric lines of 110 kV and 400 kV of the MTPP (ATULBD) – Vulcanesti (Moldova), and Vulcanesti (Moldova) – Isaccea (Romania). Implementation of this scheme will allow to increase the deliveries of electricity to Romania (a component part of the zone 2 of the Union for Coordination of the Electricity Transport (UCET), on the territory of which it will be created by prior coordination with the UCET administration, a passive energy island – a delimited load node with no sources of generation, to which the MTPP will supply electricity through a radial connection system) up to 400 MW or 290 million kWh per month (circa 3.5 billion kWh per year).

The Russian Company *Inter RAO EES'* Strategy for year 2010 is to ensure conditions for the plant to operate at a capacity of at least 1,500 MW, assuring export of energy towards the Balkan countries exceeding 6.0 billion kWh per year. Aiming at implementation of the MTPP rehabilitation and upgrading plans, the Russian company intends to invest circa 160.8 million USD in the next five years, so as to make possible to increase in the long run electricity exports up to 10 billion kWh per year.

1.1.2. Heat Production Technologies

Centralized heating systems operate currently in Chisinau, Balti and in some district centres in the country (Aneni Noi, Cahul, Calarasi, Cimislia, Edineti, Glodeni, Stefan Voda, Ungheni). Heat supply to consumers in Chisinau is performed by JSC „Termocom". Heating is provided by main heat supply pipelines (224 km), pipelines of the inter-district heat supply networks (265 km) and hot water supply pipelines (214 km), as well as polyurethane insulated underground pipelines of a length of 9,173 km and 491 central thermal points. In the city of Balti the company CHP-North, operator of the local CHP plant, performs both heat production and distribution. Distribution of heat and hot water in Balti is carried out by a 195.2 km heat supply network and 67 heat distribution points. In suburban area of Chisinau (Southern, Western, and Eastern Heat Plants) centralised heating is provide by 14 heat units with capacity 1.2 – 34.4 Gkal/h and three water supply units of capacity 320 – 400 Gkal/h each.

Simultaneous generation of electricity and heat is organized at CHP-1 in Chisinau with an installed 66 MW electric and 296 MW thermal capacity; CHP-2 in Chisinau with an installed 240 MW electric and 1,397 MW thermal capacity and CHP–North in Balti with an installed 24 MW electric and 165 MW thermal capacity.

Heating index that represents the ratio between the installed thermal capacity of the installations that function in the co-generation cycle and the total thermal capacity (co-generation plus hot water boilers) is quite small at the CHP-1, CHP-North and CHPs of the sugar factories: for example, in 1990 the total thermal capacity for the country represented 16.8 GW, and the thermal capacity of the adjustable plugs and counter-pressure turbines from the public CHPs and CHPs of the sugar factories was only 1.7 GW. Global efficiency (ratio between the sum of the electric and thermal energy and the energy of the consumed fuel) at the CHPs with a nominal functioning regime (at the designed parameters of the equipment) is quite high, of 80-90%. Because the electric efficiency at the

CHPs from the Republic of Moldova is under 20% (the efficiency at only CHP-2 is about 30%), it is considered that efficiency of these technologies is reduced.

The total electricity production has reduced during 1990-2005 in the Republic of Moldova by 82%, and the total thermal energy production – by 86% (Tables 2, 3 and 4). The strong diminution of electricity production, in particular at CHPs can be explained, first of all, by low sails of heat that depend directly on population solvability and payments for the delivered heat, which resulted in a continuous increase of the unpaid bills, especially in the early 2000'. As a result, less money was available to purchase fuel, and, consequently, the production volumes decreased.

Table 4: Heat Production on the Right Bank of Dniester River in the Republic of Moldova within the 1990-2007 time series, thousand Gcal

	1990	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Heat Production – Total	22212	10208	7507	7097	7077	6590	6120	4647
Combined Heat Power Plants	7220	4657	3641	3528	3659	3294	3127	2534
Thermal Plants	14802	5542	3862	3568	3417	3296	2991	2113
Other Production Units	190	9	4	1	1	–	2	–
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Heat Production – Total	3057	3298	3217	3347	3147	3591	3552	3094
Combined Heat Power Plants	1847	2113	2128	1922	1790	2140	2165	1855
Thermal Plants	1207	1183	1087	1423	1357	1451	1386	1238
Other Production Units	3	2	2	2	–	–	1	1

Heat is produced also by thermal plants (TP) of different types, producing hot water and steam for all sectors of the national economy, including for the residential sector. The current structure of thermo-energy sector in the Republic of Moldova is as follows:

1. Large thermal plants – from 50 to 200 Gcal/h (58-240 MW) have a share of 0.3% of all, and volume of deliveries of thermal bearer in 2007 year represented about 29.0% of all.
2. Medium size thermal plants - from 20 to 50 Gcal/h (23-58 MW) have a share of 0.7% of all, and volume of deliveries of thermal bearer in 2007 year represented about 7.8% of the total.
3. Small size thermal plants - up to 20 Gcal/h (up to 23 MW) have a share of 99.0% of all, and volume of deliveries of thermal bearer in 2007 year represented about 63.2%.

For all Moldovan thermal plants coal and heavy oil are the main fuels in non-gas-supplied areas and in gas-supplied areas these types of fuel serve as reserve ones. To be noted, that in 2007 about 1238 thousand Gcal was produced by thermal plants, from which 11 thousand Gcal based on coal combustion, 32 thousand Gcal based on residual fuel oil combustion, 1159 thousand Gcal based on natural gas combustion, 36 thousand based on renewable energy sources and 1 thousand Gcal based on other sources.

Because TPs that use residual fuel oil need steam, they are equipped, besides the hot water boiler, with steam boilers, DKVR or DE type, for heating and pulverization of residual fuel oil. The way "fuel and air – burning gas" is not too different from the way of CHPs, except the fact that preheating of air is not used. Most TPs boilers are not equipped with steam over-heaters; thus, boiler produce saturated steam. Working pressure of DKVR and DE boilers represents 14 bar; so, the steam temperature is of 194ºC. The steam is delivered to technological consumers (pressure of 10-13 bar) directly from the collecting bar of the thermal plants boilers.

In the Republic of Moldova, thermal plants of large (50-200 Gcal/h) and medium (20-50 Gcal/h) productivity are used in large and local central heating systems from country former regional centers – 39 localities, as well as at large and medium size industrial enterprises. Small thermal plants (0.6-20 Gcal/h) serve the local systems, small enterprises, institutions, administrative and commercial and residential buildings.

Thermal plants with large and medium productivity are equipped with large-size hot water boilers of type KV and PTVM and /or with steam boilers of type DKVR or DE with 25 t/h productivity.

Thermal plant of "Dobruja Cardboard Factory" is an exception, because at the beginning it was designed to be a CHP. This plant is equipped with boilers similar with those from CHP-1.

Boilers of the large and medium thermal plants have a regular efficiency: at gas burning – 89-93% and at oil burning – 86-91%, e.g. corresponds to the specific fuel consumption of 38.3-36.7 kg. c.e./GJ and 39.7-37.5 kg. c.e./GJ. Small local TPs function on natural gases and coal, and the industrial ones consume heavy oil, being equipped with steam boilers of type E, DE or DKVR with a productivity of 1-6.5 t/h. These plants are equipped with hot water boilers with a productivity of 0.1-3.0 MW. The efficiency of these boilers is 70-91% when gas is used, and 60-88% when oil and coal are burned, e.g. corresponds to the specific fuel consumption of 48.8-37.5 kg. c.e./GJ and 56.9-38.8 kg. c.e./GJ. For the same type of fuel the high specific consumption appears for smaller installations.

From the above mentioned, it comes out that about 63% of thermal energy used in the Republic of Moldova is produced at TPs equipped with small and less efficient boilers with an efficiency of 0.64-0.80, while the modern boilers of the same productivity have an efficiency of 0.95 and higher.

The large thermal plants of Chişinău (TP South, TP East, TP West and TP Munceşti) are part of "Termocom" JSC. According to JSC "Termocom", losses of heat are currently as high as 19–21%.

Reducing losses of heat supply networks remains a priority for the energy sector and complies with EU policies including the Green Paper of 2006. A key issue in this context is energy efficiency regulation, including installation of energy efficient equipment and optimization of heat demand. Heat supply network of Chisinau starts its operation in 1977 and currently operates at a low rate of its capacity.

1.2. Energy Markets

1.2.1. Electricity Market

Electricity market in 2008 has the following actors: 4 generating power plants - 3 CHPs (joint-stock companies with prevailing public capital) and 1 HPP (state-owned enterprise) holding licenses for generation of electricity; 1 transmission company (a state–owned entity) acting as a system operator; 3 distribution companies: 1 owned by Spanish company „Union Fenosa", 2 are state-owned. All companies hold licenses for distribution and supply of electricity at regulated tariffs, and 1 company is licensed for supply of electricity at non-regulated tariffs. 12 companies hold licenses for supply of electricity at non-regulated tariffs. Electricity market potential is estimated at 3.22 TWh/year and electricity consumption is 3364 GWh in 2007 (Table 5).

Table 5: Electricity Market in the Republic of Moldova (the right bank of Dniester River)

Generation	
Fossil fuel	96 %
Hydro	4 %
Electricity market size	3.22 TWh / yr
Deficit installed capacity over demand:	500 MW
Net Electricity Import	76% from Ukraine, Transnistria
Average residual electricity price (2008)	per kWh: USD ¢ 10,0
Electricity production	1100 million kWh
Electricity consumption	3364 million kWh
Electricity exports	0 kWh
Electricity imports	2931 million kWh

Source: National Bureau of Statistics, 2008

The electricity and natural gas markets in the Republic of Moldova, were mainly formed in 1997-2001, when the energy and natural gas sectors were subject to re-structuring and the main operators came into the market: electricity transport central dispatch enterprise, electricity distribution and supply companies, natural gas distribution and supply companies, ANRE (National Agency for Energy Regulation), etc.

During 2001-2008 the electricity and natural gas markets were not subject to essential structural modifications. Thus, in 2008, 2 licenses were issued in the energy sector, both of them authorizing the electricity production activity (issued for 6 months) to Moldovan Thermal Power Plant (MTPP) (another common name for the respective plant is Regional State Electric Power Station of Moldova - CERSM). In the same timeframe 4 licenses expired (2 licenses issued to MTPP for electricity production and 2 licenses for electricity supply at unregulated tariffs.

Until the start of privatization in 1997 the State Company 'MOLDENERGO' was responsible for the production of electricity and heat. In 1997, a reform of the energy sector was launched, and hence the state company was divided into 16 new entities: 8 electricity production companies, 3 district heating companies and 5 electricity distribution companies.

In 2000, the Spanish company Union Fenosa purchased almost two-thirds of the electricity distribution network, thus becoming Moldova's largest foreign investor. The company bought three of the five regional electricity distribution companies (REDs) in the country, RED Chisinau (servicing the capital), RED Centre (servicing central Moldova) and RED South (servicing southern Moldova) for USD 26 million in an open tender. The Union Fenosa service area covers 60 % of Moldova's population. Two other regional electricity distribution companies, RED North (servicing the northern Moldova) and RED North-West (servicing the north-west of the country) remain state owned.

1.2.2. Electricity Tariffs

During the beginning of 2008, ANRE adjusted the tariffs for electricity and thermal energy production and supply, establishing the following tariffs for electricity: produced by CHP-1 – 113.66 bani/kWh, produced by CHP-2 – 85.25 bani/kWh and produced by CHP North – 89.6 bani/kWh; for thermal energy produced by: CHP-1 – 390.37 MDL/Gcal, CHP- 2 – 289.28 MDL/Gcal and for thermal energy supplied to consumers by CHP North – 634 MDL/Gcal (official exchange rate for national currency on 1.06.2009 was 11.2109 MDL for 1 USD, see as reference the official web page of National Bank of Moldova: http://www.bnm.md/en/official_exchange_rates).

Proceeding from the new tariffs, applied for electricity production by CHPs and the clauses included in the contract for electricity acquisition from the Ukraine, which provide for 0.1 cent USA/kWh monthly increase in the electricity acquisition price, ANRE set new tariffs for electricity supply to consumers by REDs for 2008. According to ANRE decision, it was established that RED Union Fenosa apply the 71 bani/kWh tariff to consumers connected to 110 kV networks, the 94 bani/kWh tariffs to household consumers, living in blocks of apartments equipped, according to the projects, with electric cookers and the 98 bani/kWh tariff to other RED North-West apply the 103 bani/kWh tariff to household consumers living categories of consumers. The decision also stipulates that RED North and in blocks of apartments equipped with electric cookers and 108 bani/kWh to other categories of consumers.

Proceeding from this average tariff and the principle of adequate and non-discriminatory tariffs, in approving them, ANRE was guided by the principle of gradually removing cross subsidization between categories of consumers. The decision to increase the tariff for gas supply to CHPs by 36.1%, in relation to 27% rate of increase in the average tariff, was taken on the assumption that the tariff in force did not cover the real costs and was subsidized by other categories of consumers. Removing these subsidies led into a slower increase in tariffs (by 20.6%) both for households consuming more than 30 m^3 per month and for economic entities. Removing the subsidization placed the consumers

of thermal energy supplied by CHPs under comparative conditions, in terms of one Gcal price, with the consumers using autonomous heating systems, most of who live in rural areas. With the approval of the new tariffs for natural gas, the tariffs for electricity and thermal energy production and supply by CHPs were subject to adjustment. For CHP-1 the tariffs were set as follows: electricity 138.38 bani/kWh, thermal energy – 512.05 MDL/Gcal; for CHP-2–electricity 104.28 bani/kWh, thermal energy – 410.44 MDL/Gcal; CHP North electricity – 106.56 bani/kWh, thermal energy – 786 MDL/Gcal. On average per sector the tariffs for electricity produced by CHPs increased by 22%, those for thermal energy – by 36.4%. The fact that ANRE removed part of the existing subsidies (about 20%) for thermal energy production, made on the account of electricity, lead to a slower increase of electricity tariffs, compared to the ones for thermal energy.

Proceeding from the new tariffs for electricity produced by CHPs and the acquisition price for energy imported from the Ukraine, the adjusted tariffs for electricity supplied to consumers by RED Union Fenosa are 79 bani/kWh for consumers connected to 110 kV networks and 110 bani/kWh, for all other categories of consumers. According to the same decision, RED North and RED North-West apply a unified tariff – 120 bani/kWh for all categories of consumers. Application of unified tariffs for electricity supply to the population is motivated by the fact that currently, it is necessary to remove the existing subsidization for household consumers using electric cookers and place them under equal conditions with other consumers, which action is fully consistent with the requirements of European directives and the Collaboration Agreement between the Government of the Republic of Moldova and the International Monetary Fund in terms of setting adequate and non-discriminatory tariffs for all categories of consumers.

The updating of the afore-mentioned tariffs in 2008 was performed based on minimum costs, strictly necessary for acquisition, transportation and distribution of natural gas, electricity and thermal energy.

The tariffs for the electrical power need to be urgently adjusted to the real production costs (including depreciation of investments as if made for a new a plant). Thus the electrical power generation market could become attractive for investors, while construction of new plans and rehabilitation and upgrading of the old ones would add to the energy security of the country. In fact at least six projects for construction of electrical power generation plants were announced and even initiated in diverse regions of the Republic of Moldova in the past seven years. None of these projects has been implemented. One of the factors that blocked the projects implementation was the low tariffs, because some investors, as a project implementation precondition, required that the Government has to commit to buy the produced electrical power at a price that had to be set from the very start, that would include all production costs plus the possibility to pay back the investment within 7-10 years.

1.2.3. Gas Market

The most used type of fuel in the Republic of Moldova is natural gases. This type of fuel has been used in the RM since 1966, being 100 percent imported from Russian Federation through the gas pipeline system. The main operator on the natural gas market in the country is the Moldovan-Russian joint venture “MOLDOVAGAZ”.

The infrastructure of the ‘Natural Gas Sector’ currently includes: high and medium pressure main gas pipelines (circa 593.6 km), high and medium pressure connection gas pipelines – circa 714 km, medium and low pressure gas distribution pipelines – circa 12465 km, 5 transported gas compression and metering stations and 65 gas distribution stations (of which 9 were put into operation in 2005-2007).

Two main gas pipelines systems cross the territory of the Republic of Moldova: in the North: the Ananiev – Cernauti – Bogorodciani gas pipeline (transit capacity: 8.7 bill. m^3/year); in the South:

Sebelinka – Dneproppetrovsk – Krivoi Rog – Ismail and Razdelnaia – Ismail gas pipeline (total transit capacity: 15.8 B. m^3/year) and Ananiev – Tiraspol – Ismail gas pipeline (transit capacity: 20.0 B. m^3/year). The total capacity of the gas transit system towards the Balkans is around 43 B. m^3/year, however it is currently used at a capacity of only circa 25 B. m^3/year. Connection gas pipelines and gas distribution stations situated on the territory of the RM allow deliver around 9 B m^3/year to the consumers in the RM, while real consumption at present is around 2.5-3.0 B. m^3/year.

The RM has its own natural gas and oil resources, however quite modest. The natural gas reserves are concentrated in the settlement Victorovca, Cantemir district (the estimated amount is circa 346 billion m^3), while oil reserves are in Valeni, Cahul district (the estimated amount is circa 2-3 million tones).

On July 6, 1995 the Government of the Republic of Moldova has entered into a concession agreement with an American company Redeco LTD to research and exploit natural gas and oil resources in the Republic of Moldova. The works started in 1997, at 8 oil wells that were drilled at 1 km depth, however, with no palpable results. The amount of gas captured from the reserves at Victorovca was around 3 thousand m^3/day, or circa 1 mln. m^3 per year. The amount of oil extracted in Valeni, was also insignificant (10 tones in 2002, 600 tones in 2003). Since 2003, the Redeco LTD business was joined by AS Petrol of the RM, which by 2004 managed to increase extraction up to 14 thousand tones of oil per year (according to information provided by the Institute of Ecology and Geography of the ASM (2004), the specific density of the oil extracted in Valeni being 941 kg/m^3). The extracted petrol is refined at Comrat refinery which has a capacity of 30 thousand tones per year, and was set into exploitation on July 15, 2005. By the end of 2006, Valiexchimp LTD Company became the main partner of Redeco LTD group. By the end of 2007, Valiexchimp LTD founded a joint venture with the Irish 'Island Oil&Gaz plc', starting together a joint investment program in oil and natural gas extraction and refining, estimated at 12 million euro, including 44 oil wells drilling on the oil fields in Valeni and Victorovca, construction of 9 km of gas pipelines to connect the oil fields in Victorovca to 'MOLDOVAGAZ' J.S.C. network, and upgrading the oil refinery in Comrat, to make it possible to initiate production of bitumen and asphalt for road construction. On October 10th, 2007 the Government accepted Redeco LTD's leasing concession to Valiexchimp LTD on all rights and obligations under the Concession Agreement for development and exploitation of oil and natural gas reserves in the Republic of Moldova as of July 6th, 1995. However, the rights and obligations of Valiexchimp LTD do not include prospecting and exploitation of oil and natural gas resources in the Republic of Moldova.

LPG are used in the RM starting 1946, and are currently sold to settlements not connected to gas networks (specific density of LPG is 584 kg/m^3). LPG is refined and supplied to consumers through filling stations having a total storing capacity of 6.9 thousand m^3.

Activity data related to amounts of natural gas transited across the Republic of Moldova, as well as data about amounts of natural gas and liquefied petroleum gas sold in the Republic of Moldova are provided by the MOLDOVAGAZ (Table 6).

Like in the previous years, in 2008 the only natural gas supplier for Moldova was the Russian concern S.A.D. „GAZPROM". The total of acquired natural gas on the right bank of Dniester River was estimated at 1226.9 million m^3 and, relative to the previous year, decreased by 6.0%, the preceding decrease in 2007 being more considerable - 8.0 %.

From January 1, 2008, the contractual price for natural gas acquisition increased by 12.4%, from 170 to 191 USD/1000 m^3, a price established for the first quarter of 2008. Further, subject to quarterly modifications and calculated according to the formula pre-established in the acquisition contract, the price increased to 217 USD/1000 m^3 in the second quarter, 258 USD/1000 m^3 in the third

quarter and 284 USD/1000 m^3 in the fourth. Thus, the average price for natural gas acquisition from this company in 2008, taking into account the specific heat of combustion was estimated at 232.37 USD/1000 m^3, showing a 34.4% increase over (172.89 USD/1000 m^3).

Table 6: Consumption of Natural Gases and Liquefied Petroleum Gases in the Republic of Moldova in the time series from 1990 through 2005, million m^3 and kt

	1990	1991	1992	1993	1994	1995	1996	1997
Natural Gas Transited across the RM	25000	23000	21000	19000	18265	20909	22396	16934
Imported Natural Gas	3844	3873	3435	3093	3012	3005	3489	3676
Technological Losses	30	30	58	133	151	214	267	184
Natural Gas Sold	3814	3843	3377	2960	2861	2791	3222	3492
on the right bank of the Dniester	NA	NA	NA	1729	1558	1770	1883	1729
on the left bank of the Dniester	NA	NA	NA	1132	1233	1452	1609	1132
Liquefied Petroleum Gas sold, kt	145.9	128.0	75.4	30.9	14.5	14.1	15.7	19.3
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Natural Gas Transited across the RM	16021	16790	19170	18524	21032	22132	23625	25017
Imported Natural Gas	3333	2857	2478	2732	2420	2615	2687	2819
Technological Losses	164	155	117	90	92	103	120	103
Natural Gas Sold	3169	2702	2361	2642	2328	2512	2567	2716
on the right bank of the Dniester	1700	1221	920	1057	1052	1132	1141	1315
on the left bank of the Dniester	1469	1481	1441	1585	1276	1380	1424	1400
Liquefied Petroleum Gas sold, kt	19.8	10.2	3.4	3.1	2.9	2.1	2.8	1.7

Note: NA – Not Available; **Source:** Official Letter from S.A. MOLDOVAGAZ No. 06-1253 from 27.09.2006.

The data presented in the Table 7 show that the total consumption by the natural gas market on the right bank of Dniester (both supplied to end-consumers and directly supplied from pipelines to enterprises outside JSC Moldovagaz system, the latter being estimated at 23.6 million m^3 in 2006, 12.6 million m^3 in 2007 and 11.2 million m^3 in 2008) declined by 78.0 million m^3, or by 6.5%, in comparison with the previous year, though the decline is by 113.2 million m^3 (8.6%) less significant than in 2007. The decline was mainly caused, on the one hand, by temperatures milder than the annual average during the cold season of 2008, resulting in reduced consumers' demand and, on the other hand, by the price increase for natural gas acquisition, this urging the consumers to optimize the use of natural gas.

Table 7: Volume of Natural Gas Acquisitions and Supplies to Consumers

Indicators	Unit of Measurement	2004	2005	2006	2007	2008	Modification 2007/2006		Modification 2008/2007	
							Sum	%	Sum	%
Volume of Natural gas Acquired - total	mln.m^3	1263.0	1418.6	1418.2	1305.4	1226.9	-112.8	-8.0	-78.5	-6.0
	mln. MDL	1160.2	1364.9	2473.3	2727.3	3007.6	+254.0	+10.3	+280.3	+10.3
Volume of Natural Gas Supplied (including from transportation networks to enterprises outside JSC	mln. m^3	1141.4	1315.0	1322.0	1208.8	1130.8	-113.2	-8.6	-78.0	-6.5
	mln. MDL	1330.6	1555.2	2440.5	3148.3	3603.4	+707.8	+29.0	+455.1	+14.5

Source: ANRE, 2008

As regards the development of natural gas supply per distribution enterprise it is necessary to note that in 2008, out of the total of 12 distribution enterprises on the right bank of Dniester river, 7 enterprises increased the volumes of natural gas supply to consumers, such as "Balti-gas" LLC and "Floresti-gas" LLC, etc, by 9.9 million m^3 (9.7%), and by 7.9 million m^3 (16.3%) accordingly (Table 8, Figure 1).

The other 5 distribution enterprises decreased the volumes of natural gas supply to end consumers, among them "Orhei-gas" LLC - by 64.6 million m^3 (2.5 times). The supply decreased mainly because the most significant consumer –"Lafarge-Cement" JSC in Rezina refused to use natural gas in favour of coal. The graphs show the structure of supplies per enterprise and the structure of consumption.

Table 8: Evolution of Natural Gas Supply per Distribution Enterprises

Enterprise Name	Useful supply to consumers, million m^3					Share in the Total Supply %				
	2006	2007	2008	Deviation 2007/ 2006, %	Deviation 2008/ 2007, %	2006	2007	2008	Deviation 2007/ 2006, p.p.	Deviation 2008/ 2007, p.p.
"Chisinau-gas " LLC	760.1	710.6	677.4	-6.5	-4.7	58.5	59.4	60.5	+0.9	+1.1
"Ialoveni-gas " LLC	75.1	64.1	66.1	-14.7	+3.2	5.8	5.4	5.9	-0.4	+0.5
"Balti-gas " LLC	121.4	101.8	111.7	-16.1	+9.7	9.3	8.5	10.0	-0.8	+1.5
"Edinet-gas " LLC	50.8	44.3	44.2	-12.8	-0.2	3.9	3.7	3.9	-0.2	+0.2
"Floresti-gas " LLC	53.4	48.6	56.5	-9.1	+16.3	4.1	4.1	5.0	0.0	+0.9
"Orhei-gas " LLC	102.6	108.7	44.1	+5.9	-59.5	7.9	9.1	3.9	+1.2	-5.2
"St. Voda-gas " LLC	18.5	15.1	16.9	-18.5	+12.2	1.4	1.3	1.5	-0.1	+0.2
"Gagauz-gas " LLC	42.3	33.3	31.4	-21.3	-5.8	3.3	2.8	2.8	-0.5	0.0
"Cahul-gas " LLC	21.3	20.2	20.6	-5.2	+2.1	1.6	1.7	1.8	+0.1	+0.1
"Taraclia-gas " LLC	11.9	9.9	8.2	-17.0	-16.7	0.9	0.8	0.7	-0.1	-0.1
"Cimislia-gas " LLC	21.3	19.8	21.5	-6.9	+8.3	1.6	1.7	1.9	+0.1	+0.2
"Ungheni-gas " LLC	19.7	19.9	21.0	+0.8	+5.5	1.5	1.7	1.9	+0.2	+0.2
Total	**1298.4**	**1196.3**	**1119.6**	**-7.9**	**-6.4**	**100.0**	**100.0**	**100.0**	**0.0**	**0.0**

Source: ANRE, 2008

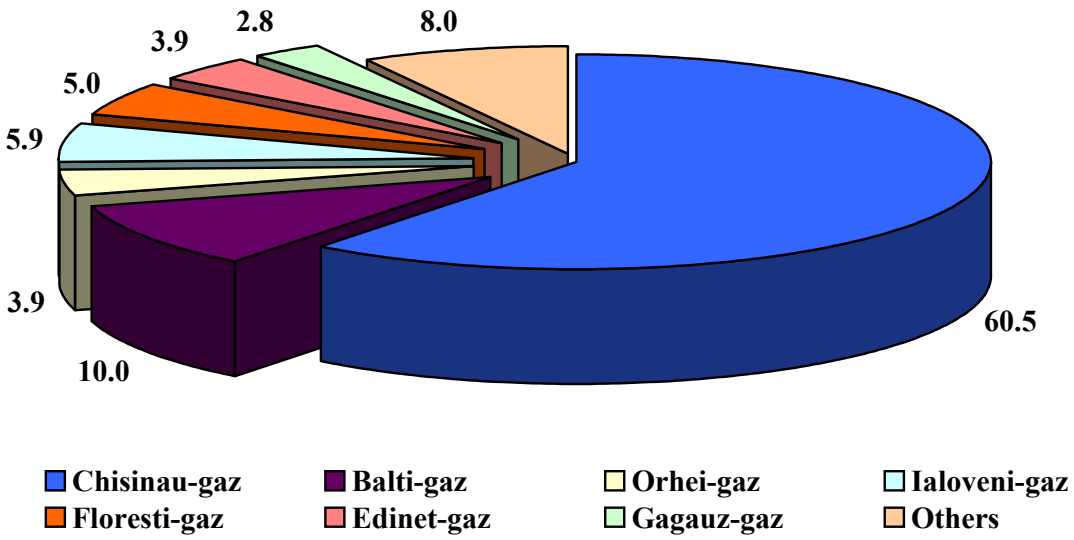

Figure 1: Structure of Natural Gas Supply in 2008, %

In 2008 the gas consumption dropped for all categories of consumers, except households, thus revealing the tendency of constant decrease in natural gas consumption, registered in the recent years.

This tendency occurred due to the decrease in the gas consumption by CHPs, thermal stations producing and supplying heat to urban consumers through centralized supply systems and other economic entities. The latter decreased consumption most significantly – by 18.4%, or 304.1 mln m^3.

The CHPs consumed 410.9 mln m^3 – a decrease by 16.7 mln m^3 (3.9%) relative to 2007, whereas the thermal stations consumed 74.1 mln m^3, less by 5.2% compared to the previous year. It is only household consumers that increased natural gas consumption – by 9.4 mln m^3 (3.1%), i.e. from 303.3 mln m^3 in 2007, to 312.7 mln m^3 in 2008.

With reference to consumption structure, the energy sector enterprises are estimated to have the biggest share - 42.9%, followed by household consumers – with 27.6%, other economic entities (other than energy sector) - 26.9% (Table 9). 2.6% is the share of natural gas supplied directly from trunks and that supplied to enterprises outside JSC „MOLDOVAGAZ".

The revised version of the Regulation on Supply and Use of the Natural Gas is the document drafted and approved in 2008 with reference to the natural gas market.

The Regulations comprises a number of newly-identified concepts, as well as provisions meant to help find timely solutions to the challenges the natural gas suppliers and consumers face.

The document includes a new separate Chapter with reference to the rights and obligations of the parties. It was also modified in the section specifying the procedures for connecting the consumers' equipment to natural gas networks. A series of other different modifications were made to improve this regulatory act.

Table 9: Natural Gas Consumption per Consumer Categories

Consumer Categories	2006		2007		2008		2007 / 2006			2008 / 2007		
	mln m^3	%	mln m^3	%	mln m^3	%	mln m^3	%	p. p.	mln m^3	%	p. p.
Natural gas consumption (useful supply), total	1322.0	100.0	1208.8	100.0	1130.8	100.0	-113.2	-8.6	0.0	-78.0	-6.5	0.0
inclusive: households	360.8	27.3	303.3	25.1	312.7	27.6	-57.6	-16.0	-2.2	+9.4	+3.1	+2.6
of which: less than 30 m^3	110.6	8.4	107.0	8.9	110.0	9.7	-3.7	-3.3	+0.5	+3.0	+2.9	+0.9
more than 30 m^3	250.2	18.9	196.3	16.2	202.7	17.9	-53.9	-21.5	-2.7	+6.5	+3.3	+1.7
Combined Heat Power Plants	444.2	33.6	427.6	35.4	410.9	36.3	-16.6	-3.7	+1.8	-16.7	-3.9	+0.9
Thermal Plants for centralized energy supply	90.2	6.9	78.1	6.5	74.1	6.6	-12.2	-13.5	-0.4	-4.0	-5.2	+0.1
Other economic entities	394.6	29.8	372.7	30.8	304.1	26.9	-21.9	-5.6	+1.0	-68.6	-18.4	-3.9
Supplied directly from transportation networks, including enterprises outside Moldovagaz system	32.2	2.4	27.2	2.2	29.0	2.6	-5.0	-15.5	-0.2	+1.8	+6.7	+0.4

Source: ANRE, 2008

With the view of creating a legal framework favourable for the business and investment environment, for the social and economic development in conformity with the Law on Basic Principles for Regulating Entrepreneurial Activity, throughout 2008, ANRE participated in amending a number of legislative acts, such as the Law on Electricity and the Law on Gas. The proposed amendments were meant to improve the mentioned laws, regulating the supplier-consumer relations.

1.2.4. Gas Tariffs

As a result of price increase for natural gas, procured by from the Russian concern „GAZPROM" and electricity imported from the Ukraine, it was necessary to go through the second stage of tariff revision. ANRE Administrative Board approved, on 30.07.2008, new tariffs for natural gas supply, for electricity and thermal energy production and supply, in force since August 1. The new gas acquisition price - 252.98 USD/1000 m^3 set by "GAZPROM" for III quarter of 2008, is 32.4% or 61.98 USD increase over the previous price of 191 USD/1000 m^3, which was taken into account by ANRE in setting the tariff in January 2008. Whereas, according to ANRE estimations, the gas acquisition price in the IV quarter of the year, calculated according to the formula agreed upon in the natural gas acquisition contract, was expected to be 287.6 USD/1000 m^3 (Figure 2).

The average tariff for natural gas supply, based on the above-mentioned acquisition prices, was calculated as 3523 MDL/1000 m^3, which is 27% or 748 MDL increase over the previously approved tariff, early in 2008.

In order to move forward in gradual alignment to the principles of EU electricity and natural gas markets, ANRE intends to further act towards such priorities as: improving the tariff methodologies, setting economically-justified tariffs, ensuring a competitive environment based on clear rules,

enabling long-term decisions to be adopted and encouraging investment activity on both energy and natural gas markets.

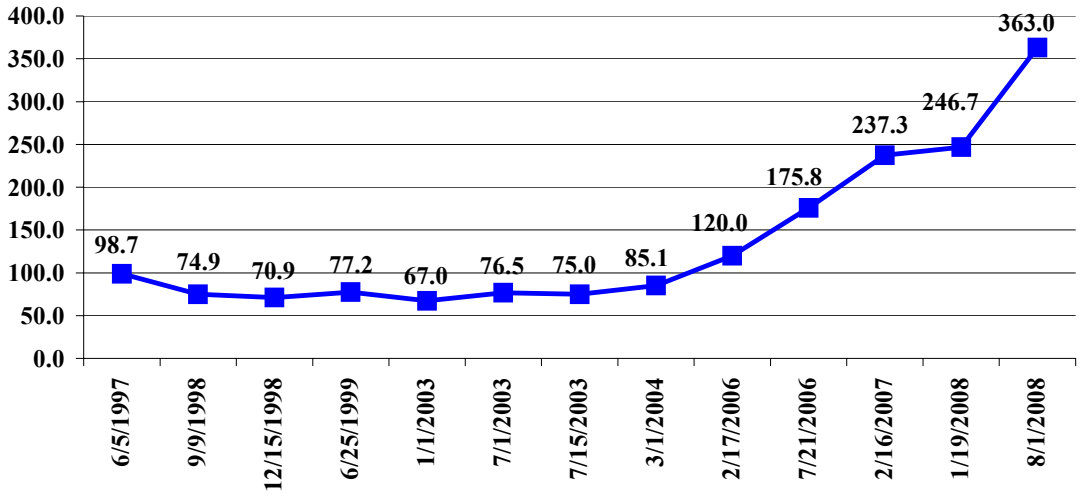

Figure 2: Evolution of Natural Gas Tariffs within 1997-2008 time series, USD/1000 m^3

1.2.5. Heat Market

Simultaneous generation of electricity and heat is organized at CHP-1 in Chisinau with an installed 66 MW electric and 296 MW thermal capacity, CHP-2 in Chisinau with an installed 240 MW electric and 1,397 MW thermal capacity and CHP–North in Balti with an installed 24 MW electric and 165 MW thermal capacity. Heat is produced also by thermal plants (heat-only) and some CHP in smaller towns.

Heat supply market is regulated by ANRE. In Chisinau and suburban area thermal energy is supplied by "Termocom" – public company of Chisinau Municipality. "Termocom" is responsible for production, transportation and distribution of thermal energy. The same functions in Balti city are carried out by "CHP-North"

1.2.6. Heat Tariffs

Tariff for thermal energy are established by ANRE and are approved by Decision No.299 of 30 July 2008 as shown in Table 10.

Table 10: Tariff for Thermal Energy, MDL/Gcal (without VAT)

Combined Heat Power Plants	Tariff, MDL/Gcal
CHP-1 Chisinau	512.05
CHP-2 Chisinau	410.44
CHP-North Balti	786.00

Source: ANRE, 2008

Removing the subsidization placed the consumers of thermal energy supplied by CHPs under comparative conditions, in terms of one Gcal price, with the consumers using autonomous heating systems, most of who live in rural areas. With the approval of the new tariffs for natural gas in 2008, the tariffs for electricity and thermal energy production and supply by CHPs were subject to adjustment. For CHP-1 the tariffs were set as follows: electricity 138.38 bani/kWh, thermal energy – 512.05 MDL/Gcal; for CHP-2– electricity 104.28 bani/kWh, thermal energy – 410.44 MDL/Gcal; CHP North electricity – 106.56 bani/kWh, thermal energy – 786 MDL/Gcal. On average per sector the tariffs for electricity produced by CHPs increased by 22%, those for thermal energy – by 36.4%.

The fact that ANRE removed part of the existing subsidies (about 20%) for thermal energy production, made on the account of electricity, lead to a slower increase of electricity tariffs, compared to the ones for thermal energy.

1.3. Energy Efficiency

1.3.1. Energy Intensity

The period following independence in 1991 has been characterized by a significant decrease in energy use in the country. This reduction in energy consumption is not a sign of improved energy efficiency, but is due to many other factors inherent to the transitional period, including production crisis, financial difficulties and irregular energy supply. Final energy consumption in 2005 was still 77% lower than in 1990.

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 transports (15%) sectors. Agriculture, although dominating in the economy of the country, has a small share in the final consumption of commercial energies (4%).

The economic and structural reforms 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 in processes is high and the energy losses are substantial. Both 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 (Figure 3).

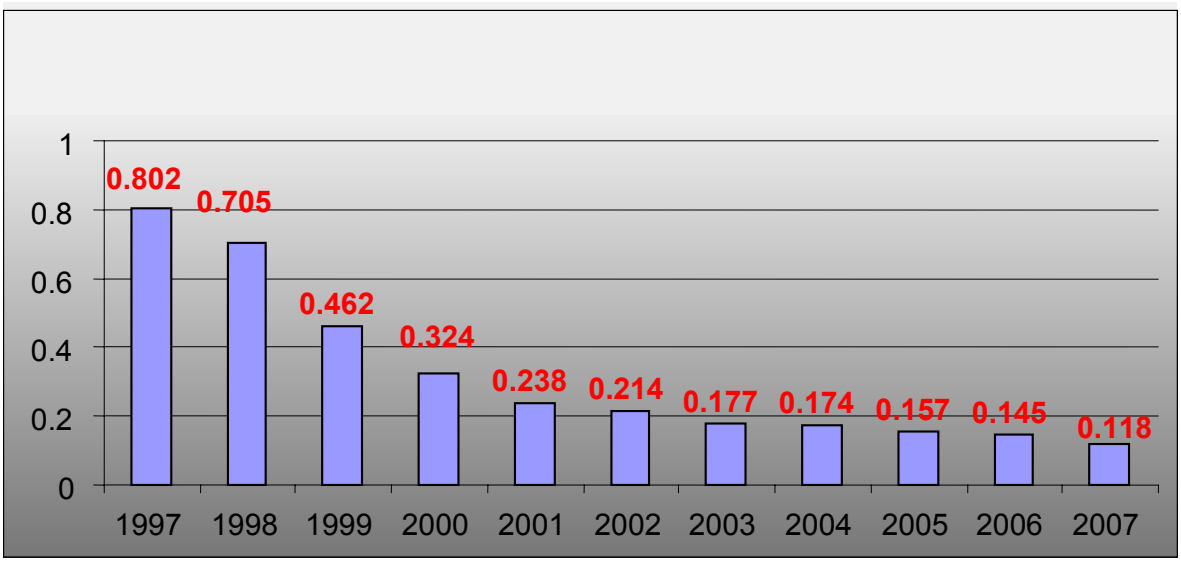

Figure 3: Energy Intensity of Industrial Production, t.c.e./1000 MDL

1.3.2. Energy Losses from Electricity, Gas Transmission and Distribution Grid

During 2008, the electricity acquired by the distribution enterprises, except eligible consumers, shows 1.2% growth (3737.4 million kWh), but the electricity supplied to consumers shows 2.7%

growth (3106.0 million kWh) over the previous year. Thus, confirming the benefit tendencies of the recent 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 separately per distribution enterprise. 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 fit the limits of losses, admitted by ANRE for 2008, exceeding it by 1.38%. The Table 11 presents the evolution of technological and commercial losses of electricity in distribution networks. The energy transmission and distribution losses make from 14 up to 25% (for comparison Germany: 6%). Power distribution networks are deteriorated and, are loaded at up to 50 % of nominal capacity.

Table 11: Losses Incurred by Electricity Distribution Companies

Electricity Distribution Companies	Losses Admitted at Tariff Calculation (In % with respect to the electricity coming into distribution networks)					Effective Losses (%)				
	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008
RED North	16.31	16.0	15.5	15.0	13.6	16.9	14.39	13.17	11.46	10.97
RED North-West	16.31	16.0	15.5	15.0	14.5	25.4	20.07	15.75	13.81	13.59
RED Union Fenosa	14.38	14.38	14.38	14.38	14.0	23.4	21.44	16.92	16.90	15.38

Source: ANRE

The Russian-Moldovan joint venture JSC MOLDOVAGAZ was set up, with 50% of its shares owned by "GAZPROM" of Russia, 36.6% by the Republic of Moldova and 13.4% by the Transnistrian region (part of the company's assets located in the administrative-territorial units on the left bank of Dniester). These shareholders are the owners of the gas system of the Republic of Moldova, including transit upstream (high pressure) pipelines in the territory of the country. According to the Gas Market Rules, MOLDOVAGAZ is designated as the national operator of the gas system.

Natural gas demand is covered by imports. The only supplier of natural gas is GAZPROM of Russian Federation. The national natural gas system includes upstream gas pipelines and a network of connecting pipes of total length about 1,400 km, four compressor stations, 74 distribution stations and several low pressure distribution networks. At the end of 2006 the total length of high, medium and low pressure gas pipelines was about 15,800 km. In addition, Moldova is also an important gas transit country. More than 20 bln m^3 of gas were transited through the Republic of Moldova in 2006.

Natural gas supply is highly uneven during the year; consumption during the cold season is 8-10 times higher than in the summer season. To cover seasonal consumption peaks natural gas stored at the Bogorodceni (Ukraine) natural underground storage is used, through the "Drochia" compressor station. Inability to regulate operation regimes diminishes the operation efficiency of this compressor station at low loads. The recent construction of the Tocuz–Cainari–Mereni main pipeline has increased security of natural gas supply in the central part of the country, whilst, through connections to this upstream pipeline, security of gas supply for the entire country also increased.

1.3.3. Electricity and Gas Metering

100% of industrial and residential customers have a conventional meter installed. If the customers do not pay for electricity, they are disconnected within 30 days period. Reconnection to electricity grid is undertaken after paying for consumption and an additional tax for reconnection. Gas metering for residential and industrial customers are installed. If one meter is installed for a residential building with more than one apartment then the indicated consumption is divided equally to number of persons in the house.

1.3.4. District Heating

Municipal company “Termocom” is district heating supplier in Chisinau and suburban area and provides:

- Heating of 200 thousand apartments; 120 kindergartens; 157 schools; 21 hospitals; 51 higher education institutions; 44 medical institutions; and a majority of all offices and organizations;
- Hot water supply for 2.4 thousand residential buildings out of total of 3.5 thousand.

Centralize heating system of Chisinau is provided by Termocom and has:

- 3 Thermal Plants (Eastern, Western and Southern);
- 19 thermal units in suburban area;
- 502 centralized heating points;
- 3118 nodes for elevators and 791 control nodes;
- 233,5 km of transport and distribution networks (in 2 pipes);
- 285 km of district heating networks (in 2 pipes);
- 204 km of hot water supply networks;
- 41 individual thermal nodes.

Since 2001 the losses of thermal energy in energy networks decreased from 593.3 thousand Gcal, in 2001, to 400.5 thousand Gcal in 2005, or from 35.66%, of total supply in 2001, to 19.17% in 2005.

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

In 2007, the Energy Strategy of the Republic of Moldova until the year 2020 was adopted. The Strategy acknowledges energy efficiency as one of the priorities for the national economy and for the energy sector. Energy Efficiency has been also 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 reduce the financial impact of the energy sector on the GDP by 1.6-1.7% per year, starting with 2008. The pursuit of higher energy efficiency does not concern only the energy sector but cuts across all sectors of the economy and energy consumption and, therefore, has a highly decentralized character. As a result, it requires a variety of approaches and types of measures, which generally differ from one sector to another.

The key principles of state policy in the field of energy efficiency are:

- gradual approximation of national legislation with EU secondary legislation on energy efficiency until the year 2010;
- increasing awareness and providing technical-scientific and information support for energy saving and energy efficiency activities;
- harmonization of interests of energy consumers, suppliers and generators for energy saving;
- transparent granting of incentives for energy efficiency interventions;
- mandatory implementation of energy saving measures by legal entities;
- efficient monitoring by the State of the progress in efficient use of energy resources.

Specific objectives in the field of energy saving and increasing energy efficiency include:

- implementation of the National Program for Energy Conservation 2003-2010 and its due extension, with an on-going biannual update, while taking into account the EU Commission Green Paper of 22 June 2005 on "Energy Efficiency - or Doing More With Less" and the Green Paper of 8 March 2006 "A European strategy for sustainable, competitive and secure energy";

- developing, approving and applying standards aimed to increase efficiency of energy consuming equipment, especially in line with standards set out in EU legislation on energy efficiency;
- developing and encouraging through promotional material and moral incentive energy saving initiatives that increase energy efficiency within the budget funded sector, households and national economy branches, including the energy sector;
- promoting the use of efficient, economically viable and non-polluting energy technologies and equipments in all sectors of the national economy;
- encouraging application of new rules for investments and incentives to increase energy efficiency whilst promoting development, such as setting up specific standards for energy resources consumption, which would accept use of resources saved as a result of energy efficiency actions for other production purposes or activities of enterprises and organizations;
- establishing a database on energy efficiency options and providing free access of legal entities and individuals to this information;
- promotion of consultancy and audit services by private or state organizations, which will provide information about energy efficiency programs and technologies, as well as technical assistance to state and private sector consumers;
- setting up zonal energy efficiency demonstration centres;
- elaborating price and taxation policies which provide clear signals favouring energy efficiency.

Measures to achieve these objectives include:

- reviving and extending the activities of the National Agency for Energy Saving, which will be assigned a role in the implementation of the National Energy Saving Program;
- cooperation in the field of energy efficiency and development of renewable energy sources with European Union and CIS structures, including technical assistance;
- closely monitoring the transposition of the EU secondary legislation on energy saving and energy efficiency;
- promoting energy efficiency through energy consumption minimization technologies in buildings and especially in public buildings, including the use of renewable energy sources;
- designing and providing financial support instruments for energy efficiency projects, efficient technologies, and research and development in this field; to this end, the National Fund for Energy Saving will seek funding both from the State budget sources and from grants;
- actions towards establishing energy service companies (ESCOs) and use of other financial instruments and organisational approaches to stimulate commercial banks to invest in energy efficiency projects;
- setting up energy efficiency demonstration zones which will disseminate and promote the achieved results from demonstration projects at both the national and local levels;
- setting up minimal energy efficiency standards for different equipment and technologies (e.g. for buildings, transportation, home appliances, common industrial equipment, etc.), to be gradually harmonised with EU standards;
- study of the possibility for establishing a market for trading green and white certificates;
- review of price setting methodologies and taxation of energy products so as to incorporate incentives for energy efficiency.

1.3.6. Energy Efficiency Markets

The market of white certificates does not exist in Moldova.

The State Owned Company "MOLDENERGO" was unbundled based on the function principle into three companies that were to be privatized (except for energy transmission and central dispatch which remained a state-owned natural monopoly) (source: Energy Strategy of Moldova till 2020):

- *Generation*: JSC "CET-1 Chisinau", JSC "CET-2 Chisinau", JSC "CET-North Balti";

- *Distribution*: JSC "RE Chisinau", JSC "RED North", JSC "RED North-West", JSC "RED Centre", JSC "RED South";
- *Transmission and central dispatch*: state-owned enterprise "MOLDTRANSELECTRO", which acquired all other assets and activities of the state owned company „MOLDEN-ERGO".

A privatization process was launched for the electricity distribution networks; as a result, in 2000 the Spanish company "Union Fenosa" acquired 100% of the share capital in three distribution companies, namely JSC "RED Chisinau", JSC "RED Centre" and JSC "RED South".

In 2000 SOE „MOLDTRANSELECTRO" was restructured into three distinct companies. These were „MOLDTRANSELECTRO" itself, SOE „MOLDELECTRICA", which undertook the functions of transmission and central dispatch, and SOE Costesti Hydro Energy Node.

The Electricity System in the Transnistrian region is operated by DNESTRENERGO Company, with headquarters in Tiraspol. DNESTRENERGO includes Eastern Electricity Networks in Dubasari, South-Eastern Electricity Networks in Tiraspol and the Dubasari Hydroelectric Power Plant. The dispatch for all these companies is centralized and performed by SOE MOLDELECTRICA.

The Russian-Moldovan joint venture JSC MOLDOVAGAZ was set up, with 50% of its shares owned by "GAZPROM" of Russia, 36.6% by the Republic of Moldova and 13.4% by the Transnistrian region (part of the company's assets located in the administrative-territorial units on the left bank of Dniester). These shareholders are the owners of the gas system of the Republic of Moldova, including transit upstream (high pressure) pipelines in the territory of the country. According to the Gas Market Rules, MOLDOVAGAS is designated as the national operator of the gas system.

1.4. Renewable Energy Sources

1.4.1. Deployment of Renewable Energy Sources

The comparison of Renewable Energy Sources (RES) Balance between 2000 and 2007 years is presented below (Table 12). The data presented are however incomplete: there were not included data on use of solar energy to dry medicinal plants and tobacco and; only partly are presented the data on biomass used for cooking and heating in rural areas (the respective data are highly uncertain due to poor statistical system to account the use of biomass in the Republic of Moldova).

Table 12: Energy Resources Balance in the Republic of Moldova

Renewable Energy Sources	Year 2000	Year 2007
Hydropower	1.0%	1.0%
Wood and Agricultural Waste	3.5%	4.5%
Total Local Energy Resources	4.5%	5.5%
Imported Energy Resources	95.5%	94.5%
Total Energy Resources	100%	100%

Worldwide there is cumulated certain experience on RES developing in the following areas:

- Wind Energy: for mechanical or electrical energy production;
- Solar Energy used for production of:
  - Low heat (temperatures under 150 ^{0}C);
  - High heat (temperatures over 150 ^{0}C)
  - Photovoltaic electricity;
- Biomass used (according to its structure and organic mass content) for:
  - Combustion, thermal power production;
  - Anaerobic digestion for biogas production;

    - Bio-combustible production for Diesel engines;
    - Methanol production, such as additive in combustion engines gasoline;
    - Gas production by pyrolyse;
- Hydraulic energy;
- Geothermal energy;
- Waves energy;
- Tide power.

RES potential varies much from one country to another. 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, respectively 5.5% of the total energy consumption. If Moldova keeps the annual increasing rate of 9.8% per year, in 2010 the Renewable Energy will represent approximately 10% of the total country energy consumption, a value in complete agreement with the National Energy Conservation Strategy. Thus, Energy Conservation Programme until year 2010 has the potential to save over 500 thousand toe from RES, structured as follows:

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

a) Wind Energy Current Status and Potential

National statistic data show that between the two world wars there were a large number of wind installations in the Republic of Moldova. In 1923 year there were documented around 6208 wind flourmills. During 1960s there were 350 wind mechanical installations for animal husbandry needs. Between 1960 and 1965 all existing wind installations were replaced by electricity.

Today, Moldova does not count 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. Non-extensive studies developed at the beginning of the 1990s concluded that Moldovan geography is not favourable for the use of wind installations. Negative appraisals were based on meteorological data of the Chisinau Weather Station. These studies did not hold 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 few favourable zones for wind installation operations. Thus, measurements made between years 1990 and 1999 at a weather station located in the south of the country showed that, at 10m over 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 over ground.

In 2001, Technical University started a research project having the goal to carry out the 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 favourable zones for wind installations, with wind speeds equal or exceeding 7 m/s at 50 m and more over ground.

In order to achieve the Energy Strategy's aim concerning Wind Resources, it is necessary to install through 2010 between 26 and 34 MW in Wind Power Stations. An estimation of the project implementation is presented below (Table 13).

Table 13: Estimation of Wind Energy Potential to be capitalized in short-term period in the Republic of Moldova

Indices	Wind Energy Potential
Total wind stations new electrical installed capacity	26-34 MW
Annual electrical energy produced by wind	88.5-111.0 GWh
Use rate of installed capacity	39%
Investment[1)]	26-34 million euros
Annual fuel substituted	20-25 thousand toe
Annual energy substituted cost[2)]	4.4-5.7 million euros
Annual CO_2 emissions reducing	80-100 thousand tonnes
New jobs created	18-22

Note: [1)] Currently specific cost is 1000 euro/kW; [2)] Currently price is 0.0517 euro/kWh

b) 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 traditionally dried using solar heat. If it considers 2002-year tobacco's production as reference, respectively 14,000 t, it estimates at 7,400 toe the annually quantity of substituted fuel. Supplementary, approximately 1,500 t/year fruits and medicinal plants are dried using solar energy. In fact, estimated potential for this operation is ten times higher. Primary energy sources used for dried fruits and medicinal plants are wooden biomass and solar energy (data missing 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 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 components' bad quality and lack of maintenance, solar equipment installed between 1982 and 1990 is non functional. Continuing the tradition, two other Moldovan companies have designed solar installations since 1993 to heat water. To be mentioned as well 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 in photovoltaic installations*. There are a few existing experimental installations to supply water pumps and weather station communication systems. Due to all consumer access to electrical supply network, PV development is limited at certain sectors, like small power irrigation or supply isolated consumers (anti-rain rackets launching stations, forest stations).

Solar energy quantity delivered on Earth depends on several factors, among which sun brightness and current distance between Sun and 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 period. The brightest Moldovan period is from April to September, representing more that 75% of the total annual brightness period. Solar radiation is 3.5% more significant in central than in north region, and 2.6% in south that in central region. In order to achieve the Energy Strategy's aim concerning Solar Energy, it is necessary to install through 2010 one million m^2 solar installations for water heating and 80 thousand m^2 solar installations for agricultural products drying. An estimation of the project implementation is presented in Table 14.

Table 14: Estimation of Solar Energy Potential to be capitalized in short-term period in the Republic of Moldova

Characteristics	Water Heating	Agricultural products drying
Solar installations	1 million m^2	80 thousand m^2
Investment	150 million euros	3.2 million euros
Annual fuel substituted	37 thousand toe	3 thousand toe
Annual energy substituted cost	9.25 million euros	0.75 million euros
Annual CO_2 emissions reducing	190 thousand tonnes	15.2 thousand tonnes
New jobs created	1500	

The potential of PV Solar Energy utilization was investigated as well. It was estimated that 5850 isolated consumers (anti-rain rackets launching stations and forest stations) might be supplied by PV Solar Energy by 2010 year (Table 15).

Table 15: Estimation of PV Solar Energy Potential to be capitalized in short-term period in the Republic of Moldova

Indices	PV Solar Energy Potential
Total PV Solar Energy installations	5850
Total electrical installed power	6300 kW
Investment	19 million euros
Annual fuel substituted	0.75 thousand toe
Annual energy substituted cost	0.19 million euros
Annual CO_2 emissions reducing	6.3 thousand tonnes
New jobs created	6500 [1)]

Note: [1)] 500 new jobs in PV exploitation and 6000 in agriculture, connected to the PV Solar Energy utilization

c) Biomass Energy Current Status and Potential

In the Republic of Moldova biomass is used mainly for the following purposes:

- Fuel wood, wooden wastes and agricultural residues burned for heating and cooking needs:

  To be noted, that in the Republic of Moldova, the areas covered with forests varied considerably over time: from 366.2 thousand ha in 1848 to 362.7 thousand ha in 2005 or circa 10.7 percent of the country's territory[3] (Figure 4).

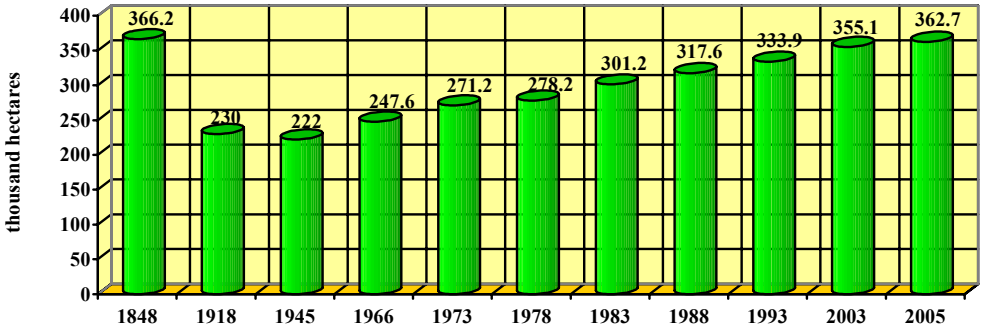

Figure 4: Evolution of Areas Covered with Forests in Moldova, 1848-2005

The total volume of standing wood mass in the forests of the Republic of Moldova is circa 45 million m^3, on average 124 m^3 per hectare. The average forest increment is 3.3 m^3/yr/ha, and the total average increment is circa 1085 thousand m^3/yr. The structure by age in all forest species is misbalanced, in particular in those of low productivity.

The volume of commercial timber, as well as the quantity of fuel wood gathered in Moldova, there were identified based on statistical data and reports on commercial fellings

[3] Gh. Vdovii, D. Galupa et al. (1997), National Report on the Conditions of the Forest Resources of Republic of Moldova, Galupa D., Talmaci I., Spitoc L. (2006), Forest Land Sector in the Republic of Moldova – issues, accomplihments, perspectives.

in managed forest land, revealed illegal logging (on other owners lands, inclusively), data being 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 (Table 16). Data on the volume of fuel wood gathered also include the volume of twigs, boughs, branches, etc., which are also used as fuel.

Table 16: Trends in Fuel Wood Harvests in the RM, 1990-2005

Year	Commercial timber, thousand m^3	Fuel wood gathering, thousand m^3	Illegal fuel wood logging, thousand m^3	Total fuel wood harvested, thousand m^3
1990	39.4	184.2	0.6	184.8
1991	27.0	260.7	140.8	401.5
1992	27.4	314.7	213.4	528.1
1993	31.5	402.6	328.1	730.7
1994	39.8	347.4	210.7	558.1
1995	68.5	420.1	205.7	625.8
1996	51.7	402.5	187.4	589.9
1997	52.7	280.2	21.4	301.6
1998	38.0	332.4	64.2	396.6
1999	38.8	326.1	22.0	348.1
2000	39.7	330.5	7.5	338.0
2001	37.3	308.1	6.0	314.1
2002	50.4	337.3	5.4	342.7
2003	47.0	372.8	5.9	378.7
2004	43.5	372.3	4.4	376.7
2005	39.0	352.2	4.2	356.4

Source: Statistical Records/Reports of "Moldsilva" State Forestry Agency and State Ecological Inspectorate for the 1990-2005 time series; D. Galupa, I. Talmaci, L. Spitoc, Study for the Republic of Moldova "Ensuring sustainability of forests and livelihoods through improving governance and control of illegal logging". Chisinau, 2005, 116 pages

As per information provided in the Table 16, within the last 10 years, annually the Forestry State Agency 'Moldsilva' provides circa 300-400 thousand m^3 of fuel wood. One m^3 fuel wood price, including transport, is approximately US $15. According to statistical available data, in 2005, a conventional family living in the rural sector used approximately 2.3 m^3 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.

Table 17: Areas of Other Types of Woody Vegetation in the Republic of Moldova within the 1990-2005 time series, thousand ha

Year	Total	Woody vegetation not included in forest resources	
		Protection forest strips	Other types of forest vegetation
1990	47.0	31.4	15.6
1991	47.0	31.0	16.0
1992	47.8	31.7	16.1
1993	48.5	31.5	17.0
1994	47.0	30.6	16.4
1995	54.1	30.4	23.7
1996	45.2	30.6	14.6
1997	54.6	30.8	23.8
1998	51.5	30.6	20.9
1999	49.4	31.0	18.4
2000	50.9	30.7	20.2
2001	50.5	31.1	19.4
2002	50.0	30.7	19.3
2003	50.5	30.6	19.9
2004	49.1	30.5	18.6
2005	49.3	30.8	18.5

Source: General Land Cadastre of the Republic of Moldova for the period of time from 1990 through 2005.

A certain amount of biomass is harvested also from protection forest strips and other types of forest vegetation (Table 17) [wood harvesting from forest strips and other types of vegetation, 95 percent of which are managed by local public authorities, is also not specified sta-

tistically, as the available national records for this type of vegetation are insufficient]; biomass is harvested as well from orchards and vineyards, in particular during the cleaning cuttings, as well as from the trees growing in private rural orchards (there was used a conventional average number of 10 trees per household) (Table 18).

Table 18: Area of Cropland with Perennial Woody Biomass in the Republic of Moldova within the 1990-2005 time series

Year	Area of vineyards, thousand ha	Area of orchards, thousand ha	Number of households	Total number of trees, thousand
1990	211.5	262.6	837891	8378.9
1991	212.8	260.7	837400	8374.0
1992	213.0	257.8	837205	8372.0
1993	212.0	254.0	857616	8576.2
1994	205.5	242.9	878978	8789.8
1995	201.6	229.1	887432	8874.3
1996	195.9	216.7	899714	8997.1
1997	191.4	207.7	912835	9128.3
1998	185.8	200.0	908577	9085.8
1999	176.9	193.9	907396	9074.0
2000	168.7	183.6	906611	9066.1
2001	162.2	172.7	905422	9054.2
2002	153.6	152.1	827224	8272.2
2003	152.8	148.0	805754	8057.5
2004	153.0	145.0	852404	8524.0
2005	155.5	142.3	830665	8306.7

Source: General Land Cadastre of the Republic of Moldova for the period of time from 1990 through 2005.

The potential of wood combustion and agricultural and wooden wastes in Moldova is estimated at 820 thousand toe, respectively 48.4% from the total gross energy resources consumption in 2001 year. According to data published in *Energy Balance for year 2001*, Moldova consumed only 6.8% from available biomass quantity (other sources indicate 23%).

In order to achieve the Energy Strategy's aim concerning fuel wood, wooden wastes and agricultural residues resources combustion, it is necessary to increase the consumption of respective RES at 300 thousand toe. An estimation potential for this kind of RES is presented in Table 19.

Table 19: Republic of Moldova potential for use of fuel wood, wood wastes and agricultural residues

Indices	2002	2010
Annual biomass consumption	56 thousand toe	300 thousand toe
Biomass annual cost	2.8 million euros	15 million euros
Annual fuel substituted	56 thousand toe	300 thousand toe
Annual energy substituted cost	14 million euros	75 million euros
Annual CO_2 emissions reducing	106 thousand tonnes	570 thousand tonnes

To be mentioned as well, that in early 1999, Moldova implemented his first experimental installation producing briquettes from agricultural resides, like sunflower and corn stalk, straw, etc. Installation, financed by the Netherlands Government and managed by 'AGROBIOENERGIA' Company, produces 250 kg briquettes per hour, for US $20-25 per briquettes tonne operation cost;

- Biogas obtained by fermentation from animal and poultry manure.

In the early 2000', two projects were developed with Netherlands assistance:

- In 2000, Dutch NGO Novib and Moldovan NGO Agroeco developed an individual anaerobic fermentation installation with 10 m^3 installed capacity, for the Grigoras family farm, from the Soroca region;
- 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 m^3 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, it was launched a project to construct a power plant in Colonita village, 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 estimate at 3700 thousand m^3. In order to achieve the Energy Strategy's aim concerning Biogas Resources, it is necessary to increase the fermentation installation capacity at 7100 m^3 (Table 20).

Table 20: Republic of Moldova potential for use of biogas

Indices	2002	2010
Total fermentation installations' capacity	710 m^3	7100 m^3
Annual biogas produced	370 thousand m^3	3700 thousand m^3
Investment	0.35 million euros	3.5 million euros
Annual fuel substituted	0.2 thousand toe	2.0 thousand toe
Annual energy substituted cost	0.05 million euros	0.5 million euros
Annual CO_2 emissions reducing	0.265 thousand tonnes	2.650 thousand tonnes

To be noted as well that 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 in operation 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 conditions of respective equipment for biogas production.

- Bio-fuel obtained from rape seed, corn, sorghum, etc.

The potential of bio-fuel in Moldova is unknown. Technological Centre 'TEHNORES' which elaborated the technology to produce bio-fuel oil for Diesel engines from rape seed (Brassicaoleracea spp.), estimates it is rational to sow with rape 2.5% from arable soils (respectively 50,000 ha) until 2010. In this context, the Centre will be able to produce annually 52.5 thousand tonnes of bio-fuel and to insure 26% of fuel needs for agricultural works. Nevertheless, until now no existing study presents economic profitability of sowing one hectare with rape versus one hectare with foodstuffs (corn, sunflower, wheat etc.). The potential for bio-fuel production in the Republic of Moldova is presented below (see Table 21).

Table 21: Republic of Moldova potential for use of bio-fuel

Indices	2010
Sown areas	50 thousand ha
Annual bio-fuel produced	52.5 thousand tonnes
Investment	0.35 million euros
Annual fuel substituted	50 thousand toe
Annual energy substituted cost	12.5 million euros
Annual CO_2 emissions reducing	165 thousand tonnes

d) Hydro Power Energy Current Status and Potential

Hydro Power Plants are generally associated with electricity production. Generally, size is the element that affects a Hydro Power Plant to Renewable Energy Sources category. In a large consideration, RES includes small power Hydro Power Plants, but this classification remains rather random. According to the installed capacity, European Union proposes the following under-classification for small Hydro Power Plants:

- Small Hydro Power Plants (from 5 MW to 10 MW);
- Micro Hydro Power Plants (from 100 kW to 5 MW);
- Mini Hydro Power Plants (under 100 kW).

Other countries, with more significant hydro potential, like Canada or China, consider the high limit of the Small Hydro Power Plants to be 50 MW.

Table 22: Potential for Use of Hydropower Energy in the Republic of Moldova (Right Bank of Dniester River)

Indices	2002	2010
Electrical installed capacity: Big stations Small stations	16 MW 16 MW 0 MW	60 MW 24 MW 36 MW
Annual electricity produced	73 thousand MWh	315.4 GWh
Investment	0	66 million euros
Annual fuel substituted	17 thousand toe	71.3 thousand toe
Annual energy substituted cost	4.3 million euros	17.8 million euros
Annual CO_2 emissions reducing	9.8 thousand tonnes	42.6 thousand tonnes

Republic of Moldova has two small Hydro Power Plants: one at Dubasari (48 MW installed capacity and 30 MW available) and other at Costesti (16 MW installed capacity and 10 MW available). here were identified 6 micro Hydro Power Plants, built by individuals or economic agencies and placed on already existing accumulation system of lakes and drainage. Their total installed power is 141 kW. he Moldova hydro potential is estimated at 3 billion kWh/year, including the potential of large rivers (1.9 billions kWh/yr) and small rivers (1.1 billions kWh/yr). The potential for hydropower energy production in the Republic of Moldova is presented below (see Table 22).

1.4.2. Renewable Energy Sources Market

Renewable Energy Sources Market is at the beginning of its development in the Republic of Moldova. In order to adjust the national normative framework to the European Union and international standards, the *Regulation on Guarantees of Origin for Electricity Produced from Renewable Energy Sources* was drafted in 2008 by ANRE. In this case the electricity market players will comply with the provisions of the Law on Renewable Energy, which requires a guarantee of origin for the electricity produced from renewable sources, to confirm these sources. They are to be issued to any renewable energy producer under no discrimination. In 2008 ANRE approved the Methodology for tariff calculation of energy from renewable energy sources. According to the methodology the equal principles will be applied for all producers of energy from renewable sources.

1.4.3. Estimated Potential for Renewable Energy Sources

Republic of Moldova is a net energy importer; domestic sources cover only about 4% of primary energy demand. Given the lack of domestic energy resources, high economic dependency on the energy imports and their growing prices renewable energy should gain a high priority in satisfying the country's energy demand.

Development of RES is in its early stage in Moldova. In 2007, the share of RES in energy consumption was 85 ktoe, just 4% of the total primary energy supply. Hydro energy and biomass have the largest share, while solar and wind energy has been inadequately explored. Biomass, hydro, so-

lar and wind energy are available resources on the territory of the Republic of Moldova. The theoretical potential for these renewable sources, excluding geothermal, has been estimated at 2.7 Mtoe.

The Energy Strategy 2020 foresees to increase the share of RES in the country's energy balance up to 6% in 2010 and to 20% in 2020. If those targets are reached, an annual reduction of CO_2 emissions of approximately 167-210 thousand tones of CO_2 equivalent will be achieved. A substantial part of this reduction can be cashed in as monetary benefit through CDM projects.

The Energy Strategy 2020 foresees the development of the energy potential of biomass (production of bio-fuel from cereals, sugar sorghum and oil technical cultures - rape, sunflower, grape seeds from wine industry etc.), solar energy by conversion to electricity and heat, wind, hydropower, and, in the future, new sources of energy.

Specific objectives of the Energy Strategy 2020 are as following:

- preparing and improving legislation related to the development of renewable energy sources by establishing a transparent and efficient national legal framework, which will include incentives approved by international practice;
- development of the scientific, technical, economic, informational, financial and production potential;
- identifying and removing barriers to renewable energy sources implementation;
- developing an efficient and continuous mechanism for implementation of the Strategy, which will include scientific research and development, estimation of renewable potential, launching pilot projects and inclusion of this potential into the economic cycle;
- establishing conditions for the stable development of the energy industry based on RES and increasing the amount of RES use in the national economy;
- increasing the level of professional training of personnel in this field;
- increasing public awareness of the importance of RES use for the sustainable development of the country;
- establishing a national fund for promoting renewable energy;
- introducing the necessary legal framework for using bio-fuel and bio-fuels mix for transportation and agriculture sectors, taking into account the relevant objectives and targets of the EU;
- use of liquid (ethanol and bio diesel) and solid bio-fuel obtained from renewable sources in order to reduce energy resources import.

The national legislation is yet to transpose Directive 2001/77/EC on the promotion of electricity produced from RES in the internal electricity market and Directive 2003/30/EC on the promotion of the use of bio-fuels or other renewable fuels for transport.

Wind Energy

According to a country profile issued by EBRD on the use of renewable energy in Moldova, there is a good potential for wind power development in the country. Even though, no wind turbines operate in the country, about 10% of the territory can be used for wind power development. The total potential wind power capacity is approximated at 1.000 MW. However, better documentation is needed. In addition to the poor measurement there is another obstacle to the use of the wind energy, namely the widespread belief that the country wind resources are poor.

Areas with high potential wind energy are as follows: in the north-east of the country, separate areas on the Podolsk Hills in the middle reaches of the Dniester River near the border with Ukraine; in the south-east, separate areas near the Dniester estuary; in the west, separate areas in the Carpathians piedmonts near the border with Romania.

The Energy Strategy 2020 foresees to install approximate 30 MW wind capacity by 2015, which is estimated to amount to a total investment o f approx. 40 mln. Euro [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm].

Solar Energy

The average solar radiation in the Republic of Moldova amounts to approximately 4,450 h/yr (in fact, the real value is 2100-2300 h/yr, approximately 50% of the maximum theoretical period). The best solar season is from April to September, representing more that 75% of the total annual solar period. Solar energy is used as much as the wind energy, which means that with the exception of some solar-heating plants with small thermal power, it finds no significant application. Solar radiation is measured only in the capital Chisinau. Monthly and annual data on solar radiation incidence is presented in the Tables 23 and 24.

Table 23: Monthly and annual total solar radiation incident on horizontal surface, MJ/m^2

Name of place	I	II	III	IY	Y	YI	YII	YIII	IX	X	XI	XII	Yearly
Chisinau	126	166	303	460	607	692	685	598	440	281	117	92	4567

Source: [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm]

A solar radiation map has been issued by the National Institute of Meteorology and Hydrology. There are good opportunities for solar energy development, and experiences from the past can be used. In the Renewable Energy Resource Assessment, the EBRD estimates domestic solar water heating for public buildings and hotels, passive solar systems, and stand alone systems for sites far from the grid, to be the most promising applications.

Table 24: Monthly and annual direct solar radiation incident on surface normal to sunlight beams**,** MJ/m^2

Name of place	I	II	III	IY	Y	YI	YII	YIII	IX	X	XI	XII	Yearly
Chisinau	140	143	253	355	464	574	591	559	450	338	124	95	4086

Source: [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm]

Geothermal Energy

The geothermal energy resource potential is estimated to be poor. A few wells with the temperature between 30°C and 50° C were discovered in the southeast part of the country, near the town of Cahul, and in the west part of the country, near the town of Ungheni. However, no wells with high temperature thermal water are available yet in the Republic of Moldova [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm].

Biomass Energy

According to the EBRD, in addition to wood sunflower stems, shelled maize cobs, maize stalks and other agricultural residues/wastes are currently used for heating, in particular in rural areas. However, since the efficiency of the domestic stoves is below 50%, biomass is used inefficiently.

The technical biomass resource potential is estimated in Moldova as more than 370 thousand toe per year. Yet, relatively high investment costs represent the biggest obstacle to construction of new biogas plants. Coal supplies, traditionally used for heating of the public buildings, have been cut back considerably. This has often resulted in the closure of public buildings in the winter period. District heating plants operate only in big cities.

To be noted that within the 2005-2008 time series, the Consolidated Agricultural Projects Management Unit (CAPMU) beside the Ministry of Agriculture and Processing Industry of the Republic of Moldova, in collaboration with the World Bank and with GEF funding implemented the Project

"Renewable Energy from Agricultural Wastes". The ultimate project goal was to lay down the foundations for large-scale efficient use of biomass which should replace the imported fossil fuel (in particular coal) and trigger the introduction and promotion of the primary agricultural waste (biomass) for generation of heat based on efficient technologies. Assistance was provided to Moldova under that project to: remove obstacles to popularization of biomass procession technologies, showing the best practice examples (11 model units have been installed and commissioned with the total capacity of 2720 kW, inclusive in 6 rural schools with installed capacity of 600 kW in Chiscareni village, Singerei District; 300 kW in Antonesti village, Stefan Voda District; 147 kW in Taraclia village, Causeni District; 153 kW in Viisoara village, Glodeni district; 140 kW in Viisoara village, Edinet district; and 190 kW in Boghenii Noi village, Ungheni district) of using biomass-based energy systems as an alternative to fossil fuel and sustainable solution for the energy supply problem for the rural communities and agribusinesses; encourage the development of the market for baled straw and the post-project replication of the biomass production and distribution business among agricultural companies; increase in the number of public buildings (in addition to those covered by the project), which have switched to biomass-based heating systems as result of the lessons learned from the project implementation results; promotion of an awareness-raising campaign on the use of renewable energy, extension among the public and promotion of the replication strategy.Below are presented the estimative biomass overall resources for the Republic of Moldova.

Table 25: Republic of Moldova's Overall Biomass Resources

Biomass Resource Type	Total Production	Production Density
Percent of total land area covered by		
Forests	3 %	
Scrublands, savannas, and grasslands	0 %	
Cropland and crop/natural vegetation mosaic	93 %	
Urban and built-up areas	3 %	
Sparse or barren vegetation; snow and ice	0 %	
Wetlands and water bodies	1 %	
Primary crop production	**(average 1999-2001, tonne)**	**(tonne/1000 ha)**
Total primary crops	8,514,487	2,587
Top 10 primary crops		
Grasses (mist), Forage & Silage	2,575,000	782
Sugar Beets	1,315,604	400
Maize	1,018,898	310
Wheat	850,142	258
Grapes	528,336	161
Potatoes	365,563	111
Maize for Forage & Silage	299,48	91
Sunflower Seed	282,817	86
Barley	201,053	61
Vegetables and Roots, Fodder	199,693	61
Animals	**(number)**	**(number/1000 ha)**
Cattle	434	132
Poultry	13,650,000	4,148
Pigs	755,95	230
Equivalent animal units	872,88	265
Annual round wood production	**(average 1996-1998, 1000 m^3)**	**(m^3/ha)**
Total	397	120.6
Fuel	346	105.1
Industrial	51	
Wood-based panels	10	3.0

Source: [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm]

Hydro Energy

By absolute indices of potential hydropower resources the Republic of Moldova is the last among the CIS countries. The table below provides an overview of the hydro power resources in the country (Table 26).

The most important river in the Republic of Moldova is the Dniester River (known in Moldova with the common name of Nistru) which rises in Ukraine and flows south-eastward through Moldova (forming part of Moldova's border with Ukraine) before re-entering Ukraine and emptying into the Black Sea. The Dniester basin covers 57% of the country territory (including the entire Transnistrian region). Major tributaries of the Dniester in Moldova include the Reut, Ichel, Bic, and Botna rivers, as well as the Cuciurgan River, which also forms part of Moldova's border with Ukraine. The second most important Moldovan River is the Pruth, a major tributary of the Danube, which forms Moldova's border with Romania. The Danube itself only briefly forms part of Moldova's southern border (where the Pruth merges) but the Danube basin covers 35% of Moldova's territory. There is also a third watershed in Moldova, the southern basin, which includes several relatively small rivers that flow into the Black sea between the Danube and the Dniester. The largest river in this watershed is the Kogilnik.

Table 26: Republic of Moldova's Potential Hydropower Resources

Characteristics	Indices		
	Total	Including small HPPs of capacity up to 30 MW	Share of HPPs, % from the total
Gross theoretical hydropower potential			
billion kWh/year	2.1	0.8	38
concentration of power resources on the territory, though kWh/km^2	62		
Technically feasible hydropower capability, billion kWh/year	1.2	0.2	17
Economically feasible hydropower capability, billion kWh/year	0.7	Not determined	-
Power generated by existing HPPs			
billion kWh/year	0.3	Not available	
per cent of economic potential, %	45		

Source: [EBRD; AEER] [see on: http://www.energyagency.at/enercee/md/references.htm]

There are only two major hydroelectric power plants, in spite of the fairly large number of rivers in Moldova. The largest of these is the Dubasari plant on the Dniester River. The power plant was built in 1954, and its installed capacity is 48 MW. The other significant hydro power plant with the installed capacity of 16 MW is located in Costesti, on the Pruth River. According to the EBRD, Moldova has a good potential for the development of small hydropower constructions.

Under the Energy Strategy 2020, mini hydro stations with a capacity of 1.2 MW are planned to be built on the Reut River, close to the village of Tribujeni, in the Orhei district.

2. PROGRESS OF REFORMS IN ENERGY SECTOR

2.1. Level of Priority Given to Country's Energy Policy

Sustainable development in the energy sector and its alignment to the European standards is possible only where an adequate legislative and regulatory framework is in existence.

Republic of Moldova's policy and strategy for the energy sector operation and development is reflected in the following principal documents: the Law No. 1525-XIII as of 19.02.1998 on Energy Sector, the Law No. 136-XIV as of 17.09.1998 on Gas, the Law No. 137-XIV as of 17.09.1998 on Electricity, the Law No. 1136-XIV as of 13.07.2000 on Energy Conservation, the Law No. 160-XVI as of 12.07.2007 on Renewable Energy, the National Strategy of the Republic of Moldova on Energy for the period until year 2020 (adopted through the Government Resolution No. 958 as of

21.08.2007), the National Development Strategy for the years 2008-2011 (approved through the Law No. 295-XVI as of 21.12.2007) as well as in the second-tier legislation approved by the National Agency for Energy Regulation (ANRE).

Although it can be stated that the legislative and regulatory framework for the energy sector has been already well developed, however it needs further development and improvement in conformity with the current requirements aimed at the implementation of the fundamental energy sector objectives in the Republic of Moldova - adequate energy security; high energy efficiency; minimum energy price thresholds obtained in competition; and minimized negative environmental impact. The legislation should be further harmonized adequately with the Energy Community Treaty and *Acquis Communautaire* in the area of energy.

In that context it is required to discontinue cross-subsidizing of the electricity and heat tariffs as soon as possible, including subsidies in the form of differentiated tariffs; to favour renewable energy generation; to focus on the diversification of energy resources in the energy balance, including the imported ones; to incentivize and regulate improved energy efficiency, etc.

It should be noted that during 2000-2007, notwithstanding the existence of certain relatively good applicable regulations, the achievement of the defined goals was facing certain difficulties created mainly due to the lack of the adequate institutional framework. For example, the National Agency for Energy Conservation was operating with insufficient capacity, thus forcing the duly empowered authorities to dissolve it and to establish instead the Agency for Energy Efficiency.

It is required to improve the independence and competence levels of the National Agency for Energy Regulation and to vest it with the authority to approve all Tier II regulations, to calculate and approve tariffs for heat generated in a centralized way in Moldova's urban centres, etc. The power grid development strategy must be amended by adding the Government-approved energy sector development plans for the next 4-5 years, which are as yet lacking, etc.

After several institutional reforms, energy is now under the responsibility of the Ministry of Economy and Trade. It is also dealing with technological aspects of energy efficiency. Ministry of Ecology and Natural Resources (MENR) focuses on environmental aspects of EE and promotes energy efficiency through GHG reduction.

As it was mentioned above, although primary legislation on energy efficiency and renewable energy exists in Moldova (see in Box 2), secondary legislation to make it operational is not fully developed yet. Furthermore, current energy efficiency legislation needs harmonization of laws in terms of intent and objectives. The economic incentives to stimulate the implementation of the recommended measures have to be established. Neither payment for energy, nor assessment of pollution payments represents real incentives for energy efficiency increase and renewable energy sources use. Current methodology to establish the cost for energy does not offer advantages to switch to renewable energy use.

Box 2: *Basic Legislative Framework of the Energy Sector in the Republic of Moldova*

- *Energy Strategy of the Republic of Moldova until 2020, Government Decision No 958 from 21.08.2007*
- *Low of renewable energy, Parliament Resolution No. 160-XVI from 12.07.2007*
- *Energy Law, Parliament Resolution No. 1525 from 19.12.1998;*
- *Electricity Law, Parliament Resolution No. 137 from 17.09.1998;*
- *Law on ratifying the Agreement on Transiting Energy and Power Capacity of CIS countries, Parliament Resolution No. 1358 from 04.10.2002*
- *Law on the concept of privatizing electricity sector undertakings, Parliament Resolution No 63 from 25.06.1998;*
- *Law on the individual project for privatizing electricity sector undertakings, Parliament Resolution No 233 from 23.12.1998;*

- *Law on energy conservation, Parliament Resolution No 1136 from 13.07.2000;*
- *Government Decision approving Regulation on Electricity Use and Supply No 1194 from 22.11.2005;*
- *Government Decision approving the Regulation on construction/reconstruction of power plants No 436 from 26.04.2004*
- *Government Decision approving establishment of the National Agency for Energy Conservation No 1527 from 26.11.2002;*
- *Government Decision approving Regulation on the National Fund for Energy Conservation No 1528 from 26.11.2002;*
- *Government Decision approving Regulation on electricity network protection No 514 from 23.04.2002;*
- *Government Decision approving the Concept of development and locating power plants in Moldova until the year 2010 No 830 from 11.07.2003;*
- *Government Decision approving National Program for energy conservation for 2003-2010 No. 1078 from 05.09.2003.*
- *Government Decision approving Regulation of the National Agency for Energy Regulation (ANRE) No 574 from 21.06.2000;*
- *ANRE Decision No 75 from12.12.2002 approving Power Market Rules;*
- *ANRE Decision No 62 from 30.05.2002 launching the process of gradual liberalization of electricity market;*
- *ANRE Decision No 194 from 04.10.2005 approving Methodology for establishing tariffs for electricity supply to end customers;*
- *ANRE Decision No 211 from 14.04.2006 approving Regulation on measuring electricity for commercial purposes.*
- *ANRE Decision No. 321 din 22.01.2009 approving the Methodology for the Determination, Approval and Application of Tariffs for the Electricity Generated from Renewable Electric Energy and Fuel.*

2.2. Liberalization of Energy Markets

National Agency for Energy Regulation (in Romanian: ANRE) regulate the electricity, heating and gas tariffs and promote competition in the energy market of the Republic of Moldova. The agency's responsibilities include: licensing, tariff setting, establishing quality of service standards, consumer protection and promotion of competition and energy efficiency.

ANRE was established in 1997 by the Government Resolution No. 767 as a permanent authority of public administration acting as a legal entity and not subordinated to any other public or private authority, except for the cases provided by the legislation.

The Agency regulates the economic and commercial activities in the energy, natural gas and petroleum products sectors, issuing licences, promoting an appropriate tariff policy and consumer rights protection.

In its activity the Agency is guided by the Constitution of the Republic of Moldova, Electricity Law, Gas Law, Energy Law, Regulation of the National Agency for Energy Regulation and other legislative and normative acts of the Republic of Moldova.

September 1997 - September 1998 represents the period of establishment of ANRE, hiring the personnel, development and promotion of legislation necessary for activity of ANRE and power and natural gas sectors, period of utilities' reorganization and establishment of joint-stock companies.

In September 1998 Parliament of the Republic of Moldova approved the Electricity Law and Gas Law, governing the ANRE activity in state regulation of generation, transmission, dispatch, distribution and supply of electricity and natural gas within the territory of the country.

In June 1999 Government of the Republic of Moldova approved the Regulation of the National Agency for Energy Regulation.

During 1998–2000 ANRE has directed its efforts to develop a regulatory system of power sector activities in Moldova, developing and implementing normative acts necessary for license issuance,

approval and application of tariffs, performance of control over licensees' activity, consumer protection rights and resolution of consumer disputes. ANRE has begun its activity in tariff policy-related issues subsequent to approval of Government Resolution no. 41 from 16 January 1998, that vested ANRE with the right to set electricity, heat and gas tariffs, later on this activity was facilitated by approval of Electricity Law and Gas Law by the Parliament in September 1998. Regulation of tariffs for natural gas, electricity and heat produced by the local CHPs has been one of the main and most difficult functions of ANRE during the mentioned period.

In 1999 the function of setting tariffs for heat supply for "Termocom" and the former "Termocomenergo" is transferred to Chisinau municipality and local public authorities, taking over the CHPs.

In 2001 according to Law on certain types of activity and Law on petroleum products market the right to issue licenses for the activities in the mentioned field was transferred from Ministry of Finance to ANRE.

In 2002 ANRE starts the activity of issuance of licenses for the activities on petroleum products market.

In the field of renewable energy ANRE regulates the renewable energy market; approves tariffs for each type of renewable energy, develops draft contracts for the commercialization of renewable energy and fuels through providing the producers of renewable energy and fuels with a free and non-discriminatory access to the electricity grid and district heating system, the fuel distribution network and installations, and issues licenses for the production of renewable fuels.

2.3. Investments in the Energy Sector

In the Republic of Moldova current investments in the energy sector are still very low.

The Energy Strategy (2007) of the Republic of Moldova until 2020 has three strategic objectives: 1) security of energy supply; 2) promoting energy and economic efficiency; and 3) liberalization of the energy market and restructuring of power industry. The document elaborates on energy saving and enhancing energy efficiency. It indicates key principles that shall guide policy and normative formulation, specific objectives in the field of increased energy efficiency and recommended measures to implement in order to achieve such objectives. The Energy Strategy also dedicates a section to International Cooperation in which it recognizes the critical importance of and calls upon international development assistance in achieving its objectives.

The National Programme (2003) of Energy Conservation for 2003-2010 sets out quantitative targets for efficiency improvements at the economy level, priority areas for energy conservation and efficiency interventions and indicates activities to carry out in order to achieve stated objectives. The Programme identifies the priority actions and aims at increasing energy efficiency by decreasing energy intensity by 2-3% annually. It looks forward to using first of all. It sets an objective to substitute about 6% of the total energy supply with local and renewable energy sources by 2010.

However, for both these documents it is not clear what financial resources are available and what the status of their implementation is.

It is understood that investment to the country's energy sector is likely to come from the following directions:

- in the subsectors that represent a natural monopoly (electricity transmission and dispatch, gas transportation), investments will come mainly from the companies involved, with possible support from the State Budget (e.g., in 2009 the distribution companies has planned

total investments of around 377 million lei (27 million Euro), inclusive: JSC "RED Union Fenosa" has planned for 2009 investments of 251 million lei, JSC "RED Nord – investments of 83 million lei, JSC "RED Nord-Vest" – investments of 83 million lei; in 2008 year the were planned total investments of 305.3 million lei, the real investments constituted 325 million lei); investment in this sector is also possible through loans from IFIs, if return on the investment can be guaranteed;

- in the sectors that are liberalised (e.g. electricity supply, distribution, oil market and eventually also the heat market), investment may come from private investors if a favourable investment climate is in place and the investor has a reasonable guarantee for the return on his investment (*e.g., on 22 December 2008, the Government has signed an agreement with the Czech company United Energy Moldova (UEM) on building a new Thermal Power Plant on coal combustion with an installed capacity of 350 MW at Ungheni; the UEM plans to invest 600 million Euro in the respective project; to be noted as well that in the frame of the project, UEM plans to build also a high voltage electric lines of 400 kV: Ungheni, Moldova – Iasi, Romania; the construction works started in early 2009, to be finalized in 2011*).

It should be also noted that the following specific objectives are set in the Energy Strategy for attracting investment in the energy sector:

- promoting legal reforms that facilitate project finance and an attractive investment climate;
- establishing and strengthening mechanisms for attracting and efficient use of financial resources for financing of energy projects;
- implementation of new financing mechanisms, based on the settlement of external debts by offsetting part of the debt with equivalent State investments in environmental protection or development of renewable energy sources;
- promoting private investment in CDM projects and, eventually, entering into appropriate agreements to work within the EU Emission Trade Scheme;
- use of internationally approved methodologies for estimating the amount of required investments to reach strategic objectives and specific objectives for each segment of the Moldovan energy industry and for prioritising development programs;
- developing an information base and a data base for energy projects financing;
- rational use of state and private investments in energy development projects;
- supporting reforms in the banking sector.

EU energy policy provides for the integration of the energy sector of all European countries, including Moldova, through the creation of trans-European networks. This represents an opportunity for the Republic of Moldova to actively seek the interconnection of its energy system with those of neighbouring countries. This is even more so in the understanding that the banking instruments of the EU (EIB and EBRD) are expected to take an interest in financing such projects, while technical assistance can be provided through the new EU neighbourhood policy instrument (ENPI). Moreover, institutional twinning programs represent an additional possibility for both technical assistance and financing.

In the absence of local knowledge of PPP (public private partnership) schemes, the country needs to: (a) raise awareness locally on the options and technicalities of PPP schemes; and (b) identify the PPP schemes that best suit its peculiarities and need to be backed by the introduction of appropriate legislation. A raising awareness exercise needs to be undertaken to popularize PPPs and their regulation and identify: (a) options relating to procurement alternatives (e.g. tenders that indicate the desired end goal but leave the bidders to propose solutions; strict performance criteria and monitoring systems which bind contractors to their bids; provisions to renegotiate contract terms over the contract life); and (b) best international practices on concession agreements (e.g. EU, UNCITRAL, OECD, EBRD and UNIDO).

The objective will be to opt and back up legally those mechanisms under which the private sector could participate in the construction/rehabilitation, maintenance, operation and management of the energy projects. To this end, the Ministry of Economy and Trade shall develop the required know-how, ideally with the support of foreign technical assistance, in relation to: (a) the Build-Operate-Transfer system (BOT) and their many variants (e.g. BO, BOOT); (b) the Design-build-finance-operate systems (DBFO); (c) the PFI set-up under which a private partner is called on to carry out and administer an infrastructure of public interest for a public authority.

By 2009 the country shall develop the PPP mechanisms best suited to it and develop the legal instruments relating to: (a) contractual arrangements and the duration of the relationship; (b) the way in which funding shall be effected; (c) the allocation of risks; and (d) opt for purely contractual PPP set-ups with only contractual links or for institutionalised PPP mechanisms involving the establishment of special purpose vehicles held jointly by the public and the private partners.

2.4. Financial Environment in Energy Efficiency and Renewable Energy Policies

2.4.1. Institutional, Legal, Regulatory and Policy Framework

At the institutional level, the lack of secondary legislation on EE and RES is a large barrier for their development. Though in the Ministry of Environment and Natural Resources it is encountered a good understanding of the issues, financial and human resources to deal with the issue are insufficient. The Ministry of Energy, then the Ministry of Industry and Infrastructure have been dissolved and they tasks have been transferred to the Ministry of Economy and Trade, which led to a discontinuity in implementation of the energy-related activities. Same could be said regarding transformation of the National Agency on Energy Conservation into the Agency for Energy Efficiency and Renewable Energy Sources under the Ministry of Economy and Trade. Institutional stability is required and the existing normative and legislative framework must be extended.

To be noted that the National Agency for Energy Conservation (NAEC) was established in 1994 however and it had to stop its activities in 2006 due to its restructuring. In July 2007, the Agency was relaunched and renamed as the Agency for Energy Efficiency (EE) according to the Law on Renewable Energy Sources. In 2008, the Law on Energy Conservation is in an amendment process in order to comply with the Law on Renewables. The Regulation of the EE Agency is currently under development. The Agency for Energy Efficiency did not actually activate in 2008 in the first part of the 2009 year.

According to the Law on Renewable Energy, the Energy Efficiency Fund should be created. The Fund shall be an independent and financially autonomous legal entity, shall hold settlement accounts in banking institutions; have its stamp, etc. The Fund's main activity shall be the management of finances, with a view of promoting the financing of energy efficiency and renewable energy in compliance with the state strategies and programs for the development of these fields.

The Fund's financial resources shall originate from the following sources:

- financial allocations of the Government of the Republic of Moldova, at least 10% of the Fund's amount necessary to reach the objectives related to energy efficiency and renewable energy indicators;
- donations of physical and legal entities from the Republic of Moldova or abroad, including from international financial institutions and funds;
- financial revenues from interests to the current accounts or to the bank deposits of the Funds, as well as from the interests and commissions associated with the financial contracts signed with the Fund's clients;
- loans or other financial instruments from banks or investors employed exclusively for the development of the Fund's objective.

The Fund's financial resources shall be used exclusively for:

- Financing investment projects of energy efficiency and renewables in the Republic of Moldova;
- Offering guarantees for loans allocated by financial and crediting institutions for investment projects with a view of increasing the energy efficiency and use of renewable energy sources in the Republic of Moldova;
- covering the Fund's own costs provided in the budget approved by the Administration Board of the Fund, including the services rendered by the Fund's administrator and Fund's financial audits.
- Technical assistance if this is considered necessary for implementation of the eligible projects.

In past years two major documents on renewable energy policy passed the Government: The Law of Renewable energy sources No. 160-XVI from 12.07.2007; and the Methodology for calculation the tariff for energy from renewable energy sources approved by ANRE Decision No. 321 din 22.01.2009.

According to "Energy Strategy of Moldova until 2020" the Republic of Moldova has the same target for 2020 about renewable energy, 20% of country energy balance should be provided from renewable energy sources, and 10% by 2010. The Energy Strategy until 2020, deals with objectives, measures and activities orientated towards a more efficient, competitive and reliable national energy industry whilst ensuring the country's energy security, the upgrading of energy-related infrastructure, improved energy efficiency and the utilization of renewable energy sources, and its integration into the European energy market.

The fundamental principles are based on the following:

- energy supply systems orientated towards serving the needs of the customer;
- improvement of the security of energy supply;
- improvement of energy efficiency;
- increased use of renewable energy sources;
- acceptable environmental impact, on the local, regional and global (climate change) level;
- energy systems that include distributed generation sources;
- selection and implementation of energy technologies based on criteria related to energy efficiency, operational security, environmental impact;
- reasonable tariffs and the development of a favourable investment climate;
- supporting research and development in the field of new and efficient energy technologies;
- enhancing Moldova's role as an important transit country for electricity and gas.

The national energy policy is still focused more on the industrial (21% of the total final energy consumption in Moldova) than the residential sector (40% of the final energy consumption), and lacks the follow-through of the development of realistic action planning and program implementation.

The existing normative-legislative framework must be extended, especially concerning: (i) imposing some energy and environment efficiency requirements (standards); (ii) elaboration of national programs and strategy for energy efficiency, first, in the housing and public sector.

Some important regulations under development should therefore be adopted in a more functional form in order for the energy conservation policy to succeed (Law on ESCOs formation; Regulation regarding energy conservation incentives, etc).

Strong points of the current Energy Efficiency and Renewable Energy Sources Legislative Framework:

- Energy efficiency is a priority in the Republic of Moldova and strategic policy objectives for energy conservation are defined. Important laws are in force: Law on energy conservation, Law on electricity, Law on natural gas, Law on renewable energy sources.
- The national objective of an annual 2-3% decrease in the energy intensity of GDP, stipulated by the Energy Strategy, is a very ambitious task.
- There is political will to improve current EE and RES legislation.

Weak points of the Energy Efficiency and Renewable Energy Sources Legislative Framework:

- Energy efficiency legislation is more declaratory than operational;
- Actions in the area of developing and implementing secondary legislation, institutional capacity building, developing sectoral programmes, and securing financing are required;
- Discrepancies and contradictions between laws;
- While legislation considered incentives for energy efficiency activity development, the lack of mechanisms and underpinning legislative framework stand as the most significant barriers against their implementation.
- Inefficient legislation to support the structure of the Agency for Energy Efficiency and Renewable Energy Sources (former National Agency for Energy Conservation (ANCE)) under the Ministry of Economy and Trade and lack of financial and human resources for its operation.

2.4.2. National Priorities for Meeting the Demand for Energy Sources

Meeting the Demand for Electricity Supply

According to the *Energy Strategy of the Republic of Moldova for the period until 2020*, the nation's energy security is expected to be achieved in two ways – by increasing the capacity for interconnection with the neighbour countries, and constructing local generation facilities operating on the imported fuel and renewable energy produced in the Republic of Moldova.

In terms of energy security, priority should be given to the construction of own co-generation plants, but due to substantial investments required for the construction of such plants and the lack of local fossil fuel the prices for the electric power generated locally by the facilities constructed in Moldova will be higher than those for the imported power. That is why, considering relatively low payment capacity of the Moldovan consumers, the priority has been given during the preceding and current periods to the extension of the capacity for interconnection with the neighbouring countries.

Under such a scheme, the refusal to import from a certain country results in imports from some other country, but evidently at a higher price. The difference is the payment for energy security. Thus, the development of the local energy sources will be resumed depending on the payment capacity of the consumers, fluctuations of the fossil fuel prices, electric power tariffs in the neighbouring countries and available generation capacities in the region. The above factors were of such nature that the development of the local energy sources had to be minimized in the last few years.

Till currently, the Moldovan Government has issued 5 directives permitting the investors to construct unregulated power plants. Three of them have been already abrogated because the investors have found the Moldovan market not attractive. The other two decisions were issued in 2004: "ITERA" was granted the right to construct a 450 MW condensing power plant in the village of Burlaceni (in the South of Moldova); and EFC "RW-DC ENERGY INVESTMENT" – the right to construct another power plant with similar capacity in Balti (in the North of Moldova).

Notwithstanding the above, such power plants will not shape a competitive electric energy market in Moldova in the short term and they will be able to contribute to the improvement of the nation's energy security. Their impact will be felt probably only after 7-10 years when the configuration of

the regional power system is assumedly modified as result of the intent of Moldova and Ukraine to accede the Union for the Coordination of Transmission of Electricity (UCTE). Thus the principal measures to solve the problems of energy security and competition at the electricity market remain those of commissioning the capacities of interconnection power lines between Moldova, Ukraine and Romania.

The interconnection power lines to the Western countries are currently very low-capacity (three 110 kV lines and one 400 kV line Isaccea (Romania) – Vulcanesti (Moldova), whereas the interconnection capacity with the East is rather high (seven 330 kV lines and fourteen 110 kV lines – all of them with Ukraine).

To increase the electric power import capacity, the construction was started in 2007 of an interconnection line to Romania (the 110 kV line Falciu – Gotesti). The Memorandum has been negotiated between State Enterprise "Moldelectrica" (Moldova) and State Enterprise "Transelectrica" (Romania) on the construction of the 400 kV line Balti – Suceava.

The Chisinau and Straseni 330 kV transformer stations have been rehabilitated and modernized under Energy Project II funded by the World Bank.

A considerable increase in the electricity consumption has been registered during the recent years (in 2005: by 4.4%; in 2006: by 11%; in 2007: by 6%). If this electricity demand pattern persists in the next few years, the risk remains of an electric energy crisis. That threat requires the development of emergency measures for the short term (1-3 years), as provided for in the *Moldova's Energy Strategy for the period till 2020*, including first of all:

- Rehabilitation of the existing domestic 110 kV power transmission lines and construction of new domestic 110 kV power transmission lines to have more possibilities to import electricity from Romania via 400 kV interconnection line Isaccea (Romania) – Vulcanesti (Moldova);
- Consolidation of the existing 110 kV interconnection lines with Romania;
- Construction of new 110 kV interconnection lines with Romania: Falciu – Gotesti (Cantemir), Mitoc – Burlaceni (Cahul), Tutora – Ungheni (the second circuit);
- Creation of conditions for the MTPP in Dnestrovsk (ATULBD) to operate at maximum capacity (the higher is the load of the power plant, the more is the capacity to import the electricity from Ukraine);
- Cost-benefit analysis to identify possibilities for the increase of the domestic generation capacities (rehabilitation and modernization of CHP-2 in Chisinau, increasing its capacity up to 440 MW; CHP-1 in Chisinau – up to 90 MW and CHP-North in Balti – up to 100 MW);
- Survey of the energy consumption growth and trends to identify and implement the measures to manage energy demand in order to prevent the significant load growth during the peak load hours on the load curve, including a most effective measure – the implementation of a motivated tariff policy (with differentiated tariffs as well as multi-zone tariffs); the current policy based on the uniform consumed power pricing does not provide any incentives to reduce loads during the peak hours;
- Introduction of differentiated and multi-zone tariffs.

The concept for the mid-term development of interconnection lines (for the next 4-6 years) is based on the goal to consolidate the Republic of Moldova's capacity to transport electricity along the route East-West as well as North-South.

In this context the best solutions to increase the transmission capacity along the route East–West will be the construction of:

- 400 kV interconnection power transmission lines Balti–Suceava and Straseni–Iasi;
- 330 kV interconnection power transmission lines Ribnitsa–Balti and Ribnitsa– Straseni.

That is the least cost-intensive solution which allows connection to a higher capacity node as compared to the others and ensures much higher capacity for energy exchange between Ukraine and Moldova. However, the 330 kV lines Ribnitsa–Balti and Ribnitsa–Straseni cannot be treated as yet as viable (as Ribnitsa is located in ATULBD). Therefore the above solution is currently suspended.

Regards the North-South route, the current plans provide for:

- Construction of a 400 kV power transmission line Dnestrovsk (Ukraine)–Balti (Moldova)–Suceava (Romania); the above three Parties are expected to sign a Memorandum of Intent to the effect, and EBRD has agreed to support the necessary surveys with the possibility of subsequent funding fore the power line construction; in 2007 the Ministry of Industry and Infrastructure implemented the construction project of the 400 kV line Dnestrovsk (Ukraine)–Balti (Moldova);
- Rehabilitation of the 330/110/10 kV station in Balti;
- Rehabilitation of the 330/110/10 kV station in Straseni;
- Rehabilitation of the 330/110/10 kV station in Chisinau;
- The scheduled 330 kV line Balti–Straseni and Straseni–Chisinau will be constructed if the generation capacity increases in the Chisinau Node.

It should be mentioned that the strategy to satisfy the demand with electricity imports from Ukraine is justified also with the actions of this neighbour country in the power sector. In conformity with Ukraine's high voltage transmission network development plans, all those lines enter the geographic region where Moldova is located. According to the Ukrainian plan, in the next 3-5 years the Western part of the country's power system will have excess generation capacity - in particular due to the increased generation at nuclear power plants in Khmelnitsk and Rovno. Ukraine expects to complete the construction of the Pumped Storage Power Plant in Dnestrovsk (PSPP Dnestrovsk) for 2450 MW. To be able to transport the electricity from PSPP Dnestrovsk, it is expected to construct in the next 5-6 years the 330 kV double circuit line HPP Dnestrovsk – PSPP Dnestrovsk and the 330 kV line Bar–PSPP Dnestrovsk. Another electric circuit will be constructed for the 330 kV line Adjalic–Usatovo in the South of Ukraine in 2007. The above development of the Ukrainian grid will increase the transmission capacity along the North-South route up to 1,000 MW.

In the context above, it should be noted that in June 2006 applications of the Republic of Moldova and Ukraine of accession to the Union for Coordination of the Electricity Transport (UCET) were accepted (the energy systems of these two countries work in parallel). Accession to UCET in fact means integration into the European Energy System. The advantages of accession to the European Energy System for the Republic of Moldova are: enhanced energy security of the country, bringing the local electric lines in line with the European standards, attracting foreign investments, etc. However, this is a long term process. The Ukrainian partners, for example, have initially announced that Ukraine, and respectively, the Republic of Moldova could integrate in the UCET in two-three years. This would require, as initially specified by them investments of circa Euro 2 billion. For the time being the Republic of Moldova did not estimate its separate costs for this process.

The *Energy Strategy of the Republic of Moldova until the year of 2020*, aligned to the European Union energy objectives, indicates year 2012 as a year for accession to the UCET. To achieve this target the country has to carry out a series of actions and make investments, in particular, in development of interconnections with the energy systems of the neighbouring countries. It will require investments of at least Euro 190 million that have to be attracted from private sources and external financing. Without all this the intention to integrate in the European Energy System will remain as a good idea only.

It is true that attempts are being made to attract funds from the international financial bodies, which however, trail. Active participation in the projects promoted by the European Commission could develop prerequisites for allocation of the funds so badly needed by this sector. For example,

participation to the Energy Communion Treaty means that the country will take part in the development of the biggest energy market in the world. The Treaty provides, for the first time in history, for an integrated energy market legal framework. Besides, the Treaty allows put into motion circa USD 30 billion earmarked for the investments into the Electric Power Sector infrastructure, in view of meeting the EU targets by 2015. This money represents a support provided already by the World Bank and the European Bank for Reconstruction and Development.

Satisfaction of the Demand for Natural Gas

A key issue for natural gas sector is the lack of access to diversified sources of gas supply. Dependence on one gas supplier is not a factor that contributes to energy security of the country. Gas transmission system in Moldova requires upgrading and strengthening first of all through installation implementing metering of natural gas transmission at the cross border points. There shall addressed the issue of payment capacity of consumers for natural gas the price for which will increase of the next years to the average level of gas supply price in European countries.

Short term priorities on satisfaction of the demand for natural gas are as following: national gasification program shall be revisited and aligned to new realities of gradual increase of gas supply to the average level of gas supply price in European countries from the perspective of customers' payment capacity; there shall be reevaluated plans for extension of gas fired generation capacities based on estimations of competitiveness on the market of electricity produced by these capacities.

Medium *term priorities* on satisfaction of the demand for natural gas are as following: extension of gas pipeline network Drochia-Ungheni-Iasi, Causeni-Chisinau, as well as the construction of some branches; construction of power stations with blocks and modules of 10 MW and more capacity, that will allow efficient use of natural gases to obtain hot water and steam for heating or other necessities with a capacity of 85-90%; upgrade and implementation of the national system for metering gas imports and transit, as well as intersystem metering; diversifying access to upstream gas pipeline for transmission of natural gas; implementation of Energy Community Treaty provisions as an observer state.

According to the *Republic of Moldova's Energy Strategy for the period till 2020*, natural gas can be supplied to Moldova from two directions:

- From the gas-main pipeline Ananyev–Chernovtsy–Bogorodceni, Ribnitsa–Chisinau and its Oliscani–Saharna branch, with interconnection to the international main lines Progress, Soyuz, Urengoi–Pomary–Uzhgorod and the natural underground storage in Bogorodceni;
- From the gas-main pipeline Odessa–Chisinau with interconnection to the international transit lines Razdelnaya–Izmail, Shebelinka–Dnepropetrovsk–Krivoi Rog–Izmail and Ananyev–Tiraspol–Izmail.

With the commissioning of the gas line Tocuz–Cainari–Mereni in summer of 2007, an additional possibility appeared for the gas supply to ensure the nation's gas supply security.

The settlements not connected to the lines of the gas supply system will use liquid gas the market of which has been de-regulated. Liquid Petroleum Gas (LPG) is imported from Ukraine, Russia, Romania, Kazakhstan and Belarus by private businesses that have an extensive LPG distribution network and storage facilities with the capacity of 4,450 tonnes.

The gas sector development has been determined by the *National Gasification Program of Moldova till 2010* and the *National Program "Moldovan Village" (2005-2015)*. The implementation of the above programs has led to an increase in the number of gasified villages from 175 villages in 2000 up to 787 in 2007 when the gasification level reached 52%. It is expected to complete the gasification of all Moldova before the end of 2009.

To implement the measures provided for in the *National Gasification Program of Moldova till 2010* it is scheduled to commission 186 km of main gas pipelines, 365 km of high pressure branch lines, 6,265 km of gas lines connecting the rural areas, 20 distribution stations and 7 gas compressor stations. A possibility will be examined during the extension of the distribution station network to install closed type turbo-installations in order to generate electricity via use of the high pressure gas coming from the main high pressure lines. Total investments in the complete gasification of Moldova will make about 2 billion lei (EUR 120 million).

Meeting the Demand for Liquid and Solid Fuels

The Republic of Moldova's demand for liquid and solid fuel is satisfied practically in full with imports, excepting small amounts of natural gas extracted in the South of Moldova in the vicinity of Valeni village as well as wood and waste wood produced in the forestry and agriculture.

According to the Republic of Moldova's Energy Balance, the total annual fuel consumption made in the last few years about 550 thousand tonnes of petroleum products (in 2005: 546 thousand tonnes; in 2006: 532 thousand tonnes; in 2007: 554 thousand tonnes). Moldova's storage capacity for petroleum products and in particular diesel oil and gasoline is about 600 thousand tonnes.

To improve the nation's energy independence, a possibility should be examined to construct a petroleum refinery in the northern part of the country (with Otaci, Soroca or Rezina as viable location options) and to complete the construction of the oil terminal in Giurgiulesti with the auxiliary infrastructure and phased increase of its operational capacity. Two ways of access to petroleum sources will be a complete solution to the problem of ensuring the supply of petroleum products. The implementation of the above Projects is possible as a joint effort at the international level as well as via cooperation between the local stakeholders and the specialized international organizations within the framework of programs such as INOGATE with the involvement of the international financial agencies (EBRD, World Bank and IMF).

To diversify the energy resources, coals can be examined as an alternative to the natural gas if the use of clean coal burning technologies is ensured and if this business turns out to be viable in economic terms. An acceptable supply option would be the imports of coal from Ukraine, Romania or Poland, i.e. the countries close to Moldova.

2.4.3. National Priorities for Heat Supply

The heat supply problem is one of the most complicated in the Republic of Moldova. Urban settlements have centralized heating systems, which in most cases are irrationally designed with reference both to heat sources, and network configuration. Co-generation sources exist only in big municipalities - Chisinau and Balti, however these are equipped with out-dated equipment, besides, they do not cover the urban areas completely.

Thermal plants were designed to use imported costly fuel, while local fuels were totally ignored. In most cases the thermal plants were placed far away from the consumers load centre, what contributed to huge heat losses and excessive consumption of energy during transportation. Poor execution during construction, irresponsible operation and mismanagement caps it all. At present these flaws are enhanced by payment incapacity of a considerable part of consumers, politization of the problem due to its social aspect, economic interests of the companies installing autonomous heating systems, incompetence of decision makers, unfavourable investment climate in the country, etc.

Such circumstances make the heat supply sector unattractive for investors and privatization attempts to fail. Financial penury does not provide for rehabilitation and streamlining of the heat supply system on the state's account. The impossibility to align tariffs to the actually incurred costs makes it difficult to rehabilitate and modernise the system on the account of the respective enterprises.

Medium term priorities for heat supply are as following: promoting the policy of decentralization and upgrading urban systems of heating supply; increasing energy efficiency of heating systems by implementing heating distribution systems under horizontal scheme in multi stores apartment blocks; use of two way pipelines scheme for heating supply; automatization of heating systems in buildings and other measures; building mini-CHPs with blocks and modules of up to 10 MW capacity, using as primary resources natural gas and RES (solar energy and solid biomass, biogas and bio-fuels); renovation of Chisinau and Balti centralized district heating system through upgrade of main pipelines and distribution networks inter - and intra-city districts made through local interventions after identification of highest losses segments to replace them with pre insulated pipelines.

Revision of Sector Policies

Starting from the fact that for Heat Supply annually there are consumed circa 40 per cent of the total amount of energy resources consumed at the national level, the fuel consumption reduction potential in this area is significant.

General measures on fuel consumption reduction include: continuous development of the sector legal framework; strengthening of the institutional sector framework; providing conditions to attract investments in the Thermal Power Sector; developing the State Program on Energy Market Liberalization; developing the draft Government Resolution on Divesting the Enterprises from the Thermal Power Sector; speeding up the re-organization of heat supply networks through demonopolization and privatization; elimination of discrepancies between the existing prices for energy resources for a more efficient use of the latter; stimulating competition on the market between energy products suppliers, including oil products and coal suppliers; diversification of sources and ways of energy resources import.

Diversification of sources and ways of energy resources import is the main factor in assuring the country's energy security, and at the same time provides favourable conditions for energy conservation and choosing fuels with less greenhouse gas emissions intensity. It should be noted that construction of the Giurgiulesti port designed for this purpose, was delayed over a number of years, inclusively as a result of unfavourable investment situation in the country, high level of corruption, resistance opposed by neighbouring countries (Ukraine and Romania), which have ports in close proximity (Reni, Ismail, Galati), etc. Among other barriers on the way of energy sources diversification are incomplete de-monopolization of the fuel supply complex and excessive reliance of the country on natural gas.

Technical measures for fuel consumption reduction within heat supply sector, include: energy efficiency enhancing activities – energy conservation in all segments of the thermal power sector: production, transportation and consumption, as well as implementation of new energy efficient technologies; reconstruction of thermal power networks implementing advanced technologies, such as placing of pre-insulated pipes connected underground with no channel and, if possible, with no compensator, with a minimum number of wells; developing thermal power networks protection regulations; using local fuels, secondary energy resources, renewable energy sources (in particular biomass and solar energy), as well as industrial or domestic energy waste to produce heat.

Legal Framework Revision

Adoption of the legal framework on energy sector has been long delayed (Law No. 1525-XIII as of 19.02.1998 on Energy, Law No. 1136-XIV as of 13.07.2000 on Energy Conservation, the draft Law on Thermal Power is still under Parliament's consideration, incoming No. 4356 as of December 25, 2003, see Parliament Resolution No. 44-XV as of 26.02.2004 on the draft Law on Thermal Power).

The current legal framework on energy sector has a purely economic nature, being however targeted towards energy saving, contributes to lowering fuel consumption, and indirectly, to GHG emissions abatement.

These laws are focused on assuring adequate political, organizational and economic conditions for efficient use of energy resources during extraction, production, processing, storing, transportation, distribution and consumption, while limiting the monopolist activity and enhancing competition in energy sector.

The energy sector development conditions and measures to promote environment protection are stipulated in the Law No. 63-XIV as of December 23, 1998 regarding the Concept of divesting enterprises in the electric and thermal power sector, the Law No. 1103-XIV as of 30.06.2000 on Protecting Competition, the Law No. 982-XIV as of 11.05.2000 on Access to Information, etc.

However, some measures stipulated in these laws pertaining to the thermal power sector received no attention in the regulatory and normative acts: support from the state, central and local public authorities to private initiatives in the Thermal Power Sector; regulation of monopolist activities and enhancing competition in the Thermal Power Sector; inviolability of investments made in the thermal power system; non-interference of central and local public authorities in the economic activity of thermal power production, transportation, distribution and supplying enterprises, except for cases expressly stated in current legislation; diversification of thermal power production sources and forms of ownership in the thermal power sector, etc.

In the heat supply sector, diversification of sources, if any at all, is made on the account of implementing autonomous heating systems based on the individual building or apartment thermal boilers. This trend is a positive step in comparison with the centralized systems which existed until present based on district or central thermal plants, however still it is not in line with the modern trends of co-generation and tri-generation sources.

Co-generation systems on the basis of the CHPs with a mixed gas-steam cycle, with the electrical power of 50-500 MW, and thermal power in the same limit, and mini CHPs with gas turbines or piston engines, with electrical power ranging from 50 kW and 10 MW and thermal power of circa 2 times higher, allow for a 20-40 percent fuel savings in comparison to the separate production mode in the most performing modern systems. Tri-generation installations, which in addition to electric and thermal power, provide for production of cold for air conditioning and potable water cooling systems, offer a better product and save fuel.

The impediments on the way of co-generation implementation are the following: poor knowledge of the advantages by the decision makers; a relatively high cost of the respective equipment; financial penury in the country; unfavourable investment climate; access to a relatively cheap electric power market of Ukraine and Russian Federation, where the cost for fuel is incomparable lower than the local one; inadequate tariffs for thermal power; interference of central and local authorities in the economic activity of the energy enterprises; a strong lobby for the enterprises importing autonomous heating systems.

Interference of authorities in the economic activity of the energy enterprises poses a serious problem. Taking into account the current economic crisis and poverty, as well as the low culture of the political class, it is hardly possible to try to avoid this interference.

Regarding the competition in the Thermal Power Sector, it is necessary to mention that under current situation with inadequate tariffs for heat (these are far from covering the actual thermal power production costs), such competition is non-existent. It is difficult to overcome this situation, however, there are solutions and the process has already started.

If the current prices for electricity (circa 5-7 US ¢ /kWh) and thermal power (circa 5 USD/GJ) in case of a big CHP (which works for the transportation and distribution networks, where the tariffs for energy increase by two times on the account of costs, losses, taxes, etc.) are inadmissible, then for an autonomous mini-CHP such prices are more than favourable.

It should be noted that the current draft *Law on the Thermal Power* provides for diverse facilities for co-generation installations, which have to be more aggressively supported at the government level.

The possible measures of financial nature that could later be reflected in sector legislation, are: (i) setting up the Energy Sector Development Fund; (ii) providing fiscal facilities to commercial banks and investment funds in the event of their participation to financing energy and environment protection focused projects; providing fiscal facilities and credits to companies which on their own account upgrade technologies aiming at reducing consumption of natural resources and environment protection, etc.

Revision of the Normative Framework

In the energy sector in general, and the thermal power sector in particular, initially the normative framework had been developed with the contribution of the Ministry of Energy, Ministry of Industry and Infrastructure, and more recently, after the National Agency of Energy Regulation (ANRE) has been established, with its contribution, too.

The ANRE developed the Methodology for calculation, application and approval of tariffs for heat supply services (Apr. ANRE No. 147 as of 25.08.2004). However, excessive politization of the problem of tariffs for heat impedes the appropriate application of this methodology, in particularly in Chisinau municipality.

The Ministry of Environment and Territorial Development issued the Order No. 423 as of 25.10.2000 introducing new specific norms for buildings providing for a minimum admissible value of the global resistance of partition-walls was raised from 0.66-1.18 m^2 K/W to 2.5-2.7 m^2 K/W, starting January 1, 1999. However, taking into account the long term of life of the buildings, and the fact that two thirds of the buildings were built after 1970, in order to save energy for heating in the short and medium term run it is necessary to improve the insulation of old buildings, in particular of those built in the ‘70-90 of the past century (over 50 percent of the existent housing stock). Also, it is necessary to develop standards regarding the limit of energy consumed to produce one unit of output in all branches of industry, for home appliances, etc.

2.4.4. National Priority Areas for Energy Efficiency

Energy efficiency is one of the priorities for the national economy and for the energy sector and has been named a key objective under the EU-Moldova ENP Action Plan (Objective 66).

Currently 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 reduce the financial impact of the energy sector on the GDP by 1.6-1.7% per year, starting with 2009.

The pursuit of higher energy efficiency does not concern only the energy sector but cuts across all sectors of the economy and energy consumption and, therefore, has a highly decentralized character. As a result, it requires a variety of approaches and types of measures, which generally differ from one sector to another.

The key principles of state policy in the field of energy efficiency are:

- gradual approximation of national legislation with EU secondary legislation on energy efficiency till the year 2010;
- increasing awareness and providing technical-scientific and information support for energy saving and energy efficiency activities;
- harmonization of interests of energy consumers, suppliers and generators for energy saving;
- transparent granting of incentives for energy efficiency interventions;
- mandatory implementation of energy saving measures by legal entities;
- close monitoring by the State of the progress in efficient use of energy resources.

Specific objectives in the field of energy saving and increasing energy efficiency include:

- implementation of the National Programme for Energy Conservation 2003-2010 (approved through Government Resolution No. 1078 from 05.09.2003) and its due extension, with an on-going biannual update, while taking into account the EU Commission Green Paper of 22 June 2005 on "Energy Efficiency - or Doing More With Less" and the Green Paper of 8 March 2006 "A European strategy for sustainable, competitive and secure energy";
- developing, approving and applying standards aimed to increase efficiency of energy consuming equipment, especially in line with standards set out in EU legislation on energy efficiency;
- developing and encouraging through promotional material and moral incentive energy saving initiatives that increase energy efficiency within the budget funded sector, households and national economy branches, including the energy sector;
- promoting the use of efficient, economically viable and non-polluting energy technologies and equipments in all sectors of the national economy;
- encouraging application of new rules for investments and incentives to increase energy efficiency whilst promoting development, such as setting up specific standards for energy resources consumption, which would accept use of resources saved as a result of energy efficiency actions for other production purposes or activities of enterprises and organizations;
- establishing a database on energy efficiency options and providing free access of legal entities and individuals to this information;
- promotion of consultancy and audit services by private or state organizations, which will provide information about energy efficiency programs and technologies, as well as technical assistance to state and private sector consumers;
- setting up zonal energy efficiency demonstration centres;
- elaborating price and taxation policies which provide clear signals favouring energy efficiency.

Measures to achieve these objectives include:

- reviving and extending the activities of the Agency for Energy Efficiency and Renewable Energy Sources (former National Agency for Energy Conservation), which will be assigned a role in the implementation of the National Energy Saving Program;
- cooperation in the field of energy efficiency and development of renewable energy sources with European Union and CIS structures, including technical assistance;
- closely monitoring the transposition of the EU secondary legislation on energy saving and energy efficiency;
- promoting energy efficiency through energy consumption minimization technologies in buildings and especially in public buildings, including the use of renewable energy sources;
- designing and providing financial support instruments for energy efficiency projects, efficient technologies, and research and development in this field; to this end, the National Fund for Energy Saving will seek funding both from the State budget sources and from grants;

- actions towards establishing energy service companies (ESCOs) and use of other financial instruments and organisational approaches to stimulate commercial banks to invest in energy efficiency projects;
- setting up energy efficiency demonstration zones which will disseminate and promote the achieved results from demonstration projects at both the national and local levels;
- setting up minimal energy efficiency standards for different equipment and technologies (e.g. for buildings, transportation, home appliances, common industrial equipment, etc.), to be gradually harmonised with EU standards;
- study of the possibility for establishing a market for trading green and white certificates;
- review of price setting methodologies and taxation of energy products so as to incorporate incentives for energy efficiency etc.

2.4.5. National Priority Areas for Renewable Energy Sources

The current state, key tasks and means for the development of renewable energy sources in the medium term are stipulated in the "Draft National Program for the Development of Renewable Energy Sources" until 2010. The country has set forth the goal of increasing the participation of RES in the country's energy balance up to 6% in 2010 and 20% in 2020.

The increased use of RES has also environmental benefits. If the targets stated above are reached, they will result in an annual reduction of CO_2 emissions by 167-210 thousand tones of CO_2 equivalent.

The aforementioned program foresees the development of the energy potential of:

- biomass: use of biomass both from energy cultures (production of biofuel from cereals, sugar sorghum and oily technical cultures - rape, sunflower, grape seeds from wine industry etc.) and agricultural, forest and urban wastes,
- solar energy by conversion to electricity and heat,
- wind energy,
- hydropower, and
- other sources of energy.

The following specific objectives are set to achieve the goals of the Program and the Energy Strategy:

- preparing and improving legislation related to the development of renewable energy sources by establishing a transparent and efficient national legal framework, which will include incentives approved by international practice;
- development of the scientific, technical, economic, informational, financial and production potential;
- identifying and removing barriers to renewable energy sources implementation;
- developing an efficient and continuous mechanism for implementation of the Energy Strategy, which will include scientific research and development, estimation of renewable potential, launching pilot projects and inclusion of this potential into the economic cycle;
- establishing conditions for the stable development of the energy industry based on RES and increasing the amount of RES use in the national economy;
- increasing the level of professional training of personnel in this field;
- increasing public awareness of the importance of RES use for the sustainable development of the country;
- establishing a national fund for promoting renewable energy;
- introducing the necessary legal framework for using biofuel and biofuels mix for transportation and agriculture sectors, taking into account the relevant objectives and targets of the EU;
- use of liquid (ethanol and bio diesel) and solid biofuel obtained from renewable sources in order to reduce energy resources import.

Measures to achieve these objectives include:

- transposition of national legislation to Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market and Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport.
- research and development in new energy sources by assimilating their potential for:
    - development of energy obtained from biomass, solar and wind energy and low thermal potential heat sources;
    - development of hydropower - build mini-hydro stations on Dniester, Pruth and Reut rivers;
    - promote research in the field of hydrogen energy, etc.

After application of the Methodology for Energy Tariff from Renewable Sources there are many advantages to invest in Moldova in the field of renewable energy. The methodology offers to the energy producer from renewable sources the guarantee of income. It is worth to mention that the benefit will be higher for first investor on the market. The Republic of Moldova has primary and secondary legislation that offers to investors the possibility to have a real benefit from renewable energy sources.

2.4.6. Interest for Receiving Equity and Mezzanine Financing

In the Republic of Moldova capital markets on the whole are underdeveloped and shallow. The primary market for government securities is well-organized but dominated by commercial banks, while the secondary market is almost nonexistent. Liquidity on the markets is constrained by the absence of nonresidents, who have sold their holdings in the wake of the 1998 Russian crisis and have not returned since then. The lack of investors on the equity market is exacerbated by fragmentation of the market.

2.4.7. Barriers to Financing Energy Efficiency and Renewable Energy Sources

All sectors have big energy efficiency potentials in the building stock, technologies and management. Lacks of financing and insufficient or non-existent economic incentives are the major barriers for the implementation of energy efficiency measures by all types of consumers.

Residential Sector

The residential sector is characterized by a broad range of inefficiencies starting from large commercial heat and hot water losses (thefts and leakages) in the systems, to wasteful end use in dwellings that are not weatherized. However, energy efficiency projects in the residential sector are not implemented with the exception of donor-assisted demonstration projects or occasional attempts by managers of some buildings.

The increase in energy price levels, combined with the low level of income (energy bill of a household might represent in winter season more than 50% of an average salary, however the average annual expenditures for dwelling and facilities, inclusive for energy services, constitutes only 13.5% out of total; [source National Bureau of Statistics, 2008]), has resulted in past in low rates of payment collection (the payment of electricity bills reached 100% after the Law on Energy allowed disconnection of non-paying consumers). Actually, it is difficult to reach real savings in the residential sector in the actual conditions, where the energy comfort is much lower than the norm, combined with difficulties in defining and explaining the “baseline energy consumption”.

Increase in prices of imported energy fuels, big system losses, and chronic non-payment by the consumers, led to a serious financial crisis of the heating sector. Since 2000, heating companies have

been established as municipal enterprises, wholly owned by the local administration. The majority of these units did not have the necessary experience and financial means to redress the problems of the heating systems, or at least for reducing the crisis. In fact, many heat supply systems have stopped operation, whereas the efficiency of the remaining ones is very low. As a result, heating services both to public and residential buildings continue to deteriorate. Many customers have started refusing the heat supply, thus reducing significantly the demand for heat, consequently affecting the efficiency of generation.

Finally, an important barrier for the implementation of energy efficiency improvements in multi-story buildings of the residential sector is the lack of legal authority of the housing associations. As there is a high share of private ownership, the associations cannot oblige the individual owners or tenants to participate in the funding of energy efficiency measures. The privatization of apartments has left the apartment owners without any obligation regarding common facilities such as heat supply, maintenance of the building shell, etc.

Institutional Sector

The legislation does not give incentives to local governments and public institutions to save energy. This, according to mayors, principles, directors of public institutions, is the main impediment why energy efficiency projects are not implemented in these given institutions.

The current budgetary regulations should be improved to give more incentives to local councils to manage their budgets rationally. The limits imposed by the central authorities on the budget expenses do not encourage local governments to develop and implement different projects that would result in reduction of costs for municipal services, including heat. Under the current itemized budget allocation system, municipal budget saving in any expenditure category will result in a reduced allocation from the central budget in the following year. For example, if a municipality would implement an energy efficiency project in schools and thus would reduce the fuel consumption by 20%, next year central authority will cut those 20% (money equivalent) from the local budget and local budget will get no savings out of the project and cannot use savings for alternative needs in the public entity (for example buy new books in the school) or to improve the quality of services in public buildings, etc.

Budget constraints, together with the deterioration of the district heating services, resulted in great difficulties for assuring enough heat for the public institutions such as schools, kindergartens, hospitals, etc. Mayors of municipalities have addressed the problem of budget creation problem, but no real improvements have been carried out until now.

Industrial Sector

EBRD experience shows difficulties in finding customers in the corporate sector reaching the minimum requirements in regard to international banking practices. Furthermore, lack of financing leads to a concentration on core business activity and little interest for energy efficiency investment opportunities. Although energy audits and implemented energy efficiency projects demonstrate high energy efficiency potential in all sub-sectors of industry, energy efficiency is still not a matter of great concern in industry. The limited awareness of the industrials about the possible benefits and needed actions results in lack of interest and motivation.

2.4.8. ESCOs

The lack of financing for core business activity limits the interest for energy efficiency investment. The limited awareness of the corporate sector of the possible benefits and needed actions results in little activity in energy efficiency investments.

Furthermore, the market conditions have not been favorable for the development of energy service companies (ESCOs) in Moldova until now, even there are engineering companies that have worked on donor-financed turn-key contracts in the range of US$ 50,000 to US$ 150,000.

One of the main barriers for energy services development is that energy prices are too low, which does not allow energy savings as a result of energy efficiency projects to compete with other types of investments. Legislative impediments in the public sector, such as budgetary proceedings, represent another barrier for energy efficiency projects to be implemented. Since the conditions in the market are changing, there are premises for ESCOs development.

The recent rise in energy prices had increased the share of energy costs in the industry, which made it more important to the managers of the respective entities. New energy efficient technologies are increasingly available on the market, which are offered using financial instruments – for example leasing.

Although there is a strong demand for leasing vehicles, especially from SMEs, the leasing industry is still underdeveloped even by regional standards mainly because of tax disadvantages for those who lease equipment. Development of leasing mechanism could be facilitated if the VAT status is adjusted appropriately.

2.4.9. Banking Sector

The Republic of Moldova performs above average in the use of international accounting standards – back in 2002, almost 82% of the sampled companies were using them, and about 46% had external auditors. This should allow banks and other potential lenders to more easily assess credit worthiness. Moldovan companies perceive themselves to be credit constrained, but their difficulty in accessing credit is similar to other transition economies. Long-term bank lending remains limited, with few companies being able to obtain loans with terms longer than 12 months. Nominal and real interest rates and collateral requirements are also high.

In 2005, new investments in the corporate sector are mostly financed on internal funds. The median debt-to-asset ratio is still very low, suggesting that companies are not becoming more leveraged and that access to affordable finance is still problematic.

While being overwhelmingly dominant in the financial sector, the banking sector is still relatively small. The relatively low level of financial intermediation is partially due to the early stage of market development and the widespread use of cash in the economy. Despite the continuous growth of deposits in banks indicating the increase of confidence in the banking sector, cash holdings are still prevalent and are supported also by the inflow of remittances from abroad through official and non-official channels.

Lack of product diversification, poor banking skills, and inadequate lending and crediting policies are de facto limiting the efficient development of new banking services. The costs of these inefficiencies are eventually transferred to the private sector as high interest margins and transaction costs. In addition, weaknesses in the operational environment are undermining the efficiency of the banking sector. Uncertainties in policy implementation by the authorities complicate bank operations, and increase costs. Since monetary operations of the National Bank of Moldova are often unpredictable for banks, they tend to keep higher liquidity. The recent increase in the level of required reserves raises the cost of compliance, exacerbating existing inefficiencies in the system. These inefficiencies are reflected first of all in very high returns on equity and returns on assets.

2.4.10. Conclusions on the State of Financial Environment for Promoting EE and RES

- Although primary legislation on energy efficiency and renewable energy exists in the Republic of Moldova, there is lack of secondary legislation; thus, energy efficiency legislation is more declaratory than operational;
- Economic incentives to stimulate the implementation of the recommended measures have to be developed;
- Inefficient legislation to support the structure of the ANCE; most important barriers posed to the fulfillment of Agency activity are the lack of financial and human resources;
- All sectors have big energy efficiency potentials in the building stock, technologies and management; however, lack of financing is a general barrier for the implementation of energy efficiency measures by all types of consumers;
- According to 2007 data, new investments in the corporate sector have been mostly financed using internal funds; capital markets on the whole are underdeveloped.
- Technological skills are reasonably well developed in the Republic of Moldova, both on energy efficiency and renewable energy issues; however there are needs for capacity reinforcement on business development issues;
- Though there is a good understanding and capacity on EE and RES issues, financial and human resources are still insufficient to implement practical actions; institutional stability is required and the existing normative and legislative framework must be extended;
- Lack of financing for core business activity limits the interest for energy efficiency investment; the limited awareness of the corporate sector of the possible benefits and needed actions results in little activity in energy efficiency investments; equity and mezzanine financing business development skills are therefore limited;
- The market conditions were not favorable for the development of energy service companies (ESCOs) in the Republic of Moldova until now.

3. ENERGY EFFICIENCY AND CDM PROJECTS IMPLEMENTATION

3.1. Energy Efficiency Projects

The EU TACIS Programme has funded energy efficiency projects, most notably a project involving 40 industrial energy audits; the creation of the National Energy Conservation Agency (ANCE); financing for energy auditing equipment for ANCE; and implementation of the recommended measures at 1 or 2 of the audited enterprises. This project had a capacity building element (intended to build capacity for energy auditing at the ANCE) but this capacity has been to a large extent lost due to the lack of follow-up, staff movements and eventual transformation of ANCE into a new Agency on Energy Efficiency, which has not yet been operational at the time of the assessment mission.

In 1997-2001 the European Bank for Reconstruction and Development (ERBD) in partnership with the Government of Moldova and Municipal Council of Chisinau and with bilateral support from the Danish Environment Protection Agency (DEPA) and EU TACIS Program implemented the project "Rehabilitation of Water Supply Services in Chisinau" (total project costs were USD 26.6 million, of which the ERBD loan made USD 14.3 million) focused on the improvement of water supply service available to the population of Chisinau, including: more reliable access to water sources for consumers; uninterrupted water supply to the population; mitigation of pollution levels to the rivers Byk and Dniester; reduction of running costs; improved financial and operational performance of the Supplier – "Apa-Canal Chisinau"; reduction of the need in major extension investments and rehabilitation of the water production capacities via implementation of loss/leakage reduction programs and better company management. The EBRD loan was used for: installation of new water supply pipelines and pumps; installation of water meters and automation of the water pumping systems; procurement of the laboratory and diagnostic equipment; and procurement of water treatment plants for domestic waste water. The environmental benefits from the project comprised:

annual reduction in the electricity consumption by approximately 80 million kWh, which allowed to reduce GHG emissions due to power generation in Moldova; reduction of water consumption by approximately 26 percent owing to prevented losses/leakages; improved monitoring over used water treatment and sludge deposits; improved drinking water quality control, etc.

Within 2001-2003, the Danish Environment Protection Agency (DEPA) implemented a number of smaller projects focused on the rehabilitation, extension and improvement of access to drinking water for the population of a number of Moldovan settlements, including: the project of ensuring drinking water supply to Borceag village (70,080 m^3 annually) for approximately 1,700 residents (total costs: DK 2.2 million); the project of ensuring drinking water supply to Chircaiesti village (180,000 m^3 annually) for approximately 4,000 residents and reduction in the energy consumption by round 480,000 kWh annually (total costs: DK 9.4 million); the project of rehabilitation and expansion of the drinking water supply system for the town of Stauceni (50,000 m^3 annually) for approximately 2,500 residents (total costs: DK 8.7 million).

Within 2001-2005, the United States Agency for International Development (USAID) has completed four projects related to energy efficiency:

- *Energy Sector Regulatory Development:* this project provides technical assistance for the establishment and organizational development of an effective, independent, and fully functional regulatory body, the National Energy Regulatory Agency (ANRE) to promote competition and efficiency in the Moldovan power and gas sectors and petroleum products market.

- *Moldova Energy Efficiency Weatherization:* the respective project resulted in energy-savings and better living conditions in institutions such as boarding schools, clinics, hospitals and orphanages throughout Moldova who suffer from chronic energy shortages to complement other USAID energy sector reform projects, and provide humanitarian assistance. The project illustrated how improvements in selected buildings (e.g. schools, hospitals, orphanages, etc.) will reduce the amount of fuel used and improve comfort. USAID contracted with Advanced Engineering Associates International (AEAI) and provided funding of US$ 0.5 million for the 1999-2000 winter weatherization program to increase the energy efficiency in eight institutions and one residential complex. Forty five institutional buildings – primarily health and educational buildings (several orphanages and boarding schools, as well as clinics and hospitals for mental patients) were included in the 2000/2001 project. As of, November 2002 weatherization work has been completed at 53 institutions in Moldova, impacting 30,000 people throughout the country.

- *Power Sector Privatization:* the program has been assisting the Government of the Republic of Moldova with the sale of power distribution and generation plants. Advice was provided to government in its negotiation of terms with the selected finalists and evaluation of bids from international investors to ensure competent bidders and fair revenue. Three of the countries' five electric power distribution companies were privatized in 2000 by Union Fenosa. USAID was funding also privatisation advisers (Deloitte and Touche) to prepare for the privatisation of the two electricity distribution companies, which remain in State ownership. It is planned that the privatisation of the two remaining distributors will be completed by the end of the first quarter of 2003. Electricity distribution privatisation should be followed by privatisation of the generators, but generation privatisation and the heating reform projects are closely related, since the viability of the CHP generation plants depends on the heat demand. The first energy donor roundtable organized jointly by USAID, Chisinau and Alliance to Save Energy was held on April 21, 2003. The urge to bring all donors acting in the energy sector under one umbrella emerged as a result of a series of meetings and interviews with donor-organizations. Within those, many respondents expressed concern about the lack of networking and coordination of activities among donor community, which, if

improved, could have increased the chances of success for all parties and their programs. The strength and visibility of the energy sector can be measurably enhanced if individual groups work together toward a common goal.

- Municipal Network for Energy Efficiency (MUNEE): Moldova is part of the USAID-Alliance supported Municipal Network for Energy Efficiency program which was created to help cities in transitional countries meet the challenge of world-market energy prices through enabling greater energy efficiency. It gives municipal leaders an opportunity to implement critical energy saving programs through regional training and exchanges, technical assistance, and policy analysis. The activity aims to provide support for energy efficiency policy reforms, link Moldova with the new MUNEE network established in the region and develop demonstration energy efficiency projects in Chisinau that show cost-savings gained from energy waste reduction. Under the framework of this regional project, USAID has introduced a 'Heating Sector Reform Project' that has significant implications for (and complementarities) to the proposed GEF project. The project has four phases, as follows: phase 1: development of a heating strategy, and drafting of changes to primary legislation required in order to meet the overall project objectives to create a commercially viable heating sector open to investment by private investors; phase 2: passage of the amendments to laws/ regulations (government, parliament, and ANRE); phase 3: development of bankable projects and project proposals to potential financiers to transform district-heating companies into viable entities; phase 4: attracting potential sources of finance for the heating sector. The project has funded a public awareness campaign on how to save energy in the home. This was followed by a similar publicity campaign to promote weatherization, which was undertaken in September 2002, just before the beginning of the heating season. A regional one-week training seminar was held (also with the participation of Armenian and Ukrainian local authorities) on municipal energy planning, which included training in the development of project proposals. The MUNEE project was also developing a regional network (under the Stability Pact) for energy efficiency and water resources. This network involves 8 countries (Albania, Bulgaria, Croatia, Macedonia, Romania, Moldova, Yugoslavia, and Bosnia). In the Republic of Moldova, the *Alliance to Save Energy* promotes energy efficiency at municipal level; the objective of the *Alliance, created by USAID in 2001,* was: (i) to develop and implement energy efficiency policy and to identify the existing barriers for its successful adoption; (ii) to strengthen the local counterpart capacity at the regional and municipal level; (iii) to develop and implement energy efficiency projects in Moldova; (iv) to disseminate good experience of other countries in better energy management; (v) to implement a demonstration project showing that small investments in energy efficiency can reduce the costs, improve comfort and bring other associated benefits.

In cooperation with the Norwegian partners – the Norwegian Energy Efficiency Group (NEEG) and the Norwegian Society of Charted Engineers (NIF) - the Cleaner Production and Energy Efficient Centre wasestablished as an NGO in 1999. In the framework of the project a small revolving Fund for Cleaner Production and Energy Efficiency ($ 30,000) has been established. Within 2000-2005 time series there were implemented a certain number of projects at industrial enterprises in Chisinau, Balti, Tiraspol, Bender and Comrat, including: "Agroconservit" Cannery, "Avicolo-Roso" Poultry Farm, Cahul Bread-Baking Plant, CHP-1 in Chisinau, Yeast Factory in Chisinau, "Floare Carpet" Factory, "Guvaier" Jewelry Plant, "Lapte" Dairy Factory, "Macon" Building Materials Plant, "Mezon" Plant, Leather Factory "Piele", "Tutun" Tobacco Factory, etc. Those surveys have identified about 300 Projects (A, B and C Rating), of which *A - Rated Projects* dealing with purely organizational issues and not involving any supplementary costs accounted for 57 percent; *B - Rated Projects* requiring minimum costs accounted for 23 percent; and *C - Rated Projects* needing major investments accounted for 20 percent of the total. Of the 197 projects that have been implemented, 79 percent were *A - Rated*; 15 percent were *B - Rated* and 6 percent were *C - Rated*. Training has been delivered to about 100 engineers representing 37 Moldovan companies. The

annual savings accomplished owing to the implementation of the above mentioned projects made about USD 1,535 thousand, of which: 11,480,425 kWh of electricity; 2,595,589 m^3 of water; 3,710 Gcal of heat; 451,660 m^3 of natural gas; 5,600 tonnes of raw materials; 348 tonnes of emission reductions. A program has been completed within the framework of such cooperation to set up an Environmental Management System: six Moldovan companies have established own Environmental Management Systems for the first time in Moldova, and 2 companies applied for ISO 14001 certificate. A training program has been delivered to the managers and engineers on energy audits of buildings (under the demonstration projects, energy efficiency measures have been identified for 6 buildings, making it possible to save about USD 44.7 thousand annually). Trainings, round table discussions, conferences, lectures on the subject have been delivered in the education and health care institutions.

Under the TACIS Project "Cleaner Production in Moldova, Georgia and Kazahstan" implemented in 2003-2006 capacity building activities were carried out in Cleaner Production and Energy Efficiency Centres in the participant countries; demonstration projects were implemented at the enterprises, raising the awareness of the key decision-makers in public institutions and promoting cleaner production and energy efficiency at industrial enterprises. In the Republic of Moldova demonstration projects were implemented at "Avicola-Roso" J.S.C. in Chisinau, dairy factory "Lactis" in Riscani and Building Materials Company "Macon" in Chisinau. The projects implementation resulted in economic benefits of about USD 340 thousand, obtained by those 3 enterprises, including the benefit from reduction of electricity and heat consumption, polluting emissions, water and raw materials consumption.

Starting in 2004, World Bank jointly with the Swedish International Development and Cooperation Agency (SIDA), IBRD/IDA and the Ministry of Economy and Commerce has been implementing Energy-II Project in Moldova (the initial loan offered for 2004–2008 was USD 35 million, and the additional funding endorsed for 2009–2012 is USD 11 million). The main objectives of the project were: to rehabilitate the energy system of the Republic of Moldova and to improve the security and safety of the power transmission system; to improve accessibility, quality and efficiency of heating systems in selected public buildings; and to offer technical assistance for power sector reform. The project results were: improved access to heating during the heating season (about 120 days in a year) for approximately 35 institutions (including schools, hospitals, kindergartens (pre-schools), orphanages) and 37 apartment houses. Improved access to heat was ensured to approximately 8,400 schoolchildren, approximately 1 million patients and visitors of the polyclinics and hospitals, and about 2,130 families whose apartments were connected to new heat plants during the last two heating seasons (2006/2007 and 2007/2008). The additional funding of USD 11 million approved for 2009-2012 will be used to ensure improved access to heating for about 18 public institutes and social assistance centres located in 10 administrative units (districts) of the Republic of Moldova.

Certain technical assistance projects in the sphere of energy efficiency are currently in the pipeline to be launched with the financial support from the Swedish International Development and Cooperation Agency (SIDA). They include: (i) rehabilitation and extension of CHP-1 and CHP-2 in Chisinau and CHP-North in Balti; (ii) implementation of certain energy efficiency projects at the Mother and Child Health Centre in Chisinau and Pulmonology Centre for children in Tirnova village; (iii) institutional capacity building assistance for the new created Energy Efficiency Agency, etc.

The European Bank for Reconstruction and Development (EBRD) is working currently of the implementation of a credit line dedicated to energy efficiency in Moldova, based on study on the EE market in Moldova conducted in 2008, as well as based on the experience of similar EE credit lines in Bulgaria and Ukraine.

3.2. CDM Projects

The Republic of Moldova implements activities related to the Clean Development Mechanisms under the Kyoto Protocol. Moldova ratified the UNFCCC in 1995 and the Kyoto Protocol in 2003. Being a Non-Annex I Party, Moldova is eligible for Clean Development Mechanism Projects.

Moldova is currently implementing the following CDM Projects in partnership with the World Bank's Prototype Carbon Fund (PCF) (the fund created by a group of industrialized economies listed in Annex B to Kyoto Protocol):

- *"Moldova: Soil Conservation Project*". That project was started in 2002 and focuses on the planting of new forests on 14,500 hectares of degraded agricultural land on 1,891 land plots scattered throughout Moldova. Such plots are located in 151 villages in 11 districts. The land which is expected to be planted with new forests is in most cases part of the available land owned by the local public authorities and cannot be reclaimed or developed. The total resultant reductions in the GHG emissions will be 3,215,296 tonnes in CO_2 equivalent, and the reduction costs will be USD 13.340 million as compared to the baseline. The Project is scheduled for 21 years. The cost per ton of reduction in CO_2 equivalent is USD 3.5. The Beneficiary under the Project is the Forestry Agency "Moldsilva".
- "*Use of Biomass as Energy Source in Rural Communities" (Projects 1 and 2*). The implementation of those projects started in the second half of 2005. Approximately 250-300 small projects focused on the improved energy efficiency in public buildings (schools, pre-schools, public offices, medical centres, etc.) are under implementation under those 2 projects. The main activities under those projects will be focused round the switch from fossil fuel to biomass burning. The expected implementation period of those two projects is 2005-2015. The total reduction of GHG emissions will make 357,768 tonnes in CO_2 equivalent, and the reduction costs will be USD 8.183 million as compared to the baseline. The cost per ton of reduction in CO_2 equivalent is USD 5.65. The Projects are scheduled for 10 years. The beneficiaries under the Projects are the local public authorities.
- „*Moldova: Energy Conservation and Reduction of GHG Emissions*". In conformity with the requirements of that project, its participants are private or public entities duly authorized by the project partners to participate in the Kyoto Protocol CDM Mechanism. Each of the 27 activities is represented by one of the beneficiaries under the Project – Ministry of Education (in case of orphanages and schools), Ministry of Health (in case of hospitals) or municipalities (in case of public buildings). The project is scheduled for 2006-2015. The total reduction of GHG emissions will make 114,469 tonnes in CO_2 equivalent.

By the middle of 2009 the following projects have been in the pipeline at the examination stage for approval by the Designated National Authority (National Commission for implementation and realization of UNFCCC and Kyoto Protocol mechanisms and provisions):

- Project Design Document (PDD) "Biogas Recuperation in Energy Production at Tintareni Landfill". The principal activity under that project is to capture and burn the biogas produced from organic decomposition of municipal solid waste at Tintareni Waste Disposal Site (landfill). The key project components are: biogas collection system, biogas generator unit, biogas boiler unit and biogas monitoring and control equipment. The biogas collection system comprises a grid of vertical gas extraction gauges, dehydration units and transportation lines and gas domes; biogas will be used for electricity generation and the excess gas will be burnt in a boiler at 850^0C. Active energy is 325 kW at exit from the biogas co-generation unit, and the electricity generation voltage is 190-440V. The key components of biogas monitoring and control equipment are: gas analyser and flow-meter. The gas analyser can test up to 4 gas components simultaneously, e.g. 3 of the following IR-sensitive gases, such as: CO_2, CH_4, CO, NO, SO_2, $CHClF_2$ and O_2. The station for biogas capture and burning/use was commissioned

officially and started operating as at 25 September 2008. The project is scheduled initially for 10 years (2008/2009 – 2017/2018). The average annual reduction of GHG emissions will make round 75,412 tonnes in CO_2 equivalent. The project beneficiary is the Moldovan-Italian Company 'Biogas Inter Ltd'.

- Project Idea Note (PIN) "Construction of a Co-Generation Plant with the Capacity of 31 MW at State Enterprise "Tirotex" in Tiraspol, Moldova". The principal goal of the project is the reduction of GHG emissions and more efficient use of primary energy sources in generation of electricity and heat (including: to ensure the quality and reliability of electricity supply; abandonment of obsolete equipment in the boiler section of the above enterprise; reduction of the enterprise's fuel consumption and associated costs; reduction of GHG emissions from burning of fossil fuel for power generation). State Enterprise "Tirotex" comprises: 2 textile factories, 1 finishing factory, 1 garments factory, 1 engineering plant, 1 thermal plant, 1 construction company, 1 ceramics factory, an agricultural complex and the research institute "Textiles" which is developing new environmentally friendly technologies among other things. The enterprise is a large energy consumer, which is normally imported from Ukraine. The power plants operating in the region are already more than 30 years old and they have low electricity generation efficiency. The heat for in-house needs of SE "Tirotex" is produced at the boiler section of the enterprise; however the majority of the equipment is obsolete and requires replacement. The construction of a co-generation plant will make it possible to increase the efficiency of fossil fuel consumption and reliability of the enterprise's power system and contribute to the reduction of GHG emissions from burning of fossil fuel for power generation. The total design capacity of the co-generation plant will be 31 MW for electricity and 35 Gcal per hour for hot water. The new co-generation plant will consume annually 56.563 million m^3 of natural gas and generate annually about 248 million kWh of electricity. The electricity generated by the Co-Generation Plant will be used to satisfy the in-house needs of the enterprise, and the surplus power will be supplied to "Dnestrenergo" power grid, thus replacing the power supplied by the power grid and more intensive in terms of CO_2 emissions. The intended project lifetime is 25 years (2009–2034). The average annual reduction of GHG emissions will vary between 47,640 and 54,760 tonnes in CO_2 equivalent. The cost per ton of reduction in CO_2 equivalent will make EUR 10. The project beneficiary is State Enterprise "Tirotex" in Tiraspol, Republic of Moldova.

3.3. Stakeholders Involved in EE, RES and CDM Projects Implementation

The Institute of Power Engineering of the Academy of Sciences of Moldova, the Agency for Innovation and Technology Transfer of the Academy of Sciences of Moldova, Technical University of Moldova and Agriculture State University of Moldova have strong scientific and technological capacity for developing and implementing EE and RES projects but so far this has only been done on small scale and as pilot projects.

"ProEnRe" is an NGO working on the promotion of Renewable Energy Sources in Moldova. Closely related to the Technical University of Moldova, they conduct research studies on RES, lobbying and also conducting prefeasibility studies on solar and wind energy projects. They created databases of RES potentials and methodologies that could be consulted during future RES projects.

Alliance for Energy Efficiency and Renewables (AEER) is a Moldovan NGO founded on May 14, 2007 as a follow-up of the MUNEE program implemented by the Alliance to Save Energy (an USA NGO), under a USAID Project during 2001-2007. The goal of AEER is to contribute to the promotion of strategies and policies in the field of energy efficiency (EE), renewable energy resources (RES) and environmental protection.

The Institute for Development and Social Initiatives (IDIS "Viitorul") is an independent think-tank, member of several national and international networks of public policies. Its main fields of eco-

nomic research include energy policy. IDIS "Viitorul" recently made assessment of public policy in the gas sector and provided support to Chisinau Municipality in sustainable provision of heating services. IDIS "Viitorul" has a good knowledge of the Moldovan banking sector. Under the EBRD project on establishing energy efficiency credit line, IDIS "Viitorul" recently assessed the Moldovan banks practices and capacity-reinforcement needs.

Climate Change Office beside the Ministry of Environment and Natural Resources was created within the Ministry of Ecology, Construction and Territory Development through Order No. 21 of 11.02.2004. The basic objective of that Office is to implement the Republic of Moldova's commitments under the UNFCCC, ratified through the Low No. 404-XIII from 16.03.1995 and Kyoto Protocol, ratified through the Law 29-XV from 13.02.2003. The main goals of the Climate Change Office include: (a) logistics support to the Government, central and local public administrations, NGO's and educational establishments in the activities implemented and promoted by the Republic of Moldova under UNFCCC and Kyoto Protocol; and (b) implementation of the Climate Change projects and programs, which provide for assessment of greenhouse gases by source and sink categories and producing the National Inventory Reports; development and implementation of mitigation projects; development and implementation of the climate change adaptation projects; evaluation of the climate change impacts on the country's biological and social-economic components; ensuring cooperation, promotion and implementation of the activities and projects under Clean Development Mechanism of the Kyoto Protocol; implementation and facilitation of the awareness raising and information activities aimed at civil society, professionals and decision-makers on climate change issues, etc.

The Carbon Financing Office was established to strengthen the institutional capacity for the implementation of the Law No. 29-XV as of 13 February 2003 on the Republic of Moldova's accession to the Kyoto Protocol and for the CDM implementation. The objectives of the Carbon Financing Office include the development, monitoring and implementation of new CDM projects. The main goals of the Carbon Financing Office are: a) production of the Monitoring Plan for the CDM projects supported by the World Bank and the European Carbon Fund – "Energy conservation and Reduction of GHG Emissions" in connection with Energy-II Project and "Public Heating Systems Burning Biomass in Rural Communities of Moldova"; b) consolidation of the institutional and human capacity under the Kyoto Protocol's Clean Development Mechanism; c) technical and financial assistance to the beneficiaries of the above projects; d) implementation evaluation and monitoring in respect of the CDM Projects and managing of the Carbon Financing Office special accounts; reporting to the Ministry of Finance, World Bank, Steering Committee and other international agencies; e) development of new CDM projects and their presentation to the National Commission for the implementation and execution of UNFCCC and Kyoto Protocol mechanisms and provisions; f) ensuring the fulfilment of the obligations under the agreements with the donors and beneficiaries; periodical field inspections, performance monitoring and evaluation; g) coordination and intensification of the project beneficiary training through organization of training coerces, seminars, workshops, conferences, web site establishment and support; h) other activities necessary for the efficient implementation of the Carbon Financing Office projects, including the development and implementation of other environmental projects.

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ANNEXE 1: ENERGY CONSUMPTION INDICATORS AND ENERGY INTECITY

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Energy consumption, thou. t.c.e.	4725	4218	3319	2647	2479	2701	2826	3065	3257	3242	3090
Energy consumption, thou. toe	3309	2955	2323	1853	1735	1892	1978	2144	2278	2271	2160
Energy consumption, TJ	138631	123756	97378	77664	72738	79244	82827	89792	95587	95131	90641
Electricity distribution - total, mill. kWh	4972	4609	3752	3379	3390	3781	4629	4383	4196	4074	4031
Electricity consumption - total, mill. kWh	3767	3211	2566	2244	2206	2449	2527	2634	2921	3215	3364
Industrial production (current price), mil.lei	5889.4	5981.9	7190.8	8167.7	10427.6	12624.1	15963.1	17591.1	20770.2	22370.7	26173.5
Energy intensity of industrial production, tce/1000 lei	0.802	0.705	0.462	0.324	0.238	0.214	0.177	0.174	0.157	0.145	0.118
Energy intensity of industrial production, toe/1000 lei	0.562	0.494	0.323	0.227	0.166	0.150	0.124	0.122	0.110	0.102	0.083
Energy intensity of industrial production, TJ/1000 lei	23.539	20.688	13.542	9.509	6.976	6.277	5.189	5.104	4.602	4.252	3.463
Energy intensity of industrial production, kWh/1 leu	0.844	0.770	0.522	0.414	0.325	0.300	0.290	0.249	0.202	0.182	0.154
Average population, thou. persons	3654	3652	3646	3639	3631	3622	3612	3603	3599	3585	3577
Consumption per capita, tone tce/pers.	1.293	1.155	0.910	0.727	0.683	0.746	0.782	0.851	0.905	0.904	0.864
Consumption per capita, toe/pers.	0.906	0.809	0.637	0.509	0.478	0.522	0.548	0.595	0.633	0.633	0.604
Consumption per capita, TJ/pers.	37.940	33.887	26.708	21.342	20.032	21.879	22.931	24.921	26.559	26.534	25.340
Consumption of electricity per capita, kWh/pers.	1361	1262	1029	929	934	1044	1282	1216	1166	1136	1127
GDP, mil. lei (current prices)	8917	9122	12322	16020	19052	22556	27619	32032	37652	44754	53354
Import, thou. t.c.e.	4758	3934	3092	2535	2394	2549	2795	2996	3123	3082	3025
Import, thou. toe	3331	2756	2164	1776	1676	1785	1956	2096	2185	2157	2115
Import, TJ	139598	115424	90719	74376	70239	74786	81920	87882	91605	90448	88767
Import per energy consumption, %	100.7	93.3	93.2	95.8	96.6	94.4	98.9	97.7	95.9	95.1	97.9
GDP per 1 kg c.e. intern consumption, lei	1.89	2.16	3.71	6.05	7.69	8.35	9.77	10.45	11.56	13.80	17.27
GDP per 1 kg o.e. intern consumption, lei	2.69	3.09	5.30	8.65	10.98	11.92	13.96	14.94	16.52	19.71	24.70
GDP per 1 TJ intern consumption, lei	0.06	0.07	0.13	0.21	0.26	0.28	0.33	0.36	0.39	0.47	0.59
GDP per 1 kWh electricity consumption, lei	2.37	2.84	4.80	7.14	8.64	9.21	10.93	12.16	12.89	13.92	15.86

Source: National Bureau of Statistics