

**ENERGY STRATEGY**  
**of the Republic of Moldova**  
**to the year 2030**

**Chisinau, 2012**

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## **EXECUTIVE SUMMARY**

The previous version of the Energy Strategy of the Republic of Moldova was approved by the RM Government in 2007. The Energy Strategy to 2030 (hereinafter 'the Strategy') has to deliver a strong **guidance for the development** of the **energy sector** in order to support sufficient economic growth and social welfare. The RM government has to solve the most important and therefore strategic problems. This time the RM Government has identified a Moldovan strategic vision and the country's strategic opportunities within the rapidly changing energy environment in the region of Central, Eastern and Southern Europe including Russia and the Caucasus region.

As the foundation of its Strategy, the Republic of Moldova has laid down a clear option to integrate into the European Union and its internal energy market. The application to adhere to the Energy Community and the successful fulfillment of the accession steps represent a clear proof of this option. In line with this target, the legislation of the country has to approximate to the Energy Community acquis and to be convergent with the EU acquis in a timely manner.

The period 2012-2020 will also represent a stage of the first expected results in the implementation of less expensive energy efficiency measures and utilization of less costly renewable energy sources. These measures will coexist with a still vulnerable procurement of natural gas and electricity, due to the limited number of alternative external sources of supply.

The strategy approaches the period 2020-2030 in a different manner when Moldova has to pay attention to those energy technological factors that today seem to be too expensive, or not yet accepted by the market.

### **Background to the strategic energy development in the Republic of Moldova**

The country is a pure transit country and a net energy importer, with only about 5% of demand for primary energy being met by domestic sources. Natural gas is the major fuel in Moldova, providing almost 53 % of the total primary energy supply. National demand structure shows 46.8% of energy consumed by households in the RM, compared with only 26.5% in the EU, and only 6.9% consumed by industry in the RM compared with 24.2% in the EU. The main topics of the generation, transmission and distribution assets in the country are: an imbalanced distribution of electricity generation on the two banks of the River Dniestr, to date insufficient capacity of the interconnection lines with Europe (both South-East and Western), aged assets for generation, transmission and distribution for electricity and heating.

The long-term economic development in the country is promising a steady growth in GDP. According to the Moldovan projections (Exhibit 1), a quicker than average growth is expected along the 2030 time frame for the construction sector, agriculture and food processing, transportation and tourism. Energy consumption per capita will grow, especially compared to the overall depopulation that Moldova will face very quickly and in the long run.

### Exhibit 1. Major Moldovan Economic Indicators by 2030 (base scenario)

Indices	2015	2020	2025	2030
GDP (in current prices), MDL, billions	120.238	173.331	238.958	320.705
Industry (in current prices) , MDL, billions	47.9	67.9	92.5	121.3
Agriculture (in current prices) , MDL, billions	27.0	32.9	40.1	48.9
Population, millions	3.553	3.437	3.357	3.327
Total energy consumption, TWh	4.241	5.556	6.996	8.491

Source: AF-Mercados; IMF, WEO, April 2012; Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: "Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention", April 1–June 31, 2011.

### The existing institutional framework of the energy market in the Republic of Moldova

In the electricity market there are 6 licensed producers, 3 suppliers at regulated tariffs, 9 suppliers at non-regulated tariffs, 3 distribution companies and 1 transmission operator (Moldelectrica). The 3 distribution companies act as default suppliers and play the role of the "last resort suppliers", though this attribute is not clearly defined in the existing market rules. Despite the existence of the 4 eligible consumers and 9 licensed suppliers at non-regulated tariffs, the retail competitive market is not functioning, because only Lafarge Ciment Moldova uses its eligible rights.

The most active player in the wholesale market is Energocom - the state- owned trading company which manages the contracts for deliveries from Moldavskaya TPP and for balancing energy from the Ukraine. The current degree of opening of the electricity market is only up to 10% for consumers connected to 110 and 35 kV was set up in 2002 by ANRE Resolution No 62 of 30.05.2002.

In the gas sector, JSC "Moldovagaz" was set up, with 50% of its share capital owned by the Russian "Gazprom", 36.6% by the Republic of Moldova, and 13.4% by the Transnistria region. This joint venture company owns the gas system of the Republic of Moldova, including transit upstream pipelines and includes the other gas companies. According to the Gas Market Rules, Moldovagas is assigned the status of national gas system operator.

In the gas market there are 23 licensed suppliers at regulated tariffs, 1 at non-regulated tariffs (through pipelines), one transmission system operator (Moldovagaz) and 24 licensed distribution companies. According to the ANRE Resolution No.408 of 06.04.2011, the natural gas market in the Republic of Moldova is regarded as non-competitive, due to the existence of a sole source of import being done by the supplier at regulated tariffs - Moldovagaz SA.

In its effort to join European regional market, the Republic of Moldova initiated a second wave of reforms, beginning with a new legislative package which amended: the Energy Law (by Law 107 17.12.2009), the Electricity Law (by Law 124 23.12.2009), the Gas Law (by Law 123 23.12.2009) according with Law 117-XVIII of 23.12.2009 for a Treaty of Accession of the Republic of Moldova to the Energy

Community. Also, ANRE updated Electricity Market Rules by Resolution #320 of 16.01.2009. But despite the very early unbundling of the electricity sector that was intended to provide a very strong signal regarding the country's intentions on further liberalization, these have not materialized over past 15 years. Besides the fact that electricity sector unbundling was not followed by gas sector unbundling, even the electricity sector unbundling did not support efficiency and investment.

### **EU and Energy Community goals. RM national targets vs. Energy Community and EU requirements**

The Republic of Moldova and the European Union first established contractual relations in 28.11.1994 through a "Partnership and Cooperation Agreement" (PCA), which entered into force in 01.07.1998. That same year 1998, a first energy legislative package was adopted by Republic of Moldova, in an attempt to transpose in the national framework the *acquis* of the first legislative package of the EU. This national package included 3 major elements:

- RM Energy Law 1525-XIII of 19.02.1998
- RM Gas Law 136 -XIV 17.09.1998
- RM Electricity Law 137 -XIV 17.09.1998,

being followed in the next four years by 3 other documents:

- Resolution of the Republic of Moldova on the approval of ANRE Regulation and Budget # 574 of 21.06.1999
- RM Law on Petroleum Products Market 461-XV of 30.07.2001
- ANRE Resolution on the Approval of the Electricity Market Rules # 75 of 12.12.2002

### **Interrelation of the strategic objectives over time**

Until 2020 the sector has to follow the key priority drivers for this period:

- a) transmission (networks & pipes) in terms of investment & improved operation
- b) rethinking the generation mix, and
- c) institutional framework for new energy markets.

By 2020 it is expected that the majority of the countries agree on this or that form to limit CO<sub>2</sub> emissions Moldova has to take measures regarding these future limits on CO<sub>2</sub> and the anticipated economic consequences.

The next decade, 2020-2030, will see carbon capture and storage technology proving to be economically viable and actively entering the market, thus drastically changing the structure, values, prices and costs of fuel for the generation technologies there. In the same time-frame smart grid technologies and equipment will be clearly proved to be economically viable and will become a de-facto standard for the electrical energy industry. This type of structuring of the energy system will greatly change the existing approaches to system topologies, balancing, metering, monitoring and energy mix.

Compared with the other contracting parties in the Energy Community, the Republic of Moldova cannot put fair competition before building the required infrastructure,

which is a part of the security of supply. The very specific situation of the country which lacks physical connections with larger markets for natural gas and electricity is the call to give the highest priority in the state energy agenda to interconnection enhancement, with the EU as its priority axis. Despite the lack of conventional energy resources, the Republic of Moldova cannot put renewable and energy efficiency ahead of market liberalization without risking increasing the final energy bill too much. The two markets: gas and electricity, may (most probably, will) come with different stages of development.

## **1. MAIN STRATEGY ELEMENTS FOR 2012-2020**

The energy strategy of the Republic of Moldova as a country which adheres to the EU's policies has **three main objectives**:

- security of supply,
- competition and availability of affordable energy,
- environmental sustainability and combating climate change.

### **Security of energy supply**

Natural gas resilience variables to consider are: diversification of sources, LNG and gas storage facilities. The diversification of supply sources has two facets to consider: enhancement of transmission interconnectors in order to provide alternative supply routes and a higher number of alternative suppliers. The real problem to be resolved by Moldova is not to guess who will win in the war of pipes, but how politically to keep the supply options open to be allowed to provide physical support for both transmission supply alternatives, first of all - to build the pipe-line between Ungheni-Iasi. If acceptance of this pipe by Gazprom cannot be achieved and it is not built, the question is useless.

Unlike natural gas, the transport of electricity has no alternative to network development and the benefits of competition and diversification. These benefits can be provided only by participation in a larger energy market and by physical facilities for network synchronous interconnection with the European ENTSO-E system.

### **New generation capacity**

It will be difficult for the Republic of Moldova to become an independent electrical energy producer, but for the security requirement and heat supply provision the country has to consider larger energy generation volumes than it has now. A critical issue in this decision might be an attitude to the energy assets of the River Dniestr.

On the basis of the expected growth in electricity demand in Moldova, the incorporation of new generation capacity has to meet part of the demand under certain changing conditions should be considered. Investments in the new generation projects in the long run will be made exclusively under Moldovan market risk conditions.

From an investor's standpoint only the market clearing prices in the wholesale energy market will reflect the system short-run marginal cost (SRMC) provided that the market is run in an efficient manner. In a well-functioning market with no shortage of generation units, SRMC pricing is commonly observed.

Without a capacity market (or capacity payments) geared towards recovering fixed costs of generating units – as is the case in the Moldovan energy market – all units except the infra-marginal unit(s) will take advantage of the difference between the market clearing price and their offer price, which theoretically should reflect their SRMC. However, it is argued that energy-only markets (i.e. markets without a capacity market or payments) are more prone to price volatility; thus, the necessary condition to be met by all future projects is to be able to obtain a price level that reflects the long run marginal cost (LRMC) of the plant. This will allow achievement of a market-based rate of return on investments as well as feasibility from a financial standpoint.

Energy efficiency, in production as well as in distribution together with sustainability requirements, should become an essential criterion for the authorization of generation capacities in the country. In order to cover the differences between internal electricity generation and forecast requirements in terms of both energy and capacity the Republic of Moldova is obliged to stay with current sources (Ukraine and Moldavskaya TPP) until connection with ENTSO-E, but meanwhile look around for the best import prices depending on transmission constraints (Romania and/or Bulgaria).

### **Energy efficiency and RES-E**

Energy efficiency is considered to be one of the main aspects of the energy strategy in the Republic of Moldova by 2020, and as a flagship initiative for a resource-poor Moldova. The existing energy savings potential is proved by audits and projects on the topic. There is an obvious complexity of energy saving policies and practical implementation even for countries with an existing more or less extensive experience in energy savings and efficiency measures. As regards the Republic of Moldova, their national energy efficiency approaches and experiences are much less extensive and require strong institutional framework in place as a precondition of its implementation.

The RES-E development directions for the period 2012-2020 will be looking very much similar conceptually as the energy efficiency development. The overall priority for RES development in the RM will be building up national institutional framework which will provide a decent support for this development, harmonized integration into the existing energy infrastructure and expected payback in terms of clean energy additional generation, low environmental burden and meeting Energy Community and EU requirements in the field. The absence of the market, providing transparent pricing and cost signals may bring a possibility to miss the fair LRMC level for renewable generation in the country. Taking into account a relatively small size of the country, limited available RES-E resource potential, presented mostly by solar and wind it might be worth considering an arrangement of centralized tenders for a limited RES-E capacity for wind and solar in the country.

### **Integration in the European energy market**

#### **Transparent and fair pricing**

The legislation will enable, and the regulation will define, price mechanisms to comply with the free market framework. It may come only with new entries, and

foreign participants will ask that of an emergent market products similar with those they benefit in EU internal energy market should be in place. This will mean appropriate trading products for the introduction of consecutive time horizons: public auctions for bilateral contracts (since 2013), a day ahead market (since 2015), intra-day trading (since 2020), ancillary services, a balancing market, etc.

### **Institutional and operational framework for real competition, effective market opening and market integration**

In accordance with the Energy Community Treaty, the liberalization of the Moldovan energy market is set for January 1, 2015 (D/2009/03/MC-En-C). Moldovan updated primary and secondary legislation will ensure that the eligible customers within the meaning of EC Directives 2003/54/EC and 2003/55/EC are all non-household customers from January 1, 2013, and from January 1, 2015 all energy customers. Eligible customers have the right to contract electricity purchase directly with any supplier, including from abroad.

According to the EU directive, the Regulator is not obliged to ensure low tariffs to households, but *"the right to be supplied with electricity of a specified quality at reasonable, easily and clearly comparable, transparent and non-discriminatory prices"*. The critical issue of the security of supply requires electricity network/pipelines development planning by TSOs to be responsible, as well as the regulator's obligation to ensure by transmission tariff establishment the availability of required investment resources for the both TSOs. The planning and investment role for network/pipeline development that definitely has to be strengthened, will enable an appropriate response to the market integration and renewable access challenges.

In order for Moldova to be ready to meet the requirements of the liberalized market in January 2015, the country has to start work on a creation of this institutional framework, as after its completion the real system and its staff have to go through adaptation and hands-on training. Market operator(s) for electricity and natural gas markets will be appointed after 2013 to provide trading, settlement and if applicable clearing as well as market coupling services after 2020. The framework will together with the TSOs provide the efficient market mechanisms and products to facilitate liquid and transparent energy trading in different terms and time horizons (public/electronic auctioning of bilateral contracts, day ahead, intra-day/balancing markets, etc.).

### **Institutional Framework for Energy Industry Development**

Accumulated debts represent not only a burden for economic agents in the energy field, but barriers to their restructuring, investment capabilities as well as a barrier to market credibility and private investment. The accumulated debts have to be resolved, while privatization will remain pending as long as this solution is pending. Fixing this problem will also represent a signal to private investment. As much as the role of the market in system development, and in this particular problem area, resolution will not be understood or accepted and this market will not become functional; the risk exists of continuing financial weakness.



While the regulator will progressively open the market by removing regulated tariffs according to a public road map towards opening milestones provided by Energy Community decisions, management of state-owned enterprises will be kept accountable for utilization of the market mechanisms to procure and sell electricity.

### **3. MAIN STRATEGY ELEMENTS FOR 2020-2030**

In 2020-2030 based on the country's affordability, Moldova has to pay attention within the framework of the Strategy and consider an opportunity to give a larger priority after 2020 to those factors that today seem to involve technologies and approaches that are too expensive, especially in the area of renewables and energy efficiency. By the time of the new decade 2020-2030 they may become affordable and accepted by the market. Also proper attention will be paid to the distribution network development using the concept of smart grid in order to optimally integrate renewables and energy efficient control.

#### **Developing renewables. Long-term CCS availability**

Within the framework of 2020-2030 a carbon capture and storage technology (CCS) may become an important driving force of the renewable development and of the shift in the electrical energy technological mix. CCS can provide the current fossil fuel-fired power plants with the opportunity to work in a low-carbon electricity sector in the future due to the drastic reduction in emissions. The uncertainty surrounding this technology, plus the lack of studies of practical experience in Europe and world-wide regarding feasible storage locations for CO<sub>2</sub> and (or) transportation facilities may add a lot of uncertainty to the strategic energy scenario options.

Moldova has a different set of priorities in this renewable development, where security of supply notions will have a primary value. Due to this criterion, technologies of RES-E generation for Moldova will go through a very thin filter of economic effectiveness and resource availability. That is why Moldova has to come back to the initial assessments of future RES-E share targets, the same as for the energy efficiency targets and policies. Considering the limited volumes of the RES resource potential and its effective level, the country has to carefully re-estimate the long-term targets: 20% RES share by 2020, approved by the Republic of Moldova.

The second stage of energy efficiency development in the country after 2020 will be based on the developed institutional framework, capacity and methodology infrastructure, practical experience in different industries, technology clusters and ownership.

CO<sub>2</sub> emissions policy will become an important factor in energy efficiency policy in Moldova. There is no final international solution on the CO<sub>2</sub> emissions policies framework, but one thing is more or less clear, namely that the policies will be based on the market-based instruments and price caps. This means that Moldova has to start preparing such an institutional change and shift in the economics of all the green-house gas-emitting entities, including power-plants.

The structure of electrical energy consumption in the RM with a predominance of the households as being the main energy consumers, future economic development based on small and medium size businesses, growing share of intermittent renewables – all these factors bring a new approach to the energy system topology and its management. Smart grid permits the achievement of this type of control to the benefit of energy savings and the final efficiency of the operations.

## 1. INTRODUCTION

1. The previous version of the Energy Strategy of the Republic of Moldova was approved by the RM Government in 2007. As quite a professional document synthesizing the widest approach to the existing national energy system and its future development, it was not able to avoid one of the most widely spread deficiencies, namely a lack of **really strategic focus**. This has been mostly visible through many different numbers and volumes, instead of a strategic analysis of scenarios, probabilities, international external factors existing and in the future, approaching and quite visible, etc. The national energy strategy cannot have many different directions and targets, or in that case it will be more of a hope of deliverance than a strategy as a notion.
2. The Energy Strategy to 2030 (hereinafter 'the Strategy') has to deliver a strong **guidance for the development of the energy sector** in order to support sufficient economic growth and social welfare. The RM government has to solve the most important and therefore strategic problems. This time the RM Government has identified a Moldovan strategic vision and the country's strategic opportunities within the rapidly changing energy environment in the region of Central, Eastern and Southern Europe including Russia and the Caucasus region.

The Strategy aims to achieve an **efficient prioritization of the country's problems** which require fast solutions and a rescheduling / resizing of the objectives according to a perceptive case by case compromise between: resources available at the moment, EU/Energy Community and national targets, agreements, international obligations and programs (also including here the neighborhood policy) and the emergency needs of the country.

3. As the foundation of its Strategy, the Republic of Moldova has laid down a clear option **to integrate into the European Union and its internal energy market**. The application to adhere to the Energy Community and the successful fulfillment of the accession steps represent a clear proof of this option.
4. The country acknowledges the reality that the process of **integration into the EU internal energy market** will be a long one, and the country's energy system as well as its overall economy and population will have to live in a transition period with the current and slowly changing conditions. For Moldova in particular it will mean almost no additional physical connections with the EU energy system and its internal energy market, exception being, possibly, the gas pipeline Ungheni-Iasi. It requires efforts to find the best solutions for energy supply over the existing routes for the country and for the implementation of political actions and technical measures in order to make this transition period as short as possible. In order to achieve this, Moldova has to be prepared for the development of a functional liberalized energy market and should not expect that the access to EU electricity and natural gas markets will simply bring easy solutions to all the country's existing energy problems.

5. The Energy Strategy of the Republic of Moldova targets 2020 as the year of full integration into the EU internal energy market. In line with this target, the legislation of the country has to approximate to the Energy Community acquis and to be convergent with the EU acquis in a timely manner. The **aquis provides the background for legal and regulatory compatibility**, but once implemented and consequently respected, it also supports the provided technical networks connection provided. In this transition stage, the reversible connection of the natural gas transportation system with the system in Romania is feasible in 2015, with a strategic target to benefit from the existing and planned connections with Romania. This connection will provide additional networking with Romania's neighbors and further in parallel with the Southern Corridor and South Stream gas highways development until later in 2020. The same year, 2020, is the proposed deadline for the finalization of a connection with the ENTSO-E network through implementation of the most feasible technical solutions after a feasibility study on the project completion.
6. To realize the ambitious but feasible target of connecting the national electricity network and the gas transmission system with the systems of the EU, the **financial dimension has to be provided** in the quickest, most efficient and least costly way. All alternatives, including European Neighborhood and Partnership Instrument, IFI support, other sources for grants, incentive regulation and private investment, will be used. The particular implementation mode has to respect the EU's relevant regulations in terms of rules and principles, or alternatively it will benefit from the agreed exceptions to the rules, as commercial consequence to encourage investments. On the other hand, the Republic of Moldova has to eliminate the accumulated arrears which represent a burden on its state-owned enterprises and undermine the country's credibility with the investors.
7. The period 2012-2020 will also represent a stage of the **first expected results** in the implementation of less expensive energy efficiency measures and utilization of less costly renewable energy sources. These measures will coexist with a still vulnerable procurement of natural gas and electricity, due to the limited number of alternative external sources of supply.
8. The decade 2020-2030 has to stem from a successful implementation of the measures and actions planned for the previous period, 2012-2020. The start of this new stage will benefit from achievement of the planned energy mix improvement, lower consumption, higher efficiency, stronger connections, more diversified sources of supply, real competition, lower concentration, consistent price discovery, accountable and honest management, with high professional level, higher social affordability. All these achievements will be **the sustainable platform** to proceed to a new stage in the development of the Republic of Moldova, with the introduction of more sophisticated technologies in respect of energy consumption control and efficient integration of small, distributed generation sources. Until 2020, the most expensive current renewable technologies will have time to mature and become affordable, and new energy generation and storage technologies as well as carbon capture technologies will acquire an economy of scale dimension,.

9. The strategy approaches the period 2020-2030 in a different manner. If, with (at this very moment) the exception of an **energy efficiency target**, the EU knows its overall plan for 2020, over 2020-2030 only projections will be launched as road maps to attempt a smooth continuation after the very stiff margin of 2020. Meanwhile the Republic of Moldova will have, during 2012-2020, the whole picture of the targeted model and will proceed with implementation, envisaging 2020 as the milestone of a comprehensive integration for the following decade. Moldova may only envisage the same lines which the EU will follow, sharing with its state members the uncertainties, risks and benefits of a large trading space.
10. Moldova has to avoid a perception that only large and powerful countries play strategic games. On the contrary, the smaller the country the **more sophisticated the strategy it has to develop** in order to benefit in a complex environment. A successful strategy is not only a very creative idea (s) but also a **consistent and persistent** and perhaps sometimes even aggressive **implementation**, when approved.
11. Being a **pure transit country** by now Moldova has a real advantage for a while, though to remain in this role for long may bring the huge risk of losing everything when transit routes change for certain reasons. It comes with the obligation in time to rethink policies and alliances and to reposition itself in the changing context.

### **1.1. Background to the strategic energy development in the Republic of Moldova**

12. The country is a **net energy importer**, with only about 5% of demand for primary energy being met by domestic sources. Natural gas is the major fuel in Moldova, providing almost 40.5 % of the total primary energy supply, which is delivered as a unique source by Gazprom from Russia (Exhibit 1).
13. **Coal is used less** in the Republic of Moldova, mainly due to a lack of coal-based power plants: 6.8 % in the RM compared with 18.3 % in the EU.
14. A comparison of **demand structure** shows 46.8% of energy consumed by households in the RM, compared with only 26.5% in the EU, and only 6.9% consumed by industry in the RM compared with 24.2% in the EU. This is not very high because of household consumption, but the reverse: having the lowest household consumption of energy per inhabitant in Europe, Moldova has very little industrial energy consumption, which makes the household share so high. Besides an obvious task to increase the energy consumption up to the socially acceptable levels, we have to underline the importance of public awareness campaigns in energy efficiency in the form of direct energy savings rather than efficiency from investment-hungry industrial technologies.
15. The main topics of the generation, transmission and distribution assets in the country are: an **imbalanced distribution of electricity generation** on the two banks of the River Dniestr, to date insufficient capacity of the

interconnection lines with Europe (both South-East and Western), aged assets for generation, transmission and distribution for electricity and heating.

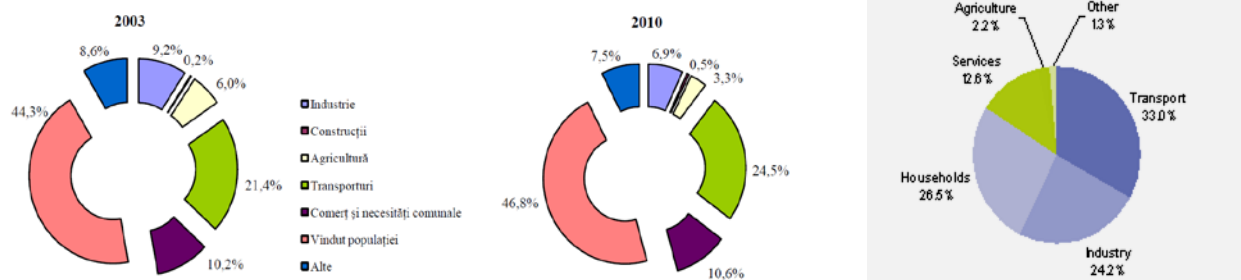
**Exhibit 1. Structure of energy mix (%)**

	procente							
	2003	2004	2005	2006	2007	2008	2009	2010
<b>Resurse, total</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>	<b>100,0</b>
Cărbune	9,3	7,7	6,8	6,7	6,6	8,3	7,1	6,8
Motorină	15,0	15,3	15,1	15,1	16,6	17,3	17,4	19,5
Păcură	1,7	1,4	1,1	1,1	0,9	1,1	2,6	1,9
Benzină auto	11,0	10,8	10,6	9,7	10,2	10,5	11,2	9,8
Gaze naturale	46,2	43,5	47,1	47,7	45,3	41,7	40,0	40,5
Gaze lichefiate	3,1	2,9	2,8	2,6	2,7	2,9	3,2	3,3
Lenne de foc	3,0	2,5	2,5	2,9	2,7	2,9	2,9	2,6
Energie electrică	7,1	12,2	10,6	10,5	10,8	10,9	11,1	11,1
Alte	3,6	3,7	3,4	3,7	4,3	4,4	4,4	4,5

Source: National Bureau of Statistics of the Republic of Moldova: National Energy Balance 2010

**Exhibit 2. Energy consumption structure in Moldova in 2003-2010**

2. Repartizarea consumului final de resurse energetice și de combustibil pe principalele activități ale economiei naționale



Sources: National Bureau of Statistics of the Republic of Moldova: National Energy Balance 2010; EUROSTAT

16. The evolution of the indicators of the **quality of electricity** delivered shows a continuous improvement since 2007, but also a stagnation or even negative evolution relating to one (CAIDI 2010) or all distribution companies (SAIDI, SAIFI 2010) during 2010. However, SAIDI value shows as being very well improved in 2011 for all three distribution companies. Also, despite the attention which the regulator's reports pays to the quality aspects of the distribution/supply service, the end consumers rarely claim compensation due to them for overdue deadlines for connections / reconnections, thereby more awareness campaigns are still necessary while end consumers rarely claim

compensation due to them for overdue deadlines for connections / reconnections.

17. Simultaneous **generation of electricity and heat** is organized at CHP-1 in Chisinau with an installed 66 MW electric and 296 MW thermal capacity, at CHP-2 in Chisinau with an installed 240 MW electric and 1,397 MW thermal capacity and at CHP–Nord in Balti with an installed 24 MW electric and 165 MW thermal capacity. Heat is also produced by heat-only plants and some small CHP plants in smaller cities.
18. Approximately **70-75% of the equipment in the energy sector is obsolete**. During 2001-2008 gas losses from pipelines were evaluated at an average of 7.0%. Today the losses are evaluated at 5.5 in distribution system and 2.3 in transmission one. During 2005-2010 the level of losses in the distribution networks was decreasing from a level of over 20% (RED Nord recording however only 14.39%) to a level of around 13%, the distribution companies being obliged to improve it under the pressure of the obligations imposed by ANRE regulation. In 2011, the losses registered by the distribution companies are: 9.89% RED Nord, 12.39% RED Nord-Vest and 19.2% RED Union Fenosa. This time, the heating sector in Moldova encountered a high level of heat losses, which accounted for 21% in 2009 and has had a tendency to increase in the past 10 years by about 6%. In 2011 the technological consumption and the thermal energy losses were achieving together 19.8%<sup>1</sup>. Technologies used for electricity generation in the Republic of Moldova are per specific fuel consumption level not as efficient as similar ones in the rest of the world, in that their nominal efficiency is half that of the modern installations. The CHP plants use gas imported from Russia and are highly inefficient. Due to reduction in energy consumption in recent years, the current operational regimes of the energy production units, especially of CHPs, are far from the nominal ones, determining a real life efficiency of the power plants that is much lower than the nominal one.
19. The long-term economic development in the country is promising **a steady growth in GDP based on the forecast** provided within the “Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: “Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention”, April 1 – June 31 2011” (Annex 2). Midterm Republic of Moldova development is presented in Exhibit 5.
20. According to the Moldovan projections (Exhibit 3), a quicker than average growth is expected along the 2030 time frame for the construction sector, agriculture and food processing, transportation and tourism, which was consequently reflected in our calculations. **Major economic indices by the year 2030** are presented in the table below. Energy consumption per capita will grow, especially compared to the overall depopulation that Moldova will face very quickly and in the long run.

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<sup>1</sup> Annual Activity Report National Regulatory Agency 2011.

### Exhibit 3. Major Moldovan Economic Indicators by 2030 (base scenario)

Indices	2015	2020	2025	2030
GDP (in current prices), MDL, billions	120.238	173.331	238.958	320.705
Industry (in current prices), MDL, billions	47.9	67.9	92.5	121.3
Agriculture (in current prices), MDL, billions	27.0	32.9	40.1	48.9
Population, millions	3.553	3.437	3.357	3.327
Total energy consumption, TWh	4.241	5.556	6.996	8.491

Source: AF-Mercados; IMF, WEO, April 2012; Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: "Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention", April 1–June 31, 2011.

17. The **consumption proportions** were calculated per sector: industry, agriculture, construction and transportation, based on their per-sector development trends. These trends were built up around GDP growth: some of them higher than the GDP trend, and some lower. The industrial and agricultural trends have been developed in the Programul Natiunilor Unite pentru Mediu Ministerul Mediului Project. We do not foresee a serious change in the electrical energy consumption national balance in the country, and we have applied the existing proportion of these industries and the rest of the consuming entities to the forecast. Consumption by the population has been extracted out of the other consuming entities' share of consumption, as the data available on per capita consumption for the previous periods are only for 2003-2010, which is not long enough to build up a trend for the following 20 years. The final results of this forecast are presented in Annex 2 of the Strategy.
18. The overall results of the consumption forecast show quite impressive growth of the electrical energy consumption in all sectors, including the population. The consultant has used both past consumption trends and structure as well as the growth forecast per sector, which was not the same. The priority in growth has been assigned to construction, agriculture and transportation. **The rapid growth of the energy consumption** in industry we refer mostly to the very low base as a result of the steep decline in the 1990s. Its rate of growth will be 1.7 by 2020 and 2.6 by 2030. Energy consumption in agriculture will grow by 20.9% by 2020, and by 49.3% by 2030. The most impressive growth will be shown by the construction sector – 3.14 times by 2030 and consumption by population which will be 16.4% by 2020 and 257.4% by 2030 compared to 2011 volumes (Annex 1, Exhibit 1.9).
19. International information sources considers the coming decades as a **natural gas era**, which overtakes the role of coal before 2030. At the same time, electricity participation in a mix of energy consumption will exceed 40%<sup>2</sup>. This results from the expectation that several concurrent conditions will, taken together, contribute to a critical mass for a large shift, and as a result lead to a higher rate of natural gas utilization.

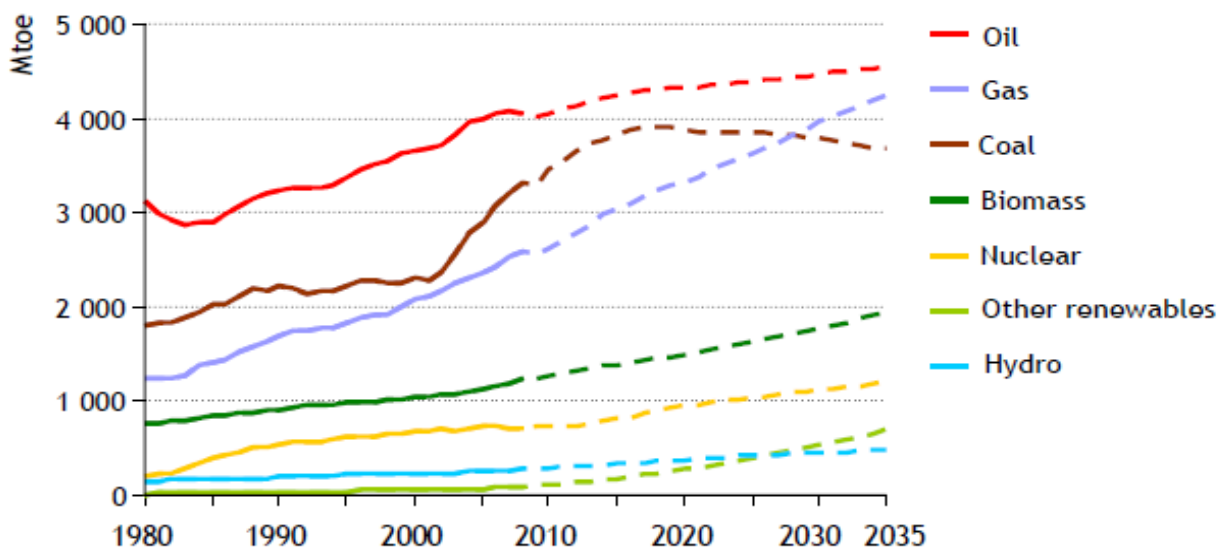
<sup>2</sup> The Outlook Energy: A view to 2040. EXXON Mobil 2012.



These concurrent conditions are: a relatively low contribution of the gas burning generation to the set of factors in climate change, required energy system balancing support for the participation of a growing renewable generation in the electrical energy systems mix, new conventional gas fields waiting for the most appropriate market conditions (after an unbalanced gas glut/decreased demand in 2008/2009), either on-shore (the Yamal peninsula in Russia, Shah Deniz II in Azerbaijan), or off-shore (Shtockman in Russia), an unconventional (shale) gas boom in USA and its widespread development in and outside the US gas market, gas transportation highways projects and expansion of LNG supporting the inter-regional/global gas trade and boosting natural gas market transformation. Among the other fuels, gas is the only one increasing year on year in all the permanently updated scenarios. Unconventional gas might provide a 40% share in all the gas supply, based on the current development trend which ensures an achievement of a 25% share of the total primary energy resources in 2035<sup>3</sup>. One important driver in the increase in natural gas demand is the increase in electricity demand of 70% by 2035 underpinned by a doubling of gas-fired generation (Exhibit 2).

**Exhibit 4. Global primary energy scenarios**

**World primary energy demand by fuel in the GAS Scenario**



Source: IEA, World Energy Outlook 2011, Special Report.

<sup>3</sup> Office of the Chief Economists (OCE) of the International Energy Agency (IEA). World Energy Outlook 2011. Special Report.

**Exhibit 5. Major mid-term Moldova economic indicators**

<b>Subject Descriptor</b>	<b>Scale</b>	<b>Units</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
<b>GDP, constant prices*</b>	MDL	Billions	9.425	10.030	10.381	10.848	11.390	12.017	12.678	13.375
<b>GDP, constant prices</b>	% change		7.09	6.41	3.50	4.50	5.00	5.50	5.50	5.50
<b>GDP, current prices*</b>	MDL	Billions	71.885	82.174	90.834	99.667	109.883	121.723	134.839	149.367
<b>GDP, current prices**</b>	MDL	Billions	n.a.	n.a.	91.600	101.000	110.800	119.918	129.007	138.841
<b>GDP, current prices</b>	US \$	Billions	5.813	7.003	7.559	8.106	8.900	9.742	10.665	11.764
<b>GDP, deflator</b>	Index		762.70	819.31	875.03	918.78	964.72	1.012.95	1.063.60	1.116.78
<b>GDP per capita, constant prices</b>	MDL	Units	2.649.00	2.819.98	2.921.79	3.053.27	3.205.94	3.382.26	3.568.29	3.764.54
<b>GDP per capita, current prices</b>	MDL	Units	20211.67	23104.46	25566.48	28052.82	30928.23	34260.75	37952.35	42041.71
<b>GDP per capita, current prices</b>	US \$	Units	1.634.52	1.968.95	2.127.73	2.281.59	2.505.06	2.741.00	3.001.95	3.311.17
<b>GDP based on PPP valuation of country GDP</b>	Current intern. \$	Billions	11.039	11.998	12.577	13.341	14.215	15.238	16.336	17.570
<b>GDP based on PPP per capita GDP</b>	Current intern. \$	Units	3.103.72	3.373.3	3.539.87	3.755.06	4.001.05	4.288.89	4.597.98	4.945.20
<b>Implied PPP conversion rate</b>	National currency per current internat. \$		6.512	6.849	7.222	7.471	7.730	7.988	8.254	8.502
<b>Total investment</b>	% of GDP		23.524	24.491	24.715	25.489	25.907	26.119	26.310	26.667
<b>Gross national savings</b>	% of GDP		15.206	13.876	14.981	15.569	16.709	17.799	18.387	18.893
<b>Inflation, average consumer prices</b>	Index		33525.17	36089.71	38075.86	39975.23	41983.48	44085.04	46287.80	48599.30
<b>Population***</b>	Persons	Mln	3.557	3.557	3.553	3.553	3.553	3.553	3.534	3.515

\* Base year - 1995

\*\* Based on Republic of Moldova MoE forecast from: Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: "Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention", April 1 – June 31 2011

\*\*\*Not considering migration

Source: AF-Mercados; IMF, World Economic Outlook, April 2012; Ministerul Economiei al Republicii Moldova, April 2012

## 1.2. The existing institutional framework of the energy market in the Republic of Moldova

20. The **early steps of the Republic of Moldova** towards energy market liberalization are not unlike the first European Union steps, and were provided under the aegis of EU-RM partnership. Based on the "Energy Charter Treaty" (1994, OJ no L69 9.03.1998), the European Commission started its neighborhood cooperation policy with a program document, the White Paper "Preparation of the Associated Countries of Central and Eastern Europe for Integration into the Internal Market of the Union" issued in May 1995.

21. Before 1997, when the process of **reform of the energy sector** including privatization started, the State Company Moldenergo was responsible for the production of electricity and heat. Moldenergo was unbundled following three main directions: Generation (JSC "CET-1 Chisinau", JSC "CET-2 Chisinau", JSC "CET-Nord Balti"), Distribution (JSC "RE Chisinau", JSC "RED Nord", JSC "RED Nord-Vest", JSC "RED Centru", JSC "RED Sud"), Transmission and central dispatch (state-owned enterprise "Moldtranselectro").

Moldelectrica is the owner of the license for **operating the electricity transmission network** on the right bank of the river and for dispatching the system on both banks of the River Dneistr. The competences of the system operator are described by Electricity Act No.124 of 23.12.2009.

22. The Republic of Moldova has gone further, by **privatizing** in the year 2000 **a big part of the distribution sector** (about 70%), meaning three out of five power distribution companies which merged into RED Union Fenosa SA while the other two remained state-owned: RED Nord SA and RED Nord-West SA.

23. In **the electricity market** there are 6 licensed producers, 3 suppliers at regulated tariffs, 9 suppliers at non-regulated tariffs, 3 distribution companies and 1 transmission operator (Moldelectrica). An electricity supplier may only be a legal entity registered in Moldova, and has to comply with the stipulations of the national Electricity Law. The 3 distribution companies act as default suppliers and play the role of the "last resort suppliers", though this attribute is not clearly defined in the existing market rules. Despite the existence of the 4 eligible consumers and 9 licensed suppliers at non-regulated tariffs, the retail competitive market is not functioning, because only Lafarge Ciment Moldova uses its eligible rights.

24. The **most active player in the wholesale market** is Energocom - the state-owned trading company which manages the contracts for deliveries from Moldavskaya TPP and for balancing energy from the Ukraine. The contract for balancing energy is managed by Energocom, while the contract for balancing services has Ukraine and Republic of Moldova transmission system operators as counterparts.

25. The current **degree of opening of the electricity market** is only up to 10% for consumers connected to 110 and 35 kV was set up in 2002 by ANRE Resolution No 62 of 30.05.2002. In accordance with the Energy Community Treaty, the liberalization of the Moldovan energy market is set for January 1, 2015 (D/2009/03/MC-En-C), with an intermediary target of 1 January 2013 for non-households.

26. In the gas sector, **JSC "Moldovagaz" was set up**, with 50% of its share capital owned by the Russian "Gazprom", 36.6% by the Republic of Moldova, and 13.4% by the Transnistria region. This joint venture company owns the

gas system of the Republic of Moldova, including transit upstream pipelines and includes the following companies:

- two transmission companies: "Moldovatrangaz" (operating on the Right Bank) and LLC "Tiraspoltrangaz" (operating in the Transnistrian region),
- 12 distribution companies on the Right Bank, with branches in every regional centre, and
- 6 distribution companies in the Transnistrian region, which operate distribution networks and supply natural gas to end consumers on a contract basis,
- a company specialized in importing and distributing liquefied gas.

According to the Gas Market Rules, Moldovagas is assigned the status of **national gas system operator**. The competences of the system operator are described by Natural Gas Act No.123 of 23.12.2009.

27. In **the gas market** there are 23 licensed suppliers at regulated tariffs, 1 at non-regulated tariffs (through pipelines), one transmission system operator (Moldovagas) and 24 licensed distribution companies. According to the ANRE Resolution No.408 of 06.04.2011, the natural gas market in the Republic of Moldova is regarded as non-competitive, due to the existence of a sole source of import being done by the supplier at regulated tariffs - Moldovagas SA.
28. In December 2009 the Energy Community Ministerial Council agreed the accession under the terms and conditions set out in the "Protocol concerning the Accession of the Republic of Moldova to the Energy Community". The protocol was signed on March 17, 2010 in Vienna, according to the Decision of the Ministerial Council of the Energy Community of December 18, 2009 approving **the accession of the Republic of Moldova to the Energy Community** on the conditions set out herein (Decision 2009/03/MC-En-C).
29. In its effort to **join this, the largest regional market** in the world, the Republic of Moldova initiated a second wave of reforms, beginning with a new legislative package which amended: the Energy Law (by Law 107 17.12.2009), the Electricity Law (by Law 124 23.12.2009), the Gas Law (by Law 123 23.12.2009) according with Law 117-XVIII of 23.12.2009 for a Treaty of Accession of the Republic of Moldova to the Energy Community. Also, ANRE updated Electricity Market Rules by Resolution #320 of 16.01.2009. Further steps by Moldova in respect of **En-C acquis implementation** have to focus on:
  - implementation of the acquis at the date of accession, responding to the Energy Community annual report input (a more accurate transposition of the energy directives and regulation implementation but at the same time transposition of both security of supply directives for natural gas and electricity and some aspects regarding competition not approached before); this is expected to be completed no later than 2013.
  - implementation of the updates to the En-C acquis since the Republic of Moldova's accession; this is expected to be completed no later than January 2015, which the European Union stated during the 9th meeting of the Ministerial Council to be an end deadline.

Preparation to implement the framework guidelines from ACER and network (market) codes from ENTSO-E, announced to become a further part of En-C

acquis as long as EC adopt them; it is expected to be required by En-C as soon as ENTSO-E and ENTSG is able to deliver and the EC to approve.

30. **The overall conclusion of the review on the energy sector in terms of assets and their efficiency** is that, despite the very early unbundling of the electricity sector that was intended to provide a very strong signal regarding the country's intentions on further pro liberalization, these have not materialized over past 15 years. Besides the fact that electricity sector unbundling was not followed by gas sector unbundling, even the electricity sector unbundling did not support efficiency and investment. The country is very unbalanced in attracting donors' support rather than business community interests to provide the necessary investment. The incomplete acquis implementation and missing steps towards a physical connection to the EU network and pipe system put into question the meaning of the political steps. The overall conclusion of the analysis of the energy sector regarding market framework is that no real market competition currently exists in Moldova. It may come only with new entrants, and the foreign participants will ask of an emergent market that products similar with those they benefit from in the EU internal energy market should be in place. After accession to the Energy Community, Moldova is obliged in a short space of time to take highly challenging steps which need institutional and operational support.

### **1.3. EU and Energy Community goals. RM national targets vs. Energy Community and EU requirements**

31. The Republic of Moldova is living in a **challenging regional context** within a permanently evolving geopolitical equilibrium. The country's energy supply within the existing framework is also a part of this difficult mosaic and has to be considered adequately.
32. European Membership (En-C) / Partnership (EU) as a strategic alliance including the energy sector is requiring considerable efforts on the part of the country and even greater efforts are expected in the short- and mid-term future. However, the country still has a **higher rate of increase in obligations than specific obtainable benefits** due to the existing technical barriers to a real market integration.
33. The Republic of Moldova and the European Union first established contractual relations in 28.11.1994 through a "Partnership and Cooperation Agreement" (PCA), which entered into force in 01.07.1998. That same year 1998, a first energy legislative package was adopted by Republic of Moldova, in an attempt to **transpose in the national framework the acquis** of the first legislative package of the EU. This national package included 3 major elements:
- RM Energy Law 1525-XIII of 19.02.1998
  - RM Gas Law 136 -XIV 17.09.1998
  - RM Electricity Law 137 -XIV 17.09.1998,
- being followed in the next four years by 3 other documents:
- Resolution of the Republic of Moldova on the approval of ANRE Regulation and Budget # 574 of 21.06.1999
  - RM Law on Petroleum Products Market 461-XV of 30.07.2001
  - ANRE Resolution on the Approval of the Electricity Market Rules # 75 of 12.12.2002

34. The most recent and most ambitious **EU energy strategy**, so-called "Energy Strategy 2020" states 5 main priorities:
- a) Achieving an **energy-efficient Europe** (An efficient use of energy that translates into 20% savings by 2020). The EU confirms previous commitments and requires even more in the perspective of the new energy efficiency directive adoption.
  - b) Building a **pan-European integrated energy market** (ensuring the free movement of energy). The building of an EU integrated market is dependent on time; the energy savings target is proposed to move from the existing indicative one of 9% in 2014 to a 20% mandatory one in 2020. Buildings and transport provide the highest saving potential, industrial competitiveness, energy supply are seen as directions to act with great leveraging potential of the National Energy Efficiency Action Plans and accurate implementation of legislation. A blueprint for European infrastructure development for 2020-30, with faster implementation by streamlining of related permit procedures and the relevant financing framework provision, was already issued after the strategy adoption.
  - c) Empowering consumers and achieving the **highest level of safety and security** (Secure, safe and affordable energy for citizens and business). Empowering consumers with affordable prices delivered by competition enhancement with an improvement of safety in oil and gas extraction and nuclear safety improvement is the third ranking priority.
  - d) Extending Europe's **leadership in energy technology and innovation** (Making a technology shift); preparation for a new energy era and a new energy technology platform comes with reinforcement of the existing joint programs for wind, solar, smart grids, nuclear fission and carbon capture storage pilot projects and launching four new projects for larger smart grid integration of different technologies based projects spread over the continent, electricity storage, large-scale sustainable biofuel production, smart cities' innovation partnership.
  - e) Strengthening **the external dimension of the EU energy market** (Strong international partnership, notably with our neighbors). This is the most tangible EU energy strategy priority for Moldova, covering the Enlargement process and the Neighborhood policy as well as privileged partnership with suppliers and transit countries. A proof of EU commitment to market integration for the countries which are not representing EU member states is demonstrated by the conclusions of the Energy Community Ministerial Council meeting in Chisinau in 2011 when the Energy Community embraced the third package as a new part of the Treaty acquis.
35. The Energy Community broadly shares priorities with the European Union, but **changes the ranking of the priorities** and instead of ambitious high technology-based projects puts a specific focus on the social dimension, thus proving realism on both lower scale of possibilities and lower affordability. The main priorities for the Energy Community are:
- a) creating a competitive integrated regional market,
  - b) ensuring security of energy supply;
  - c) environmental improvements, mitigating climate change;

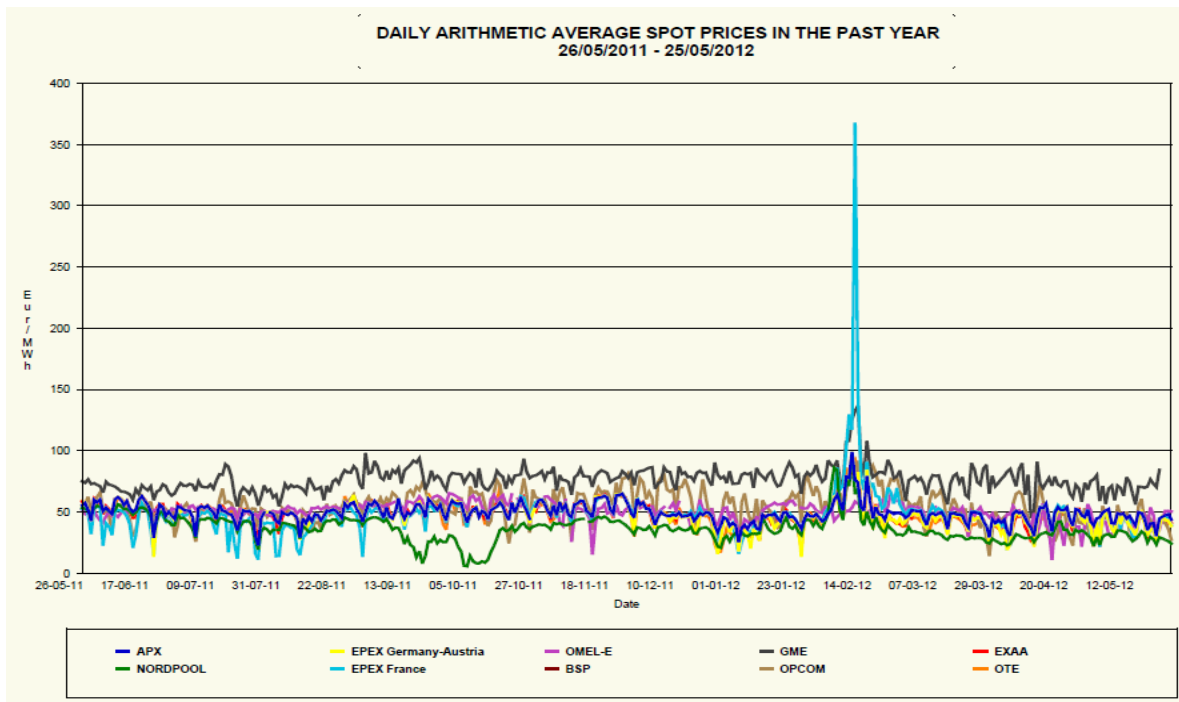
d) providing infrastructure needs;

e) paying attention to the social dimension; external relations approach.

36. The special attention paid to the **social dimension** comes from the peculiarities of the South Eastern European region in terms of social affordability. It should not be understood as derogation from the acquis component, which article 3 of the directive is. The Energy Community strategy considers it necessary to make clear that vulnerable consumer support has to come from the governments through their social policy and not as a distorting end consumer-regulated tariff. The public service obligation has not to be imposed on all undertakings in the country as a way of postponing market liberalization.
37. Beyond the main directions of EU energy strategies which the Republic of Moldova broadly shares, but paying attention to its own prioritization in terms of the country's own context and interests, the Energy Strategy of the Republic of **Moldova acknowledges two most important achievements of the EU**. These are:
- The countries' stakeholders representatives were able, through intensive work and based on wide public consultation support, to deliver a pan-European electricity market model including capacity allocation and commodity trading at the end of the previous decade. It was not about a theoretical construction to be put further in place with the inherent risk of such an implementation, but rather an effort to capture in a regulatory framework the experience of real achievements obtained at that time through a stepwise approach. It is true now that what remains to be delivered is only the connection to the integrated North-West region of the remaining "islands": UK-Ireland, Spain-Portugal (already internally connected), Italy-Slovenia (already internally connected), Czech Republic-Slovakia-Hungary, mid 2012 internally connected) and South Eastern Europe with Romania, Bulgaria, Greece and Serbia at different stages of advanced steps to implement the EU model. A new model broadly following the electricity model was adopted by the Madrid Forum for natural gas trading, based also on real achievements.
  - The achievement of the current EU market in delivering convergent and stable price signals in the existing EU power exchanges, which Exhibit 6 presents over year 2011. Even Eastern Europe power exchanges hosting energy trading with about a 15-20% market share were able to stabilize prices over the last period at around 50 Euro/MWh base load, as Exhibit 7 shows.

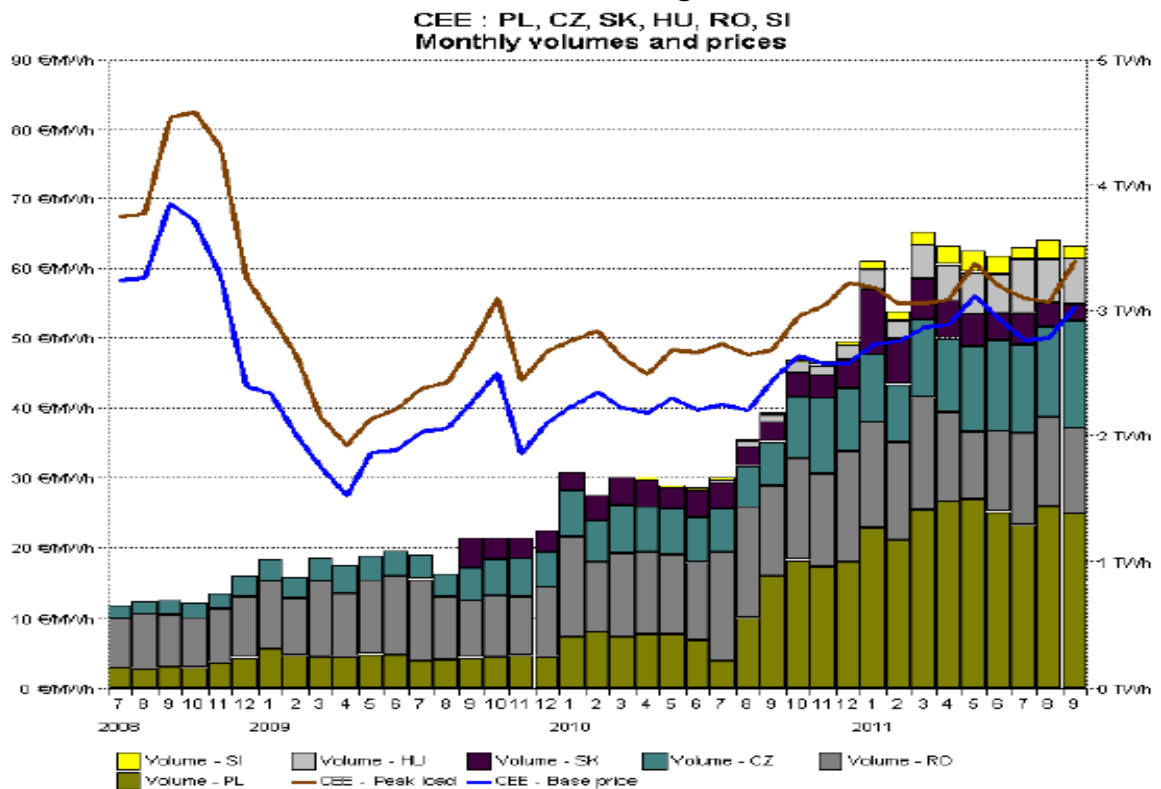
Close to these achievements, a promising perspective on further natural gas market evolution following the example of electricity market is also acknowledged after decisions of 2012 Madrid Forum.

**Exhibit 6. Average daily prices for electrical energy in the European markets**



Source: EUROPEX

**Exhibit 7. Evolution of prices and volumes in Eastern Europe power exchanges**



Sources:

*TGE (PL), OTE (CZ, SK), OPCOM (RO), HUPX (HU), BSP (SI)*

Source: European Commission, DG EN



38. The Energy Community contracting parties are mainly countries whose small markets are not allowed to obtain the same results which a large market may obtain standalone. Their cooperation and solidarity is, however, only a first step **to integration of the region** into an even larger space which is the internal energy market of the EU.

In terms of renewable, the Energy Community works in the direction of **more affordable targets**; implementation of the new directive is mostly restricted to recommendations.

In the natural gas sector, the Energy Community focuses on **gas ring construction** as a main project in this domain which does not directly benefit the Republic of Moldova, as neither Northern nor Southern branches of the project are directly connected with the Moldovan pipeline system. However, Moldova and Romania are the beneficiaries of a grant for additional, and reversible, connection, while two other projects inside the Energy Community, the Hungary-Romania and Hungary-Croatia interconnectors, were completed before the end of 2010. In the framework of EEPR co-financing also being available for the Romania-Bulgaria and Bulgaria-Greece interconnector projects, it will again enhance the connectivity alternatives for Romania, which at the same time represents additional opportunities for Moldova in terms of security of gas supply.

39. In accordance with the objectives of an EU energy efficiency development, and given the commitments of the Republic of Moldova aligned with the *acquis communautaire*, the National Programme for Energy Efficiency 2011-2020 establishes long-term energy savings amounting to 20% by 2020. The intermediate target for energy savings to be achieved by 2016, is established as 9%.

The Moldovan national energy targets for the year 2020 with an intermediate milestone in 2015 are coherently laid down by the National Development Strategy of the Republic of Moldova for 2012-2020 and the National Programme for Energy Efficiency 2011-2020:

- In the specific domain of **energy security**:
  - Larger interconnections in the form of more 139 km of electricity lines and 40 km natural gas pipelines in 2020;
  - More energy from renewable sources in total gross domestic consumption: 20% in 2020 with an intermediary target 10% in 2015;
  - A share of bio-fuels in the total of fuels used of 10% in 2020, with an intermediate target of 4%;
  - Larger domestic capacity for electricity: a total installed generation capacity of 800 MW in 2020.
  - Ensuring the share of annual electricity production from renewable energy sources of 10% in 2020.
- In the specific domain of **energy efficiency**
  - An energy intensity decrease of 10% in 2020;
  - Reducing losses in transmission and distribution networks by up to 11% in 2020 (up to 13% in 2015) for electricity, by 39 % in 2020 (by 20% in 2015) for natural gas and by 2% in 2020 (by 5% in 2015) for heating;

- Reducing greenhouse gas emissions (compared to 1990) by 25% in 2020;
- Reducing the contribution of natural gas to the national energy mix from 53% in 2010 to 45% in 2020;
- Reducing energy consumption in buildings by 20% in 2020;
- A share of renovated public buildings of 10% in 2020.

40. **The conclusion after analysis** is that targets are set at the level of the most ambitious targets which even the European Union is still struggling to impose, and that the renewable targets are very high in the context of the very cautious approach of the Energy Community. Real implementation of the both directives: renewables and CO<sub>2</sub> reductions, is expected to be costly and burdensome for the citizens of Moldova. Most critical are the targets for interconnections. As regards the targets for 2030, these cannot be decided yet as precise thresholds because of many uncertainties which do not merely apply to the Moldovan context but have to be linked with international targets not yet decided. What the strategy indicates is there are other alternatives less costly than renewable to solve the security of supply as well as climate change abatement. A judicious policy of imports combining medium-term contracting and short-term trading may bring the same results in terms of security and reductions in CO<sub>2</sub> emissions, but may be less of a burden on the energy bill which consumers are paying.

#### 1.4. Interrelation of the strategic objectives over time

41. **The leading strategic focus over decades.** Not to be confused with different reasons and interests which often put together priorities, which realistically may not share the same time horizon, the Moldovan Strategy has to pay attention to the analyses which try to capture the few leading directions of energy sector development.

##### **LEADING STRATEGIC FOCUS OVER DECADES**

- Until 2020 the sector has to follow the targets which have already been described above. A long list may be provided, but the key priority drivers for this period have to be:
  - *transmission (networks & pipes) in terms of investment & improved operation*
  - *rethinking the generation mix, and*
  - *institutional framework for new energy markets.*
- By 2020 we expect the majority of the countries on the globe to agree on this or that form to limit CO<sub>2</sub> emissions from the power plants in those countries. The EU is definitely in the forefront of this development, and as such we expect that Moldova has to take measures very soon regarding these future limits on CO<sub>2</sub> and the anticipated economic consequences.
- The next decade, 2020-2030, will see carbon capture and storage technology proving to be economically viable and actively entering the market, thus drastically changing the structure, values, prices and costs of fuel for the generation technologies there.
- In 2020-2030 smart grid technologies and equipment will be clearly proved to

be economically viable and will become a de-facto standard for the electrical energy industry. This type of structuring of the energy system will greatly change the existing approaches to system topologies, balancing, metering, monitoring and energy mix. All these changes will be more in favor of those renewable technologies that are currently only accommodated in the existing energy systems with obvious difficulties.

42. There is an issue of **time and logic correlation** between these strategic targets. Moldova cannot wait for the new energy stakeholders to come into the national market as a condition to create a competitive energy market. And the strategic approach for the country should be the other way round: unless there is a competitive energy market, pricing and regulation, it is hard to expect new players to come into the national arena. Without market signals, it will be very difficult for investors to identify the appropriate short-term and long-term marginal costs as a condition for the project to become economically viable.

43. Despite the different prioritization and embodiment in their own strategic documents, the European Union and the Energy Community already have **very similar strategic objectives, nominally declared**. The most compact formula of the shared objectives is the name of the EU Strategy 2020 itself: "A Strategy for Competitive, Sustainable and Secure Energy", which order of priorities is not quite the ranking of priorities inside, but almost identical with the ranking preferred by the Energy Community.

It is quite obvious that inside this EU strategic document the sustainability attribute represented by energy saving is setting a precedent for competition, because the EU has much earlier put an emphasis on competition as well as integration, namely in 2005-2006 when the Energy Community had just been created. In the EU today the results of this **early focus** are evident, with effective unbundling and market coupling as exemplary results, while in the Energy Community union contracting parties in both competition and integration show a stage and intensity typical of an emergent market.

44. We have to conclude that specific schemes supporting sustainable energy development are a better fit and are much more affordable when introduced in a **competitive market environment** than in an emergent one. It would be very difficult to understand, accept and afford market-based approaches to renewable and energy savings if the competitive energy market were not currently working in the country.

45. Despite the lack of conventional energy resources, the Republic of Moldova **cannot put renewable and energy efficiency ahead of market liberalization** without risking increasing the final energy bill too much. Disproportionally increasing social costs cannot be a price worth paying for solving energy poverty. It may be added that, even in EU member states, there is a rising concern that competitive markets which succeeded in delivering acceptable prices are shrinking, every day confronted with growing market share of renewable represented by regulated prices. As a result of these concerns, many countries are driving their renewable sectors to more market-based formats and support measures. The same is true for the other sustainability agenda items: limiting CO<sub>2</sub> emissions with market pricing, market-based measures for energy efficiency, green, white and brown certificates for supporting different energy efficiency measures, etc.

46. Compared with the other contracting parties in the Energy Community, the Republic of Moldova cannot put fair competition before building the required infrastructure, which is a part of the security of supply. The very specific situation of the Republic of **Moldova which lacks physical connections with larger markets for natural gas and electricity** is the call to give the very highest priority in the state energy agenda to interconnection enhancement, with the EU as its priority axis. However, the unavoidable time limits for conforming with the system connection requirements in the ENTSO-E system can be taken as quite discouraging for their efforts, but they have only to try to discover sensible and cost-effective solutions to deal with this. For example, it can be correlated with the new generation capacity building, coexistent with boosting competitive markets.
47. When a regulatory authority starts providing the above-mentioned market instruments and product rules in cooperation with the market operator, the latter will also be developing the administrative and instrumental capacity. The two markets: gas and electricity, may (most probably, will) come with **different stages of development**. These timeframes will not be the same as in the EU and different for Moldova in terms of timetable feasibility. Only after Madrid Forum meeting in April 2012, which approved the new gas market model, has the EU gas market been guided by the Council of European Energy Regulators and Agency for Cooperation of Energy Regulator to follow the existing electricity internal market model. What happens now in the isolated gas hubs, which Moldova currently is, will be extended to the similar but larger hubs, to other, new hubs, or the old and new hubs will just be connected together.

After that Moldova will have a ready-made model for its electricity market and will more or less share the experiment with the EU in the new model for gas market implementation. In terms of existing transmission support, much more time will be required for Moldova to join the EU's mature electricity market than to join the rather emergent European gas market.

## 2. MAIN STRATEGY ELEMENTS FOR 2012-2020

48. The energy strategy of the Republic of Moldova as a country which adheres to the EU's policies has **three main objectives**:

**Security of supply**

**Competition and availability of affordable energy**

**Environmental sustainability and combating climate change**

49. As the **priorities to proceed towards** the achievement of these objectives, the strategy identifies four main pillars for 2012-20:

- A. Act in a fast manner to provide funds (including grants and loans) and/or attract private investments to realize physical gas and electricity connections with Romania and from their completion further (including synchronous operation of an electricity system with the ENTSO-E network) - to integrate these into the EU internal energy market. Enhancement of the internal electricity network represents a priority only where this is required by stable, synchronous operation with the ENTSO-E system. Rehabilitation where needed of the internal electricity and natural gas networks has to come later. Provide in the legislation and regulations clear responsibilities regarding the projects, organize tenders where needed, and award contracts to capable leading companies.
- B. Enable and promote without delay a fair and effective transposition of the EU legislation according to the Energy Community Treaty obligations and negotiation of agreement with the EU, but really focusing on how acquis components are working together to the eventual benefit of economic growth and social welfare.
- C. Rethinking the management principles of public institutions, including state owned economic agents in the energy field in a sustainable way, through modern, efficient corporate governance based on a strategic approach, competence and, last but not least, honesty, where the interests of the citizens are accountably represented. Provide a legal basis for this.
- D. Developing a network of strategic alliances combining politics with economic interests which include neighbors and strong stakeholders in the region and worldwide (including international organizations and corporations) to help with the best possible positioning of the country with regards to the opportunity for participating in joint projects, to obtain grants and loans and to negotiate energy prices. While in the region Turkey and Azerbaijan will continue to grow, Ukraine is tending to do its best to reposition itself, but the

Russian Federation plays a key role in meeting natural gas needs of the EU and will continue to do so. Equally important is to attract into Moldova not only EU-based investment but also investment from the above mentioned countries.

## 2.1. Security of energy supply

50. The electricity and gas security of supply directives will be transposed in the energy legislation without further delay, and the specific regulation will continue this transposition in order to obtain acquis benefits from a complete implementation. Transparency in making the public aware of the planned actions towards security of supply will also be part of transposition/implementation.

51. **Natural gas resilience** variables to consider are: **diversification of sources, LNG and gas storage facilities.**

The diversification of supply sources has two items to consider: enhancement of transmission interconnectors in order to provide alternative supply routes and a higher number of alternative suppliers.

- From a **transmission** point of view, the Republic of Moldova has only two neighboring countries which may stream supply flows from one or more supply sources. However, the existing gas supply connection with Romania does not allow a reversible flow, the only possible direction to date being towards Romania.
- From the point of view of **gas supply**, both neighbors rely today on the same upstream source, which is Russian Gazprom, while Romania also has its own natural gas production and Ukraine intends to rediscover its own gas potential. Both countries have alternatives in offshore gas and shale gas. These neighbors aim to diversify their own sources of supply with specific steps which are both targeting Caspian gas as resource, Romania through the Nabucco and AGRI projects and Ukraine through building an LNG terminal.

The real problem to be resolved by Moldova is not to guess now what project initiative will prove as being viable by its eventual implementation, but how politically to keep the options open. We mean to be allowed to provide physical support for both transmission supply alternatives, thereby to build the pipeline between Ungheni-Iasi. If **acceptance of this pipe by Gazprom** cannot be achieved and it is not built, the question is useless. If the pipe may be built, with or without the Gazprom embracing the project, then comes another question: if Gazprom is the most reliable partner for the EU, why is the same not true of Moldova.

The problem has three facets:

- a) who is the most reliable partner, Gazprom or the Azerbaijan gas supplier whose name Moldovan decision-makers are not allowed to know today,
- b) what is the most reliable supply corridor, and
- c) what is the best method of trading.

As to the name of the section, the wise response is to proceed always in a manner so as not to close off any realistic alternative, in order to support diversity.

Over decades,

- Until around 2015 there may be no alternative to the Russian gas and until 2020 there will be no problem with transport through Ukraine.
- After 2020 the corridor through Ukraine may close, and two parallel highways will pass through the territory of the Energy Community. It makes great sense for the Republic of Moldova to discover the concrete advantages of being a member of the Energy Community by actively participating in the life of community.

As a last finding, it can be said that until 2020 Azerbaijan may discover that China is a better deal than the EU, and Moldova may discover that the new gas market model may work; thereby Moldova could be fed from the Western direction with inter alia Eastern gas, not necessarily from Azerbaijan, but quite feasibly with Russian gas.

52. **LNG.** In case of a shortfall, as the 2009 gas crisis has proved, liquefied natural gas may account for an important share of additional supplies; at that time it was about 10%. LNG is a chance for the SEE gas market to grow in volume as well as to increase its liquidity, which may provide a basis?? for short-term trading. However, specific conditions have to be considered when the Republic of Moldova decides after careful consideration to become a part of the initiative: LNG investments are very costly compared with pipelines, and the Bosphorus is not expected to permit the transit of LNG tankers.

Once the AGRI project, which includes Hungary, Romania, Georgia and Azerbaijan, may become feasible, depending on additional investment, the alternative for the Republic of Moldova to participate in the project has to be analyzed in terms of viability from both financial and technical points of view.

53. **Gas Storage.** The possibility of achieving the security of supply standards using gas storage facilities located not only in Ukraine but also in Romania has to be capitalized as a part of agreements related to building an additional interconnection with Romania through a specific bilateral agreement, as the applicable directive suggests. Meanwhile, the possibilities for building gas storage capacity on Moldovan territory were explored in two studies delivered in 2009 by Berkeley Associates and in 2011 by the Institute of Geology and Seismology of Academy. The possibility of implementing the outcome of the studies will be explored with the donors later on. The benefits of natural gas storage capacity will be the improved capability of the supply system to cover peak consumption as well as guaranteeing supply in conditions of disrupted transit.
54. Unlike natural gas, the transport of electricity has no alternative to network development and the benefits of competition and diversification. These benefits can be provided only by **participation in a larger energy market** than will ever appear in the Republic of Moldova in the absence of physical facilities for network **synchronous interconnection with the European ENTSO-E system.**

### 2.1.1. Additional connectors: electricity and natural gas

55. **Natural gas.** In the context of the Nord Stream pipeline first stage completion and South Stream pipeline construction start, which may force a decline of gas transit through Ukrainian GTS, the gas interconnection Ungheni - Iasi has become a critical strategic item. It may at the same time provide the diversification of supply sources, meaning Romanian natural gas and possibly Caspian gas, as well as the supply routes diversification for Russian gas. On May 31, 2011, the Feasibility Study and the Environmental and Social Impact Assessment studies were finalized by both the Republic of Moldova and Romania. A grant of €7 million was approved from the Joint Operational Programme; the remaining financing has successively attracted an interest from EBRD, Transgas RO. But most feasible in this case might be a grant from Romania which will cover the missing portion. The most likely date for the pipeline to become operational is 2015.
56. **Electricity interconnector to Romania.** At the moment the only interface between Moldova and Romania is one 400 kV line between Vulcanesti–Isaccea. There is a critical need for new high voltage lines in order to fulfill the security criteria and to increase the interface capacity.

The future electricity network extension by 2020 has to include as a minimum: 2 lines on 400 kV interconnection with the Romanian network: Suceava-Balti, Straseni-Ungheni-Iasi, and 1 on 110 kV with Romania: Falciu-Gotesti. The 400 kV line Balti - Suceava (115 km, 55km on Moldovan territory). A feasibility study was financed by EBRD and is finalized, but the development of the further steps depends on the ENTSO-E CE Power System interconnection project as well as on cost financing.

The estimated cost goes up to around €60 million. It is an ambitious program, which neither the state budget nor Moldelectrica can afford. Some alternative scenarios are seen as possible to compensate for the lack of funds.

- For the time being, a Moldova-Romania interconnection and connection with ENTSO-E is not a priority in the TEN-E program with a yearly call for funds approval. However, the conclusions of the 9<sup>th</sup> Ministerial Council meeting in 2011 in Chisinau notices invitation of Ministerial Council that all Energy Community institutions to initiate work towards increasing cooperation of public authorities and stakeholders of the Contracting Parties with ACER, ENTSO-E and ENTSO-G directly. It can be done to help put this interconnection as top priority on the agenda of the EU and ENTSO-E.
- The donors have previously contributed in a major way to the development of Moldova's internal electricity network as well as to improve its operation through new facilities and instruments. All these contributions have to end up in a final effort to transform the Moldovan electricity system into a viable component of the EU system. Effective implementation of acquis is conditioned by this connection.
- The owner of Moldavskaya TPP has to be aware of an opportunity to support its energy exports by investing in such an interconnector, while these exports do not harm the security of national supply, and instead may bring some additional cash for transit. One has to consider that, to date, only half of its installed capacity is able to produce a return to the owners because of the limited volume of the tight Moldovan energy market. Foreign companies like Union Fenosa already present here as



distributors may also consider this as an opportunity to consolidate their business by investing in additional interconnecting merchant lines. As it is presented below, a fourth external source of investment may be new generation capacity owners who can export their energy to the EU market through a merchant line as being Straseni-Ungheni-Iasi.

57. **Electricity interconnector to Ukraine.** The bottleneck on the Moldova-Ukraine interconnection is limiting the import and transit of electricity. The value of the necessary import/transit depends on consumption in the South-West part of the Ukrainian system and the power generated at Moldavskaia TPP. In order to increase the capacity of the Moldova – Ukraine interconnection it is envisaged a new 330kV voltage line “Balti-Novodnestrovsk” 121.5 km (88 km on Moldovan territory). As well as for the previous project, the development of the further steps here depends on ENTSO-E CE Power System interconnection project as well as on the cost of financing.
58. **Electricity network rehabilitation and modernization.** The World Bank has already financed the project Energy II, which provides power equipment modernization and a new metering system, now completed, and a new SCADA system has been installed. As a continuation of the electricity network rehabilitation and enhancement works, the company Moldelectrica has the opportunity to rehabilitate the transmission network using an approved senior loan provided by EBRD of up to € 17 million (USD 21.5 millions), EIB has approved a loan of up to € 15 millions (USD 19 millions) and European Commission Neighborhood Investment Facility (NIF) grant financing to the amount of €7 million (USD 9 million). The Project Cost estimation varies from €35 millions (USD 44 millions) to € 42 millions (USD 52 millions). The rehabilitation will improve the energy efficiency of Moldelectrica’s network, will strengthen the stability of power supply and improve the company’s overall operations, a necessary prerequisite for Moldova’s integration into the European transmission network ENTSO-E.

### 2.1.2. Joining the ENTSO-E network

59. **A pending question to reflect on.** the EU Ministerial Council decided at the meeting in February 2011 that 2014 will be a deadline year for European internal energy market integration. Recent events show this deadline as being feasible. For Moldova to meet a similar deadline will be quite problematic even considering its vital importance in the medium term. The year 2018 represents the most optimistic deadline for connecting the networks, while a deadline beyond 2020 cannot simply be accepted. A difficult question has to receive a fast response: how feasible is the Republic of Moldova connection to ENTSO-E together with Ukraine? The question has to receive a response not only from a feasibility study but also at a political level. If the joint action with Ukraine implies a delay considering the real time progress of the project, Moldova has to immediately take a decision to separate their joint action plan from that of their neighbor, preferably through a commonly accepted decision.
60. **Stepping (slowly) into the process.** An MoU was signed between Moldelectrica (Republic of Moldova) and Transelectrica (Romania) in 2010 towards ENTSO-E joining together. A joint application was submitted before the deadline of 31 March 2011 by Moldova, Ukraine and Romania to the Joint Operational Programme, for funding the feasibility study on the conditions of Moldova and Ukraine joining ENTSO-E together. Phase I of the application was approved, and Phase II with a detailed project proposal is in preparation. At

the beginning of May 2012 the Joint Programme approved a €5 million grant for the Feasibility Study. As regards the interconnection between Republic of Moldova (Balti) and Ukraine (Novodnistrovsk), the feasibility study is finalized on the Moldovan line.

61. Joining the ENTSO-E network with or without Ukraine means **joining the EU large regional market**. The projects to interconnect the Republic of Moldova to the EU internal energy market by the new electricity lines and gas pipelines as well as internal network/ pipelines supporting measures are critical for both security of supply and Moldovan social welfare. Their eventual success will not only prevent foreseeable black outs in the absence of a connection to the EU, but will offer better market prices too, which will result in an overall less costly energy bill for consumers in the country.

### 2.1.3. New generation capacity

62. It will be difficult for the Republic of Moldova to become an independent electrical energy producer, but for the security requirement and heat supply provision the country has **to consider larger energy generation volumes** than it has now. A critical issue in this decision might be an attitude to the energy assets of the River Dniestr.
63. On the basis of the expected growth in electricity demand in Moldova, the incorporation of new generation capacity to meet the demand under **certain changing conditions should be considered**. In the long run current installed capacity and announced incorporations will be insufficient for a sustained growth in demand in the mid- and long-term time period.
64. The basic hypothesis considered is that investments in the new generation projects in the long run will be made exclusively **under Moldovan market risk conditions**. This means that such projects should be financed with the expectation of yielding a reasonable rate of return based on the revenues obtained from the sale of electricity production at prevailing wholesale prices.
65. As a principle condition for the coming investments, there are some **major economic preconditions**, regarding interrelations between the investment costs and expected revenues. These interrelations are important for every reasonable investor, not only in Moldova but in any other country as well. Though it does mean either that the requirements for Moldovan investments will be the same as in any other locations.
66. From an investor's standpoint, in the long run, it does not matter which of the alternative generation expansion plans is finally adopted by the Moldova Government, but **only that the market clearing prices in the wholesale energy market will reflect the system short-run marginal cost (SRMC)** provided that the market is run in an efficient manner, hence, the system SRMC (or the clearing price) will be equal to the SRMC of the infra-marginal unit whose offer price sets the clearing price. In a well-functioning market with no shortage of generation units, SRMC pricing is commonly observed. The investment costs will have to be earned back during peak hours with higher prices.
67. Without a capacity market (or capacity payments) geared towards recovering fixed costs of generating units – as is the case in the Moldovan energy market – all units except the infra-marginal unit(s) will take advantage of the difference between the market clearing price and their offer price, which

theoretically should reflect their SRMC. However, it is argued that energy-only markets (i.e. markets without a capacity market or payments) are more prone to price volatility; thus, the necessary condition to be met by all future projects is to be able **to obtain a price level that reflects the long run marginal cost (LRMC) of the plant**. This will allow achievement of a market-based rate of return on investments as well as feasibility from a financial standpoint.

68. For the sake of **ensuring district heating** but also for a further promotion of electricity produced in cogeneration mode, the overall district heating system has to be reassessed in order to reduce energy losses through rehabilitation as well as gas consumption levels through a new cogeneration technology with or without extending a CHP's capacity. Overall thermal efficiency of the existing power plants in Moldova, on average, is now 71%. According to the latest governmental decisions, the energy efficiency of the heat-supply power plants equipped with a new combined cycle facilities will by design be no less than 90%, and power will represent 45-50%. Plans may go further, towards building a totally new CHP in Chisinau, CCGT technology-based, taking into consideration that the above-mentioned requirements for the new heating load requires a new design approach nevertheless. The investment has to be ensured by attracting mostly foreign investments. The greatest benefit will come if the investment, backed by cogeneration mandatory off-take agreements, attracts the interest of a company well versed in the natural gas supply business.
69. A better investigation of the **country's renewable resource potential**, with a definition of reasonable share targets, is accordingly a necessary precondition before introducing the appropriate incentives for the sector. The regulatory support measures to be executed include not only the RES-E tariffs calculation, but also a definition of the additional cost pass-through mechanism from a RES-E generator to the consumer, priority dispatch procedures, grid connection rules and procedures. RES-E incentives and RES-E project auctions for additional investment might be required, and related market contractual arrangements to balance the intermittent renewable based generation will also have to follow.
70. In order to cover the differences between internal electricity generation and forecast requirements in terms of both energy and capacity the Republic of Moldova is obliged to **stay with current sources** (Ukraine and Moldavskaya TPP) **until connection with ENTSO-E**, but meanwhile look around for the best import prices depending on transmission constraints (Romania and/or Bulgaria).
71. An alternative approach with possible implementation in the medium term (2020) may represent a compromise between competition and market opening on one hand, and ensuring system adequacy as part of supply security in the longer term. It is less costly to propose capital and strategic investors build a **joint venture for constructing additional energy generation capacity**, which can be connected immediately to the ENTSO-E system and to the large regional market.

The construction of the **400 kV connection line Strășeni—Ungheni-Iași** may also be seen as a merchant line and subject to investments for the investors in a generation capacity. Generation and transmission assets investments may become feasible by using the Internal Energy Market of the EU as a vehicle for investments recovery instead of currently prohibited by EU

*acquis* PPA. What remains is just to analyze a legal framework for such an approach in order to allow favorable conditions for this really **strategic project**, provided by the RM Government to attract strategic investors (considering the adoption of a drafted Law on State Aid and its possible limits).

72. Energy efficiency, in production as well as in distribution, should become an **essential criterion for the authorization of generation** capacities, and efforts are needed to substantially increase the uptake of high efficiency cogeneration, district heating and cooling. Also CCS readiness has to be fulfilled.
73. For many years, the generation from Moldavskaya GRES and alternatively/jointly from Ukraine proved impossible to challenge with EU prices. This may be a reason to delay decisions on Moldova/ENTSO-E interconnection. At this very moment it is clear that (a) import from the EU became competitive and (b) their dominant position and temptation to collude will always make price negotiation difficult. The only way to keep the two sources from the East as viable "options" will be to oppose them to other competitors in a market where until now they were ruling the price. In a simplified SWOT analysis, the previous items will be questioned as an opportunity to encourage.

## **EXTENSION GENERATION CAPACITY SWOT ANALISIS**

### **Moldavskaya GRES**

good: (a) already exists, (b) can be incentivized to participate in a partnership- based merchant line to export in the Balkan region, which may increase its load, reshaping their business profile, (c) low carbon

bad: (a) the tense background of relations due to political and commercial precedents, (b) unreliable information regarding the real state of the assets

### **Increased efficiency and capacity for the (new) CHP capacity in Chisinau;**

it can be opportune to increase the capacity to about 450 MW capacity as in 2007 it was intended to do, or even more, up to 700 MW.

good: (a) the efficiency of cogeneration has to be improved somewhat, (b) it will be viable in the market, taking benefit from cogeneration priority; the cogeneration tariff will act as an old-fashioned PPA, but will not be forbidden (c) low carbon;

bad: (a) the price could be high, to mitigate it, it can be used a fixed tariff for a period depending on the date of connection with ENTSO-E and possibly a bonus scheme afterwards.

### **RES based FIT**

good: (a) clean, contributing to the future commitments meeting, (b) reduces dependence from import

bad: (a) expensive

inter-relation with gas-burned solutions requiring more sophisticated balancing and a back-up capacity;

#### **New (coal based) capacity**

good: (a) contributes to a reduction of the gas share in the mix; (b) it is allowed to come with solutions for interconnection which are important because they may support import which replaces itself in the market for a period; double flow increases available capacity.

bad: (a) not low-carbon, unavailable for a period depending on connection to ENTSO-E, while it could be operational in an island mode.

74. The SWOT analysis is provided not to eliminate one alternative, because the market needs competition, but to choose the right proportion between overall CHP and new coal-based. If these together contribute to an 800 MWh increase which is the target for 2020, the decision makers may be more relaxed in incentivizing renewables.
- o In respect of new power plant investment on the border with Romania, it makes great sense to reflect on changing plans as regards a gas burning power plant, which in competition with Moldavskaya GRESS for the same share of consumption (the other share being prioritized CHP and renewable) will not damage the existing mix by adding more gas.

#### **2.1.4 Energy efficiency and RES-E**

75. Besides a low level of energy resources and very high import dependence, low energy efficiency and high energy intensity are the reasons why energy efficiency is considered to be one of the main aspects of the energy strategy in the Republic of Moldova by 2020, and as a **flagship initiative for a resource-poor Moldova**. The existing energy savings potential is proved by audits and projects on the topic. The evolution of energy intensity shows a greater than three times reduction in five years (1997-2002), while in 2007 the intensity has been halved in comparison with 2001. This means that these relatively positive changes in the energy efficiency indicators were mostly provided by the economy slowing down during 2002-2007 compared with the previous period. The problem for Moldova will be to keep this positive trend also in a situation of faster economic growth along the 2020 time frame and beyond.
76. The European Commission's latest estimations, which take into account the national energy efficiency targets for 2020 that Member States have set in the context of the Europe 2020 strategy, suggest that the EU will achieve only half of the 20% target in 2020<sup>4</sup>. It only once again confirms **the complexity of energy saving policies and practical implementation** even for countries with an existing more or less extensive experience in energy savings and efficiency measures. As regards the Republic of Moldova, their national energy efficiency approaches and experiences are much less extensive. On the other hand, it may also result in a leap-frog approach for the country, bypassing those ineffective or less successful policies and particular measures.

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<sup>4</sup> SEC(2011)277.

77. On November 20, 2011 the Government of Moldova approved a “National Program on Energy Efficiency for 2011-2020”. The National Program provides a trans-sectoral set of activities for the period 2011-2020 as well as a national information strategy for final consumers. The Ministry of Economy in cooperation with the National Energy Efficiency Agency and other relevant central bodies of public administration will develop a regulatory framework necessary to promote and incentivize energy efficiency (EE) and renewable energy. That is why the first strategic goal of Moldova for the period by 2020 will be **to set up a modern energy efficiency regulatory framework**, to provide built capacity within the administrative system and to provide its effective administration and management.
78. In accordance with the objectives of an EU energy efficiency development and given the commitments of the Republic of Moldova aligned with the acquis communautaire, the National Programme for Energy Efficiency 2011-2020 will establish long-term **energy savings** amounting to 20% by 2020. An intermediate target for energy savings **to be achieved by 2016**, is set at **9%**.
79. The **Moldovan national targets** for the year 2020 are set up by National Programme for Energy Efficiency 2011-2020:
- 20% of renewable energy in final energy consumption in the country;
  - 10% of energy from renewable sources in all forms of transport
- Intermediate targets for 2015 are:
- 10% - the share of renewables in final energy consumption;
  - 6% - volume mixture of ethanol and gasoline in gasoline volume sold;
  - 5% - volume mixture of biodiesel and diesel oil volume sold.
80. The energy efficiency **targets** for 2020 have been set and they **are set at the level of the most ambitious targets** which even the European Union still struggles to impose, and the renewable targets are also very high in the context of the very cautious approach of the Energy Community. Real implementation of both directions is expected to be costly and burdensome for the citizens of Moldova. As regards the targets for 2030, these cannot be decided yet as precise thresholds because of many uncertainties which do not only stay within the Moldovan context but have to be linked to international targets not yet decided. What the strategy indicates is that there are other alternatives less costly than renewable for resolving security of supply as well as climate change abatement. A judicious policy of imports combining medium-term contracting and short-term trading is allowed to bring same results in terms of security and CO<sub>2</sub> emission reduction, but less of a burden on the energy bill which consumers are paying.
81. This new energy efficiency regulatory framework includes as a key element the recently established National Energy Efficiency Agency. The system of the national energy efficiency action plan to be developed by the agency every 3 years will become a **backbone of the strategy implementation** regarding the energy efficiency.
81. **The set of main energy efficiency measures** to be implemented includes: development of centralized heat supply systems, CHP energy generation priorities, developed metering systems and devices for heat and energy, labeling of all electrical devices depending on their energy efficiency class, energy consumption and noise levels, energy efficient buildings, etc. Within

the framework of all the possible energy efficiency measures, those which are relatively simple in organization and provide a quick and visible effect have to be implemented earlier. Such an approach will lead to raised awareness of these issues and visibility of the results after the measures have been taken.

82. Special care in the field of EE promotion will be given to the **education and training of personnel**, of university and school students and of the wider population in relation to the efficient use of energy, energy saving and related actions. To this end, a series of educational programs for public awareness purposes will be developed, contests will be organised and achievements in this field will be demonstrated.
83. The main reason for such a recommendation is **an absence of practical EE experience and of the institutional framework** of EE activity in the country. In this respect it should not be an issue when the first NEEAP will be dedicated mostly to institutional framework creation as a basis for future development in the energy savings and efficiency measures and results.
84. The RES-E development directions for the period 2012-2020 will be looking very much similar conceptually as the energy efficiency development. The overall priority for RES development in the Republic of Moldova will be building up national institutional framework which will provide a decent support for this development, harmonized integration into the existing energy infrastructure and expected payback in terms of clean energy additional generation, low environmental burden and meeting Energy Community and EU requirements in the field.
85. As it was already stated above the Republic of Moldova cannot put renewable development ahead of market liberalization without risking to increase the final energy bill too much. The absence of the market, providing transparent price and cost signals may bring a possibility to miss the fair LRMC level for renewable generation in the country. On the other hand taking into account a relatively small size of the country, limited available RES-E resource potential, presented mostly by solar and wind to a lesser extent it might be worth considering an arrangement of centralized tenders for a limited RES-E capacity for wind and solar.

This tendering procedure if organized in a fair and transparent way will provide an economically viable compensation to the investors based on the competitive selection and an ability for the RM Government to control the RES-E capacity commissioning and its overall cost for the public. A volume of 300-350 MW of wind capacity in line with a declared obligation to purchase all the energy generated at a final tender price with attract interest of the potential investors in wind which ability to find appropriate land sites in Europe is rapidly shrinking.

A solar energy development may be a second priority in RES-E development because of the technology cost implications at the current level. This might be either a case by case scenario, or a conscious delay in development based on the expectations of the further learning curve suppressing the cost for solar.

## **2.2. Integration in the European energy market**

### **2.2.1. Transparent and fair pricing**

86. For a long period regulated tariffs and bilateral contract negotiation were the only price formation mechanisms. A lack of cost-reflection of the early tariffs

set still represents a historical burden for the economic agents as well as non-payments due to the unclear or even missing contracts.

87. A positive evolution of electricity network losses as a component of energy prices has partly compensated the steady?? increase in the upstream costs in the energy bill, but it can be expected that soon the decline in these transmission losses will slow down or even end; in this way the fuel cost portion and share will be entirely and proportionally reflected in electricity end consumer price.
88. Despite liberalization, a still relevant market share will belong to the regulated prices due to supporting schemes for renewable and cogeneration introduction as well as to the current contribution of CHPs in consumption coverage and the increasing future contribution of renewables. This fact has a definite disadvantage as regards prices levels, but an advantage for greater predictability. The regulatory authority will set up tariffs for priority generation: renewable and cogeneration; the strategic decision is dependent on volume: more volume means higher cost.
89. The legislation will enable, and the regulation will define, price mechanisms to comply with the free market framework.
90. No real market competition exists in Moldova today. It may come only with new entries, and foreign participants will ask of an emergent market that products similar with those they benefit in EU internal energy market should be in place. This will mean appropriate trading products for the introduction of consecutive time horizons: public auctions for bilateral contracts (since 2013), a day ahead market (since 2015), intra-day trading (since 2020), ancillary services, a balancing market, etc.

### **2.2.2. Institutional and operational framework for real competition, effective market opening and market integration**

91. The Energy Law and the Electricity Law and the Gas Law will be amended to reflect provisions of the applicable directives/regulation regarding security of supply, and the same legislation and regulation will also be amended regarding transposition and implementation of the third package.
92. In accordance with the Energy Community Treaty, the liberalization of the Moldovan energy market is set for January 1, 2015 (D/2009/03/MC-En-C). Moldovan updated primary and secondary legislation will ensure that the eligible customers within the meaning of EC Directives 2003/54/EC and 2003/55/EC are all non-household customers from January 1, 2013, and from January 1, 2015 all energy customers. Eligible customers have the right to contract electricity purchase directly with any supplier, including from abroad.
93. The law also has to provide accurate definitions of a vulnerable consumer, public service, supplier of last resort and its selection and appointment scenarios, contractual mechanisms to support energy acquisition by last resort supplier.
94. According to the EU directive, the Regulator is not obliged to ensure low tariffs to households, but *"the right to be supplied with electricity of a specified quality at reasonable, easily and clearly comparable, transparent and non-discriminatory prices"*. The manner for procuring energy for households either by default suppliers or by a single buyer entity acting as last resort supplier has to respect these above-mentioned conditions. The best thing would be this



being procured through public auctions in a competitive wholesale market combined with the acquisition of renewable-based generation.

95. Primary legislation will be updated to reflect the specific roles and responsibilities of the regulator and of TSOs according Energy Community legislation and the best practices available in the EU.
96. For both TSOs (gas and electricity) the capacity to operate balancing market and cross-border capacity auctioning has to be developed. Third-party access will be fully implemented and transaction-based transmission tariffs removed.
97. The critical issue of the security of supply requires electricity network/pipelines development planning by TSOs to be responsible, as well as the regulator's obligation to ensure by transmission tariff establishment the availability of required investment resources for the both TSOs. The planning and investment role for network/pipeline development that definitely has to be strengthened, will enable an appropriate response to the market integration and renewable access challenges. To stress the fact that every national development plan has to fit into a regional one in order to have an optimized route of development. The regional plan has to be revised periodically and on a major unpredicted changes.
98. In order for Moldova to be ready to meet the requirements of the liberalized market in January 2015, the country has to start work on a creation of this institutional framework, as after its completion the real system and its staff have to go through adaptation and hands-on training. Market operator(s) for electricity and natural gas markets will be appointed after 2013 to provide trading, settlement and if applicable clearing as well as market coupling services after 2020. The framework will together with the TSOs provide the efficient market mechanisms and products to facilitate liquid and transparent energy trading in different terms and time horizons (public/electronic auctioning of bilateral contracts, day ahead, intra-day/balancing markets, etc.)
99. The trading products offered by market operators for both gas and electricity markets have to obtain appropriate mechanisms and a calendar with clear, rational and efficient gate closure times, and have to represent input and leverage for systems scheduling. The available interconnectors' capacity has to be allocated on a regular basis and over the standard time horizons by auction-based mechanisms commonly agreed and commonly administered with neighboring TSOs. Their calendar has to be synchronized with the energy trading calendar.

### **2.3. Institutional Framework for Energy Industry Development**

100. Accumulated debts represent not only a burden for economic agents in the energy field, but barriers to their restructuring, investment capabilities as well as a barrier to market credibility and private investment. The accumulated debts have to be resolved, while privatization will remain pending as long as this solution is pending. Fixing this problem will also represent a signal to private investment. As much as the role of the market in system development, and in this particular problem area. resolution will not be understood or accepted and this market will not become functional; the risk exists of continuing financial weakness.
101. State-owned enterprises have to set up and disclose to the public their corporate objectives and monitoring indicators, and their management have to obey strict rules of conduct and avoid possible conflict of interests. The

managers will be appointed on high level criteria and their activity be appraised against well-defined performance criteria.

102. While the regulator will progressively open the market by removing regulated tariffs according to a public road map towards opening milestones provided by Energy Community decisions, management of state-owned enterprises will be kept accountable for utilization of the market mechanisms to procure and sell electricity. Stakes in the state-owned companies in the electricity field will be listed on the stock exchange (Bucharest/Warsaw/Vienna, etc.) to help investment and to show performance. The sector needs capitalization.

### 3. MAIN STRATEGY ELEMENTS FOR 2020-2030

103. In line with a view from the top on EU issues and worldwide evolution over the decade 2020-2030 as well as the country's affordability, Moldova has to pay attention within the framework of the Strategy and consider an opportunity to give a larger priority after 2020 to those factors that today seem to involve technologies and approaches that are too expensive, especially in the area of renewables and energy efficiency. By the time of the new decade 2020-2030 they may become affordable and accepted by the market. Also proper attention will be paid to the distribution network development using the concept of smart grid in order to optimally integrate renewables and energy efficient control.

#### 3.1. Developing renewables. Long-term CCS availability

104. Within the framework of 2020-2030 a **carbon capture and storage technology** (CCS) may become an important driving force of the renewable development and of the shift in the electrical energy technological mix. CCS technology is a promising but not yet mature technology of CO<sub>2</sub> elimination from fossil fuel power plants emissions. CCS can provide the current fossil fuel-fired power plants with the opportunity to work in a low-carbon electricity sector in the future due to the drastic reduction in emissions. Currently CCS technology is at an early stage of development, having few implementations world-wide with different results.
105. The **uncertainty surrounding this technology**, plus the lack of studies of practical experience in Europe and world-wide regarding feasible storage locations for CO<sub>2</sub> and (or) transportation facilities may add a lot of uncertainty to the strategic energy scenario options. If implemented as a fully commercial technology in the market, CCS could strongly undermine the whole technology mix of the energy generation world-wide. The international policy regarding climate change and green-house gas emissions is more or less clear in terms of long-term approaches.
106. A base case development scenario will consider a non-constrained **development of this technology in the country**, only limited by its economic profitability. The two additional scenarios consider:
- No CCS development: either because the technology never achieves its desired economies of scale and promising results, or because of the lack of storage sites, this scenario will consider that there is no CCS available at all.

- Limited CCS: this scenario will stand in the middle of the base case and the fully constrained CCS scenario, limiting the storage capacity of CO<sub>2</sub> in Turkey, thus limiting the possible development of generation projects using it.
107. The renewable development in Moldova cannot run ahead of the **required institutional reforms**, which include not only the tariffs that have been set up, but also the rest of the market framework. A Moldovan approach to renewable generation development has to be different from that in other countries. The rest of the world considers this opportunity as an instrument for changing the generation structure in order to protect the environment in the country, boosting generation efficiency, using the existing vast RES-E resources. Moldova has a different set of priorities in this renewable development, where security of supply notions will have a primary value. Due to this criterion, technologies of RES-E generation for Moldova will go through a very thin filter of economic effectiveness and resource availability. That is why Moldova has to come back to the initial assessments of future RES-E share targets, the same as for the energy efficiency targets and policies.
  108. Considering Moldova's growing dependence on imported major energy sources, as well as that of the other European countries, the security of energy supply in the country is a strong motivation for adopting and **implementing new and updated RES strategies**, which is given increasing attention in Moldova. Additional social and economic public benefits of RES development, like reducing environmental impact, creating new industries and businesses, positive structural effects on regional economies or job creation, may be other motives to support RES in the country.
  109. The attempt to implement renewable energy development already has a long history in Moldova as a notion for decreasing dependence on fossil fuels and allowing reductions in CO<sub>2</sub> and greenhouse gas emissions. Now **renewable energy penetration in Moldova is relatively low**, but state government is developing a legislative and normative framework to promote RES-E.
  110. There are **three major documents on renewable energy policy** in the Republic of Moldova, i.e., the Law on Renewable Energy Sources (Parliament Resolution No. 160 of 12 July 2007); the Methodology for the Determination, Approval and Application of Tariffs for the Electricity Generated from Renewable Electric Energy and Biofuel (ANRE's Decision No. 321 from 22.01.2009, Official Monitor No. 45e46 of 27 February 2009), as well as the Regulation on the Guarantees for Origin of Electricity Generated from Renewable Electric Energy and Biofuel (ANRE's Decision No. 330 from 03.04.2009, Official Monitor No. 99e100 of 5 June 2009).
  111. Moldova's renewable **energy policy is controlled by** the following organizations: the Ministry of Economy, the Ministry for Construction and Regional Development, the National Agency for Energy Regulation (ANRE), and the recently established National Energy Efficiency Agency under the umbrella of the Ministry of Economy. The Ministry of Economy is in charge of the general outlines of the national energy strategy and development including RES policies. The Ministry for Regional Development and Construction supervises the heating energy sector as a part of construction and housekeeping and maintenance policy, while the National Energy Efficiency Agency has to develop and implement the national energy efficiency plans, programs and actions, including RES policies and programs as a part of these efforts. ANRE is in charge of the methodical integration of the RES national

support policy and measures with the national energy regulation and energy market through tariffs establishing and regulation.

112. As a member of the Energy Community, the Republic of Moldova has to follow and implement those obligations imposed on the Contracting Parties. These obligations what is more all include a provision for an implementation plan for national renewable energy development, covered by the Directives (2001/77/EC and 2003/30/EC) and later an amending new EU Renewable Energy Directive 2009/28/EC, which has set a mandatory target of 20% of RES by 2020, with pre-determined and individually tailored targets for each member state<sup>5</sup>.
113. Considering the above-mentioned volumes of the RES resource potential and its effective level, we have to carefully re-estimate the long-term targets: 20% RES share by 2020, approved by the Republic of Moldova, and if confirmed to formulate the most effective ways to meet these. It is worth considering a paradigm change from a certain share of RES-E in the balance to the utmost use of the existing RES potential in the country, and only after such an assessment to evaluate the targeted RES-E share in the balance.

### **3.2. Energy Efficiency Expansion**

114. The second stage of energy efficiency development in the country after 2020 will be based on the developed institutional framework, capacity and methodology infrastructure, practical experience in different industries, technology clusters and ownership. This background will let Moldova built up a more sophisticated policy and action items than in the previous time period before 2020.
115. It is assumed that Moldova will join the EU in the future, implying that the country will mandatorily join the EU Emissions Trading System (ETS). In this case, CO<sub>2</sub> emissions policy will become an important factor in energy efficiency policy in Moldova. There is no final international solution on the CO<sub>2</sub> emissions policies framework, but one thing is more or less clear, namely that the policies will be based on the market-based instruments and price caps. What confirms such an approach is a decision on the CO<sub>2</sub> emissions limits and its pricing already applied by the EU.
116. In 2012, the aviation sector which contributes 2% of global greenhouse gas emissions will be mandatorily included in the European Union Emission Trading Scheme (EU ETS). That is, all the airline companies flying from and to the EU have to mandatorily compensate their flight emissions by buying EUAs<sup>6</sup> (EU Allowance) or CERs<sup>7</sup> (Certified Emission Reduction). The emission cap for 2012 is -3%, and for 2013-2020 -5% respectively, compared to base year emissions in 2004-2006 (EU Directive 2008/101/EC, 2008). Therefore, the EU regulations for flights from Moldova to the EU and vice versa are also valid for Moldova, making Moldova's aviation sector the first Moldovan sector to be mandatorily included in EU ETS with an official emission cap. There are actual discussions going on, to include some other sectors also in the next few years,

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<sup>5</sup> Official Journal of the European Union, Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Belgium, 2009.

<sup>6</sup> European Union Allowances (EUA) are standardized tradable units at EU ETS. An EUA is a tradable unit of 1 tCO<sub>2</sub>e.

<sup>7</sup> The generated certificates from CDM and therefore, standardized tradable units, are called Certified Emissions Reductions (CER). A CER is a tradable unit of 1 tCO<sub>2</sub>e.

that may impact Moldova economic and energy development in the 2020-2030 time period.

117. This CO<sub>2</sub> air transport initiative has already provoked quite an active reaction of the many European air business-related companies (Airbus, Lufthansa, British Airways, Safran, MTU, Virgin Atlantic) expecting reverse measures as well as from the affected non-European companies and countries outside Europe (US, China, Russia). This front though is not totally consolidated, as South Korea has announced a national green-house gas emissions trading system from 2015, Australia has such a decision on a similar system applied from 2015, and New Zealand had one back in 2009.
118. The most likely response might be a start-up of national green-house gas emissions trading systems in the immediate future by at least the US and probably Russia. This means that Moldova has to start preparing such an institutional change and shift in the economics of all the green-house gas-emitting entities, including power-plants, as such a system being implemented will quickly cover not only air-traffic pollution but the rest as well.
119. With respect to the implementation of the carbon scenario, the general framework corresponds to the fact that the costs of thermal generation and the formation of electricity prices will take into account the impact of the carbon price assumption presented in the table below.

**Exhibit 7. CO<sub>2</sub> Prices in EUR/ton**

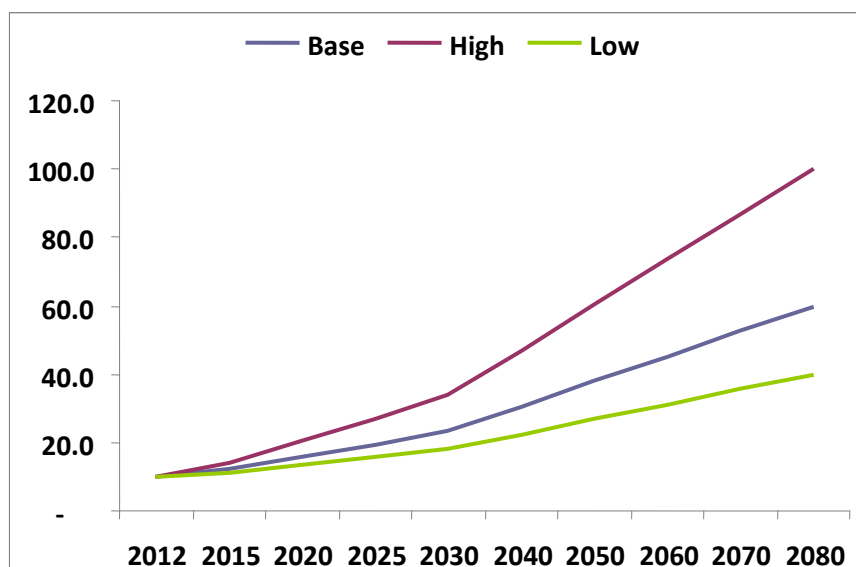
<i>Year</i>	<i>Scenario</i>		
	<i>Base</i>	<i>High</i>	<i>Low</i>
<b>2012</b>	10.0	10.0	10.0
<b>2015</b>	12.2	14.0	11.3
<b>2020</b>	15.9	20.6	13.5
<b>2025</b>	19.6	27.2	15.7
<b>2030</b>	23.2	33.8	17.9
<b>2040</b>	30.6	47.1	22.4
<b>2050</b>	37.9	60.3	26.8
<b>2060</b>	45.3	73.5	31.2
<b>2070</b>	52.6	86.8	35.6
<b>2080</b>	60.0	100.0	40.0

Source: The ICE

120. These prices assume an evolution towards €60/ton in CO<sub>2</sub> prices in the long term, for the short/mid-term prices are aligned with current future markets<sup>8</sup> as can be seen in the next figure. The other scenarios may also assume long term price of €100/ton and €40/ton for the optimistic and pessimistic runs.

<sup>8</sup> Source: The ICE

**Exhibit 8. CO<sub>2</sub> prices comparison**



Source: The ICE

121. Another key element of this next stage development in Moldova will be the concept of a new intellectually-based, distributed, mostly RES-based energy system in which the consumers of energy will be also playing their role in balancing the system in line with the generation base and transportation system.

### **3.3. Smart Grid Introduction**

122. The structure of electrical energy consumption in the Republic of Moldova reveals households as being the main energy resource consumers. The future economic development in the country can and should reveal small and medium size businesses opening and being quickly developed. This type of customer together with the households are small, dispersed and tend to have better control of their energy consumption. Smart grid permits the achievement of this type of control to the benefit of energy savings and the final efficiency of the operations.
123. From the point of view of RES-E grid integration, the renewable resources distribution in the Republic of Moldova looks scattered over the entire territory of the country, which is another strong argument in favour of deploying smart grid facilities to integrate these relatively small distributed generation sources, and not to waste them if wind and solar are fluctuating. The integration of the utility-scale intermittent energy resources poses several challenges to the operation and management of the power system. Safe and effective integration of the utility-scale wind farm projects is a key benefit of the smart grid facilities. Smart grid is also a development vehicle for the telemetry and communication system of the network. In most cases, precisely the communication system becomes a backbone of the facility and might be a barrier to development at the same time.
124. To enable project development, it will be necessary to provide a specific regulation to implement the provisions of the updated legislation according to best global practices. The identification of applicable distributed renewable resources and investigation of potential groups of targeted consumers to

provide a demand response platform will follow, accompanied by intensive promotion of the investment opportunity, alternatively organized by auctions. Attracting necessary funds according to a thorough analysis of short-term investment costs and long-term systemic benefits as well as development of a fair cost-sharing model will also be required.

## 4. CONCLUSIONS

1. The Energy Strategy of the Republic of Moldova by the year 2030 considers the realities of country's energy sector, acknowledging the unavoidable geopolitics and the undeniable legacy behind these realities. Current and future decision makers have to formulate and firmly implement required countermeasures to the consequences of these if they are negative or threatening, and they have to find new solutions to the new challenges. When solutions are found, the most affordable alternatives have to be chosen. The decision makers will have to follow a logical triad: situation analysis – vision development – action program.
2. An additional precondition, that Moldova is challenged by the acquis implementation based on the obligations due to its adherence to the Energy Community and partnership with the EU, has to be accepted when the Strategy is predesigned and built. However, it has to be acknowledged that the so-called "acquis communautaire" (hereinafter "acquis") was not elaborated on very abstract models, but according to the average approach of the EU member states in terms of needs, levels of development achieved and past experience, which generally has to make the steps more affordable. The acquis itself are meant to serve the EU and welfare of citizens of potential candidate countries citizens stable economic growth in the region. Belonging to the international communities, treaties and associations, Moldova has to, and can, use the experience of the energy acquis incorporations as part of the overall EU acquis, in order to find solutions for its own problems in the energy field. The acquis implementation has to be used as an effective and safe vehicle for the Moldovan energy market's seamless integration in to the EU internal energy market.
3. The integration into the EU internal energy market will place Moldova in a position to share with contracting parties of the Energy Community and EU member states both the benefits and risks specific to a large community. But most important is that Moldova will not alone face existing and further energy challenges, and will definitely benefit from being a member of a large energy regional community within the market.
4. Affiliation to a large community brings the benefits of sharing with the other members a large trading space with a more stable and predictable evolution of energy resources supply and related acquisition costs. The fundamental principle of a free movement of goods, the requirements of the regulations to provide a level playing field, and the interconnected highways for oil and gas transport and electricity networks, will give to the overall economy of Moldova access to the main resource of economic growth and to the citizen's indispensable component of welfare: energy.
5. The access to the energy from the internal Energy Market (IEM) of the EU when the Republic of Moldova will effectively be integrated through infrastructure, regulation and practices will result in a security of supply based on fair competition and sustainability.
6. Best EU practices assimilation is the smoothest way to effective and efficient market integration. However, before assimilation these have to be evaluated as regards their applicability here, and whether they bring real value. As practices have to be understood not only as a technical and commercial regulation and infrastructure creation but also as a corporate governance excellence, responsibility and prudent administration of the assets as well as



strategically wise positioning of the players and stakeholders in the domestic and internal market.

7. It is true that individual markets of EU member states showed several flaws when these were implemented over the last decade, the EU diverse, punctual and permanently moving strategies, but these were rather due to individual mistakes such as an incomplete transposition of directives, inadequate regulation tailoring, poor framework implementation, a lack of technical, mathematical and legal substantiation, a lack of awareness, political interference and consequently this does not prove the *acquis* is failing in concept, but rather shows up deviations from it.
8. The strategic political and economic partnership with countries which are non-EU members nevertheless remains critical for Moldova. Permanent change and re-assortment of the alliances in the Black Sea and Central Asia region and its obvious impact on the energy field requires of Moldova a much more active presence at the negotiation tables regarding setting up the infrastructure projects and the energy routes. Russia, Ukraine, Azerbaijan, Turkey from outside the EU and Romania, Bulgaria as well as Greece, Hungary and Slovakia have to represent the focus of Moldovan attention in the years to come. However, in many cases the transnational interests and the omnipresence of multinational companies are the coordinates of the relationships in the energy field, and the area of Black Sea and Central Asia is not an exception. Their driving interests have to be understood as well and their partnerships have to be well appreciated for the wealth of the country, and Moldova has to carefully examine whether its business-oriented attitude proves to be more flexible than that of one of its traditional negotiation partners in this geopolitical area.

#### **4.1. Recommended strategic actions**

9. In specific terms of the Republic of Moldova, which in the long term may prove to be an EU partner, and is recently integrated into the Energy Community as contracting party, the strategic priorities such as security of supply, competition and availability of affordable energy, environmental sustainability and combating climate change have to be translated in the following strategic actions.

- The RM Government has to set up a program for new electrical interconnections implementation, meaning a declared notion to do it leaving Ukraine as not performing, setting a project body, program committee, SPV, etc. with the only target to provide this integration by 2018 and accountable for fund rising and project implementation.
- Opening natural gas and electricity markets according to the deadlines required by the Energy Community, without delay and freely acknowledging that this will represent a tremendous shift in the energy market framework development.
- Start of implementation of an effective market institutional framework in the country for both electricity and natural gas sectors with real market players licensed, registered on the market and fully responsible for their actions in the day-by-day market framework, supply and consumption, according to trading arrangements (bilateral and/or participation in a spot market) where

the balancing mechanisms and obligations of responsible balancing parties are fully capable of providing correction to deviations.

- Targeting a diversified energy and energy carriers supply including conventional gas transported through pipelines or liquefied, as well as well shale gas, diversification that has to be supported by the physical connectivity to the most diversified and most reliable sources (pipelines) and increased storage capacity, and taking concrete steps in this respect.
- Prudently tailoring a hybrid policy which combines the best alliances to increase the power to bargain on bilateral contracts with anonymous access to large trading platforms belonging to the markets, which provides liquidity and price shock mitigation. Over the last decade these EU markets were able to provide average prices which show at least the same level as the current offer from traditional suppliers.
- Substantiate alternatives and make the best choices for new electricity generation capacity with minimum state funding on the basis of:
  - investment climate improvement,
  - energy market opening and development,
  - real move demonstration of the new interconnections with the EU markets provided by the RM Government,
  - encouragement of private-public partnerships.
- Implement high standards for the quality of the supply service, incentivize and monitor achievements;
- Facilitate sustainable development, meaning:
  - energy efficiency improvement which brings welfare, comfort for citizens and energy savings that helps in a reduction in CO<sub>2</sub> emissions,
  - development of a market for energy services based on contracts against performance proof as well as a scheme of obligations quotas
- Stepping into sustainable development, meaning utilization of renewable as main domestic resources with:
  - the provision of affordable supporting schemes providing incentives to investors,
  - the provision of the technical integration to the network, meaning connection, backstopping and priority dispatching.

## The Moldovan energy system – description and status

The country is a net energy importer with only about 5%<sup>9</sup> of demand for primary energy being met by domestic sources. Natural gas is the major fuel in Moldova, providing almost 40.5 % (in 2010) of the total primary energy supply, which is delivered by Gazprom from Russia as a unique source (Exhibit 1.1).

**Exhibit 1.1. Structure of energy mix (%)**

1.5. Balanța energetică		mii tone echivalent petrol							
	2003	2004	2005	2006	2007	2008	2009	2010	
<b>Resurse, total</b>	<b>2189</b>	<b>2377</b>	<b>2463</b>	<b>2430</b>	<b>2358</b>	<b>2410</b>	<b>2312</b>	<b>2401</b>	
Surse interne	87	84	87	92	88	110	124	104	
combustibili lichizi	2	8	10	7	16	26	38	31	
combustibili solizi	79	71	70	78	69	77	81	66	
energie hidroelectrică	6	5	7	7	3	7	5	7	
Import	1956	2096	2185	2157	2115	2104	1973	2071	
combustibili lichizi	577	609	622	603	643	668	659	666	
gaze naturale	1062	1083	1205	1201	1110	1057	977	1033	
combustibili solizi <sup>[1]</sup>	166	115	103	105	110	124	84	112	
energie electrică	151	289	255	248	252	255	253	260	
Stocuri de combustibil la începutul anului	146	197	191	181	155	196	215	226	
<b>Distribuție, total</b>	<b>2189</b>	<b>2377</b>	<b>2463</b>	<b>2430</b>	<b>2358</b>	<b>2410</b>	<b>2312</b>	<b>2401</b>	
Consum intern <sup>[2]</sup>	1978	2144	2278	2271	2160	2191	2071	2209	
transformat în alte tipuri de energie	681	783	842	817	767	764	716	737	
necesități tehnologice de producție:	1297	1361	1436	1454	1393	1427	1355	1472	
industrie și construcții	124	130	161	163	156	142	85	107	
agricultură	80	71	61	59	52	51	46	48	
transporturi	279	254	267	285	325	336	291	358	
comerț și necesități comunale	137	126	120	123	119	120	172	157	
vândut populației	575	656	704	691	598	632	660	689	
altele <sup>[3]</sup>	102	124	123	133	143	146	101	113	
Export	12	42	3	4	7	5	15	18	
Stocuri de combustibil la sfârșitul anului	199	191	182	155	191	214	226	174	

Source: National Statistic Bureau Republic of Moldova

In terms of the Republic of Moldova's major energy dependence, the structure of fuel consumption is almost the same as the structure of imports. There are several countries in the EU, smaller or bigger than the Republic of Moldova with a level of energy import dependency (from 77% to 100%) close to that of Moldova, and even much greater dependency in terms of natural gas (from 87 to 100%) as the table Exhibit 1.3. presents.

However,

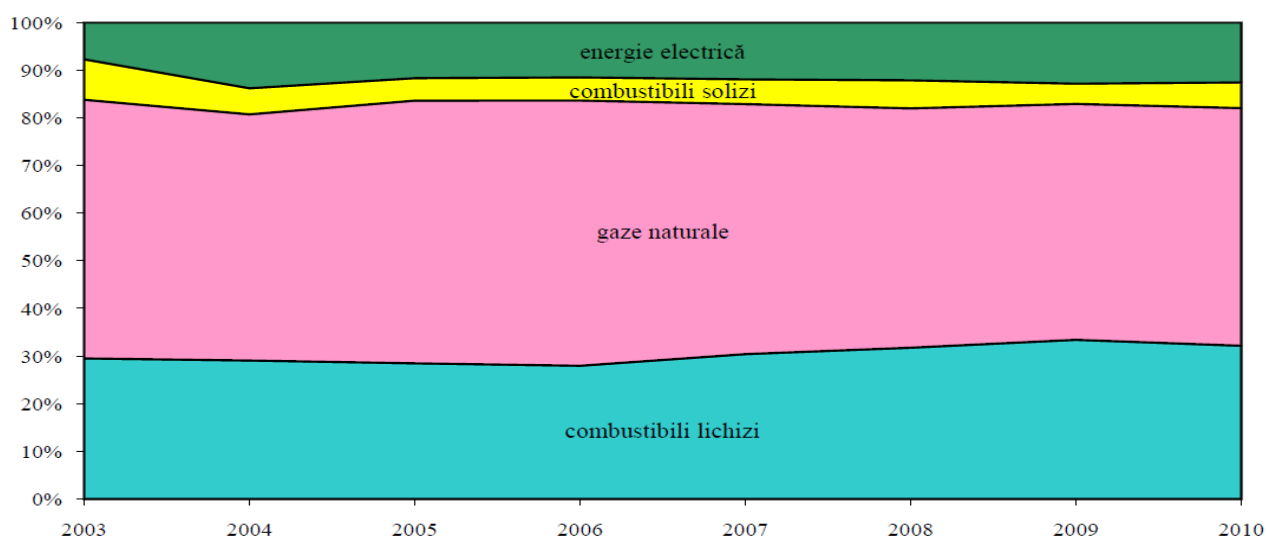
- These countries were not in the best position during the crisis,
- The structure of fuel consumption of the EU 27 is very different from that of the Republic of Moldova in term of natural gas (23.9% compared with 40.5%, thereby almost only half), thus the impact of this dependence is lower.

<sup>9</sup> National Statistic Bureau Republic of Moldova: National Energy Balance 2010

- The greater accessibility of these countries to supplies of gas, meaning LNG opportunities for countries on the sea (Belgium) or even surrounded by sea (Italy, Spain, Portugal, Ireland)

Regarding the contribution of liquid fossil fuel, this is more balanced: 31.2% in the RM compared with 36.4% in the EU. Coal is less used in the Republic of Moldova, mainly due to the lack of coal-based power plants: 6.8% in the RM compared with 18.3% in the EU.

**Exhibit 1.2. The structure of fuel and energy import**



**Exhibit 1.3. The import dependency of the EU and energy dependency of countries close to the Republic of Moldova**

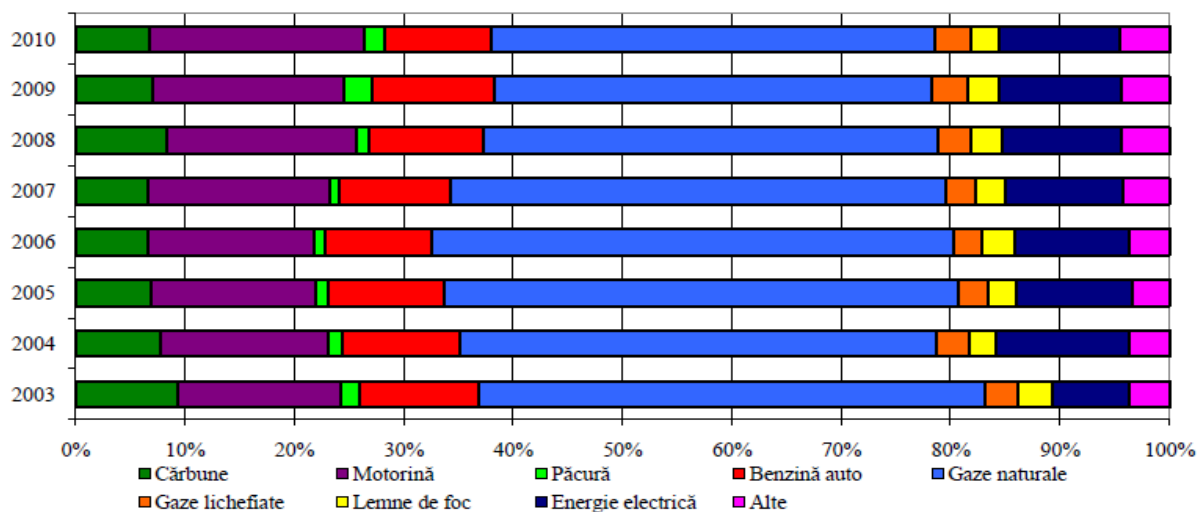
COUNTRY	IMPORT DEPENDENCY 2007 (%)			
	ALL FUELS	SOLID FUELS	OIL	GAS
EU 27	53.1	41.2	82.6	60.3
MT	100	100		
LU	97.5	100.00	98.8	100
CY	95.9	68.0	98.6	
IE	88.3	65.1	97.0	91.4
IT	85.3	99.2	92.5	87.0
PT	82.0	100	98.9	98.7
ES	79.5	66.6	99.7	98.9
BE	77.2	95.8	97.4	99.8

Source: EUROSTAT

**Exhibit 1.4. National energy balance 2003-2010**

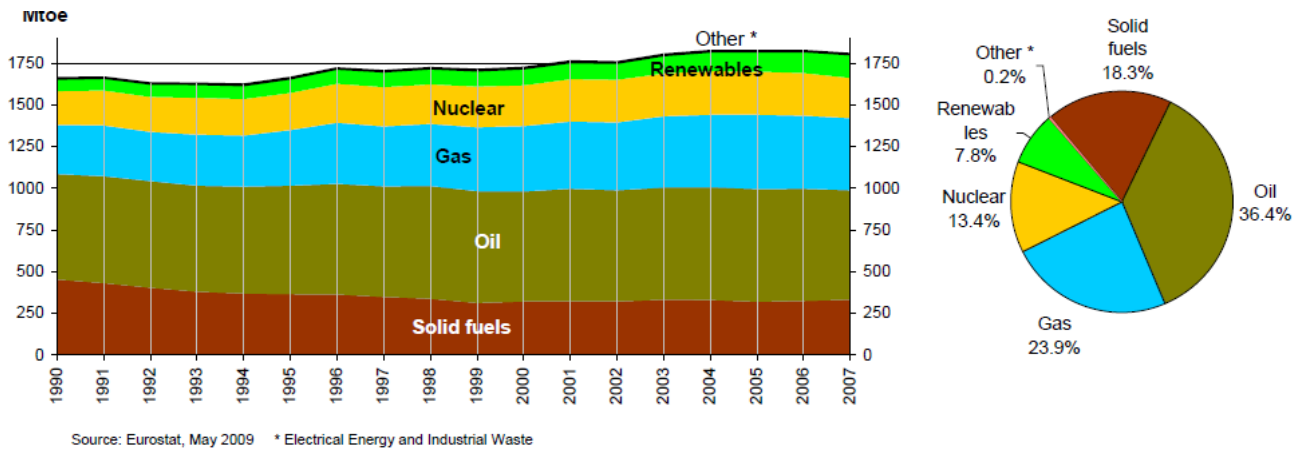
	mii tone echivalent petrol								
	2003	2004	2005	2006	2007	2008	2009	2010	
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energie electrică	151	289	255	248	252	255	253	260	
Stocuri de combustibil la începutul anului	146	197	191	181	155	196	215	226	
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industrie și construcții	124	130	161	163	156	142	85	107	
agricultură	80	71	61	59	52	51	46	48	
transporturi	279	254	267	285	325	336	291	358	
comerț și necesități comunale	137	126	120	123	119	120	172	157	
vândut populației	575	656	704	691	598	632	660	689	
altele <sup>[3]</sup>	102	124	123	133	143	146	101	113	
Export	12	42	3	4	7	5	15	18	
Stocuri de combustibil la sfârșitul anului	199	191	182	155	191	214	226	174	

**Exhibit 1.5. Structure of energy mix in 2003-2010**



Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

**Exhibit 1.6. EU 27: Structure of energy mix in 1990-2007**

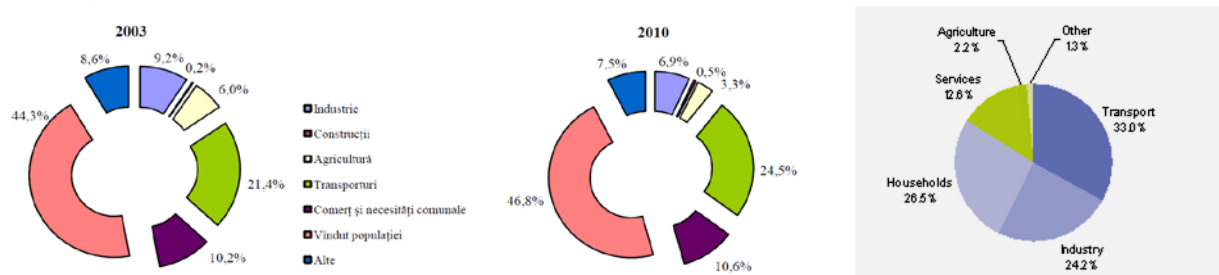


Source: EUROSTAT

A comparison of demand structure shows 46.8% energy consumed by households in the RM while only 26.5% in the EU and only 6.9% consumed by industry in the RM compared with 24.2% in the EU, which provides information on direct energy efficiency for public awareness rather than for technical industrial efficiency.

**Exhibit 1.7. Republic of Moldova – energy resources breakdown on consumers, compared with EU27**

2. Repartizarea consumului final de resurse energetice și de combustibil pe principalele activități ale economiei naționale



Sources: National Statistic Bureau Republic of Moldova: National Energy Balance 2010, EUROSTAT

Electricity demand in Moldova has been rising quickly over the last decade as Exhibit 1.8 shows, with the relevant exception of the year 2009 under overall world crisis impact. However, it recovered in 2010. Exhibit 1.9 shows the evolution of the breakdown of electricity consumption per sectors for the Right Bank during 2003-2010. Industry sector consumption went down from more than a third part to almost a quarter, while residential consumption rose by 10%. This suggests targeting awareness campaigns to householders with better information on energy savings including electricity.

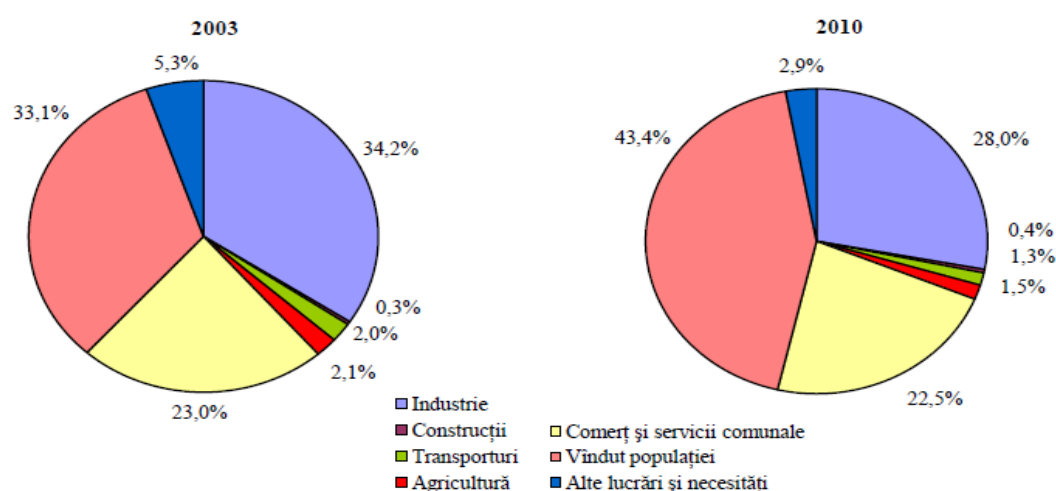
## Exhibit 1.8. Republic of Moldova – energy resources breakdown of consumers

### 4.3. Consumul de energie electrică, pe principalele activități ale economiei naționale

	milioane kWh							
	2003	2004	2005	2006	2007	2008	2009	2010
Resurse de energie electrică, total	4629	4383	4196	4074	4031	4058	3974	4097
Consumat energie electrică	2527	2634	2921	3215	3364	3428	3378	3486
Industrie	865	871	974	1026	1049	948	872	975
Construcții	8	10	10	14	15	14	13	13
Transporturi	51	47	50	58	65	62	50	46
Agricultură	52	48	51	55	50	54	59	54
Comerț și servicii comunale	581	539	671	753	745	841	866	783
Vândut populației	836	964	1041	1154	1295	1371	1450	1514
Alte lucrări și necesități	134	155	124	155	145	138	68	101

Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

### Exhibit 1.9. Republic of Moldova – electricity consumption breakdown

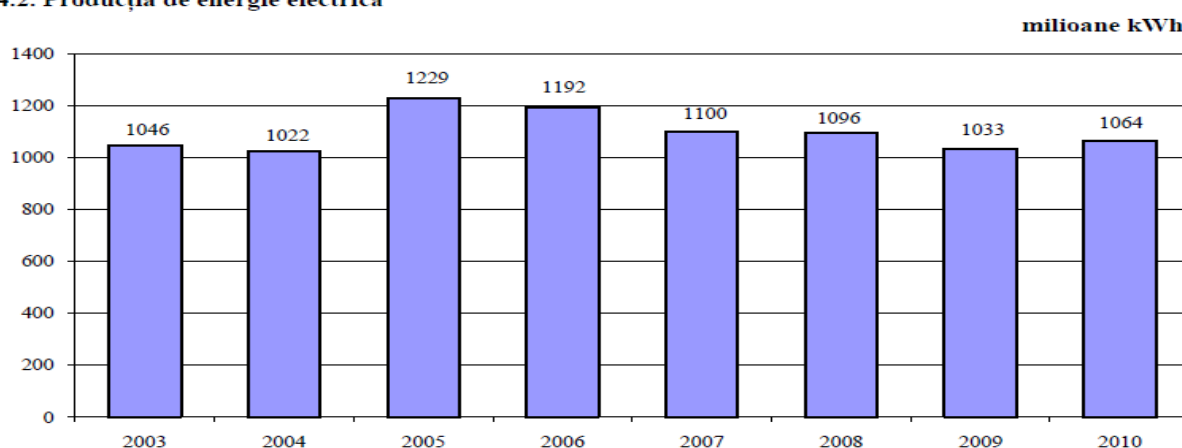


Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

The main challenges of the generation, transmission and distribution assets in the country are: imbalanced distribution of electricity generation on the two banks of River Dniestr, to date insufficient capacity of interconnection lines with Europe (both South-East and Western), aged assets for generation, transmission and distribution for electricity and heating.

## Exhibit 1.10. Electricity generation evolution 2003-2010

### 4.2. Producția de energie electrică



Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

## Exhibit 1.11. Electricity generation breakdown per producers, and electricity consumption breakdown per supply companies

Indicii	2001	2005	2009	2010	2011
<b>Producția de energie electrică (livrată de la liniile electrice de plecare) – total, mil. kWh</b>	<b>1042,9</b>	<b>999,8</b>	<b>865,8</b>	<b>888,1</b>	<b>854,3</b>
incl.: CET-1	115,4	128,9	116,7	82,0	59,8
CET-2	812,6	724,7	639,2	665,4	655,9
CET-Nord	81,5	55,5	53,5	57,1	57,8
NHE Costești	72,2	83,8	54,0	78,3	75,5
alți producători interni	11,2	6,9	2,4	5,3	5,3
<b>Procurările de energie electrică – total, mil. kWh</b>	<b>3194,8</b>	<b>3465,1</b>	<b>3799,6</b>	<b>3915,6</b>	<b>3993,7</b>
incl.: RED Nord	569,7	588,1	638,6	651,0	662,9
RED Nord-Vest	314,9	287,1	330,6	342,4	344,1
RED Union Fenosa	2310,2	2484,3	2749,2	2842,2	2902,5
consumatori eligibili		105,6	81,1	80,0	84,2

Source: Annual Activity Report National Regulatory Agency 2011.

On both banks of the River Nistru the electricity generation capacity includes:

- Moldavskaya TPP (2,520 MW, gas, HFO, built 1964-1982, owned and operated by the Russian utility company InterRAO UES and located in the region of Transnistria),
- Chisinau-2 CHP (240 MW electric, available 210 MW, 1200 Gcal/h thermal, built 1976-1980),
- Chisinau-1 CHP (66 MW electric, available about 40 MW, 254 Gcal/h thermal, built in 1951-1961),



- North CHP, Balti (28.5 MW, available 24 MW, 200 Gcal/h thermal, built in 1956-1970),
- Dubasari HPP (48 MW, available 30 MW, wear degree 75%, built in 1954-1966 located in the region of Transnistria),
- Costesti HPP (16 MW, available is about 10 MW, wear degree 67%, built in 1978)
- other power plants including 9 CHPs of sugar factories (97.5 MW, Gas, HFO, built in 1956-1981).

Out of the relatively high total nominal capacity on both sides of the River Dniestr (2996.5 MW, 2548.5 on left and 448 on the right bank), only about 346 MW can be used from the right bank and only about half of installed capacity is used on left bank mostly due to difficult commercial conditions. Moldavskaya TPP and imports from Ukraine through Energoatom covers a part of the country's supply, stabilized to around 76-79% during 2007-2010, with a relevant switch from latter to the even higher share in 2009. However the price is not stabilized, recently going to about €54/MWh for both sources, which represents a 13% increase and attempting to go over the EU market prices. The remaining part is covered by CHPs and the Costesti HPP located on right bank of the River Dniestr. Despite their relatively high installed capacity, the 9 CHPs of sugar factories make a very low contribution, delivering electricity only when processing sugar beet and consequently representing only 0.6% of domestic generation and covering 0.13% of national consumption<sup>10</sup>. Dubasari hydro power plant does not supply the right bank of the river any more.

The transmission system operator for electricity Moldelectrica, administers the internal transmission grid on the right bank of River Nistru, including 5,977.5 km of transmission lines of 400, 330, 110 kV, while radial lines of 35 and 6-10 kV amount to 25,877.4 km. The interconnections include 7 lines on 330 kV and 11 lines on 110 kV to Ukraine, and one line 400 kV and 3 lines 110 kV to Romania and from there to Bulgaria. The Moldovan electricity system is operated synchronously with the IPS/UPS system and only in island mode with Romania in Moldova or in Romania. While today the connection with Ukraine is totally used, a big part of the utilization being transit, and operated with maximum security, the operation of connection with Romania provides low cross border exchange as well as low security of supply.

While the private company "Union Fenosa in Moldova" and the state-owned enterprises JSC "RED Nord" and JSC "RED Nord-Vest". provide electrical distribution on the right bank, on the left bank the service is provided by JSC RED Est and RED Sud-Est.

The evolution of the indicators of the quality of electricity delivered shows a continuous improvement since 2007, but also a stagnation or even negative evolution relating to one (CAIDI 201) or all distribution companies (SAIDI, SAIFI 2010) over the latest period (2009, 2010). Also, despite the attention which the regulator reports pays to the distribution/supply service quality aspects, more awareness campaigns are still necessary, while end consumers rarely claim compensation due relating to overdue deadlines for connections/reconnections.

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-Nord in

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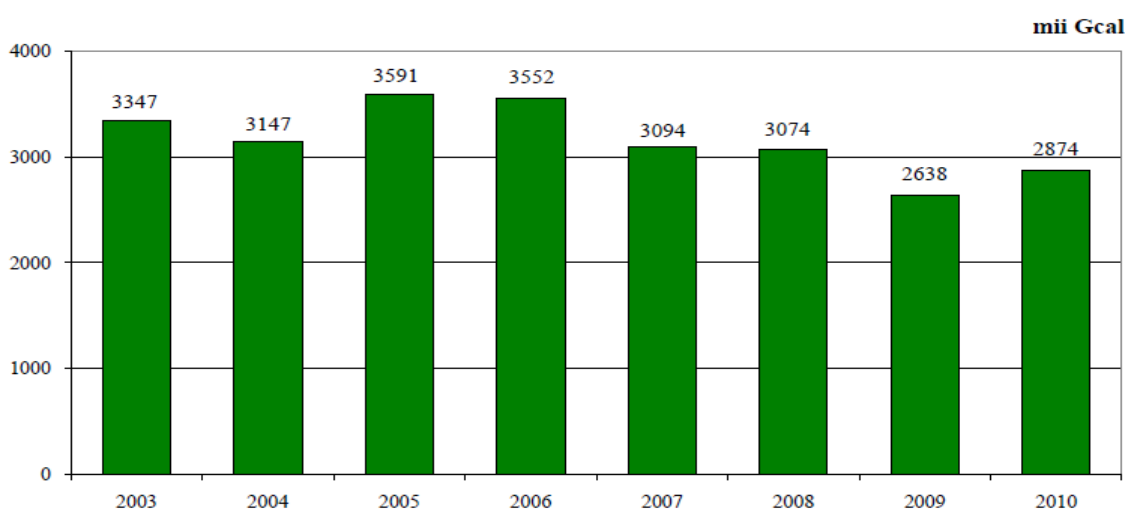
<sup>10</sup> ANRE reports.

Balti with an installed 24 MW electric and 165 MW thermal capacity. Heat is also produced by heat-only plants and some small CHP plants in smaller cities.

Transmission of heat to consumers in Chisinau is carried out by JSC „Termocom”. The assets include Boiler plants EAST, SOUTH and WEST, 19 sub-urban boiler plants, 258 km of trunk and distribution heating networks, 263 km of inter-residential area heating networks, 195 km of heating networks of hot water supply, 18 pumping stations 364 group stations, 3,250 substations and 258 individual substations. JSC Termocom produces about 30% of the supplied thermal energy, while the rest is produced by CHP 1 and 2.

The company CET-Nord, operator of the local CHP plant in Balti, carries out heat production and distribution. Distribution is carried out by a 195.2 km network and 67 heat distribution points.

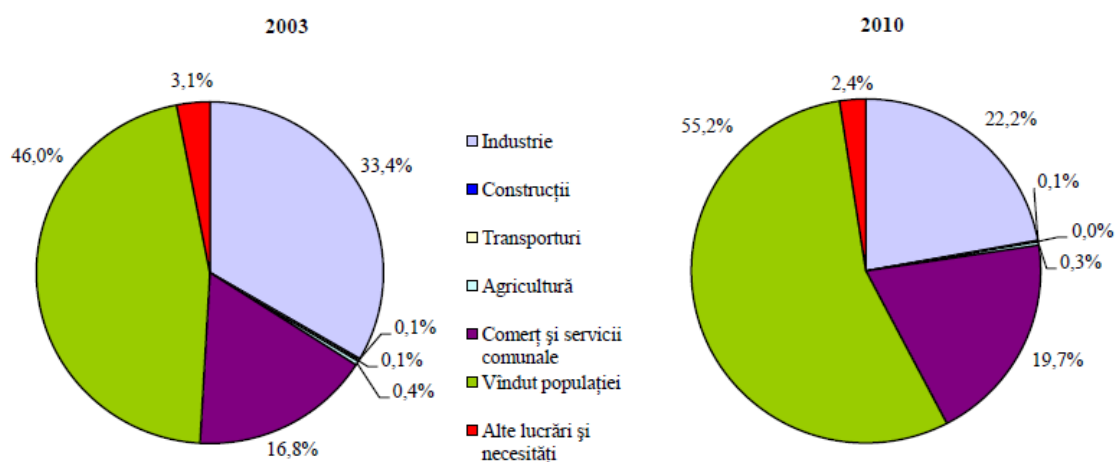
**Exhibit 1.12. Thermal energy generation, 2003-2010, millions Gcal**



Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

**Exhibit 1.13. Thermal energy consumption breakdown per consumers**

5.5. Structura consumului de energie termică, pe principalele activități ale economiei naționale



Source: National Statistic Bureau Republic of Moldova: National Energy Balance 2010

The Republic of Moldova's oil reserves are very low. These are located in the south of the country, being previously extracted from the Cahul district, while the reserves identified in the Cantemir district were never exploited.

The gas transmission system operator Moldovatrangaz is owned by JSC Moldovagaz, owned by: Gazprom (50%), Government of the Republic of Moldova (35%) and Tiraspoltrangaz (14%) as well as 12 DSOs out of the 27 existing DSOs. The natural gas transmission system includes 4 pipelines for transit and 5 compressor stations.

**Exhibit 1.14. Moldovagas – relevant figures**

<b>Indices</b>	<b>2005</b>	<b>2007</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
<b>Import volume, millions m<sup>3</sup></b>	1 418.5	1 305.4	1 126.3	1 187.8	1 152.1
<b>Transit volume, millions m<sup>3</sup></b>	25 313.0	23 692.8	1 7891.0	16 670.0	19 989.5
<b>Pipelines, km, incl.:</b>	12 259.2	15 456.5	18 472.4	21 025.6	21 884.9
<b>highways, km</b>	1 307.6	1 379.1	1 474.5	1 527.3	1 559.6

Source: Moldovagas

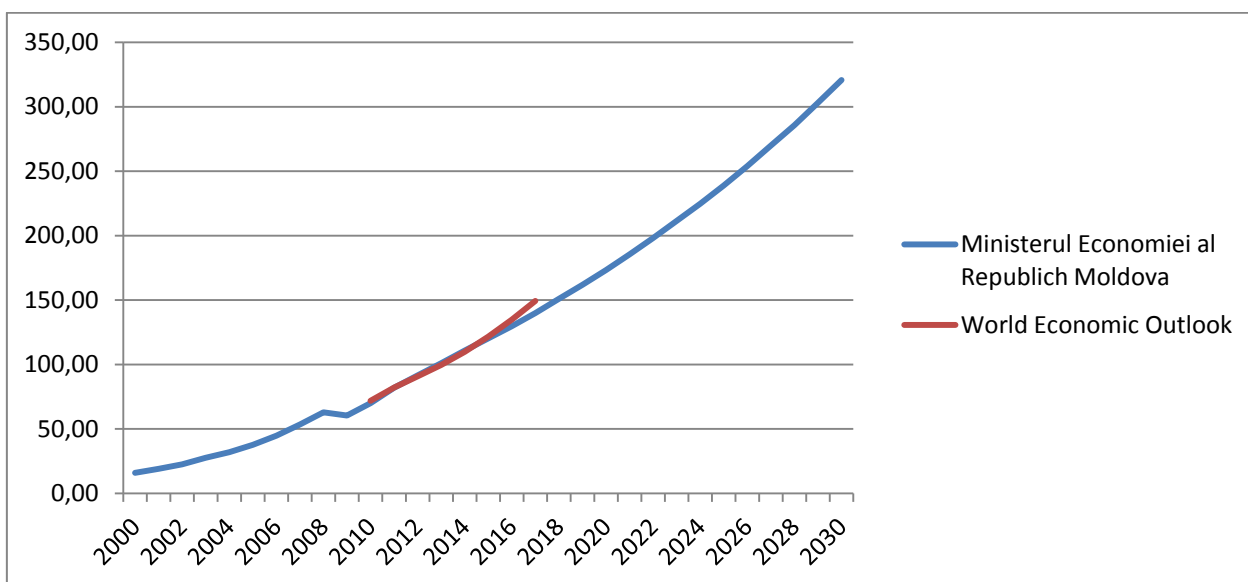
During the 2008-2010 period, the Republic of Moldova reported an increasing investment in gas infrastructure from about €15 millions (2008) to about €28 millions in 2010. The highway Balti-Ungheni, put in operation in 2009, supported the connection of large part of the Falesti, Singerei, Ungheni districts and the investment plans for 2012-2014 provide for construction of over 500 km of pipelines with the connection of potential customers.

Approximately 60-70% of the equipment in the energy sector is obsolete. During 2001-2008 gas losses in pipelines were estimated at an average of 7.0%. Technologies used for electricity generation in the Republic of Moldova are per specific fuel consumption level not as efficient as similar ones in the world outside, in that their nominal efficiency is half that of modern installations. The CHP plants uses gas imported from Russia and are very inefficient. Due to the energy consumption reduction in recent years, the current operational regimes of the energy production units, especially of CHPs, are far from the nominal ones, determining a real life efficiency of the power plants that is much lower than the nominal one. Consequently, the tariff of the existing CHPs is high, showing the conditions of assets as being embarrassing for today and not viable for the future. In 2007–2008, there was a decrease in heat supplied, as consumers turned to alternative supplies of gas, coal, and wood, which had a negative impact on the municipal heat supply system CHP and energy generation.

## Moldova – Long-Term Economic and Energy Development: Comments

The long term economic development in the country is promising a **steady GDP growth** based on the forecasts provided by the IMF and within the “Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: “Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention”, April 1–June 31, 2011” (exhibit 2.1).

**Exhibit 2.1. GDP growth trends in Moldova for 2000-2030**

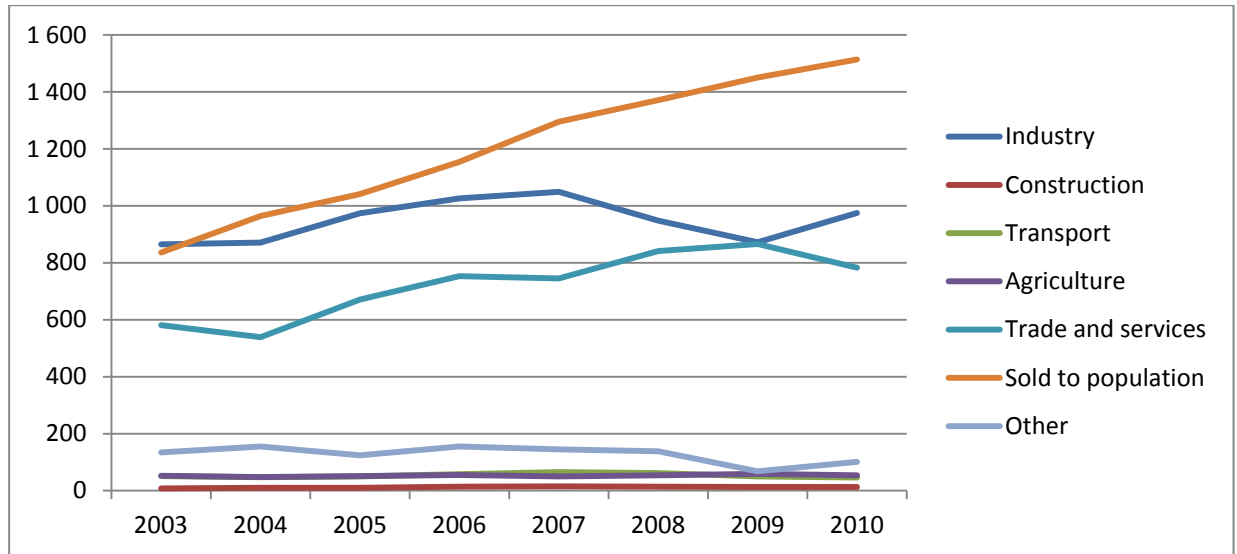


Source: AF-Mercados; IMF, WEO, April 2012; Programul Natiunilor Unite pentru Mediu Ministerul Mediului. Project: “Enabling Activities for the preparation of the Third National Communication under the UN Framework Climate Change Convention”, April 1–June 31, 2011.

We have to admit that both forecasts, the IMF (World Economic Outlook, April 2012) and the MoE are quite close and practically merge in the graphs. Though one has to dig deeper to get the more focused results, we found it sufficient for the purposes of our project as long as we use the GDP and industries forecast only as an interim stage in order to get the energy consumption indexes chain. Major forecast results are presented in Exhibits 4 and 5 of the Strategy.

Energy **consumption trends in the period of 2003-2010** were not very homogeneous due to a rapid restructuring of the Moldova national economy in this period of industrial growth renewal, as well as due to the global crisis of 2008-09 which also reflected on Moldova energy consumption (Exhibit 2.2).

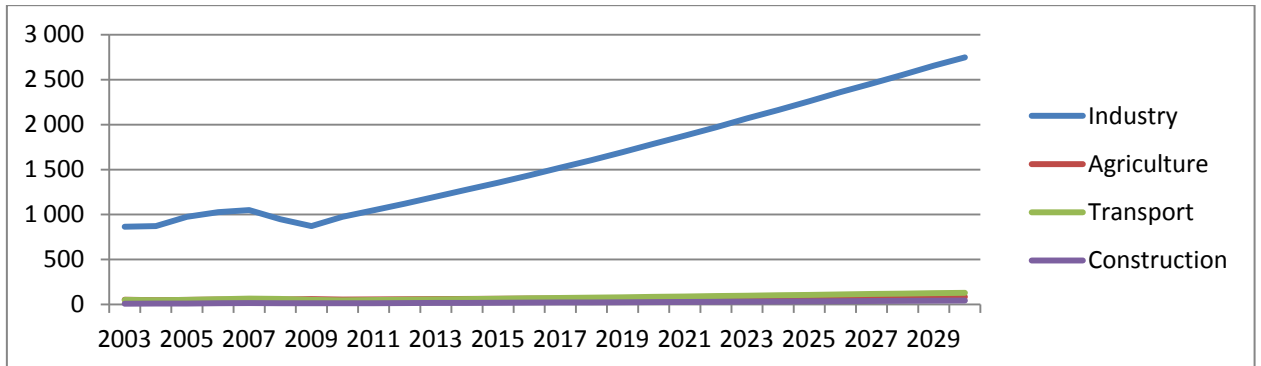
**Exhibit 2.2. Energy consumption in Moldova in 2003-10, per sector, kWh**



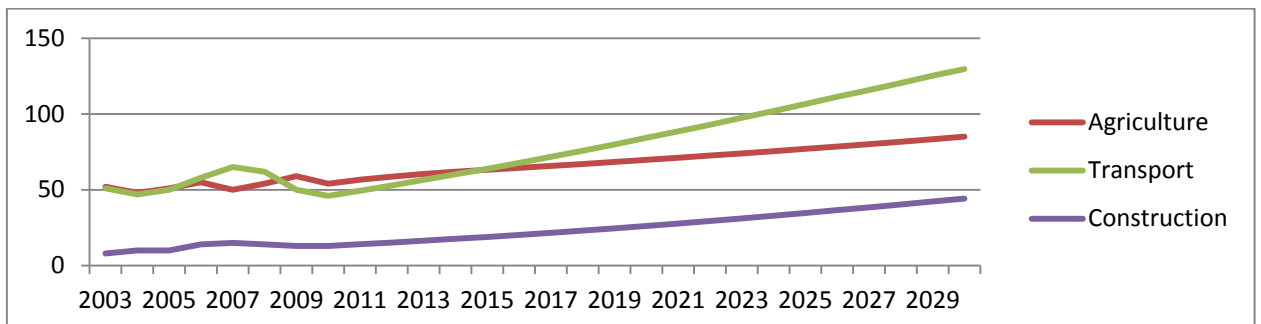
Source: AF-Mercados; Biroul National de Statistica al Republicii Moldova, Balanta Energetica a Republicii Moldova. Culegere Statistica,2010;

Energy consumption per sector by 2030 shows more homogeneous growth, and is presented in two exhibits, 2.3 and 2.4 below. The graphs also include the actual results of the previous period, briefly described above.

**Exhibit 2.3. Electrical energy consumption per main sectors in Moldova by 2030, millions kWh**



**Exhibit 2.4. Electrical energy consumption per main sectors in Moldova by 2030 (excluding industry), millions kWh**



Source: AF-Mercados; Biroul National de Statistica al Republicii Moldova, Balanta Energetica a Republicii Moldova. Culegere Statistica,2010; Programul Natiunilor Unite pentru Mediu Ministerul

The overall results of the forecast show quite impressive growth in the electrical energy consumption in all sectors, including the population. The consultant has used both the past consumption trends and structure as well as the growth forecast per sector which were not the same. The priority in growth has been assigned to construction, agriculture, transportation. Rapid growth of energy consumption in industry we mostly refer to the very low base as a result of the steep decline in the 1990s. Its rate of growth will be 1.7 by 2020 and 2.6 by 2030. Energy consumption in agriculture will grow 20.9% by 2020 and 49.3% by 2030. The most impressive growth will be shown by the construction sector, 3.14 times by 2030, and consumption by the population which will be 168.4% by 2020 and 257.4% by 2030 compared to 2011 volumes (Exhibit 2.9).

**Population.** The overall consumption results were heavily affected by the demographic situation in Moldova for the period 2010-2030. This decade trends are quite positive in terms of demography, though the next decades will demonstrate the negative effect of depopulation and the ageing of the existing population. Various forecasts (Exhibit 2.5) all confirm this negative trend of depopulation, which will be long and threatens national demographic security.

**Exhibit 2.5. Demographic forecast for Moldova by 2050**

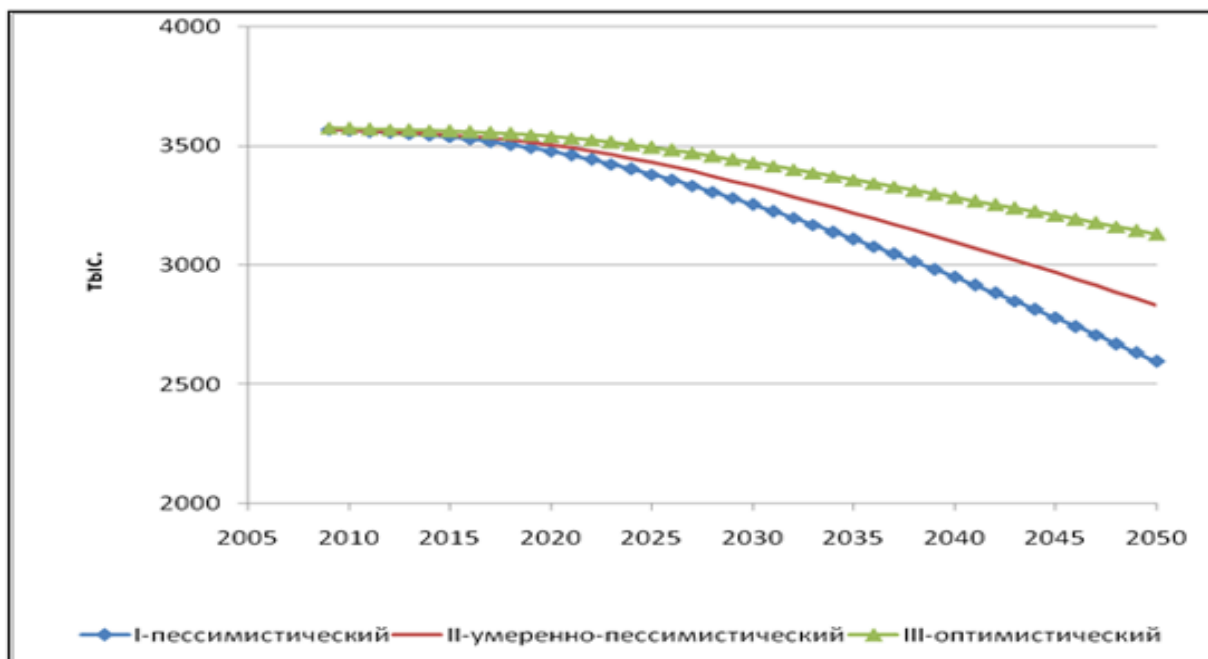
Responsible organizations	Scenario types	Population, thousands			Ageing coefficient		
		2010	2025	2050	2010	2025	2050
UN, Department of Economic and Social Affairs*	low	3,576	3,254	2,558	15.9	23.7	36.7
	middle	3,576	3,291	2,734	15.9	22.7	31.2
	upper	3,576	3,426	3,202	15.9	21.8	26.7
Independent Actuarial Information Center, Moscow, Russia	pessimistic	-	3,354.7	2,593.6	-	-	-
	moderate-pessimistic	-	3,356.7	3,004.0	-	-	-
Institute of European Integration and Political Science, Moldova Academy of Sciences	pessimistic	3,563.6	3,379.8	2,596.2	14.3	20.3	30.3
	moderate-pessimistic	3,563.8	3,430.0	2,830.8	14.3	20.4	30.8
	optimistic	3,572.6	3,493.5	3,129.8	14.4	20.8	31.9

Source: AF-Mercados; World Population Prospects: The 2010 Revision: <http://esa.un.org/unpp>; Пенсионная система Республики Молдова: актуарная экспертиза. Под ред. В. Н. Баскакова. Москва: РИА «Социальное и пенсионное страхование», 2007 (Pension System of the Republic of Moldova: Actuarial Expertise. Edit. V.N.Baskakov, Moscow, 2007).

All the estimated results were presented without taking into account migration flows, which will only aggravates the actual situation and do not demonstrate any decline. According to official statistics the volume of these varies around 10% of the population. According to the long-term forecast, the Moldova population may decrease to around 2,596 million people by 2030 within the pessimistic scenario and to 3,13 million in the optimistic one (Exhibit 1.6).

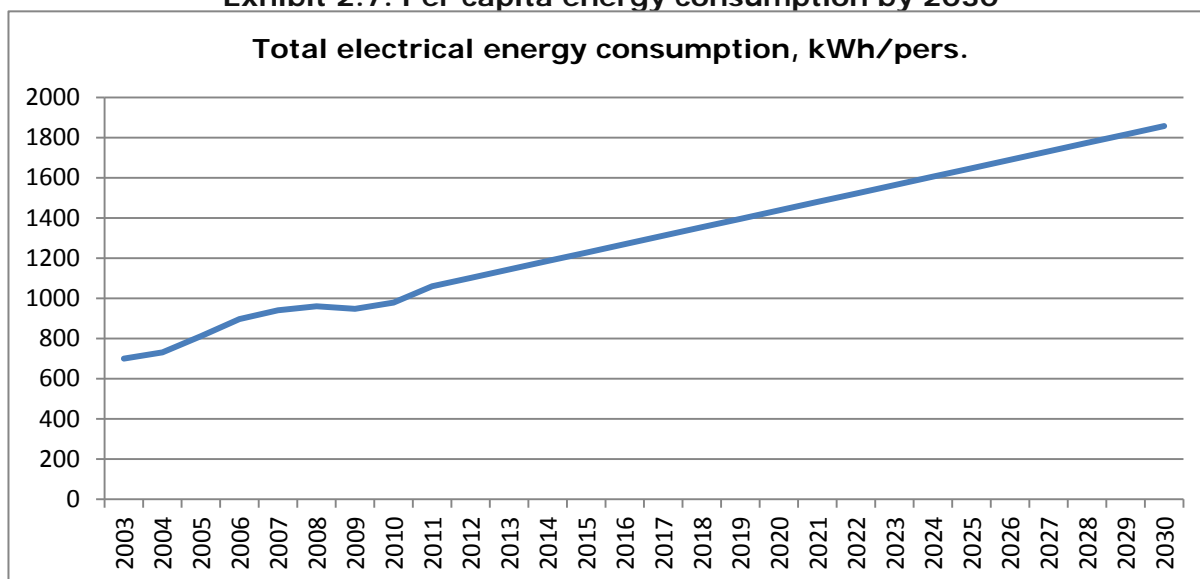
If there were no depopulation forecast, then the electrical energy consumption would have had to be even higher, though the per capita consumption would gradually decline compared to the projected trend (exhibit 1.7).

**Exhibit 2.6. Long-term population trends in Moldova by 2050**



Source: Гагауз О.Е., Пенина О.А. Демографические перспективы Молдовы. In the book: "Основные вызовы демографической безопасности: сходства и различия в Молдове и Беларуси" - Кишинев: Штиинца, 2010. (Gagauz O., Penina O. Moldova Demographic Prospects. In the book: Major Challenges of the Demographic Security: Differences and Commonalities in Moldova and Belarus. - Chisinau, Shtiintsa, 2010.

**Exhibit 2.7. Per capita energy consumption by 2030**



Source: AF-Mercados; Biroul National de Statistica al Republicii Moldova, Balanta Energetica a Republicii Moldova. Culegere Statistica, 2010.

**Exhibit 2.8. Energy consumption indicators growth in 2011-2030 per sector, percent**

Subject Descriptor	Scale	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>GDP, current prices, billions.</b>	MDL	82.1	91.6	101	110.8	120.238	129.701	139.963	150.977	161.864	173.331
<b>GDP (deflated growth)</b>	%	105	105	105	104.5	104.9	104.5	104.6	104.5	104.1	104
<b>Industry (deflated growth)</b>	%	107.5	107	107	106.5	106	106	106	105.5	105.5	105.5
<b>Agriculture (deflated growth)</b>	%	105	103.5	103	102.5	102	102	102	102	102	102
<b>Construction (deflated growth)</b>	%	106	106	106	105.5	105.9	105.5	105.6	105.5	105.1	105
<b>Transportation (deflated growth)</b>	%	105	103.5	103	102.5	102	102	102	102	102	102
<b>Other sectors (deflated growth)</b>	%	107.4	106.8	106.8	106.3	105.8	105.8	105.9	105.4	105.4	105.4
<b>Population, thousands*</b>	Persons	3,557	3,553	3,553	3,553	3,553	3,534	3,515	3,495	3,476	3,456

Subject Descriptor	Scale	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>GDP, current prices, billions.</b>	MDL	185.556	198.147	211.517	224.802	238.958	253.935	269.943	285.697	303.122	320.705
<b>GDP (deflated growth)</b>	%	104	104	104	103.5	103.5	103.5	103.5	103	103	103
<b>Industry (deflated growth)</b>	%	105	105	105	104.5	104.5	104.5	104	104	104	103,5
<b>Agriculture (deflated growth)</b>	%	102	102	102	102	102	102	102	102	102	102
<b>Construction (deflated growth)</b>	%	105	105	105	104.5	104.5	104.5	104.5	104	104	104
<b>Transportation (deflated growth)</b>	%	102	102	102	102	102	102	102	102	102	102
<b>Other sectors (deflated growth)</b>	%	105	105	105	104.4	104.4	104.4	104	104	104	103,5
<b>Population, thousands*</b>	Persons	3,437	3,417	3,397	3,377	3,357	3,337	3,317	3,297	3,277	3257

\*Not considering migration flows



**Exhibit 2.9. Energy consumption indicators growth in 2011-2030 per sector**

Subject Descriptor	Scale	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Total consumed, incl.:</b>	millions kWh	3,303.5	3,528.7	3,749.1	4,007.3	4,241.4	4,488.1	4,750.5	5,005	5,274.3	5,556
<b>Industry</b>	millions kWh	1,003	1,073.2	1,148.4	1,223	1,296.4	1,374.2	1,456.6	1,536.7	1,621.2	1,710.4
<b>Agriculture</b>	millions kWh	67	69	71	73	75	76	78	79	81	81
<b>Construction</b>	millions kWh	14.1	15.2	16.5	17.7	19	20.2	21.7	23.1	24.6	26.2
<b>Transportation</b>	millions kWh	49.5	53	56.6	60.3	63.9	67.7	71.8	75.8	80	84.3
<b>Population</b>	millions kWh	1,518.9	1,622.8	1,733.6	1,843.3	1,951	2,065	2,185.7	2,303.3	2,427.3	2,557.9
<b>Other sectors</b>	millions kWh	651	695.5	723	790	836.1	885	9,36.7	9,87.1	1,040.2	1,096.2
<b>Total consumption, per capita</b>	kWh/pers.	938.5	1,003.8	1,072.3	1,140.2	1,206.8	1,277.3	1,352.1	1,424.7	1,501.4	1,582.2

Subject Descriptor	Scale	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>Total consumed. incl.:</b>	millions kWh	5,829.6	6,115.8	6,415	6,699.3	6,996.1	7,306.2	7,594	7,894.1	8,206	8,490.8
<b>Industry</b>	millions kWh	1,796	1,885.7	1,980	2,069.1	2,162.2	2,259.5	2,350	2,443.9	2,541.6	2,630.6
<b>Agriculture</b>	millions kWh	84	86	87	89	91	93	94	96	98	100
<b>Construction</b>	millions kWh	27.7	29.4	31.1	32.9	34.7	36.6	38.4	40.4	42.4	44.3
<b>Transportation</b>	millions kWh	88.5	93	97.6	102	106.6	111.4	115.9	120.5	125.3	129.7
<b>Population</b>	millions kWh	2,683.4	2,815.2	2,953.5	3,084.4	3,221.1	3,364	3,497	3,635.3	3,779.1	3,910.3
<b>Other sectors</b>	millions kWh	1,150	1,206.5	1,265.8	1,321.9	1,380.5	1,441.7	1,498.7	1,558	1,619.6	1,675.9
<b>Total consumption. per capita</b>	kWh/pers.	1,716.0	1,810.7	1,910.8	2,007.4	2,108.9	2,215.6	2,317.1	2,423.33	2,534.6	2,638.7