

ENERGY STRATEGY
of the Republic of Bulgaria till 2020
FOR RELIABLE, EFFICIENT AND
CLEANER ENERGY

June 2011

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A VISION OF 2020

The Energy Strategy is a fundamental document of the national energy policy that is approved by the Council of Ministers and passed by the National Assembly of the Republic of Bulgaria.

The present National Energy Strategy till 2020 reflects the political vision of the Government of European Development of Bulgaria pursuant to the up-to-date European energy policy framework and the global trends in the development of energy technologies.

The starting point of the European energy policy is in several priority directions:

- 1) Overcoming of the negative climate changes;
- 2) Reduction of the economy's energy intensiveness and energy efficiency improvement, including that in energy self-sufficient buildings;
- 3) Limiting the European Union (EU)'s external dependency on imported energy resources, and
- 4) Promotion of the economic growth and employment,

thus providing reliable and affordable energy for the consumers.

These priorities are unattainable without the existence of a well-developed internal energy market.

The sustainable energy development is brought to the center of the energy policy and its achievement is bound to long-term quantitative targets up to 2020:

- o 20-percent reduction of the greenhouse gas emissions as compared to 1990;
- o 20-percent share of RES in the overall energy mix and 10-percent share in the energy for transport;
- o 20 % increase of energy efficiency.

The energy strategy is directed to overcoming the main challenges faced by the Bulgarian energy nowadays, namely:

- 1) High energy intensiveness of GDP: Regardless of the positive trend to improvement, the energy intensiveness of the national GDP is 89% higher than the EU average (considering the parity of the purchasing power);
- 2) The high dependency on energy resource imports: Bulgaria meets 70% of its gross demand through import. The dependency on natural gas, crude oil and nuclear fuel imports is practically full and has a traditional single origin - the Russian Federation;
- 3) The necessity for environmentally sound development: the world is facing the challenges of climate changes influenced by the growing volume of greenhouse gas emissions.

The main priorities in The Energy Strategy can be summarized in the following five directions: to guarantee the security of energy supply; to attain the targets for renewable energy; to increase the energy efficiency; to develop a competitive energy market and policy for the purpose of meeting the energy needs, and to protect the interests of the consumers. These priorities also determine the Government's vision for development of the energy in the coming years, namely:

- o Maintaining of a safe, stable and reliable energy system;
- o The energy sector remains a leading branch of the Bulgarian economy with definite orientation to foreign trade;
- o Focus on clean and low-emission energy – nuclear and from renewable sources;
- o Balance between quantity, quality and prices of the electric power produced from renewable sources, nuclear energy, coal and natural gas;

- Transparent, efficient and highly professional management of the energy companies.

Diversification of the sources and routes for supply of natural gas is important for the country's national security and energy independence, one element of which is also the possible building of terminals for liquefied and compressed natural gas, inclusive of Bulgaria's participation in neighbor countries' projects. We will make best efforts to build reverse interconnections with Greece, Turkey, Serbia and Romania and will look for possibilities for extension of the existing gas storage at Chiren, as well as for building of a new storage at Galata. With a view to guaranteeing the state's energy independence with strict adherence to the environmental requirements, the development of new natural gas fields, including, without being limited to, shale gas and deep water wells in the Black Sea, will be actively supported.

Efficient utilization of the indigenous energy resources: an emphasis in the national energy strategy from the viewpoint of security and sustainability is preservation and development of the coal industry with strict observation of the environmental protection standards. In relation to that, the existing coal potential of Bulgaria will be utilized to the maximum. The state will support the coal-fired power plants, rendering support for full compliance with all environmental requirements, including the restrictions for admissible limits of noxious emissions (sulphur, nitrogen oxides and dust); it will perform monitoring and will seek international support for projects for construction of new and/or replacing capacities, operated on the basis of indigenous coal, using necessarily up-to-date highly efficient and low-emission carbon capture and storage technologies. With a view to ecologically sound development of the national energy sector and in conformity with the Bulgarian and European legislation, a time schedule for modernization or closing down of heavily polluting generating capacities will be prepared, and their owners will be obligated to comply with the adopted environmental standards.

Renewable energy sources, being important indigenous inexhaustible resources, will be a priority of the national energy policy. The water potential, as well as the other sources of clean energy (wind, solar, geothermal water, and biomass) will be used to the maximum for the achievement of more than 16 % share of RES in the total final energy demand in the country after 2020. The state and the municipalities will have an active part in the achievement of that target and will support the private initiatives in the process of increasing the energy self-sufficiency of public and residential buildings by means of retrofitting and reduction of energy costs by means of solar water heating installations, biomass based local heating systems or thermal and geothermal energy sources, etc. Our efforts will also be directed towards the best possible utilization of the hydro-power potential of Bulgaria, including the water of the rivers Danube, Arda, Mesta, etc.

In search of the reasonable balance between the available energy resource in the country and the European clean energy objectives, Bulgaria shall further support and encourage the development of nuclear energy. We will maintain our points before the European institutions for preservation and increase of the nuclear energy share in the country by extension of the service life of units 5 and 6 of Kozloduy NPP to the maximum as well as the construction of 2000 MW new nuclear capacities. Another major commitment will be construction of a national storage for low- and medium- radioactive waste and a dry storage for spent nuclear fuel in conformity with the best international standards, as well as investment in waste repositories for ultimate disposal of the spent nuclear fuel.

A forthcoming step is development of the market for electric eco-cars, as well as energy storage systems. The use of eco-cars, including ones driven by electric power generated by RES, is another step towards building of the Bulgarian „green“ cities of the future and of the infrastructure required for them.

Along with energy efficiency, energy self-sufficient buildings, electric road vehicles and increase of the share of energy from renewable sources, the efforts will be directed also to building of the front-end control systems – the so-called Smart Grids based on mathematical computations of the behaviour of the low- and high-voltage transmission and distribution systems and the integration of RES capacities in it, as well as assessment of the data from remote reading electric meters. The Smart Grid is a new generation energy infrastructure that will improve the service quality and will enable more flexible energy demand.

Energy saving is the measure best prepared for application and a reliable way for achievement of the European target for 20-percent reduction of greenhouse gas emissions by 2020. In that respect the efforts of the Bulgarian state will be directed to improvement of the efficiency in the generation of electrical and heat energy, reduction of energy transmission and distribution losses, earlier use of more economical vehicles and more intensive use of the public transport, timely improvement of the energy characteristics of the existing buildings and introduction of stricter energy standards for newly constructed buildings, including energy self-sufficient buildings, and consistent tax policy for more efficient energy use. As a result of energy efficiency increase in the final demand in the energy sector and increase of the share of directly used natural gas and renewable energy sources, Bulgaria will practically increase its capacity for power export by more than additional 1500 MW.

The district governors and mayors of municipalities will have extensive powers for organization and coordination of activities related to implementation of the national programs for energy efficiency and rational use of indigenous renewable sources. Inclusion of the settlements in the plans for development of the utilization of indigenous RES resources will contribute to achievement of the targets for local sustainable development. Decentralized generation of energy from RES or the use of solar, wind, geothermal energy and biomass depending on the local potential and needs is a sector with great perspectives in the country – thus avoiding all costs related to connection to the grids and energy transmission and distribution losses.

A priority of the Government is the development and extension of household gasification in the country. Currently, only 1.5% of the Bulgarian households are gasified. The increase of this percentage to 30% in 2020 and replacement of the electricity used for heating by highly efficient natural gas appliances may result in more than one billion Levs saved energy costs for the households.

Preservation of the centralized district heating also remains a priority, in which case the companies shall be technically modernized and financially stabilized. The methods for highly efficient co-generation of heat and electric power will be actively supported. For that purpose, a program for stabilization and development of the heating sector will be developed and adopted.

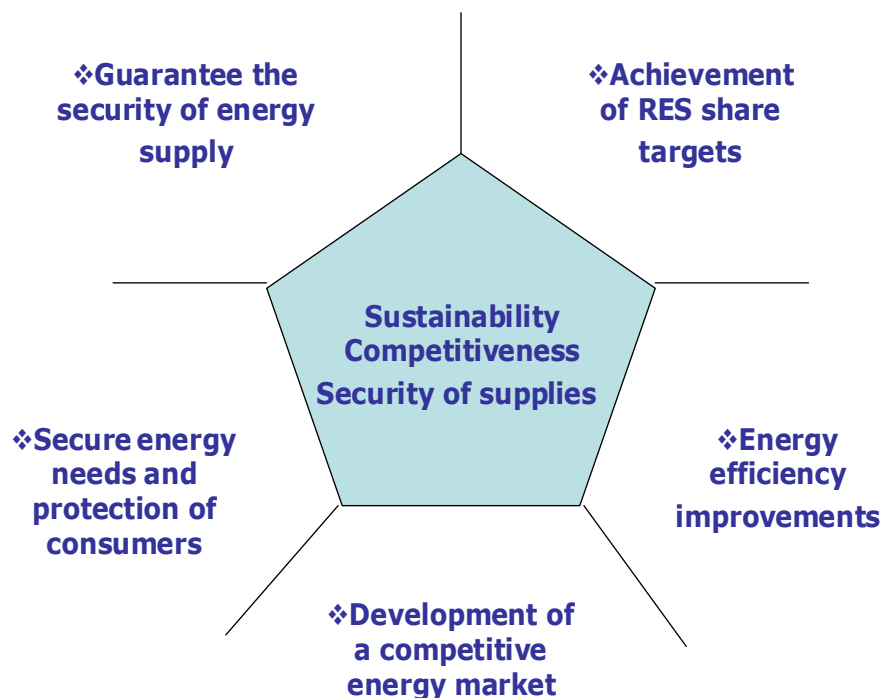
In order to create confidence and transparency of the electricity market, by the end of 2011 we will establish a power exchange in the country, through which, building upon the principle of competitiveness, we will achieve transparent price formation, flexibility in negotiation, maximum use of interconnection transmission capacities and capability for simultaneous allocation of power and capacity. Through the Bulgarian power exchange, the European policy for integration of the national markets and establishment of well functioning regional markets, and subsequently, of a common European market, will be implemented. Bulgaria shall obtain a stable position on the regional energy map and realize the opportunities for export of electricity

to the countries in this region, including Turkey, Greece, Italy etc.

The state will continue to conduct a purposeful policy towards creation of a favorable investment climate and will promote the private initiative for financing of energy projects in Bulgaria. Institutional support will be rendered to projects of strategic significance to the energy security.

In order to enhance research and development in the energy sector, we will seek financial support through facilitation of investors' access to scientific development works, as well as through specialized credit lines and facilities from European funds and programs. With funds raised by bids for greenhouse gas emission allowances and by other financial sources and fiscal instruments, the generation and use of energy from renewable sources and investments in new balancing power plants will be supported.

All the above-listed priorities have one single purpose: Achievement of high-technology, secure and reliable energy system based on up-to-date technologies that meet the European criteria, making at the same time the best possible use of the available resources in Bulgaria and protecting the Bulgarian users to the highest degree.



I. ENERGY SECURITY

1. European framework

There are five priority areas for Europe¹ on the road to higher security and continuity of energy supply: building of the required infrastructure and diversification of the energy supplies; coordinated foreign relations in the area of energy and strengthening of solidarity; increasing the stocks of oil and natural gas and improving the crisis response mechanisms; additional urgent efforts for energy efficiency improvement; better utilization of the indigenous energy resources of the EU.

The first area is especially important for the energy security. The European networks require billions of Euro investments for replacement of an outdated infrastructure and its adaptation to low-carbon and renewable energy sources. The following **six strategic initiatives** are of critical importance for the energy security of the EU:

- **Interconnection** of the still isolated **energy markets in Europe** (the Baltic Plan for interconnection of the energy systems);
- Development of a **Southern gas route** for supply of natural gas from sources in the Caspian region and the Middle East. For that purpose the European Commission (EC) and the member states must work together with partners such as Azerbaijan, Turkmenistan, Iraq, Egypt, Syria and Jordan for the common purpose of securing, in the short term, of firm commitments for supply of natural gas and construction of gas lines. In the longer term, supply of natural gas from countries such as Uzbekistan and Iran would be a significant additional source for supply to the EU;
- **Liquefied** natural gas is of great importance for ensuring the liquidity and diversity of the European gas markets. The capacity for liquefied natural gas created in the EU should be accessible to all member states – directly or through other member states, on the basis of solidarity agreements. That is of particular significance to those member states that are currently relying primarily on one single natural gas supplier;
- Overall completion of the Mediterranean **energy ring** connecting Europe and the Southern Mediterranean by means of electric power and natural gas transmission lines;
- Priority construction of **transmission lines** for natural gas and electric power along the North-South axis in Central and South East Europe;
- Off-shore power transmission network in the North Sea – for optimization of the use of wind energy in the North Sea.

¹ Second Strategic Energy Review [COM (2008) 781 Final].

2. Status

Bulgaria covers more than 70% of its gross energy demand by imports, this indicator being 76% for 2008. The dependency on import of natural gas and crude oil is practically full and has a traditional single origin - the Russian Federation. The Russian natural gas is supplied by one route - through the Ukraine. Besides, our country relies completely on the import of nuclear fuel from Russia, although nuclear energy, according to a Eurostat methodology, is considered as indigenous energy source.

Energy dependency 2008, %

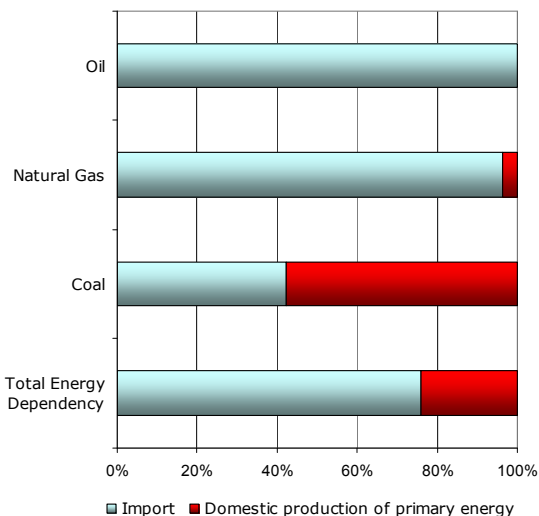
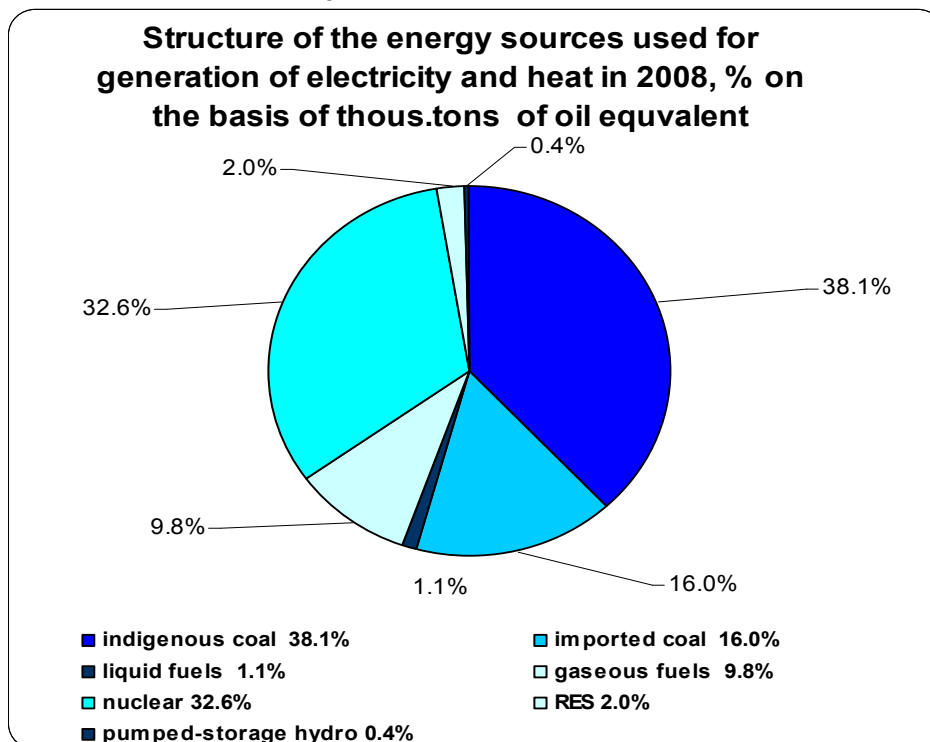


Fig. 1. Dependency on fuel imports 2008, %
Source: NSI

The prevailing quantity of heat is produced on the basis of natural gas and the risks for the final consumers are much lower. The district heating companies are obliged to maintain stocks of alternative fuels which would create a buffer between the supply of natural gas and heat supply to the consumers.

Fig. 2. Structure of the energy sources used for generation of electrical and heat energy in 2008, % on the basis of thous. tons of oil equivalent



Source: MEET

As a whole, the region of Central-East Europe is characterized by high dependency on oil and gas import, fragmented markets and absence of interconnections between

neighboring countries. Besides, since the direction of flows is primarily East to West, this region is particularly vulnerable as regards security of gas supply.

The dependency on imports in the electricity generation sector is considerably lower – 54%, mainly as a result of traditionally intensive use of indigenous lignite and hydro-power. This permits stabilization of the prices of the national power generation mix and their relative independence of price changes of the liquid fuels and natural gas.

3. Regimes Applied to Building of a New Energy Infrastructure

The requirement for reliable energy supply in Bulgaria necessitates taking into account of the national specificities, as well as of the EU's rules. With a view to the European framework, it is important to note that competition in the construction of power generating capacities is achieved through a transparent **permission procedure**. The essence of this procedure is that every investor has the right of free decision for investment of funds in a new power plant, while taking the risks, as well as the profits from its initiative. In the case of such procedure the owner of the new capacity himself seeks realization of the generated power.

In the event that insufficient power generating capacities have been built on the basis of the permission procedure, the member states must guarantee the security of supply through introduction and organization of **tenders for construction of new capacities**.

The Bulgarian legislation and practice have adopted and apply both types of procedures, the second one – tender procedure, being initiated by the electricity system operator (ESO), approved by the Council of Ministers and conducted by the State Energy and Water Regulatory Committee (SEWRC).

The national network infrastructure (for electric power and natural gas) is developing by different rules. Since the networks are natural monopolies, their operation and investments in their development and maintenance are the subject of long-term planning, and the amount of the required funds is approved by the Energy Regulator on the basis of assessment of the system's and the users' needs.

One exception are the transnational gas transmission networks which run across the territories of several transit countries from the gas field to the users. The projects for new transit infrastructures are characterized by high investment costs, a long payoff period and high risk (resource-related, market, financial and political).

4. Policy and Lines of Development

Energy security is an element of the national security and a prerequisite for economic stability. Improvement of the energy security is a long-term process, requiring considerable investments and sustainable policy, directed to:

- Reduction of the dependency on import of energy resources, in particular of those with volatile and uncontrollable prices;
- Diversification of the suppliers and sources;
- Diversification of the routes.

In particular, in the period till 2020 the Bulgarian policy directed to improvement of the energy security will be developed in the following main directions:

(1) Bulgaria has a direct interest and will participate directly in the implementation of the EU's strategic initiatives for **building of the required infrastructure** and diversification of the energy supply to the EU, namely – a Southern gas route,

access to liquefied natural gas and interconnections along the North-South axis, etc. Considering the high gas dependency and unsatisfactory energy infrastructure in the country, these initiatives are of particular importance both to us and to the whole region of South East Europe.

(2) The high-priority infrastructure projects cannot be implemented without the creation of **adequate financial instruments** for the purpose. Beside the use of the existing instruments (such as the TEN-E programme, cooperation with EIB and EBRD, public-private partnerships), the adoption of a new, more efficient financial instrument is forthcoming – Energy Security and Infrastructure Instrument. The use of these facilities must be given a priority direction to those countries and regions that are currently heavily depending on one single supplier of natural gas and, due to an unsatisfactory infrastructure, cannot avail themselves of the solidarity and crisis response mechanisms functioning at a European level. Since Bulgaria and the South East Europe region are a typical example in this respect, at national and regional level we will make efforts, in coordination with the countries of the region, to have sufficient funds from these instruments directed to such a type of national and regional projects.

(3) The short-term investment measures which must be immediately adopted with a view to guaranteeing gas security are testing of the reverse connections and **construction of interconnections** with neighbor countries, extension of the natural gas storage capacity and daily production rate to the extent required to meet the demand, negotiation of new contracts with the Russian Federation.

(4) Priority investment in **geological exploration of new** oil and gas fields, including those of shale gas, and deep water drilling in the Black Sea.

(5) Nuclear energy will be supported institutionally not only as a promising resource for generation of emission-free electricity, but also due to the accumulated successful experience and professional capability for operation of nuclear capacities. The support will be accompanied by high requirements with respect to security, safety, nuclear waste management and decommissioning. Bulgaria will participate actively in the development of the new nuclear safety measures on an international scale.

(6) The significance of the **indigenous coal** for energy security is indisputable. The Bulgarian energy policy will follow the technological development with respect to generation efficiency and clean coal technologies, and will apply the technological achievements in conformity with the European requirements and the economic capabilities of the country. In order that the indigenous coal can perform a stabilizing role in the future national electricity generation, up-to-date technological, highly efficient and low-emission solutions will be applied in the construction of new and rehabilitation of the existing power plants.

(7) The increasing share of **renewable energy sources** is an opportunity for diversification of the country's own sources and in combination with the energy efficiency measures contribute significantly to guaranteeing the energy security. With a view to successful achievement of the RES targets the state will render institutional support to the investors in additional new capacities that will be required for balancing the generation of power plants using renewable sources.

(8) Preservation and development of **the centralized district heating** also remains a task. In order to perform it the companies must be technically modernized and financially stabilized. The methods for highly efficient co-generation of heat and electricity with emphasis on technologies using RES, including waste biomass, vegetable and animal waste, will be actively supported.

(9) Construction of a gas distribution network in the territory of the country is still at an initial stage. Only 1.5% of the Bulgarian households have access to natural gas, while for Europe this percentage is 55%. At the same time, almost 40% of the energy used in the Bulgarian households (including for heating and housekeeping) is electrical, while for Europe this percentage is 11%. The excessive use of electricity of households in the country results in three times higher costs of the primary energy in comparison with the ecological and less expensive alternative – direct use of natural gas. Replacement of the electric energy with natural gas for domestic heating and for housekeeping needs will contribute to three times higher saving of primary energy and for this reason it should be viewed as one of the methods for improvement of the energy security.

(10) Technical security of the energy system related to the reliability of the energy capacities, of the transmission and distribution networks, is an element of the national energy security. An important condition for guaranteeing uninterrupted and high-quality energy supply is investment in extension and rehabilitation of the grids.

The implementation of these policies has a dual effect on the energy security. On the one hand, an increased demand for natural gas will lead to higher dependency on the import of energy resources. On the other hand, however, the gasification will improve the energy security, because it will reduce the need for primary resources. Such a contradictory effect will be also obtained by increase of the nuclear power generation.

From the point of view of energy security and sustainable development, renewable sources are the most preferable energy resource. At the same time, however, the comparatively more expensive, for the present time, technologies for their utilization do not permit their quick adoption. For this reason the nuclear energy and natural gas are suitable resources for the transition to low-carbon energy and economy.

(11) As a member state of the EU, Bulgaria will participate in the future initiatives of the European Commission for interconnection of the routes for supply between the Baltic, Adriatic and the Black Sea along the gas axis North-South based on the advantages of **the regional cooperation**, for the purpose of assisting the performance of energy infrastructure projects and improvement of market development in the region.

II. REDUCTION OF GREENHOUSE GAS EMISSIONS

1. European framework

The world is facing the challenges of climate changes caused by the increasing volume of greenhouse gas emissions. One of the main sources of greenhouse gas emissions is the use of energy resources. Due to that the sustainable energy development, more particularly – the reduction of greenhouse gas emissions, is brought to the focus of the energy policy.

The Community targets known as „**20-20-20 up to 2020**“ are allocated at a national level and will be achieved through the efforts of all member states. The allocation of the mandatory targets is done on the basis of fair criteria – taking into account the level of GDP per capita of the respective member state, the progress made, as well economic growth forecasts. The member states with lower GDP per capita than the EU average are assigned reduced targets at the expense of the member states whose GDP per capita is higher than the EU average -27.

The common European objective for 20% reduction of greenhouse gas emissions by 2020 compared to the base year 1990 will be realized through:

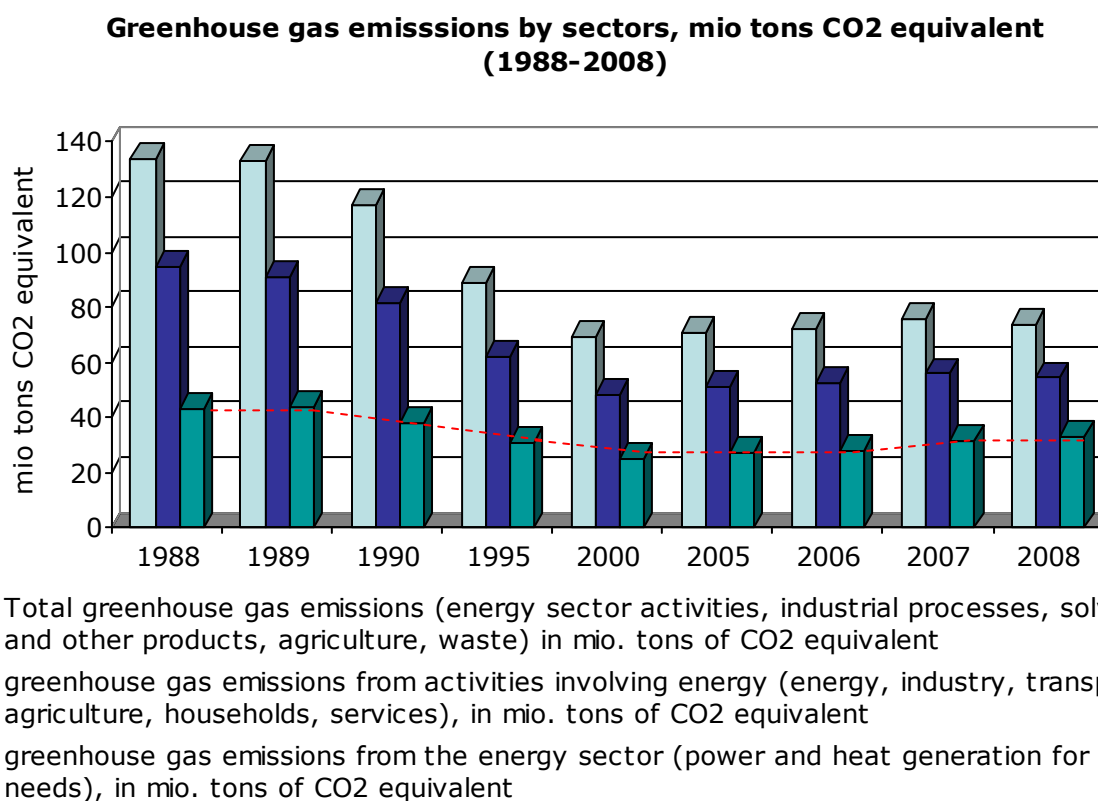
- 10% reduction compared to 2005 of emissions from plants not included in the European scheme for greenhouse gas emission allowance trading (buildings, light industry, transport, agriculture and waste);
- 21% reduction compared to 2005 of emissions from plants participating in the scheme for emission trading (all large industrial and energy sources of emissions, as well as the aviation sector).

2. Status

The share of greenhouse gas emissions from all energy generation activities, included in the energy, industry, transport, agriculture and domestic sectors, is 70%². Those from the energy sector are 40% of the total greenhouse gas emissions in the country.

The power plants and the district heating companies are a major source and release over 25 mio. tons of CO₂/year, the quantity of released emissions only from the coal-fired power plants in 2009³ being 19,8 mio. tons of CO₂. Such energy companies are obligated to participate in the European Scheme for greenhouse gas emission allowance trading. The scheme works on the principle „the polluter pays“. Payment consists in purchase of allowance for release of certain quantities of greenhouse gas during generation of electric power and heat energy and as a result of other generating activities. The purpose of the scheme is to encourage, in a market-based manner, the development and proliferation of low-emission and highly efficient technologies. Between 2008 and 2012 the scheme functions through a national system for emission ceilings and national plans for allocation of allowance for greenhouse gas emission trading among plants. In practice, however, the Bulgarian plants started their effective participation in the scheme only in the beginning of 2010 after approval by the EC of the National Plan for allocation of allowance for greenhouse gas emission trading for the period 2008 – 2012.

Fig. 3. Greenhouse gas emissions by sectors of the Bulgarian economy, in mio. tons of CO₂ equivalent (1990 – 2008)



Source: International Environmental Agency

The carbon intensiveness of the electric power in 2008 defined as relationship between the total emissions from power plants and the total generation of electric power, is 555 kg/MWh.⁴

3. Participation in the European scheme for greenhouse gas emission allowance trading from 2013

The beginning of 2013 is the start of the third eight-year period of the European scheme for greenhouse gas emission allowance trading. The fixed national emission ceilings will be cancelled and one common ceiling is introduced for the whole EU, after which it decreases linearly every year of the period up to 2020 in conformity with the set goal of 21% emission reduction compared to the levels in 2005. Allocation of free allowances is effected by the member states on the basis of transitory rules for harmonized free of charge allocation of emission allowances in conformity with Art. 10a of Directive 2003/87/EU, valid for the whole EU. The main principle of allocation is that free of charge allowances will be determined on the basis of product indicators approved in advance for the whole EU, and not on the basis of total past-period emissions from each plant, as they were in the period 2008 – 2012. The indicators represent a threshold value of the quantity of free of charge allowance that a plant can receive per unit of generated product. The share of allowances which will be allocated through bidding by the member states is considerably increased. The „polluter pays“ principle is retained.

The obligation for the plants to return every year a quantity of allowance, equivalent to their verified greenhouse gas emissions during the preceding year is retained. Free of charge allocation of allowance to **the electricity producers** is not envisaged, and they will be obligated to purchase all the allowance needed by them from 2013 on. For countries with electric power sectors characterized by high dependency on one type of fossil fuels or unsatisfactory rate of interconnection with the European electric power

system, a possibility for **derogation** of that rule is envisaged. Ten member countries, including Bulgaria, may apply for the above-mentioned derogation.

Allowances which are not allocated freely by member states will be offered at bids organized in conformity with Regulation (EU) No. 1031/2010 of November 12th 2010 on the schedule, management and other aspects of bids for greenhouse gas emission allowances in conformity with Directive 2003/87/EC of the European Parliament and the Council for establishment of a scheme for greenhouse gas emission allowance trading within the Community framework and purchased at the achieved bid prices. Bulgaria will participate jointly with the rest of member states in a common bidding platform which is to be established.

Every member state will receive definite annual quantities of allowances intended for offering to bidders. The quantitative allowances are not allocated proportionally, but through a reallocation mechanism directing additional quantities to member states with lower GDP than the EU average, including Bulgaria. The revenues from bids will be collected in the national budgets of the member states, which will ensure annually relatively higher incomes for the poorer states. Minimum 50% of these revenues must be used for climate change combat, including promotion of RES, introduction of clean coal technologies (for capture and storage of CO₂) and mitigation of the social consequences of increased energy costs.

With a view to mitigation of the negative economic consequences from application of the Energy/Climate package and in conformity with the principles of solidarity, the member states with lower than the average gross domestic product per capita, such as Bulgaria, received reduced national targets and certain compensations at the expense of the rest of EU countries. Regardless of this, the transition to low-carbon energy will inevitably result in growth of the energy costs. The adequacy and timeliness of the political decisions and measures will determine the price that the Bulgarian business and citizens will have to pay for the transition to low-carbon energy.

4. Policies

The reduction of greenhouse gas emissions can be achieved through:

- Use of less energy, i. e. improvement of energy efficiency in energy generation and consumption;
- Use of cleaner energy, i. e. improvement of the energy mix through increase of the share of low-emission energy;
- Fast technological progress, inclusive of introduction of new energy (clean coal) technologies.

With a view to the stabilizing effect of indigenous coal as a resource for power generation, the state will support, financially and institutionally, the construction of power plants with facilities for capture and storage of carbon dioxide by the schemes and mechanisms adopted at an European level, and in accordance with a balanced policy between environmental legislation and promotion of the indigenous energy resources.

For achievement of sustainable development without painful economic consequences for the country, however, the following more important steps shall be followed in the short and medium term:

(1) Some additional revenue will enter the budget of the country from sale of allowances by bidding. At least 50% of this revenue shall be invested in environmental projects for reduction of greenhouse gas emissions, such as development of renewable energy

sources, energy efficiency and introduction of „smart grids“, measures for prevention of deforestation and increase of afforestation and reforestation, environmentally safe capture and storage of CO₂ in geological formations, promotion of low-emission freight and public transport vehicles, and others.

(2) With a view to full exercise of the trading rights given to Bulgaria, we will make the required efforts to draft and create in a timely manner working mechanisms, including through participation in a common European platform for conducting of bids for emission allowances, so that the revenue can be used in the exercise of rights granted to the state.

(3) Along with the revenue raised at national level by bids for allowances, up to 300 mio. emission allowances with estimated value between 6 and 9 billion Euro have been allocated at European level for financing of clean technologies – demonstration projects for carbon capture and storage technologies and inovative projects for renewable energy. The rules and criteria for selection of projects with these funds were defined with EC’s decision of November 3rd 2010. Bulgaria, as a member state, will avail itself of this chance and is preparing to apply for financing of such projects on national territory as early as in the first procedure – by the end of 2011, as well as in the second one – by the end of 2012.

III. INCREASE OF THE SHARE OF RENEWABLE ENERGY SOURCES IN THE TOTAL FINAL ENERGY CONSUMPTION

1. European framework

The development of the renewable energy sector is acquiring increasing significance for achievement of the political targets of the EU. The use of RES is viewed as one of the main factors for transition to low-carbon economies, for development of new highly-technological industries and ensuring the so-called „green“ growth and „green“ jobs.

Directive 2009/28 on the promotion of the use of energy from renewable sources set the general framework for development of the sector in the EU, including the common European target for increase of the RES share to 20% of the total final energy consumption by 2020.

The share of renewable energy in the total final energy consumption of the EU was 8.5% in the base year 2005, which means that the Community needs an average 11.5% increase for achievement of the 20% target in 2020. Individual, legally binding targets were adopted for the realization of that goal for each member state.

Flexible mechanisms through which the common European target for RES would be achieved with least costs are envisaged. Arrangements enabling those member states which can develop RES at relatively low cost to sell their surplus to countries where such production is more expensive were adopted for this purpose, so that, eventually, the common goal of the EU should be achieved at the least possible costs.

Specific rules for cooperation between the member states are introduced through performance of joint projects related to generation of electricity, heat and energy for cooling by renewable sources, as well as joint projects with third countries in the area of electricity.

Directive 2009/28 envisages also a significant incentive for wider use of electric vehicles supplied with energy from renewable sources, in which case, upon reporting of the national balance, the energy used by such vehicles within the share of RES is accounted as 2,5 times larger.

2. Status and potential

According to data for the base year 2005 (in conformity with Eurostat) the energy from renewable sources in the country amounts to 1 mio toe, or 9,4% of the total final energy consumption, of which: biomass – 70%, hydro-power – 24% and other RES – 6%.

At present in Bulgaria the potential of solid biomass is most fully utilized primarily as fuel for heating in households and public buildings, as well as that of hydro-power from HPP.

Generation of electricity by wind generators and photovoltaic plants, as well as the use of solar energy for domestic water heating is developing at high rates.

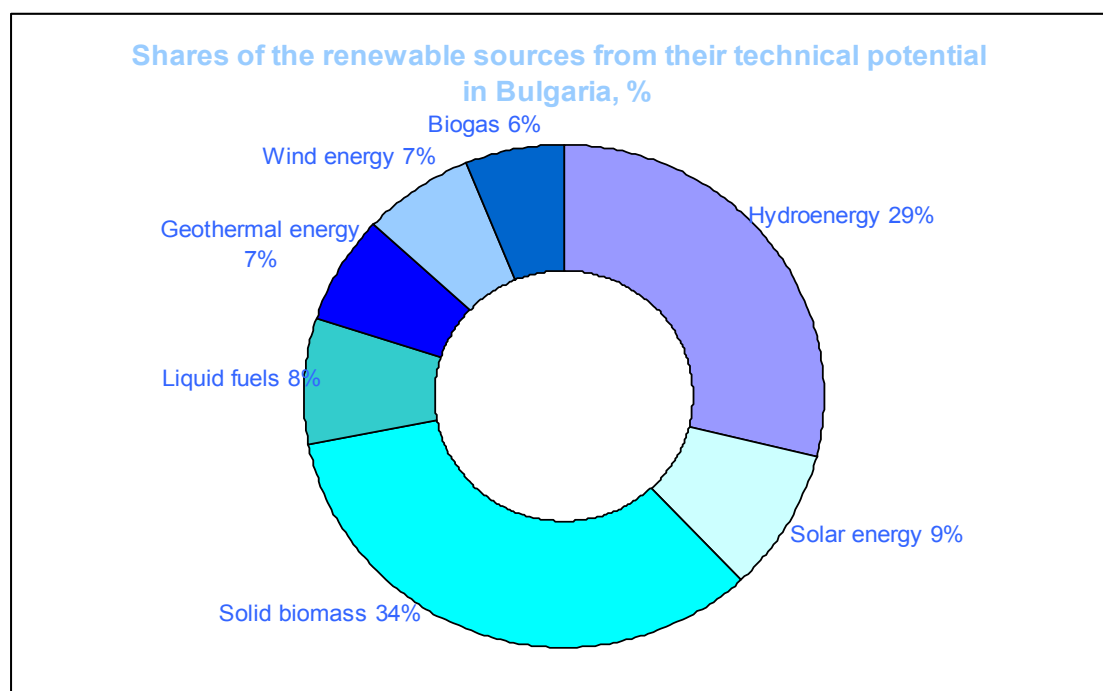
According to the national action plan for energy from renewable sources, the aggregate technical potential for generation of energy by renewable sources in Bulgaria is approximately 4500 ktoe/year. Its distribution among the various types of sources is uneven, with the largest share held by hydro-power (~29%) and biomass (~34%). The geographic position of Bulgaria determines the comparatively minimal share of wind energy (~7,5%) and tidal energy. At the same time the country has considerable forest resources and well developed agricultural production – sources of both solid biomass and of raw material for generation of biogas and liquid fuels.

Table 1. Estimate potential of the renewable energy sources in Bulgaria as per an updated assessment of 2009.

Renewable source according to Regulation 1099/2008 for the energy statistics	Technically available potential, ktoe
Hydro-power	1290
Geothermal energy	18 (331)*
Solar energy	389
Tidal energy	Unspecified
Wind energy	315
Solid biomass	1524
Biogas	280
Liquid fuels	366
Total	4495

* The figures in brackets reflects the potential available with use of reinjection technologies.

Fig 4. Shares of the renewable sources of their technical potential in Bulgaria, %



Source: National Action Plan for energy from renewable sources in conformity with Directive 2009/28

With a view to utilization of the water potential of Bulgaria to the maximum, our efforts will be directed to utilization of the hydro-power capacity of the river Danube, as well as that of the rivers Arda and Mesta.

Our efforts will be directed to construction of hydro-energy systems on the Danube using the flexible mechanisms provided for in Directive 2009/28. These projects will contribute to achievement of the national goal for RES and to improvement of the environmental indicators of the electric power mix.

After the commissioning of HPP Tzankov Kamak Integrated water-power system and redirection of the water of the Mesta River to the Dospat-Vacha Cascade, the usability of constructed hydro-power capacities will be increased.

3. Support Mechanisms

Energy from renewable sources has one main drawback – it is still considerably more expensive in comparison with the energy produced from conventional sources and by traditional technologies – coal, natural gas, nuclear fuel. This is a barrier in the way of proliferation of renewable energy in a market manner and necessitates the use of various arrangements and mechanisms for their support in order to attract the investors' interest.

Bulgaria conducts purposeful policy towards creation of a national scheme of mechanisms that would assist the development of RES. The greatest support is rendered to producers of electricity from RES, for whom the following is provided:

- Priority connection to the grid;
- Guaranteed purchase of the generated electric power;
- Guaranteed payoff through feed-in tariffs of the generated electric power;
- Credit incentives;
- Relieved administrative procedures.

Beside the system of feed-in tariffs, practically no other mechanisms for promotion of RES development are applied. We also acknowledge that in the case of energy generation by renewable sources for heating and cooling purposes the support mechanisms are not sufficiently developed.

The prices of energy generated by renewable sources are the only ones that will decrease in the longer term thanks to the progress in the generating technologies. The prices of the traditional energy resources will rise due to depletion of the fossil resources and their environmental characteristics. These two trends will result in narrowing of the price gap. During the next decade, however, the need of support for RES is not expected to disappear.

4. Targets

The national mandatory target for Bulgaria to achieve is that 16% of the total final energy consumption in the country in 2020 should be from renewable sources, considering that the country receives the lowest additional increase (6,6%) compared to the rest of member states.

The national target must be achieved through increase of electricity production from renewable sources, of the final energy consumption from renewable sources for heating and cooling purposes and of the energy demand from renewable sources in the transport. Of all sector targets, only the one for consumption of renewable sources in the transport sector is mandatory – 10-percent of the energy consumed by the transport by 2020 shall be from renewable sources.

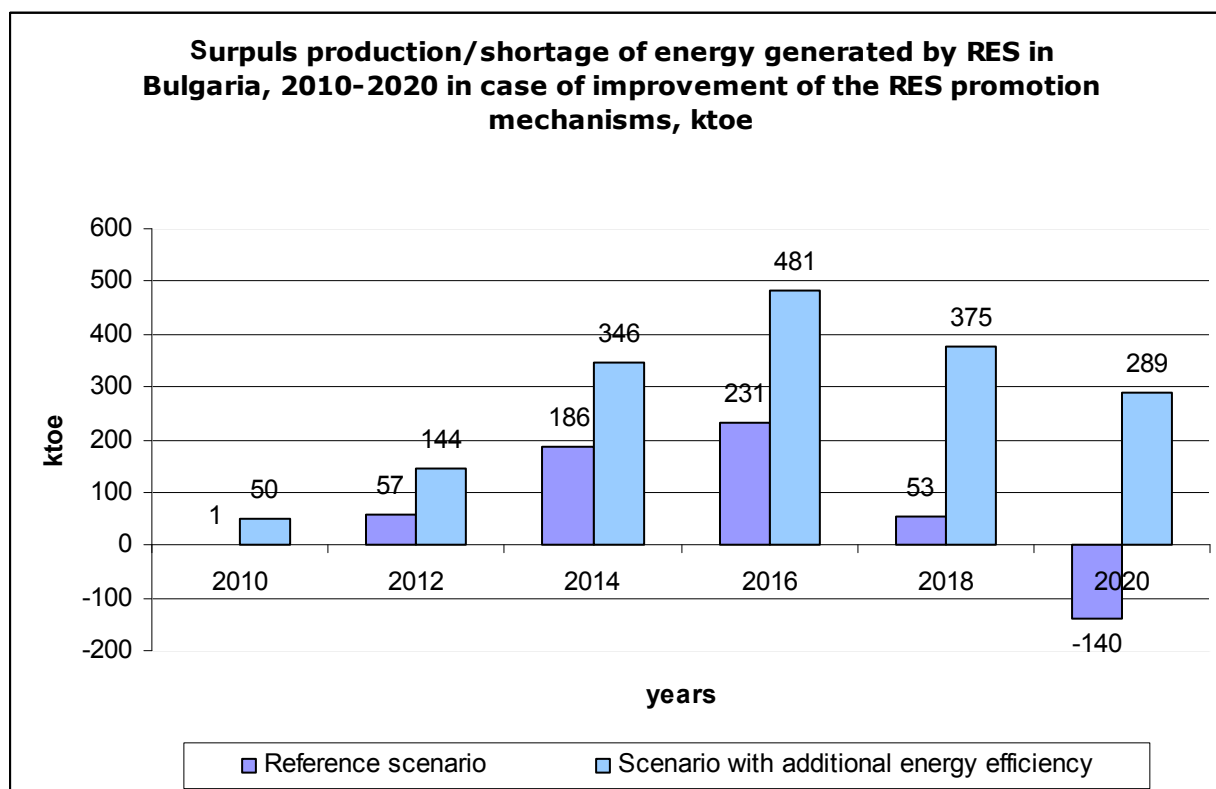
Achievement of the national target in 2020 depends mainly on the developments in the area of energy efficiency in the final energy demand, in the transmission/distribution of

electricity and heat energy and own consumption at the power plants. This is the reason for which the policy in the area of energy efficiency and that for renewable energy promotion are closely synchronized with a view to achievement of the national targets in both directions at the least costs and with the highest possible positive economic result.

In the Forecast document and the National Action Plan for energy from renewable sources it is estimated that:

- With the existing promotion mechanisms the development of RES will involve unduly high public costs due to promotion of only one part, more than that – of expensive resources and technologies, on the one hand, and will be unbalanced compared to the existing technical potential of RES, on the other hand;
- With improvement of the existing mechanisms for promotion of RES and extension of their range the development of RES will be achieved at lower costs to the society;
- In the case of simultaneous improvement of energy efficiency and of the RES promotion mechanisms the national target can be performed with significant surplus. Overperformance of the target will enable the country to sell „the surplus” – 1685 th. toe in the period 2011 – 2020 – through the adopted mechanisms for statistical transfers to other EU states.

Fig. 5. Surplus production/shortage of energy generated by renewable sources in Bulgaria, 2010 – 2020 in case of improvement of the RES promotion mechanisms, ktoe



Source: National Action Plan for energy from renewable sources in conformity with Directive 2009/28

The analyses made indicate that the 10% target for renewable energy in the transport sector is the hardest to implement owing to the strict requirements for biofuels sustainability. For this reason special attention will be paid to the opportunities for development of the market for electric vehicles supplied with energy from renewable sources.

5. Policy

With a view to creation of the required conditions for sustainable development of the RES sectors in Bulgaria and achievement and overperformance of the national target, a process of improvement of currently conducted policies and of the existing normative base is pending.

Adoption of the policies for support is forthcoming with the new Renewable Energy Act, with an emphasis mainly on overcoming of the existing barriers through implementation of:

(1) Regulatory/legislative support observing the principles of flexibility that would adequately reflect all changes in the market environment and the technological progress, such as:

- Further development of the regulatory instruments and introduction of clearer, transparent and non-discriminating rules and criteria with respect to connection of producers of electricity from renewable sources to the grids, as well as promotion of the required investments in building of a technical infrastructure and management, as well as application of the „smart grids“ concept;
- Introduction of clear rules and regulation of the responsibilities of RES electricity producers and network operators related to connection of energy facilities, development of the grids for provision of the required capacity and implementation of declared investment intentions;
- Creation of the required legislative framework for providing access of producers of biogas processed into methane to the gas transmission network similar to the priority connection of RES electric power producers;
- Relief of the procedures for construction of small (domestic) RES energy appliances, such as plants for utilization of the solar potential for water and space heating and/or electricity generation, utilization of the potential of the thermal and geothermal energy, biomass, etc.;
- Changes in the normative documents in force concerning participants in the investment process and their obligations in connection with the requirements in Directive 2009/28/EC related to the design of buildings and the use of energy from renewable sources in them;
- Adoption of requirements for efficiency of domestic heating appliances (installations) operating with biomass, with a view to reduction of the total volume of forest felling for meeting of energy requirements;
- Drawing up of regulation governing the registration and certification of qualified installers of biomass-fired boilers and heaters, photovoltaic and solar thermal systems, surface geothermal plants and heat pumps in conformity with the requirements of Directive 2009/28;
- Use of the EU's best practices.

(2) Trade preferences, tax and post-investment support:

- Creation of clear rules for maintaining a relatively uniform profit ratio for all RES electricity producers and decrease of the price of the generated electric power in a long-term aspect through current updating of the preferential purchase prices for electric power from renewable sources on the basis of changes in the investment costs and efficiency of technologies;

- Extension beyond 2015 of the deadline for application of preferential purchase prices and mandatory buying-out of the electric power produced from renewable sources, including that generated by co-generation power plants operating with renewable sources.

(3) Direct financial support:

- Establishment of flexible financial instruments and schemes for supporting energy production from renewable sources and biofuels corresponding to the specificity of the individual renewable sources technologies with funds raised by tenders for greenhouse gas emission allowance, EU funds and by other financial sources and fiscal instruments;
- Specific support to private physical persons for construction of installations utilizing solar, thermal and geothermal energy and biomass for households needs in buildings;
- Encouraging the construction of RES projects on disturbed terrains;
- Specific support for development and introduction of electric road vehicles, including ones supplied with energy from renewable sources, as well as of energy storage systems;
- Achievement of equal treatment and balance between all producers of energy from renewable sources through increase of the direct financial support for construction of energy capacities meeting house consumption needs;
- Provision of financial support for enhancement of research and development activities in the area of renewable sources, electric road vehicles and biofuels, facilitation of investors's access to scientific works.

(4) Information and administrative support:

- Improvement of the administrative procedures with a view to removal of regulatory and non-regulatory obstacles to the development of RES. One opportunity in this respect is creation of a single coordinating administrative body which will be responsible for the processing of all administrative documents (permits, licenses, etc.) related to installation and use of RES technologies, as well as for rendering of administrative assistance to applicants;
- Provision of easier public access to detailed up-to-date information about the possibilities for use of various RES technologies by geographic regions by means of accelerated implementation of the National RES Public Information System including up-to-date information about: capabilities of the national electric power network for connection of new producers; territories with restrictions on the construction of new RES capacities arising from the environmental legislation as well as territories categorized by the three-stage color code according to the risk of conflict with the object and targets for preservation of protected zones and of the biodiversity as a whole;
- Introduction of rules and requirements for conducting of active information campaigns and provision of accessible information about the measures and arrangements for support, net benefits, costs and energy efficiency of the equipment and systems for use of electricity and energy for heating and cooling from renewable sources;
- Extension of the spectrum of training and schooling of highly qualified specialists in the new areas: production of energy carriers from renewable sources, technologies for conversion and use of renewable sources, including possibilities for small-scale energy generation, or the so-called „distributed energy generation“: up-to-date control systems for electric power networks, including in connection with the integration of renewable sources into the electric power networks and others.

(5) Enhancement of the local authorities' role:

- A major role for increasing the use of the local RES potential will belong to the local and regional authorities. On the one hand – by their example of rational use of energy and indigenous renewable resources, and on the other hand – by creation of favorable conditions for development of the private investments and erection of facilities and systems for use of electricity and energy for heating and cooling purposes from renewable sources in residential and industrial zones in their territory.
- One significant element is access to financing, availability of flexible financial instruments and schemes corresponding to the specificity of the individual RES technologies and to the opportunities for obtaining technical assistance from the local administrations as well as from the companies and citizens.

(6) Management of risks related to environmental protection:

- Setting up of the sustainability criteria in conformity with Directive 2009/28 on production and consumption of biofuels and liquid fuels from biomass. The use of biofuels and biomass should lead to reduction of the greenhouse gas emissions during their production by at least 35% in the short term. From January 1st 2017 this reduction shall be at least 50%, and from January 1st 2018 – at least 60%, for biofuels and liquid fuels, produced at installations which have started production after January 1st 2017;
- Imposing of a requirement for development and annual updating of a map of zones sensitive from environmental protection point of view, including the zones coming within the network „Natura 2000“, where utilization of the potential of some RES requires compliance with stricter environmental standards or where it is no longer permitted due to reaching of the respective concentration thresholds. Thus the investors' interest will be directed to places and zones where there is no risk of adverse environmental impact;
- The development of hydro-power plants shall correspond to the measures, conditions and restrictions provided in the plans for management of river basins;
- Upon observation of significant change in the land use as a consequence of production of biofuels and/or construction of RES plants, introduction of remedial measures for the purpose of preserving the agricultural production in these regions and limiting, as much as possible, the possible increase of the prices of basic foodstuffs;
- Inclusion, in all schemes for state support for RES, of a provision that the concrete projects shall meet all conditions for sustainability and environmental protection.

IV. ENERGY EFFICIENCY IMPROVEMENT

1. European framework

Energy saving is the measure ready to the highest extent for implementation and a reliable way for achievement of the goal 20-percent reduction of the greenhouse gas emissions by 2020.

At the spring European Council in 2007 it was agreed to increase the energy efficiency in the Community with a view to saving 20% of energy by 2020. At the same time, however, the EU is still far from achievement of the 20-percent target. The latest forecasts predict stabilization of the present levels of consumption till 2020 accompanied by GDP increase by 28%.

Due to this energy efficiency will continue to be a priority of the Community's energy policy. In the end of 2010 the **European Commission** presented Communication **Energy 2020** - A Strategy for competitive, sustainable and secure energy, according to which the achievement of an **energy-efficient Europe** is the first of five main priorities. For achievement of the European goals in the area of energy efficiency, a new, more ambitious and wider-scope action plan for energy efficiency is to be presented in 2011.

The plan will be followed by specific Regulatory proposals in the course of this year and will also encompass the important financing-related aspects of the access to funds, availability of innovative products for financing, incentives for investments in energy efficiency, as well as the role of EU financing, more particularly from the structural funds, by further developing of the achievements on the basis of existing successful examples. Four high-priority actions for achievement of the national targets in the area of energy efficiency were identified, namely:

- Utilization of the full potential for energy saving with emphasis on the building sector and transport;
- Enhancement of the industry's competitiveness through efficiency increase, including imposition of stricter standards, better labeling of appliances and devices and application of energy management schemes (energy audits, plans, energy managers, etc.);
- Increase of energy supply efficiency, including increase of the energy efficiency downcircuit from generation, through transmission to distribution of energy to the end users;
- Maximum use of the national action plans in the area of energy efficiency.

All these policies will significantly contribute to performance of the EU's Strategy „Europe 2020“ including three topical mutually strengthening priorities, namely:

- 1) Intelligent growth or development of an economy based on knowledge and innovations.
- 2) Sustainable growth or building of the economy on the basis of more efficient utilization of the resources, environmental protection and improved competitiveness.
- 3) Uniting growth or promotion of an economy of high employment, contributing to social and territorial cohesion.

The document sets a framework for implementation of consistent political action at European and national level in the medium- and long term directed to building of a more intelligent and more ecological market economy based upon new knowledge and innovative solutions that would contribute to establishment of favorable conditions for further development of the European economies and capabilities for shorter-term overcoming of the consequences of the economic and financial crisis.

The EU's targets „20-20-20“ are confirmed and the member states are expected to define the energy efficiency targets at national level.

2. Status

The sustainable economic growth over the recent years was accompanied by a trend towards energy intensiveness decrease. Over the period 1999 – 2007 GDP grew by 5.3% per annum on the average, while the gross domestic energy demand increased by 1.4%, and that of electricity – by 0.9%. As a result, the energy intensiveness per unit of GDP decreased by 25.4%.

Regardless of this positive trend, energy intensiveness of the national GDP is 89% higher than the EU average (measured by gross domestic energy demand per unit of GDP and taking into account the parity of purchasing power) – 302 toe/MEUR05 compared to 160 toe/ MEUR05 in the EU. There are considerably smaller – 42.6%, differences between the national and the European indicator measured by final energy demand. This is an indicator of inefficient use of the primary energy resources, which is corroborated also by the relation between produced energy and the resources put into the production. This relation is 49% for the national energy balance and 64% - for Europe. For comparison, this difference of 15 points indicates that 3 mio. toe more energy resources are consumed in Bulgaria annually, which makes ~900 mio. Euro more energy costs per year.

With the significant differences thus found, the Bulgarian energy and economy as a whole cannot be expected to obtain successfully a position in the European market without considerable efforts in the sphere of energy efficiency – in conversion (generation and transportation), as well as in the consumption of energy.

On the strength of the Energy Efficiency Act, an Agency for Energy Efficiency was established, whereby the required institutional prerequisites were ensured for application of an integrated approach in the energy efficiency area.

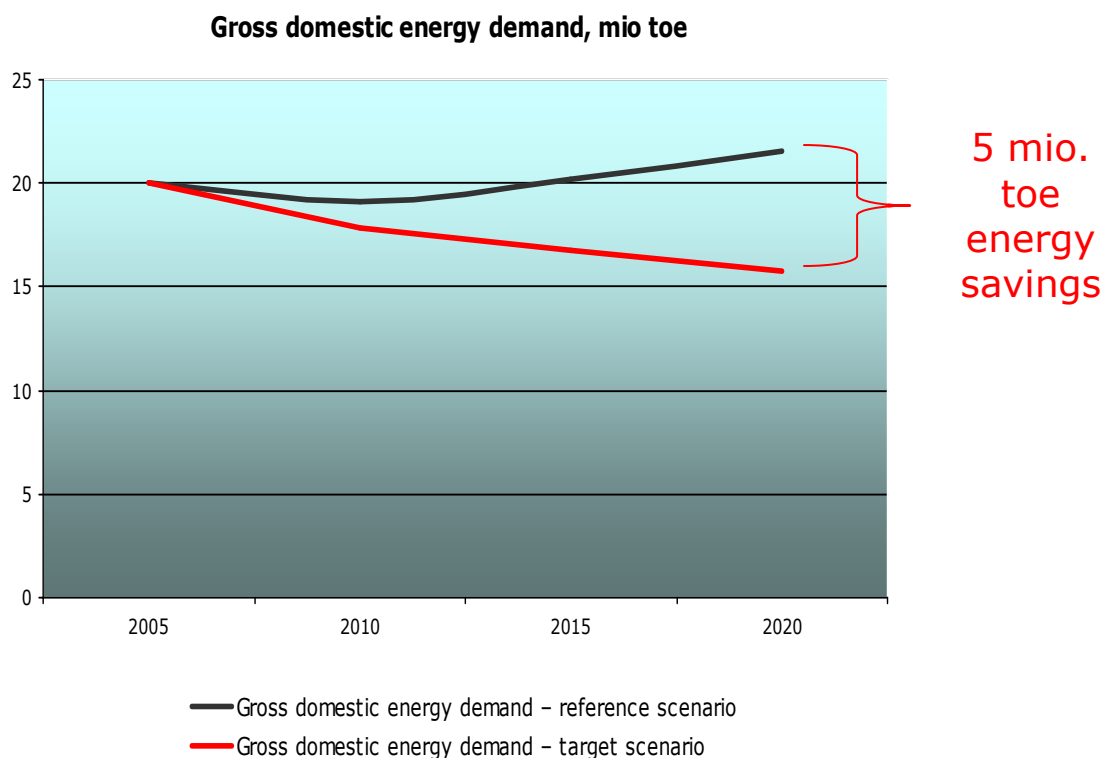
A Bulgarian fund for energy efficiency was created through a public-private partnership and now it is successfully functioning. Through it, financing of energy efficient projects in various sectors of energy generation and consumption is provided.

3. Targets

At present, the energy efficiency targets are not legally binding upon the member states, however, discussions in this respect are ongoing and regulation will probably become a fact in the near future. Notwithstanding the European decisions, we must start intensive policy at a national level.

Bulgaria aims to reduce the energy intensiveness of GDP by 50% till 2020, reaching a value of 456 toe/MEUR05 of this indicator compared to its level in 2005, 913.3 toe/MEUR05. The performance of measures and policies which are to be approved with The Energy Strategy of the Republic of Bulgaria 2020 with respect to improvement of the energy efficiency aims to result in raising the energy efficiency approximately by 25%, or saving of more than 5 mio. toe of primary energy in comparison with the reference scenario of development till 2020.

Fig. 6. Gross domestic energy demand– reference scenario and scenario with maximum utilization of the energy efficiency potential.



These intentions are motivated by the many-sided benefits from energy saving, namely:

- **Limiting of the climate changes** – energy saving is the quickest possible and cost-efficient way to: achievement of the national strategic targets for combat of the climate changes, guaranteeing of energy security and achievement of sustainable economic and social development.
- **Competitiveness, employment and recovery of the economy** – energy saving will make the Bulgarian industry more competitive and the Bulgarian citizens – more prosperous. In addition, the measures for energy efficiency in the households and transport will create numerous jobs across the country.
- **Security of energy supply** – the national dependency on fuel and energy imports is currently 47% and will grow. This carries political and economic risks. Energy efficiency is the least expensive and most efficient way for mitigation of these risks.
- **Struggle against energy poverty** – part of the Bulgarian citizens have difficulties with payment of their energy bills, which constitute a significant share of their incomes. Helping these citizens to reduce their energy consumption in a cost efficient manner is the most appropriate way to solve this problem. With respect to public finances and their energy component, retrofitting of the public buildings is of significance.

For this reason energy efficiency is the highest priority in the country's energy policy. The main areas with potential for energy saving are:

- Energy saving on the final consumption side, including households, transport, industry and services;

o Energy saving in the processes of energy generation and conversion, including development of the gas distribution network, reduction of the energy transmission and distribution losses, increase of the efficiency of thermal power plants, increase of the share of energy produced by means of highly efficient combined generation technology.

The proposed target - 50% reduction of the energy intensiveness of GDP was defined on the basis of assessment of the existing technical potential in the country, as well as on the basis of analysis of other member states' achievements. We will treat it as a minimum target the performance of which is mandatory.

4. Policy

(1) There is a large potential for energy saving in the energy branch – all along the chain of energy production, conversion and transportation. In this respect, it is the national Regulator's highest priority to create Regulatory and market economic incentives for implementation of energy efficiency measures both for the energy companies and for the end users.

(2) In order to create conditions for the efficient use of energy for heating by the population, we will provide conditions for access to the gas distribution network for 30% of the households in the country. The use of natural gas for heating and housekeeping requires three times less energy in comparison with the use of electricity.

(3) The most effective and reliable way for meeting the energy requirements is the decentralized energy generation by RES, including that in our homes. The decentralized generation integrates many benefits because it avoids the energy transmission losses, the costs for construction of a transmission network, uses a clean and inexhaustible resource.

(4) Major efforts will be made for improvement of the energy characteristics of buildings – private and public ones, including also accelerated, as compared to the European standards, imposing of the requirements towards buildings with near to zero net energy demand in the public sector.

(5) Apart from being an important factor for our energy security, centralized district heating is a means of energy saving. Co-generation of heat and electricity will be further supported and encouraged, subject to meeting the requirements for high efficiency (at least 10% economy of energy resources).

(6) Due to the extreme significance of energy efficiency to this country, the Council of Ministers will develop a Strategy for energy efficiency, which will be approved by the National Assembly as early as in 2011.

(7) In order to improve the energy efficiency, efforts are required in every sphere of energy use. This means everywhere – at our homes and in the buildings where we work, as well as at power plants and in the industry. Therefore every citizen, every company and institution can contribute to energy saving. This requires a high degree of coordination and harmonized policies. The National Energy Efficiency Agency was established for such purpose. The enhancement of its role, professional capability and responsibilities is a high-priority measure as a guarantee of subsequent effect of the policy conducted.

(8) The sources of financing the energy efficiency measures and projects are of particular significance for the successful implementation of the policy. Within the period till 2013 we will provide increasing flow of financial resources from the operative programs, from the Kozloduy International Fund, as well as from sales of the national surplus of prescribed greenhouse gas ERU's. After 2013, the revenues from sale of greenhouse gas emission allowances under the European scheme for greenhouse gas emission allowance trading will constitute an additional financial source.

In our judgement and that of the European institutions, the member states' national funds shall be the main instrument for financing of energy efficiency measures. Since such a fund already exists in our country, it shall continue to operate after its additional financial and administrative strengthening.

(9) An important part in reaching the sustainable energy goals will be played by the state and local authorities. In the process of assignment of all public procurement contracts for construction, services or products, the energy criteria shall be observed (with respect to efficiency, use of renewable sources and smart grids). The district governments and the municipalities are important participants in the required change and therefore their initiatives shall be further enhanced. Cities and urban regions that consume nearly 80% of the energy are simultaneously part of the higher energy efficiency problem and part of its solution. Special support will be rendered to inovative integrated energy solutions at a local level, contrubuting to the transition to the so-called green cities.

V. INDEPENDENT REGULATED AND COMPETITIVE ENERGY MARKET

1. European framework

The European energy policy is built upon the principle that an independent regulated and competitive energy market is the most effective and efficient way for achievement of both long-term competitiveness of the economy and of the priorities for energy security and sustainable development.

The European energy markets still do not function satisfactorily. As a result, the European consumers and the economy as a whole have not yet fully benefited from the advantages of the free market, especially as far as lower prices or possibility for choice of a service provider are concerned.

In view of the unsatisfactory evaluation of the achievements of the market liberalization process since the 90-ies of the last century and after the adoption of a Green Book for an European strategy for sustainable, competitive and reliable energy (March 2006), the energy sector of the EU and more particularly the internal energy market are becoming a political priority in the programs of the European Commission, The Council of Ministers and the European Parliament.

This necessitated revision of the enforced legislation. In September 2009, a new energy legislation related to the rules of organization and functioning of the internal electricity and natural gas markets came into effect in the form of a Third Energy Liberalization Package. The changes are directed to achievement of the following **targets**:

- Free choice of supplier by the consumers;
- Unhindered and equal access to the power transmission and gas transmission network;
- Fair prices;
- Cleaner energy;
- Energy security.

The priority areas requiring efforts for achievement of the targets are:

- Ensuring independence of the electricity and gas transmission system operators through their unbundling along with the transmission assets from the energy generation/supply/provision functions;
- Creation of a power exchange;
- Increased independence and extended powers of the national Regulators;
- Cooperation of the national Regulators at European level;
- Increasing the transparency of the market;
- Better consumer protection;
- Promotion of cross-border cooperation and investments;
- Facilitation of cross-border energy trading.

2. Status

An independent State Energy Regulatory Commission was set up in 1999 with the Energy and Energy Efficiency Act. With the Energy Law adopted in 2003 – a fundamental legislative act based on The Energy Strategy of 2002 and harmonized with the requirements of the European Directives, some changes in the powers and scope of regulation were introduced and conditions for the work of the State Energy and Water Regulatory Commission (SEWRC) in a stable law environment were created. Gradually, SEWRC obtained greater autonomy, competences and functions which are defined and clearly distinct from those of the Ministry responsible for energy. The functions of SEWRC with respect to regulation of the water sector were added later with a view to making use of the administrative and professional capacity already accumulated in the sphere of energy.

A market model was introduced in the electric power and gas sector. The market model of the internal electricity (and natural gas) market is based on a third-party regulated access to the network, where the transactions are effected through direct bilateral contracts between producers/traders and consumers and a balancing market (where the lacking quantities are bought and the surplus under bilateral contracts is sold). During the transition period of gradual liberalization the relations between market players are effected in a regulated and in a free electricity market. The established market model was subsequently adopted at the regional level as a market model for the countries of South East Europe (SEE) in conformity with the regional strategy for electric power development in Southeast Europe (2005) and by signature of the Treaty Establishing an Energy Community between these states and the European Community (in effect since July 2006).

From the point of view of development of the gas market in SEE, the significance of Bulgaria for the region is related to its well developed ring-shaped gas transmission system, which, in the next few years, will be further interconnected through construction of new interconnections with Greece, Romania, Turkey and Serbia.

Since July 1st 2007 the Bulgarian electricity and natural gas market has been fully liberalized. This means that each consumer receives a legitimate right to choice of supplier and of free and equal access to the network for energy transportation to the point of consumption. Regardless of the favorable law prerequisites created in 2003, an exchange type of market has not been organized in the country yet.

3. Policy

We are definitely convinced that the targets for sustainable development cannot be fulfilled without creating an independent regulated and competitive electricity and natural gas market. In order to fulfill that target, we will apply efforts in the following directions:

(1) For competition in the electricity market to exist, there shall be sufficient supply and a larger number of suppliers, so that each consumer should be able to choose and switch its supplier without problems. Creation of conditions for competition in generation and supply requires integrated and coordinated efforts on the part of the Regulator and the Ministry of Economy, Energy and Tourism (MEET). We are committed to implementation in the shortest term, by the end of 2011, of the idea about a power exchange, in cooperation with operating exchanges, which is the proven instrument for creation of a liquid market.

(2) Every market player must have free and non-discriminatory access to the network, in order to be able to transport its energy to the respective contracting party. The transmission and distribution enterprises are natural monopolies – due to the absence of competitive routes they can discriminate one market player in favour of another. That is why we will create conditions providing to every player equal access to the network by clear and non-discriminatory rules.

(3) Unbundling of the transmission operators from the generation and supply activities is our primary task not just to meet the requirements of the European legislation, but also as a guarantee for unhindered and equal access to the network. In conformity with the selected unbundling model – „Independent Transmission Operator“, the two operators will be two autonomous and independent legal entities, who will own their assets. Control of the companies' activities will be exerted by their principal in the person of the Minister of Economy, Energy and Tourism. The restructuring will be completed within the shortest term, before the deadline set for this by the Directives – December 31st 2011.

(4) The available capacity of the network shall be disclosed and fairly allocated among all users. It is also important that the network should be developed in favour of all participants, thus guaranteeing that in the future its capacity will still be sufficient and available to everybody. This can happen only if the required investments for implementation of the „smart grids“concept are provided for. For that purpose the transmission operators, ESO and Bulgartransgas are developing ten-year development plans, which are subject to consultation with all market players and to approval by SEWRC.

(5) Bulgaria will meet the requirements of the Common European Policy, giving priority to the creation of an internal market and its extension into a Pan-European Energy Community. The country has a considerable potential at its disposal that consists of a strategic geopolitical and geographic location, strong positions in the SEE region with respect to energy export and transit, as well as capacity for strengthening of these positions through our involvement in large-scale regional energy projects.

It is our firm belief that the key steps towards an independent regulated and competitive energy market, with consideration for transparent operation and development of the grids, the power exchange and unbundling of the transmission operators, are feasible within the framework of our mandate and are the right way to win the confidence of the Bulgarian business and citizens in the electricity market.

VI. MEDIUM-TERM PROGRAM TILL 2013

The period 2010 – 2013 will lay the beginning of transition to low-carbon economy and energy both at European and national level. The successful fulfilment of the national targets by 2020 will depend to a great extent on the prerequisites and conditions that will be created by us for this during this initial period.

The Government of European Development of Bulgaria clearly realizes its responsibility for the achievement of the long-term targets, for which reason it will adopt an Energy Strategy of Bulgaria till 2020 containing, among others, a medium-term program till 2013 with a package of measures and results, so that the strategic priorities would be achieved.

1. Energy security for the Bulgarian industry and population

- Diversification of the sources and routes for supply of natural gas.
- Provision of Regulatory incentives for investments in the network infrastructure and for development of the grids adequate to the needs of their users, including application of the „smart grids“ concept.
- Development by the end of 2011 and adoption of a District Heating Sector Stabilization and Development Program.
- Institutional support and monitoring of projects of strategic significance to energy security, including those of investors in new power plants (required for balancing the generation by wind and solar power plants), as well as in a new nuclear capacity as a project with prevailing participation of foreign investors.
- Institutional support and monitoring of projects for construction of new and/or replacing capacities using indigenous coal and mandatorily using up-to-date highly efficient and low-emission carbon capture and storage technologies, including technologies for development and improvement of the power system.
- Construction of a national storage for radioactive waste and a dry storage for spent nuclear fuel in conformity with the best international standards.
- Updated Strategy for management of spent nuclear fuel and radioactive waste.
- Development of a system of adequate mechanisms for energy social protection.

2. Reduction of greenhouse gas emissions

- Timely creation of working mechanisms for conducting of bids for greenhouse gas emission allowance after 2013 and participation in a Common-European trading platform.
- Regulation of the spending of revenues from the bids for greenhouse gas emission allowance in projects for sustainable energy development, construction of „smart grids“ and creation of administrative capacity and procedures for project selection and evaluation.
- Active participation of the state in the European procedures for financing of clean technologies – demonstration projects for capture and storage of carbon dioxide and inovative projects for renewable energy.

3. Increase of the share of renewable energy sources in the total final energy demand

- Increase the share of electric power generated by renewable energy sources (RES), using mechanisms for achievement of the quantitative targets at the least cost to users.
- Adoption of a National Action Plan for energy from renewable sources till 2020.
- Imposition of the requirements of Directive 2009/28/EU – adopting of a new law and secondary legislation on renewable energy with a view to removing the barriers hindering the integration of RES into the electricity and gas networks and implementation of a package of measures for promotion of investments in RES technologies, generation and consumption of energy from renewable sources and scientific research.

- Improvement of the existing support mechanisms for the generation and consumption of energy from renewable sources and financial incentives of projects through specialized credit lines, financing from European funds and programs and from other sources.
- Creation of favourable conditions for development of a market for electric road vehicles, including ones supplied by RES, as well as of systems for storage of energy.
- Acceleration of the work for implementation of joint projects for utilization of the existing hydro-power potential in the country.

4. Energy Efficiency Enhancement

- Development and adoption of a National Energy Efficiency Strategy of the Republic of Bulgaria till 2020 with emphasis on the promotion of measures for energy efficiency in the residential sector, in the public buildings, transport and industry.
- Changes in the Energy Efficiency Act (EEA) related to transposition of the requirements of Directive 2010/31/EU on the energy characteristics of buildings, stimulation of the energy services market and accelerated adoption of market mechanisms for promotion of energy efficiency.
- Development of a second National Energy Efficiency Action Plan the purpose of which is to detail the requirements towards programs in specific sectors and to formulate the high-priority measures for energy efficiency for the period 2011 – 2014.
- Development, by the end of 2011, and adoption of a Program for Accelerated Gasification of the Republic of Bulgaria, the performance of which is expected to save considerable amounts of primary energy.
- Financial incentives for energy efficiency measures through schemes of the Energy Efficiency Fund, specialized credit lines, financing under European funds and programs and creation of additional schemes and instruments, including those for performance of the national program for refurbishment of residential buildings in the Republic of Bulgaria.

5. Building of a competitive energy market as a way to achievement of high-priority objectives - competitiveness, energy security & sustainable development

- Amendments and supplements to the Law on Energy and the secondary legislation transposing the requirements of the Third Liberalisation Package for the purpose of creating an efficient energy market, transparency of the public energy companies in combination with better protection of the rights of consumers.
- Development, by the end of 2011, and adoption of a Programme for Accelerated Market Development of the Electric Power Industry.
- Creation of a power exchange.
- Enhancement of the professional capability and independence of the Regulatory body in the energy sector.
- Protection of the rights of consumers.

6. Better utilization of the indigenous energy resources

- Development, by the end of 2011, and adoption of a Programme for efficient use of the indigenous energy resources, taking also into account the opportunities for sustainable and ecologically sound use and management of soils with preservation of their environmental functions and prevention of their damage, as well as reclamation of already damaged soils and limiting and/or mitigation of damages to levels free of risk to the environment and human health.
- Updating of the legislative basis with a view to guaranteeing unified management of mineral resources.
- Standardization of the procedures and documents related to granting of rights for prospecting, exploration and production of mineral resources, inclusive of promotion of the development of new gas fields in the country.

7. Alternatives to the supply of natural gas

The security risks can be managed through diversification of the energy resource types, sources, suppliers and routes taking into account the regional and global trends in the energy markets. Viewed from that angle, the diversification of energy supply will assist the creation of competition between the main energy suppliers and will stabilize the prices of primary energy resources.

Construction of terminals for import of liquefied and compressed natural gas, through which alternative gas supply for the country will take place, as well as of the lacking infrastructure – interconnections with neighbor countries, will be an indispensable element of the set of measures for guaranteeing, in the long-term, the security of supply to the country, and also as a mechanism that will contribute to more flexible crisis response.

The access to alternative sources and routes for import will enable the achievement of more competitive conditions in the import of natural gas from gas-producing countries, such as the countries of the Caspian region and Asia Minor, as well as from Algeria, Egypt, Libya, Qatar, Oman, United Arab Emirates, Nigeria, etc.

Through the projects for interconnections the security of gas supply to Bulgaria will be improved and the negative effects from potential crises due to full or partial loss of supply from the single for the time being source on the national economy will be avoided.

In this connection the state will direct its efforts to implementation of the following alternatives:

- Possible construction of a regasification terminal for liquefied natural gas (LNG), through which natural gas will be supplied not only to Bulgaria, but to third countries as well, through the well developed Bulgarian gas transmission network;
- Implementation of a project for supply of compressed natural gas (CNG) from Azerbaijan across the Black Sea;
- Construction of gas interconnections with Turkey, Romania, Greece and Serbia, as follows:
 - Gas interconnection with Turkey that will permit supply of natural gas to Bulgaria from Azerbaijan, Turkmenistan, Iraq, Libya, Egypt etc., as well as alternative LNG supply to the terminal at Marmara Sea (Qatar, Oman, Nigeria);
 - Construction of a gas pipeline Bulgaria – Romania (Rousse – Giurgiu) – a cross-border reverse gas pipeline of estimated length 25 km, connecting the Bulgarian gas transmission system at the automatic gas distribution station (AGDS) Rousse-East to the Romanian gas transmission system in the region of GIS – Giurgiu;
 - Construction of a gas pipeline Greece – Bulgaria of approximate length 168.5 km, connecting the Greek gas transmission system in the region of Komotini to the Bulgarian gas transmission system in the region of Stara Zagora;
 - Gas interconnection Bulgaria – Serbia that will permit natural gas supply to Bulgaria through Serbia from the gas transmission system of the EU and from natural gas suppliers alternative to Russia.

8. Expected results

- 20% lower energy intensiveness of GDP by 2013.
- Increase of the RES share to 12% of the total final energy consumption by 2013.
- Increased share of freely negotiated quantities of electricity in the internal market.
- Established power exchange.
- Higher-quality energy supply at affordable and predictable prices.

- Improved standards for security of energy supply and environmental protection.
- Attracted investments in the sector.
- National legislation fully harmonized with the acts of the EU Energy/Climate Package.
- National legislation fully harmonized with the acts of the Third Energy Liberalisation package of the EU.
- Transmission network operators independent of the production and supply industries.
- Working and capitalized Energy Efficiency Fund.
- Efficient and independent Regulatory control.
- Securing the energy needs and protection of the interests of the consumers, including an improved system for social protection of energy users.

VII. A VISION OF 2020 IN FIGURES

This section was developed on the basis of:

(1) Forecast energy balance for 2020 – 2030 considering the development of the energy sector under the existing energy policy (Reference scenario).

The prognostic energy balance has been developed and updated at regular intervals for Bulgaria (as well as for the rest of the member states) by commission of the Directorate General for Energy and Transport of the European Commission.

The version of December 2009⁵ presented below takes into consideration the impact of the economic and financial crisis and was developed on the basis of the following assumptions for variations of the prices of imported fuels and emissions:

Prices of imported fuels and emission allowance

Year	Oil	Natural gas	Coal	Allowance
	€ (2008)/boe			€ (2008)/t CO ₂
2005	46,3	30,9	10,9	0
2010	50,2	30,9	12,0	14,5
2015	54,9	37,4	16,4	20,0
2020	72,9	51,2	21,3	25,0
2030	90,8	65,7	25,2	39,0

(2) Estimated target indicators, showing energy development in the process of performance of the defined strategic targets (Target scenario).

(3) Forecasts of utilization of the RES potential in Bulgaria up to 2020.

The forecasts are developed by the Ministry of Economy, Energy and Tourism in accordance with the requirements of Directive 2009/28/EO.

1. Energy Balance – Reference scenario

General indicators

The growing prices of imported energy resources are a major factor for the changes in the energy balance up to 2030. Under their influence, the energy intensiveness of GDP steadily decreases by 30% in 2020 and by 43% in 2030, respectively. This leads to nearly 100% increase of GDP against 10-percent increase of energy demand in the country. The dependency on import decreases by 4 points thanks to the increased consumption of nuclear energy which is assumed to be an indigenous source – taking into account commissioning of two new 1000 MW nuclear units. The consumption of oil and natural gas grows insignificantly. If the nuclear energy is assumed to be an imported resource, the dependency on import will increase to 77 %.

Indicator	2005	2010	2015	2020	2030
Gross domestic product (000 M€05)	21,9	25,8	30,5	34,7	42,2
Generation of primary energy (Mtoe)	10,6	9,7	9,8	11,8	12,6

Gross domestic consumption (Mtoe), of which:	20,0	19,1	20,2	21,6	22,1
Fossil fuel	6,9	7,1	7,8	7,4	5,8
Oil	4,9	4,6	4,9	5	4,8
Natural gas	2,8	2,8	2,8	3	3,3
Nuclear energy	4,8	3,8	3,8	5,6	7,4
Electricity	- 0,7	- 0,4	- 0,5	- 0,9	- 1,1
RES	1,2	1,2	1,4	1,5	1,9
Net imports (Mtoe)	9,5	9,5	10,4	9,9	9,6
Dependency on import (%)	47,4	49,5	51,5	45,8	43,3
Final energy demand (Mtoe)	9,6	9,8	10,5	11,1	11,7
Relation b/n final & gross consumption (%)	48	51	52	51	53
Energy intensiveness (toe/M€05)	913,3	742,5	661,9	623,6	524,9

Power sector

Electricity demand increases by 8% in 2020 and by 23% in 2030, respectively, compared to 2005. It is fully guaranteed by domestic generation which increases at pre-emptive rates – by 13% in 2020 and by 32% to 2030, respectively. The surplus production intended for export reaches 10.4 TWh in 2020 and 13 TWh in 2030. It is expected that in the period 2025 – 2030 some replacing capacities fired with lignite coal with carbon capture and storage technologies will be built. As a result of commissioning of new nuclear, RES and clean coal capacities, the emission intensiveness is expected to decrease from 500 to 156 kg CO₂/MWh.

Electricity generation in the country, 2020, by NPP, TPP and HPP, in TWh and in %:

Generation of electricity (TWh)	2005	2020
Nuclear	18.6	22.3
RES	4.31	5.8
Thermal power plants, incl. biomass	21.1	21.6
TOTAL:	44.0	49.7

Generation of electricity (%)	2005	2020
Nuclear	42.3	44.9
RES	9.8	11.7
Thermal power plants, incl. biomass	47.9	43.4

Indicator	2005	2010	2015	2020	2030
Generation (TWh), of which:	44	39,7	43,2	49,7	58
Nuclear	18,6	14,7	14,7	22,3	30
Hydro + Wind	4,3	4,5	5,2	5,8	6,9
TPP incl. biomass and new gas capacities	21	21	23,4	21,6	21,2
Consumption (TWh)	36,4	35,5	37	39,3	45
Export (TWh)	7,6	4,2	6,2	10,4	13

Co-generation of heat and electricity (%)	6,8	14,8	17,6	15,1	13,1
Generation through CCS (%)	-	-	-	-	19,4
Emissions from TPP's (Mt of CO2)	26,3	25,1	27,7	25,9	10,8
Captured and stored CO2 emissions (Mt of CO2)	0	0	0	0	9,2
Emission intensity (tons of CO2/MWh)	0,494	0,500	0,488	0,407	0,156
Average electricity generation costs (€05/MWh)	34,5	38,7	53,7	63,7	68
Average electricity price (€05/MWh)	59,1	62,6	75,3	91,5	109,7

Renewable energy sources

With the existing mechanisms for promotion of RES and of energy efficiency in the period 2012 – 2018, surplus generation of energy by renewable sources is expected compared to the indicative curve determined for the country in the amount 4 ÷ 122 thous. toe/year.

In this connection, in order to guarantee the security of the energy system the state will create flexible mechanisms for avoidance of any shocks in the energy networks and will seek the reasonable balance, in order to guarantee the security and reliability of supply.

With a view to the maximum utilization of Bulgaria's potential for generation of electric power from renewable sources, opportunities will be sought for acceleration of the development of the market of electric road vehicles supplied by renewable sources.

In the Reference Scenario the mandatory national target - 16-percent share of RES in the total final consumption of energy will not be fulfilled – the share of RES in 2020 will reach 13 %.

Expected energy generation by renewable sources by sectors (thousands of toe)

Indicator	2010	2012	2014	2016	2018	2020
Energy for heating and cooling	741	794	884	956	985	1019
Electricity	332	366	468	553	576	602
Transport	30	62	99	129	62	92
TOTAL	1103	1222	1451	1638	1623	1713
Surplus /shortage	4	39	117	122	-117	-382

Forecast share of RES in the individual energy sectors compared to the total final energy consumption (%)

Indicator	2010	2012	2014	2016	2018	2020
Energy for heating and cooling	15,3	15,8	16,2	16,6	16,4	16,5

Electric power	10,6	11,4	14,1	16,3	16,5	16,7
Transport	1,1	2,2	3,3	4,2	1,9	2,8
TOTAL	10,3	11	12,3	13,3	12,7	13,0

2. Energy balance – Target scenario

INDICATORS FOR COMPARISON	2005	2020	2020
Gross domestic product (000 M€05)	21,9	34,7	34,7
Gross domestic consumption (Mtoe)	20	21,6	15,8
Dependency on import of oil and natural gas (%)	38	36,7	48
Final consumption (Mtoe)	9,6	11,1	9,16
Relation final/total (%)	48	51	58
Energy intensity (toe/ M€05)	913,3	623,6	456
Energy from renewable sources (Mtoe)	1,1	1,71	1,96
Share of RES (%)	9,4	13	18,8
Total energy costs (000 M€05)	6,6	11,9	9,2
Energy costs as a percentage of GDP (%)	30,14	34,2	26,5
Energy costs in the final energy demand (€05/ MWh)	59,1	91,5	86,4

If the targets set are fulfilled, significant improvement of the main energy indicators will be achieved. The comparison is made on the basis of the situation in 2005, the forecast for 2020 assuming preservation of the present-day policy (Reference Scenario) and the forecast for 2020 assuming implementation of the strategic goals (Target scenario):

- The key goal to be pursued is energy efficiency improvement. The main indicator of this is energy intensiveness of the GDP. If the targets for two-fold reduction of energy intensiveness by 2020 are achieved, this national indicator is expected to come closer to the average for the Community, which will be reflected in many-sided benefits.
- Achievement of the target indicator of energy intensiveness, 456 toe/MEUR05, will enable the sustainable economic growth, realized with lower energy demand. Till 2020 the total energy demand decreases by 21%, while GDP increases by 58.5% compared to 2005.
- Performance of the planned measures and policies with respect to energy efficiency will produce the following positive effects in comparison with the Reference Scenario around 2020: 17.5% lower, or 1.94 mio. toe final consumption of energy; saving of 26.8%, or 5.8 mio. toe primary energy per year as a result of energy efficient final consumption, energy efficiency in the energy sector and larger share of the directly used natural gas and RES.
- As a result of efficiency improvement in the energy sector and of adoption of the direct use of natural gas and RES in the households, the relation between final and total energy demand reaches 58%. This means that the same energy requirements of the end users in 2020 will require 17% less primary energy resources compared to 2005, respectively 12% less compared to the Reference scenario.
- The increased use of natural gas in the households has a positive energy saving and environmental effect, but a negative impact with respect to dependency on import of energy resources. With access to natural gas granted to 30% of the households by 2020, the import of natural gas will grow, as a result of which the

dependency on oil and natural gas imports will be increased from 36.7% under the Reference Scenario (without gasification) to 48% under the Target Scenario. The energy security of the users will be guaranteed through implementation of projects for diversification of the routes and sources of natural gas supply.

- The consumption of energy from renewable sources under the Target Scenario increases by 14% compared to the Reference Scenario, whereupon the share of RES in the total final energy consumption in 2020 exceeds the 16-percent target. The surplus, which is 289 thous. toe only for 2020, will provide conditions for financial revenues to the state through transfer of certificates to other member states of the EU. And vice versa, under the Reference Scenario the country will fail to reach its mandatory target, which will necessitate purchase of certificates from other member states.
- In summary, achievement of the strategic goals can be presented in the following economic terms up to 2020: reduction of the total energy costs by 2.7 bln. Euro per year compared to the Reference Scenario; reduction of the total energy costs as percentage of GDP from 34.2% under the Reference scenario to 26.5% under the Target Scenario; reduction of the energy costs per MWh in the final energy consumption from 91.5 Euro under the Reference Scenario to 86.4 Euro under the Target Scenario.

MONITORING AND UPDATING

The energy sector is developing in a dynamic environment, requiring adequate and timely political decisions. For this reason the performance of the targets and priorities set in the energy strategy will be monitored with a view to identifying any need for changes in the envisaged mechanisms, as well as in the legislative basis.

Monitoring will be performed on the basis of a system of quantitative and qualitative indicators, including energy, economic, social indicators and indicators for environmental impact assessment in the process of application of the Strategy.

On this basis, biennial monitoring reports will be developed, including analysis of the performance of the set targets and priorities, proposals for changes in the prevailing mechanisms and legislative environment with a view to correcting the trends in the implementation of the strategy and updating the estimate energy balance for 10 and 20 years ahead.

CONCLUSION

The Government of European Development of Bulgaria will apply efforts to achieve:

- **G**uaranteed reliable and affordable energy at fair prices for the Bulgarian business and citizens;
- **C**reation of confidence in the market on the part of the consumers;
- **O**vercoming of the dramatic differences between Bulgaria and the other EU member states in respect of energy efficiency;
- **R**edirection of a massive financial resource for cleaner environment and sustainable living;
- **O**verperformance of the renewable energy targets;
- **A** new way of viewing energy and a different behavior of everyone of us as consumers, *in* an environment of transparency, intensive dialogue and common efforts between the institutions, business and the research community.

List of Abbreviations

NPP	Nuclear power plant
GDP	Gross domestic product
GDED	Gross domestic energy demand
RES	Renewable energy sources
HPP	Hydro-power plant(s)
GW	Gigawatt(s)
GWh	Gigawatthour(s)
goe	Gram(s) of oil equivalent
goe/Euro GDP	Grams of oil equivalent per unit of gross domestic product
goe/Euro '05 GDP	Gram(s) of oil equivalent per unit of gross domestic product at comparable 2005 prices
SEWRC	State Energy and Water Regulatory Commission
EC	European Commission
EU	European Union
kWh	Kilowatthour(s)
MW	Megawatt(s)
MWh	Megawatthour(s)
MEuro	Million Euros
MEET	Ministry of Economy, Energy and Tourism
Mtoe	Million tons of oil equivalent
bln. Euro	Billion Euros
Mio. Euro	Million Euros
bln. kWh	Billion kilowatthours
bln.m³	Billion cubic meters
SME	Small and medium enterprises
Mt	Million tons
SNF	Spent nuclear fuel
RAW	Radioactive waste
TPP	Thermal power plant(s)
toe	Tons of oil equivalent
t CO₂/MWh	Tons of carbon dioxide emissions per Megawatthour
HES	Hydro-energy systems
thous. toe	Thousand tons oil equivalent
SEE	Southeast Europe
CCS	Carbon Capture & Storage (Technologies)
CO₂	Carbon dioxide
UCTE	Union for the Coordination of the Transmission of Electricity

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