

REPUBLIC OF HUNGARY

**MINISTRY OF TRANSPORT,
TELECOMMUNICATIONS AND ENERGY**

FORECAST DOCUMENT

**on the development of use of renewable energy sources
until 2020**

(Data provision required under Article 4 (3) of Directive 2009/28/EC)

December 2009

TABLE OF CONTENTS

The participation of Hungary in international cooperation concerning renewable energy sources in the light of the results of the examination until 2020	2
DETAILED ANALYSIS.....	4
1. Expectations of Directive 2009/28/EC towards Hungary.....	4
2. Conformity of the objectives of Directive 2009/28/EC with Hungarian energy policy 4	
2.1. External and internal challenges in energetics affecting the use of renewable energy sources	4
2.2. Main principles of Hungarian and European energy policy	5
3. Developments of use of renewable energy sources between 2005 and 2008 ..	5
4. The renewable energy sources strategy and national objectives of Hungary ..	7
4.1. The renewable energy potential of Hungary	7
4.2. Differences between the renewable energy sources strategy and the national objectives.....	10
4.3. The objective concerning national renewable energy use in the view of possible economic development paths and the corresponding total energy demands 11	
4.3.1. Possible economic development paths	11
4.3.2. The development of energy demands in the course of various economic development paths	12
4.3.3. National target of use of renewable energy sources for 2020	15
5. Development of renewable energy use between 2008 and 2020	15
6. Conditions necessary to achieve the targets	17
6.1. Technical and economic conditions	17
6.2. Financing conditions	19
7. International Cooperation (export-import, joint projects)	19

The participation of Hungary in international cooperation concerning renewable energy sources in the light of the results of the examination until 2020

Under Directive 2009/28/EC, the proportion of use of renewable energy sources to be achieved by Hungary by 2020 is 13% of total energy demand.

According to the scenarios taking into consideration the effects of the economic crisis and assuming different rates of development, the expected volume of total energy use in 2020 stands at 992-1 035 PJ per year. Consequently, in line with the proportion of 13%, as a result of total energy demand, the use of renewable energy sources in 2020 should stand at 129-135 PJ per year. **Taking into consideration the various social and economic benefits of increasing the use of renewable energy sources, the higher figure should be considered as the national target. Therefore, as laid down in Directive 2009/28/EC, the national target for use of renewable energy sources for 2020 is 135 PJ from renewable energy sources per year.**

In order to achieve 135 PJ renewable energy source use per year, the use of renewable energy sources of 49.9 PJ per year in 2005, the year specified as base year by the Directive, is to be increased by 270% by 2020. Chapter 6 of the detailed justification describes the volumes use of renewable energy sources for the interim years until 2020, as well as the list of renewable energy sources used for power and heat production broken down by the kinds of renewable energy sources.

It is a strategic objective of energy policy to exploit as much of the social and national economic benefits of the use of renewable energy sources as possible, and to increase the use of renewable energy sources even higher, than the abovementioned target. To this end and with regard to domestic characteristics, we plan to increase even more dynamically the use of biomass in the agriculture sector by developing and supporting intensively the production of energy crops.

In case of Hungary, the flexibility measures, statistical transfers, joint projects between the Member States and/or joint support schemes facilitating the achievement of the targets concerning the use of renewable energy sources may primarily affect electricity and biomass. The future planned cooperation situation in this respect is as described below:

- Directive 2001/77/EC sets forth a national target concerning the proportion of green electricity to the total use of electricity, which target, in case of Hungary, is to achieve 3.6% by 2010. The proportion of green electricity to the total national use of electricity was 5.4% in 2008, meaning that Hungary considerably exceeded its obligation imposed by the EU. There is an indirect relationship between this figure and the obligation arising from Directive 2009/28/EC, since the increase in electricity production using renewable energy sources affects the aggregate proportion of the use of renewable energy sources, thus the feasibility of the 13% target partially depends on the volume of green electricity production.

Hungary does not plan to export green electricity, and all electric power produced using renewable energy sources is booked as part of domestic use of renewable energy sources. There are no import needs concerning green electricity.

- Hungary both exports and imports timber (and, in a broader sense, biomass). Increasing energy crops production is necessary to provide supply in the future, in case the planned developments will be implemented, thus the strategic objective is to satisfy domestic demand. Equipped with developments in the agricultural energy sector and by balancing raw material production and use, Hungary will not need to import either, thus the volume of international trade in this respect will be negligible in the future.
- The situation of Hungary in respect of biofuels differs in the cases of bioethanol and biodiesel.

Long-term future plans outlined by potential investors in bioethanol production considerably exceed domestic demands, thus Hungary may even be able to export considerable volumes, if the necessary developments, which are also encouraged by domestic support schemes, are implemented. Volume of the export capacity cannot be planned in advance, it is dependent on the development of agricultural production and to the implementation of eligible investments.

As for biodiesel, the domestic characteristics are expected to satisfy only approximately 80% of the forecast demand. The primary objective is to satisfy the requirement regarding the proportion of biofuels by increasing the use of bioethanol. If it cannot be fully satisfied, Hungary may be forced to import biodiesel. The volume of necessary import cannot be specified in advance, it is also subject to the implementation of possible investments.

- Joint projects may advance the feasibility of obligations of the partners, thus Hungary will endeavour to participate in reasonable and economic joint projects in the future. However, there are no preliminary plans on this field.

In summary, Hungary fundamentally strives to be self-sufficient in increasing the use of renewable energy sources, and cooperation activities within the EU will probably be limited to the field of biofuels.

DETAILED ANALYSIS

of the use of renewable energy sources during the period of 2010 to 2020

1. Expectations of Directive 2009/28/EC towards Hungary

Directive 2009/28/EC of the European Parliament and of the Council aims to foster the achievement of the following objectives for 2020:

- use of renewable energy sources shall be at least 20% at EU level, and
- proportion of biofuel use shall be 10% at least.

In order to achieve 20% use of renewable energy sources, the Directive lays down requirements at the level of Member States, with regard to the characteristics of the Member States. An EU requirement toward Hungary is that the proportion of use of renewable energy sources reaches 13% of the national energy demand by 2020. Under the Directive, the Member States are required to prepare national action plans by June 2010 using a harmonised template defined by the EU. The base year for scheduling the use of renewable energy sources in national action plans is year 2005.

2. Conformity of the objectives of Directive 2009/28/EC with Hungarian energy policy

2.1. External and internal challenges in energetics affecting the use of renewable energy sources

The high proportion of import is a definitive characteristic of the power supply of Hungary. Domestic production satisfies one fifth of the mineral oil needs and one sixth of the natural gas consumption, while known and expected stocking data presume future decrease in these figures. It is to be expected that **there will be a global competition for energy sources on the international markets raising security policy issues, while the continuous purchase of mineral oil and natural gas will become more and more difficult, and the risk of shortage will be increased**, which will also affect the prices.

The **tendency of increasing energy prices** on the world market will continue on the long term. The world market price of energy, especially of mineral oil and natural gas, will further increase on the long term, due to rapid increase in demand from certain quickly developing Asian countries, to increasing exploitation costs, and to various foreign policy events.

The increasingly strict environment protection and climate policy requirements affect the operating conditions of energetics. Power supply and power use has considerable effects on the environment and mitigating these effects is a key issue for energy policy. Protecting the environment and reducing pollution will become an absolute necessity during the decades to come. **Resolutions relating to energy**

policy shall be passed being aware of the fact that the provisions concerning environment protection and climate policy will become more and more strict.

All the above factors represent two requirements concerning domestic energy policy: energy saving shall be encouraged and the domestic proportion of use of renewable energy sources shall be increased.

2.2. Main principles of Hungarian and European energy policy

The entire European Union is facing challenges similar to those faced by Hungary, thus, irrespective of the requirements concerning the Member States, the energy policy priorities are identical. The most important strategic principles of European and Hungarian energy policy are built around the below three terms:

- **security of supply,**
- **competitiveness,**
- **sustainability.**

Improving energy efficiency and increasing the proportion of renewable energy sources are means that contribute to the performance of all pillars of energy policy.

An energy policy objective is to increase the **proportion of use of renewable energy** in Hungary in line with the characteristics and financial capacity of the country while fostering the competitiveness of the Hungarian economy, and the compliance of Hungary with the requirements of the European Union.

Due to the characteristics of Hungary, the use of biomass, biofuel, geothermal energy, and, in certain areas of Hungary, solar energy and wind power may be considerably developed among the renewable energy sources. With regard to the social and economic benefits of domestic use of renewable energy sources, we plan to encourage the use of renewable energy sources by setting up a clear legal and economic framework, and by granting supports utilising EU and domestic financial resources.

3. Developments of use of renewable energy sources between 2005 and 2008

Table 3-1 describes the use of renewable energy sources by Hungary between 2005 and 2008.

The use of renewable energy sources, including municipal waste, was 68.4 PJ within the total domestic energy use in 2008, which represented 6.1% of national energy use.

The electricity of 2362.8 GWh produced from renewable energy sources in 2008 represented 5.4% of the gross electricity use of 43.98 TWh.

Table 3-1

Use of renewable energy sources and consumption of electricity produced from renewable energy sources between 2005 and 2008

Energy source	Unit:	2005	2006	2007	2008
Geothermal energy	TJ	3 627	3 600	3 600	4 000
Solar collector	TJ	81	83	105	159
Firewood	TJ	22 189	22 519	23 224	24 053
Other sources (wood waste + agricultural waste)	TJ	21 368	22 900	24 955	27 015
Biogas	TJ	297	512	700	906
Electricity generated by hydropower plants in TJ (calculated with 3.6 MJ/kWh physical equivalent)	TJ	728	670	756	767
wind	TJ	36	156	396	738
photovoltaic	TJ	0.36	0.36	1.08	1.98
biofuels	TJ	214	450	1215	6900
Total renewable energy sources in heat value	TJ	48 540	50 890	54 952	64 540
Total renewable energy sources in heat value	PJ	48.5	50.9	55.0	64.5
Municipal waste	TJ	2 764	3 920	4 528	3 863
Renewable + municipal waste	PJ	51.3	54.8	59.5	68.4
Primary electricity					
hydroelectric power	GWh	202	186.0	210	213
wind power	GWh	10.1	43.4	110.0	205.0
photovoltaic	GWh	0.1	0.1	0.3	0.6
Total	GWh	212.3	229.5	320.3	418.6
Electricity from transformation of renewable sources					
from biomass	GWh	1585	1171	1379	1766
from biogas	GWh	25	36.7	47	69
Total electricity from transformation of renewable sources	GWh	1610	1208	1426	1835
produced from municipal waste	GWh	118	187	281.7	219.4
Electricity production from half renewable sources + municipal waste	GWh	1881.3	1531	1887	2362.8
Gross electricity consumption	GWh	41 982	43 066	43 945	43 928
Electricity production from half renewable sources+ municipal waste	GWh	1881.3	1531.1	1887.2	2362.8
On renewable source + municipal waste basis / Gross electricity consumption	%	4.48	3.55	4.27	5.40
Primary energy consumption by national economy	PJ	1153.2	1152.0	1125.4	1126.3
Renewable sources + municipal waste	PJ	51.3	54.8	59.5	68.4
Renewable sources + municipal waste / from total primary energy consumption	%	4.4	4.8	5.3	6.1

4. The renewable energy sources strategy and national objectives of Hungary

4.1. The renewable energy potential of Hungary

Biomass

Domestic analyses show that biomass is the largest energy source base in Hungary with the greatest potential for expansion. Though targeted energy crop production is not of considerable volume, biomass stocks may be increased significantly by producing energy crops, which is allowed by the measures of the New Hungary Rural Development Programme. The energy recovery of biomass-like by-products and waste has great potential, since technologies resulting in waste recovery (such as biogas production) are of increasing importance.

The energy recovery of biomass is an extremely important issue for agriculture, since energy recovery may generate further sales channels. The energy recovery of agricultural by-products and waste generates extra revenue for farmers, thereby improving profitability.

State-of-the-art combustion plants are available for the high-efficiency energy recovery of biomass. Plans provide for further development with regard to adaptation to local characteristics, assurance of continuous feedstock provision, transport and storage solutions, and promoting combined use with other renewable energy sources (such as bio-solar installations).

Upon establishing the support scheme for biomass production and use, we strive to benefit underdeveloped regions in order to eliminate differences in regional development.

Solid biomass

The potential of solid biomass is defined by the quantity of available feedstock and of feedstock producible with due regard to sustainability aspects. With sustainable forest management, 9 million m³ could be exploited from domestic forests, while, in reality, an annual quantity of 7 million m³ timber has been exploited for years. Utilised timber is 5.5 million m³, 3.5 million m³ of which is wood in stacked cubic metres, which is used as wood fibre, firewood, or pulpwood. The domestic plywood industry, the firewood demand from households, export, and energetic utilisation represent the main markets for the ca. 4 million m³ wood materials consisting of wood in stacked cubic metres and of 400-500 thousand m³ industrial waste wood generated in the course of wood processing.

Due to reductions and supports, several electricity producing capacity using biomass has been realized during the previous years. Expecting cheaper fuels, several Hungarian district heating company switched over to solid biomass based operations, and investments of considerable demand for wood were realized by transforming previously coal-fired power plant blocks to biomass utilisation (wood-fired block is operational in the power plants of Pécs, Kazincbarcika, Ajka and Oroszlány, while co-fired blocks are used in the power plant of Mátra).

Studies show that domestic forests are capable of satisfying the current demand with sustainable forest management, but feedstock for new capacities utilising considerable volumes of biomass could be assured only by harmonized and diversified biomass mix (briquettes, by-products, energy crops with targeted production). Establishment of new biomass capacities are subject to the effective implementation of the energetics program of the agricultural sector, of which the followings form important parts: harmonized collection of agricultural and forestry by-products and waste, increasing the efficiency of use of waste, and domestic development of energy crops production.

Energy recovery from tree crops and grasses will remain the main technology for power production using renewable sources in the future. The advantageous characteristics, regulability, and additional advantageous features (job creation, rural development) of these technologies, as well as the favourable agricultural potential of Hungary justify the application of these techniques.

Biogas

Biogas is currently used for heat and power production at ca. 40 locations in Hungary. In most cases the biogas utilisation facilities are installed by purification plants. A biogas facility established in Nyírbátor, which is of considerable significance even at European level, producing electricity based on farming and agricultural waste commenced its operations at full capacity in 2003. We plan to increase the number of biogas facilities using manure and various food industry waste by assuring advantageous support conditions. Municipal landfill sites possess serious biogas potential as well.

Wind power

The first wind power plant in Hungary has been operational since December, 2000, and the installed capacity was 202 MW at the end of 2009. This capacity is expected to be increased to 330 MW by the end of 2010, since the Hungarian Energy Office granted its authorization earlier for this capacity.

The fact that the Hungarian Energy Office published tenders for the installation of further 410 MW capacity in 2009 gives a new impetus to the spread of wind power plants, thus we plan to increase the domestic wind power plant capacity to 740 MW within a few years, which exceeds 8% of the installed power plant capacity of the domestic electricity system.

Geothermal energy

Hungary is a country of advantageous geothermal characteristics. The geothermal gradient is approximately 150% of the world average: the average heat output of an area unit is 90 mW/m², while the same average on the European continent is 60 mW/m². Accordingly, the temperature of rocks and enclosed water is 60°C at 1 km and 110°C at 2 km below surface. The geothermal gradient is the highest in the South-Transdanubia region and on the Great Plain, while it is lower, than the national average, on the Little Plain and highland areas.

The main area of use of geothermal energy in Hungary is direct heat utilisation and balneology (use of thermal springs and thermal water in thermal baths). As of this day, there are over 900 thermal wells in operation (wells and springs with the water being warmer, than 30°C at the outflow), ca. 31% of which serves balneology related purposes, more, than 25% of which is used as fresh water, and 45% of which serves direct heat utilisation purposes. The heating power of extracted thermal water is generally used in the agricultural sector for heating green houses, heating buildings, swimming pools, to produce hot water, and occasionally for the purposes of district heating. We are increasing the domestic use of geothermal energy by promoting the gradually spreading use of heat-pump technology.

As of now, there is no geothermal energy based electricity production in Hungary. The use of geothermal energy to produce electricity is limited by the relatively low temperature of hot springs (typical temperature range of known hot wells is between 40 °C to 95 °C), thus the efficiency of energy production may only be considerably low. According to present expert estimations, there are eight locations in Hungary that may be suitable for combined heat and power production with a total possible electric capacity of approximately 80 MW. Only the capacity of Fábianszék is estimated to be high (64 MW), while other locations are suitable for installation of small capacities (1 to 5 MW) only. The strict environmental regulations (the repression requirement concerning fluidum, deposition of formed salt) are considerably increasing the costs, thus should be taken into consideration in the course of implementation.

Solar energy

The potential of Hungary with regard to the utilisation of solar energy is relatively good, the annual number of hours of sunshine ranges from 1900 to 2200. This number is considerably higher, than that of Austria or Germany; however, domestic utilisation is only a fragment of the volume of utilisation in those countries.

As witnessed by the calls for tenders, there is an ever increasing interest in investments involving solar collectors in Hungary and we expect serious improvements in the future. Use of solar energy may be further accelerated by Directive 2002/91/EC on the energy performance of buildings transposed by Decree No. 7/2006 (V. 24.) of the Minister Without Portfolio. The directive prescribes that in case of new buildings with a total floor area over 1000 m², among others, the economic feasibility of decentralised energy supply systems based on renewable energy and the application of district heating shall be considered.

The use of solar energy to produce network electricity by photovoltaic devices is less common. Most of the domestic applications were designed to provide autonomous power supply by using suitable storage batteries. We intend to allow a greater role to this solution in the future on the field of supplying areas without electricity (highways, farms) with power, since, in case of long distances, the installation of autonomous power supplies with solar collector may be altogether cheaper, than establishing network connections.

Hydropower

The total installed performance of the 31 hydropower plant operating in Hungary is 55 MW, and their power production fluctuates around 200 GWh / year. Approximately 90% of produced electricity is generated by the four major hydropower plants (power plants in Kisköre, Tiszaölök, Kesznyéten, and Ikervár).

The hydropower utilisation potential of Hungary is not high, we have the lowest potential in European comparison. The hydropower reserves of small currents represent a theoretic potential of ca. 40 MW and a theoretic power potential of 200 GWh / year. Further construction of major hydropower plants in the following years, after the failure of the construction of the power plant system of Bős-Nagymaros, cannot be realistically taken into consideration, and the notable improvement of hydropower plants of smaller capacity is also unlikely due to the high investment unit costs. Possible locations for utilising hydropower plants are mostly dams without utilising hydropower built on rivers and currents in Hungary.

4.2. Differences between the renewable energy sources strategy and the national objectives

The Government of Hungary adopted the renewable energy sources strategy of Hungary for 2008 to 2020 by virtue of Gov. Decree No. 2148/2008 (X. 31.) forming part of national energy policy. **The renewable energy sources strategy sets specific targets.** According to the Gov. Decree, it is a strategic objective to achieve that the use of renewable energy sources in Hungary reaches 186.3 PJ by 2020. (The volume of use of renewable energy sources was 57.2 PJ in 2007.)

Sectoral targets were specified among the strategic objectives:

- the use of renewable energy sources in electricity production reaches 9 470 GWh by 2020, in comparison to the 1 887 GWh of 2007,
- the energy value of biofuels in fuel consumption reaches 19.6 PJ by 2020, in comparison to the 1.21 PJ of 2007.

The strategic objectives established in 2007 shall be reviewed with regard to the following criteria when specifying the national targets under Directive 2009/28/EC:

- the previous strategy did not take into consideration the effects of the economic recession of 2008 and 2009 reducing power demand. Latest power demand forecasts predict a considerably lower power demand for 2020, than the previous strategy, with regard to the energy savings expectations of the EU published in the meantime for 2020;
- the national targets of use of renewable energy sources are to be specified depending on total power demand and in line with EU methodology, where the national target of Hungary for 2020 is 13% of the total power demand;

- when elaborating the assumption of national obligations, the economic background of the country and the possibly available future support opportunities are to be taken into consideration. In case of Hungary, the scarcity of support sources shall be taken into consideration on the long term.

We set the national target of renewable energy use to be 13% of the national power demand of 2020 as predicted with regard to the above criteria, which is in compliance with the expectations of the EU.

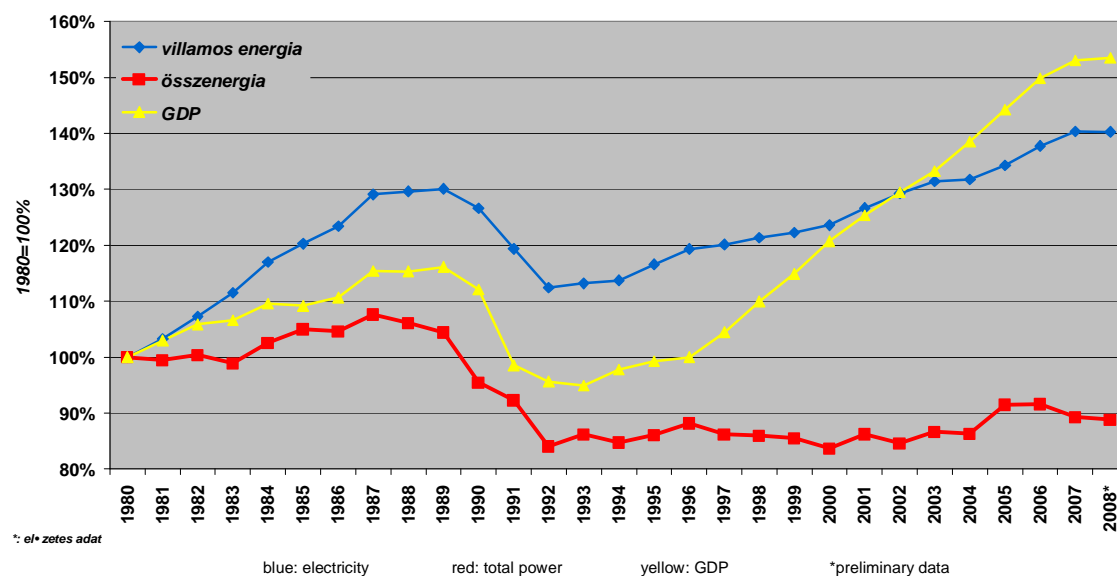
Our strategic objective is to significantly increase the use of renewable energy sources in order to realize the potential national benefits, thus Hungary will strive to achieve a future volume of use of renewable energy sources in the excess of the national targets by utilising the domestic and EU support opportunities.

4.3. The objective concerning national renewable energy use in the view of possible economic development paths and the corresponding total energy demands

4.3.1. Possible economic development paths

Table 4.3-1 demonstrates the developments to the annual GDP describing the economic development of Hungary and the past developments to total energy use and to electricity use.

Table 4.3-1



Data show that the GDP increased by a total of 27.5% between 2000 and 2008, while electricity use increased by 13.7% during the same period. Total energy use increased by 6.7%. During the last 8 years, 1% annual increase in GDP was accompanied by 0.5% annual increase in electricity demand and 0.25% annual increase in total energy demand. Based on this regression correlation and by

extrapolating to the period until 2020, the expected energy demand of each economic development path can be estimated, which estimation is to be corrected by the volume of realistic energy savings.

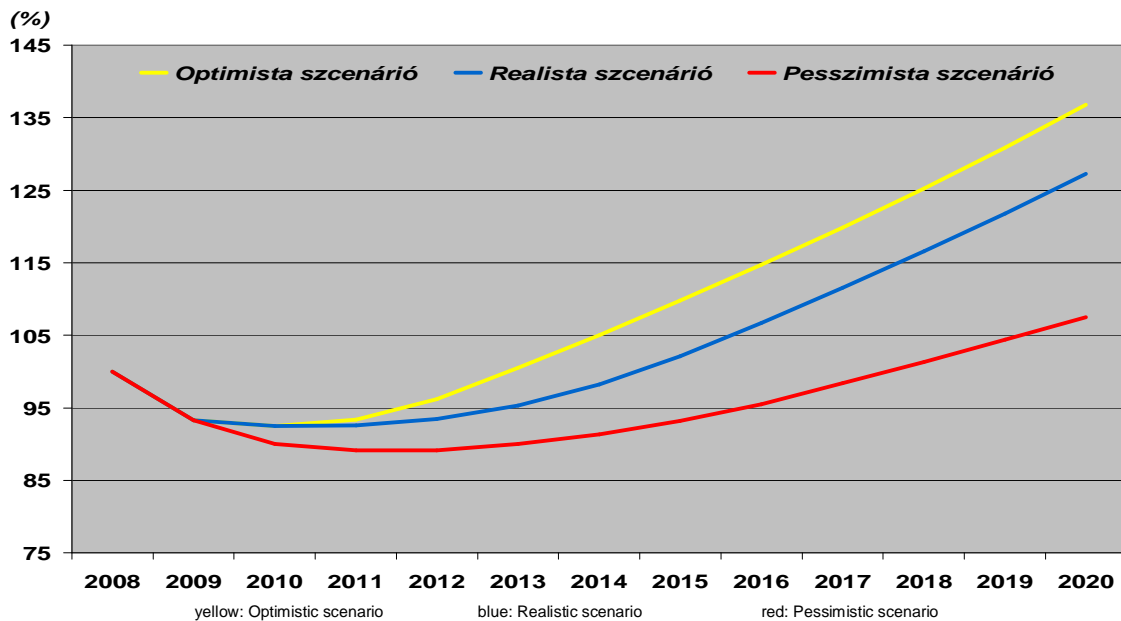
4.3.2. The development of energy demands in the course of various economic development paths

The economic development paths serving as basis for the possible energy demand forecasts are described in Table 4.3-1 and are demonstrated in Table 4.3-2.

Table 4.3-1

Year	GDP INCREASE SCHEDULE [% / year]		
	Optimistic scenario	Realistic scenario	Pessimistic scenario
2009 (expected)	-6.7	-6.7	-6.7
2010	-0.9	-0.9	-3.5
2011	1.0	0.1	-1.0
2012	3.0	1.0	0.0
2013	4.5	2.0	1.0
2014	4.5	3.0	1.5
2015	4.5	4.0	2.0
2016	4.5	4.5	2.5
2017	4.5	4.5	3.0
2018	4.5	4.5	3.0
2019	4.5	4.5	3.0
2020	4.5	4.5	3.0

Table 4.3-2



In addition to the examined development paths, the following increases in GDP apply to the period between 2009 and 2020:

- Optimistic scenario: 135.4%
- Realistic scenario: 127.3%
- Pessimistic scenario: 107.5%

Based on the GDP – energy use regression for the period between 2000 and 2008, the following increases in energy demand and energy demand may be considered for 2020:

Scenario	Energy demand in percent in 2020 [year 2007 = 100%]	Energy demand in PJ in 2020* [year 2007 = 1125 PJ]
Optimistic	108.09%	1217 PJ
Realistic	106.39%	1198 PJ
Pessimistic	101.93%	1148 PJ

* The energy demand does not contain the energy saving measures

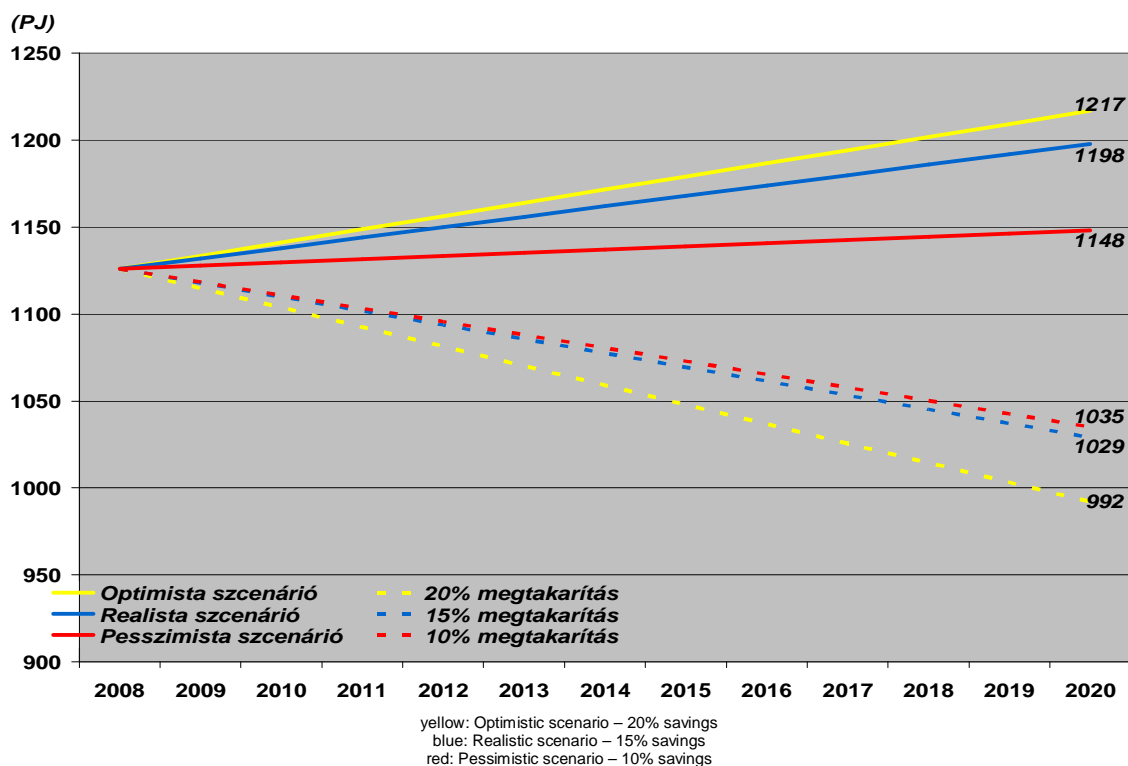
Energy demands indicated in the table are to be reduced – in the spirit of the EU expectations – by the energy savings to be made until 2020.

Based on the economic aspects of the various economic development paths, the **available energy savings can be estimated using the following assumptions for each path:**

- Under the optimistic scenario and taking into consideration possible EU supports, considerable domestic resources can be committed to promote energy savings. Under advantageous economic circumstances the 20% energy saving, in comparison to the data of 2008, expected by the EU can be achieved.
- Under the realistic economic development path the supports are less advantageous, thus energy saving may become less secure. Under less advantageous economic circumstances the forecast regarding the volume of possible energy savings cannot be higher, than 15%.
- Under the pessimistic economic scenario the support opportunities become considerably tighter, assets of economic actors become scarcer, thus promotion of energy savings is to be based on EU sources. Under disadvantageous economic circumstances, even a 10% energy savings rate is to be deemed as a favourable outcome.

The developments in demand under the discussed scenarios are demonstrated on Table 4.3-3, in which the trends indicated with broken lines show energy consumptions after energy savings.

Table 4.3-3



According to the analysis criteria discussed above, the total energy demand in 2020 falls between 992 and 1035 PJ / year.

4.3.3. National target of use of renewable energy sources for 2020

The volume of use of renewable energy sources in 2020, in line with the expectations of the EU toward the Member States, is 13% of the total energy demand of 2020. Under the discussed various scenarios and in line with the expectations of the EU toward the Member States, the followings are the possible targets of use of renewable energy sources in 2020:

- 129 PJ / year under the forecast 992 PJ / year total energy use of the optimistic scenario,
- 133 PJ / year under the forecast 1029 PJ / year total energy use of the realistic scenario,
- 135 PJ / year under the forecast 1035 PJ / year total energy use of the pessimistic scenario.

With the forecast total energy demand, the 13% proportion of use of renewable energy sources in 2020 will vary between 129 PJ / year and 135 PJ / year. **Taking into consideration the possible social and economic benefits of increasing the use of renewable energy sources, we set the target of use of renewable energy sources under Directive 2009/28/EC at the higher value, that is 135 PJ / year from use of renewable energy sources.** In order to achieve the use of renewable energy sources of 135 PJ / year, we have to increase the use of renewable energy sources of 49.9 PJ / year of base year 2005 by 270% by 2020.

5. Development of renewable energy use between 2008 and 2020

The mix of the forecast use of renewable energy sources until 2020, in line with the national target requirement, is described in Table 5.-1, and the development of production capacities is demonstrated in Table 5.-2.

Table 5.-1

Renewable production electricity		2005	2008	2010	2015	2020
Total	GWh	1803	2363	2662	5133	7790
Hydropower	GWh	202	213	215	230	250
Wind	GWh	10	205	450	1370	1700
Solar power (Solar cell)	GWh	0,1	0,5	2	8	16,5
Geothermal	GWh	0,0	0,0	0,0	65	422
Biomass	GWh	1506	1766	1800	3000	4440
Biogas	GWh	25	69	85	350	660
Renewable part of waste	GWh	59	110	110	110	187
Use of renewable energy sources for heat production		2005	2008	2010	2015	2020
Total	PJ	28.30	38.93	40.23	48	53.7
Solar power (Solar collector)	PJ	0.08	0.16	0.25	0.8	1.26
Geothermal energy	PJ	3.63	4.0	4.5	7.0	9.0

Biogas + bio-methane	PJ	0.07	0.29	1.0	5.0	7.0
Firewood, biomass	PJ	23.94	33.63	33.63	34	34.94
Renewable part of waste	PJ	0.57	0.85	0.85	1.2	1.5
TPES equivalent of renewable electricity		2005	2008	2010	2015	2020
Total	PJ	21.41	20.67	21.2	41.17	61.75
Hydropower	PJ	0.73	0.77	0.77	0.83	0.9
Wind	PJ	0.04	0.08	0.16	4.93	6.12
Solar power (Solar cell)	PJ	0.0	0.002	0.007	0.03	0.06
Geothermal	PJ	0.0	0.0	0.0	0.23	1.52
Biomass	PJ	19.62	18.1	18.4	30.9	45.7
Biogas	PJ	0.23	0.62	0.76	3.15	5.9
Renewable part of waste	PJ	0.81	1.1	1.1	1.1	1.55
Total use of renewable energy		2005	2008	2010	2015	2020
Total	PJ	49.92	66.5	70.43	104.17	135
Biofuel	PJ	0.21	6.9	9	15	19.55
Total (without biofuel)	PJ	49.71	59.6	61.43	89.17	115.45
Hydropower	PJ	0.73	0.77	0.77	0.83	0.9
Wind	PJ	0.04	0.08	0.16	4.93	6.12
Solar energy (Solar cell + Solar collector)	PJ	0.08	0.16	0.26	0.83	1.32
Geothermal	PJ	3.63	4.0	4.5	7.23	10.52
Biomass	PJ	43.56	51.73	52.03	64.9	80.64
Biogas+bio-methane	PJ	0.30	0.91	1.76	8.15	12.9
Renewable part of waste	PJ	1.38	1.95	1.95	2.3	3.05

Table 5.-2

Electricity production¹		2005	2008	2020
Total electric performance	MW	416.55	588.85	1945
Hydropower	MW	55	56.9	66
Wind	MW	55	178	920
Solar power (Solar cell)	MW	0.05	0.45	15
Geothermal	MW	0	0	65
Biomass	MW	290	321	725
Biogas	MW	4.5	12.5	120
Renewable part of waste	MW	12	20	34
Heat production		2005	2008	2020
Solar collector surface	1000m ²	50	100	700
Produced biogas + bio-methane	Mm ³ /év	13	39	560
Firewood, biomass demand	Mt/year	3.63	4.31	6.72
Renewable part of waste	Mt/year	0.2	0.28	0.44

¹ Remark: conversion of electricity to PJ:

- in case of hydropower, wind power and solar power
- in case of biomass
- in case of biogas
- in case of waste incineration

1 kWh: 3600 kJ
1 kWh: 10 300 kJ
1 kWh: 9 000 kJ
1 kWh: 10 300 kJ

According to the forecast, the use of renewable energy will increase from 49.8 PJ of 2005 to 135 PJ. Use for heat production will somewhat decrease within the use of renewable sources, but the proportion of green electricity production and of use of biofuels will increase.

As for the mix of use of renewable energy sources, solid biomass will play a dominant role in 2020 as well, but its proportion will decrease from 87% of 2005 to 60% by 2020, while its volume will increase from 43 PJ / year to 80 PJ / year. Utilisation of biogas, geothermal and wind energy will be more significant in the future. We also plan to multiply the earlier volume of use of solar energy and waste.

Green electricity production will increase from 1803 GWh of 2005 to 7790 GWh by 2020, mostly due to biomass based production, and wind power plants are expected to improve considerably. Structurally, the one-sided use of resources of 2005 will be softened: the proportion of solid biomass in green electricity production will decrease from 83% to 57% by 2020, even if the use of fuels increases from 20 PJ / year to 45 PJ / year. Proportion of use of wind energy will significantly increase (to ca. 22%), and the use of biogas (8.4%) and geothermal energy (5.4%) will also gain more significant roles.

The forecast assumes the installation of 1529 MW electricity production capacities between 2005 and 2020, which will be mostly due to investments in wind energy and biomass (the total increase in capacity will be 1300 MW by 2020).

The use of renewable energy will increase from 28 PJ of 2005 to 54 PJ by 2020. Within the use of renewable energy, the proportion of heat production is expected to be 40% by 2020, meaning that its proportion will considerably decrease in comparison to 2005 data.

Similarly to green electricity production, the use of renewable energy sources on the heat market will be more balanced by reducing the proportion of solid biomass (from 85% to 65%) and increasing the proportion of use of biomass and solar energy.

6. Conditions necessary to achieve the targets

6.1. Technical and economic conditions

Electricity production

- Biomass based technology plays an exceptional role in the improvement of electricity production. Dynamic increase is subject to the following conditions:
 - Use of biomass production is based on currently operational or shortly becoming operational (already authorized or to be authorized) units in the near future. In case of these power plants the volume of electricity production and use of fuel can be forecast with high precision and reliability. As an effect of the support scheme, the improvement of several new projects is expected in the future.

- We plan to establish the increase in use of biomass by an effective agricultural by-product/waste utilisation stimulation program and an energy crops production program, providing the sufficient biomass raw material in an environment friendly manner.
- We assure the harmony between the use of agricultural by-products, the energy crops production program, and the arising demand for biomass. Shortage in raw material may result in supply problems, while storage of unused energy crops and other by-products is costly.
- With due regard to environmental, cost and size efficiency related, and rural development considerations, we plan to give an emphasized role to decentralized power production.
- Despite its lower potential, we handle with special attention the utilisation of biogas among biomass, due to its advantageous and versatile usability for energetic, environmental and rural development purposes.
- As for use of hydropower and based on current data, we do not expect considerable improvements on mid-term. In order to promote economic development opportunities, we intend to have prepared a detailed evaluation analysis of the unexploited hydropower potential of Hungary, including the areas of smaller streams and rivers. Based on the evaluation analysis, we also will have elaborated a recommendation on prospective power plants (including pumping power plants) describing local characteristics, circumstances, and potential results.
- Despite considerable natural reserves, geothermal energy based electricity production has not been proved a promising route for development, yet. The reason is that these kind of investments seem to be risky undertakings due to the high cost of geothermal energy based power plant drilling technologies and to geological characteristics (relatively low water temperatures work usually with low efficiency thus allowing only for uneconomic investments); however, new statutory provisions allow opportunities for geothermal energy based electricity production.
- As for the development of wind power plants, we promote that the allowed capacity of 740 MW be realized by 2015.
- Based on international experiences, significant decrease in the costs of production of solar cells is probable on mid-term and long term, which would support the increasing use of solar power for electricity production purposes.

Heat power production

- We need to achieve an approximately 20% decrease in current heat demands within the next 15 years, as a result to absolutely necessary energy efficiency measures on the side of consumers.
- Recently arising demand from consumers on both centralized and decentralized heat markets shall meet the provisions of TNM Decree No. 7/2006 (V. 24.) on

energy performance of buildings and shall meet the more and more strict requirements of Directive 2002/91/EC.

- We need to decrease the specific use of energy of technological heat demands by increasing the overall level of technology and by providing necessary supports.
- We promote the installation of new geothermal energy power plants by utilising dry hydrocarbon wells.
- We promote the reasonable use of systems directly using geothermal energy and of new energetic heat pumping systems connected to water use for spas utilising higher heat grades, even in order to approach the standard of EU Member States, where the number of installed heat pumps increased by 500% in the last 10 years.
- In relation to district heat supply, we support the realization of combined heat and power production using renewable sources (biomass or geothermal energy) on the heat market.

We regard it as an important duty of the State, that investors and **consumers are provided with adequate information** and reference, in order to broaden the publicity of environmental problems and the opportunities in the use of renewable energy sources.

6.2. Financing conditions

According to preliminary estimates, the funding needed to achieve the national targets (green electricity production of 7 790 GWh per year and total use of renewable energy sources of 135 PJ per year by 2020) is HUF 300-350 billion.

A significant proportion of these funds is available under the support scheme managed by the Ministry of Agriculture and Rural Development, which is to be used for agricultural purposes. For the support of technical investments, HUF 63 billion is available until 2013 under the Environment and Energy Operational Programme of the Rural Development Plan, with lower amounts available under other support schemes.

It is clear from a comparison of the funding required and the funds available that, in order to increase the use of renewable energy sources as planned, **we need to take measures to provide the necessary funds from domestic and EU sources and we need to significantly enhance information and awareness-raising activities.**

7. International Cooperation (export-import, joint projects)

Export and import opportunities may involve electricity and biomass. The future and planned cooperation situation in this respect is described below.

- Directive 2001/77/EC sets forth a national target concerning the proportion of green electricity to the total use of electricity, which target, in case of Hungary, is to achieve 3.6% by 2010. The proportion of green electricity to the total national use of electricity was 5.4% in 2008, meaning that Hungary considerably exceeded its obligation imposed by the EU. There is an indirect relationship between this figure and the obligation arising from Directive 2009/28/EC, since the increase in electricity production using renewable energy sources affects the aggregate proportion of the use of renewable energy sources, thus the feasibility of the 13% target partially depends on the volume of green electricity production.

Hungary does not plan to export green electricity, and all electric power produced using renewable energy sources is booked as part of domestic use of renewable energy sources. There are no import needs concerning green electricity.

- Hungary both exports and imports timber (and, in a broader sense, biomass). Increasing energy crops production is necessary to provide supply in the future, in case the planned developments will be implemented, thus the strategic objective is to satisfy domestic demand. Equipped with developments in the agricultural energy sector and by balancing raw material production and use, Hungary will not need to import either, thus the volume of international trade in this respect will be negligible in the future.
- The situation of Hungary in respect of biofuels differs in the cases of bioethanol and biodiesel.

Long-term future plans outlined by potential investors in bioethanol production considerably exceed domestic demands, thus Hungary may even be able to export considerable volumes, if the necessary developments, which are also encouraged by domestic support schemes, are implemented. Volume of the export capacity cannot be planned in advance, it is dependent on the development of agricultural production and to the implementation of eligible investments.

As for biodiesel, the domestic characteristics are expected to satisfy only approximately 80% of the forecast demand. The primary objective is to satisfy the requirement regarding the proportion of biofuels by increasing the use of bioethanol. If it cannot be fully satisfied, Hungary may be forced to import biodiesel. The volume of necessary import cannot be specified in advance, it is also subject to the implementation of possible investments.

- Joint projects may advance the feasibility of obligations of the partners, thus Hungary will endeavour to participate in reasonable and economic joint projects in the future. However, there are no preliminary plans on this field.

In summary, Hungary fundamentally strives to be self-sufficient in increasing the use of renewable energy sources, and cooperation activities within the EU will probably be limited to the field of biofuels.