Monitoring Community greenhouse gas emissions and the implementation of the Kyoto Protocol

Biannual report of

The Republic of HUNGARY

in accordance with Article 3(2) of Decision 280/2004/EC

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1 Introduction

The Decision 2004/280/EC concerning a mechanism for monitoring Community GHG emissions and for implementing the Kyoto protocol in its article 3(2) requires that Member States shall, for the assessment of projected progress, report to the Commission every two years:

- information on national policies and measures which limit and/or reduce greenhouse gas emissions by sources or enhance removals by sinks;
- national projections of greenhouse gas emissions by sources and their removal by sinks;
- information on measures being taken or planned for the implementation of relevant Community legislation and policies and
- information on institutional and financial arrangements and decision making procedures to coordinate and support activities related to participation in the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol.

This report provides the relevant information and projections as required under Article 3 (2) of the Decision.

2 Methodology notes and uncertainty

2.1 Notes on the methodology of policy effect forecasts

In order to give a clear and quantified picture of the mechanism of how the individual policies and measures result in GHG emission reduction, the input data and the method of calculation is explained one-by-one in the "Effects and impacts" section of the relevant chapters. The origin of the input data is diverse and it is due to the different nature of the individual policies, often either the baseline or the method of calculating the emission reduction is different, too. These differences and the applied methodologies are therefore described in each case.

As a consequence the resulting emission savings may not be directly added up in order to receive a cumulative GHG emission reduction value. Taking into account the overall effect of the measures requires a rather complex transformation of values, which was incorporated in the national emission forecast.

As to the methodology of the national forecast, a separate chapter explains its basic principles and assumptions.

2.2 Uncertainty

The reliability of data of the forecasts is determined by the reliability of the inventory data of the recent years and the uncertainties of the forecast itself.

In preparing the inventory, the reliability of source category was calculated according to Good Practice Guidelines, mainly for the key source categories. Where no such possibility was

available, the level of uncertainty was judged by the experts working on the inventory calculations. Regardless of the actual values, it can be generally stated that the lowest uncertainty is associated with CO_2 emissions, and the highest uncertainty is related to N_2O emissions from fuel combustion.

By following the instructions provided in Good Practice Guidelines the report tries to determine the uncertainties associated with each activity. The reliability of the actual inventory is characterised by the following overall aspects:

The most reliable calculation is the emissions of CO_2 and its weight within the emissions is by far the largest (in CO2 equivalent is above 70 %). The highest uncertainty is associated with the calculations of N_2O, which represents some 15 % in overall emissions. The same weight is attached to the emissions of CH_4 that features medium uncertainty (about 11 %). Fluoride gases have no significance from this aspect, as their contribution to the emissions is only 1%. By these considerations the estimated uncertainty of emission of each gas is as follows:

CO2	+/-2-4 %
CH4	+/-15-25 %
N2O	+/-80-90 %

As a consequence, the overall uncertainty of the total inventory emissions is estimated below 10%.

The uncertainty of the forecast itself is estimated as the double of that of the inventory.

3 National policies and measures

3.1 General

Hungary's greenhouse gas mitigation policies are all based on a set of basic legislation which establishes a legal and /or financial framework for more concrete, targeted policy tools. Although these pieces of legislation have no direct, quantifiable emission reduction effects, they are worth to be provide a brief description of them in order to better illustrate Hungary's efforts under the UNFCCC and the Kyoto Protocol is to be provided. The scope of this legislation covers areas far broader than GHG mitigation; in the following sections only those aspects are discussed that are directly related to the subject matter of this report.

3.1.1 Act on general rules of the protection of the Environment

Act LIII of 1995 codifies the general principles of environmental protection and creates the legal basis for all the subsequent regulations that are related to the environment.

3.1.2 Act on Electricity

Act CX of 2001 on Electric Energy declares among its general provisions, that production distribution, commerce and utilisation of electric power must be conducted by taking into account the aspects of, among others, environmental protection, nature conservation, energy saving and protection of human health. Through these provisions the Act provided basis for several further pieces of legislation and measures that supports GHG mitigation. The Act also defined what is considered renewable energy, introduced the concept of IPPs.

Besides the general provisions, the Electricity Act also laid down the principles of support for renewables and cogeneration and tasked the Minister of Economy do develop the details of support mechanism.

3.1.3 National Development Plan and National Rural Development Plan

In preparing for the utilisation of the EU Structural Funds, Hungary has prepared the National Development Plan (NDP). On the basis of a thorough analysis of economic and social conditions, NDP identified the priorities that are to be supported by using finance from the Structural Funds.

Improved quality of the environment is among the three major objectives of the Plan. Low level of renewable energy utilisation is identified as a major problem, and increasing the share of renewables within overall energy use is considered as key element of achieving the long-term goals of the NDP.

The specific goals of the Plan are to be achieved through five operative programmes, three of which has relevance from the aspect of GHG mitigation (Environment and Infrastructure Operative Programme – KIOP; Agriculture and Rural Development Operative Programme – AVOP; Regional Development Operative Programme – RFOP) and will be referred to in the current document.

The National Rural Development Plan (NRDP) was developed in order to identify priorities for the utilisation of support provided by the European Agricultural Orientation and Guarantee Fund. The general objectives of NRDP are

- To improve income and safeguard employment in rural areas;
- To ensure environment-friendly development of agriculture, rationalisation of land-use
- and to encourage landscape management.

The specific objectives include the improvement of the quality of the environment and increasing forest cover and thereby improve the ecological conditions.

3.1.4 Energy Saving and Energy Efficiency Action Programme

Based on the principles of Business Model of the Energy Sector and related policy decisions, the government adopted the new Energy Saving and Energy Efficiency Action Programme (ESEEAP) (Resolution of the Government 1107/1999.(X.8.) Korm. that began in 2000 and is to run until 2010. The Action Programme also includes initiatives related to renewable energy sources. The Action Programme lists 15 specific policy measures. That will be referred to later in this document. The overall goals of the Action Programme are: 3,5% /year reduction of energy intensity; the saving of 75 PJ/year of primary energy use; reduction of 50 kt/year of SO2 and 5 Mt/year of CO2 emissions, increase of renewable energy production.

3.1.5 2nd National Environmental Protection Programme

As the sequel of the First National Environmental Programme (NEP-I) between 1997-2002, on 8 December, 2003, the Hungarian Parliament approved its Resolution 132/2003. (XII.11.) OGY, on the National Environmental Programme (NEP-II.) for 2003-2008.

NEP-II relies on the most important Hungarian and international environmental policy principles, which can be classified into three main categories:

- Traditional environmental protection principles, for example, principles of precaution, prevention, reconstruction, liability, co-operation, information, publicity and the 'polluter pays'.
- Additional principles exemplary for Hungary on the basis of the environmental government activities of developed countries (shared responsibility, transparency in planning, decision-making, financing, implementation and control, predictability in regulation and financing, accountability, clear objectives, measurable performance, partnership, subsidiarity, additionality, measures with multiple benefits).
- Taking into account the principles of sustainable development[1]; NEP-II must promote the establishment of social, economic and environmental conditions required for the transition towards sustainable development.

The primary objectives of the NEP-II are the following:

- The protection of the ecosystem
- Provision of a harmonic relationship between society and environment
- Enforcement of environmental criteria in economic development.
- Strengthening of knowledge on, and awareness of environmental processes, impacts, environment and nature conservation and co-operation

These primary aims are broken down to individual concrete objectives, which are planned to be achieved through nine specific Thematic Action Programmes of:

1. Raising Environmental Awareness
2. Climate Change
3. Environmental Health and Food Safety
4. Urban Environmental Quality
5. Biodiversity Conservation and Landscape Protection
6. Rural Environmental Quality, Land-area and Land Use
7. Protection and Sustainable Use of Water
8. Waste Management
9. Environmental Security.

The relevant foreseen actions will be referred to in the current document. It is noted that tasks within the Thematic Action Programmes of NEP-II are divided into two groups. NEP-II partly includes interventions which are currently working (existing tasks), they are present separately or in other programmes and in this framework their necessary resources are also targeted. Incorporating these tasks into NEP-II is justified because environmental problems are dealt in a complex way. At the same time there are new elements among the goals and tasks, which have not belonged to the tasks of any programme but are indispensable for the solution of a given environmental problem.

[1] Sustainable development is understood according to the definition of Herman Daly, i.e. as "progressive social betterment without growing beyond ecological carrying capacity".

3.2 Energy

3.2.1 Supply side

3.2.1.1 Limitation of SO_2 emissions from power plants

3.2.1.1.1 Objectives and description

The general and primary objective of the relevant legislation was to significantly reduce air pollution from stationary sources, especially that caused by SO_2. The Decree 22/1998 (VI.26) KTM and a sequel Decree of the Minister for Environment and Water 10/2003. (VII.11.) KvVM which is replacing it have set more strict emission limits than those in force earlier and offered two alternatives for the operators of the emission sources: either provisions are made to reduce emissions below the limit (e.g. FGD[2] units are installed) or the operation has to be stopped. The deadline for the measures for large power stations was January 1st 2005, for other plants it is (mainly industrial) 31st December, 2008.

Within the energy industry the new regulation affected primarily those power stations that used low quality, mainly domestic coals with high sulphur content.

The secondary objective of the policy is to reduce GHG emissions by the fuel switch and technology improvement projects stemming form the policy.

3.2.1.1.2 Policy instrument type

Regulatory.

3.2.1.1.3 Status of implementation

Implemented.

3.2.1.1.4 Implementing entity

Regional Environmental Inspectorates, via the construction and operation licensing procedures.

3.2.1.1.5 Monitoring indicators

The achieved emission reduction can be monitored through the electric power production and fuel use data of the affected power plants. These can be evaluated against the theoretical emissions that correspond to the same quantity of electric power generated from coal in the same plants. The data are available from MAVIR[3].
The national GHG inventories (LRTAP, UNFCCC) can also be used for monitoring.

3.2.1.1.6 Effects and impacts

As the direct result of the policy several mitigation measures were put in place, including the installation of FGDs and a series of fuel switch projects[4]:

FGD unit installation:

[2] Flue Gas Desulphurisation
[3] MAVIR – Hungarian Power System Operator Company
[4] It is noted that the application of the FGD technology increases CO_2 emission, but the other strategies (fuel switch, suspending operation) result in a net emission reduction.

- **Mátra Power Plant**: Installation of a wet SO_2 scrubber in 2000. Besides, other modernization measures were/are being taken:
    - Mining retrofit program finished.
    - Plans exist to increase the capacity of the plant by installing a new unit with mixed fuel combustion after 2008. The purpose of this is to achieve a 1000MWe capacity by the end of 2010, instead of the current 836 MW. However, the Capacity Plan of the system operator does not calculate with the planned increase until 2015.
    - Experiments have also started with adding woodchips to the fuel mix. It is planned that the share of renewables will exceed 10% in the fuel use by 2006.
- **Vértes Power Plant:** The installation of an FGD has been completed. The mine of this plant (Márkushegy Mine) is the only subsurface mine viable in the future. Its planned production after the investment is 1500-2000 kt/year.

Fuel switch projects:

- **Borsod Power Plant**: has decided to switch two of its boilers to biomass fuel with a planned 260GWh electricity production and the combustion of 316 kt of biomass. This replaces the 700 kt sub-bituminous coal from the Lyukóbánya Mine, which was closed. The rest of the boilers have been switched to natural gas.
- **Tiszapalkonya Power Plant**: it has switched to co-firing of wood-chips and sub-bituminous coal.
- **Pécs Power Plant**: The plant accomplished a major reconstruction project by converting all but one of its units to natural gas in place of coal. The remaining 50 MW unit was converted to wood-chip firing.
- **Ajka Power Plant**: In order to meet the emission limits the plant was modified so that adding woodchips to the coal fired would be possible.
- **Tatabánya Plant**: Switched to natural gas and installed gas engines to improve efficiency.

Stop operation:

- **Inota Power Plant:** Its owners have temporarily suspended the operation of the plant. Plans exist to install a natural gas fired CCGT[5] unit, but no concrete steps have been made as yet.
- **Bánhida power plant:** Stopped operation from the beginning of 2005. Various plans exist for the utilisation, but no concrete projects have been so far initiated.

Regardless, how important is the reduction of SO_2 emissions from the aspect of Hungary's international commitments, this alone would not qualify this measure to be included in the current report on GHG emissions. It must be noted however, that as result of the implementation of the policy its secondary aims, i.e. the indirect reduction of GHGs is also fulfilled through the following benefits:

[5] Combined Cycle Gas Turbine

- Through the fuel switch projects coal was substituted by natural gas (with more than 40% less specific CO_2 emissions) and biomass (zero net CO_2 emission).
- Due to the falling demand for domestic coal the mining-related direct (energy use) and fugitive emissions are reduced.
- Stop of operation of the Inota plant may also reduce overall GHG emissions, although this effect is questionable, as the power production of the plant is obviously substituted by other sources such as increased output form other plants and/or imports.
- It is important to emphasize, that as a special benefit this policy combined with the subsidies for renewable based power generation (discussed separately) resulted the first biomass-power projects in Hungary (Pécs, Borsod, Tiszapalkonya, Ajka). This, besides the direct CO_2 emission reduction significantly contributed to
    - increasing awareness through the wide media coverage
    - creating markets for wood fuel and eventually energy crops.

The quantitative effects can be forecast using the monitoring method described above. It is noted that in the calculation allowance is made for the eventual improvement of plant efficiencies due to the conversion projects. Thus the savings are calculated by comparing the forecast emissions against the emissions calculated with the specific emissions normalised to power generation of the individual plant before the measures[6]. It is also assumed that the – as no further increase of capacity of the plants in question is planned, the yearly power production and fuel use in 2010 and 2015 will be the same as forecast for 2005. Thus the reduction of CO_2 emissions achieved is 980 kt in each year examined[7].

3.2.1.2 Support of cogeneration

3.2.1.2.1 Objectives and description

The objective of this policy item is to promote combined heat and power (CHP) production as a highly efficient form of energy generation and tool of GHG emission reduction. The relevant legislation (Decree of the Minister of Economic Affairs and Transport 56/2002(XII.29) GKM.) adopts two ways of support:

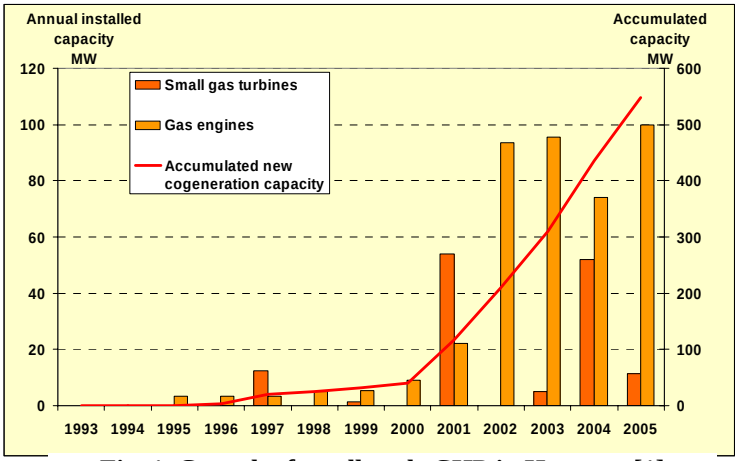

Fig. 1. Growth of small-scale CHP in Hungary [1]

- Stipulates the mandatory purchase of co-generated electric power
- Provides financial support for the operators of CHP plants in the form of regulated and subsidised feed-in tariff.

Finance for the subsidies is provided by a small earmarked fraction of the regulated end-user electricity prices.

[6] Source of input data: Capacity plan of MAVIR 2003.
[7] It is noted that the calculation includes the Pécs Borsod and Ajka power stations only, as there are no reliable data on the performance of the Tiszapalkonya plant as yet and the future of Inota is uncertain.

The mandatory purchase of co-generated power created a safe market for primarily small-scale CHP plants and the subsidised feed-in tariff ensured attractive economic performance. As a consequence rapid growth of small-scale CHP capacity has been experienced. By the end of 2005, it is estimated that the installed capacity of small-scale CHP, (practically all of them use the natural gas fuelled gas engine technology or gas turbines, smaller than 50 MW) exceeded 500 MW. It is to be noted that in relation to the installation of CHP plants in district heating systems, considerable modernisation has taken place in the primary systems, and the heat sources.

However, the rapid growth of small scale CHP capacities created some problems in the control of the national power system, therefore limitations were included in the legislation that are expected to considerably slow down further growth:

- Yearly and monthly overall efficiency criteria are set as a condition of subsidy
- Bigger than 6 MW_e capacity plants can only receive subsidy if their heat is used in district heating
- The latest feed-in tariffs provide lower economic attractiveness.

The GHG-emission reduction benefits of the policy are the following:

- The new natural gas fired CHP units replace some of the fossil (coal and oil) power generation capacity of the Hungarian power system, as well as some of the heat-only thermal plants.
- The overall efficiency of the CHP plants is higher than the combined efficiency of conventional power generation and heat only plant, resulting in net fuel saving and hence emission reduction.

3.2.1.2.2 Policy instrument type

Economic and regulatory

3.2.1.2.3 Status of implementation

Implemented

3.2.1.2.4 Implementing entity

Hungarian Energy Office

3.2.1.2.5 Monitoring indicators

Monitoring is through the yearly energy production and fuel use data of the individual CHP plants. These data are mandatorily provided to the Hungarian Energy Office on a monthly and to MAVIR on a yearly basis.

The emission reduction can be calculated by comparing the energy production data to a baseline scenario, where the same amount of electricity is generated in the Hungarian Power system and the heat in gas fired heat only plants.

3.2.1.2.6 Effects and impacts

The mandatory purchase of co-generated power created a safe market for primarily small-scale CHP plants and the subsidised feed-in tariff ensured attractive economic performance. As a consequence rapid growth of small-scale CHP capacity has been experienced. By early

2005, the installed capacity of small-scale CHP exceeded 500 MW, with a net production capacity of more than 400 MW.
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The forecast of the quantitative effects follows the monitoring method. As to the baseline values for power generation, they are based on the values and methods developed by the Ministry of Environment and Water for the calculation of reference CO2 emission factors used for baseline calculations of JI projects[2]. As these values are developed for 2008-2012 only, using their linear trends between 2008-2010, and 2010-2012, extrapolations are made to 2005 and 2015.
In the forecast it is assumed that due to the limitations built in the regulations the growth of CHP capacities will be slower than in the recent years. The forecast also assumes a slight increase in overall equipment efficiencies with regard to technological development.

Input data forecast		2005	2010	2015
Power output	TWh	1,509	1,650	2,06
Heat sales	PJ	6,40	7	10
Primary fuel use	PJ	14,6	16	21,2
CO2 emission total	kt	817	893	1183
Baseline				
Heat baseline				
Fuel use	PJ	7,1	7,8	11,1
CO2 emission heat	kt	396,9	434,2	620,2
Power baseline				
Specific CO2 emission	kt/TWh	698	714	664
CO2 emission power	kt	1053	1178	1368
CO2 baseline emission total	kt	1450	1612	1989
Reduction achieved	**kt**	634	719	805

3.2.1.3 Support of renewable-based power generation

3.2.1.3.1 Objectives and description

Similarly to the support of CHP power generation from renewable energy sources is supported by both the mandatory purchase of such power by either the national transmission company or by the distribution companies and through subsidised feed-in tariffs.

The primary objective of the policy and the relevant legislation (Act LXXIX of 2005 on the amendment of Act CX of 2001 on electricity; Decree (XII.29) GKM.) is to ensure that Hungary can comply with its international commitments to increase the share of renewable based power generation to 3.6%, and the share of overall renewable energy to 5% by 2010, as a part of the general GHG mitigation policy of the European Union.

With these deadlines approaching some further incentives were incorporated in Hungary's renewable support policy such as technology-specific increased feed-in tariffs.

3.2.1.3.2 Policy instrument type

Economic and regulatory

3.2.1.3.3 Status of implementation

Implemented

3.2.1.3.4 Implementing entity

Hungarian Energy Office

3.2.1.3.5 Monitoring indicators

Monitoring is through the yearly energy production and fuel use (where applicable, such as biomass plants) data of individual plants. These data are provided mandatory to the Hungarian Energy Office on a monthly and to MAVIR on a yearly basis.

The emission reduction can be calculated by comparing the energy production data to a baseline scenario, where the same amount of electricity is generated in the Hungarian Power system. The specific CO_2 emission of the JI projects referred to earlier can be used as basis.

3.2.1.3.6 Effects and impacts

The implementation of this policy item increases the attractiveness of renewable power projects by providing a safe market and subsidised revenues. However, due to the large variety of the available technologies the forecast of the realised CHG mitigation requires a short review of the feasibility of the major options.

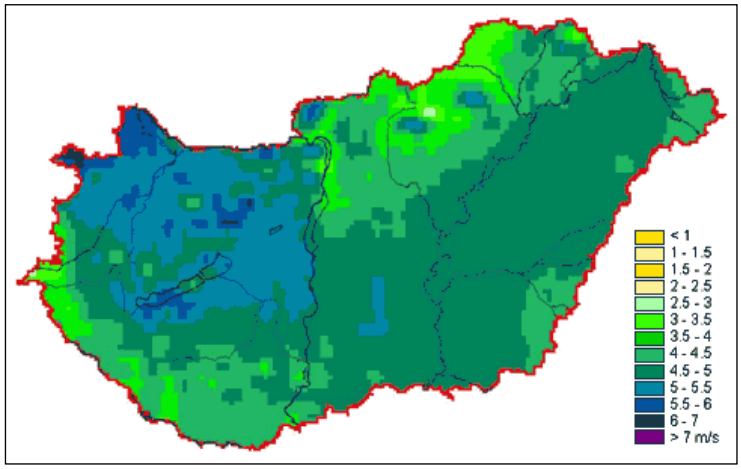


Fig. 2. Average wind in Hungary velocities at 50 m height

Wind power

Hungary has limited endowments in terms of wind power: the typical potential ranges between 70-200 W/m^2, the highest values reaching 260 W/m^2 in the north-western part of Hungary. In the long term, the total installed wind power capacity is also limited by load control considerations of the national power system: roughly the 50% of

the total electricity demand covered by the Paks nuclear plant, the fossil fuel plants need to provide hot stand-by capacities for wind power.

Due to the limited subsidies and insufficient wind potential, so far only a few wind-power plants with relatively small unit sizes have been commissioned (Kulcs: 600 kW, Inota: 200 kW, Mosonszolnok: 2 x 600 kW, Mosonmagyaróvár 2 x 600 kW.) The most recent changes in the renewable policy however gave a boost to windpower project ideas: there are investor initiatives for some 200 projects with the installed capacity exceeding 1000 MW. Such a rapid increase, compared to the actual peak demand of Hungary (forecast to increase from 6270 MW in 2005 to some 7500 MW in 2015), with the specialities of the Hungarian power system (high share of nuclear energy and fossil fired plant to provide system control) in mind, is clearly unrealistic. Therefore, adopting the conservative forecast of MAVIR the actual installed wind power capacity is expected to reach 100-200 MW by 2010 and some 220-440 MW by 2015 maximum. In the calculations the following forecast is used:

	Installed capacity MW	Electricity output TWh
2005	3,2	0,005
2010	170	0,250
2015	245	0,375

Biomass

In terms of renewable potential, Hungary is best endowed with biomass, owing to the importance of agriculture and forestry within the economy, the high level of forestation and the farming traditions in some large regions. The share of biomass is estimated to be more than 70% within the technical potential[8]. For power generation purposes hard-wood provides the best opportunities in the short term due to its favourable combustion characteristics. In the long term herbaceous plants, such as energy grass, can have high importance, when some current technical problems with their combustion at high temperatures necessary for efficient power generation, are resolved.

Beside the already implemented fuel switch projects referred to in section “Limitation of SO2 emissions from power plants” new biomass (woodchip-fired) capacities will have to be created before 2010 if Hungary is to meet its international commitments. These can either be co-firing biomass with coal in the existing plants (e.g. Mátra, Tiszapalkonya) or preferably some green-field projects. This, however, can be limited by the quantity of the available fuel from the existing forests, thus simultaneous development of energy forests is of high importance (see it discussed in the relevant section).

In pursuing the renewable targets biomass is not only preferred due to its high potential and availability but also for the spin-off effects of such projects, such as infrastructure development, job creation or the general regional development.

The forecast biomass-based power generation data - excluding those referred to in the fuel switch projects – are the following:

[8] Please refer to: 3rd National Communication for the UNFCCC

	Installed capacity MW	Electricity output TWh
2005	24	0,11
2010	175	0,937
2015	210	1,128

Geothermal energy

Hungary is richly endowed with geothermal energy, in the estimation of renewable energy potential geothermal is considered to be the second most important after biomass. This, however is not true is power generation potential is considered. Due to the relatively low geothermal well temperatures (typically 40-95°C) the cycle efficiency of the possible ORC[9] plants is low, and the net power output is small. With respect to the high investment costs this feature, together with the problems created by the salt content of the waters geothermal based power generation is considered to have small significance in the time span investigated.

Hydro power

Hungary being mainly flat, hydropower has little potential within the overall electricity balance. The currently installed total capacity is 55 MW, the annual power generation is around 195 GWh, depending on the weather. Although the theoretical hydropower potential is 7500 GWh, whose 72% is provided by the Danube mainly due to historical and political reasons a large scale hydropower project is not planned in the medium term. The theoretical potential of the small rivers and streams is 338 GWh/year, which indicates that considerable increase is unlikely. Plans however exist, including, among others, a 5MW small hydro plant for the utilization of the cooling water from the Paks nuclear plant.

The forecast data for hydropower are the following:

	Installed capacity MW	Electricity output TWh
2005	55	0,195
2010	60,1	0,250
2015	70,1	0,285

Solar power

Although Hungary has relatively high number of sunny hours, there is an agreement between the experts that the major field of solar energy utilization is and will be primarily hot water generation in the medium term. Solar electric power generation, due to the high expenses of the technology and the low output of the currently available solar cells is unlikely to play a decisive role in the time-span investigated. Still, there are pilot projects, but the capacity of even the largest solar energy plant, just recently commissioned in the Gödöllő University, is only 10 kW. At any rate, with the improvement of the technology some modest increase of installed solar power capacity is forecast, in particular for those special applications where autonomous power supply is pursued. The following contribution of solar power to the overall power balance is foreseen:

[9] Organic Rankine Cycle

	Installed capacity MW	Electricity output TWh
2005	0	0
2010	14	0,001
2015	30	0,002

Biogas

It is noted that the utilisation of biogas is not considered here, as such projects are typically either cogeneration projects or heat-only applications. The cogeneration projects were accounted for in the chapter on power generation. The heat-only use of biogas is taken into account in forecast of agriculture.

With all the forecast data the CO_2 emission reduction to be achieved calculated using the principle of the monitoring and the specific CO_2 emissions of the JI projects referred to earlier. It is noted here that since the effect of the support policy is to be evaluated, only the increase of installed capacities and power production shall be taken into account, in relation to the capacities that existed before the policy was implemented, i.e. practically before 2003. This is particularly important when hydropower is considered, where all major plants existed already before 2003. Thus the forecast savings of all the renewable power projects are the following:

	Installed additional capacity MW	Electricity output GWh	Emission reduction achieved kt
2005	27	115	80
2010	419	1447	1033
2020	555	1808	1201

3.2.1.4 Land-based support for energy crops and forests

3.2.1.4.1 Objectives and description

In line with the priorities of National Rural Development Plan, Decree 28/2005. (IV. 1.) FVM provides for financial support for various agricultural activities that are entitled for support from the European Agricultural Orientation and Guarantee Fund. For these purposes additional national support may be obtained. The decree allocates EUR 946 000 for the production of energy crops (both wood and herbaceous plants). The detailed regulation of the support is codified by 74/2005. (VIII. 22.) FVM. The latter decree defines which plant classifies ad energy crop, maximises the area that can obtain financial support and the obtainable finance: for wheat, corn, rape and sunflower together it is 16000 ha and EUR 27/ha, for energy grass 10000 ha and 32 EUR/ha and for energy forest 2500 ha and 194,13 EUR/ha.

The primary objectives of the measure are to improve the competitiveness of agricultural production and food processing; to promote environment-friendly development of agriculture; rationalisation of land use and to assist to the realignment of rural areas.

3.2.1.4.2 Policy instrument type

Economic

3.2.1.4.3 Status of implementation

Implemented.

3.2.1.4.4 Implementing entity

Ministry of Agriculture and Rural Development and Office for Agriculture and Rural Development (MVH)

3.2.1.4.5 Monitoring indicators

Implementation is monitored via the support system managed by MVH. All supports are allocated via a regulated application process, that provides enough data about the lands and planned energy plants for the monitoring of the impact of the measure. Thus the main indicators of monitoring are of land, type of energy crop, expected yield.

3.2.1.4.6 Effects and impacts

Although the energy crops act as short-term carbon sinks, due to the short rotation it is not considered as GHG mitigation effect. The major impact of the measure is all plants grown on the supported lands will be used either directly as fuel (energy grass, wood) or indirectly as raw material for automotive fuel or biogas[10].

Besides the direct impact, this tool is also of utmost importance because it enables the implementation of further bio-energy projects, by providing excess fuel at lower prices.

The quantitative effects of the measure, however are not evaluated separately, but they are included in the forecasts for biomass, biogas and bio-ethanol utilisation.

3.2.1.5 Life extension of the Paks nuclear plant

3.2.1.5.1 Objectives and description

In the Resolution 85/2005 (XI.23) OGy. of the Parliament, the life extension and capacity increase of the Paks nuclear power plant was approved. The rationale of the project identifies the environmental commitments related to the Kyoto protocol and its foreseen sequel among the most important objectives.

The four units of the Paks plant were commissioned between 1982-87. Currently the total capacity of the four units is 1866 MW. The Paks plant is the base power station of the Hungarian power system supplying about 40% of the total power production at low costs with no GHG emissions. The planned technical lifetime of the units ends between 2012-17, but all investigations show that the operation can safely be extended by at least 20 years. In the framework of the retrofits needed for the life-extension, the capacity of the plant will be increased by same 150 MW, chiefly through the improvement of control systems and use of upgraded fuel cells.

[10] Existing contracts with the to-be buyer of the crops, indicating the purpose of utilisation are the precondition of the financial support.

Thus the objective of the project is to ensure the availability of some 2040 MW nuclear capacity until at least 2032-2037, thus improving the safety of supply and save considerable GHG emissions.[3]

Although the project, as it will require neither finance nor guarantees from the government, first appears as a general development project by an enterprise, it may still classify as part of the national policy, partly because the Paks plant is state owned, partly due to its sheer size that has long-time impact on the national energy strategy, thus requiring governmental approval.

3.2.1.5.2 Policy instrument type

Other: technical

3.2.1.5.3 Status of implementation

Adopted

3.2.1.5.4 Implementing entity

The Paks Nuclear Plant

3.2.1.5.5 Monitoring indicators

The amount of generated power.

3.2.1.5.6 Effects and impacts

The measure has no impact on CO2 emission reduction before the end of the originally planned lifetime of the individual units, since it may be well assumed that they would remain in operation until then, as they are at present. However, from then on, all the generated power of the individual units will substitute power that should be generated in other (fossil) power plants or imported, if the life extension did not take place.

It is very difficult to establish a baseline for calculation the actual emission reduction as there is practically no alternative to the life extension:

- natural gas based capacity developments are limited by the capacity of the gas supply system (almost utilised up to 100% even now);
- imports are also limited by the capacity of the transmission system;
- susbstituting 1860 MW by renewable is rather unrealistic.

Still, for the sake of estimating the emission savings, it is assumed, that in case the life extension did not happen, some combination of the above choices would be implemented, however costly they would be.

The forecast applied rests on then following assumptions:

- If the life extension did not happen, 50% of the so missing power would be covered by fossil plants, partly utilising some existing reserve capacities (e.g. in the Dunamenti plant) partly from new fossil, most likely natural gas fired CCGT plants. The average

specific CO_2 emission is assumed as 0,4 kg/kWh, on the basis of the average value of the most modern capacities of the Hungarian power system.

- The other 50% of the power would come mostly from imports and a much smaller share from renewable sources. Neither of them generate national level CO_2 emissions, hence the specific emission is zero.
- The emission savings due using nuclear power before the end of the lifetime of the Paks units are not considered as the result of the measure, so they are not shown here.
- The reconstruction and upgrading of the nuclear units will be finished by the same year when their original lifetime would end (commissioning + 30 years), i.e. in 2012, 2014, 2016 and 2017.

Thus the savings are the following:

	Installed additional capacity MW	Electricity output GWh	Emission saving kt
2005	0	0	0
2010	0	0	0
2015	1020	7385	1477

3.2.1.6 Emission Trading System

3.2.1.6.1 Objectives and description[11]

In compliance with the relevant Community acts (2003/87/EC; 2004/156/EC) the Hungarian Parliament approved the Act XV of 2005 on the trading system of greenhouse gas emission units. This created the official framework for the allocation, trade, utilisation of GHG emission units and also codified those activities that are subject to emission licences.

The creation of the Act was preceded by some two years of intensive preparatory work, which resulted not only in the Act, but also in the preparation of all the necessary documents and procedures that were necessary to launch the trading system in Hungary. This included the detailed rules of the emission rights allocation and trading which were set forth in detail in the implementation decree of the Act, Government Decree 143/2005. (VII. 27.) Korm., and also the National Allocation Plan and the detailed Allocation List. The preparation work included a wide range public discussion about these documents.

The ultimate objective of the entire trading system is to reduce the risk of climate change. This is to be achieved by creating incentives for GHG emission-conscious behaviour an emission reduction measures, implemented by the biggest polluters.

The system is ready and operative for the first trading period (2005-2007) and preparation for the second period (2008-12) has started. The draft of the allocation principles for the second period has been written and disseminated and a series of public consultations have been announced.

[11] The ETS obviously affects not only the energy industry but other industries. It is discussed here because the energy industry is responsible for the vast majority of GHG emission under the ETS.

3.2.1.6.2 Policy instrument type

Regulatory, economic

3.2.1.6.3 Status of implementation

Implemented.

3.2.1.6.4 Implementing entity

Ministry of Environment and Water Management

3.2.1.6.5 Monitoring indicators

Quantity of traded emission rights

3.2.1.6.6 Effects and impacts

The indirect impacts of the ETS on GHG emission reduction are not yet possible to measure or forecast. It is commonly agreed, however, that the first and most important impact of the ETS is that it considerably increases the awareness of the large companies – this has been strongly confirmed by their feedback during and since the preparation of the legislation. The companies rather soon realised the fact that they can generate extra revenues by reducing their GHG emissions. At the same time the limited availability of "free" emission rights for new entrants puts a constraint of energy use reduction on new developments.

However, quantitative forecasts will only be possible to make when the experience of the first trading period will be available.

3.2.2 Demand side

3.2.2.1 Energy tax and environmental levy

3.2.2.1.1 Objectives and description

A high level regulation (Act LXXXVIII of 2003) introduced the energy tax on the sales and imports of electric power and natural gas. Sales to residential consumer are exempt for the duty of paying the tax. The amount of the tax currently is HUF 186/MWh of electricity, and HUF 56/GJ of natural gas.

The primary objective of the tax is to incorporate some of the external costs of energy use in the price of energy, and to create incentive for energy saving and improving energy efficiency, in order to meet the general objectives of environmental protection and energy conservation.

Act. LXXXIX of 2003 introduced the environmental levies, in order to reduce the burden of the environment, protect nature, promote environmental awareness, and – not in the least - to provide funds for nature conservation. The objectives also include the use of best available technologies.

The levy is to be paid by the users of the environment in proportion to the quantity of pollutants emitted to the atmosphere, surface waters and soil. The amount of the levy is pollutant-specific. Residential users of the environment are exempt from the air pollution levy. The following pollutants are levied:

Air: SO_2, NO_x, solid, non-toxic particles
Water: COI, phosphor, inorganic nitrogen, mercury, cadmium, chrome, nickel, lead and copper.
Soil-related levy is not pollutant-specific, its amount based on the quantity of waste waters.

The two measures are discussed together because their working principle is very similar. The effect of both measures on GHG mitigation is indirect, and they work through fiscal incentives.

3.2.2.1.2 Policy instrument type

Regulatory / Fiscal

3.2.2.1.3 Status of implementation

Implemented.

3.2.2.1.4 Implementing entity

For the energy tax: Hungarian Customs and Finance Guard (VPOP)
For the environmental levy: State Tax Authority (APEH)

3.2.2.1.5 Monitoring indicators

The effects of the measure are monitored directly through the amount of tax and levy, and/or the actual quantity of energy sales / pollutants the tax and levies are based on.

3.2.2.1.6 Effects and impacts

The direct effects i.e. the amount of tax and levy collected or the amount accumulated for the financing of environmental projects may easily be quantified. This volume is well demonstrated by the relevant lines of the state budget:

Line code	Item	Million HUF
2004		
19.7.1	Energy tax	10.921,8
19.7.2	Environmental levy	6.482,2
2005		
1.7.1	Energy tax	10 700,0
1.7.2	Environmental levy	9 000,0

The effects of these policy items on GHG emission reduction, however, are rather indirect (GHGs are not levied), as they act through the following mechanisms:

Energy tax
- Increasing energy awareness
- Improving the feasibility of energy efficiency projects

- Creating incentive for energy efficiency measures or for the substitution of gas/electricity with other types of energy

Environmental levy

- Creating incentive for reducing energy use or for modernizing equipment
- Creating incentive for reducing polluting activity

There are some ways of assigning measurable quantities, such as comparing the amount of energy tax with energy prices as to show how strong the incentive for improving energy efficiency (see the following table), but the actual GHG mitigation effect is not possible to quantify, since any mitigation may be the result of several incentives and policies together.

	Typical communal	Small enterprise	Industry
Electricity			
Price, HUF/kWh	20,7	12,9	11,29
Energy tax	0,90%	1,44%	1,65%
Gas			
Price, HUF/MJ	1,069	1,610	1,643
Energy tax	5,24%	3,48%	3,41%

3.2.2.2 Energy audits in industry and the communal sector

3.2.2.2.1 Objectives and description

It is widely recognised that demand side energy efficiency actions can only be effective if they are preceded by energy audits that can identify the most efficient course of action. Therefore energy audits have been supported through various tools:

- Energy audits in industry is an important item of the Energy Saving and Energy Efficiency Action Programme (ESEEAP). The program allocated financial support to such audits in the form of a soft loan. In practice, during the implementation phase of the Programme the audits were supported mainly through grants. First 75% then 50% of the total audit cost was provided as grant, in the framework of the "Széchenyi plan"[12].
- Communal (municipality) energy audits were supported in the framework of both the UNDP-GEF Municipal Energy Efficiency Programme and Széchenyi Plan.
- Energy audits were also encouraged by including them as a precondition of several financial support mechanisms for energy efficiency projects (e.g. Energy Efficiency Credit Fund, Phare Co-financed Loan Programme).

The objectives of these measures were:

- to identify energy saving opportunities in the industrial and communal sector and to found the base for further projects
- to ensure that expenditures on energy efficiency measures are efficiently made
- to increase energy awareness

[12] The Széchenyi-Plan was a broad effort to fund modernisation of the Hungarian economy, launched in 2000.

Recognizing that the audits alone do not generate direct energy savings, the original legislation did not set any quantitative targets.

3.2.2.2.2 Policy instrument type

Economic

3.2.2.2.3 Status of implementation

Implemented/suspended

The original resolution (ESEEAP) that was the basis for all these measures is in effect till 2010. The main tools of its implementation were the annually revised energy efficiency programmes: the energy chapters of the Széchenyi Plan (SZT-EN 2001; SZT-EN 2002), the National Energy efficiency Programme (NEP 2003; NEP 2004). While SZT-EN 2001 and SZT-EN 2002 opened application possibilities for the support of energy audits, this opportunity was not offered in NEP 2003; NEP 2004, basically due to lack of funds.

Still, ESEEAP is effective and its most recent review by the Energy Efficiency, Environment and Energy Information Agency (Energiahatékonysági, Környezetvédelmi És Energia Információs Ügynökség Közhasznú Társaság - Energy Centre for short) recommends that energy audits are to be supported. Therefore it is expected that energy audits will receive further support before 2010, and possibly onwards.

3.2.2.2.4 Implementing entity

Energy Efficiency, Environment and Energy Information Agency (Energy Centre)

3.2.2.2.5 Monitoring indicators

Number of energy audits conducted; energy saving potential identified

3.2.2.2.6 Effects and impacts

In the past years when support was available the following results were achieved [4]:

Source of support	Total project cost	Support	Number of projects
	[M HUF]	[M Ft]	
Industry			
SZT-EN 2001	187,1	118,8	32
SZT-2002-EN	8,5	4,3	1
NEP 2003	Not supported		
NEP 2004	Not supported		
Municipalities / Communal			
SZT-EN 2001	215,7	106,7	58
SZT-2002-EN	0	0	0
NEP 2003	Not supported		
NEP 2004	Not supported		
UNDP-GEF (between 2002-2004)	72,3	47,6	117

The effect of the audits on energy use or GHG emissions were not quantified by the implementing agency. It is also not possible to make well-founded forecasts as to the achievable GHG mitigation because:

- savings depend on how much of the audits' recommendations are the actually implemented;
- the future of available supports is uncertain, especially after 2010;
- much of the industrial audits do not use the available support but financed directly by the industry owners.

3.2.2.3 New legislation for the energy efficiency of buildings

3.2.2.3.1 Objectives and description

In line with the principles of the Directive 93/76/EEC of European Commission that is aimed reducing the GHG emission through energy efficiency measures and the related Directive 2002/91/EC on the energy efficiency of buildings, the Hungarian Government acknowledges the potential of improving energy efficiency of buildings in GHG emission mitigation and puts emphasis on taking appropriate actions in this field. As regards setting out appropriate provisions on the minimum energy performance requirements, especially regarding new buildings, the relevant Hungarian legislation is under preparation and the newly adopted regulations are planned to be effective from the beginning of 2006. The regulation will introduce new standards for the energy performance of buildings. Both the methodology of evaluation (thermal calculations) and some key parameters (e.g. U-values and normalised heat loss) are prescribed. Meeting with these prescribed values will be the precondition for the issuance of licences for construction or major refurbishment of buildings. The objective is considerable savings through the more strict performance requirements.

As for the use of energy efficiency certificates, and regular inspection of boilers and HVAC systems as major energy consumer equipments within the buildings, unfortunately due to the lack of qualified and accredited experts, the application of these instruments suffers delays. Due to these problems, the Hungarian Government intends to avail itself of the possibility of having some additional period for the implementation of these provisions, while making every effort to make such a system is operational as early as possible.

3.2.2.3.2 Policy instrument type

Regulatory

3.2.2.3.3 Status of implementation

Adopted.

3.2.2.3.4 Implementing entity

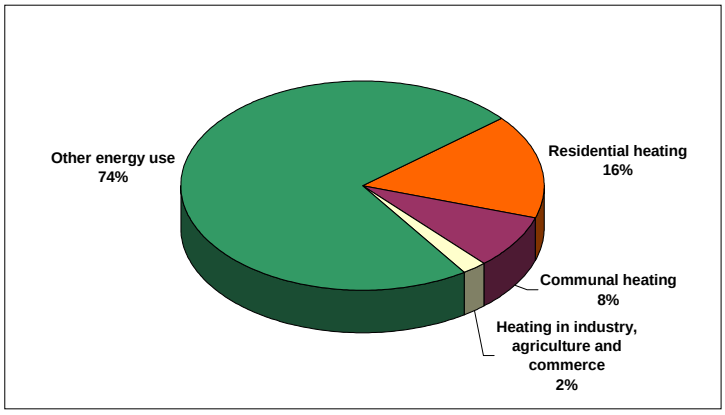
Authorities for construction licences (municipalities)
National Office for Housing and Construction (OLÉH)

3.2.2.3.5 Monitoring indicators

Number of issued Building Energy Certificates
Number / heated volume of new or reconstructed housing.

3.2.2.3.6 Effects and impacts

The importance of heating in buildings is high: according the background study of OLÉH for their "Long-term Sustainable Building Energy Concept" it represents more than 26% of the total energy end-use and the related primary energy demand is 314 PJ per year. Having in mind the fuel mix of space heating the associated CO_2 emissions almost reach 19 000 kts. The measure has also impact on cooling, however, there are no reliable information as to the cooling energy demand, only estimations exist. According to those, approximately 1,05 PJ primary energy use can be associated to space cooling, that can be considered insignificant as compared to heating.



3. Fig. Importance of space heating in total energy end-use

It is difficult to forecast the actual effect of the new legislation on GHG emission reduction, as there are no reliable forecasts available regarding the number of new housing to be constructed. Still, there are scenarios which were drafted on the basis of past experience. The concept foresees some subsidies for the improvement energy performance of buildings, but also some "spontaneous" saving that is due to those modernisation efforts that happen without support. Besides, the forecast calculates with the effect of the more strict standards.

For the purposes of the current document the foreseen subsidy of building modernisation is not taken into account so as to achieve a more conservative estimation. With this the following forecast is made for 2010 and 2015 (as the measure is planned to become effective from 2006):

	Number of new homes	Number of modernised or partially modernised homes			CO_2 emission saving kt
		Detached houses	Multi-flat housing	Housing estates	
2010	40 000	40 000	25 000	10 000	97
2015	40 000	40 000	30 000	10 000	108

3.2.2.4 Improving energy awareness

3.2.2.4.1 Objectives and description

One important action of the ESEEAP is to assist reaching its overall objectives by providing state-of-the-art information and training via the educational system and the organisation and operation of advisory networks and consumer offices, as well as via advertisements, the media etc. Another specific point of action is the promoting the use of energy efficiency labels. The relevant legislation set an overall 10 PJ energy saving until 2010 via energy awareness raising tools.

3.2.2.4.2 Policy instrument type

Information, education

3.2.2.4.3 Status of implementation

Implemented.

3.2.2.4.4 Implementing entity

Energy Efficiency, Environment and Energy Information Agency (Energy Centre), through a application system.

3.2.2.4.5 Monitoring indicators

Number of project applications, information outreach indicators.

3.2.2.4.6 Effects and impacts

Similarly to the support of energy audits, this action was also mainly implemented through the annually revised energy efficiency programmes (SZT-EN 2001, SZT-EN 2002). In 2001 14 of 46 projects were approved and supported with altogether HUF 42.5 million. In 2002 only 8 of the 13 applications were approved. From 2002 onwards the annual energy efficiency programmes (NEP2003, NEP2004) did not include awareness raising components.

Still, the implementation of action is not suspended, as there have been other sources and tools such as the Environmental Protection Fund of the Ministry of Environment and Water Management, that provided an almost HUF 200 million support for 163 civil projects for energy awareness campaigns and projects. [4] Besides the UNDP-GEF programme for Municipal Energy Conservation, managed by the Energy Centre also included several educational components, from organising training course for municipal officials to publishing best practice guides. Even the creation of the Energy Centre in 2000 (see resolution 1031/2000) was done with educational objectives in mind, and the Centre still fulfils several awareness raising and educational duties, by providing energy efficiency information on-line, publishing energy efficiency manuals and guides, operating their specialised library.

Even if the ESEEAP set a concrete target of 10 PJ saving, it is not possible to quantify the effects of energy awareness actions, due to their very indirect nature. However, it may well be stated, that these activities were rather successful. This certainly shows in large number of applications for support for energy efficiency projects, the increasing number of events targeted at energy efficiency, large number of inquiries the Energy Centre, the customer offices of energy distribution companies and advisory agencies receive.

3.2.2.5 R&D for energy efficiency and renewables

3.2.2.5.1 Objectives and description

This action of the ESEEAP aims at encouraging the participation of Hungarian experts in foreign research, as well as the incorporation of energy saving and environmentally friendly technologies is the Hungarian R & D, including demonstration projects. According to the ESEEAP, the priority of energy efficiency within R & D has to be ensured with legal instruments and with preferential credits.

Besides the ESEEAP, other strategies, strategy documents also address R&D. Thus the 2002. Governmental Program, or the Mid-term Economic Policy Program adopted in August 2002., all identify R&D as key element.

The support of energy efficiency and renewable energy related R&D was administered through the National Research and Development Programmes (NKFP), The Central Technical Development Base Program (KMÜFA) and the GVOP sub-program of the National Development Plan. NKFP supports large, long term complex programmes, the other sources aid smaller (less than HUF 100 million budget) projects. The form of support is mainly grants, or – to a lesser extent – preferential (zero interest) loans. Each of the three sources identified energy efficiency and renewable energy utilisation as top priorities within their energy chapters.

Besides the above sources the annual energy efficiency programs (SZT-EN and NEP) also included R&D related targets.

Due to the nature of R&D projects no concrete quantitative target was set for energy saving or GHG mitigation.

3.2.2.5.2 Policy instrument type

Economic

3.2.2.5.3 Status of implementation

Implemented.

3.2.2.5.4 Implementing entity

Ministry of Education (earlier)
National Office for Research and Technology (from 2004)
Energy Centre

3.2.2.5.5 Monitoring indicators

Supported project budgets, number of projects.

3.2.2.5.6 Effects and impacts

From the different sources altogether almost HUF 2 billion was spent on energy efficiency and renewable research and development, HUF 1,4 billion of which was spent on renewable energy. [4]

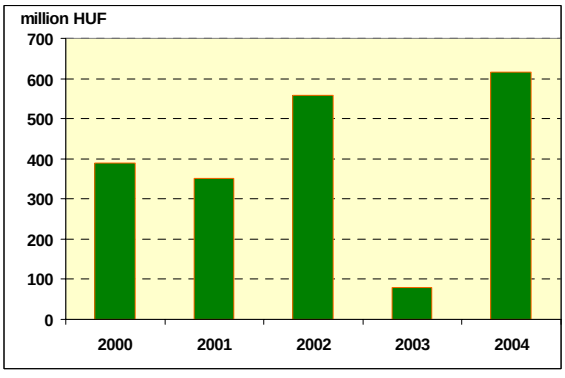


Fig.4. Energy related R&D expenditures

The forecast, however difficult, as the expenditures on this purpose largely varied from year to year. The figures, however reflect the priority of the field therefore it is foreseen that the average level of support will be maintained in the medium term. It is not possible though to identify the quantitative effects of R&D on GHG mitigation. It is obvious that much of the results appear in the development of renewable energy generation (e.g. the availability of Hungarian-developed energy crops, energy grass) the bioethanol programme and in other areas but these effects are indirect and are incorporated in the forecasts that are relevant for those sectors.

3.2.2.6 Support for the improvement of industrial energy efficiency

3.2.2.6.1 Objectives and description

One of the actions of the ESEEAP was aimed at reducing industrial energy consumption. The objectives of the action were

- modernisation of energy processes of industrial production,
- improving thermal insulation,
- improving the efficiency of energy consuming equipment and
- improving the efficiency of energy generating equipment.

The form of support foreseen was preferential loans, but no concrete amount was allocated. The expected target reduction of industrial energy use was 8.5 PJ until 2010.

Similarly to other actions of the ESEEAP the primary tools of implementation were the annually revised energy efficiency programs (SZT-EN, NEP), but similarly important was that preference was given to industrial energy efficiency in other existing support schemes, such as the Energy Saving Loan Fund (EHA) or the Phare Co-financed Loan Programme.

3.2.2.6.2 Policy instrument type

Economic

3.2.2.6.3 Status of implementation

Implemented

3.2.2.6.4 Implementing entity

The Energy Centre as the manager of energy efficiency funds, under the supervision of an inter-ministerial committee.

3.2.2.6.5 Monitoring indicators

Achieved energy saving.

3.2.2.6.6 Effects and impacts

The implementation of the policy required the following resources and resulted in the following savings [4]:

	Total project cost	Support	Energy saving	Number of projects
	[M HUF]	[M HUF]	[TJ]	
EHA 2000…2003				
Gas engine cogeneration	1034	400	298	5
Heat supply modernisation	2185	1124	484	34
Process modernisation	214	163	37	7
Wind power project	*330*	*145*	*30*	*2*
Complex refurbishment	107	67	57	2
EHA total	***3870***	***1899***	***906***	***50***
SZT-EN 2001				
Heat supply modernisation	189	55	24	19
Waste heat recovery	35	8	9	1

	Total project cost	Support	Energy saving	Number of projects
	[M HUF]	[M HUF]	[TJ]	
Building envelope modernisation	4	1	1	1
Process modernisation	53	14	11	3
Thermal insulation	19	6	1	1
Complex refurbishment	133	37	26	9
SZT-EN 2001 total	***432***	***121***	***72***	***34***
SZT-2002-EN				
Space heating and indoor lighting modernisation	53	16	10	1
Building envelope and space heating modernisation	5	1	0	1
Thermal insulation	5	1	0	1
Process modernisation	53	16	6	1
SZT-EN 2002 total	***116***	***35***	***16***	***4***
NEP 2003	386	95	72	17
Heat supply modernisation	55	15	12	3
Building envelope modernisation	39	12	2	4
Thermal insulation	3	1	0	1
Process modernisation	75	22	22	3
Two processes combined	39	9	10	3
Three processes combined	149	30	25	1
Four processes combined	26	7	1	2
NEP 2003 total	***386***	***95***	***72***	***17***
NEP 2004	***93***	***26***	***14***	***7***
Phare 2000…2003				
Gas engine cogeneration	1100	133	254	3
Heat supply modernisation	740	135	220	5
Waste recovery	28	5	7	1
Phare 2000…2003 total	***1868***	***273***	***481***	***9***
TOTAL	**6765**	**2449**	**1561**	**121**

It is apparent from the figures that the majority of the savings come from space heating related (heat supply modernisation, thermal insulation, building envelope modernisation etc.) and cogeneration /wind-power projects. The latter are not considered in the further calculations, as they were accounted for in the among the supply side measures. Considering the fuel mix of industrial space heating, the total emission reduction achieved by saving 754 TJ energy earlier used for this purpose results in 53 000 tons CO_2 emission reduction.

There are no forecasts available about the potential of further industrial energy saving, therefore the following assumptions are made in order to estimate the future effect of the policy:

- The technical lifetime of the already implemented projects is more than 10 years, therefore the generated savings will still be generated in 2010 and 2015.
- The support mechanism will stay in place after 2010.
- The average level of subsidy will be somewhat lower as there will be no Phare resources. In the meantime the investment costs will grow, therefore the subsidy can ”buy” less projects.

- The efficiency of subsidy will also be lower as the best projects have been implemented already.
- The effect of projects implemented until 2010 will still be present in 2015.

With these assumptions the following emission reductions are forecast:

	CO_2 emission saving kt
2005	53
2010	63
2015	73

3.2.2.7 Residential and communal energy saving programmes

3.2.2.7.1 Objectives and description

Besides the reducing industrial energy consumption the ESEEAP also put emphasis on the support of residential and communal energy efficiency projects. This action of the ESEEAP focused on the improvement of thermal insulation and upgrading of building envelopes (facades, roofs, cellars, doors and windows) and the improvement the secondary heating systems of district-heated homes (primarily control and metering).

The foreseen tool of support was direct subsidies (grants) and the saving target was 10 PJ/year until 2010. Similarly to industrial energy efficiency improvement and other actions of the ESEEAP the primary tools of implementation were the annually revised energy efficiency programs (SZT-EN, NEP), but similarly important was that residential/communal energy efficiency projects were included in other existing support schemes, such as the Energy Saving Loan Fund (EHA) or the Phare Co-financed Loan Programme.

3.2.2.7.2 Policy instrument type

Economic

3.2.2.7.3 Status of implementation

Implemented/suspended

3.2.2.7.4 Implementing entity

The Energy Centre as the manager of energy efficiency funds, under the supervision of an inter-ministerial committee.

3.2.2.7.5 Monitoring indicators

Achieved energy saving.

3.2.2.7.6 Effects and impacts

The key figures of the related programmes were the following [4]:

	Total project cost [M Ft]	Support [M Ft]	Energy saving [TJ]	Number of projects
EHA 2000…2003	1530	863	210	28

SZT-EN 2001	5637	1558	239	4086
SZT-2002-EN	9888	2655	448	7554
NEP 2003	7840	1951	403	4736
Phare	1223	269	155	11
Total	**26118**	**7297**	**1454**	**16415**

Of which residential projects:

	Total project cost [M Ft]	Support [M Ft]	Energy saving [TJ]	Number of projects
EHA 2000…2003	0	0	0	0
SZT-EN 2001	4456	1214	142	3989
SZT-2002-EN	8396	2335	283	7500
NEP 2003	5478	1519	186	4665
Phare	0	0	0	0

The EHA fund – with the exception of one small gas engine project – supported the modernisation of heat supply or thermal insulation in public buildings. As to the Phare source, roughly 50% support was spent on space heating modernisation, the remaining projects dealt with waste water and landfill-gas utilisation. The early residential projects included several complex heat supply modernisation measures, while the later years the vast majority of support was spent on the replacement of windows and doors.

The GHG emission saving is estimated on the basis of the achieved energy saving and the fuel average fuel mix of the residential and communal sector. Thus the 1,45 PJ saving resulted in 81 kt CO_2 reduction.

In order to forecast the effect of the measure, similarly to those of the industrial energy efficiency measures, the following assumptions are adopted.

- The technical lifetime of the already implemented projects is more than 10 years, therefore the generated savings will still be generated in 2010 and 2015.
- The support mechanism will stay in place after 2010.
- The key area of projects will be space heating related measures (boiler replacement, thermal insulation, window replacement etc.)
- The average level of subsidy will be lower. (In 2005 the support of residential and communal energy efficiency was suspended. Due to the low support intensity other areas were preferred, but with the introduction of energy tax it is hoped that some level of support will be maintained.) The basis of forecast will be the SZT-EN and NEP figures, as Phare is likely to be discontinued and the criteria of EHA are too strict to support considerable number of residential/communal projects.
- In the meantime the investment costs will grow, therefore the subsidy can ”buy” less projects.
- The effect of projects implemented until 2010 will still be present in 2015.

With these assumptions the following emission reductions are forecast:

	CO_2 emission saving kt
2005	81

2010	97
2015	112

3.2.2.8 Support for end-user renewable energy

3.2.2.8.1 Objectives and description

Promoting the use of renewable energies is one of the priorities of the ESEEAP. Two of its sub-programmes address this area:

- Promoting alternative (primarily biomass fuelled) firing systems and
- Increasing the utilisation of renewables in general.

The general objective of the ESEEAP was to achieve 50 PJ/year renewable energy utilisation by 2010. The other quantitative target within this objective was to have solar collectors on 20 000 homes or public buildings by 2010 ("20 000 solar roofs programme"). The foreseen form of support was direct subsidies (grants).

The instruments of implementation were also the SZT-EN and NEP programmes and support was also provided from the EHA and Phare funds or from the Environmental Fund (KAC).

3.2.2.8.2 Policy instrument type

Economic

3.2.2.8.3 Status of implementation

Implemented.

3.2.2.8.4 Implementing entity

The Energy Centre as the manager of energy efficiency funds, under the supervision of an inter-ministerial committee.
Ministry of Environment and Water

3.2.2.8.5 Monitoring indicators

Achieved energy saving.

3.2.2.8.6 Effects and impacts

Detailed information is available about the SZT-EN and NEP programmes only that can serve as basis for impact forecasts. The most important figures were the following [4]:

	Number of projects	Total project cost M HUF	Support M HUF	Energy saving [TJ]
Heat generation type				
Geothermal and heat pumps	27	428	123	25
Woodchip firing	12	1000	92	194
Biogas utilisation	2	261	71	104
Other biomass	9	137	41	12
Other renewables	6	181	46	31
Power generation type				
Photovoltaic	6	222	19	0,43
Wind power	5	1120	182	93
Hydro	1	137	37	41
Photovoltaic + wind power	1	1	0	0,03
Miscellaneous technologies	4	20	1	0,1
"20000 solar roofs"				
Solar collector	437	768	198	15
Solar collector + biomass	12	26	6	2
Total	**522**	**4302**	**816**	**518**

The related CO_2 emission reduction is calculated differently for the two basic project types:

- For power generation type projects those specific reference CO2 emission factors are used that were developed for baseline calculations of JI projects. It is noted, however, that the indicated savings are primary energy savings, therefore – although the projects in question are end-user projects – the factors of the generation type projects are used, disregarding distribution losses. In order to calculate the electricity generation related to the given primary energy uses, the forecast average plant efficiencies of the big power plants (without the Paks nuclear) is used.
- For the fossil heat replacement type projects (heat generation and solar) the emission reduction is calculated with the fuel mix of the residential and communal sector.

Thus the total GHG emission reduction achieved by the above projects is 29 kt CO_2, of which 8 kt is from power generation type projects, 21 kt from heat generation type ones.

For the forecast of impacts of the measure the same set of assumptions are used as in case of the residential and communal programmes, with the following additional consideration:

- Power generation type projects are not considered, as the related forecasts are included in the chapter on supply side promotion of renewables.

With these assumptions the following emission reductions are forecast:

	CO_2 emission saving kt
2005	29
2010	38
2015	46

3.2.2.9 Modernising district heating systems

3.2.2.9.1 Objectives and description

District heating plays an important role in space heating and hot water supply in Hungary, especially in the residential sector. There are some 100 district heating schemes in the country, supplying heat to more than 640 000 homes. The inefficiency of the systems and the high space heating costs of the district heated buildings are not only a technical problem but also an evergreen political issue. Therefore the modernisation of the district heating systems was included among the priorities of the ESEEAP. The quantitative target was to achieve 10 PJ/year saving till 2010 by providing support for:

- increasing the share of cogeneration within the heat generation capacities of the district heating systems;
- primary side reconstructions including the installation of meters in the substations;
- secondary side modernisation, primarily for better controls and cost allocation.

Similarly to the other ESEEAP actions, the support was provided through the SZT-EN and NEP programmes and the EHA and Phare funds.

3.2.2.9.2 Policy instrument type

Economic

3.2.2.9.3 Status of implementation

Implemented

3.2.2.9.4 Implementing entity

The Energy Centre as the manager of energy efficiency funds, under the supervision of an inter-ministerial committee.

3.2.2.9.5 Monitoring indicators

Achieved energy saving.

3.2.2.9.6 Effects and impacts

In the following tables and calculations only those projects are considered that are not co-generation related, as the effects of cogeneration were accounted for in the relevant chapter.

The support proved and the achieved savings are summarised in the following table[4]:

	Number of projects	Total project cost	Support	Energy saving
		M HUF	M HUF	[TJ]
EHA (2001-2003)	1656	966	346	19
SZT-EN 2001	2668	773	557	32
SZT-EN 2002	566	167	69	8
NEP 2003	1613	475	281	22
Phare	874	60	220	1
Total	**7377**	**2441**	**1473**	**82**

The emission reduction savings achieved through the energy saving realised can be calculated with the actual fuel mix of district heating. Thus the specific emission factor is 63,9 that results in a 94 kt CO_2 emission reduction by all the non-cogeneration projects of the three years investigated.

The forecast of further emission reduction is based on similar assumptions as those of the residential energy efficiency programmes. However, a stronger degradation of subsidy intensity is assumed, as due to the low number of DH schemes the replicability of projects is lower. The so forecast emission reductions are the following:

	CO_2 emission saving kt
2005	94
2010	114
2015	129

3.2.2.10 Energy efficiency support schemes

3.2.2.10.1 Objectives and description

In the previous chapters several references were made to various financial support schemes, energy efficiency programmes. In the current chapter a general overview of these policy tools is given in order to provide a complete picture of their background and objectives. The order of reviews does not reflect priority.

UNDP energy efficiency programme for Municipal Energy Conservation

The aim of the assistance programme is to reveal the possibilities of rational use of energy; to reduce CO2 emission by financing energy audits and the compilation of feasibility studies at the municipal institutions. The programme is open for municipalities, county governments, district notaries and organisations in total or partial municipal ownership as well as for legal entities or business organisations dealing with issues of municipal energy use (such as the auditors themselves.) The form of support is direct subsidy (grant). In 2005 the following conditions of subsidy apply:

- 40% of the total costs of the audit or the feasibility study can be covered directly from the support;
- A further 40% can be granted (altogether maximum 80 per cent), if an investment into energy efficiency is initiated by 31 October 2006. (i.e. some or all of the recommendations of the audits are actually implemented.)

The total size of the funds available for the purposes of the programme is 1.535 million USD. The programme is planned to remain operative until the end of 2005.

EHA - Energy Saving Loan Fund (German Coal Aid)

The Government of Federal Republic of Germany offered Hungary DEM 50 million specially for the acquisition of coal in 1991. Sixty per cents of the HUF equivalent of the original aid, working as a revolving fund, are still used for the financial support of energy efficiency

projects and the reduction of energy demand. The support can be obtained in the form of discounted repayment loan through an open application procedure.

The Fund finances the implementation of developments for achieving energy saving which contribute to the reduction of the energy demand and the energy costs of the national economy efficiently, reduction of pollution of the environment as well as dependence upon energy import. The aims are to substitute the traditional sources of energy with renewable energy sources and energy from waste, to establish the conditions of efficient management of energy sources and the reduction and termination of energy losses at the least possible cost. Supported measures include:

- Reduction of energy losses of energy generation, distribution and use.
- Procurement and use of modern, lower energy consumption process equipment.
- Heat recovery and the utilisation of renewable energies.
- Cogeneration
- Thermal insulation projects
- Better space heating control, especially in district heating.

Phare Co-Financed Energy Efficiency Loan Construction

A 10-year energy efficiency loan construction established within the frame of European Union's Phare programme and supported by Phare Revolving Fund is operated via the Commercial and Credit Bank plc. and Raiffeisen Unicbank plc. The aim of the loan construction is to provide the financial incentive for developments focusing on the improvement of energy efficiency. The soft loan is open for private enterprises, municipalities or municipal institutions and independent public institutions. A precondition of the loan is that the energy efficiency project is based on an energy audit or feasibility study. The amount of the loan is based on the actual project cost that may include feasibility planning, engineering, commissioning, training of operators, hardware.

National Energy Saving Programme (SZT-EN, NEP)

The Programme is the sequel of the Energy Chapter of the Széchenyi Plan, starting in 2001. The conditions of support are reviewed annually according to changing emphases in the energy policy, but the major strategic goal are based on the priorities of the Energy Saving and Energy Efficiency Action Programme. The key objectives of the NEP in 2004 were the following:

- Support of domestic energy saving for private individuals
- Reduction of energy utilisation and energy cost of municipal, governmental and other institutions
- Support of the modernisation of street lighting (of small settlements)
- Modernisation of the district heating on the customer side
- Extension of the utilisation of renewable energy sources for municipalities and private individuals
- Extension of the utilisation of renewable energy sources for business organisations
- Support of R+D type of energy efficiency developments of small and medium size business organisations with low capital and the reduction of energy utilisation of production sector to reduce energy expenditures.

- Support of energy saving investments for enterprises with the involvement of third party financing.

In 2005 the due to the disproportion between the demand for support and the size of available funds the NEP was temporarily suspended but is planned to be continued in 2006.

KIOP-2004-1.7.0.f (Operative Programme for the Environment and Infrastructure Environmental friendly development of energy management for 2004-2006)

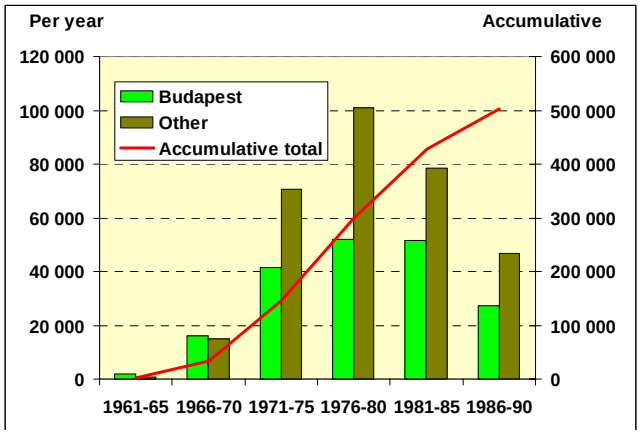
KIOP is one of the five operative programmes of the National Development Plan.On of the actions set forth within KIOP was the Environmental friendly development of energy management. The key objectives of the action is the

- increased utilisation of renewable energies
- improved energy efficiency.

The tool of meeting the objectives is direct subsidies covering 25-75% of the justified costs of renewable projects and 30-75% of energy efficiency projects. The support cannot exceed HUF 300 million per project. The funds for the support is prided from the European Regional Development Fund (75%) and from national resources (state and municipal budgets) (25%).

This tool is designed for large projects: the minimum projects size is HUF 125 million. The support is available for governmental and municipal institutions, municipality-owned enterprises, non-profit NGOs, churches and SMEs[13].

Support for the energy efficient reconstruction or modernisation of pre-fab technology buildings ("Panel Programme" Code: LKFT-2005-LA-2)



5. Fig. Number of "panel" buildings constructed

Due to their large number, age and the technology used in their construction, the buildings constructed from pre-fabricated concrete elements between the end of the 1960s and 1990 ("panel" buildings) represent large potential in residential energy saving. The same applies to the "mass-produced" housing constructed with some other technologies. In order to realise some of this saving potential support is provided for the energy efficient reconstruction or modernisation of such buildings. The supported measures are primarily:

- thermal insulation of building envelope;
- replacement of windows and doors
- modernisation of heating, water supply, sewage and ventilation systems.

Maximum 33% of the total project cost or 400.000 HUF/home, whichever is the lower, can be provided in the form of grant. The support system is managed by the National Office for Housing and Construction (OLÉH).

[13] Small and Medium Size Enterprises

Hungarian Energy Efficiency Co-Financing Programme (HEECP)

The purpose of the Programme is to provide assistance in the financing of energy efficiency within the financial sector. Three forms of assistance is offered:

- Guarantee Fund: By providing guarantees HEECP is instrumental in promoting the energy efficiency services of financing institutions, in the financial and technical preparation of projects.
- Technical assistance: HEECP is ready to cover the 50% of the personnel costs of one person who is working on preparation or monitoring of energy efficiency related projects, or on energy efficiency marketing. HEECP can also provide up-front financing for project preparation.
- Operation: Financing is available for information exchange, conferences, workshops, or work of experts.

3.2.2.10.2 Policy instrument type

Economic

3.2.2.10.3 Status of implementation

Implemented

3.2.2.10.4 Implementing entity

Please refer to the description of the individual tools.

3.2.2.10.5 Monitoring indicators

Number of projects, energy savings achieved.

3.2.2.10.6 Effects and impacts

Included in the forecasts for the different measures and projects discussed in the other chapters.

3.2.3 Summary of policies and measures

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas thousand tons CO2 eq.		
						2005	2010	2015
Limitation of SO2 emissions from power plants	Fuel switch in power plants	CO2	Regulatory	implemented	Regional Environmental Inspectorates	980	980	980
Support of cogeneration	Increase the share of combined heat and power generation	CO2	Regulatory Economic	implemented	Hungarian Energy Office	634	719	805
Support of renewable-based power generation	Promote renewables in order to meet EU targets	CO2	Regulatory Economic	implemented	Hungarian Energy Office	80	1033	1201
Land-based support for energy crops and forests	Assist growing plant for energy use	CO2	Economic	implemented	Ministry of Agriculture and Rural Development and Office for Agriculture and Rural Development	included in the forecasts for related measures		
Life extension of the Paks nuclear plant	extend nuclear-based power generation for at least 20 years	CO2	Other: technical	adopted	The Paks Nuclear Plant	0	0	1477
Energy tax and environmental levy	incentives for energy saving, funding for nature conservation	CO2, CH4	Regulatory Fiscal	implemented	Hungarian Customs and Finance Guard (VPOP) State Tax Authority (APEH)	not directly quantifiable, but included in the overell emission forecasts		

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas thousand tons CO2 eq.		
						2005	2010	2015
Energy audits in industry and the communal sector	identify energy saving opportunities increase energy awareness	CO2	Economic	implemented / suspended	Energy Efficiency, Environment and Energy Information Agency (Energy Centre)	not directly quantifiable, but included in the overell emission forecasts		
New legislation for the energy efficiency of buildings	reduced energy consumption for space heating	CO2	Regulatory	adopted	Authorities for construction licences (municipalities) National Office for Housing and Construction (OLÉH)	0	97	108
Improving energy awareness	increased energy awareness of the public leading to concrete savings	CO2	Information, education	implemented	Energy Centre, through a application system	not directly quantifiable, but included in the overell emission forecasts		
R&D for energy efficiency and renewables	imporevd R&D with emhasis on energy efficiency and rennewable energy	CO2, CH4	Research	implemented	Ministry of Education (earlier) National Office for Research and Technology (from 2004) Energy Centre	included in the forecasts for related measures		
Support for the improvement of industrial energy efficiency	Reduced energy consumption in industy	CO2	Economic	implemented	Energy Centre, through a application system	53	63	73
Support for the improvement of residential/communal energy efficiency	Reduced energy consumption in the residential and communal sector	CO2	Economic	implemented / suspended	Energy Centre, through a application system	81	97	112

Name of policy or measure	Objective and/or activity affected	GHG affected	Type of instrument	Status	Implementing entity or entities	Estimate of mitigation impact, by gas thousand tons CO2 eq.		
						2005	2010	2015
Support for end-user renewable energy	larger share of renewables	CO2	Economic	implemented / suspended	Energy Centre, through a application system	29	38	46
Modernising district heating systems	improved efficiency in district heating	CO2	Economic	implemented	Energy Centre, through a application system	94	114	129
Energy efficiency support schemes	improved efficiency, larger utilisation of renewables	CO2	Economic	implemented	Energy Centre, Ministries, National Office for Housing and Construction (OLÉH)	included in the forecasts for related measures		

3.3 Transport

3.3.1 National targets and support for renewable automotive fuels

3.3.1.1 Objectives and description

The Directive 2003/30/EC of the European Parliament and the European Commission requires that the member states would increase the share of automotive bio-fuels to 2% until 2005 an then establish a growth rate of 0,75%/year in order to reach 5,75% share by 2010.

In order to address these targets, Government Decree 18/2003. (II. 19.) Korm. introduced a subsidy system for bio-diesel and also provided a safe market for such products. This attempt proved to unsuccessful[14], therefore the system was abandoned.

As in several EU member states, the use of bio-ethanol (ethanol) and ETBE[15] produced from bio-ethanol, as well as the use of bio-diesel produced from vegetable oils is considered feasible in Hungary. Due to professional and financial considerations, direct blending of bio-ethanol in engine fuel is not preferred, however, technically, there is no restriction on the blending in of ETBE produced by the addition of isobutylene, a by-product of oil-refineries.

Thus in order to meet Hungary's international commitments, however, the Government in the Government Resolution No. 2233/2004. (IX. 22.) Korm. agreed that the share of renewable fuels (bio-diesel and ETBE produced from bio-ethanol) within the total automotive fuel consumption shall reach 2% by 2010[16]. The decree also provided a tool for achieving the target by installing a excise-duty refund system until 2010.

Some further details of the use and commerce of bio-fuels are regulated by Government Decree 42/2005. (III. 10.) Korm., primarily by providing adequate definitions for the various types of bio-fuels.

3.3.1.2 Policy instrument type

Fiscal

3.3.1.3 Status of implementation

Implemented.

3.3.1.4 Implementing entity

Ministry of Economic Affairs and Transport

[14] In the framework of the bio-diesel programme launched in 19999 two experimental bio-diesel plants were built in Hungary; their production was planned to be utilized in a so-called closed-circuit, integrated producer-manufacturer system, while keeping bio-diesel totally tax-free. In the pilot phase, the aim of the programme was to facilitate bio-diesel use among agricultural producers manufacturing plant materials. However, due to the special, low-rate excise duty on diesel granted for agricultural producers, the use of biodiesel was not an economical option for them, thus, the programme failed.

[15] ethyl-tertio-butil-ether

[16] This target is behind the EU expectations but Hungary applied for derogation on the grounds of limited bio-fuel production potential.

Ministry of Environment and Water Management
Ministry of Agriculture and Rural Development
Ministry of Finance

3.3.1.5 Monitoring indicators

Quantity of bio-fuels sold/used. The Government Decree 42/2005. (III. 10.) Korm makes it obligatory for all traders of bio-fuels to make a detailed report every year for the ministry responsible for transport.

3.3.1.6 Effects and impacts

One of the obstacles before the faster bio-fuel production is the lack of ETBE production capacities. At the time when the current targets were set, production capacity for bio-ethanol required for 40 thousand tons of ETBE was available. Subsequent to the new decree in late 2004, MOL Hungarian Oil and Gas Company plans to make investments in their Tiszai refinery, so that the total ETBE production capacity is expected to be over 100 000 tons from 2007. The bio-ethanol necessary for ETBE production is to be procured through tender procedures that triggers competition for the construction of ethanol production capacities. The first tender for was launched in the summer of 2005.

It is difficult to make statements as to the quantitative impacts of the policy as yet, because the first results are about show in 2006. According to the background studies of the Government's renewable strategy the 2% share target is realistic if the excise-duty refund (or zero excise duty) system is in place. All estimations are based on this quantitative target figure. The absolute value of renewable energy consumption in transport through the use bio-fuels is thus expected to be 3 PJ in 2010. After 2010 the 2-2,5% share is thought to be maintained.

It is even more difficult to quantify the GHG emission reduction effect of the measure as there is no commonly agreed estimation regarding the impact of bio-fuels on overall GHG balance. Some scientists, for example, even argue that the energy balance of alcohol production is negative, i.e. the production requires more energy (typically produced from fossil fuels) than the final product contains[17]. Other authors in a more recent study[18] claim that owing to modernised methods of farming and the optimisation of the conversion process the balance turned positive in recent years, presenting 8-15 MJ/litre energy gain, depending on the feedstock and the technology used for conversion. It is clear that converting the estimated energy gains to GHG emission savings is even more difficult and site-dependent, as it much depends the fuel used in the plant and the fuel mix of power generation in the given region. According to the study the achievable GHG reduction ranges from 0,3 to 1,8 kg CO_2 eq. depending on the feedstock and the fuels used. The wide range well shows that it would be irresponsible to make any statements regarding Hungary's emission reductions as yet, since the construction of the production capacities are in the preparation phase. Still, just to illustrate the order of magnitude, using the above range, it is calculated that the use of the expected quantity of bio-fuels in 2010 may result in saving of 0,04-0,26 kt per year.

[17] Pimentel and Patzek in Natural Resources Research (Vol. 14:1, pp 65-76)
[18] Henke-Smitz:Innovations in the Production of Bioethanol and their Implications and Greenhouse Gas Balances. F.O.Lichts World Ethanol Report, vol. 3, no.23, 2005

3.3.2 General transport related policies and measures

3.3.2.1 Objectives and description

An important specific and operative objective within the Action Programme of Urban Environmental Quality is the reduction of urban environmental problems that are due to the traffic, particularly in densely populated areas of towns. This objective is planned to be achieved through:

- Comprehensive transport plans, organization and management to reduce traffic in inner-city areas, particularly centres of towns (constructing by-pass roads, planning and establishing P+R systems, constructing a network of bicycle paths)
- Development of urban and agglomeration public transport, considerable improvement of its quality (including the integration of urban public transport, establishment of traffic associations; development of intermodal junctions; modernization, replacement of vehicles; development of capital, local and suburban traffic)
- Protective investments to prevent the propagation of harmful impacts, among them the construction of noise protection structures, noise abatement elements

NEP-II. does not set concrete quantitative targets to these actions.

The Action Programme of Climate Change also includes a transport related operative objective, i.e. the reduction of pollution emission from transport, that is to be achieved by:

- Accelerating the modernization rate of the vehicle stock
- Moderation of the environmental impact of freight transportation: supporting the propagation of environmentally friendly transportation ways, shifting freight transportation from trucks to railway
- Support for environmentally sustainable means of transport.

In order to implement the planned measures an ambitious Action Programme is being developed with concrete individual measures. The planned measures include

- Yearly updated promotion / support scheme for environmentally friendly vehicles
- Establishing a carbon trading system for heavy vehicles, later for lorries then for passenger cars.
- Improving the efficiency of regular emission tests of the vehicles by utilising the Internet; by providing improved technology for the tests,; by random on-the-road tests.

The target emission reduction to be achieved by the measures of the Action Programme is the following:

CO2	15 %
NOx	70 %
CO	60 %
CH	50 %
Particles	70 %

Plans also exist for balancing the various ways of cargo transport by

- limiting the use of heavy road transport through more stringent regulation, limits on the time frame and lengths when and where such transportation is allowed, offering bonuses, combined discounts if transport is shifted to railways of waterways;
- supporting the construction of infrastructure and equipment, vehicles for combined transport (new terminals, loading technologies, Ro-Ro types ships etc.)
- ensuring that costs of transportation would be related to the load by introducing differentiated road tolls, review of vehicle tax system.

Training and information dissemination measures will also be instrumental in achieving the targets. The planned measures include:

- information system of transportation will be established (incorporation information on the environmental impacts of transportation in the curriculum of schools, cooperation between governmental bodies and NGOs)
- legislation that reflects the environmental benefits of modern, state-of-the-art vehicles;
- labelling and other type of information about the environmental impacts of the vehicles.

3.3.2.2 Policy instrument type

Mainly economic.

3.3.2.3 Status of implementation

Adopted.

3.3.2.4 Implementing entity

3.3.2.5 Monitoring indicators

- share of local and interurban public transport within modes of transport;
- changes in passenger-km of local and interurban public transport;
- changes in the length of local and interurban public transport network detailing the transport modes (railway, road);
- occupancy indicators of local and interurban public transport;
- share of bicycle transport within modes of transport;
- changes in the length of bicycle paths;

3.3.2.6 Effects and impacts

The impacts of the planned actions are rather indirect therefore it is not possible to forecast the emission reductions achieved by these. Some sort of forecast will be possible only for some of the individual actions when the concrete targets will be clear and input data according to the monitoring indicators are available. Still, in the course of modelling and forecasting Hungary's GHG emissions some assumptions were made with all the planned measures in mind and with respect to expected growth rate of the economy, the forecast increase of the road network system, the average distance travelled by the different vehicles (primarily lorries and heavy transport vehicles), the price elasticity of automotive fuels and the expected growth of vehicle stock. With all these the forecast GHG emission reduction achieved, as compared to the also forecast baseline are shown in the following table. It is, however, noted, that the forecast emissions, compared to the transport emission levels of 2005 the absolute values show increase, shown in the third column of the table.

	CO_2 emission saving against baseline kt	Emission increase relative to 2005 kt
2005	0	0
2010	925	583
2015	2118	1176

3.4 Industry

3.4.1.1 Objectives and description

The process-related industrial GHG emissions are basically determined by the production levels that are dependent on the general development of the national economy, the market conditions, owbership changes, acquisition etc. The major developments in selected industries are shortly listed below:

Mining industry

Due to the low economic performance of coal mining and the strong competition in the coal market a number of mines were closed or stopped in 2003 and 2004. Demand for coal also dropped due to the fuel switch project of some power plants, but the share of coal has also dropped in the residential sector as a result of the widespread use of natural gas.

As to domestic oil and gas mining, due to the gradual depletion of domestic sources its importance in GHG emission is lower than earlier.

Cement production
The main consumer of cement is construction industry, so its prosperity is the figure of the improvement of construction industry. Cement is mostly used for concrete production. There is a very strong price competition in this sector. Holcim and the Heidelberg group own the main plants in Hungary. One of the Holcim plants, Hejőcsaba operates dry technology and has 2 times greater capacity than the size it operates presently. The other Holcim plant, Lábatlan runs wet technology. The 2 plants belonging to the Heidelberg group is Beremend, with dry technology, planned to be modernised and Vác, with a modern, dry technology having one line permanently out of operation because of the low demand. The overall utilisation of cement production capacities in Hungary is just 60%.

Lime production
Lime production is highly concentrated, the capacity is composed of 3 factories. The capacity of these can be increased in the coming years by app. 25%, so the capacity barrier is not expected to show. With the reduction of national production the ratio of import began to rise, the source of which is mainly Slovakia and Austria. The reason for the increase of import is not a more competitive price, but the growing demand for quality lime. The relatively quick appearance of lime import was the result of the closure of national factories (mainly the Dunaferr Lime Plant). As the capacity of the operating plants can be increased, export is predicted to reduce.

Consumption is stabilised. Increase can emerge in the paper industry for the production of quality paper, presently supplied from import. The prosperity and changes in the applied technologies of the construction industry can also raise demand. New consumption can appear in the environmental protection and agriculture.

Ceramics and porcelain industry
The product structure, and hence the market for the products in this sector is quite heterogeneous. No typical trends can be identified, as, for example, no significant relationship can be found between the production volume of building material ceramics and the volume index of the construction industry. However, a slowly growing trend of production is foreseen.

Paper industry
Paper consumption in Hungary is app. 80 kg/person, which is far below the EU average. The average consumption of the EU-5 is 2.5 times higher, 200 kg/person. Based on this fact a dynamic improvement of production is expected.

Chemical industry
Chemical industry probably is the most concentrated sector of processing industry, contributing to the total production of processing industry by 75-80%, which is produced by only 15-20 companies. An important, sector-specific tendency is that in many cases the national production of raw materials and intermediers is going to cease, companies are going to import these materials then. The big company size is also the result of a significant vertical integration, which is extremely true for the petrol-chemistry sub-sector (mineral oil processing, plastic production). Though the concentrated structure is a general characteristic of the sector, there are huge differences between sub-sectors. Coke production and mineral oil processing is shared by 2 company groups (Dunaferr and MOL Rt.) as there are only a few actors in the plastic raw material, fertilizer, pharmaceutical and rubber industry. Petrol-chemistry sub-sector (including plastic manufacture, mineral oil processing and plastic fibre production) has a cyclic character. Fertiliser and pesticide industry was the loser of the evolution of the previous period of chemical industry as a result of the decline of the Hungarian intensive agriculture, the accelerated import. In the future demand level for fertiliser is predicted to fix at a relatively stable value, which is considerably lower than in the previous period. Hungarian pharmaceutical industry is one of the most competitive sectors of the whole economy even abroad. Therefore a strong growth rate is predicted. Rubber and plastic manufacture has shown a very dynamic improvement since 1990. Experts foresee an even 4 times higher growth than the GDP increase here.

Coke-, pig iron and steel production
The production side of the national steel market has a few actors, which can significantly be influenced by the periodical or final disappearance, modification or technology change of an actor. The national demand is influenced mainly by construction activities, but overall production heavily depends on what happens in the world market, such as how China's demand will change. Predictions show a dynamic growth in the construction sector. Coke in Hungary is produced by only by one plant, and the demand for coke is determined by the steel production.

The above described situation well reflects how the production of the industry is exposed to a wide range of factors. It must also be noted that the vast majority of the industrial GHG

emissions are due to energy generation, combustion or other energy conversion processes. The direct process-related emissions represent a small fraction only.

Therefore there are no industry specific mitigation policy: the general policies and measures described elsewhere in the current document influence the emissions of the industry. The most important such measures are:

- The introduction of the Emission Trading System. This creates a strong incentive for the biggest emitters of the industry for reduction measures.
- General environmental protection measures, such as emission limits of combustion equipment. These force the industries to modernise their equipment, that usually results in efficiency improvement and hence GHG emission reduction.
- Energy tax and environmental levy.
- Waste management legislation and programmes. These have the highest effect in the industry (such as reduction in packing materials) beside the agriculture.
- Support programs for cogeneration.
- Support on energy efficiency measures (audits, projects, awareness raising).

3.4.1.2 Policy instrument type

Regulatory, economic, fiscal

3.4.1.3 Status of implementation

Various

3.4.1.4 Implementing entity

Various

3.4.1.5 Monitoring indicators

Only indirect effects can be monitored, as the data appearing in emission inventories reflect the effect of a host of various influencing factors other than the measures. However, some monitoring method (discussed at the individual measures) allow differentiation between the industries and other emitters. (An example is the support of energy efficiency measures, where each supported project can be evaluated individually.)

3.4.1.6 Effects

The quantifiable effects are included in the forecasts for the individual measures in the relevant chapters of the current document.

3.5 Agriculture

3.5.1.1 Objectives and description

The key elements of GHG emission mitigation policy within agriculture are the following:

- Modernisation of animal husbandry including the
  - application of foddering technologies that reduce the products of enteric fermentation
  - switching the manure management technology from liquid to semi-liquid; application of less methane intensive manure management and leak-free storage technologies
- Promotion of natural farming methods with much less chemicals, organic fertilisers (manure) and energy use.
- Change of land use.

There is a wide range of legal measures and policies to support such changes.

National Agri-environment Programme

In the Government Resolution 2253/1999 (X.7.) Korm, the Government of Hungary approved the National Agri-Environment Programme (NAEP) as a sub-programme of the National Environmental Programme. This Programme contains various horizontal and zoned target programmes supporting environmentally friendly farming. (A detailed summary of the NAEP is given in Hungary's 3rd National Communication for the UNFCCC, 2002.)

The SAPARD Plan of Hungary (2000 – 2006)

Decree No. 53/2001. (VIII. 17.) FVM identified Hungary's priorities in agriculture and rural development in order to prepare for the optimum use of the EU's SAPARD funds. This decree (SAPARD Plan for short) was based on, among others the NAEP. Reducing the negative impacts of agriculture on the environment is listed among the SAPARD Plan's specific objectives and the emphasis on environmental considerations is an integral part of the proposed strategy. The latter is planned to be put into practice by promoting natural farming methods.

Of the measures prescribed in the SAPARD Plan, the activities involved in the measures entitled, "Protection of agri-environment" and „Technical Assistance" provided the basis for some corresponding measures with GHG mitigation aims or effects.

Nitrate Action Programme

Government Decree 49/2001. (IV. 3.) Korm on protection against the nitrate contamination of waters from agricultural sources (Nitrate Decree for short) contains provisions in line with Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. In a manner similar to the directive, the Nitrate Decree, which came into effect in 2001, contains the list of settlements in nitrate sensitive areas, the rules of "Good Farming Practice in manuring" that farmers are obliged to keep and the time-schedule of implementation in the form of an action plan. The Action Programme was launched on 1 January 2002 and extends to 31 December 2013. Along with nitrate sensitivity, its priorities include the requirements applicable to the manure storage systems of animal keeping sites that use semi-liquid manure technology.

Agriculture and Rural Development Operative Programme (AVOP)

AVOP is the part of the National Development Plan, which identifies the environmentally friendly agriculture and the rational use of land among the general objectives of rural development and sets forth the following specific objectives:

- Environment-conscious and sustainable land use
- Improvement of the status of the environment
- Increasing afforestation.

Second National Environmental Programme - Thematic Action Programme of Climate Change

Among the specific and operative objectives of the Climate Change Action Programme, the following objectives are included:

"3.2.4 Reduction of greenhouse gases from agriculture and waste by strengthening carbon dioxide sink capacities

a) Reduction of methane emission form animal breeding and cultivation

b) Support for cultivation aimed at power generation and increasing the binding potential"

These policies are implemented by, among others, various support schemes. The most important ones, that affect GHG mitigation are the following:

- Entry Level Scheme (ELSs)

Entry level schemes promote environmentally friendly farm management in each land use type to provide broad scale opportunity to farmers to enter commitments to reach environmental achievements in their farming practice. Elements of the ELS have already been introduced in Hungary in 2002-2003 under Government Resolution 2253/1999 (X. 7.) on the introduction of the National Agri-environment Programme. ELSs are designed to encourage farmers to use farming methods adapted to the local environmental and agricultural conditions, to target production systems suitable to soil and climate conditions and natural environment, with special attention to relevant environmental protection aspects.

- Organic Farming Scheme

The OFS is designed to encourage farmers using conventional farming methods to convert their production systems to organic production as prescribed by Regulation 2092/91 (as amended). Conversion to organic farming systems provides gains in terms of soil health and fertility, benefits for bio-diversity and wider landscape benefits through the use of organic soil cultivation, crop rotation and the absence of synthetic pesticides, herbicides and fertilisers. Besides organic farming contributes to reduced GHG emissions through the use of manure as fertiliser and the limited energy use.

All farmland in the land use concerned must be entered into the scheme, parallel farming (both organic and conventional) is not allowed. Any farmer who is controlled by any organic production certification organisation approved under Article 9 of Regulation

2092/91 is eligible for aid under the OFS regardless that he/she is in conversion or already converted. For areas in conversion period the higher payment rates apply, this is 2 years for annual crops and 3 years for permanent crops.

Environmentally beneficial extensification, especially the reduced, optimised use of fertilisers and pesticides, the considered (limited) application of dangerous substances and other accompanying benefits for the environment are among the main priorities for agricultural practice. Integrated farming is based on the internationally approved principles and practices of integrated pest management (IPM, IOBC guidelines). This production system should be targeted as a future standard for market oriented agricultural production due to the economical and efficient production that it facilitates, its environmental merits and its food safety aspects. The (Integrated Crop Management System (ICMS) was introduced in Hungary in 2002, on the introduction of the National Agri-environment Programme

The ICMS is designed to encourage farmers to use integrated farming methods of production in compliance with higher environmental standards, to optimise the use of fertilisers and pesticides and to apply all available means (equipment and know how) of sound farming. The application of integrated farming systems provides benefits in terms of soil conservation, water protection and bio diversity through the use of environmentally friendly crop patterns, cultivation techniques, nutrient management, crop rotations, as well as the optimised, limited use of synthetic pesticides, herbicides and fertilisers

- Support for meeting standards

The general purpose of the support is to ensure that the requirements of the valid standards animal husbandry are met. Within the support a separate “sub-measure” covers the area of environmental protection. The aim of this type of support is to ensure the adequate on-site placement and management of the organic manure and the storage in line with the environmental requirements. The form of support is provided by providing subsidy for the investment costs. In the framework of this support mechanism assistance is also provided for compliance with provisions concerning keeping and foddering technology, although reduction of enteric fermentation is not identified as a target.

3.5.1.2 Policy instrument type

3.5.1.3 Status of implementation

Continuous

3.5.1.4 Implementing entity

Ministry of Agriculture and Rural Development

3.5.1.5 Monitoring indicators

Number of projects supported; Number of events; Fund spent on projects; Specific quantitative indicators of projects (e.g. number and type of animals foddered, quantity of manure managed)

3.5.1.6 Effects

The above discussed measures obviously have GHG mitigation effects, although, due to either their indirect nature or the lack of adequate data the impacts are very difficult to quantify. The more so because the overall GHG emissions of agriculture are much more influenced by other, stronger factors, such as the market mechanisms and demand for animals of organic products. There are other adverse effects, too. For example, considerable decrease in the use of fertilisers is highly unlikely, as in the past years the problem of Hungarian soils is not the excess of fertilisers, but rather – due to the negative balance of nutritive elements - the degradation of soil quality.

In the modelling process some assumptions were made as to the effect of the planned measures. It is strongly emphasized, however, that the following figures do not reflect the impact of measures only, but rather the result of complex processes, whose part are the measures. As to the possible effect of mitigation measures, however a good indication is the difference between the "with measures" and "with additional measures" scenarios, because the latter is based on the spread of more natural modes of farming, a reduced fertiliser use, and a farming practice that complies with the requirements of the agro-environmental program. This scenario also assumes the strongest afforestation scenario through supports and other significant measures are taken in the agricultural sector.

	with measures		with additional measures	
	CO_2 emission saving against baseline kt	Emission change relative to 2005 kt	CO_2 emission saving against baseline kt	Emission change relative to 2005 kt
2005	0	0	0	0
2010	57	1828	353	1531
2015	123	2527	751	1899

3.6 Land use change and forestry

3.6.1 Afforestation

3.6.1.1 Objectives and description

Increasing the area of forests is in the national interest for several reasons. Afforestation within the scope of alternative land use primarily furthers the objectives of agricultural policy as it is considered environment-friendly land use and produces environment-friendly raw materials while contributing to the GHG mitigation effort of Hungary. Afforestation aimed at meeting the complex social requirements applicable to forests play ecological, economic and social functions that all promote rural development and the improvement of the standard of living of the rural population. Afforestation is also of key importance in areas affected by water and wind erosion as well as the region of the Great Plain that is often covered by internal water and floods. Therefore massive afforestation efforts were made in the past and afforestation is among the key priorities of rural development. The legal and policy background of these efforts are summarised below.

National Afforestation Programme

Based on the considerations of agricultural land utilisation concepts, the national long-term afforestation concept was completed in 1996. According to the concept, 778 thousand hectares is a realistic estimate of the quantity of agricultural land suitable for afforestation, and the afforestation of that area would raise the forest rate of Hungary to the optimum level of 27%. optimal. This concept provided the basis for the National Afforestation Programme drafted in 1997. Due to limited resources available, changes of land ownership and lack of information for the new land owners, however, the set targets were not met.[5]

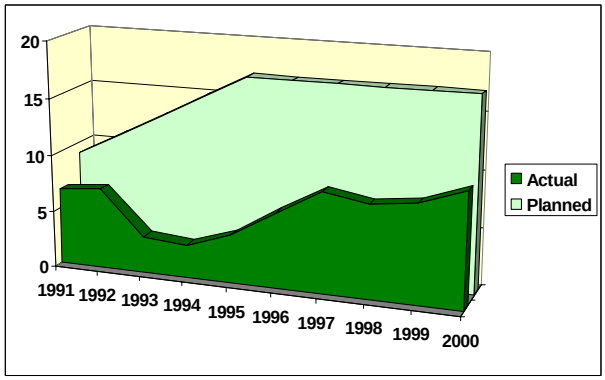


Fig. 6. Planned and actual afforestation in Hungary

National Rural Development Plan and AVOP

Afforestation is among the top priorities and measures of the NRDP. NRDP –in order to avoid overlapping measures – is in close relation to AVOP, the operative programme of the National Development Plan, which identifies the environmentally friendly agriculture and the rational use of land among the general objectives of rural development and sets forth the following specific objectives:

- Environment-conscious and sustainable land use
- Improvement of the status of the environment
- Increasing afforestation.

National Agri-environment Programme

The NAEP, a sub-programme of the National Environmental Programme, approved by the Government Resolution 2253/1999 (X.7.) Korm, includes several horizontal and zonal targets. One of them is to increase the territorial proportion of semi-natural forest management. NAEP also looks at afforestation as a tool of implementing some of its measures, such a forest plantation on flood areas in order to protect wetland habitat.

Act LIV of 1996 on the forests and their protection

Hungary has a very elaborate legislative framework for the protection of the forests, that ensures that forestry would be sustainable. The legislative framework is based upon the Act LIV of 1996 and the Decree 29/1997. (IV.30) FM on its implementation. Forestry activities are conducted in accordance with a regularly updated 10-year plan that is broken down into individual one-year operative plans. Both types of planning are approved by independent bodies.

The quantitative targets of the policies are based on the draft of the National Afforestation Programme, but learning from the experience of the past years, they are somewhat reduced and an escalating schedule is foreseen. In practice, according to financing targets of the National Rural Development Plan, the following afforestation schedule is set: in 2005: 10 000 ha, in 2006: 11 000 ha, and then this value is predicted to rise to 15000 hectare/year between 2007-2013. These forests are predicted to be planted on low and medium quality arable lands, as most of the grasses are under protection. EU subsidies for afforestation are competitive with ploughing subsidies, so there is no danger of any barriers before turning arable land into

forests. The annual wood felling is expected to stagnate around app. 8 million cubic meters of harvested wood.

The above described policy is implemented through a set of support schemes:

- Plantation: direct support for the afforestation of agricultural land, and, in justified cases, supplementary aid for certified additional activities performed in conjunction with the plantation. The amount of subsidy depends on the type (topography) of land and the type of trees planted. The additional activities also supported are the following:
    - Protection of the soil of afforested areas
    - Protection of the afforestation against grazing animals, game and trampling damage
    - Protection of afforested areas against inundation/flood damage
    - Protection of afforested areas against fire
- Maintenance: protection and fill-in planting of newly planted forests, disbursed for a maximum period of 5 years. This support aims at the maintenance of forests established in agricultural areas, including measures required or protection against harmful biotic effects, for five years following the establishment. This includes the annual maintenance (machine weeding, hoeing, sickle cutting, removal of young shoots, etc.) of forests along with their pest protection and the ploughing and cleaning of fire protection strips. The cost of additional maintenance and protection after establishment is determined for each target type as a lump sum, which applicants will receive in the third and fifth years after plantation.
- Premium for loss of income for the afforested area, disbursed for a maximum period of 20 years. The aim of this support is to provide compensatory payment to farmers for the loss of revenue or income caused by the afforestation of their agricultural land. Pursuant to paragraph 1of Article 31 of Council Regulation (EC) n°1257/1999 , support will be granted annually to cover loss of income due to the afforestation of agricultural land for a maximum period of 20 years.

3.6.1.2 Policy instrument type

Economic

3.6.1.3 Status of implementation

Implemented.

3.6.1.4 Implementing entity

Ministry of Agriculture and Rural Development

3.6.1.5 Monitoring indicators

Increase of afforested area; type of forests (CO_2 sequestration capability)

3.6.1.6 Effects and impacts

It is apparent from the past history of the National Afforestation Programme, that the actual results are much dependent on political decisions. Therefore in order to however roughly, but realistically the CO_2 sequestration potential the following three scenarios were used:

- Baseline scenario: It assumes that the afforestation rate is equal to the lowest one in the past few decades (~4,000 ha/year).
- "With measures" scenario: it is assumed that average afforestation rates in the past several years (~8,000 ha/year) are maintained until 2050,
- "With additional measures" scenario: this is the technical potential scenario that involves afforesting 773 000 ha of former agricultural land in 50 years.

Thus the CO2 emission saving against the baseline will be the following:

	with measures	with additional measures
		CO_2 emission saving against baseline kt
2005	55	82
2010	630	945
2015	1857	2800

3.7 Waste management

3.7.1 Objectives and description

The basis of Hungary's waste management policy is the Act XLIII of 2000 on waste management and the National Waste Management Plan (NWMP) that was codified by the Resolution No. 110/2002. (XII. 12.) OGY of the Hungarian Parliament.

The basic purpose of the Act XLIII of 2000 was to create a framework for waste management that serve

- sustainable development and providing adequate conditions for the future generations;
- reduction of energy and raw materials consumption by improving efficiency and reducing the volume of waste;
- reduction of loads caused by waste on human health and the natural environment.

The Act put on emphasis on preventing the production of wastes, on recycling and the environmentally friendly treatment of wastes, and adopts the "polluter pays" principle. It codifies the rights and duties of manufacturers (producers), traders and consumers, identifies who is responsible for the treatment, collection, transport, recycling and treatment of wastes and the basic principles of all these activities. Among other provisions it stipulates that a national waste management plan then specific regional waste management plans have to prepared. The different authorities of the local and regional governments and the Environmental Inspectorates are also identified. Two more provisions of the Act need also be mentioned: it creates the legal background for waste management fines and prescribes that a Waste Management Information System would be established.

The NWMP identifies concrete tasks in the following fields:

- Regulation and standards
- Development if institutional background
- Information dissemination, awareness raising
- Training, education

- Research and Development
- Prevention and treatment

The major quantitative targets of the NWMP are:

- Through prevention measures it should be achieved that by 2008 the quantity of waste produced would not exceed the level in 2000.
- The share of organic matters within the landfilled waste shall be reduced to the 50% of the 1995 level by 2007.
- By 2008 some 50% of the non-biomass type wastes shall be re-used either as raw material or in energy generation.
- Landfilling of any biomass type organic waste shall be stopped by 2008, they shall be utilised for biogas production.
- The utilisation of effluent sludge shall be increased to 55% from the current 40% by 2008.

These targets are to achieved by a set of specific programmes:

- Program for the non-hazardous wastes of the industry, commerce and services
    - Prevention and recycling programme of industrial wastes
    - Industrial waste treatment programme
    - Program for improving the waste management performance of SMEs
- Program for wastes from agriculture, food processing and biomass
- Program for municipal wastes
    - Program for the management of municipal solid waste
        - Establishing complex regional collection and treatment systems
        - Selective waste collection
        - Recultivation of old landfills.
        - Reconstruction of the Budapest Waste Incinerator Plant
    - Program for municipal liquid wastes
        - Program for achieving that all effluents are collected and treated
        - Pre-treatment and utilisation of effluent sludge.
- Program for hazardous wastes
- Program for special waste types (packing materials, batteries, tires, medical wastes, vehicles, asbestos etc.)

The programs of the NWMP are partly implemented by regulatory instruments, a large set of lower-level legislation that codify the details for example of the utilisation of effluent sludge in agriculture (Government Decree 50/2001. (IV. 3.) Korm.), or of technical requirements of municipal solid waste landfills (Decree 5/2002. (X. 29.) KvVM), technical requirements of composting and treatment of biological wastes (Decree 23/2003. (XII. 29.) KvVM), etc.

The implementation of the policy is also aided by allocating finance from various sources:

- in the framework of targeted support HUF 5812 million was provided from the state budget to finance some 45% of the total investment cost of 48 landfills;
- considerable part (typically 20-25%) of the Environmental Fund was used for waste management related projects (this amounted to HUF 2,5 billion between 1996-2001)
- in the Budget of the Ministry of the Interior HUF 4 billion was allocated for waste management projects.

Similarly to these past examples, the NWMP foresees that some 50-60% of the programs will be financed from central (state budget) resources and regional support systems, another 20-30% is planned to be covered from international funds and the remaining 10-20% will have to be paid for by the municipalities. Central support for the operation of the waste treatment systems, however, is not possible as it would contradict the relevant Community acts (2001/C37/03). Thus the operation will need to be financed primarily fro the fees the polluters pay for waste collection and treatment.

3.7.2 Policy instrument type

Regulatory, economic

3.7.3 Status of implementation

Implemented.

3.7.4 Implementing entity

Ministry Environment and Water Management
Regional Environmental Inspectorates
Municipalities

3.7.5 Monitoring indicators

Quantity of wastes, number of projects, budgets used for financing.

3.7.6 Effects and impacts

The results of the NWMP and the lower level legislation stemming from it have started to show. Several municipal landfill projects have been completed, just as the reconstruction of the Budapest Waste incinerator. The Information System on Wastes (HIR) is operative and several information dissemination efforts have been completed (school textbook on wastes for children, training package on wastes for pupils and teachers, specialised web-site, information booklets for households etc.)

The quantitative impacts on the GHG emissions are incorporated in the national projections of greenhouse gas emissions and removal, to be shown in the following chapter.

4 National projections of greenhouse gas emissions and removal

4.1 Background and methodology

4.1.1 Basic approach

The projections presented are based on an extensive research project to forecast the national greenhouse gas emissions. The research project was prepared for the Ministry of Environment and Water Management by a large community of researchers in 2004. This research was updated in 2005, and the effects of policies and measures and other assumed mitigating factors are presented in two scenarios.

The sector-specific forecasts are based on individual studies, which rely almost exclusively on official statistical data collected and published by government offices, national authorities and designated agencies. The method of projections was to first identify relevant products, whose production results in GHG emissions. Then changes in the production of the relevant goods were forecast by robust statistical models. Explanatory variables were chosen from sector specific and general economic factors. Models were improved until observed variations in production and in relevant activities could be reliably estimated. Eventually, GHG emissions were calculated form combustion and process emissions of the technology in each sector along the guidelines of IPCC, the Monitoring and Reporting Guidelines and data from literature.

General macro-economic forecasts were considered, and the official macro-economic projection of the Ministry of Finance was applied. The results were published, and all sectors provided feedback, number of stakeholders suggested corrections. The final version of the national GHG forecast as follows, was approved by the Ministry of Environment and Water.

The "with measures" and "with additional measures" scenarios were developed with the following two basic differentiating factors: changes in agricultural and forestation policies, application of previously mentioned policies and measures, improved utilisation of renewable energy sources, and different transportation policies.

The “with measures scenario” includes a higher penetration rate of renewables in electricity generation, increased afforestation ratio and a more effective transportation policy change. The effects and differences are presented for each sector if applicable. At the end of the chapter a comprehensive outline of the scenarios and their graphic representation is given.

4.1.2 Methodology

According to the UNFCCC guidelines on reporting and review this projection excludes all policies and measures implemented, adopted or planned after the year chosen as the starting point of this projection, The study was prepared in 2004, so first projected year is 2004, However, all projections are based on official statistical data going back to at least 1995, but most of the forecast are based on econometric time series models with starting year in 1985,

Inventory data was available from 2001 through 2003, Emission projections for the preceding years were presented relative to these actual inventory data.

Projections are presented on a gas-by-gas basis for the following greenhouse gases (in accordance with UNFCCC guidelines/43,(a)):

- CO_2
- CH_4
- N_2O

The projections are made up of the data of following sectors (in accordance with UNFCCC guidelines/43,(a)):

Domestic energy production – projections by fossil fuels

1. Transport
2. Non-transport, broken down to the following sectors
   - Cement Industries
   - Coal Mining
   - Lime Industries
   - Glass Industries
   - Pulp and Paper Industries
   - Natural Gas Industries
   - Power Plants
   - Ceramics Industries
   - Oil Industries
   - Coke-Ferrous metals-Steel Industries
   - Other industrial activities

Technological emission from the following industries:

Mineral products

- Technological emission from the Cement Industries
- Technological emission from the Lime Industries
- Technological emission from the Glass Industries
- Technological emission from the Ceramics Industries

Chemical industry

- Technological emission from the chemical industries,

Production of ferrous metals

- Technological emission from the coke industry
- Technological emission from the ferrous metals industries
- Technological emission from the steel industries

Pulp and Paper Industries

- Technological emission from the Pulp and Paper industries,

Agriculture, land use change, forestry (LUC)

Emissions from afforestation, land use change, and agricultural activities

Waste treatment

- Technological emission from waste water management
- Technological emission from solid waste management

Projections have been prepared in an aggregated format for each sector as well as for national total, using global warming potential (GWP) values agreed upon by the Conference of the Parties, (CO_2 =1; CH_4 =21; N_2O =310)

A detailed account is given about the results in the 4th National Communication. Here, however only aggregated data are presented.

4.1.3 The model used

Bottom-up sector-wise modeling (with ref, to UNFCCC guidelines/43,(b). Models are in most cases time series econometric models about production growth within the sectors. Moreover,

all fossil fuel markets were analyzed independently from the energy using industrial sector models, and the national energy balance was reproduced by forecast fuel breakdown, Emissions from energy users not covered by sectoral models (e,g, households) were estimated on the basis of their projected use of fossil fuels.

All sectoral models were designed and developed for the purpose of the National GHG Emissions Baseline Research Project in the coordination of the Regional Centre for Energy Policy Research (REKK) at the Corvinus University of Budapest, 2004, The only exception is the electricity production capacity model, which was originally developed by the Hungarian Electricity System Operator (MAVIR) and was adapted by the researchers for GHG emissions projection.

Strength of the research was that fossil fuel combustions were projected fuel-wise and sector-wise so no systematic omissions are expected.
The baseline projection does not cover PFCs, HFCs and SF6 (with ref, to UNFCCC guidelines/35). It neither contains the projection emissions related to fuel sold to ships and aircraft engaged in international transport (with ref. to UNFCCC guidelines/36). This projection does not cover the emission from the production of non-ferrous metals, the use of halocarbons, SF6 and NMVOC solvents (with ref. to UNFCCC guidelines/34 and 35).
For chemical industry there was no data was available for the methane emission from carbon black production nor for the N2O emission of catalytic cracking of crude oil.
Besides combustion emission based on the IPCC Method additional technological emissions were estimated for glass, paper and ceramics industries.

Econometric model specifications were computed with numerous explanatory variables sector by sector, models were refined until best fit was achieved, Overall fit of models was presented by R^2 values and Durbin-Watson-statistic. Sensitivity to each independent variable is shown by the estimated parameter values and the t-statistics, all of which are included in the detailed report.

4.2 Forecast emissions

4.2.1 The scenarios

The baseline is the "without measures" forecast, without the effect of any policies or measures.

The "with measures" includes the effect of the currently implemented and adopted policies and measures. It is noted however, that some of the implemented but currently suspended policies whose future in the light of past experience seems uncertain (e.g. support of residential energy efficiency projects) are not included here, since their forecast savings are based on somewhat arbitrary assumptions. These are included in among the additional measures. The forecast savings of the individual measures were converted to a common reference year and baseline scenario.

The scenario "with additional measures" assumes a higher rate of governmental interest and support in aiding the Kyoto emission reduction targets with the means of energy efficiency, renewables use, and transportation and traffic redesign, This scenario was approved and amended by the experts in the governmental agencies.

The scenario with additional measures is different from the „with measures" scenario in the followings,

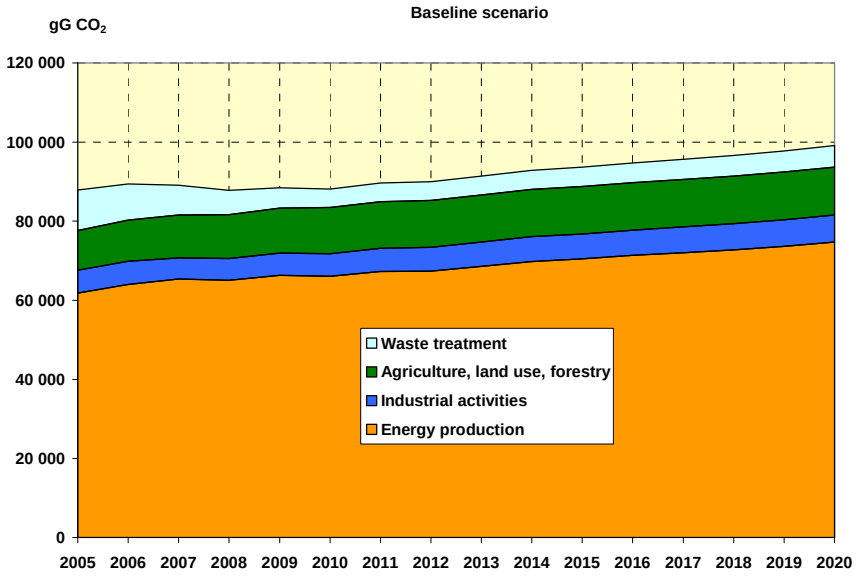
- the government develops and implements from 2015 a radically new traffic and transportation scheme, resulting in a decreasing trend from 2015
- the strongest afforestation scenario is supported and implemented from 2010
- significant measures are taken in the agricultural sector
- the support on energy efficiency and renewables in real value grows to 400% of its present value beginning with 2010

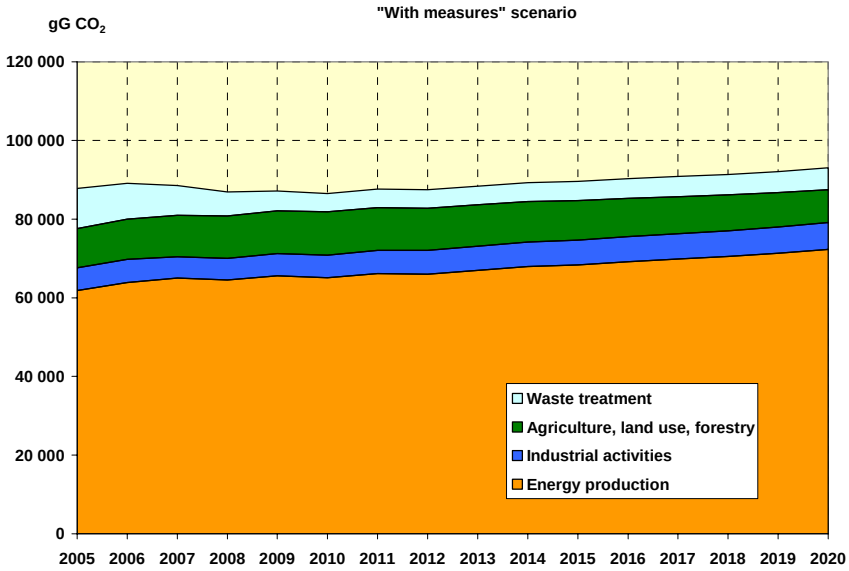
It is noted that these are not unrealistic and impossible assumptions even if we consider the present budgetary conditions. There is a high chance that the European Commission takes a more stringent approach from 2010 and guides the government to increased support in reaching its commitments under Kyoto. Moreover, after the end of the first commitment period, it is expected that there would be further commitments which, regarding the growing trends in Hungary's emissions can not be reached unless decisive governmental action is taken.

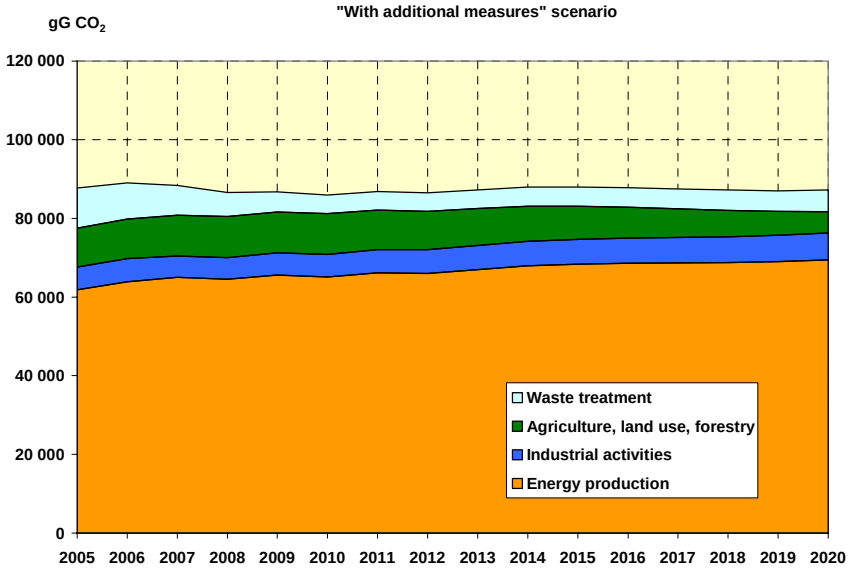
As it can be seen in the following chart, even in the case of radical actions taken, significant reduction of the emissions can not be achieved, only a stabilisation with a slight drop in the emissions seems realistic.

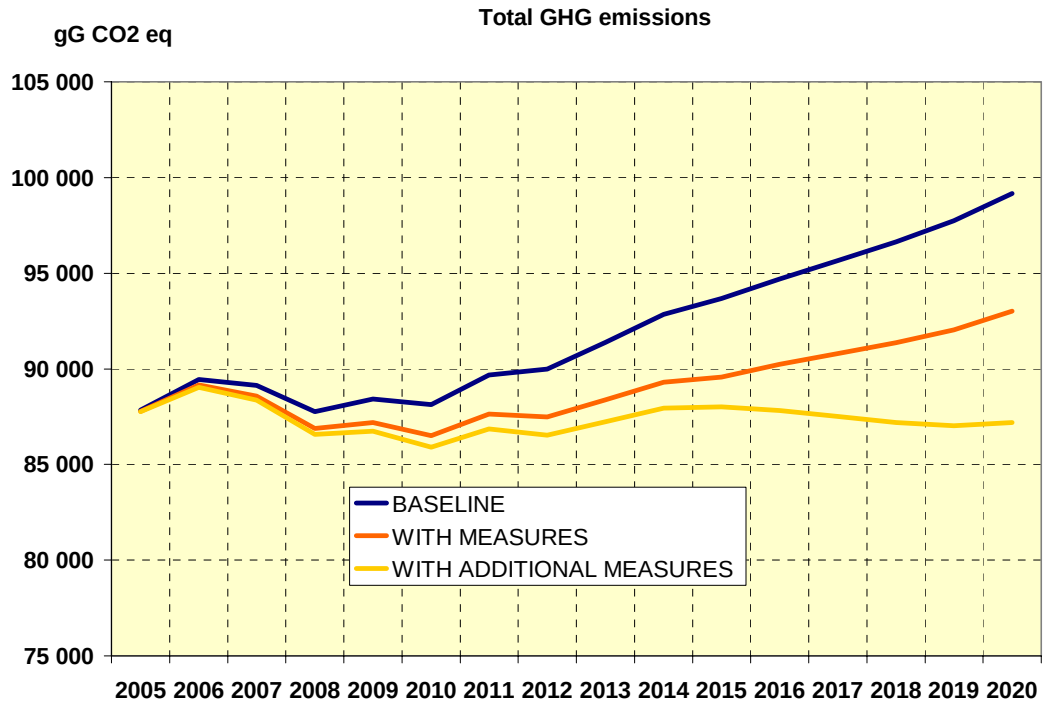
4.2.2 The results

The results of modelling are presented in the following charts. The detailed numerical data are attached in the Annex.




"With measures" scenario
gG CO_2
120 000
100 000
80 000
60 000
40 000
20 000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Waste treatment
Agriculture, land use, forestry
Industrial activities
Energy production


"With additional measures" scenario
gG CO_2
120 000
100 000
80 000
60 000
40 000
20 000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
Waste treatment
Agriculture, land use, forestry
Industrial activities
Energy production



5 Implementation of relevant Community legislation

The measures of Hungary's GHG mitigation policy, which were discussed in detail in the previous chapter all have extensive legislative background that is eventually based on the relevant Community legislation. The individual pieces addressing certain GHG mitigation measures or policies of the Hungarian regulatory and legislative system were introduced in the previous chapter. In order to avoid repetitions, here only a reference is made so as to point out the link with the relevant Community legislation. The individual items of the following list include a reference in square brackets to the relevant chapter of the current document where more in-depth information on the actual measure or piece of legislation can be found.

5.1 Emission Trading System (ETS)[3.2.1.6]

The relevant legislation (Act XV of 2005 on the trading system of greenhouse gas emission units; Government Decree 143/2005 (VII. 27.) Korm. on specific rules of the trading system of greenhouse gas emission units) is based on a strictly follows the relevant Community legislation (2003/87/EK; 2004/156/EC).

5.2 Legislation for the energy efficiency of buildings[3.2.2.3]

Although not yet effective the draft of the new regulation is structured as the relevant Community legislation (Directive 2002/91/EC) requires and includes corresponding provisions. The objectives of the legislation are in accordance with the Commission Directive 93/76/EEC.

5.3 Regulation of cogeneration[3.2.1.2]

The Hungarian legislation that regulates the support mechanism of combined heat and power generation, is in line with the Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal

energy market, although in some aspects the current prescribed efficiency targets are more strict than those in the directive.

5.4 Support of power generation from renewable energy [3.2.1.3]

The support system described in the chapter referred above was designed in order to meet Hungary's commitments within the overall European Union renewable targets.

5.5 National targets and support for renewable automotive fuels [3.3.1]

The national targets for bio-fuels are set by the Government Resolution No. 2233/2004. (IX. 22.) Korm. Although the methods stipulated and structure of the legislation corresponds to the relevant Community legislation (Directive 2003/30/EC of the European Parliament and the European Commission), the set targets (2% share of bio-fuels in the total automotive fuel consumption by 2010) stay behind the expectation of the European Union. (5,75% share by 2010.)

According to the directive, member states may be provided derogation from the EU reference values for either because the national potential to produce bio-fuel from biomass is limited or resources for the production of biomass are to be used for a purpose other than transport, and the special technical and climatic characteristics of the fuel market.

Hungary meets the condition of limited bio-fuel production potential. The prime factor hindering progress is that production capacities may only be eliminated on the long run. In the case of bio-diesel, compared to other parts of Europe, we need to consider the poor national average production rate of rape (cca. 1.8 ton/ha), which would be cheaper but the crop of which depends on climatic factors [6].

5.6 Waste management policy[3.7]

The Hungarian legislation that regulates waste management (Act XLIII of 2000 on waste management; Parliament Resolution 110/2002. (XII. 12.) OGY on the National Waste Management Plan and the related lower level legislation) are based on and are in coherence with Directive 75/442/EEC on wastes, amended by Directive 91/156/EEC.

6 Arrangements to support the Kyoto flexible mechanisms

Hungary, being one of the Annex I. Parties, can make use of the Joint Implementation flexible mechanism offered by the Kyoto Protocol. Joint implementation under Article 6 of the Kyoto Protocol provides for Annex I Parties to implement projects that reduce emissions, or remove carbon from the atmosphere, in other Annex I Parties, in return for emission reduction units (ERUs). The ERUs generated by JI projects can be used by Annex I Parties towards meeting their emissions targets under the Protocol. Since Hungary intends to meet the eligibility requirements, the so-called "track one" procedure is pursued, i.e. Hungary as the host Party of JI projects wishes to apply its own national rules and procedures to the selection of JI projects and the estimation of emission reductions from them.

In order to facilitate the implementation of JI projects, the Ministry of Environment and Water Management has accomplished the following tasks:

- Developed the procedure for evaluating and approving JI projects. As a part of the procedure
- Developed standard formats for various project documents such as the „Project Description" (PD - necessary for the issuance of the Letter of Endorsement) and the „Project Design Document" (PDD - necessary for the Letter of Approval). The standard formats and clear criteria help much the potential projects that seek recognition as JI projects.
- Created and maintains a web site with the relevant, updated information on the application procedure and general information on JI projects. This includes the publication of PDDs submitted for approval, that provides opportunity for the public the have a say on the projects themselves and also serves as examples for potential applicants in making their own documents.
- Developed a Manual for the calculation of reference CO2 emission factors used for baseline calculations of JI projects affecting the generation or use of electric power [2]. This was particularly useful for any applicant who wished to submit a project that involved electric power related emission savings. This method was necessary because as the baseline of JI projects that affect the generation or use of electric power is both specific to the given country and is variable in time, there is no generally accepted overall methodology available for its calculation. The methods used for this purpose in Hungary earlier, either gave less realistic values (the own calculations of project developers) or were somewhat inaccurate due to their general nature (such as the so-called "Dutch method"). The method developed reflects the specific features of the Hungarian power system and is based on extensive data from the power system operator.
- Developed a manual that defines the additionality criteria for Hungarian JI projects.
- Regularly publishes the list of already submitted project initiatives and their status.

So far 36 project application have been considered, 27 of which has received the Letter of Endorsement. 14 projects have been approved. The total CO_2 emission reduction potential of the 14 approved projects is 8 697 000 tons during the 2008-12 period.

7 References

[1] Bercsi - 'Sigmond: Kapcsolt energiatermelés Magyarországon - régi és új kihívások az EU csatlakozást követően. Magyar Energetika 2005/5 (Cogeneration in Hungary)

[2] Manual for the calculation of reference CO2 emission factors used for baseline calculations of JI projects affecting the generation or use of electric power (Ministry of Environment and Water Management

[3] H/17395. számú országgyűlési határozati javaslat a kis és közepes aktivitású radioaktív hulladékok tárolójának létesítését előkészítő tevékenység megkezdéséhez szükséges előzetes, elvi hozzájárulásról és a paksi atomerőmű üzemidejének meghosszabbításáról (Bill to the Parliament about the life extension of the Paks nuclear plant and the preparation of a rad-waste storage facility)

[4] Tanulmány a „1107/1999.(X.8.) Kormányhatározat a 2010-ig terjedő energiatakarékossági és energiahatékonyság-növelési stratégiáról, valamint az ennek mellékletét képező Energiatakarékossági és energiahatékonyságnövelési Cselekvési Program" végrehajthatóságáról. Energiaközpont 2005. június (Study on the results of the ESEEAP.)

[5] Erdővagyon-gazdálkodási Intézet: Az erdőtelepítés helyzete és lehetőségei. Sopron 2001

[6] Report of the Republic of Hungary to the Commission on the promotion of the use of bio-fuels for transport

8 Glossary

APEH	State Tax Authority
AVOP	Agriculture and Rural Development Operative Programme
CCGT	Combined Cycle Gas Turbine
CHP	Combined heat and power
EHA	Energy Saving Loan Fund
Energy Centre	Energy Efficiency, Environment and Energy Information Agency
ERU	Emission Reduction Units
ESEEAP	Energy Saving and Energy Efficiency Action Programme
FGD	Flue Gas Desulphurisation
GEF	Global Environmental Fund
GHG	Greenhouse gas
HIR	Information System on Wastes
HUF	Hungarian Forint
ICMS	Integrated Crop Management System
JI	Joint Implementation
KAC	Environmental Fund
KAC	Environmental Fund
KIOP	Environment and Infrastructure Operative Programme
KMÜFA	The Central Technical Development Base Program
MAVIR	Hungarian Power System Operator Company
MVH	Office for Agriculture and Rural Development
NAEP	National Agri-environment Programme
NDP	National Development Plan
NEP	National Energy Efficiency Programme
NEP-II.	2nd National Environmental Protection Programme
NKFP	National Research and Development Programmes
NRDP	National Rural Development Plan
NWMP	National Waste Management Plan
OLÉH	National Office for Housing and Construction
RFOP	Regional Development Operative Programme
SME	Small and medium size entreprises
SZT-EN	The energy efficiency chapter of the Széchenyi Plan
UNDP	United Nations Development Programme
VPOP	Hungarian Customs and Finance Guard

ANNEX
NUMERICAL DATA OF EMISSION PROJECTIONS
Unit: gG CO_2 eq.

BASELINE SCENARIO

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Energy production	61 810	64 012	65 365	65 048	66 300	66 038	67 301	67 373	68 566	69 816	70 478	71 338	72 046	72 770	73 674	74 710
Industrial activities	5 795	5 900	5 379	5 498	5 611	5 724	5 881	6 048	6 153	6 249	6 318	6 386	6 501	6 594	6 717	6 863
Agriculture, land use, forestry	10 014	10 332	10 811	11 118	11 401	11 684	11 762	11 830	11 890	11 941	11 990	12 018	12 039	12 055	12 064	12 068
Waste treatment	10 220	9 198	7 576	6 101	5 109	4 684	4 728	4 730	4 779	4 832	4 886	4 968	5 077	5 220	5 283	5 515

WITH MEASURES SCENARIO

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Energy production	61 810	63 846	65 023	64 522	65 580	65 113	66 160	66 004	66 963	67 960	68 360	69 166	69 813	70 474	71 315	72 291
Industrial activities	5 795	5 900	5 379	5 498	5 611	5 724	5 881	6 048	6 153	6 249	6 318	6 386	6 501	6 593	6 717	6 863
Agriculture, land use, forestry	9 960	10 207	10 587	10 772	10 902	10 997	10 867	10 699	10 493	10 256	10 010	9 724	9 412	9 075	8 716	8 335
Waste treatment	10 220	9 198	7 576	6 101	5 109	4 684	4 728	4 730	4 779	4 832	4 886	4 968	5 077	5 220	5 283	5 515

WITH ADDITIONAL MEASURES SCENARIO

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Energy production	61 810	63 846	65 023	64 522	65 580	65 113	66 160	66 004	66 963	67 960	68 360	68 617	68 685	68 757	69 015	69 431
Industrial activities	5 795	5 900	5 379	5 498	5 611	5 724	5 881	6 048	6 153	6 249	6 318	6 386	6 501	6 594	6 717	6 863
Agriculture, land use, forestry	9 932	10 097	10 378	10 446	10 442	10 385	10 093	9 747	9 349	8 908	8 438	7 857	7 251	6 632	6 010	5 396
Waste treatment	10 220	9 198	7 576	6 101	5 109	4 684	4 728	4 730	4 779	4 832	4 886	4 968	5 077	5 220	5 283	5 515