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SOCIAL AND ECONOMIC IMPACTS OF CLIMATE CHANGE POLICIES AND MEASURES: A CASE STUDY

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Abstract

The paper gives an overview of the Hungarian climate change related policies and measures and its social impacts. In the framework of the research undertaken for the preparation of the 5th National Communication to the UNFCCC of Hungary the research team examined the potential impacts of climate change related policies and measures in the country. Based on a bottom-up model developed specifically for this task an economic assessment was made of different mitigation options. Social impacts of different policies and measures were examined and comprehensive country-level emission scenarios were developed in order to gain a reliable overview of the burden for the future generations.

Key Words: *climate change mitigation, energy modeling , environmental economics*

JEL Classification: Q20, Q47, Q54

1. INTRODUCTION

The aim of this paper is to assess the greenhouse gas (GHG) mitigation potential in Hungary for each sector and identify the measures and the specific costs to achieve them. The study sets a baseline, a reference situation, relative to which the potential and cost of each of the proposed mitigation measures are calculated. The energy and emission scenarios in Hungary are then presented until 2020.

To develop GHG mitigation scenarios, a bottom-up model has been developed to cover CO_2 mitigation potentials in six sectors (households, tertiary, industry, transport, energy supply and waste).

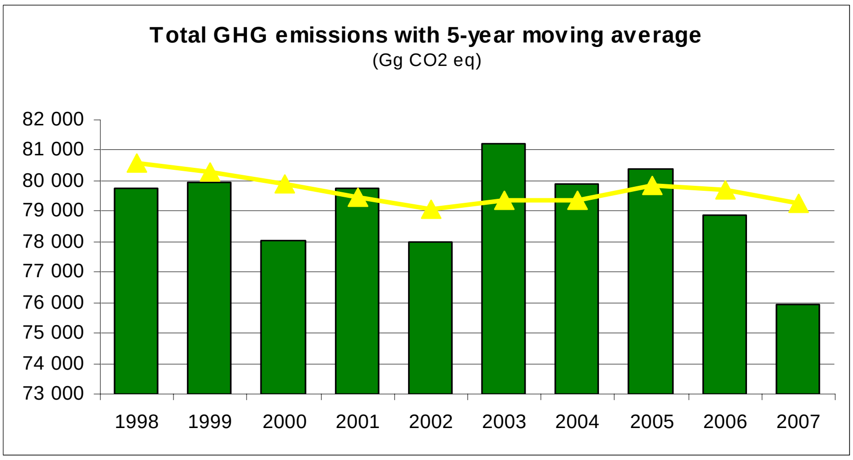
The technical and non-technical GHG mitigation measures examined in this research comprise both currently existing and emerging technologies, given the relatively long timeframe of the assessment period. Different types of measures are identified: measures to improve new stock/equipment, technical measures to improve existing stock (retrofit), behavioural measures, fuel substitution and LULUCF (Land Use, Land Use Change and Forestry) measures.

2. GREENHOUSE GAS EMISSIONS: PAST TRENDS

In 2007, total emissions of greenhouse gases in Hungary, were 75.9 million tons carbon dioxide equivalents (excluding the LULUCF sector). This is 5 % below the 10 year average of the quite stable period 1996-2005, and by far the lowest value in the whole inventory period (second lowest was 2002 with 78.0 million tons). Taking into account also the mostly carbon absorbing processes in the LULUCF sector, the net emissions of Hungary were 71.8 million tons CO_2 eq. in 2007. This is the second lowest value in the whole time-series (1985-2007). This coupled with the steady but stable growth until present times indicates the energy efficiency improvements in the economy.

With less than 8 tons, the Hungarian per capita emissions are below the European average. By ratifying the Kyoto Protocol, Hungary committed to a reduction of GHG emissions by 6%. Now, our emissions are 34% lower than in the base year (average of 1985-87).

Figure-1: Total GHG emissions of Hungary, 1998-2007



Source: Hungarian Meteorological Service (OMSZ), 2009

Emissions decreased by almost 4% (-2.9 million tons) between 2006 and 2007 and by 6% between 2005 and 2007. The reduction between 2006 and 2007 is mainly due to processes in the energy sector (-2.3 million tons).

3. RELEVANT POLICIES AND MEASURES

A broad range of policies are adopted by the Government to promote domestic mitigation measures. Major cornerstones of domestic policies towards sustainable development and climate change mitigation are the Renewable Energy Strategy and the National Energy Efficiency Action Plan, both of them fundamentally based on and strongly complying with the EU's energy savings and renewable energy0 directives. By setting ambitious goals and chronological schedule, these programmes are foreseen to have serious impact on Hungarian emission reduction compliance, and energy policy.

A significant step forward, the National Climate Change Strategy (NCCS) was prepared pursuant to the ratification of the UN Framework Convention on Climate Change and of the Kyoto Protocol. In accordance with the national commitments, the Climate Change Strategy was elaborated for the period 2008-2025. The objectives of the National Climate Change Strategy will be implemented by National Climate Change Programmes to be prepared on a biannual basis.

In the framework of the New Hungary Development Plan (NHDP) some HUF 7000 bln (approximately 25 bln Euros) may be spent on Hungary's development in the period 2007–2013 for the utilisation of the EU Structural Funds. The specific goals of the Plan are to be achieved through 14 operational programmes. The expected implications of relevant policies and measures are summarised in Table 1.

Table 1. Estimated impact of major climate policies and measures in Hungary

Name of policy or measure	Objective and/or activity affected	Implementing entity or entities	Estimate of mitigation impact (Mt CO_2 equivalent)		
			2010	2015	2020
National Energy Efficiency Action Plan	Improvement of efficiency of energy use	Ministry of Transport, Telecommunication and Energy, National Development Agency	1.258	4.857	5.464
Renewable Energy Strategy	Increase of renewable penetration	Ministry of Transport, Telecommunication and Energy, National Development Agency	6710	9223	11391
Retrofit and capacity enlargement of Paks NPP	Enlargement and lifetime extension of Paks NPP	National Atomic Energy Agency, Ministry of Transport, Telecommunication and Energy	-	-	(800-1000)
EU ETS	Emission Trading	National Inspectorate for Environment and Water, Ministry of Environment and Water Management	2.778	3.801	6.248
TDOP	Transportation modernisation	Ministry of Transport, Telecommunication and Energy	-	50	-
Unified Transport Development Strategy	Transportation modernisation and modality change	Ministry of Transport, Telecommunication and Energy		312	180

Source : 5th National Communication of Hungary, 2009

4. METHODOLOGICAL CONSIDERATIONS

For the purposes of GHG emission trends development the HUNMIT model was applied, a bottom-up model developed and adopted to the Hungarian conditions by an international research team. Considerations outlined by the review of the previous National Communication were incorporated in the model development. The model benefits from giving coverage of the economic sectors to an almost full extent. The HUNMIT-model is able to model the competition between given sectors, technologies, measures of the economy, allowing for the optimal, cost – effective solutions to be selected. This also enables to get a more realistic picture about the mitigation effects and costs and the total social costs of a given range of measures.

The base year (2005) for the reference situation is characterized by the physical activity levels, the energy use (by fuels) and the GHG emissions. Based on these parameters, the energy and emission intensity is calculated for each sector and sub-sector. The future reference scenario is defined as the growth of the activity levels using a fixed energy (or emission) intensity. The energy or emission intensity is defined as the energy use (or emissions) of the base year relative to the activity level of the base year. Efficiency improvements resulting from stock turnover are incorporated into the reference scenario.

Both in 2005 and in 2020, the power and heat producing sector has the largest contribution to the total emissions, however when allocating emissions from electricity to end use sectors one finds that the residential and the service sector have a much larger share in the total emissions mainly due to lighting and appliances. It is also clear that as time passes emissions of different sectors in the reference scenario increases, except for the waste sector.

The most important strength of the method used is that it provides a detailed picture of GHG emissions and a detailed investment schedule for prioritising detailed mitigation options, broken down into technology subcategories. The focus is put here on the differentiating between different sectors.

However, its limitation also comes from its strengths: since the consumption is constructed from end-use subcategories and technologies, inevitably the model simplifies real life and can only model a part of the technologies and options. This study focuses on key technologies/options that address more than 1% of Hungarian emissions, and some options that address smaller fractions of emissions have not been covered. Even within the sectors that are responsible for more than 1% of total emissions, measures can be identified that have not been covered by the study. The focus has been on the most important measures. Overall, however, these measures still may add up to a considerable potential.

Another set of mitigation interventions which are difficult to include into a technology oriented mitigation assessment model are behavioural/lifestyle measures. While studies exist that can quantify the size of the potential, putting a precise cost for achieving a certain reduction is an impossible task with the present state of knowledge. Similarly, structural measures, such as better urban planning and modal shift in transport are very difficult to include in models with respect to their costs, as monetising such measures is also very uncertain.

As a result of the above elements, the estimate of the potential provided in this paper may be an underestimate of the real technical/economic potential, because these various mitigation options discussed above cannot be included in the model.

Another important omission from any mitigation cost-benefit assessment prepared today is the lack of coverage of the co-benefits. These co-benefits translate into very tangible costs at the national level, such as healthcare cost reductions, increased employment and thus tax revenues, business opportunities, increase of the value of the capital and building stock, reduction in the need for social benefits such as natural gas subsidies and compensation schemes (because people already pay less for their energy bills due to improved efficiency), etc. However, these financial benefits are also difficult to precisely quantify in relation to a certain measure, and thus are not included in cost-benefit assessments. At the same time, these are very important cost considerations for national governments, and their potential inclusion may change the priority order of the cost-effective investments.

One remedy for this problem is that during the climate strategy creation sectors with especially high co-benefits can be prioritised. Such sectors include the residential sector where energy-efficiency investments are associated with particularly high social, economic, health and political dividends.

5. ENVIRONMENTAL AND ECONOMIC IMPACTS

In concordance with the UNFCCC guidelines three scenarios were developed, a baseline to represent the business-as-usual development, a so-called With Existing Measures (WEM) scenario was composed to represent the most likely case of future emissions, and a With Additional Measures (WAM) scenario was presented to give an optimistic pathway by outlining the best possible scenario.

The assumptions of the baseline scenario were as follows:

- Listed technical measures are not applied to any of the sectors of the model
- Renewable energy utilisation stagnates, share does not increase in any sector
- No improvement of efficiency was foreseen in the power sector.
- The energy demand rises without any energy saving measures

The assumptions of WEM scenario were the application of adopted/implemented policies and measures as presented in the following subchapters, with some additions as follows.

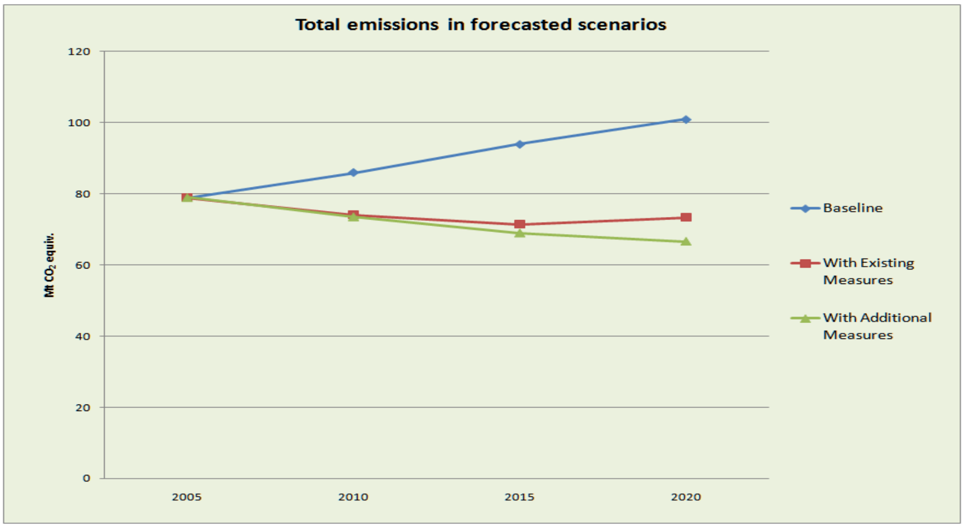
- Renewable policy targets will be achieved according to the base case in the Governmental Renewable Strategy
- Existing policies and measures as described will be implemented and are considered with the estimated savings potential.
- The effect of modernisation, technological measures in the respective sectors will result in a decreasing energy intensity, therefore energy savings arising later will result in a smaller emissions savings than those occurring at an earlier period.

The assumptions of the WAM Scenario are as follows.

- Renewable energy utilisation will be according to the higher scenario of the Renewable Strategy.
- Measures described earlier will be realised, other planned and possible measures will be implemented
- EU ETS will be prolonged until 2020, with non-ETS sectors taking a 10% reduction obligation (burden sharing). Without any numerical estimation existing at present point, the emissions allowances surrendered can just be forecasted, however the applied modelling framework allows for an assessment of emissions savings generated in the ETS sectors along unit price assumptions made.
- Mitigation measures are supported to the fullest possible extent

The results are summarised in Figure 2.

Figure 2. Total emissions in the forecasts



Source : 5th National Communication of Hungary, 2009

The figure shows that the Hungarian emissions will stay well under the country's Kyoto commitment. It is also clear that compared to earlier forecasts, a significant decrease is foreseen, this difference is due to the efforts and commitments undertaken by the government in setting goals for emission reduction and the impact of the adaptation to the respective EU directives.

Despite the tendencies, the Government clearly states in the NCCS that Hungary's goal is not just to comply with but to reduce further her emissions beyond the present and future targets.

The research provided various quantitative policy analyses on various reduction targets. The difference in abatement costs between different targets is small. At a discount rate of 6% targets up to 25% reduction (in 2020 compared to 2005) are met for less than around €25/ton CO_2. For more ambitious reduction targets, abatement costs increase rapidly. Measures needed for 30% reduction compared to 2005 amount up to € 85/ton CO_2 (discount rate 6%). Low costs measures are especially found in the residential, tertiary and industry sector. For an overall reduction of 15% in 2020 compared to 2005 72% of the total residential potential, 96% of the total tertiary potential, 92% of the total industry potential (excluding CHP) and 96% of the total waste potential is used.

When only considering the ETS sector, the target of 21% reduction in 2020 compared to the base year in 2005 results in costs that depend how much has already been done in other sectors. If nothing has been done in other sectors, the target for the power and the industry sector will costs up to € 145/ton CO_2. If the other sectors have also implemented energy saving measures, the burden for the power sector is reduced. The ETS target can then be reached at € 10/ton CO_2.

6. CONCLUSIONS

An important point to emphasise regarding mitigation policies, is the importance of long-term policy-making frameworks. The cost curves for 2010 and 2025 demonstrate well that significantly higher potentials can be achieved in the long term, if policies are in place for longer periods (counter suggesting the so far often implemented stop-and-go subsidy schemes etc.). Longer term stability in the policy environment fosters longer term investments.

Another important criterion for the establishment of climate mitigation strategies to observe is the lifetime of the capital-stock. The longest-living capital stock, including the industry and building infrastructure, determines GHG emissions in the order of a century, but at least for multiple decades. Thus, early and ambitious action for these sectors is pivotal. Similar arguments hold for new industrial or power plants. Policy and market decision taken at the moment will have consequences for very long time periods. This should be taken into consideration when designing climate policies.

BIBLIOGRAPHY

Fekete-Farkas M, Beres-Husti K, Szucs I (2007), "Economic evaluation of chemical pollution, food safety, biodiversity and sustainability", *Cereal Research Communications* 34 (1): 797-800 Part 2

Fekete Farkas, M.-Farkas, I.-Gazdag, A., "Comparative cost analysis of renewable energy sources including environmental externalities", *Energy and the Environment, Vol. I.* /ed by B. Frankovic/, Croatian Solar Energy Association, Opatija

Molnár S., Molnár M. (2008), "Financing Energy Efficiency and Sustainable Energy Projects in Hungary", *Bulletin of the Szent István University*, Gödöllő, pp. 359-375, 2008

Molnár S (1997).: "Assessment of Mitigation Measures and Programs In Hungary", *Applied Energy*, Vol 56. pp. 325-332, 1997

Molnár S. (ed.): "5th National Communication to the UNFCCC", *Ministry of Enivornment and Water of Hungary*, 2009