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Progress towards emission targets through the development of climate change policies and measures in Hungary

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Abstract—Parties included in Annex I to the UNFCCC are requested to regularly submit National Communications to the Secretariat. This report presents an overview of the results of the 6th National Communication (NC6) of Hungary with respect to the relevant provisions of the Convention and Article 8 of the Kyoto Protocol.

Key-words: mitigation scenarios, emission reduction, national reporting

1. Introduction

Hungary, as a Member State of the European Union and a Party to the Kyoto Protocol, considers efforts against climate change to be one of the most important challenges. Implementing, adopting, and planning measures and policies to tackle climate change related threats, designing mechanisms and plans to adapt to climate change, and pursuing scientific activities to assess, monitor, and decrease climate change vulnerability are in the focus of the Hungarian Government and the experts.

The recent findings outlined in the Fifth Assessment Report of the IPCC conclude that human activities are highly likely to be causing climate change and that actions against global warming are indispensable. In accordance with these results and responding to the 19th Conference of Parties in Warsaw in 2013, Hungary presents the future commitments, the progress made and other relevant topics in the 6th National Communication (*Ministry of National Development,* 2013), where Hungary provides information on greenhouse gas emissions and trends, quantified emission reduction targets, and progress towards their accomplishment, and gives an overview of emissions projections and financial and technical support provided to developing countries (*Molnár S. et al.*, 2012).

2. Information on GHG emissions and trends

In 2011, total emissions of greenhouse gases in Hungary were 66.1 million tons carbon dioxide equivalents (excluding the LULUCF – land use, land use change, and forestry – sector), which is the lowest value in the whole time series (1985–2011). Considering the carbon sinks in the LULUCF sector, the net emissions of Hungary were 62.4 million tons CO_2 equivalents in 2011. Being about 6–7 tons, the Hungarian per capita emissions are below the European average.

By far, the biggest emitting sector was the energy sector, contributing 71.6% to the total GHG emission in 2011. Agriculture was the second largest sector with 13.2%, while emissions from industrial processes (with solvent and other product use) accounted for 9.8%, and the waste sector contributed 5.3%. Compared to the base year, emissions were significantly reduced in the energy (–40.3%), agriculture (–54.0%), and industrial processes (–57.7%) sectors. In contrast, emissions in the waste sector have increased since 1985 (+14.5%). Solvent and other product use and land use, land use change and forestry (LULUCF) sectors show fluctuating behavior.

The most important greenhouse gas is carbon dioxide, accounting for 75.2% of the total GHG emissions. The main source of CO_2 emissions is burning of fossil fuels for energy purposes, including transport. CO_2 emissions have decreased by 41.8% since the middle of the 80's. Methane represents 12.8% in the GHG inventory. Methane is generated mainly at waste disposal sites and in animal farms, but the fugitive emissions of natural gas are also important sources. CH4 emissions are by 37.2% lower than in the base year. Nitrous oxide contributes 10.2% to the total GHG emissions. Its main sources are agricultural soils and manure management. N_2O emissions are 60.4% lower compared to the base year. The total emissions of fluorinated gases amount to 1.8%, but their steadily growing tendency seems to level off since 2008.

By ratifying the Kyoto Protocol, Hungary has committed to reduce its GHG emissions by 6%. Now, our emissions are 43.2% lower than in the base

year (average of 1985–87). For the most part, this significant reduction was a consequence of the economic transition in Hungary (1989–1990), which brought significant decline in the output of the national economy. The production decreased in almost every economic sector including also the GHG relevant sectors like energy, industry, and agriculture. Then, between 2005 and 2011, after a period of about 14 years of relatively stagnant emission levels (1992–2005), GHG emissions fell again quite significantly by 16.7 per cent.

The global financial and economic crises exerted a major impact on the output of the Hungarian economy, consequently on the level of GHG emissions as well. After a quite significant drop of 8.4% between 2008 and 2009, our emissions in the following three years (2009–2011) remained the lowest in the entire time series. Although the decline in economic output stopped in the first quarter of 2010 and Hungary had a moderate growth of 1.6%, emissions fell again by 2.6% in 2011, after a slight increase (+0,8%) in 2010.

Compared to the base year, emissions were significantly reduced in the energy (–40.3%), agriculture (–54.0%), and industrial processes (–57.7%) sectors. In contrast, emissions in the waste sector have increased since 1985 (+14.5%). Solvent and other product use and land use, land-use change and forestry (LULUCF) sectors show fluctuating behavior.

3. Assessment of the current situation

Under the EU's Climate and Energy Package, Hungary as an EU member is committed to a quantified economy-wide GHG emission reduction target of 20% by 2020, compared to the 1990 levels. This target is coupled with a renewable penetration rate of 14.65% for Hungary and an energy efficiency improvement of 20%; while the RED Directive (2009/28/EC) of the EU set the renewable target for Hungary as minimum 13% of the total gross final energy consumption, the objective defined by the NREAP is 14.65%.

This means that Hungary committed herself to a reduction of 20% of the 96 961,78 kt CO_2 equivalents emissions of 1990 (incl. LULUCF), the target to be achieved is 77 568,8 kt by 2020.

Sectors under the EU ETS are forecasted to provide a basis of GHG emissions savings until 2025. Beginning with 2013, from the third trading period onwards, a single EU-wide cap determines the amount of emissions allowed to be emitted by the EU ETS sectors. Furthermore, from 2013 onwards, a linear reduction factor of –1.74 % per annum applies to achieve a total of 21% of reduction in the ETS sectors. Under the joint Effort Sharing Decision (ESD) of the EU, Hungary took the commitment of a maximum 10% increase of the non-ETS sectors greenhouse gas emissions compared to their 2005 levels by 2020.

Hungary is also influenced by the Kyoto second period target of the EU. The EU has also committed to reduce its emissions by 20% under the Kyoto Protocol's second period, which runs from 2013 to 2020. Despite its identical nature, this commitment differs in several important respects from the EU's unilateral 2020 commitment:

- The Kyoto commitment is measured against base years, not 1990.
- LULUCF: the LULUCF sector in the EU is not included in the 20 % target under the Climate and Energy Package, but is accounted for under the KP according to the relevant decisions made in Durban.
- Inclusion of nitrogen trifluoride (NF3): NF3 is not included in the Climate and Energy Package, whereas the scope of the second commitment period has been extended to include the additional gas. The impact of NF3 on aggregate EU emissions is insignificant.
- It requires the EU to keep its emissions at an average of 20% below base-year levels over the whole period, not only in 2020.
- It differs in scope (for instance, it does not cover emissions from international aviation, since these are outside the scope of the Protocol, but it does cover emissions and their removals from land use, land use change and forestry, which is not covered by the unilateral commitment).
- The EU will meet its Kyoto commitment jointly with Iceland.

4. Policies and measures

Legislative and policymaking activities in climate change and the energy sector have been united under the auspices of the Ministry of National Development with the establishment of a sovereign State Secretariat of Climate Change and Energy Policy with two aides of the state secretary – a deputy state secretary for energy policy and another deputy for green economy development and climate change. The most important task of the Secretariat was the formation of the long-term energy strategy of Hungary, as well as submission of the National Action Plan for Renewable Energy to the European Commission. Recently, the administration was reformulated into a State Secretariat of Development, Climate Policy, and Key Public Services.

In the following section, the framework of climate change policies will be outlined. Details are provided in Chapter 4 of the 6th National Communication of Hungary.

The general context of policy development is the Programe of National Cooperation. Although in itself the Programe of National Cooperation is not focused on the GHG mitigation, the implementation of the Programe includes several similar elements, and the Programe itself has some priorities that serve this purpose. Some relevant key elements are:

- Promotion of the European initiative to employ “green” technologies and to research the energy efficiency of buildings and construction materials;
- Launching of a large scale energy efficiency program aiming at reconstruction of pre-fab buildings, thermal insulation projects of other building types, reconstruction of public buildings, etc.;
- Encouragement of renewable energy investments.

A cornerstone of climate change policy is the National Climate Change Strategy which was revised in 2013. Its key characteristics are as follows:

- Main areas of intervention are:
  - Energy efficiency in buildings;
  - Renewable energy utilization;
  - Transport (road tolls, other economic incentives, modal split change);
  - Afforestation.
- New element is increased emphasis on adaptation to climate change.
- The responsibility of the government is to create the necessary regulatory-legal framework; to review and adjust the subsidy systems; to raise the awareness of the society by giving priority to sustainability and providing good example.
- The residential sector is a key field of change: peoples’ lifestyle needs to be changed; a large-scale reduction of demands for energy and materials must be achieved (by subsidized energy efficiency projects, among others);
- Industry and other enterprises also need to reduce their energy consumption, adopt emission reduction measures, "green" their profile, products, and services.
- NGOs, civil organizations shall have increased role in the dissemination of information, awareness raising, and civil control.

As the new EU Sustainable Development Strategy adopted by the European Council requires, Hungary prepares and regularly updates its National Sustainable Development Strategy (NSDS). The new NSDS has been adopted by the Hungarian Parliament in 2013.

Beginning from 1995, a regularly (every six year) revised and updated National Environmental Protection Programe (NEP) is prepared. The recent National Environmental Protection Programe 2009–2014 (NEP-III) was adopted by the Parliament in 2009. Similarly to the previous programes, the NEP-III identifies general objectives, which are then broken down to specific actions, the so-called thematic action programes or TAPs. The general objectives are the following:

- Improving the quality of the environment and life locally;

- Preservation of natural resources;
- Promotion of sustainable lifestyle, production, and consumption;
- Improvement of environmental safety.

The following TAPs are relevant from the aspect of GHG mitigation:

- Reinforcing environmental awareness:
  - Education, training within the education system from the elementary school to the university;
  - Environmentally conscious production and consumption;
  - Access to environment-related information, information dissemination;
  - Combating climate change;
  - Reduction of GHG emissions (EU-ETS system, improvement of energy efficiency [NEEAP]);
  - Reducing the environmental impact of transport (reducing demand, restructuring modal split, alternative fuels);
  - Reducing emissions from the agriculture (improvement of production efficiency);
  - Afforestation according to the National Afforestation Programe.
- Environment and health:
  - Transport and environment (reversing the tendency of shifting to individual transport).
- Protection and sustainable utilization of waters:
  - Utilization of the energy of geothermal waters.
- Waste management:
  - Prevention (reduction of waste quantities);
  - Utilization of wastes and recycling;
  - Reduction of landfill waste.

The National Sustainable Development Strategy has recently been reformulated and accepted by the government, and it is an important element together with the National Environmental Programe. The New Széchenyi Plan (NSZP) is an economic development programe providing an operative background for the realization of strategic objectives.

The programes of the NSZP concerning GHG mitigation are as follows:

- Energy policy:
  - Energy policy is to serve economic growth and job creation, together with security of supply, resource diversification, and the reduction of import dependence;

  - Production and utilization of renewable energies are to be encouraged.
- Transport:
  - Creating the financial resources necessary for a sustainable transport system;
  - Encouraging intermodal transports;
  - Enforcing environmental and climate policy considerations;
  - Transformation of the primary energy mix – a greater proportion of renewable energy is necessary;
  - Development of an adequate traffic and transport system, nodes as well as intermodal and multifunctional logistics centers and related industrial parks established in these nodes to reduce road transit.

The Green Investment Scheme (GIS) is considered to be a key source of funding GHG mitigation projects and efforts. Several of the policies described in this report have been or will be financed at least partly from GIS sources. The GIS is planned to be restructured with the following priorities in mind:

- Complex (deep) energy efficiency revamp of multi-flat and family houses, to increase the approximately 40% energy saving achieved by GIS programes so far to at least 60%;
- Support for the construction of new highly efficient buildings;
- Loan guarantee for the investors of the above projects, so that they could take loans at better conditions to provide their own share for the other supports from the GIS.

Maximum 5% of the GIS revenues can be used for covering the administrative costs of the GIS. It is also required by the regulation that the supported project should be additional (i.e., not implemented without the support).

The impact of policies and measures are summarized in *Table 1*.

Table 1 The impact of policies and measures in CO_2 equivalent

	Policy name	Status	2015 ($ktCO_2eq./yr$)	2020 ($ktCO_2$ eq./yr)	2025 ($ktCO_2$ eq./yr)	2030 ($ktCO_2$ eq./yr)
1	Promotion of renewables	implemented	5 600.2	8 821.2	11 299.1	13 061.0
2	Nuclear power	adopted	2 762.6	5 172.8	7 875.8	10 593.8
3	"Liveable panel buildings" sub-program	implemented	509.7	953.5	1 374.1	1 592.7
4	"Our home" reconstruction sub-program	implemented	402.9	844.4	1 324.6	1 861.8
5	"Power saving households" program	implemented	535.4	1 117.1	1 439.7	1 573.6
6	Renewable public institutions sub-program	implemented	366.6	722.1	1 058.1	1 360.4
7	Reduction of power demand of public institutions	implemented	495.3	972.8	1 451.6	1 866.4
8	District heating efficiency sub-program	implemented	135.1	242.0	312.7	347.2
9	Reducing the energy use of enterprises	implemented	655.9	1 477.6	2 182.0	2 737.5
10	Horizontal measures	implemented	126.3	336.7	547.2	757.7
11	Reducing the energy demand of cargo and passenger transport	implemented	38.7	98.2	111.8	122.4
12	Directing transport to railways	planned	51.3	80.6	89.7	89.7
13	Directing transport to public transport and developing public transport	planned	19.6	52.4	84.7	106.5
14	Reducing road transport emissions	adopted	727.5	1 549.7	2 578.0	3 622.7
15	Environmental awareness in agriculture	adopted	NA	NA		
16	Less nitrate get into water and N-cycle	implemented	NA	NA		
17	Draw attention to decrease GHG emission in agriculture	implemented	NA	NA		
18	National Forest Programe for increasing forest area	implemented	500.00	700.00	1 000.00	1 300.00
19	Frame for forestry management and forest protection	implemented	NA	NA		
20	Mitigation of agricultural emissions with partial change of nitrogen fertilizer utilization and cultivations change	implemented	200.00	NA		
21	Support for perennial herbaceous energy plantation by the European Agricultural Fund	implemented	NA	NA		
22	Complementary financing to support the plantation of energy crops by the European Agricultural Fund	implemented	NA	NA		
23	Rural development for sustainable and modern agriculture	implemented	NA	NA		
24	Climate protection by efficient manure management and biogas	implemented	135.00	NA		
25	New waste management instruments	adopted	2.14	4.62	12.70	16.96
26	Setting up regional waste management projects	implemented	17.14	20.77	34.29	51.83
27	Packaging waste governmental regulation	adopted	6.43	23.08	39.37	58.43
28	Budapest municipal door-to-door separate waste collection	adopted	12.86	20.77	31.75	45.24
29	Landfill recultivation, remediation	adopted	2.14	4.62	11.43	16.02
30	Prevention	adopted	0.00	9.23	25.40	29.22
31	Waste landfill tax	implemented	4.29	13.85	31.75	39.58

Source: Ministry of National Development (2013)

The total effect from policies and measures is summarized in *Table 2*.

Table 2. Total effects of policies and measures until 2030

Gg CO_2 equivalent per year	**2015**	**2020**	**2025**	**2030**
Estimated emission savings from PAMs	13 307.19	23 237.98	32 915.95	41 250.61

5. Projections and the total effect of policies, measures, and supplementarity relating to the Kyoto Protocol mechanisms

Average 2008–2011 emissions in Hungary were 40.8 % lower than the base-year level, well below the Kyoto target of -6 % for the period 2008–2012. In the sectors not covered by the EU ETS, emissions were significantly lower than their respective target, by an amount equivalent to 33.6 % of the base-year emissions. LULUCF activities are expected to reduce net emissions by an annual amount equivalent to 1.9 % of base-year level emissions. Hungary intends to use flexible mechanisms at governmental level by selling an amount of Kyoto units equivalent to 3.5% of base-year emissions per year. Taking all these effects into account, average emissions in the sectors not covered by the EU ETS in Hungary were standing below their target level, by a gap representing 31.1 % of the base-year emissions. Therefore Hungary was on track towards its Kyoto target by the end of 2011.

6. Progress towards EU 20/20/20 goals (ESD)

Total GHG emissions of Hungary decreased by 3.7% between 2011 and 2012, based on approximated GHG inventories for the year 2012 (see *Table 3*). When considering the scope of the EU's climate and energy package, which includes emissions from international aviation, Hungarian emissions in 2012 are approximately 55% lower compared to 1990 levels (98 980.69 Mt). Thus Hungary reaches its 20% reduction target, eight years ahead of 2020. This should not mean that the country has no dedicated tasks, as the reduction of emissions can be accounted to the decline in economic activity and economic growth beyond expectations.

Aggregated projections from Hungary indicate that the total emissions will further decrease between 2012 and 2020 (and 2025, see the Biennial Report for forecast figures). With the current set of national domestic measures in place, emissions are expected to reach a level in 2020 which is 65% below the 1990 level. Implementing the additional measures (at planning stage or realized at lower implementation levels) it is expected to achieve a reduction of 74% below the 1990 level in 2020.

Table 3. Hungary's emissions in the first commitment period

	Mt CO_2 equiv.	2008	2009	2010	2011	2012	Average of 2008-2012	Total of 2008-2012
1	Total GHG emissions	73.6	67.4	67.9	66.1	63.7	67.7	338.7
2	Verified emissions under the EU ETS	27.2	22.4	23.0	22.5	21.3	23.3	116.4
3	Non-ETS emissions	46.4	45.0	45.0	43.7	42.4	44.5	222.4
4	Initial Assigned Amounts (AAUs)	108.5	108.5	108.5	108.5	108.5	108.5	542.4
5	Allowances issued under the EU ETS	25.1	23.9	25.7	25.0	32.8	26.5	132.5
6	Non-ETS target	83.3	84.6	82.8	83.5	75.7	82.0	409.9
7	Difference between target and actual emissions (non-ETS domestic)	37.0	39.6	37.8	39.8	33.3	37.5	187.5
8	Expected carbon sequestration from LULUCF	2.2	2.2	2.2	2.2	2.2	2.2	11.1
9	Difference between target and actual emissions (non-ETS domestic) incl. carbon sequestration	39.2	41.8	40.0	42.0	35.5	39.7	198.6
10	Planned use of Kyoto mechanisms by government (net transfer of AAUs + purchase of CERs+ERUs)	–4.0	–4.0	–4.0	–4.0	–4.0	–4.0	–20.0
11	Emission reduction units (ERUs issued in JI projects)	0.0	1.2	1.4	1.6	3.1	1.5	7.3
12	Difference between target and actual emissions (non-ETS, domestic, incl. Kyoto mechanisms and carbon sinks)	35.2	36.6	34.7	36.4	28.4	34.3	171.3

Source: EEA Report (2013)

The projected reductions are to be achieved both in the sectors covered by the EU ETS (mostly energy supply and industry), where an emission cap is determined at EU level, and in the other sectors covered by national emission targets under the Effort Sharing Decision (ESD). Beyond the EU ETS itself, the largest reductions are expected via measures supporting renewable energy under the Renewable Energy Directive (RED) and implementation of efficiency and energy saving measures.

The average annual emissions and removals from LULUCF in the 2008–2011 are as follows: –1.15 Mt CO_2 equivalent for the average net carbon stock change (Art 3.3.), and –1.06 Mt from forest management (Art 3.4).

Concerning non-ETS emissions in Hungary, the absolute gap between the average non-ETS emissions in 2008–2012 and the Kyoto targets are 37.5 Mt CO_2 equivalents (excluding carbon sinks), which is 32.5% less than the targeted value.

Thus, the average 2008–2012 emissions in sectors not covered by the EU ETS, including the effect of carbon sinks, are less than the target for non-ETS sectors.

Despite these promising results, energy efficiency measures in the residential and services sectors are of key importance in the provision of further emission reductions by 2020.

Concerning the national GHG targets under the ESD: 2012 non-ETS emissions were below the 2013 ESD targets and 2020 non-ETS emissions are projected to be lower than the 2020 ESD target with the existing measures. Concerning the national targets for the RES share in the gross final energy consumption, the 2011 RES share was above the RED and NREAP 2011–2012 trajectories.

Concerning energy efficiency, some progress is made in reducing energy consumption, but further improvements are necessary to further develop policies or to better implement the existing ones.

Regarding the current progress towards 2013 ESD targets, the following conclusions can be drawn. Considering the proportional targets of 2020 by 2013 – the so-called 2013 ESD targets – then the reduction of -5% is the proportional goal until 2013 and +10% by 2020 for non-ETS sectors is allowed. The actual emissions from non-ETS sectors are 18% less in 2012 than the 2005 values and the 6.9 Mt (13%) below the 2013 ESD target.

Considering the projected emissions in 2020 in non-ETS sectors and comparing them with the targets for 2020, the With Existing Measures scenario forecasts a –8% aggregate emission reduction (a 11 Mt reduction) compared to the target, whilst the With Additional Measures scenario forecasts a 21 Mt reduction and a –16% relative gap.

Overall, the projections show that with the current measures, the non-ETS emissions in 2020 will be below the 2020 targets.

The projections presented herewith are developed for the years 2015, 2020, and 2025. The projections rely on energy demand forecasts, latest emission factors, and technological data, and use parametric assumptions. The detailed sectoral impact of measures is enumerated in Chapter 5 of the NC for the industry, energy, and power sector, transportation, public sector, agriculture, and forestry sectors.

Throughout the development of the projections, the impacts of EU level policy requirements and specific domestic policies were considered (e.g., Renewable Energy Directive, EU ETS). For the sake of a concise and methodologically sound forecast, the HUNMIT model was developed and adapted to the present forecast, which is a bottom up model enlisting all measures, their technical and economical characteristics. The model is capable of selecting an optimal set of measures allowing for a cost efficient emission reduction.

Table 4 summarizes total emissions for the two scenarios (with and without LULUCF).

Table 4. Total emissions in the WEM and WAM scenarios (Gg. CO_2 equivalent)

	2010	2015	2020	2025
Without measures scenario	67 679.0	63 568.7	65945.7	69473.6
WOM including LULUCF	63 694.3	66 193.0	68731.3	69473.6
With existing measures	67 679.0	63 475.5	59 840.2	58 598.0
WEM including LULUCF	63 694.3	60 680.0	58 046.5	56 391.1
With additional measures	67 679.0	61 515.1	56 774.2	55 400.2
WAM including LULUCF	63 694.3	58 719.6	54 980.5	53 193.4

It is visible that the two scenarios do not differ significantly at the end of the forecasting period. This indicates that the WEM scenario already incorporates a large share of potential abatament measures and mitigation options.

7. Conclusions and recommendations

Bringing together the results of the current progress towards the 2013 targets (based on 2012 proxy data) and projected progress to 2020 targets (based on Member States projections) allows for an overall assessment of the progress achieved so far by Hungary towards her objectives under the ESD. Thus, Hungary is presently considered to be on track towards her respective 2013 ESD targets, i.e., 2012 non-ETS emissions were below these targets.

If a modified base year (2005) would be set for the 2020 ESD targets (adjusted according to Art. 10) for Hungary it would mean a 16% reduction target or a 57 Mt CO_2 equivalent emission cap in the non-ETS sectors until 2020. This is expected to be reached already under the assumptions of the WEM scenario, which forecasts 43 Mt emission, while the WAM forecasts GHG emissions equivalent to 40 Mt of CO_2 by 2020. Thus Hungary is expected to reach her 2020 target with the current set of policies and measures through domestic emission reductions alone, even if a more demanding base year is chosen.

Overall, combining the above findings Hungary is well on track towards the ESD targets with 2012 emissions below 2013 ESD targets, and current policies and measures are sufficient to achieve 2020 targets through domestic emission limitations or reductions only.

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