

Economic effects of a more  
ambitious EU carbon target in  
Hungary

# Economic effects of a more ambitious EU carbon target in Hungary

## *Final Report*

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## Summary

The costs and benefits for Hungary of an EU-wide -30 % greenhouse gas (GHG) reduction target are assessed in this report. This assessment is based on the assumption that reductions in the ETS sectors and non-ETS sectors in Hungary, under this target, will amount to -34% and +6% respectively, compared to 2005 emissions.

A -20 % and also a -30 % EU target can possibly be met by Hungary at negative cost. Overall cost savings within a -20 % EU target are estimated to be approximately €2.6 billion (708 billion HUF). These savings are estimated to be only €60 million (16 billion HUF) lower under a -30 % target. In the ETS sectors, saving occurs under both targets. In the non-ETS sectors, additional costs are accrued in Hungary with a -30 % target, but many options are still likely to be realised at negative cost. These results critically depend on our modelling assumptions. This includes assumptions on future energy prices, non-economical barriers and the discount rate. We used a discount rate of 6 % that fits with a social planner perspective, not with a pure business perspective.

Implementing GHG reduction measures is anticipated to result in the creation of additional jobs. This direct employment effect is estimated to be 10% higher under a -30 % target, compared to the effects under a -20 % target. Energy security in Hungary would also be slightly improved.

Hungary can potentially reduce its emissions even further than under a -30 % target. An additional amount of roughly 2.6 Mt CO<sub>2</sub> can be reduced in the ETS sectors, and roughly 1.6 Mt CO<sub>2</sub> in the non-ETS sectors at a cost lower than 30 €/t. It is important that these additional negative and low cost domestic abatement options are exploited. For Hungary, additional abatement would increase investments, which likely results in additional employment and energy security benefits. For the EU, emission reductions could be achieved more cost-effectively if Hungary's negative and low cost abatement options were exploited fully.

For the ETS sectors, full flexibility is available for parties in other EU Member States to utilise low cost abatement options in Hungarian ETS installations. For non-ETS sectors, Hungary could consider to explore further options to sell surplus emission allocations (accrued by capturing low cost emission reductions) to other EU member states.

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# 1 Introduction

Since late 2008, both Hungary and the European Union (EU) have experienced the consequences of a severe global economic crisis. This has significant repercussions for employment, public finances and investments. The economic situation required an updated EU reference scenario for climate and energy policy impact analysis (ICCS-NTUA, 2009). This scenario reflects the economic downturn since 2009, as well as national and EU policies implemented until April 2009.

In May 2010, the European Commission concluded, on the basis of this new reference scenario, that the economic recession, together with existing EU climate and energy measures, significantly reduced the EU's emissions, with lasting impacts on projected emissions for 2020. As a result, the ultimate EU-wide costs linked to a 20 % greenhouse gas (GHG) reduction target are projected to have fallen from a predicted €70 billion per annum (year 2020) to €48 billion<sup>1</sup>. Following the conclusions of the European Commission, tightening the GHG reduction target, through a long term horizon of policies of 30 % would cost €11 billion more, EU-wide, than the total costs of a 20 % target estimated 2 years ago in the impact assessment of 2008.

Both the EU and Hungary are currently at a strategic crossroad for both climate change, energy and economic policies. In the next few months the Council of the European Union will discuss options to increase the EU's carbon target beyond 20 % and the potential costs and benefits of doing so. The Hungarian government is also currently formulating its national energy strategy until 2030. Moreover, in the first six months of 2011 Hungary will hold the Presidency of the Council of the European Union.

The specific economic effects for Hungary of a possible strengthening of the EU carbon target to -30 %, considering the new economic parameters, have not yet been assessed however.

Considering the expectation of upcoming EU and Hungarian debates for a more ambitious EU carbon target and related discussions on the effects on employment, fossil fuel imports and economic recovery, Greenpeace and E3G are interested in acquiring a new in-depth and independent insight into the fundamentals of the economic effects of a more ambitious EU GHG emission reduction target in Hungary.

Greenpeace and E3G have therefore engaged Ecofys to assess, from an economic perspective, the effects of a -30 % carbon target in integral sectors of the Hungarian economy.

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<sup>1</sup> European Commission (COM(2010) 265 final), The European Commission analysis was based on the PRIMES 2009 reference scenario (ICCS-NTUA, 2010)

## 2 Approach

### 2.1 The HUMIT model for costs and potential of GHG abatement measures

In order to assess the implications of a -30 % EU target for Hungary, Ecofys used the technology-oriented bottom-up sectoral model, "HUMIT". This model has been developed by Ecofys (2009) to estimate CO<sub>2</sub> mitigation potentials in ETS and non-ETS sectors. Forestry and agriculture (3% of total greenhouse gas emissions in 2008, Hungarian Meteorological Service, 2010) are not included in the model. The reason for this was that emissions in these sectors depend heavily on activities, and technologies and measures have little influence on reduction. Furthermore, sets of data that would be required for setting adequate models and scenarios are not publicly available.

Based on the cost and GHG reduction potential of a wide range of GHG mitigation measures included in the model, it constructs a marginal abatement cost curve (MACC). The MACC then shows how the cost of abatement is amplified in a stepwise manner as increasingly expensive measures are deployed. Based on this MACC, the HUMIT model calculates the cost of meeting a predefined GHG reduction target. This includes:

- Total cost, i.e. the cost of all measures needed to meet a predefined target [€].
- Marginal cost, i.e. the cost for the most expensive measure needed for meeting the predefined target [€/t CO<sub>2</sub>-eq].
- Average cost, i.e. the average cost of all measures needed for meeting the predefined target [€/t CO<sub>2</sub>-eq].

This approach calculates the costs and benefits involved in meeting predefined GHG mitigation targets, as well as the employment effects.

The model contains an extensive set of GHG mitigation measures, both for ETS sectors comprising of power and industrial installations, and non-ETS sectors, including mainly residential, tertiary, transport, and waste management.

- Measures for the energy supply sector consist of long term fuel switches, replacement or retrofits of obsolete equipment, and an increase of more renewable energy sources in electricity and heat production.
- In industry, three types of GHG mitigation options are distinguished. These are cross-cutting measures applicable to energy demand in various subsectors, process-specific measures for individual sector-specific processes and measures to expand the use of combined heat and power technologies.
- Measures in the residential sector incorporate thermal components, such as passive energy design of buildings, as well as electricity and appliances. These measures are also important for the tertiary sector, although a number of additional measures are also conceivable for this sector, regarding energy consumption through vending machines and computers, for example.

- In the transport sector, measures can be divided into technological options, such as stop-start technology, that improve energy efficiency, behavioural changes that improve driving efficiency and supply options.
- In the waste management sector, measures include inter alia landfill gas collection, composting biodegradable waste, increased incineration and mechanical-biological treatment.

Below we introduce the scenarios considered in this study as well as assumptions on energy prices. Box 1 provides insight into some of the key sensitivities of the model.

## **2.2 Reference scenario and two mitigation scenarios**

The initial calculations of the HUMIT model are based on a conservative reference scenario, against which the volume of required GHG emissions reductions can be estimated. In this study this reference scenario is updated with the use of the PRIMES 2009 reference scenario for 2010-2025, which reflects the economic downturn since 2009 (ICCS-NTUA, 2010). This scenario was translated into anticipated business-as-usual developments for each sector in detail, including activity levels (e.g. transport kilometres), energy consumption and emissions in 2020. The reference scenario incorporates national and EU policies and measures implemented until April 2009.

Next to this conservative reference scenario, scenarios with -20 % and -30 % climate packages for the EU were considered. For both scenarios the specific Hungarian mitigation requirements in sectors covered by the EU's Emissions Trading Scheme (ETS sectors) Directive and sectors covered by the EU Effort Sharing Decision (non-ETS sectors), have been defined.

The mitigation scenarios include policies adopted by December 2009. National policy strategies related to mitigating GHG emissions, introducing renewable energy and improving energy efficiency include: National Sustainability Strategies (in the years 2007-2009), Energy Policy (2007-2020), Renewable Energy Strategy, National Energy Efficiency Action Plan.

## **2.3 Energy prices**

The output of the HUMIT model is dependent on energy prices, since the benefits associated with emission reductions measures are entirely reliant on the price of fossil fuels saved. Assumptions for energy prices were based on 2010 energy prices provided by the Energy Office in Hungary (2010; see Table 1).

**Table 1 Energy prices in the HUMIT model (Energy Office, 2010)**

Fuel	Price [€/kWh]
Diesel	0.12
Petrol	0.14
Electricity- households	0.13
Electricity-industry	0.10
Natural gas- households	0.033
Natural gas- industry	0.025
Coal- households	0.024
Coal- industry	0.015
District heating- households	0.045

**Box 1 Key sensitivities in the HUMIT model**

The GHG potentials and costs calculated by the HUMIT model are sensitive to alterations in a number of key parameters. Below we discuss three key parameters.

**Discount rate**

The discount rate has an impact on the investment costs of the technical measures and therefore on the overall costs. The default discount rate in all sectors is 6%, but by using a different discount rate instead, the no regret savings potential could be lower. The CHP industry, transport and power sector are sensitive to discount rates because of the capital intensity of the mitigation measures. Industry (without CHP), waste and the tertiary sector are less sensitive to discount rate because the mitigation measures are less capital intensive in these sectors.

**Emission factors for electricity**

CO<sub>2</sub> emission reductions from electricity savings calculated in the model are based on emission factors for the current fuel mix for electricity production. The model provides two standard emission factor scenarios and the possibility to add an individual scenario. The two standard scenarios are 1) an emission factor based on the baseline fossil fuel mix for electricity production (used in this study) and 2) a highly efficient natural gas combined cycle power station. The choice of one emission factor scenario over the other has a considerable impact on the resulting CO<sub>2</sub> emissions. Using natural gas emission factors will increase the cost of realizing a given abatement potential, in particular in combined heat and power in the ETS sectors.

**Energy prices**

Low capital mitigation measures are highly sensitive to energy prices. Energy prices are dictated per energy carrier per sector. High energy prices create large reduction potentials at 'no regret' level. This is a result of the large potential for energy saving measures, which result in cost savings.

### 3 The economic crisis facilitates meeting more stringent targets

#### 3.1 -34% for ETS-sectors and +6% for non-ETS sectors

Under a -20 % EU climate package, Hungary has a +10% target compared to 2005 for non-ETS sectors. In addition, Hungarian installations participating in the ETS operate under an EU-wide reduction target of 21% compared to 2005 levels.

An EU-wide target of -30 % compared to 1990 emissions, will incite a strengthening of the targets for Hungary (Table 2). Based on an impact assessment of options to move beyond the -20 % target, the European Commission concluded that the cost-effective split between efforts in the ETS and non-ETS sectors under a -30 % reduction target is relatively similar to that under a -20 % target (COM(2010) 265 final).

If a -30 % target for 2020 was adopted, the ETS reduction target would be 34% rather than the current 21% below 2005 emissions and the overall target for sectors in Hungary not covered by the ETS would be +6%, rather than the current +10% above 2005 emissions. These targets follow the current approach of the EU on the distribution of efforts. However, depending on the negotiations between EU Member States, also other targets for ETS and non-ETS emission reductions could be agreed.

**Table 2 Emission reduction objectives under two EU emission reduction scenarios**

	EU -20 % package	EU -30 % package	base year	base year emissions [Mt CO <sub>2</sub> -eq]
EU27	-20 %	-30 %	1990	
ETS sectors Hungary	-21%	-34%	2005	26.9 <sup>1)</sup>
Non-ETS sectors Hungary	+10%	+6%	2005	29.4 <sup>2)</sup>

1) Based on EC, 2007. These are 2005 verified emissions of existing installations included in first phase national allocation plan, multiplied by relative development factors 2005-2010 for GDP and carbon intensity, and by an annual effect from increase in scope from 1st to 2<sup>nd</sup> phase

2) ICCS-NTUA, 2009. Residential, tertiary and transport sectors

For reference, total GHG emissions in Hungary in 2008 were 69.8 Mt CO<sub>2</sub>-eq (Hungarian Meteorological Service, 2010).

#### 3.2 Part of the effort can be met by CDM/JI offset credits or banked ETS allowances

The costs of meeting GHG reduction targets for Hungary are affected by the possibility of offsetting emissions reductions abroad. This can be achieved through the purchase of Certified Emissions Reductions (CERs, realised in Clean Development Mechanism projects) or Emissions Reduction Units (ERUs, realised in Joint Implementation projects).

The EU ETS legislation provides for the use of credits for up to 50% of the overall reductions below 2005 levels<sup>2</sup>. In 2008 and 2009, the volume of CER offsets purchased in Hungary amounted to 1.74 and 1.28 Mt CO<sub>2</sub>-eq (Sandbag, 2010a). Under the Effort Sharing Decision, non-ETS sectors are permitted to use Kyoto credits for 3% of 2005 emissions<sup>3</sup>.

In addition, EU ETS installations may bank allowances not used in Phase II (2008-2012) and reserve them for use in Phase III (2012-2020). Earlier studies have shown that the economic recession has resulted in a considerable surplus of allowances, which ETS participants can bank to surrender in future years (Sandbag, 2010b). Indeed, Table 3 shows that although allocated allowances in Hungary still fell short in 2008, there was a surplus of allowances in the following year. The total surplus of allocated allowances in Phase II is estimated at about 4.8 Mt CO<sub>2</sub>-eq.

**Table 3 Surplus of allocated emissions [Mt CO<sub>2</sub>-eq] in Phase II of the EU ETS for Hungary**

	Source	2008	2009	2010	2011	2012	Total
Allocations	CITL*	25.0	23.4				133
Power generation/ district heating	Primes 2009	16.6	16.3	16.1	16.0	15.8	
Industry	Primes 2009	6.1	6.0	6.0	6.0	6.0	
EU ETS installations	CITL (for 2008- 2009); Primes 2009	27.2	22.4	22.1	21.9	21.8	115
In reserve, incl EUAs for auctioning	CITL						13.2
Surplus 2008-2012		-2.2	1.1				4.8

\* Community Independent Transaction Log

<sup>2</sup> Directive 2009/29/EC, Article 11

<sup>3</sup> Decision No 406/2009, Article 5.4

**Table 4 Calculation of total and domestic mitigation effort for Hungary under an EU -20 % and -30 % climate package**

	2005 emissions [Mt CO <sub>2</sub> -eq]	Total effort relative to 2005	2020 emissions [Mt CO <sub>2</sub> -eq/yr]	CDM/JI offsets [Mt CO <sub>2</sub> -eq/yr]	Banking [Mt CO <sub>2</sub> -eq/yr]	2020 emissions corrected for offsets/banking [Mt CO <sub>2</sub> -eq/yr]
<b>EU -20 % climate package</b>						
ETS	26.9	-21%	21.3	1.5 <sup>1)</sup>	0.6 <sup>3)</sup>	23.4
Non-ETS	29.4	+10%	32.3	0.9 <sup>2)</sup>	NA	33.1
<b>EU -30 % climate package</b>						
ETS	26.9	-34%	17.8	1.5 <sup>1)</sup>	0.6 <sup>3)</sup>	19.9
Non-ETS	29.4	+6%	31.2	0.9 <sup>2)</sup>	NA	32.1

1) average from 2008 and 2009 offsets (Sandbag, 2010a)

2) 3% of 2005 emissions

3) Surplus of 4.8 Mt from Phase II spread evenly over the years 2013-2020.

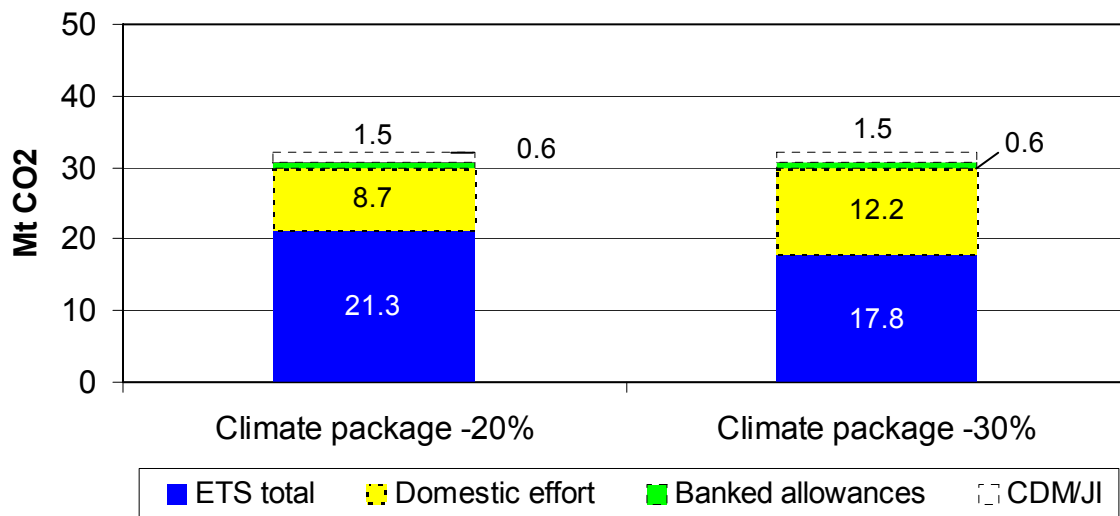
Part of the mitigation effort can therefore be met by the usage of banked allowances and CDM/JI offsets. For calculations of mitigation efforts in Hungary it was assumed, that in 2020 about 0.6 Mt (4.8 Mton surplus over 8 years) of banked allowances will be surrendered in the ETS sectors under both a -20 % and a -30% EU target. In addition, considering offsets purchased in previous years, we assume that approximately 1.5 Mt of CO<sub>2</sub> may be fulfilled in 2020 with CDM/JI offsets at an estimated cost of 15 €/t CO<sub>2</sub>-eq. Other market schemes may also be used in 2020 such as purchasing AEAs<sup>4</sup> from other member states. This market is at this moment not yet operational and future trade volumes are difficult to assess.

### 3.3 Cost and potential of mitigation in the ETS sectors

The remaining part of the mitigation efforts in the ETS sectors are fulfilled through domestic mitigation measures. Figure 1 shows the shares of CDM/JI, banked allowances and domestic efforts. The amount of CO<sub>2</sub> mitigated through domestic efforts amounts to approximately 8.7 Mt under a -20 % EU target and 12.2 Mt under a -30 % EU target.

<sup>4</sup> Transferable Annual Emission Allocations under the EU Effort Sharing Decision

### Mitigation efforts in the ETS sectors (in Mt CO<sub>2</sub>)



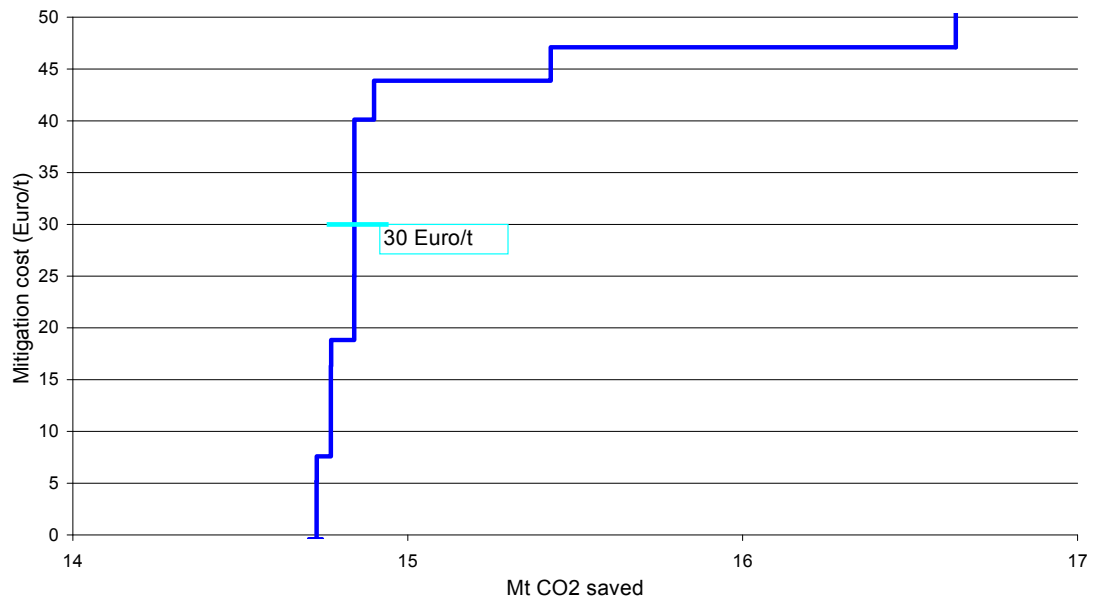
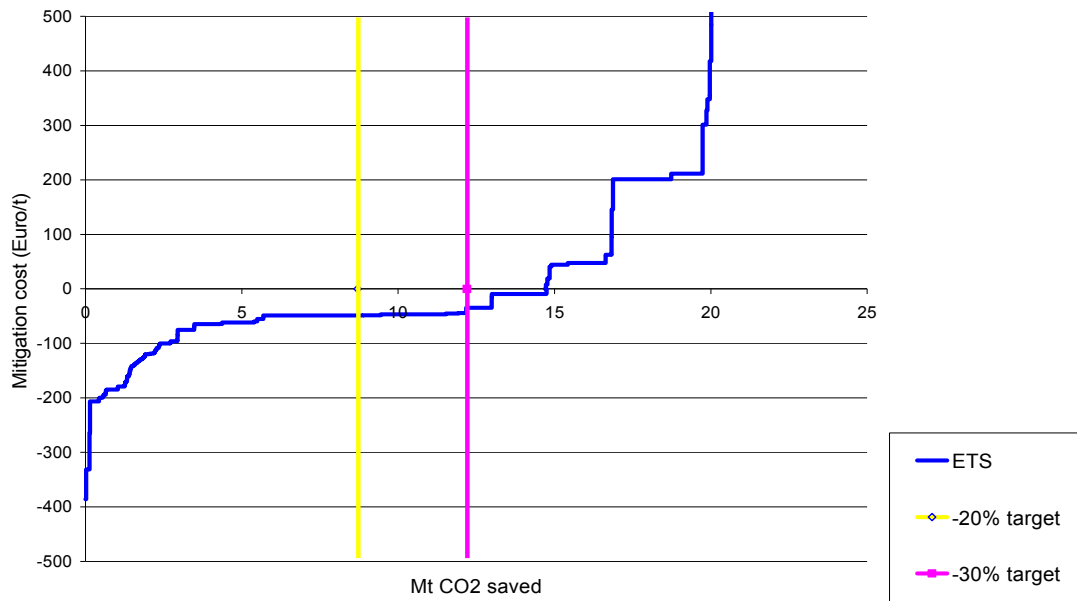
**Figure 1 Mitigation efforts in the ETS sectors under an EU -20 % and -30 % climate package. These bars show the efforts (dashed lines) required to meet the target in 2020 (blue bar).**

Marginal abatement cost curves may be used to determine at what cost domestic mitigation efforts can be achieved.

Figure 2 shows a cost curve for the ETS sectors. The cost curve shows the mitigation measures with their cost in €/t CO<sub>2</sub>-eq (y-axis) and the amount of CO<sub>2</sub> saved with that measure (x-axis). The most cost effective measure is presented on the left in the cost curve and the most expensive option is on the right in the graph.

From this graph we can see that both the -20 % and the -30 % target for the ETS sectors cross the supply curve below 0 euro. This suggests that under our assumptions both targets can be met at negative cost. A minimal number of additional measures is required to achieve the GHG reductions for a -30 % climate package. These concern primarily combined heat and power generation in various branches of industry.

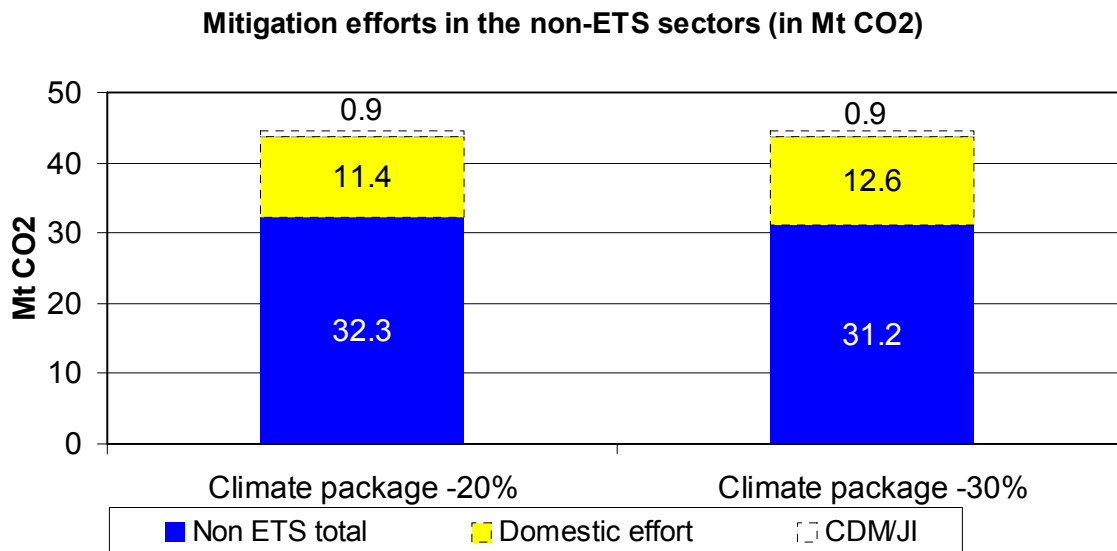
The cost curve also shows that about 2.6 Mt in the ETS sectors can be reduced in addition to the -30 % target at cost below 30 €/t CO<sub>2</sub>-eq.



**Figure 2 a and b Marginal abatement cost curve (MACC) for GHG emissions reductions in ETS sectors in Hungary. The reference lines show the domestic efforts required in these sectors under an EU -20 % and -30 % climate package**

### 3.4 Cost and potential of mitigation in the non-ETS sectors

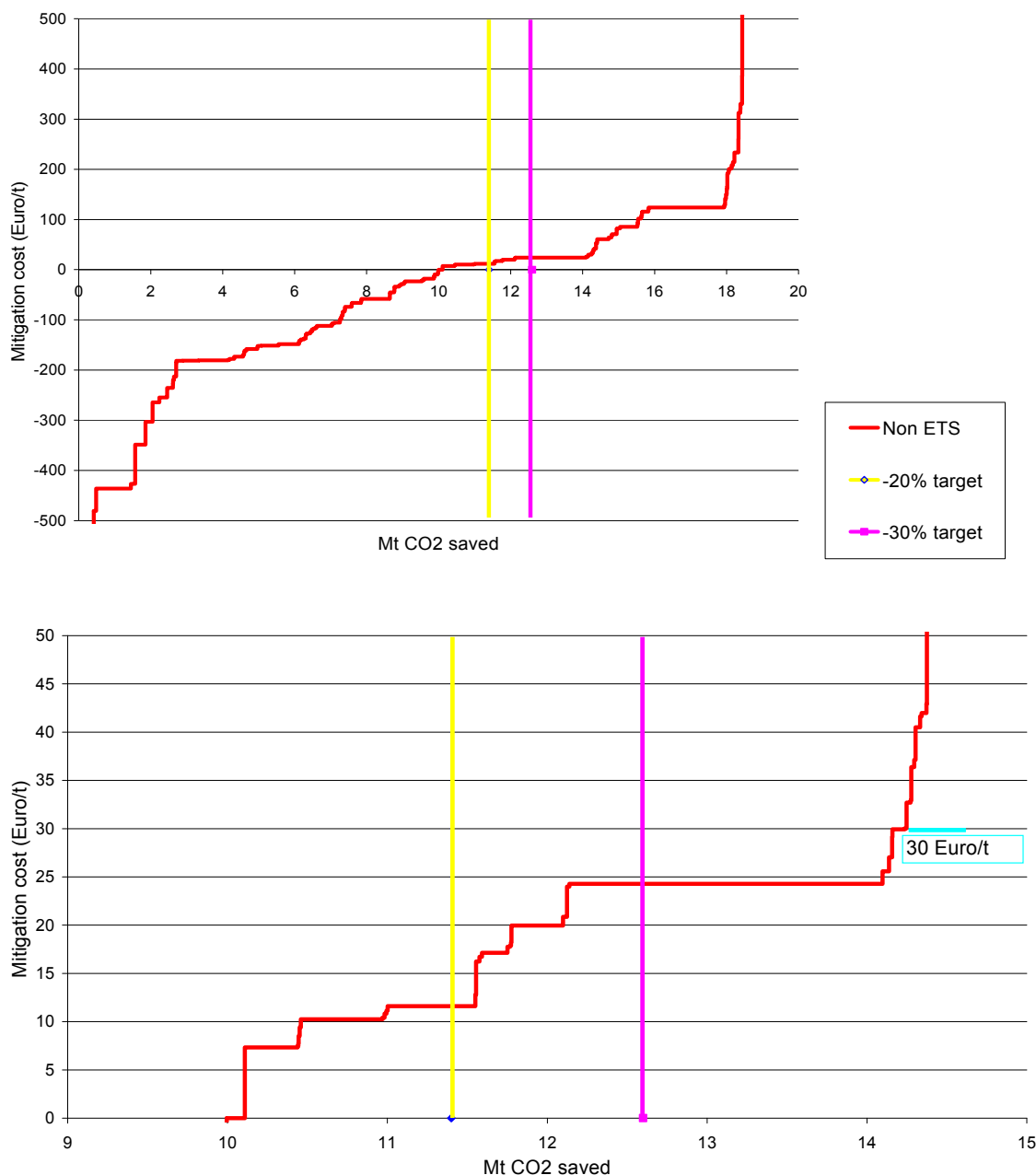
In order to determine the domestic effort for the non-ETS sectors, we initially estimate the maximum amount of CDM/JI offset in 2020. This is 3% of 2005 emissions, or 0.9 Mt. The domestic effort is shown in Figure 3 and amounts to 11.4 and 12.6 Mt respectively, under an EU target of -20 % and -30 %.



**Figure 3 Mitigation efforts in the non-ETS sectors under an EU -20 % and -30 % climate package. These bars show the efforts (dashed lines) required to meet the target in 2020 (blue bar).**

A cost curve of the mitigation measures has also been constructed for the non-ETS sectors. Adopting a -30 % target results in altering the cost curve, from the yellow to the purple vertical line. Additional costs therefore accompany a stricter climate target, but a large share of the mitigation effort can still be achieved at negative cost. Additional measures under a -30 % target are primarily in the tertiary sectors, and to a minor extent in the residential sector and transport, for example, the introduction of condensing gas boilers for heating in public buildings, passive energy designs for buildings, and biofuels.

The cost of the most expensive measure necessary to achieve the -30 % target is still below 30 €/t CO<sub>2</sub>. In fact, before reaching the 30 €/t CO<sub>2</sub>-eq a further 1.6 Mt can be reduced in the non-ETS sectors.

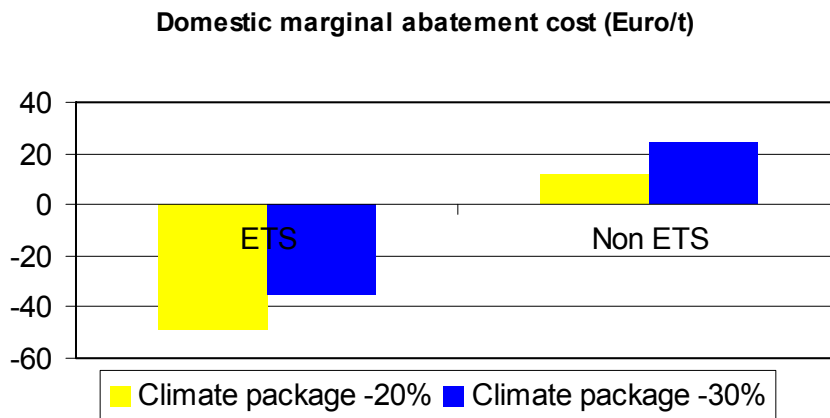


**Figure 4 a and b Marginal abatement cost curve (MACCs) for GHG emissions reductions in Non-ETS sectors in Hungary. The reference lines show the domestic efforts required in these sectors under an EU -20 % and -30 % climate package**

### 3.5 Comparison of mitigation costs in ETS and non-ETS sectors

The marginal abatement cost curves for both ETS and the non-ETS sectors make it possible to compare the cost of increasing efforts. A strong indicator for the difference in cost of changing from the -20 % target to the -30 % target is the marginal abatement cost. This cost can be read from the graphs (Figure 2 and Figure 4) at the crossing point between the cost curve and the vertical lines that represent the targets.

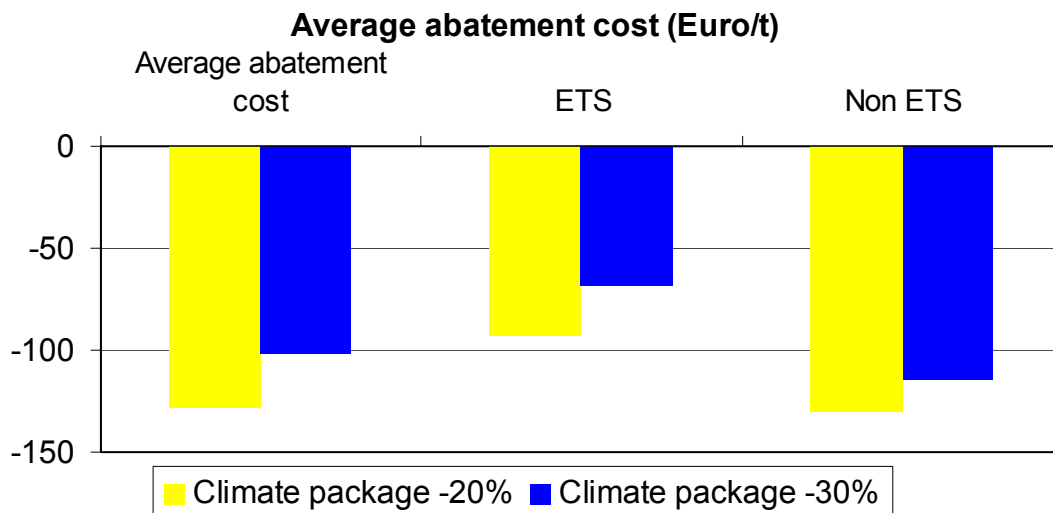
These points on the cost curve indicate the cost of the most expensive mitigation measure that is necessary to meet that target. In Figure 5, the crossing points, or marginal abatement cost is presented for the ETS and non-ETS sectors under a -20 and -30 % target.



**Figure 5 Domestic marginal abatement cost in Hungary under an EU -20 % and -30 % climate package**

This figure shows that the **marginal abatement costs** in the ETS sectors are negative under both targets and lower than the cost in non-ETS sectors. Switching from the -20 % target to the -30 % target requires the implementation of further and more expensive measures. For the ETS sectors, this means a cost increase from -49 to -35 €/t CO<sub>2</sub>-eq and for the non-ETS sectors this means an increase from 12 to 24 €/t CO<sub>2</sub>-eq.

The marginal abatement cost should not be confused with the overall **average abatement cost**. The average cost is calculated by summing all the costs and benefits of the mitigation measures, including the cost of CDM/JI allowances, and dividing this by the total amount of CO<sub>2</sub> saved through these measures. These average costs are shown in Figure 6. The average abatement cost is lower in the non-ETS sectors. The reason for this is the large amount of emission reduction that can be achieved at negative cost in these sectors. The average cost increases from -131 to -115 €/t CO<sub>2</sub>-eq when trying to achieve the -30 % target. In the ETS sectors this increases from -93 to -69 €/t CO<sub>2</sub>-eq. Overall, for all sectors combined, the average cost increases from -129 to -102 €/t CO<sub>2</sub>-eq.



**Figure 6 Average abatement cost in Hungary under an EU -20 % and -30 % climate package (including domestic efforts and cost of CDM/JI)**

Meeting the -20 % target results in overall cost savings of approximately €2.6 bln (708 bln HUF) in 2020. Adopting the -30 % target will result in an increase in mitigation cost of about €60 mln (16 bln HUF). Switching from the -20 % target to the -30 % target results therefore in cost increase because some of the more expensive measures need to be used, but on average the cost of abatement is still negative. Meeting the -30 % target results in an overall cost saving amounting to €2.5 bln (692 bln HUF). This means that CO<sub>2</sub> mitigation generally remains a cost saving activity.

### 3.6 Employment in Hungary increases under an EU -30 % target

Greenhouse gas mitigation measures affect the economy as a whole. The impact of these measures is not restricted to the energy sector. Households, industry and services are all affected by such measures through changes in prices and demand, which have a direct impact on the output and employment of an economy. When assessing the impacts of greenhouse gas mitigation measures, three typical effects can be identified:

- Direct effects, from the creation of new jobs directly related to the mitigation measures, e.g. jobs in the construction industry for insulation measures
- Indirect effects, from all the sectors that supply materials and services to the business designing and implementing a measure
- Induced effects, arising from the disposable income available to families as a result of energy savings and wages from the additional jobs created

In this study, only the **direct effects** of implementing mitigation measures are estimated. Indirect and induced effects of measures are not estimated here due to a lack of data on the measures (and sectors) included in the HUMIT model.

The direct effects are estimated using the labour intensities of Hungarian sectors (see Table 5) and its subsectors. Per mitigation measure we determined in what sector investments are needed in order to realise a measure. This is generally within the construction and manufacturing industry, where jobs are created following an investment.

We also determined in what sector cost savings would be realised as a consequence of the measure. Cost savings in a sector tend to result in lower turnovers and jobs lost in that sector. This is predominantly the sector producing 'Electricity, gas, steam and hot water' or the sector 'Manufacture of coke, refined petroleum products and nuclear fuel' ('Manufacturing' in Table 5).

The net effect on employment then depends on the amount of investments and savings and on the labour intensity of the sectors affected by the measure. Table 5 shows that the energy supply sector, typically, has a low labour intensity compared to the construction and manufacturing sectors. This information has a significant effect on the outcomes of this study.

**Table 5 Labour intensities per sector (based on 3CSEP, 2009)**

Sectors	Average fte/ M€ turnover
Mining and quarrying	10
Manufacturing	15
Electricity, gas and water supply	3
Construction	13

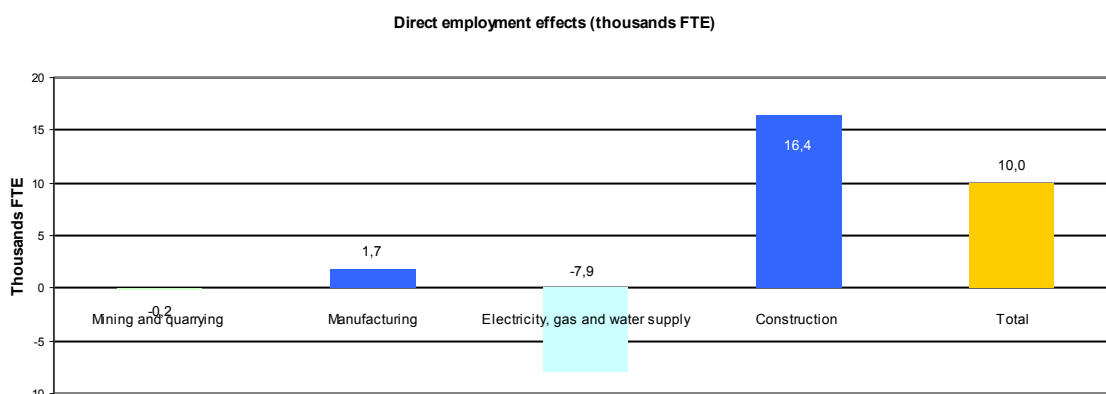
In Figure 7 and Figure 8, the net effects, of meeting the -20 % and -30 % targets, on employment are shown. The sectors mainly affected by climate mitigation measures are the energy supply sector and the construction or manufacturing sectors. We see a loss in jobs in the energy supply sector and an increase in the construction and manufacturing sectors. The effect of jobs in mining and quarrying is small because this is not a large economic sector in Hungary.

Considering the overall cost savings reported earlier in this study, the net effect of climate mitigation measures on employment is expected to be negative. However, the figures show that climate action has a positive net effect on employment. The primary explanation for this is that the labour intensity in the energy supply sector is the lowest of all sectors and that loss of turnover and jobs in this sector is easily compensated by the additional turnover and creation of jobs in other sectors.

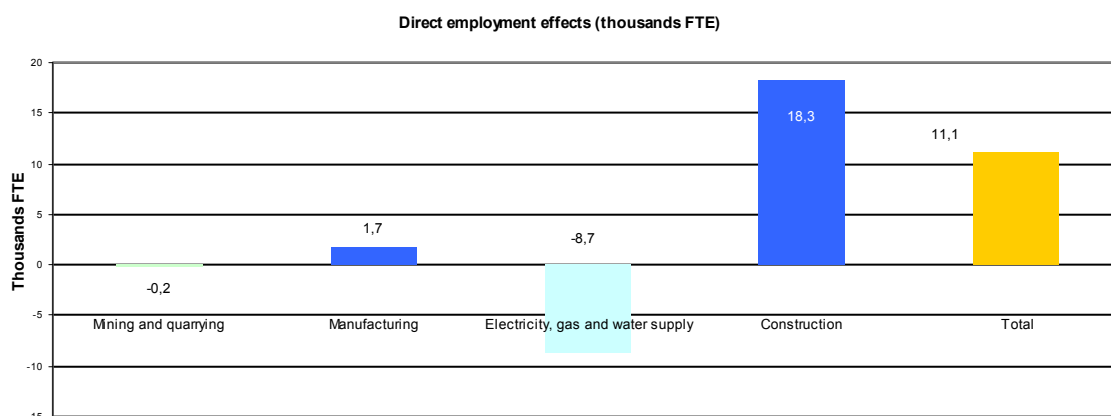
Under the -20 % target, approximately 10,000 full time equivalents (fte) would be created. Under the -30 % target, this is estimated to be 11,000 fte. Extensive climate action is expected to result in the additional creation of about one thousand fte (a

~10% increase in additional direct employment effects)<sup>5</sup> compared to the -20% target.

The explanation for this is that the additional mitigation options needed for switching from the -20 % to the -30 % target require more investments per ton of CO<sub>2</sub> reduced, which therefore results in more jobs than lower cost measures. The overall result is that net employment is most likely to increase with stricter climate targets.



**Figure 7 Direct domestic employment effects (expressed in full time equivalent, fte), per sector, when implementing mitigation measures under an EU -20 % climate package.**



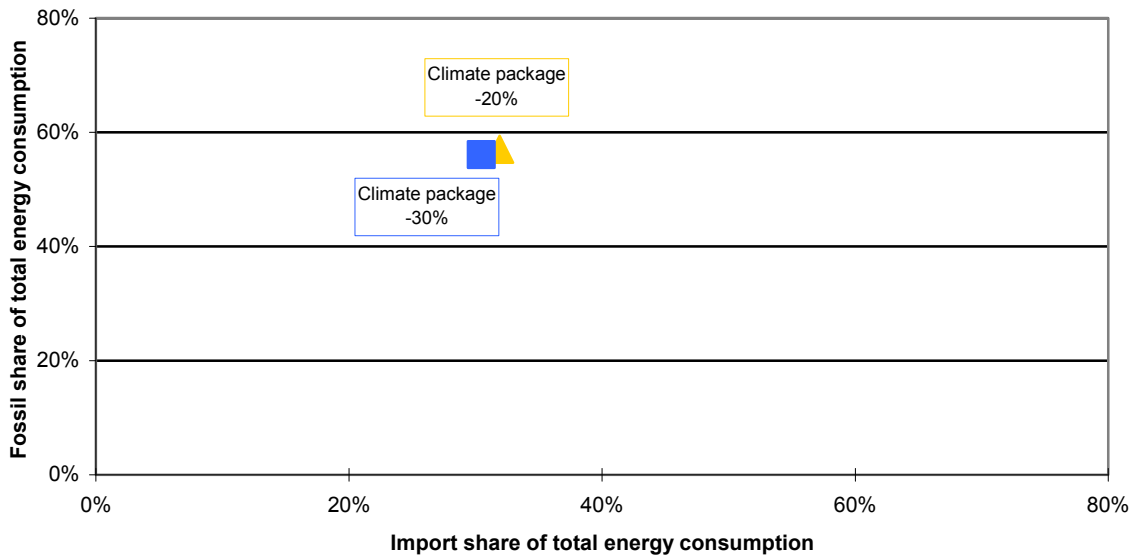
**Figure 8 Direct domestic employment effects (expressed in full time equivalent, fte), per sector, when implementing mitigation measures under an EU -30 % climate package.**

<sup>5</sup> It should be noted that in this study only the direct employment effects are calculated with a high degree of uncertainty. When the indirect economic effects of climate action are also taken into account, these figures may change considerably.

### 3.7 Energy security improves slightly under a -30 % target

Energy security under a -30 % climate package is slightly better than that under a -20 % climate package. The share of fossil fuels and nuclear in total energy consumption remains constant under a -30 % climate package in our model, however, the import of fossil fuels falls from 235 to 220 PJ, representing a 6% decrease compared to the situation under a -20 % climate package.

Energy from renewable sources is just over 150 PJ under both climate packages, equating to 21% of the total energy demand. This is greater than the share of renewable energy required under the Renewable Energy Directive<sup>6</sup>. This directive stipulates an increase of the share of renewables from 4.3% in 2005 to 13% in 2020.



**Figure 9 Share of energy import and fossil energy consumption as percentage of total primary energy consumption. This figure can be used as an indicator for the dependency on energy import and fossil energy.**

<sup>6</sup> Directive 2009/28/EC

## 4 Policy options for capturing the full potential of low and negative cost options

### 4.1 Additional negative and low cost options available for trade with other member states

The Impact Assessment of the European Commission, in the context of the Communication "Analysis of options to move beyond 20%" (COM(2010) 265 final), projected a 30 €/t CO<sub>2</sub> carbon price by 2020 under a "30 % with flexibility" scenario.

The analysis in this report shows (see paragraphs 3.3 and 3.4) that at a cost below 30 €/t CO<sub>2</sub> an additional 2.6 Mt CO<sub>2</sub> can be saved in the ETS sectors and 1.6 Mt CO<sub>2</sub> in the non-ETS sectors in Hungary. Under the EU ETS, full flexibility is available for parties in other EU Member States to utilise low cost abatement options in Hungarian ETS installations.

For the non-ETS sectors, Hungary will not require these volumes to meet its assumed target of +6% above 2005 levels (target in line with EU -30% target). Therefore, these volumes would be available for other EU Member States that have difficulties meeting their commitments cost-effectively. With these additional emission reductions, further benefits in employment and energy security could be exploited.

The Hungarian government could explore options to exploit domestic low cost reduction options and sell the resulting surplus Annual Emission Allocation (AEAs) to other EU Member States. EU Member States can currently trade up to 5% of AEAs with each other and can bank and borrow 5% between years. Hungary could use these options and could explore relevant EU debates for a possible increase to a -30 % EU target and increase the possibilities for trade. Alternatively, an EU financial instrument could be established to purchase and cancel AEAs to achieve additional low cost GHG reductions.

The Green Investment Scheme (GIS), launched in Hungary in 2009, could also help exploit additional low cost emission reduction options. The GIS channels the revenues from the sale of leftover Assigned Amount Units (AAUs) under the Kyoto protocol into emission reduction projects (Tuerk et al., 2010). Under the GIS, two programs were launched in Hungary; one supporting energy efficiency measures in brick buildings with an expected annual saving of 5.7 kt per year and one for obsolete concrete buildings from the communist era, with an estimated annual saving of 63 kt.

## 4.2 Policies to capture the full potential of low and negative cost options

A significant part of the mitigation measures involve an upfront investment of resources in making existing or new infrastructure more efficient (combined heat and power, building insulation) and then, earning these costs back over time through lower energy costs. Over the past few years, such options have become even more profitable due to increasing energy costs.

The question is, why businesses and consumers have not already captured these negative and low cost options. Several obstacles and disincentives prevent this, including a lack of knowledge or awareness, institutional barriers and financing hurdles. Designing the right policy framework to capture the potential of economic options is a pivotal challenge for Hungary. Such a framework could include:

- Binding technical standards for buildings and transportation. Currently, energy efficiency must be taken 'into consideration' when designing new buildings, no binding standards are yet in place. For transport, no measures targeting vehicle efficiency are supported in Hungary.
- A clear price signal by strengthening energy and carbon taxation for economic activities in non-ETS sectors. ETS-sectors receive a clear price signal from the carbon market, for the sectors outside of ETS a comparable incentive should be created.
- EU financial instruments, for example green bonds issued by the European Union or support from EU Cohesion Policies could help leveraging additional private investments in economic mitigation measures.

A long-term horizon for industry and power sector investors is vital. Currently, no specific policies exist to stimulate the use of renewable energy in industrial processes, and no policies are in place to target energy efficiency in industry. The ongoing development of Hungary's 2030 Energy Strategy and the National Renewable Energy Action Plan provide opportunities to put the first policies in place.

Furthermore, current network capacity and difficult permitting procedures limit an increase in renewable energy capacity. Improved planning and financing of electricity infrastructure, including the use of new EU financial instruments, and more simple permitting procedures for infrastructure and renewable generation capacity would help remove existing barriers.

## 5 Conclusions

This report includes an assessment of the costs and benefits for Hungary if the EU were to increase its prevailing mitigation effort and commit to a -30% GHG reduction target, rather than the current -20 % target. The assessment was based on the assumption that reductions in the ETS sectors in Hungary and across the EU would then amount to -34% compared to 2005 emissions. The growth of emissions in non-ETS sectors in Hungary is assumed to be limited to +6%. From our analysis, the following findings emerged:

- In the ETS sectors, commitments under both the -20 % and the -30 % EU climate package can possibly be met at a negative cost. Additional measures required under a -30% EU target concern primarily combined heat and power generation in various branches of industry.
- In the non-ETS sectors, additional costs are associated with a -30 % target, but a large proportion of options is still likely to be realised at negative cost. Additional measures required under a more stringent target are primarily in the tertiary sectors, but are also present in the residential and transport sectors.
- Overall cost savings under a -20 % EU targets are estimated to be approximately €2.6 billion. These savings are estimated to be approximately €60 million less under a -30 % target, but on average, the cost of abatement under a -30 % target remains negative.
- Implementing GHG reduction measures is anticipated to result in the creation of additional jobs. Under the -30 % target, this positive direct employment effect is approximately 10% higher than under a -20 % target. Under the -30 % target this is calculated to be approximately 11,000 full time equivalents.
- Energy security in Hungary, under a -30 % EU target, is expected to improve slightly due to a small drop in fossil fuel imports and a decreased proportion of fossil fuels in the total energy demand. The import of fossil fuels is estimated to decrease slightly with 6%.
- After meeting commitments under an EU -30 % target in Hungary, options still remain at a cost lower than 30 €/t CO<sub>2</sub>. The results indicate an additional amount of roughly 2.6 Mt CO<sub>2</sub> that can be saved in the ETS sectors and roughly 1.6 Mt CO<sub>2</sub> in the non-ETS sectors. The Hungarian government could seek means to exploit this additional low cost domestic potential. This will increase investments in Hungary and help the EU as a whole to meet a -30 % target more cost-effectively.

- A range of policy options exists for exploiting the negative and low cost potential for GHG reductions in Hungary. Although a long-term horizon is vital for any policy to provide long-term certainty to investors, a more detailed comparison of options is also recommended to capture the economic potential for abatement of GHG emissions in Hungary.

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