GLOBAL CARBON MECHANISMS: EMERGING LESSONS AND IMPLICATIONS

Global Carbon Mechanisms Annex II: Emissions and demand projections to 2020

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Global Carbon Mechanisms Annex II: Emissions and demand projections to 2020

1. Introduction

Projections of Greenhouse Gas (GHG) Emissions up to and beyond 2012 are vital in analysing the efficacy of current mitigation efforts and the future efforts required for compliance with existing emissions commitments. Projections beyond 2012 are required in order to inform the Post-Kyoto framework as to business as usual estimates and feasible targets.

Emissions projections can also help to inform the future trajectory of carbon prices as they determine the likely demand in the European Union (EU) Emissions Trading Scheme (ETS) and also demand for the Kyoto Mechanisms (Clean Development Mechanism (CDM) and Joint Implementation (JI)).

Despite their importance there have been relatively few, independent, robust estimates for many areas covered by the Kyoto Protocol. Geographical coverage varies; while the EU-15 and to a lesser extent the EU-27, has been modelled extensively, there are few studies of countries such as Ukraine and Russia; yet it is these countries with their large surpluses under the Kyoto Protocol that could determine global compliance with the treaty, and the future trajectory of carbon prices. There has also been relatively little independent modelling of emissions within the EU ETS, despite its importance to both compliance with Kyoto targets and future carbon prices.

Emission projections are based on economy or sector modelling and are thus dependent on estimating the future based on historical trends. This requires that historical relationships hold into the future and that key exogenous assumptions are up-to-date and accurate. This requires that projections are regularly updated to take into account the ever-changing wider economy. This is especially relevant in 2008 during which there has been a rapid growth in energy prices, and also the start of effects of the credit crunch on the real economy. [1]

This note outlines a body of work compiled in order to inform a recent Carbon Trust Report examining Global Carbon Mechanisms.[2] It builds on modelling by Cambridge Econometrics commissioned by the Carbon Trust and a survey of emission projections and data for the areas beyond the scope of the Cambridge Econometrics analysis.[3] It highlights estimates of emissions in relation to Kyoto targets and ETS caps up to 2012 for the EU-15, the new member states of the EU, Japan, and the other Annex 1 countries, and also highlights work on projections beyond 2012 for the EU ETS and gaps where future work is required.

[1] Subsequent to the analysis there has been a rapid reduction in oil prices down to approximately $50/barrel. This now implies that Scenario 1 in the modelling is probably the most realistic of the scenarios in terms of energy prices.
[2] Carbon Trust (2008), Global Carbon Mechanisms : Emerging lessons and implications
[3] Cambridge Econometrics (2008), Updated European Emission Projections: A final report for the Carbon Trust, 11 November 2008

2. Methodology

The analysis by Cambridge Econometrics was based upon the modelling framework of their Energy-Environment-Economy Model for Europe (E3ME). This is a large-scale econometric model with detailed sectoral composition (42 sectors). The model comprises:

- Accounting balances for commodities from input-output tables, for energy carriers from energy balances and for institutional incomes and expenditures from the national accounts;
- Environmental emission flows;
- 29 sets of time series equations, including aggregate energy demand and fuel substitution equations.

The model requires a number of key exogenous inputs:

- Activities outside E3ME's geographical scope such as world growth rates and inflation;
- Demographics (eg population stocks and flows);
- Primary energy supplies from EU sources (ie oil, coal and gas output, but not imports)
- Activities of government such as tax rates, interest rates and exchange rates.

Data for the model is drawn from international data from Eurostat national accounts, the OECD Stan database, DG Ecfin's AMECO database, and IEA data.

This modelling framework was used to produce projections under a baseline and three scenarios. The baseline scenario was calibrated to be consistent with the projections presented in European Energy and Transport Trends to 2030 – Update 2007 (European Commission DG Tren 2008).[4] For consistency the same fuel and ETS allowance prices were assumed (See Table 1).

TABLE 1: BASELINE PRICES, REAL TERMS

	2010	2020	2030
Oil ($/boe)	54.5	61.1	62.8
Coal ($/boe)	13.7	14.7	14.9
ETS allowance (€/tCO2)	20.0	22.0	24.0

Note(s) : All prices are in 2005 constant base.

Source(s) : European Commission (DG TREN, 2008).

Source: Cambridge Econometrics 2008

Three further scenarios were also produced in order to model the rapid changes in energy prices during 2008, and the start of a possible future growth slowdown. It should be noted that the modelling did not otherwise take into account any adverse

[4] European Commission, DG Tren (2008), European Energy and Transport Trends to 2030 – Update 2007 Available at http://www.energy.eu/publications/KOAC07001ENC_002.pdf

additional economic impacts resulting from the global credit crunch, as in October 2008, when the modelling was undertaken, these were still highly uncertain.

The three scenarios modelled were:

Scenario 1: 2008 Update

A scenario taking into account energy prices in the first nine months of 2008, and a reduced growth rate for 2008. The following were assumed:

- EU-27 GDP growth is fixed at 1.4%;
- Oil and gas increase by 57% compared to 2007. Oil reaches an average of $112.5pb. The price of both commodities reverts back to baseline post 2008.
- Coal prices increase by 100% in 2008 [5], but beyond 2008 revert back to baseline values as shown in Table 1.

Scenario 2: A permanent increase in energy prices

This scenario builds on Scenario 1 by utilising the same updated data for 2008 but assuming an oil price close to $100pb in 2008 prices throughout the forecast period. All other external variables such as US growth and inflation are unchanged.

Scenario 3: A slowdown in GDP growth

This scenario builds on Scenario 2 by reducing GDP growth projections for the forecast period. GDP growth is reduced to 1% pa over 2009-2012 and thereafter resumes at 2% after 2012. This was not an attempt to model the effects of the credit crunch, which may be much more severe in the short term.

For the baseline and all three scenarios, ETS emissions up to 2020 were estimated along with average total emissions for all EU member countries for the period 2008-12. In addition estimates of Non-ETS emissions over the Kyoto target were also produced.[6] These were produced from overall GHG Emissions estimates, assuming that the ETS was fully compliant with its cap.

3. EU-ETS, EU-15 and Japanese emissions up to 2012

Cambridge Econometrics' modelling produced estimates of both ETS projected emissions from 2010 to 2020, under the baseline and scenarios and also average total emissions for 2008-12 in EU member states.

For the period up to 2012 in the baseline and in all three scenarios Cambridge Econometrics analysis predicts that the ETS sector emissions will be below its cap at a carbon price of €20/tCO_2. The scale of this surplus extends from 155MtCO_2 in total from 2010-12, with a peak surplus of 69Mt in 2010, in the baseline scenario, to 360Mt in total from 2010-12 with a peak surplus of 129Mt in 2012, in Scenario 3. In Scenario 1, (which is increasingly looking the most plausible of all the Scenarios, in

[5] This is a rough estimate as it was not possible to obtain exact figures for coal prices in the time available and coal prices in any case can vary by users between countries, due, for example, to transport costs.

[6] The Kyoto targets were based upon the base year data, available at the start of the analysis. Subsequently base year data has been revised, although the majority of the revisions are minor.

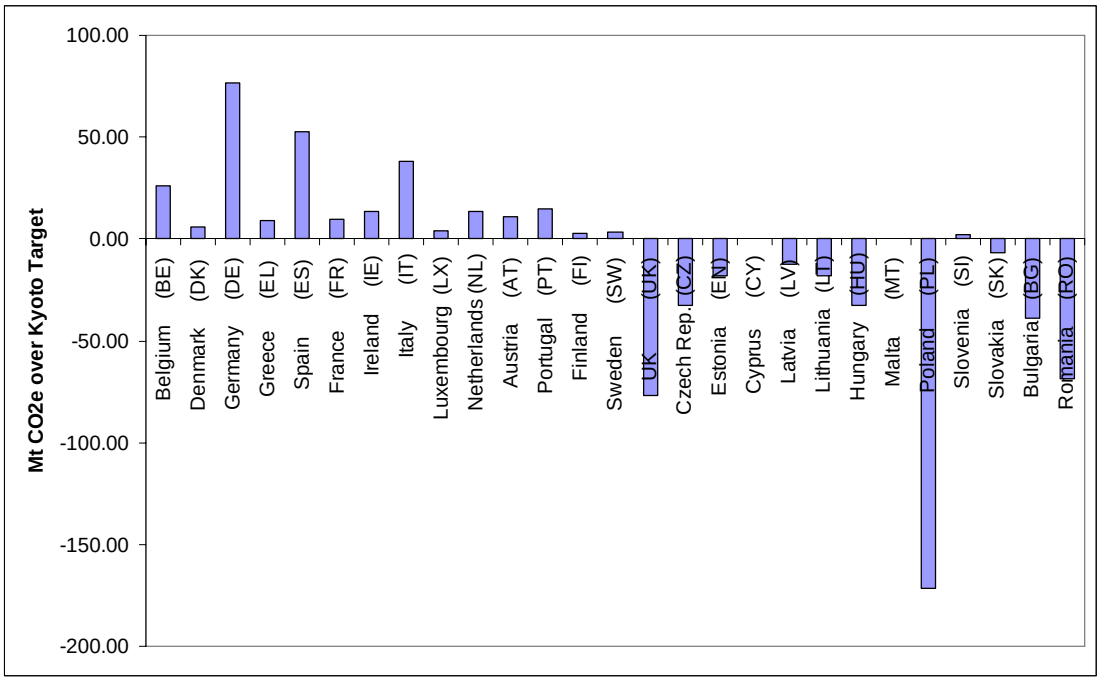
terms of fuel prices) the total surplus from 2010-12 was estimated at 195Mt, with a peak surplus in 2010 of 79Mt.

The implications of this is that, with a Carbon price of €20/tCO_2 the ETS will be in surplus, implying that a Carbon price of €20t/CO_2 is unsustainable and that overall there will be little demand from the ETS for project credits from external sources such as the CDM and JI. There may be some demand from individual firms but likely to be little overall, without a dramatic drop in the Carbon price, and a large response from firms, as discussed below.

Cambridge Econometrics also estimates annual average GHG emissions for EU member states for 2008-12. This allowed a calculation of Non-ETS emissions over the Kyoto target (assuming that the ETS met its cap). In the baseline this figure for the EU-15 was 252 MtCO_2e, implying a total deficit up to 2012 of 1258 Mt In Scenario 1, this deficit fell to 204 Mt annually or 1018 Mt overall. In Scenario 3 this deficit reduced to 107 Mt annually or 534 Mt annually.

This deficit implies that some purchasing of project credits or other allowances will be necessary for the EU-15 overall to comply with their Kyoto targets.

Germany, Spain and Italy are the countries for whom the largest inflow of emission credits will be necessary, with annual average deficits of 76, 52 and 38MtCO_2e respectively in Scenario 1. The UK is the only country that has a surplus in both the baseline and all three scenarios, with projected annual average emissions of 77Mt below it's baseline in Scenario 1. Sustained high energy prices and lower growth in Scenario 3 cause France and Sweden to move towards surpluses compared to deficits in the baseline scenario.



Source: Cambridge Econometrics (2008)

Figure 1: Surpluses and deficits from their Kyoto targets for EU member states

The E3ME model used by Cambridge Econometrics does not include Japan, so an off-model calculation was performed, with crude assumptions about efficiency rates and no changes in sectoral composition or the fuel mix in electricity.

By applying the same growth rate in emissions as that occurred in the EU, projections were computed for the baseline and two other scenarios. Baseline average annual emissions for 2008-12 were estimated at 1316 $MtCO_2e$, 120 Mt above Japan's Kyoto target. In Scenario 1 (2008 energy prices) the deficit falls to 101 Mt, implying average annual emissions of 1296 Mt. In Scenario 2 (sustained high energy prices) the deficit fell still further to 60 Mt, implying average annual emissions of 1255 Mt.

Sensitivity to carbon prices

The Cambridge Econometrics modelling was conducted in the framework of a fixed price for EU emission allowances (EUA) of €20/tCO_2. Given the results of the modelling, that the ETS would have a surplus of allowances at this price, a price of €20/tCO_2 would be unsustainable and the price is likely to fall. The impact of such a fall is beyond the current work, but previous studies have undertaken some modelling that allows the scale of such a response to be estimated.

Neuhoff et al (2006) analysed emissions projections up to 2012 versus national allocation plans.[7] This included testing their projections with two carbon price scenarios, one of a zero carbon price and another where the price was €20/tCO_2. Results came from the Integrated Planning Model of the ICF for the power sector and from two separate reports for the non-power sector, one from a DTI study where a zero carbon price was assumed and one from a study using the E3ME model (Matisse, 2006) where a positive allowance price rising from €18/tCO_2 to €25/tCO_2 during phase II was assumed. Their results for a number of different fuel price scenarios placed total emissions savings from moving from a zero to a €20/tCO_2 carbon price between 50-150tCO_2 per year. From this an approximate assumption can be made that a fall in the price of allowances from €20 to €10/tCO2 up to 2012 might increase emissions within the ETS by approximately 50 Mt a year or 250 Mt in total compared to emissions at a €20 allowance price.

Comparison with other studies

There have been other estimates produced that attempt to estimate demand for the Kyoto Mechanisms within the EU-15 and Japan. The majority of these, however, do not explicitly forecast emissions; other assumptions are made in order to project demand.

The World Bank's (2008) report projects total demand for the EU-15 and Japan in the Kyoto market.[8] They project government demand through surveying existing plans in place and assumed that private demand would mostly arise from the EU ETS (with some additional demand from Japanese firms) who would import the legal maximum of credits allowed up to 2020, 1,400 Mt, before 2012. This implies that they believe

[7] Neuhoff, K, Ferrario, F, Grubb, M, Gabel, E, and Keats K, (2006), Emissions Projections 2008-12 versus national allocation plans II, Climate Policy 6(4), p395-410

[8] World Bank (2008), State and Trends of the Carbon Market 2008, Available at http://siteresources.worldbank.org/NEWS/Resources/State&Trendsformatted06May10pm.pdf

that total private EU demand for credits will exceed this figure, the reasons behind this are unclear and it is impossible to determine whether it represents compliance demand or purchasing of credits for banking forward to future phases.

Both Societe Generale (2008) and Point Carbon (2008) have produced estimates of demand for the Kyoto mechanisms.[9] They are, however, similar to the World Bank, to the extent that their estimates are not based upon clear emissions projections, but are subject to other assumptions, in both cases the key one being, that the ETS will import their legal maximum of 1,400 Mt before 2012. Societe Generale rationalise this by assuming that the price of CERs are lower than EUAs and that due to constraints in purchasing of CERs post-2012 the majority of this demand will occur before 2012. Point Carbon estimates that 909 Mt will be required for the ETS to be compliant, but assume that the legal maximum is imported due to banking.

In all three of these reports it is assumed that banking stabilises ETS demand at the legal maximum, but say little about what emissions are actually estimated for this sector, and thus what is required for actual compliance. They also say little about what the effect of higher energy prices or lower growth would be. Thus justifying further work to more clearly project emissions and therefore demand

The European Environment Agency (EEA) has also produced projections of future emissions that can be used to estimate emissions, and thus demand in the global carbon market, up to 2012. EEA (2008) presents data for the EU-15 for 2006 along with projections for 2010.[10] These projections consists of emissions with existing measures, planned measures, and also estimates of carbon sinks and use of the Kyoto mechanisms. Applying a linear growth trend forward to 2012 based on these two data points allow us to produce alternative projections up to 2012. Under existing measures the EU-15 is projected to be in deficit, compared to its Kyoto target, in all years, with a total deficit for 2008-2012 of 931 $MtCO_2e$. With planned measures this total deficit declines to 229 Mt. This is a similar range of projections as those from Cambridge Econometrics.

This work allows us to produce an estimate of the deficits from their Kyoto targets and Japan. Sensible ranges are from 500-1250 $MtCO_2e$ for the EU-15 and 300-500 Mt for Japan.

4. Australia, New Zealand and Canada emissions up to 2012

The remaining Annex I countries are at different stages of compliance with the Kyoto treaty. Australia is likely to comply with its Kyoto target without reproach to the Kyoto mechanisms, mainly due to changes in its forestry and land-use activities. New Zealand is likely to demand a small amount of CERs as it is likely to have a small deficit from its Kyoto target, although domestic sinks and its ETS may be enough to meet the deficit (although there may be some private demand from the scheme). The

[9] Societe Generale (2008), Fundamentals Update: European CO_2 market, 16 July 2008 and Point Carbon (2008), Carbon Market Analyst: The Kyoto balance: Saved by the AAUs, 18 September 2008

[10] European Environment Agency (2008), Greenhouse gas emission trends and projections in Europe 2008, Available at: http://reports.eea.europa.eu/eea_report_2008_5/en

World Bank (2008) provides estimates of 45 Mt demand for external credits for these countries.

Canada is a different case. As it stands today the Canadian government does not intend to meet its international treaty obligations and meet its Kyoto target through the Kyoto mechanisms. Should it change this position its demand for external credits could be substantial. Based upon the most recent data its emissions in 2006 were 162 $MtCO_2e$ over its target. If this level stabilises over the period up to 2012 its total deficit over the period would be 811 Mt. Canada's emissions, however, fell from 2005 to 2006, should that trend continue, a likely assumption if it was required to meet its Kyoto target, the total deficit up to 2012 would fall to 548 Mt. This implies that in a world where Canada would enter the carbon market its demand for external credits is likely to be in the range of 500-600 Mt.

5. Supply estimates to 2012: beyond the project mechanisms

Carbon Sinks

Emissions and removals from Land Use, Land Use-Change and Forestry (LULUCF) play an important role in the Kyoto framework and may allow some countries, such as Australia, to meet their Kyoto targets without having to use CDM or JI credits and may reduce the demand from other countries for external credits.

Reporting of GHG emissions from LULUCF activities falls under two Articles of the Kyoto Protocol. Article 3.3 allows Annex I parties to count net changes in GHG emissions by sources and removals by sinks through direct human-induced LULUCF activities, limited to afforestation, reforestation and deforestation (ARD), against their emission reduction commitments. There is a supplementary Article, Article 3.4, which countries can opt into. Under this countries can elect to report additional human-induced LULUCF activities that are then added to their ARD contributions. If a country is a net sink under these two articles (or combination that they are party to), they may issue Removal Units (RMUs).[11]

The complexity of this legislation, coupled with the fact that countries can opt into different LULUCF activities under Article 3.4, make projecting, and analysing RMUs very difficult, hence the relative lack of projections that have been conducted.

The EEA (2008) estimate emission removals from Carbon Sinks from the EU-15 at 57 $MtCO_2$ in 2010. As part of the fourth National Communication from the European Community mitigation potential from ARD and Forest management was estimated at approximately 33 $MtCO_2/yr$.[12]

Assuming that 2010 represents an average, allowing some small element from Japan carbon sinks and conservatively estimating removals of approximately 60Mt CO_2e up

[11] For further information see http://unfccc.int/methods_and_science/lulucf/items/4129.php

[12] European Commission (2006), Fourth National Communication from the European Community under the UN Framework Convention on Climate Change p78, Available at: http://unfccc.int/resource/docs/natc/eunce4add.pdf

to 2012 from sinks in Australia and New Zealand[13], could account for between 100 and 300 Mt of RMUs being issued from 2008-12. Further work, however, is required in order to produce robust estimates of removals in this area up to 2012, and especially up to 2020 in order to inform the Post-2012 policy debate.

Central and Eastern Europe, Russia and Ukraine emissions up to 2012

The new member states of the European Union and other eastern European countries such as Russia and Ukraine are integral to the Kyoto process. Due to the economic decline of the early 1990s the vast majority of these countries are on course to have large surpluses of Assigned Amount Units (AAUs) under their Kyoto targets. The issue of the sale of 'hot air' has been much discussed and a view emerged that countries were unlikely to buy surplus allowances without agreement on the use of the revenues. The use of JI and the emergence of Green Investment Schemes (GIS), however, mean that these surpluses can still play an important role in compliance with the Kyoto Protocol.

In recent years many of these countries have been enjoying rapid economic growth, either through the benefits of EU membership or through high energy prices. This has led to a 'bounce' in emissions in some countries, or at the least a halt in decline, in recent years in many of these countries, reducing or stabilising their emission surpluses. The size, scale and durability of this 'bounce' have had little study and there are few projections of these countries' emissions up to and beyond 2012.

The Cambridge Econometrics analysis includes the new member states in their modelling of average Greenhouse Gas emission demand from 2008-12. Their modelling found that, assuming the ETS is fully compliant with its cap; these new member states would have a surplus of on average of 387 $MtCO_2e$ per year in the baseline scenario. This equates to a total surplus across these years of 1,937 Mt per year.

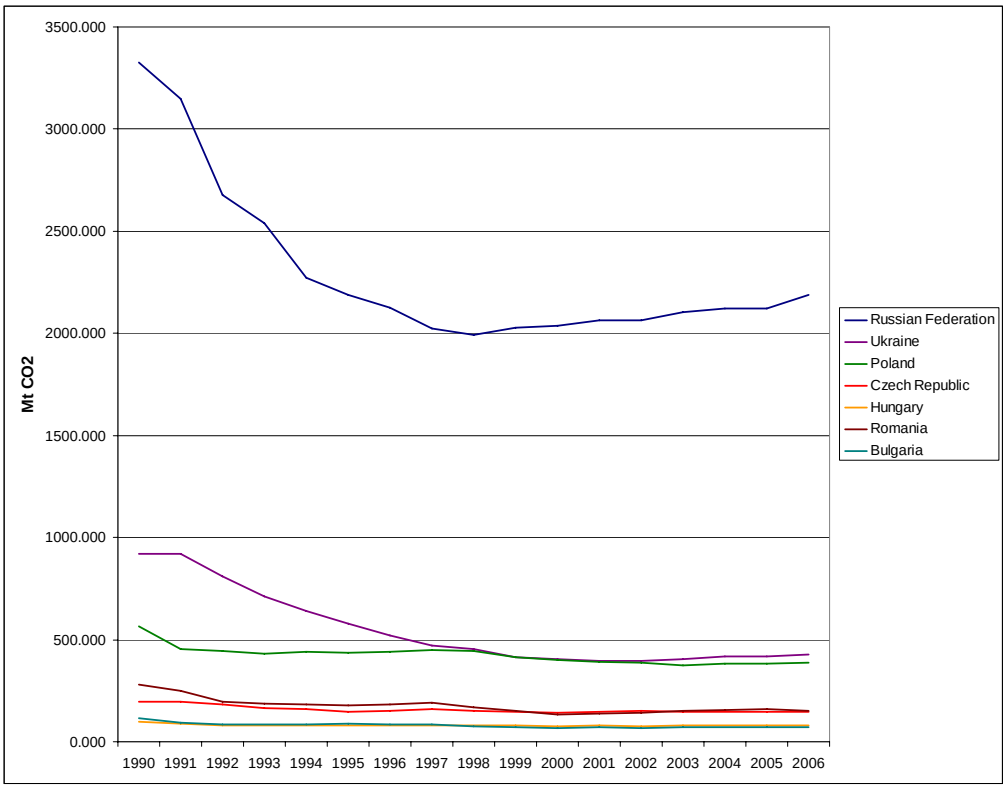
The sensitivity of these surpluses between scenarios was also analysed. The effect of sustained higher energy prices and lower growth increased the surplus by approximately 9% annually, implying a total difference in surplus across the period of 168 Mt. The difference from high energy prices in 2008 was 2% annually, with a total difference in overall surplus of 48 Mt.

The robustness of these estimates can be seen when compared to projections from the EEA (2008). [14] They estimate emissions in 2010 for all EU member states. Extrapolating growth rates from their 2006 data and 2010 projections, and applying them linearly to emissions up to 2012 allows us to compute projected surpluses up to 2012. The total surplus from these projections up to 2012 for the new member states was 1,941 $MtCO_2e$, in the same range to that from the Cambridge Econometrics work.

[13] Australia is likely to have a net balance or a small surplus in LULUCF as sinks in forestry are expected to rise to meet falling emissions in land-use. New Zealand's Ministry of Environment estimates total removals from sinks between 48-85Mt CO_2.
[14] EEA (2008), Greenhouse gas emission trends and projections in Europe 2008

A further estimation was conducted by estimating forward using data from the UNFCCC. The growth rate of total GHG emissions between 2004 and 2005 was assumed to be constant over the period up to 2012 for the new member states. This gave a total surplus of 2,347 $MtCO_2e$ from 2008-12. This estimation can serve as an upper bound for the surplus.

The surpluses available in both Russia and Ukraine are far larger than those in the new member states and thus the scale of Joint Implementation and GIS could be much larger and thus even more important to Kyoto compliance. The scale of the 'bounce' has also been much more significant in Russia than in many of the new member states (see Figure 2 below). Despite this there has been relatively few projections relating to Russian emissions and virtually none dealing with Ukraine.



Source: UNFCCC data

Figure 2: GHG emissions for selected New EU Member States, Russia and Ukraine 1990-2006

Estimations for Russia and Ukraine were done using a similar methodology to the estimation using UNFCCC data that was done for the new member states. This gave total surpluses for 2008-12 of 4,600Mt for Russia, and 3,300Mt for Ukraine. The estimate of the surplus for Ukraine may be artificially low due to the political difficulties in 2004, which impacted on economic growth and therefore emissions, causing a lower than may be expected growth rate in emissions.

Using updated growth rates between 2005 and 2006 and a similar methodology gave estimates of surpluses of 2,075 Mt for Ukraine and 4,200 Mt for Russia.

The World Bank (2008) reported estimates of surpluses from both Russia and Ukraine. For Russia they reported an estimated surplus up to 2012 of 3,330 $MtCO_2e$ and for Ukraine they report 2,170 Mt.

Estimates of Russian emissions from fuel consumption up to 2020 based upon Russia's recent Long-term Socio-Economic Development Program., coupled with estimates of the contribution of this source of emissions to total emissions can produce estimates of total Russian emissions up to 2012.[15] Assuming emissions follow a linear trend up to 2012 a total surplus for 2008-12 can be calculated. For a low-growth scenario (4.5% average annual GDP growth) the surplus is estimated at 3,867 $MtCO_2$; for a high-growth scenario (6.5% average annual GDP growth) the surplus is estimated at 3,667 $MtCO_2$.

Given these projections and estimations we estimate that Russia is likely to have a surplus in the range of 3,500-4,000 $MtCO_2e$ and Ukraine a surplus in the range of 2,000-2,300 Mt.

7. Total Annex I emissions up to 2012

In total from these projections compliance for all countries with the Kyoto Protocol targets is possible, thanks to the large surpluses available in former Eastern Bloc states.

The EU-15 is likely to require between 550-1250 Mt of external credits, Japan between 300-500 Mt and somewhere between 40-80 Mt from other Annex 1 countries. If Canada decides to meet its international obligations it is likely to require between 500-600 Mt of external credits. In total perhaps a total demand in the range of 890-1,830 Mt plus Canada.

The surplus available is much larger than this, though it is unlikely to be fully traded due to questions over the additional nature of emissions from countries with large surpluses, the large majority of which have arisen due to the economic collapse that occurred in ex-Soviet bloc countries in the early 1990s. Russia, Ukraine and the new member states of the EU could supply between 7,400-8,600Mt although the supply of these credits through GIS schemes is likely to be much smaller.

8. EU Emissions up to 2020

Cambridge Econometrics produced results for ETS emissions up to 2020 in the baseline and for the three scenarios.

Emissions were modelled in relation to the existing cap of 2080 $MtCO_2$ up to 2012, and a cap declining to 1,720 Mt in 2020 as per the Proposed EU Directive on the ETS.[16]

[15] The Long-term Socio-Economic Development Program is available in Russian at http://www.economy.gov.ru/. We are thankful to George Safonov for these calculations.

[16] European Commission (2008), Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community, Available at: http://ec.europa.eu/environment/climat/emission/pdf/com_2008_16_en.pdf

The modelling found that, in the baseline, emissions were below the cap up to 2012, but carried on increasing up to 2020, thus, with the declining cap the ETS has a large deficit in 2020 of 452 $MtCO_2$.

The effect of the adjustment for higher energy prices in 2008 (Scenario 1), reduced this deficit across the whole period 2012-2020, with emissions in 2020 83 $MtCO_2$ lower with a deficit in 2020 of 369 Mt. Sustained energy prices to 2020 reduced this further, by an additional 108 Mt, with a deficit over the proposed cap of 261 Mt.

This analysis did not take into account the EU meeting its renewables target of sourcing 20% of its energy needs by 2020. A detailed analysis of meeting the renewables target went beyond the scope of the work. An off-model calculation, however, was produced for the power-generation sector only. It was assumed that 50% of the target was met by electricity generation and, based upon the share of electricity in final consumption; emissions from power generation were scaled down as if the target had been met. This simple calculation excludes any change in the power mix, beyond the shift to renewables, and also any contribution of renewables to heat production in the ETS. This latter figure may be significant, with as possibly as much as half of total savings from increasing renewables emanating from this source.[17]

The results from this calculation were an additional reduction in ETS emissions of approximately 50 $MtCO_2$ (54.4 Mt in the baseline reducing to 47.77 Mt in Scenario 3). It should be clearly noted however that this only represents a small part of the contribution that meeting the renewables target could make in the EU as a whole. Large reductions are likely to come from the use of renewables to generate heat, both within and outside of the ETS, and also from the use of renewables in transport. Alternative analysis from the European Commission find a total possible reduction in emissions from meeting the whole renewables target in the range of 600-900 Mt a year up to 2020.[18]

From this it can be deduced that while renewables can play a substantial role in reducing emissions, the target alone is not sufficient to meet the proposed ETS cap.

An analysis from the Carbon Trust (2007) gives an interesting comparison.[19] The report show that the 2020 targets can be met through a delivery of the 2006 Energy Efficiency Action Plan, meeting the renewables target and structural and capital changes within the EU. The Cambridge Econometrics analysis, however, does not assume that either the 20% efficiency nor the renewables targets are met, and the scheme has a deficit of allowances at a €20t/CO_2 carbon price, implying a higher future carbon price. Meeting the renewables target is not enough to wipe out this deficit. This is in line with a further prediction from the Carbon Trust report, where efficiency targets are not met and carbon prices post-2012 rise towards (or even over) €50t/CO_2.

17 Poyry (2008), 'Compliance Costs for Meeting the 20% Renewable Energy Target in 2020', A report to The Department for Business, Enterprise and Regulatory Reform, p20, available at: http://renewableconsultation.berr.gov.uk/download?filename=compliance-costs-for-meeting-the-20-renewable .

18 SEC (2008), Annex to the Impact Assessment 85/3, p82

19 Carbon Trust (2007), EU ETS Phase II allocation : implications and lessons

9. Conclusions

Emissions projections are a crucial tool in informing climate policy, defining the likelihood of compliance with international targets such as those defined under the Kyoto Protocol, informing the policies needed to ensure compliance and to help predict future demand for emission allowances and credits and thus carbon prices.

This note draws together a number of sources to paint an overall picture of emissions up to 2020. It builds on work by Cambridge Econometrics commissioned by the Carbon Trust, and from a number of other sources, in order to provide estimates for a Carbon Trust publication, Global Carbon Mechanisms: emerging lessons and implications.

The key conclusions of this are:

- At a carbon price of €20/tCO_2 the ETS is likely to be under its cap, implying little overall demand for external credits for compliance. There may be some element of demand from individual firms and from future banking of allowances but the scale of both, especially the latter are uncertain.
- The EU-15 is likely to have an overall deficit between 500-1250 MtCO_2e from its Kyoto target, depending on the trajectory of energy prices.
- Japan's total deficit up to 2012 is likely to be in the range of 300-500 MtCO_2e.
- The new member states of the EU are likely to have a surplus in the range of 1900-2300, based upon information from a number of sources.
- Russia and Ukraine will have large surpluses from their Kyoto target. Russia's surplus is likely to be between 3,500–4,000 MtCO_2e and Ukraine's between 2,000-2,300 MtCO_2e, although there are few projections for these countries and further work is required.
- Up to 2020 the ETS is likely to be in deficit at a EUA price of €20/tCO_2, assuming efficiency and renewables targets are not met, implying a rising carbon price post-2012.

Further work for all of these geographical areas is required as the effects of the credit crunch become more certain, in order to inform targets for any Post-2012 framework and to help predict the trajectory of future carbon prices.

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